JACOBS

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Submitted to:

Flood Control District of Maricopa County

City of Peoria

Pre-Design Report **Volume I of 2**

83rd Avenue / Pinnacle Peak Road Drainage Improvements
FCDMC Contract No. 2003C060
Project Control No. 450.02.33

September, 2004

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Foreword

This Pre-Design Report has been prepared to summarize and document the Pre-Design Study. As described in the 83rd Avenue/Pinnacle Peak Road Drainage Improvement scope of work, the Pre-Design Study will 1) investigate and evaluate alternative locations and configurations for the Calle Lejos Detention Basin, 2) provide a preliminary layout of the Pinnacle Peak detention basin, 3) study the open channel versus closed conduit system issue, 4) study the landscape aesthetics and multi-use opportunities, and 5) prepare the concept and site development plans.

After this Pre-Design Report has been reviewed and approved, completion of design and construction documents will begin immediately. Public involvement and guidance by the Flood Control District of Maricopa County (District) and City of Peoria will continue to provide the direction needed to complete this project and meet the project goals.

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Section 1
Introduction

This project was identified in the Glendale/Peoria Area Drainage Master Plan (ADMP) Update prepared by the consultant firm Entellus. The study was completed in December, 2001 and was sponsored by the Flood Control District of Maricopa County. The purpose of the study was to update the original Glendale/Peoria ADMP prepared in 1987 by CDM Inc. and JM Montgomery Inc. The ADMP update was divided into three Levels – Level 1 thru 3. Level 1 included the evaluation of flooding issues, evaluation of the previous ADMP and formulation of very general mitigation alternatives. Level 2 evaluated and refined the base alternatives and Level 3 determined and developed the recommended alternatives.

As identified in Level 3, this project was the recommended alternative for the Northwest Region – 83rd Avenue/Pinnacle Peak Road Region, Preferred Alternative Number 4. This project also ranks first in the City of Peoria's priority of projects as a FY 2002-2003 Capital Improvement Project.

1.1 Project Site

This project is located in center of Maricopa County in the northwest portion of the Phoenix metropolitan area. The study area is between Deer Valley Road and Hatfield Road and between 81st Avenue and 89th Avenue, as shown in Figure 1-1. In the area between 83rd Avenue and 89th Avenue, storm water runoff drains by sheetflow and small concentrated flows in a southerly direction from the Sunrise Mountains to Deer Valley Road. Most of the streets in this area are unimproved without a storm drain system.

1.2 Project Objective

The project consists of collecting the runoff from the project watershed and conveying it to a detention basin located at the intersection of Calle Lejos and 88th Avenue and to another detention basin at the intersection of 83rd Avenue and Pinnacle Peak Road. The detention basins will contain the 100 year storm event flows and then drain to an existing channel on the east side of 83rd Avenue and south of Williams Road. The goal is to provide 100 year storm protection to neighborhoods between Hatfield Road and Deer Valley Road and between 83rd Avenue and 89th Avenue. The design team vision for this project is focused on the implementation of solid flood control protection. This will be done while ensuring an aesthetic design theme that unifies the project improvements to fit with the existing landscape character. The ultimate goal is to design a functional system that blends in seamlessly with the local environment.

The drainage improvements and public space use areas that may occur within the proposed Pinnacle Peak basin and proposed Calle Lejos basin will be designed to blend in with this aesthetic theme in every aspect. Planning has been done to insure that the project integrate into the regional Equestrian/ day hiker trail systems. The project strives to implement the drainage improvements with the least visual impact to existing natural vistas and lookouts. The structural elements will incorporate aesthetically attractive features that blend with the natural surroundings as well as the general landscaping theme of the surrounding community.

1.3 Purpose of the Pre-Design Study

A Pre-Design Study was required for the evaluation of several issues prior to final design. The Calle Lejos Detention Basin would be evaluated for three alternative layouts. The Pinnacle Peak Detention Basin would be investigated for its preliminary layout, capacity, and hydrologic/hydraulic features. Storm water conveyance by open channels or closed conduits would be evaluated. Landscape aesthetics, multi-use opportunities, and future public facilities opportunities for the project would be studied. Proposed improvements would include grading and earthwork activities. These construction tasks would be reviewed for its opportunities and constraints. The last issue to be considered includes concept and site development. Landscape themes, trail systems, and aesthetic enhancements are among the issues to be evaluated.

1.4 Project Vision

The design team's vision for this project is focused on the implementation of solid flood control protection while ensuring an aesthetic design theme that unifies the project improvements to blend in and fit with the existing landscape character. The ultimate goal is to design a functional system that blends in seamlessly with the surrounding environment.

The drainage improvements and public space use areas that may occur within the proposed Pinnacle Peak Basin and proposed Calle Lejos Basin will be designed to blend in with this aesthetic theme in every aspect. Planning has been done to insure that the project integrate into the regional Equestrian/ day hiker trail systems. The project strives to implement the drainage improvements with the least visual impact to existing natural vistas and lookouts. The structural elements will incorporate aesthetically attractive features that blend with the natural surroundings as well as the general landscaping theme of the surrounding community.

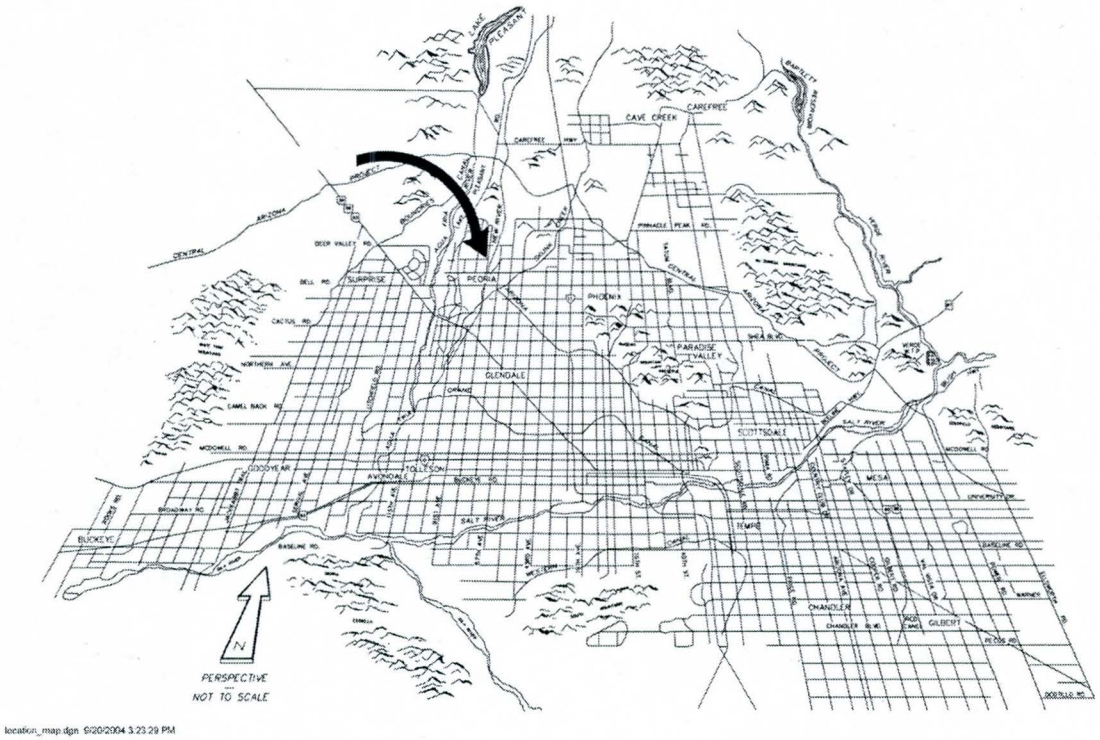

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Figure 1-1
Location Map

Section 2
Data Collection

Data collection is the first step in understanding the complexities of any project. This process takes on an even greater role when the data collection will involve both hard engineering data and the softer landscape architecture data. The data collection begins with the gathering of reports and studies previously completed for the project area and a physical assessment of the natural resources and constructed features within this area. Site visits were performed along with the collection of previous reports and plans. The reports included the ADMP and drainage reports for existing and proposed developments. Record drawings of developments, streets and utilities were also made a part of the data collection process. The following sections summarize the results of this research.

2.1 Existing Studies and Development Plans

Drainage reports and development studies were obtained from the District and the City of Peoria. These reports assisted in understanding the area drainage patterns and existing drainage facilities. The following pertinent reports and studies were utilized for this drainage analysis.

Glendale/Peoria Area Drainage Master Plan Update (ADMP), Entellus, January 29, 2001

The 83rd Avenue roadway has a history of being a major storm water conveyance for runoff from north of Pinnacle Peak to Williams Road. Inadequate drainage improvements along 83rd Avenue and development encroachments into existing drainageways have been contributing factors for the flood conditions experienced in this area.

The Glendale/Peoria ADMP study identified the drainage problems in the project area. The Level 3 report presented alternatives to mitigate flooding within those project limits. The recommended alternative consisted of two detention basins and a series of interconnecting storm drains and channels to collect, detain, and route the storm water runoff that has been contributing to the flood conditions. These improvements have been shown in Figure 2-1.

HEC-1 analyses were prepared to model the existing conditions and the effects of proposed alternatives. The 100 year 6 hour storm event was the design storm in these analyses. The HEC-1 input and output files are contained in Appendix A.

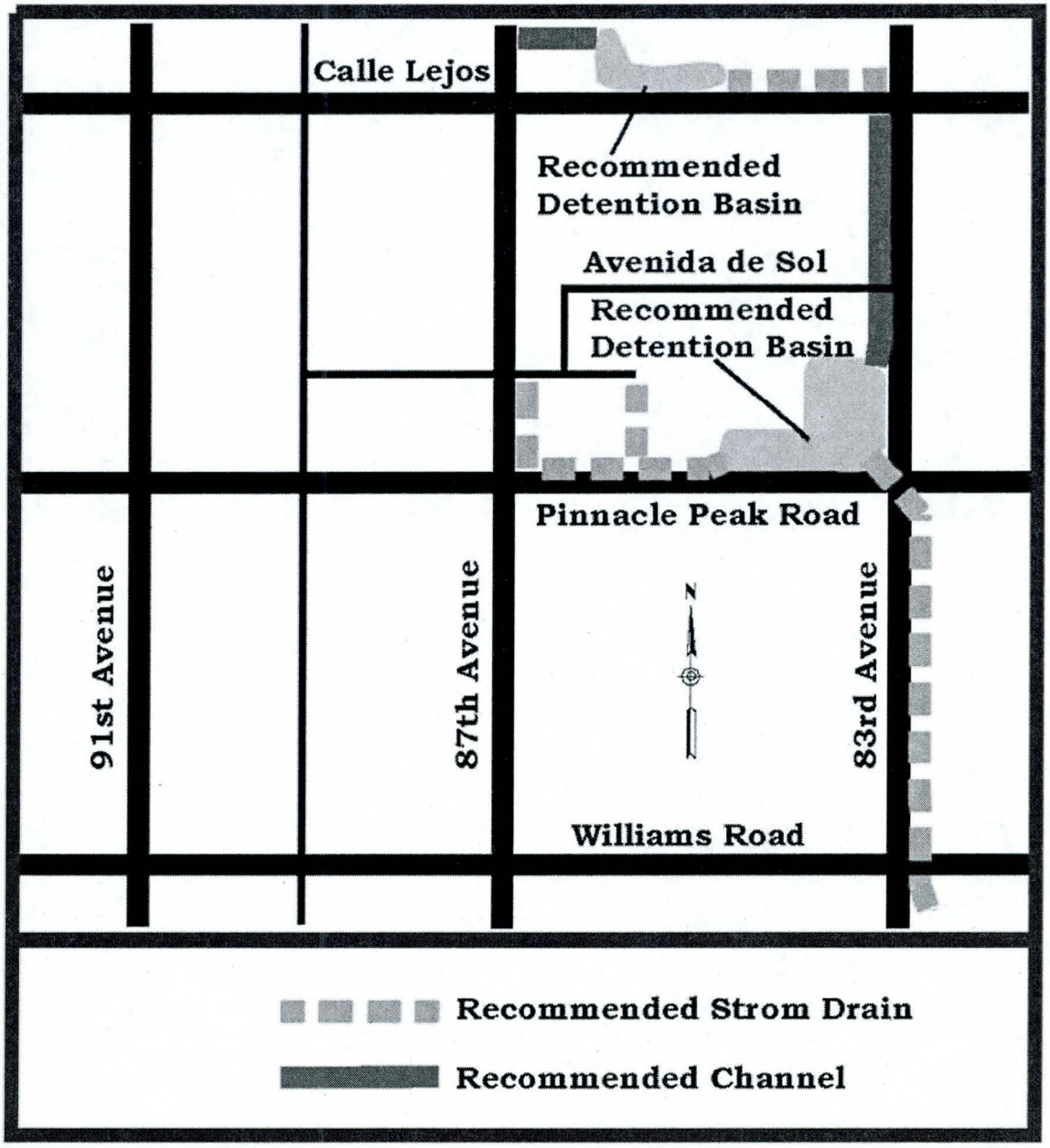


Figure 2-1
ADMP Update – Recommended Alternative

Other Reports Reviewed

Several drainage reports were reviewed during the Pre-Design Study phase of this project. The goal was gain a better understanding of the historic drainage patterns in the area and to update the hydrology based upon development changes. The following development drainage reports were reviewed.

- Drainage Report for Peoria 60 (Ventana Picachos)
- Drainage Report for La Caille
- Preliminary Drainage Report for Summit at Sunrise Mountain
- Final Drainage Report for Eagle Canyon
- Final Drainage Report for Clearview Estates
- Deer Valley Estates Final Drainage Plan
- Fletcher Heights, Phase 1 Final Drainage Plan

The locations of these developments have been shown in Figure 2-2.

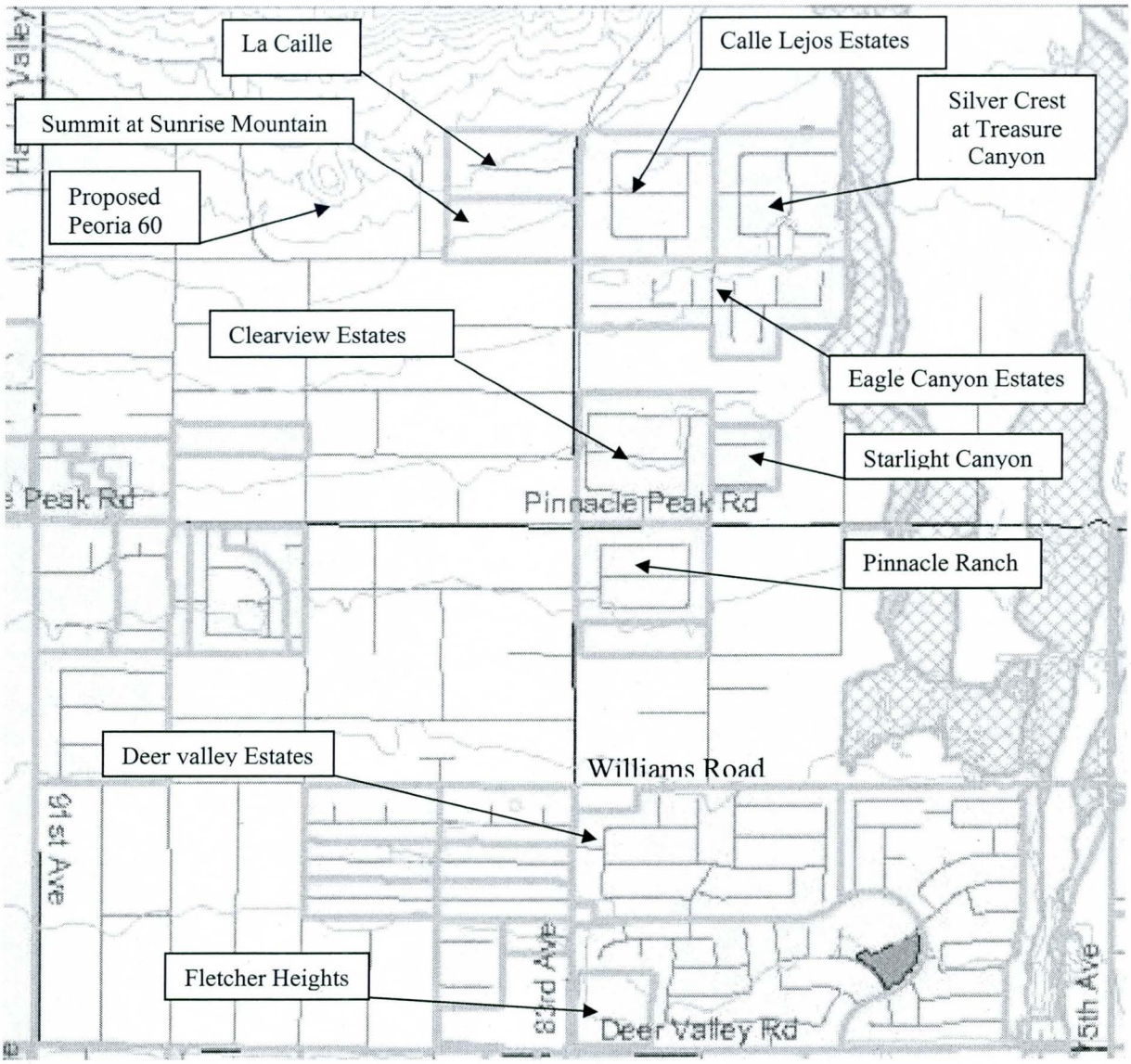


Figure 2-2
Project Vicinity Developments

Drainage Report for Peoria 60 (Ventana Picachos), SKG Enterprises, Inc. May 20, 2004

Peoria 60 is located on the north side of Calle Lejos Road, south of Hatfield Road between 89th and 86th Avenues. The development is presently in the final plat planning and development stage. The property occupies the proposed location of one of the Calle Lejos detention basin alternatives.

The developers of Peoria 60 have coordinated with the City of Peoria and the District and are aware of the ADMP Update Level 3 recommendations. As part of the drainage analysis and design, the Peoria 60 design team suggested locating the proposed detention basin north of Peoria 60 along the Hatfield Road alignment. This property is under the jurisdiction of State Lands and currently has an easement for SRP 230 KV power transmission lines. The offsite flows would be attenuated by the basins and onsite flows would be retained in retention basins up to and including the 100 year 2 hour event. Figure 2-3 shows the preliminary Peoria 60 site plan with the proposed drainage routing.

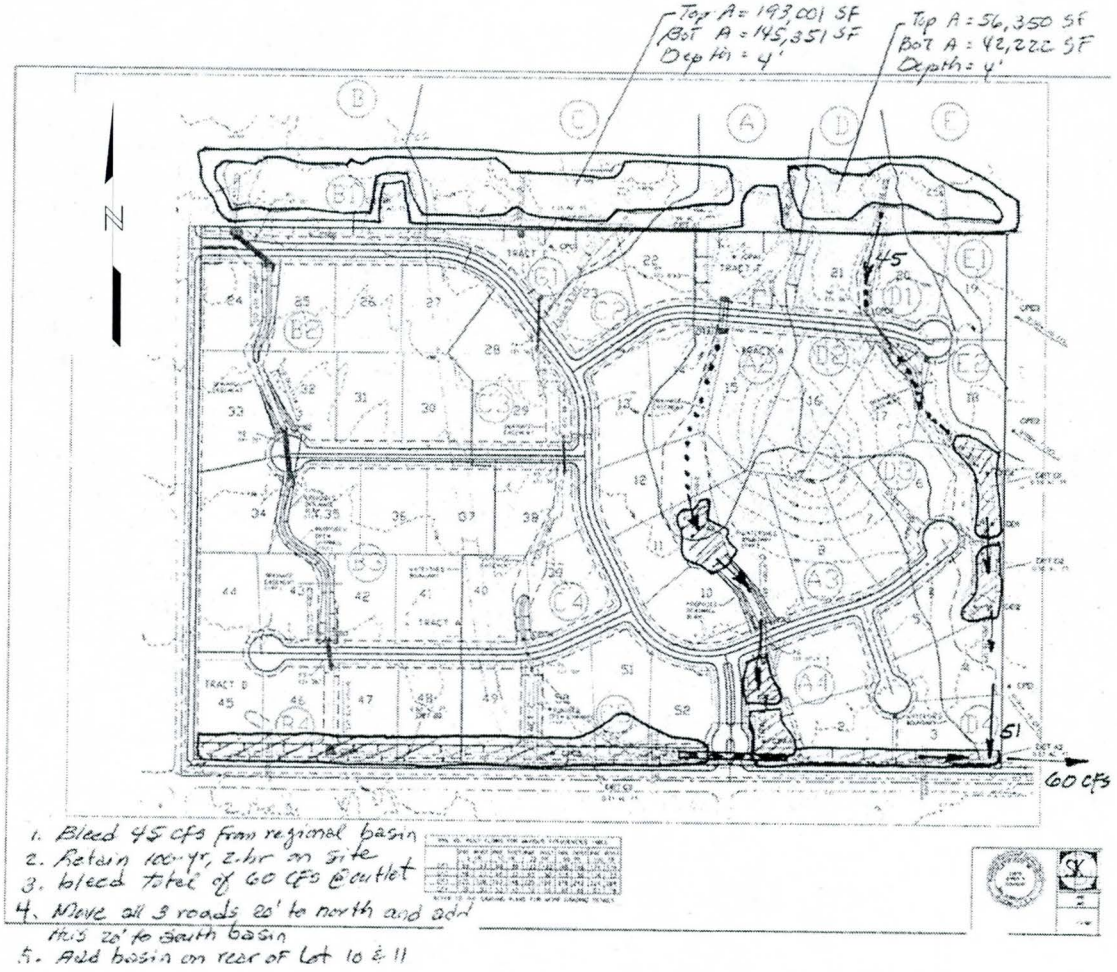


Figure 2-3
Peoria 60 Site Plan and Drainage Patterns

The drainage report identified two drainage conditions, interim and ultimate. The interim condition assumes the existing offsite drainage will not be altered prior to construction of the State Lands/SRP Corridor Basin Alternative. These offsite flows will be captured and attenuated by detention basins located along the north property line. Onsite flows will be collected in retention basins sized to store the 100 year 2 hour storm event flow. The 100 year retention volume for the site was shown to be 9.93 acre-ft. Dedicated drainage easements will be constructed to route flows to Calle Lejos. Linear basins will be constructed along the southern property boundary adjacent to Calle Lejos. These retention basins are designed to fill up and allow storm water to cascade and sheet flow along its historic flow path.

The ultimate condition anticipates that a regional detention basin will be constructed along Hatfield Road similar to the State Land/SRP Corridor Basin Alternative identified in this Pre-Design Study. Since the offsite flows will be intercepted, the three detention basins from the interim condition will be eliminated. The final onsite retention volume provided will be 6.82 acre-ft. The State Land/SRP Corridor Basin Alternative would intercept all offsite flows and meter the discharge through a storm drain. Based on the ADMP update hydrology, this scenario would result in a discharge of 45 cfs through the development. A total of 60 cfs would therefore be released from Peoria 60 at the southeast corner of the development.

Drainage Report for La Caille, CMX Group, December 22, 1994

The La Caille development is located north of Calle Lejos immediately south of Hatfield Road between 85th and 83rd Avenues. The development consists of 1 acre to 1.5 acres single family residential lots. The development drainage report was reviewed by the Pre-Design team members to determine how offsite and onsite flows are collected and conveyed. The report also gave insight into the drainage patterns north of the site and along 83rd Avenue. The report was used to update and validate elements of the Pre-Design HEC-1 modeling.

Offsite flows are passed through the site in drainage easements. Onsite retention is provided within the building envelopes so that preconstruction flows were not exceeded for post developed condition. The general offsite basin delineation, as depicted in the drainage study report, is shown in Figure 2-4.

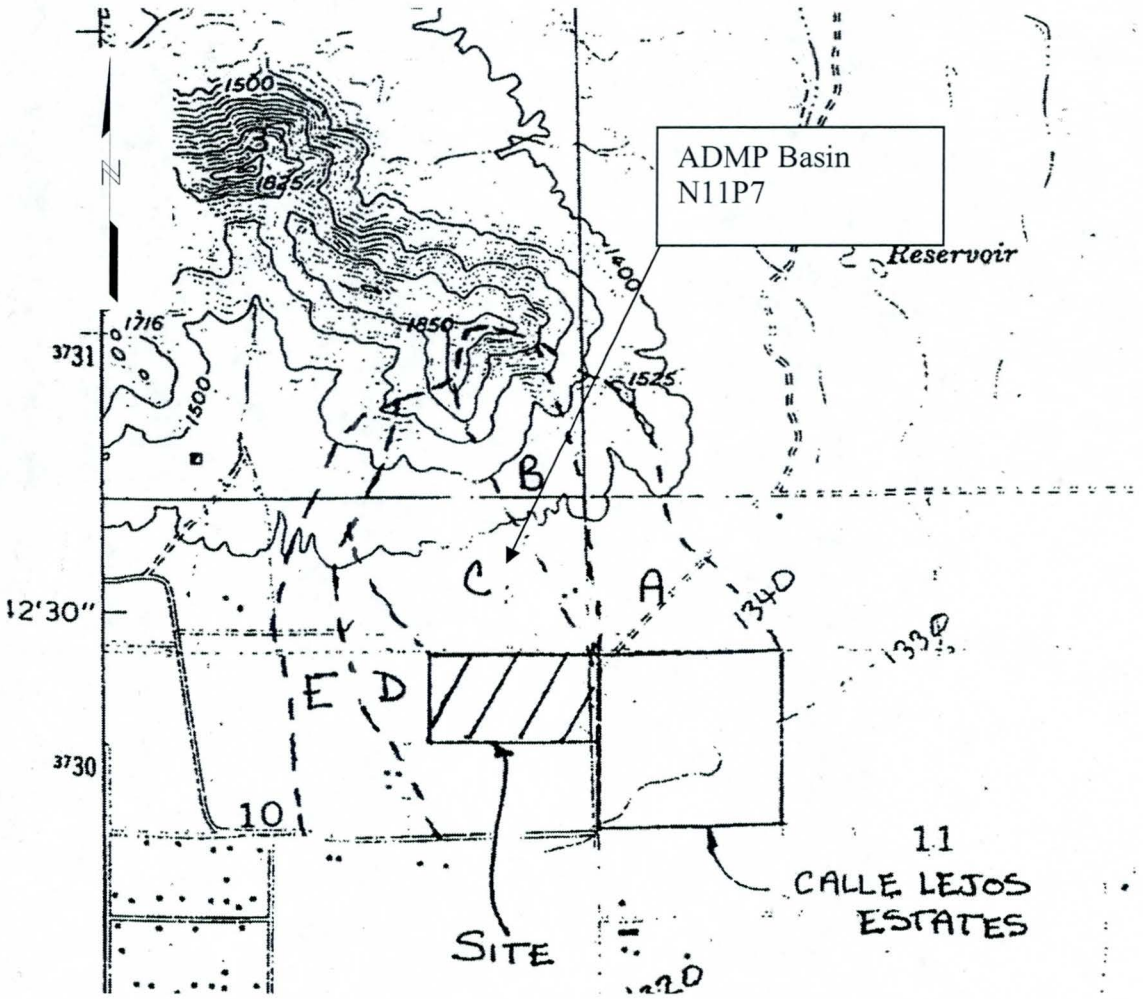


Figure 2-4
La Caille Offsite Drainage Areas

The report included the estimated the 100 year flow rates using the FCDMC rational method. These runoff rates were estimated to be 147 cfs for Subbasin A, 107 cfs for Subbasin B, 226 cfs for Subbasin C, and 142 cfs for Subbasin E. The flow rate for Subbasin D was not available. The ADMP peak flow for Subbasin N11P7 was 234 cfs. However, Subbasin N11P7 does not exactly match Subbasin C since it is larger and encompasses parts of Subbasins E and D, north of Hatfield Road.

Preliminary Drainage Report for Summit at Sunrise Mountain, RBF & Associate/American Engineering Co., October 30, 1999

Summit at Sunrise Mountain is a single family residential development, located at the northwest corner of 83rd Avenue and Calle Lejos. The study identified and quantified offsite drainage impacting the site. It also detailed the onsite and offsite post construction modifications.

Offsite flows originate to the north and northwest on Sunrise Mountain. The offsite flows are routed along 83rd Avenue and through the La Caille development located to the north. No onsite retention is provided. Flows also approach from the west as overland flow and are collected in a swale and routed along the west property line to Calle Lejos Road. Although a wall was constructed along the perimeter of the La Caille subdivision located to the north, openings are provided to allow offsite flows to pass through. These offsite flows continue through the Summit at Sunrise development within easements to match the natural flow patterns. The flows eventually concentrate at the southeast corner of the development, northwest corner of Calle Lejos and 83rd Avenue. These flows are conveyed through three 36" diameter pipes to a retention basin located at the southeast corner of Calle Lejos and 83rd Avenue. This basin lies within the Eagle Canyon development. Flows in excess of the capacity of the 36" diameter pipes continue south along the west side of 83rd Avenue. There are drainage swales located along the north side of Calle Lejos and the west side of 83rd Avenue. The swale on Calle Lejos has a capacity of 9 cfs and the swale along 83rd Avenue has a capacity of 22 cfs. The riprap swale along Calle Lejos was constructed for the Summit at Sunrise development and has a capacity to match the existing capacity of 9 cfs. The riprap channel constructed along the west side of 83rd Avenue designed for a capacity of 60 cfs although the total flow was estimated to be 76 cfs. See Figure 2-5 for the drainage map from the development drainage report.

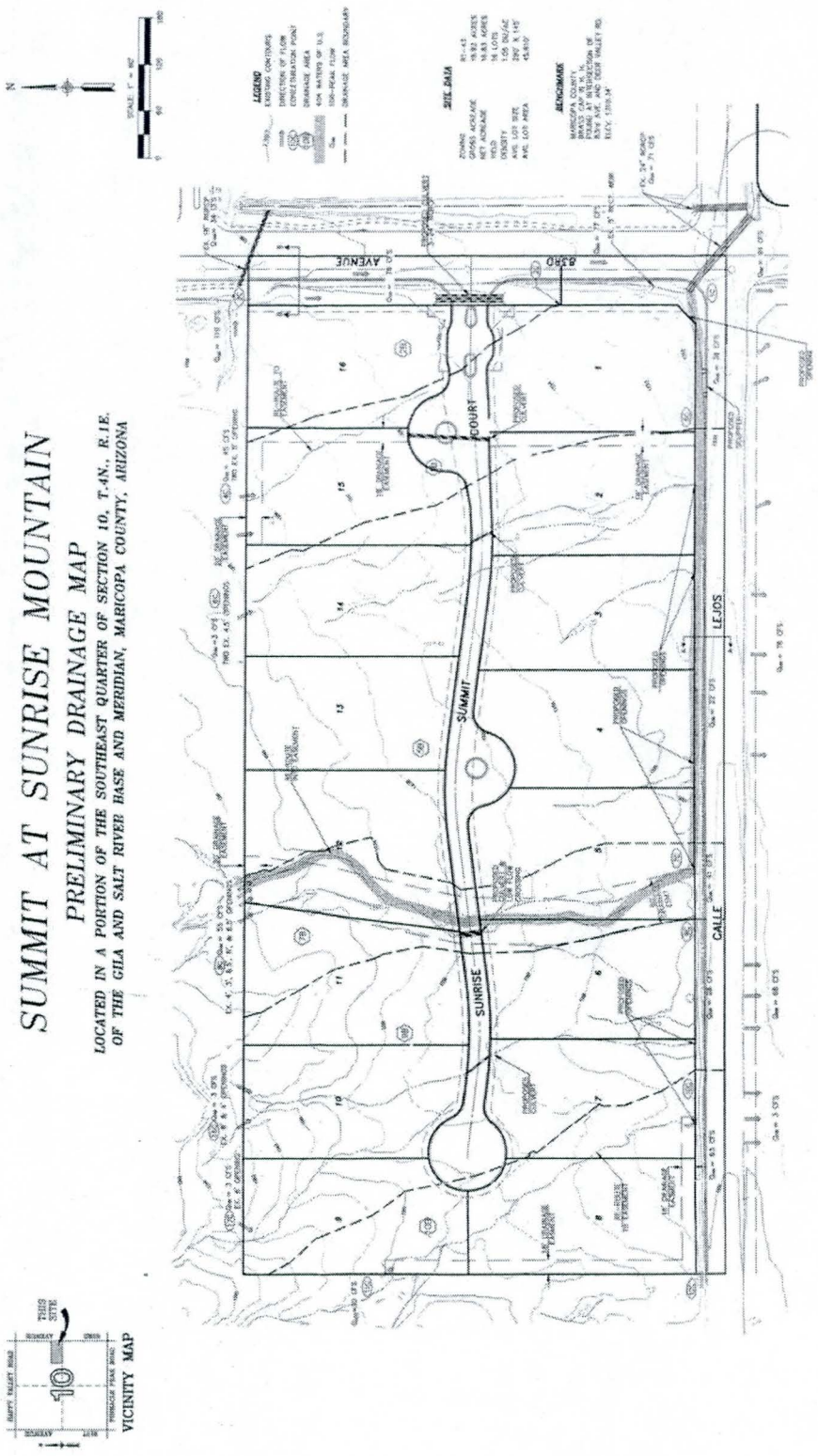


Figure 2-5
Summit at Sunrise Drainage Map

Final Drainage Report for Eagle Canyon, American Engineering Company, January 7, 1998

A large offsite basin was built at the northwest corner of the site. This basin intercepts flow from the area northwest of the development. The basin was designed to attenuate the existing offsite flows that previously passed through the site. The offsite runoff is conveyed to the basin by six pipes culverts, three passing under 83rd Avenue and Calle Lejos from the northwest and three from the north swale along 83rd Avenue. The peak inflow was estimated to be 181 cfs with 138 cfs being captured by the basin. Excess flows bypass to the south along the east side of 83rd Avenue in a drainage swale or to the east along Calle Lejos. The offsite basin is designed to be dewatered after the storm event by pumps discharging into adjacent curb opening catch basins along Calle Lejos. Retention basins are provided in Tracts C, D, E, and L. Total retention volume is 15.4 acre-ft. The Eagle Canyon drainage map has been included in Figure 2-6.

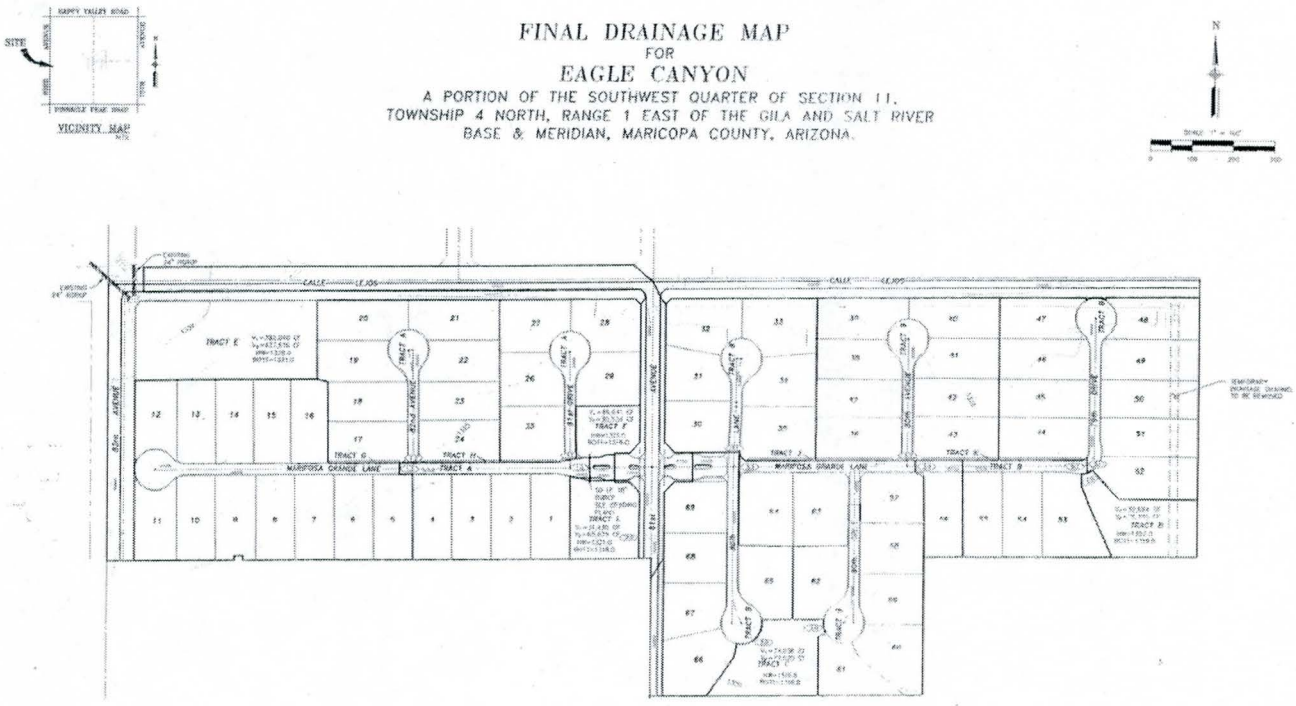


Figure 2-6
Eagle Canyon Drainage Map

Final Drainage Report for Clearview Estates, Sage Engineering Corporation, April 7, 1999

This development is located at the northeast corner of 83rd Avenue and Pinnacle Peak Road. The drainage report contains the onsite and offsite drainage design for the development. Offsite 100 year flows were determined to be mostly concentrated in 83rd Avenue with a peak rate of 131 cfs. These flows are conveyed in the existing 83rd Avenue channel facilities on the east side and within the roadway cross section. The west side of the development did not increase the capacity along 83rd Avenue.

Some offsite flows were estimated to impact the north and northeast sides of the development. These offsite flows, with peak rates of 56 and 48 cfs respectively, are routed around the development to the retention basin at the southwest corner of the development in Tract A. See Figure 2-7 for the Clearview Estates drainage map. The report did not indicate that large flows were being conveyed along Pinnacle Peak Road to 83rd Avenue from the east.

The basin is designed to hold the 100 year 2 hour volume, estimated to be 5.2 acre-ft. The volume provided was 6.2 acre-ft. Once the basin fills, the report indicated that flows will overflow the basin and continue south. It was anticipated that future development upstream would significantly reduce flows arriving at the site. Curb opening inlets are provided on the north side of Pinnacle Peak Road along the south side of the development to capture half street flows and route that storm water to the retention basin.

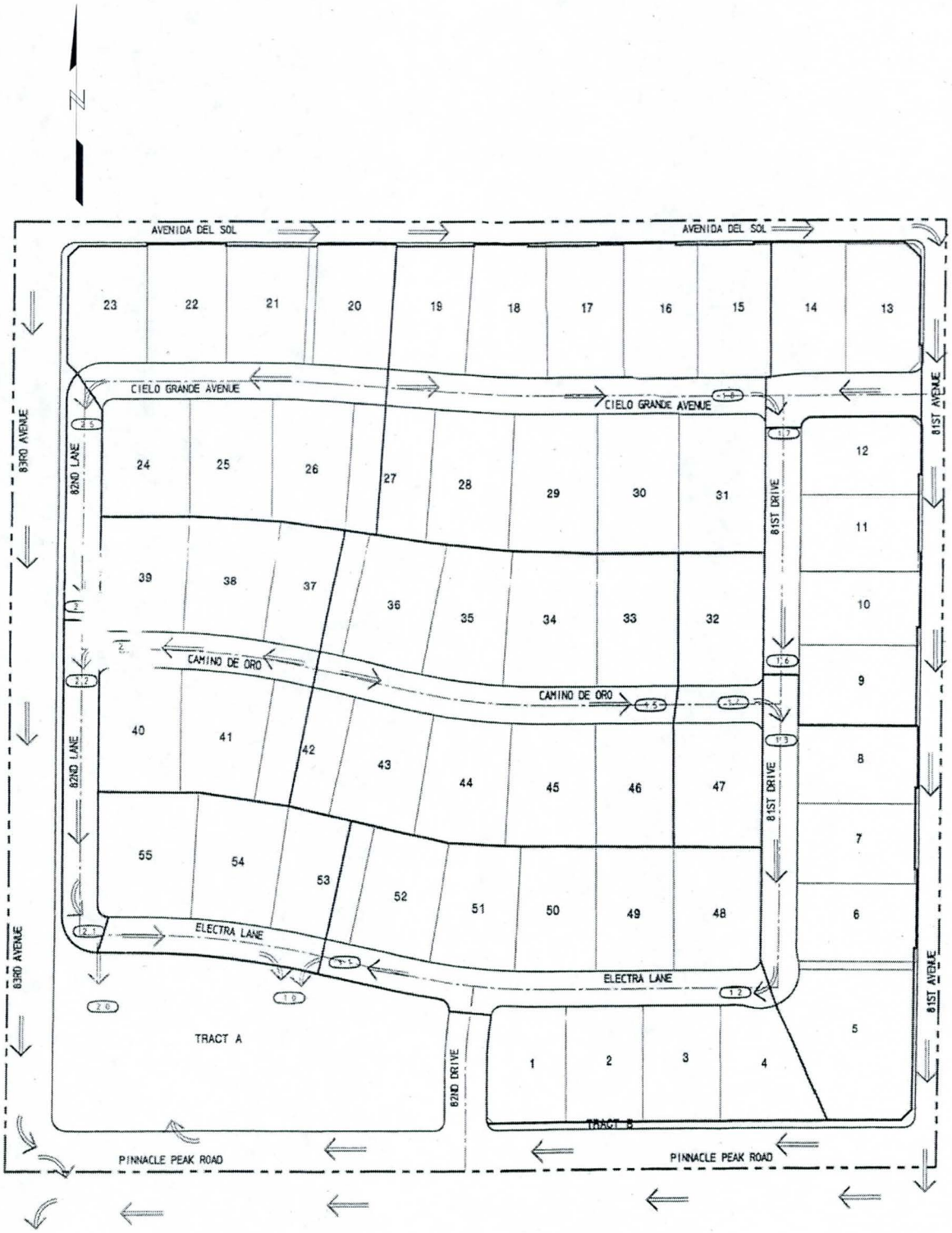


Figure 2-7
Clearview Estates Drainage Map

Deer Valley Estates Final Drainage Report, CMX Group Inc., February 2, 1997

Deer Valley Estates western conveyance channel, the 83rd Avenue Channel, will serve as the outfall point for all runoff collected and detained by the 83rd Avenue/Pinnacle Peak Road Drainage Improvements. The development drainage report analysis estimated that the 100 year 6 hour flow rate was 570 cfs into the channel. A portion of the flows are being conveyed within 83rd Avenue street right-of-way. One foot of freeboard above the 100 year water surface was provided. As indicated in the final drainage report, the detention basin outfall tailwater elevation is 1291.71 MSL.

The channel discharges at the southwestern corner of the development to a detention basin that is designed to meter out flows through a 4-3'x8' concrete box culvert back to the 83rd Avenue channel. In an agreement with the City of Peoria, no onsite retention basins were required. The onsite flows are routed to and through two detention basins, one located at the southwestern corner, 83rd Avenue, and one at the southeastern corner, Williams Road. The outflow from the 83rd Avenue basin was estimated to be 563 cfs. The downstream development is the Fletcher Heights development. Offsite flows arriving at Fletcher Heights are routed through the development where they ultimately outfall to New River. The Deer Valley Estates development general drainage arrangement is presented Figure 2-8. Further discussion on Fletcher Heights follows this section.

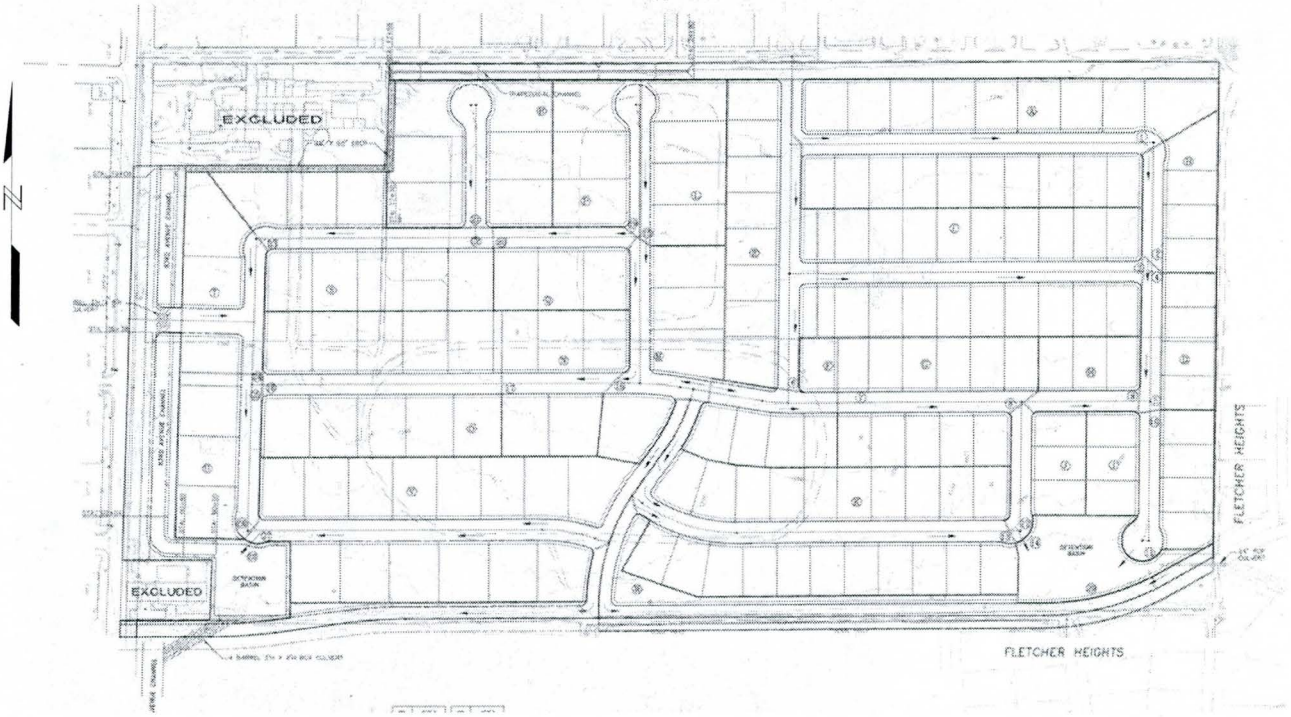


Figure 2-8
Deer Valley Estates Drainage Map

Fletcher Heights, Phase 1 Final Drainage Plan, CMX Group Inc., March 23, 1997

Fletcher Heights is located immediately downstream of Deer Valley Estates. The offsite flows in 83rd Avenue Channel are routed through Fletcher Heights and outlet at New River. The 100 year 6 hour flows in 83rd Avenue Channel at the upstream side of the development were estimated to be 544 cfs. The downstream flow was estimated to be approximately 648 cfs at New River. The schematic shown in Figure 2-9 identifies in plan view the general layout of the development.

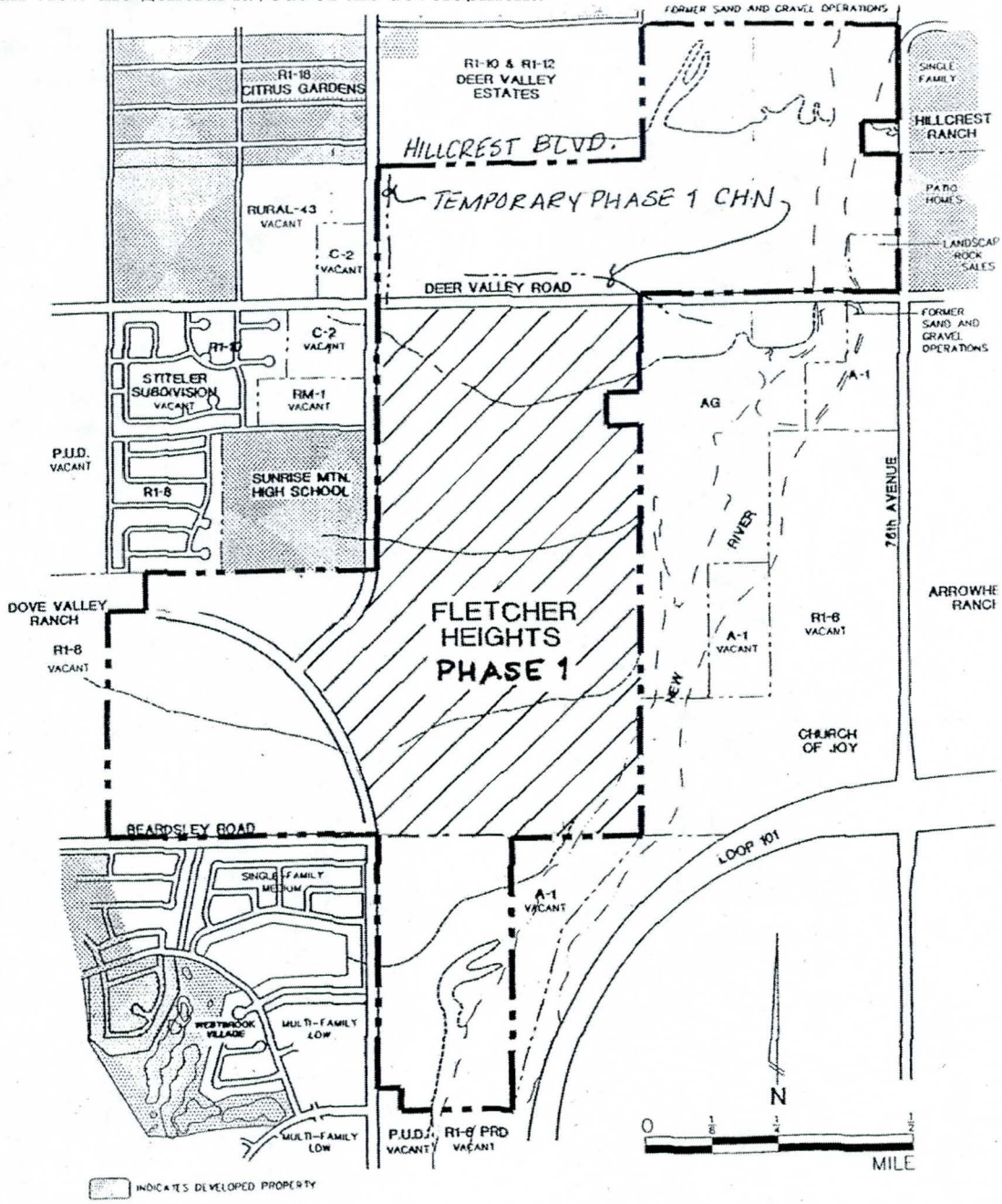


Figure 2-9
Fletcher Heights Development Plan

2.2 Existing Utilities

In the vicinity of the Calle Lejos Detention Basin Alternatives, no existing utilities are located near the proposed improvements. A 6" diameter water line lies within the Calle Lejos right-of-way between 83rd Avenue and 89th Avenue. This facility it not expected to be impacted by the proposed drainage improvements. North of Peoria 60, in the State Lands/SRP Corridor Basin Alternative site, the 240 KV power lines are present. This requires accommodations for the power line towers and access for SRP maintenance. East of Peoria 60 to 83rd Avenue, existing utilities consist of the 6" diameter water line, power lines and telephone lines. Since these facilities are located on the north side of the right-of-way, impacts from the proposed improvements are expected to be minimal.

Along 83rd Avenue from Calle Lejos to Pinnacle Peak Road, existing utilities consist of a 15" sanitary sewer main, 8" and 16" water mains, telephone and power transmission lines. To minimize the impacts to these facilities, proposed storm drain improvements are expected to be located on easements along the west side of 83rd Avenue. South of Avenida Del Sol, right-of-way and utility restrictions make closed conduit storm drains the only option.

Within the Pinnacle Peak Road right-of-way lies a 24" sanitary sewer, water, telephone and power mains.

2.3 Site Analysis

The site analysis process that the design team undertook as part of the data collection phase of the project included an inventory, evaluation, and investigation process. This process was undertaken in order to gather a comprehensive understanding of the project site and its surroundings. To assist the project team during the design process, the following items were specifically reviewed.

- COUNTY AND CITY RIGHTS-OF-WAY – The design team gathered information that could assist in identifying the limits of ownership and responsibility. Base data from the District, City of Peoria, and the Peoria 60 developer was used to determine the exact District, City, and private ownership rights-of-way. One issue that affects the design of the basin at 83rd Avenue and Pinnacle Peak Road is the governmental jurisdiction. This property is currently in unincorporated Maricopa County. Because of this, the current City of Peoria plan for this tract is development into an equestrian staging area. However, equestrian amenities will not be a part of this project. At a later date, when this parcel is incorporated by the City of Peoria, the equestrian staging area may be developed into a neighborhood park with the equestrian staging area being relocated to a different location.

- LAND USE – The inventory process allowed the design team the opportunity to review the existing and surrounding land uses that impact and/or will be

impacted by the proposed project improvements. These land uses include single family residential units, commercial properties, and suburban ranch residential units. The project area includes both City of Peoria and Maricopa County jurisdictional areas.

- TRANSPORTATION CORRIDORS – The design team reviewed the existing street and transportation corridors for the project area. The main north-south corridor is 83rd Avenue, while the main west-east corridors are the Hatfield Road alignment, presently an unpaved utility corridor, Calle Lejos, Pinnacle Peak Road, and Williams Road. An existing equestrian trail currently runs along Pinnacle Peak Road west to 83rd Avenue, where it terminates. The proposed equestrian staging facility at the Pinnacle Peak Basin will provide a link for this existing trail and allow the equestrian trail to eventually be extended west and north from this basin site. The site analysis phase also allowed the design team the opportunity to view the corridor as a motorist and as a pedestrian. As a result, it was found that several views at specific project areas should be framed by selective placement of vegetation and site design to capitalize on these views. Most notably, the existing views of Sunrise Mountain at both the proposed Calle Lejos and Pinnacle Peak Road basins should be kept open and preserved where possible. The views into the open space at the 83rd Avenue and Pinnacle Peak basin should also be kept open to capitalize on the aesthetics of the proposed future improvements there. The data collection process assisted the design team in identifying these corridors and their overall visual impact to the project.

- VEGETATION —The site analysis process allowed the design team to better understand the amount and diversity of vegetation within and adjacent to this project. The selected removal, protection, and planting of vegetation for this project will have a direct impact on the planned improvements and the visual relationship with the surrounding environment. The design team's objectives with regard to vegetation will include, but not be limited to, protecting existing significant vegetation if possible, re-vegetation of disturbed areas with native materials where feasible, selection of specific plant species that reinforce the design intent of the overall planting scheme and vision, and the salvaging and re-use of selected plant materials where feasible. Generally, the project areas will fall into two landscape categories: native open space or suburban stylized desert. The native open space areas are tracts of land that generally have not been disturbed, and maintain a native vegetation appearance. The suburban stylized desert theme areas are the landscaped areas that occur within subdivision planned area developments, and along the streetscapes. The design team's intent is to utilize the proper planting design that will merge the various areas of the project with the surrounding environment, while at the same time respecting the natural open space areas and blending into those aesthetic zones as well.

- DRAINAGE FEATURES —The design team visited the site and examined plans and reports in an effort to gain an understanding of the existing drainage elements and patterns. The team identified earthen and riprap lined channels, concrete and metal pipe, reinforced concrete box culverts, turf-lined detention and retention storage basins, and multiple storm drain inlets. The inventory process allowed the design team an opportunity to review the impact that existing drainage features will have on the proposed detention basins, storm drains, and channels.

- The existing features protect the developments from offsite storm waters traveling from northwest to southeast. In newer planned residential communities it was apparent that the storm water facilities, such as channels and pipe culvert headwalls, were designed to aesthetically blend in with the surrounding area. Colors of riprap and headwalls were chosen to be consistent with existing rock outcrops and native soils and vegetation. Additionally, there appeared to be an effort to avoid detracting from the natural aesthetics of the surrounding landscape by minimizing the visual footprint of the drainage facilities. Storage basins were typically landscaped with Mesquite and Palo Verde to mimic the surrounding vegetation. The basins utilized turf to facilitate multi-use activities and to soften the impact of the basin.

- The design team will seek opportunities to maintain and enhance the successful approaches taken by developers and residents when designing the proposed drainage facilities. The design team will propose drainage facilities that complement and supplement the existing systems, from a hydrologic and hydraulic aspect as well as from an aesthetic and environmental standpoint. To enhance aesthetics of the drainage systems, the drainage structures will be blended into the existing natural character of the area through the use of a variety of potential techniques, such as graphics, staining/painting, screening/masking, or re-use of on-site riprap within drainage features. For the overall site analysis, see Figure 2-10.

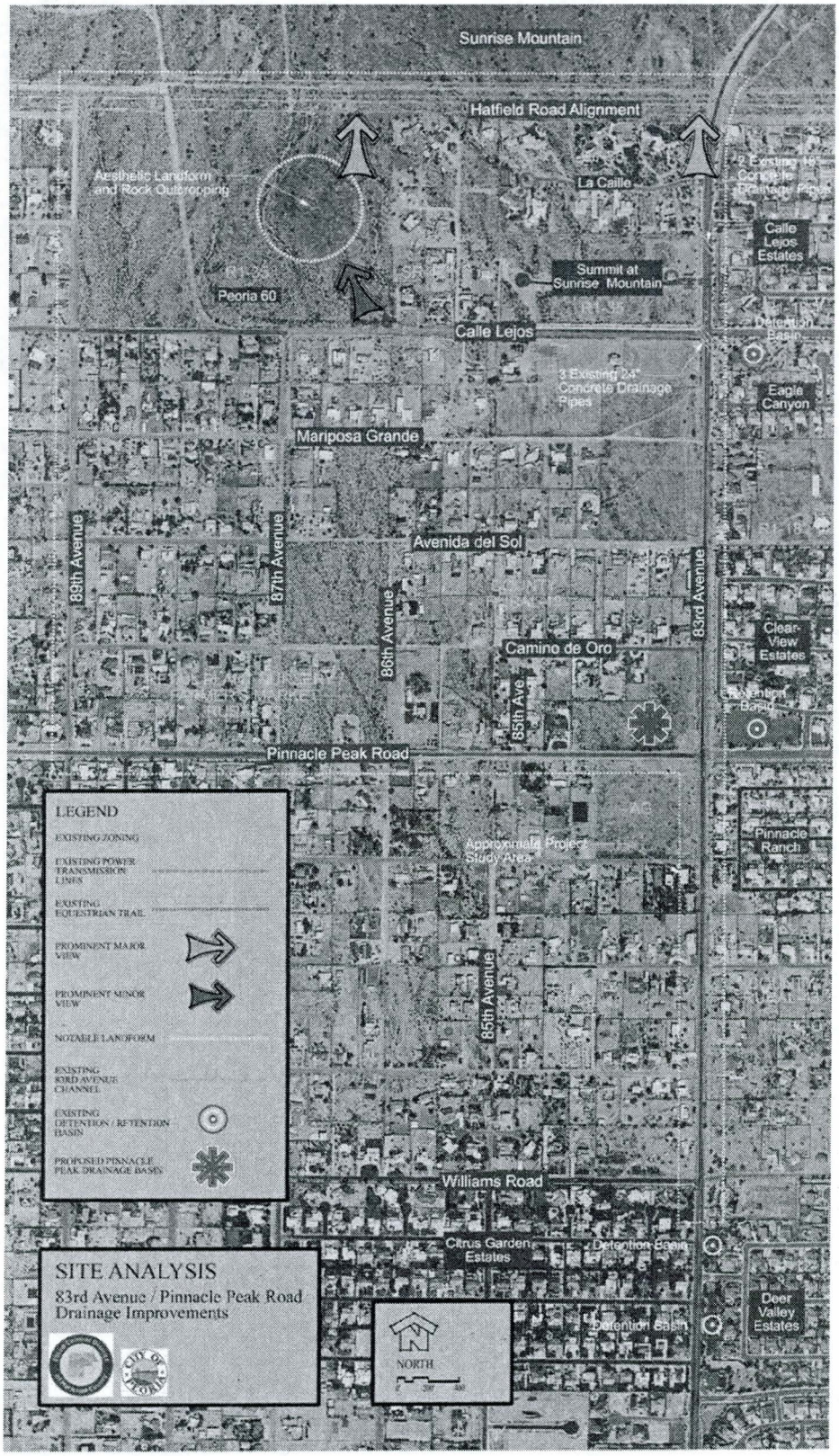


Figure 2-10
Site Analysis

2.3.1 Photograph Inventory

In order to become familiar with the character of the site, the design team met with representatives of the District and City of Peoria at the site to gain insight into the major elements of the project. Upon completion of this field meeting, the design team photographed the site from key locations. The results of this overview are presented in Appendix B. The locations of the photographs taken are shown in Figure 2-11.

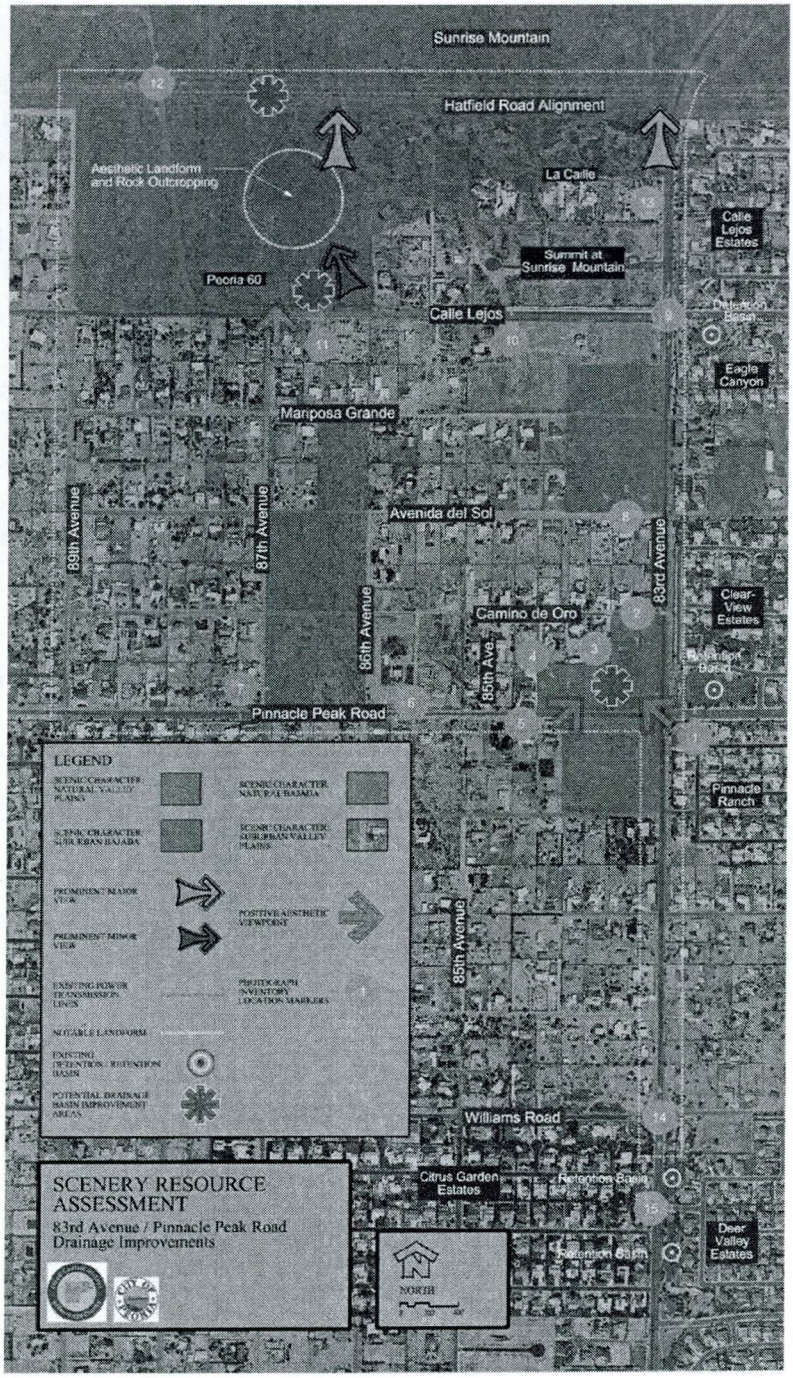


Figure 2-11
Scenery Resources Assessment

2.3.2 Recreation and Open Space Needs Assessment

This assessment will be used as one of the key elements in planning and designing the project multi-use features. The intent of this effort is to study the existing recreation and open space opportunities available to the public in the project area. This will enable the District, City of Peoria, and the design team to determine the recreation and open space needs that may be addressed with this project. The overall assessment process included site visits, review of aerial mapping, review of the ADMP, review of land use mapping, visits to the recreation sites within 2 miles of the project to review existing conditions, and discussions with City of Peoria staff regarding open space linkages and the opportunities associated with each.

There are very few existing open space recreation areas within the area of the 83rd Avenue / Pinnacle Peak Drainage Improvements Project. The most significant open space park area within the project vicinity is the Beardsley Road regional flood control system, located approximately 2 miles southwest of the project area. This basin system is located along the north side of Beardsley Road and provides a series of flood control basins that have been designed as a passive open space system. This area includes Parkridge Park, a City of Peoria facility located at 95th Avenue and Beardsley Road. Parkridge Park is approximately 7 acres in size and includes a restroom building, a tot lot play area with swings, a shaded ramada, soccer fields, and seating areas. The design of the park is essentially a turfed basin with soft, meandering design forms. Some areas of decomposed granite groundcover and river rock riprap meander aesthetically throughout the park site. The decomposed granite groundcover areas are planted with trees and shrubs with a lush desert theme, consisting of Mesquite, Sissoo, Palo Brea, and Eucalyptus trees.

An existing equestrian trail is located along the south side of Pinnacle Peak Road east of 83rd Avenue, and terminates at the southeast corner of 83rd Avenue & Pinnacle Peak Road. The City of Peoria plans to have this trail eventually extend westward towards Lake Pleasant Road and the Agua Fria River. This will provide a connection to the overall regional equestrian system. The City of Peoria would also like to have the equestrian trail system extended north along 83rd Avenue to the Hatfield Road alignment where a future trail system could also extend west to Lake Pleasant Road and the Agua Fria River. The design team will plan for this equestrian trail system accordingly.

To the east of the project area, at a distance of approximately ½ to ¾ miles, is New River. This north-south river corridor provides equestrian and pedestrian trails that eventually may tie into the project area's improvements.

In summary, the lack of neighborhood parks and open space recreation zones within the project area is a need that the City of Peoria would like to address. See Figure 2-12 for the recreation and open space needs assessment display. Single-family residential planned area developments have recently been constructed in the vicinity of this project. However, park construction has not kept pace with the population growth.

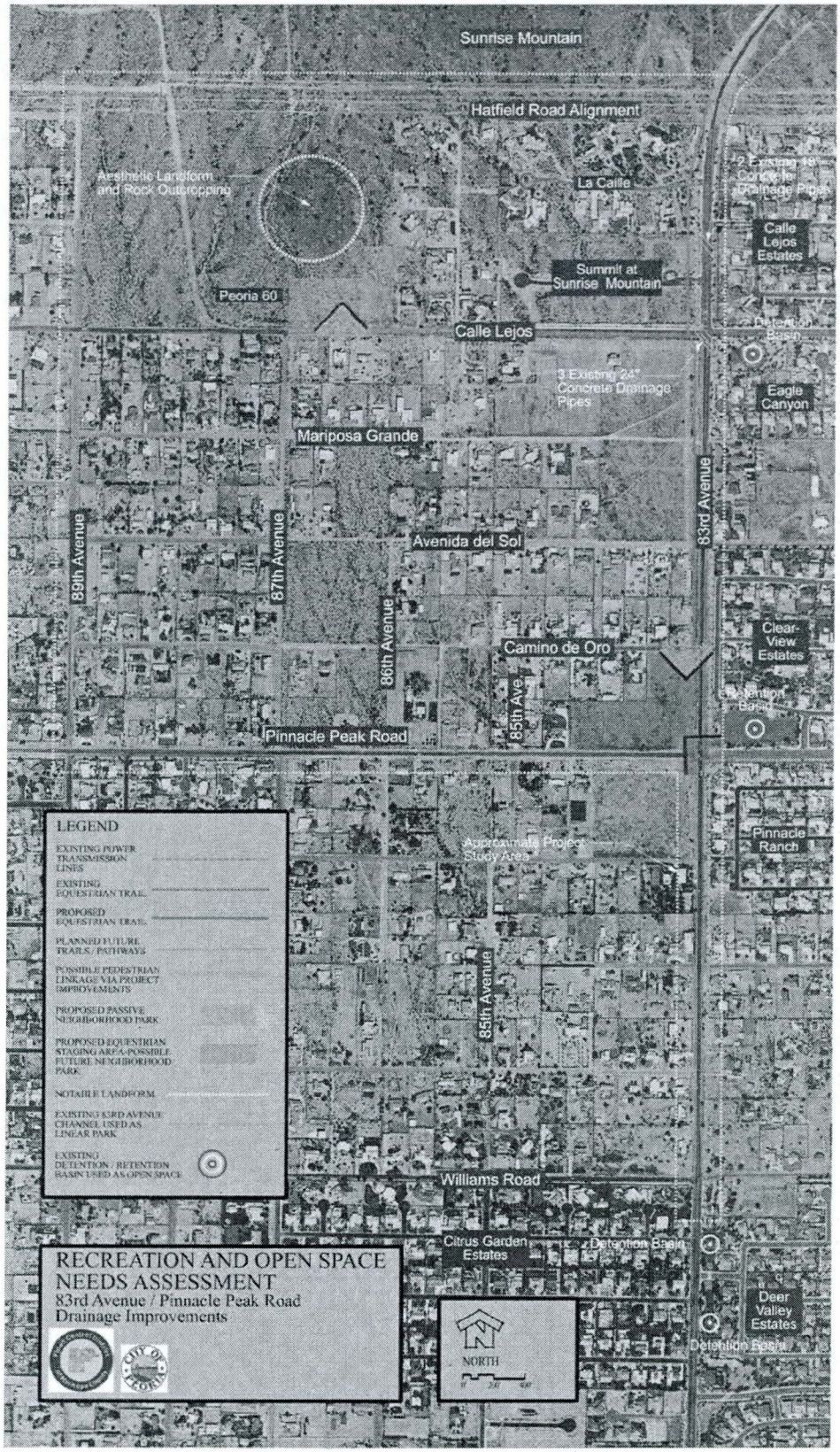
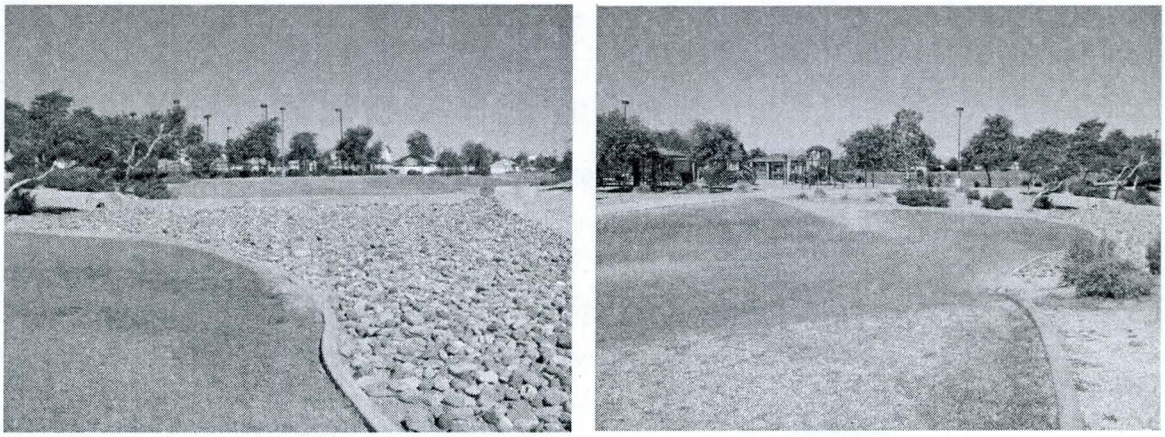


Figure 2-12
Recreation and Open Space Needs Assessment

The proposed detention basins at Calle Lejos and Pinnacle Peak Road could also be used to address the need for park open space. The City of Peoria has indicated a desire to improve the Calle Lejos Basin with neighborhood park amenities in the future. Some of these future possibilities could include a tot lot play area, turf grass play zone, shade ramada, restroom building, and parking area. The City of Peoria would also like to eventually have the Pinnacle Peak Basin serve as a larger neighborhood park, but that will occur only after the tract of land is annexed by the City of Peoria. Until that time, the City plans to improve this basin as an equestrian staging area. Although the equestrian facilities will not be included in this project, the project design team will plan and design the basin to accommodate future equestrian and neighborhood park facilities.



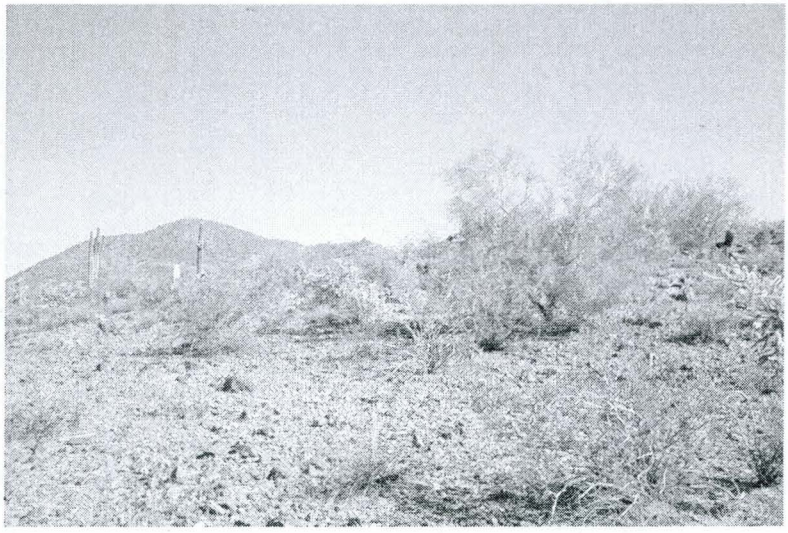
Photos showing site character of Parkridge Park, along Beardsley Road in Peoria

2.3.3 Scenery Resource Assessment

The scenery resource assessment was used to determine scenic priorities and the visual character of the project area. By determining this, the project design team can then utilize the information to assist in preserving outstanding views, enhance or screen undesirable views, and design the project improvements to blend seamlessly with the surrounding environment. The overall assessment process included review of the ADMP, site visits, review of aerial mapping, review of land use mapping, and discussions with City of Peoria and District staffs regarding scenic character, design theme, and aesthetic intent for the project.

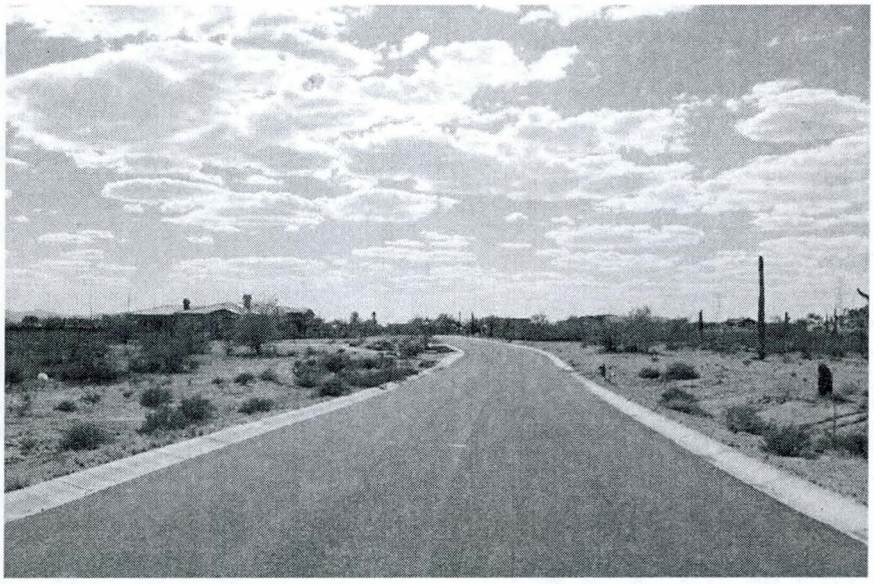
The most dominant visual landform within the project area is Sunrise Mountain, just north of the project area. This mountain can be seen from all portions of the project, and provides a striking visual backdrop for the neighborhood and the project area. The natural foothills of Sunrise Mountain can be classified as **"natural bajada"** in scenic

character. These foothills descend to a lower foothill subdivision area, **"suburban bajada"** that has been developed in the gated La Caille subdivision of suburban ranch homes. The suburban bajada then transitions to the **"suburban valley plains"** character. The majority of the project area is this type; however scattered throughout the project area are several natural or semi-native undeveloped open spaces classified as **"natural valley plains"** character areas.

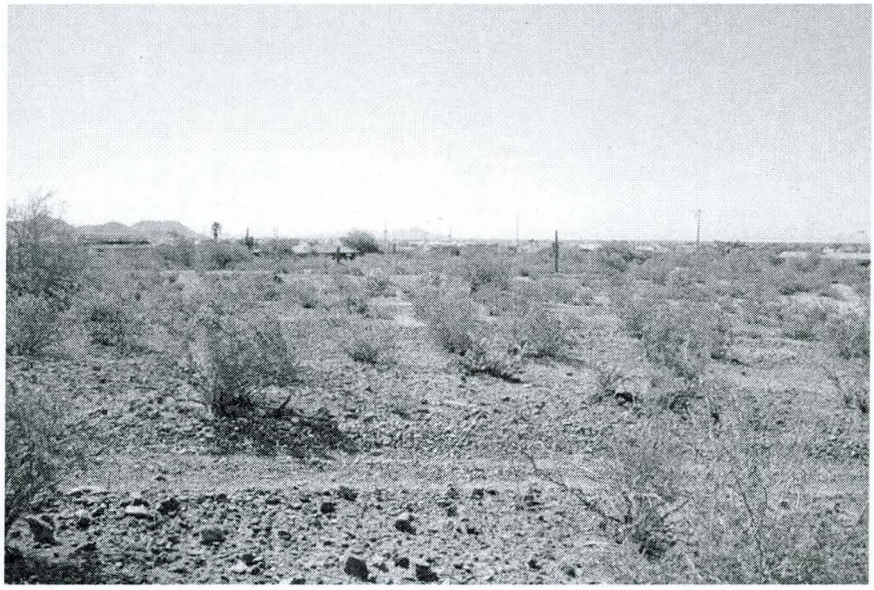


Natural Bajada Character Type, with Sunrise Mountain Beyond

Another prominent landform image is the rock outcropping hill located in the proposed Peoria 60 development north of Calle Lejos. This hill will most likely be preserved by the developer, so any project improvements in this vicinity should take advantage of this outcropping hill view as well as the views of Sunrise Mountain. Other views worth utilizing within the project area are views into the Pinnacle Peak Basin site, views into the potential open space basin at Peoria 60, and views of the open space area at Pinnacle Peak Road and 86th Avenue.



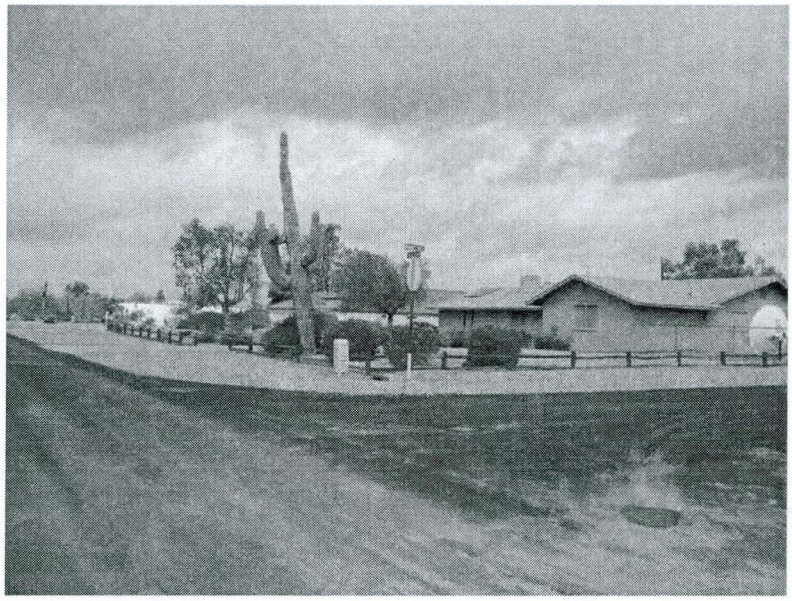
Local Street through Suburban Bajada Character Type



Natural Valley Plains Character Type

In terms of visual cohesion or intactness, some areas within this project boundary can be considered intact landscape areas, due to the overall visual impression of the landscape. These intact areas occur primarily in the natural bajada, natural valley plains, and suburban bajada character zones, due to the low level of development on the natural visual landscape in these areas. Where possible, the project team should try to preserve as much of the intact qualities of these zones as possible.

The scenery resource assessment process for the 83rd Avenue/Pinnacle Peak Road Drainage Improvement Project has resulted in a more thorough understanding of the project area aesthetic appeal and its relationship to the surrounding community and environment. By understanding the visual resources and qualities of this project site, the design team will be able to produce a design that is sensitive to the aesthetics of the surrounding environment.



Suburban Valley Plains
Character Type

2.4 Site Hydrology and Hydraulics Inventory

This project involves the hydrologic modeling for a 1.3 square mile watershed. The area of analysis is bounded by the Sunrise Mountains to the north, Pinnacle Peak Road to the south, 89th Avenue to the west and New River to the east.

Topography and Land-Use

The Sunrise Mountains (also known as West Wing Mountains) comprise the upper limit of the watershed. General topographic gradient is to the southeast. Elevations range from 1825 MSL at the peak of the Sunrise Mountains to 1360 MSL at Pinnacle Peak Road and 1290 MSL just south of Williams Road. Slopes range from 15% in the upper watershed to 1% in the vicinity of Pinnacle Peak Road. The watershed drains to New River located to the east-southeast of the project site. Figure 2-13 shows the watershed graphically.

From the summit point of the Sunrise Mountains to Hatfield Road, the land use is characterized as undeveloped desert. From Hatfield Road to Calle Lejos the land use is low density single family residential with some open desert areas and rock outcrops interspersed. South of Calle Lejos, significant development has taken place consisting of single family residential developments and light industry (e.g. planting nursery and equipment staging areas). Many of the older 1 acre lots do not have onsite retention. Offsite flows entering the properties are generally routed through these lots. The newer planned residential communities generally utilize onsite retention for the 100 year 2 hour event and have dedicated tracts to route offsite and onsite storm water.

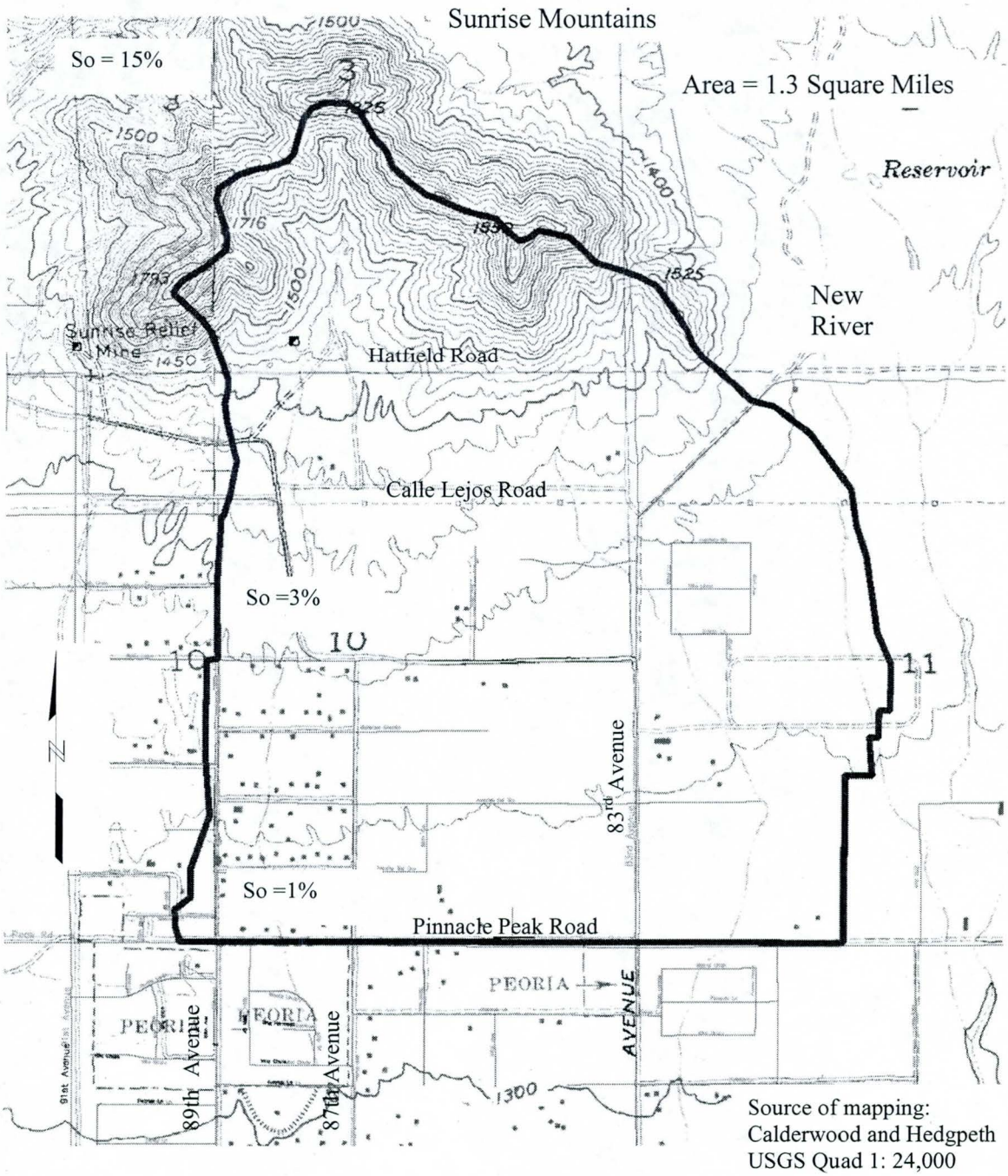


Figure 2-13
Project Watershed

The land use for the upper portion of the watershed, Sunrise Mountains, is characterized as undeveloped desert. From the summit point of the Sunrise Mountains to Calle Lejos land use is low density single family residential. Open vacant fields are common with some rock knolls and outcrops interspersed throughout the area. Significant development has taken place in the lower watershed. Single family residential developments have been constructed south of Hatfield Road. Many of the older 1 acre parcel lots do not have onsite retention. Offsite flows entering the properties are generally passed through these older lots. The newer planned residential communities generally utilize onsite retention for the 100 year 2 hour event and have dedicated tracts to route offsite and onsite storm water.

Vegetation and Soils

Vegetative cover is typical of the Sonoran desert southwest. Saguaros, Ocotillo, Palo Verde and Mesquite comprise the large vegetation. Desert grasses, Creosote, Ironwood and multiple small cacti such as Cholla and Prickly Pear comprise the predominant lower vegetation. Vegetative cover is estimated to be approximately 10%. Figure 2-14 shows typical site vegetation.

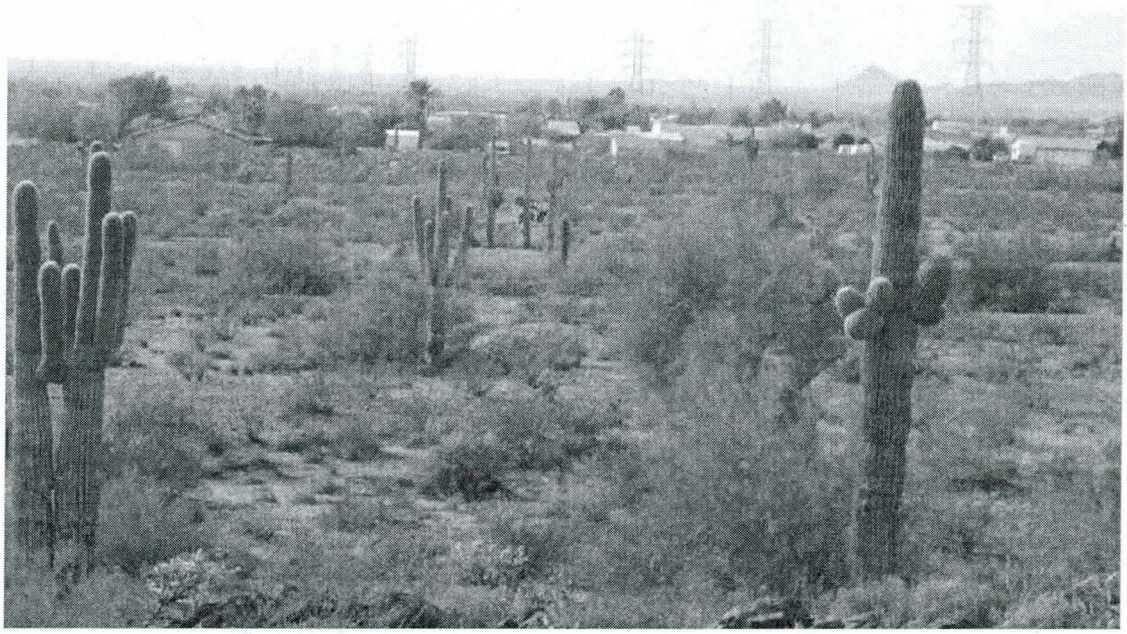


Figure 2-14
Site Vegetation

The specific soil associations found in the project limits are documented in the *Soil Survey of Maricopa County, Arizona- Central Part.*

- CO – Cherioni Rock Outcrop complex
- RS – Rock Outcrop Cherioni complex
- PWB – Pinal-Suncity complex 0-3 % slopes
- GWD – Gunsight-Pinal complex, 1-10% slopes
- GN – Gilman Laveen association
- CV – Coolidge Laveen association
- LcA – Laveem Loam, 0 to 1% slopes
- MR – Mohall Clay Loam
- Vf – Vecont Clay

Green-Ampt HEC-1 parameters are based on soil associations and complexes. The Pre-Design Report hydrologic analysis matched the loss parameters used in the ADMP Update study. Therefore, for this hydrologic analysis, the soil loss parameters were essentially the same as those used in the ADMP update. The soils located on the project site are shown in Figure 2-15.

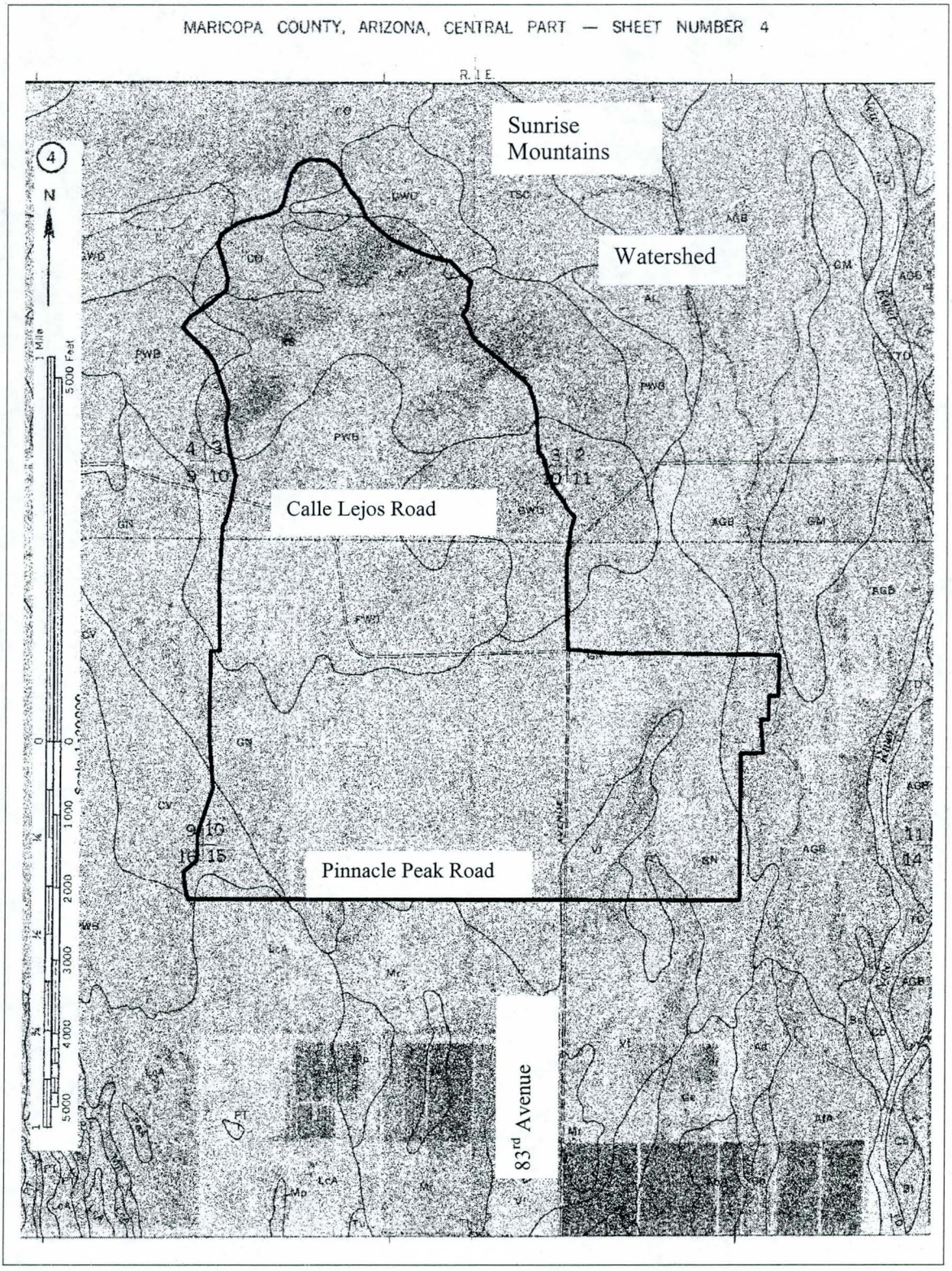


Figure 2-15
Project Soils

FEMA Floodplains

The project area is located on Federal Emergency Management Agency (FEMA) Flood Insurance Rate (FIS) Map panel 1180 of 4350. The FIS map number is 04013C1180 F, revised July 19, 2001. The project site is located in flood Zone X. Zone X is defined as "Areas of 500-year flood; areas of 100-year floods with average depths of less than one foot or with drainage areas less than one square mile; and areas protected by levees from 100-year flood". Figure 2-16 includes the FIS map.

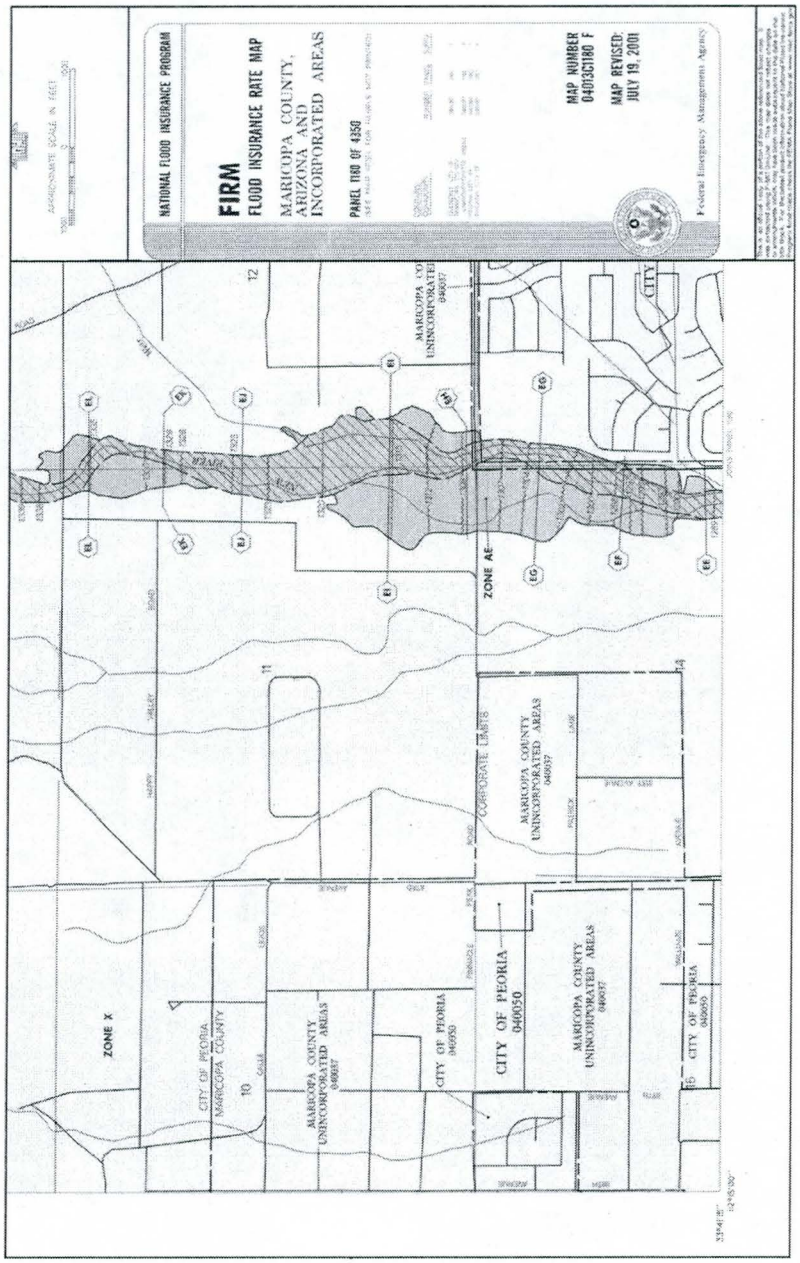


Figure 2-16
FIRM Panel 04013C1180F

Site Drainage Structures

The major drainage structures located within the project limits are comprised of concrete and metal pipe culverts, concrete box culverts, catch basin inlets, earth and riprap lined channels and storm water storage basins, retention and detention. These facilities have been described in Section 2.1, Existing Studies and Development Plans.

Undeveloped Areas

The less developed upper portion of the watershed routes storm water runoff through natural washes and roadside ditches. Erosion was evident with head cutting and riling. There was evidence of sediment deposits at locations where the washes and ditches crossed Hatfield Road and Calle Lejos. Generally storm water overtops the roads where the washes intersected the roadway.

Residential Developments

Residential developments generally can be categorized into two categories, individually built, single family residences with lot sizes of ½ to 1 acre and planned community developments. Individually built and owned lots were established prior to the planned community developments and drainage planning was not coordinated in an organized fashion. Generally, these parcels did not have dedicated onsite retention facilities and passed offsite flows through or around the parcels.

Planned community developments built within the last 10 years, typically have onsite retention storage basins and dedicated offsite storm water facilities. Notable exceptions are the two developments located north of Calle Lejos and west of 83rd Avenue, La Caille and Summit at Sunrise Mountain. These developments pass offsite flows through wall openings and dedicated drainage tracts within the subdivision. Lot sizes are large enough to allow retention of the runoff generated by the individual lots. Pipe culverts were used to pass flows under roadways between drainage tracts. Riprap lined channels were provided to route both offsite and onsite flows.

Where retention and detention basins were provided, curb and gutter sections routed onsite flows to catch basin inlets. These flows are then routed by storm drains or spillways to the basins. See Section 2.1 for a more detailed discussion of the individual development drainage.

83rd Avenue

Storm water generated upstream drains to 83rd Avenue and is routed south. This storm water is conveyed by the roadway section and existing open channels located along either side of 83rd Avenue. There is no storm drain trunkline along 83rd Avenue. Pavement flows in curb and gutter sections are collected by curb open inlets and conveyed to adjacent roadside ditches or channels or retention/detention basins.

Pinnacle Peak Road

Storm water generated north of Pinnacle Peak Road is routed south by north-south arterials and roadside ditches. Pinnacle Peak Road to the east acts as a collector for these flows and routes the water to 83rd Avenue. There is no storm drain trunkline along Pinnacle Peak Road. Pavement flows in curb and gutter sections are collected by curb open inlets and conveyed to adjacent roadside ditches or channels or retention/detention basins.

Hydrologic Analysis and Modeling

As part of the data collection process the HEC-1 files used in the ADMP Update were obtained and used as the basis for Pre-Design Study hydrologic modeling. LEVEL3.dat was the HEC-1 file created to model the ADMP Update recommended alternatives. The design team utilized this model as the base hydrologic model and updated it utilizing available information. New mapping, land use information, drainage facilities, etc. were available and used to update the hydrologic models. The revised model was also limited to modeling subbasins pertinent to this project and not to the ADMP Update watershed which was considerably larger. The Pre-Design Study HEC-1 model simulates the 100 year 6 hour storm event. Final design HEC-1 models used to size proposed storm water facilities may use other storm events. HEC-1 output files are contained in Appendix A.

HEC-1 Modeling Methodology

HEC-1 uses numerical parameters to describe the amount and temporal distribution of rainfall, the runoff characteristics of the watershed, and the hydraulic properties of overland flow planes and channels that collect and convey the direct runoff to concentration points. Appendix A contains the HEC-1 input and output data for the 50 and 100 year events. Each of the HEC-1 components is discussed below.

HEC-1 Precipitation, PC Record

The HEC-1 model computes a hypothetical storm using the Corps of Engineers hypothetical rainfall distribution. The input consists of point rainfall depths for various storm events which were determined from the NOAA Atlas and FCDMC methodologies, as previously described. The precipitation values were input into the HEC-1 model using the PC record. The 6 hour storm duration is typically used for basins with a total area less 20 square miles and the 24 hour storm duration is used for basins area greater than 20 square miles. Therefore, the 6-hour duration was used on this project. The rainfall distribution matched the ADMP Update model. The rainfall depths are shown in Table 2-1 as a function of return period and storm duration

HEC-1 Rainfall Losses, LG Record

Rainfall losses are primarily due to surface retention and soil infiltration. The ADMP Update estimated rainfall losses in accordance with procedures outlined in the FCDMC

Drainage Design Manual for Maricopa County Volume 1 – Hydrology. Rainfall infiltration losses were estimated by the Green and Ampt method. The rate of soil infiltration is primarily a function of the soil texture. This method calculates losses based on soil texture, vegetation cover and soil moisture. Losses due to surface retention were obtained from Table 4.2 in the FCDMC Manual. The Pre-Design Study hydrology utilized the Green and Ampt values used in the ADMP Update HEC-1 model.

HEC-1 Unit Hydrograph, UC Record

The basin outflow hydrograph was calculated using the Clark Unit Hydrograph method. This method requires the estimation of three parameters: time of concentration (T_c), storage coefficient (R), and time-area relation. The Maricopa County Unit Hydrograph Program1 (MCUHP1) was used to estimate Tc (Papadakis-Kazan equation 5.5) and R (storage coefficient). MCUHP1 estimates R with equation 5.6 in the drainage manual.

HEC-1 Time Area Relation, UA Record

The MCUHP1 implementation of the Clark Unit hydrograph utilizes synthetic dimensionless time area values as defined on Table 5.2 in the drainage manual. The subbasin UA category is defined as urban, natural or HEC-1 default (all others). Natural and urban categories were used for the Pre-Design Study HEC-1 modeling.

HEC-1 Normal Depth Routing, RS, RC, RX, RY Records

The Normal depth method was performed to simulate routing by natural washes, arterial streets or roadways and other irregular cross sections drainageways.

HEC-1 Kinematic Wave Routing, RK Record

The Kinematic Wave routing function was used to simulate routing by prismatic routing shapes such as trapezoidal channels and pipe conduits.

HEC-1 Subdivision Retention, DQ and DI Records

Where a portion of a subbasin is drained to a retention basin, a flow diversion operation was used to divert the volume of water corresponding to the capacity of the retention storage volume.

HEC-1 Street Intersection Diversions, DQ and DI Records

Where a flow split occurs at an intersection, diversion cards were used to define the amount of flow being passed to multiple downstream directions. In general, the ADMP Update diversions were utilized.

Section 3
Calle Lejos Detention Basin

The purpose of the Calle Lejos Detention Basin is to collect and attenuate runoff from north and west of 83rd Avenue and Calle Lejos. The origin of the primary offsite flows contributing to the proposed basin is Sunrise Mountain. The primary areas contributing to the detention basin, as denoted in the HEC-1 ADMP model for the 100 year 6 hour storm, are subbasins N11P1, N11P5 and N11P6. The peak flow identified in the ADMP entering the basin was 575 cfs. In the ADMP, it was recommended to use a single 36" diameter concrete pipe to meter flows at the peak rate of 45 cfs to 83rd Avenue. The ADMP proposed the Calle Lejos Detention Basin volume to be 18 acre-ft. See Figure 3-1 for the ADMP concept for this detention basin.

The ADMP also recommended using a 50 foot bottom width trapezoidal channel to collect offsite flows from west of the detention basin. The flows would be routed through a 1-6'x4' concrete box culvert under 88th Avenue to the proposed detention basin. The ADMP identified a peak discharge of 90 cfs being collected and conveyed by this channel.

To evaluate the detention basin alternatives, the ADMP Update HEC-1 model was reviewed and updated. A working HEC-1 model was constructed using the original HEC-1 Level 3 model, level3.dat, it was then adjusted where necessary to reflect latest topographic mapping as well as adjustments to the original concept and design.

The Calle Lejos Detention Basin was studied for three alternatives. These included the ADMP Basin Alternative, State Lands/SRP Corridor Basin Alternative and Peoria 60 Southern Boundary Basin Alternative. These alternatives have been shown in Figure 3-2.

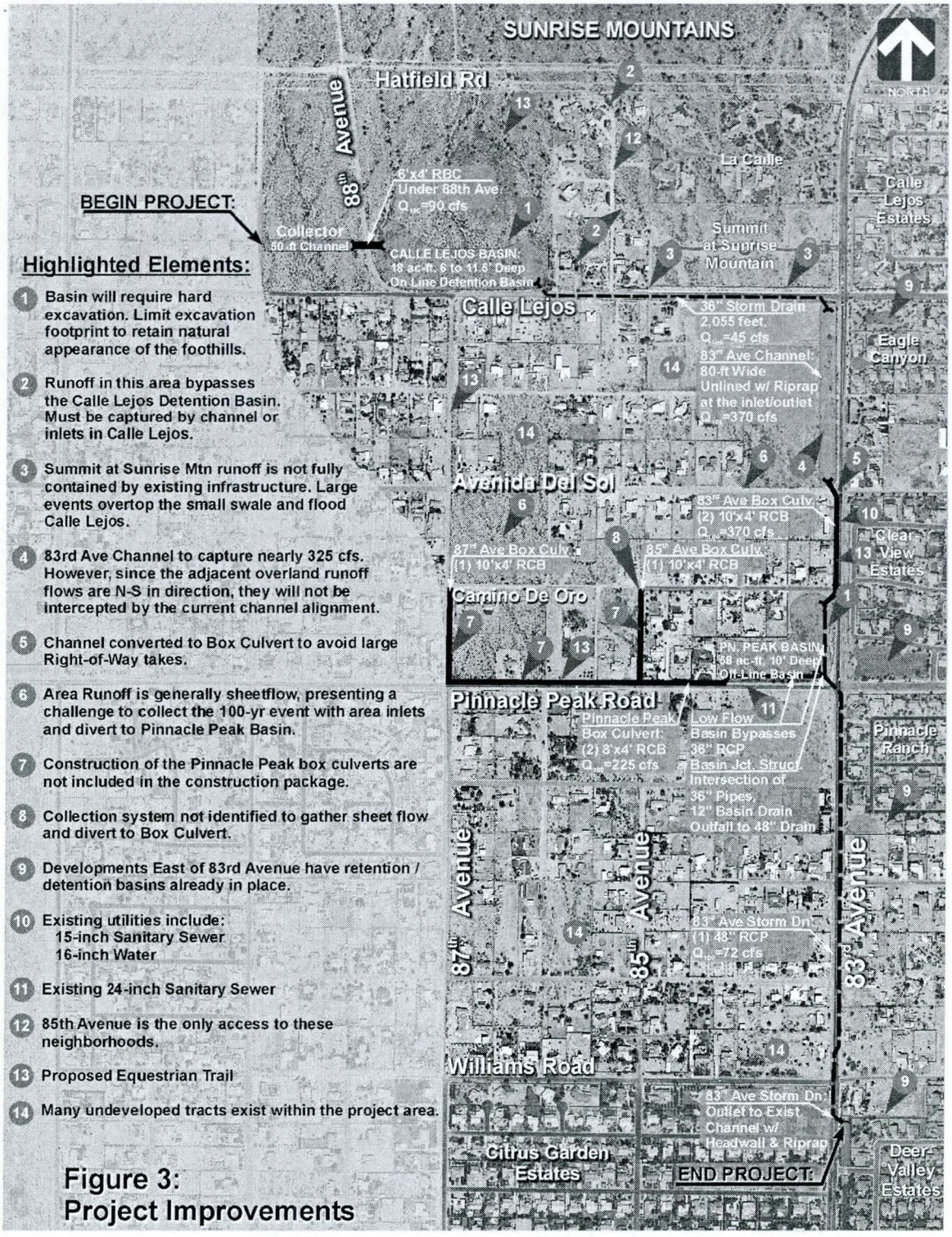


Figure 3-1
ADMP Basin Concept

3.1 ADMP Basin Alternative

The Glendale/Peoria Area Drainage Master Plan Update (ADMP) recommended the construction of a detention basin at the southeast corner of the Peoria 60 property. This basin would be 6' to 11.5' deep and have a capacity of 18 acre-feet. Storm water flowing in a southerly direction but west of the detention basin, would be intercepted by an open channel and conveyed to the detention basin with a concrete box culvert under 87th Avenue.

A review of the Peoria 60 preliminary plat, shown in Figure 3-3, indicated Lots 1, 2, 3, 4, and 5 along with Tract B and a portion of Tract H would provide the capacity required for storm water attenuation. Use of these parcels would also minimize the impact to the development planned for Peoria 60. The drainage basins shown on the preliminary plat along the southern boundary would be used for the open channel collection facility identified in the ADMP.

This basin layout, as shown in Figure 3-4, is north of Calle Lejos and between 85th Avenue and 87th Avenue. Storm water in the natural washes in the eastern portion of Peoria 60 would flow directly to the ADMP Basin. To accommodate multi-use opportunities, basin side slopes were varied from 4:1 to 8:1. Also, area was set aside for parking, pavilions, and restrooms. A perimeter walkway is included along with a boundary fence. This fence is proposed to be a low block wall with wrought iron view fencing on top. Other landscape features are described in Section 6.

Drainage of the detention basin will be provided through an outlet structure in the southeast corner of the facility. This structure will be drained to 83rd Avenue by a 36" diameter storm drain. The proposed detention basin has a maximum depth of eight feet and volume of 18.3 acre-ft. The 100 year 6 hour peak inflow to the basin was determined to be 490 cfs. The peak discharge rate through the 36" diameter storm drain is 49 cfs.

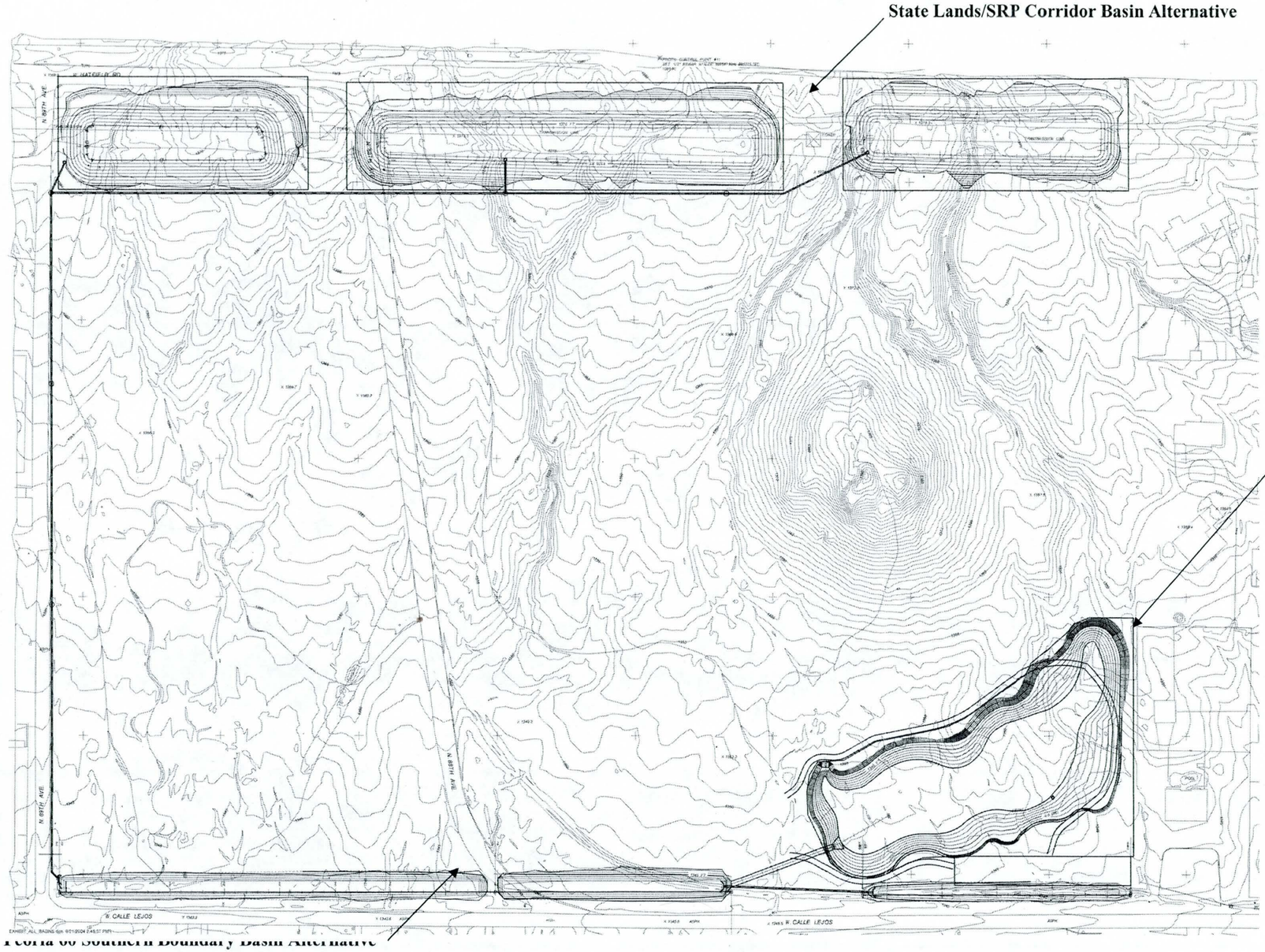


Figure 3-2
Calle Lejos Detention Basin Alternatives

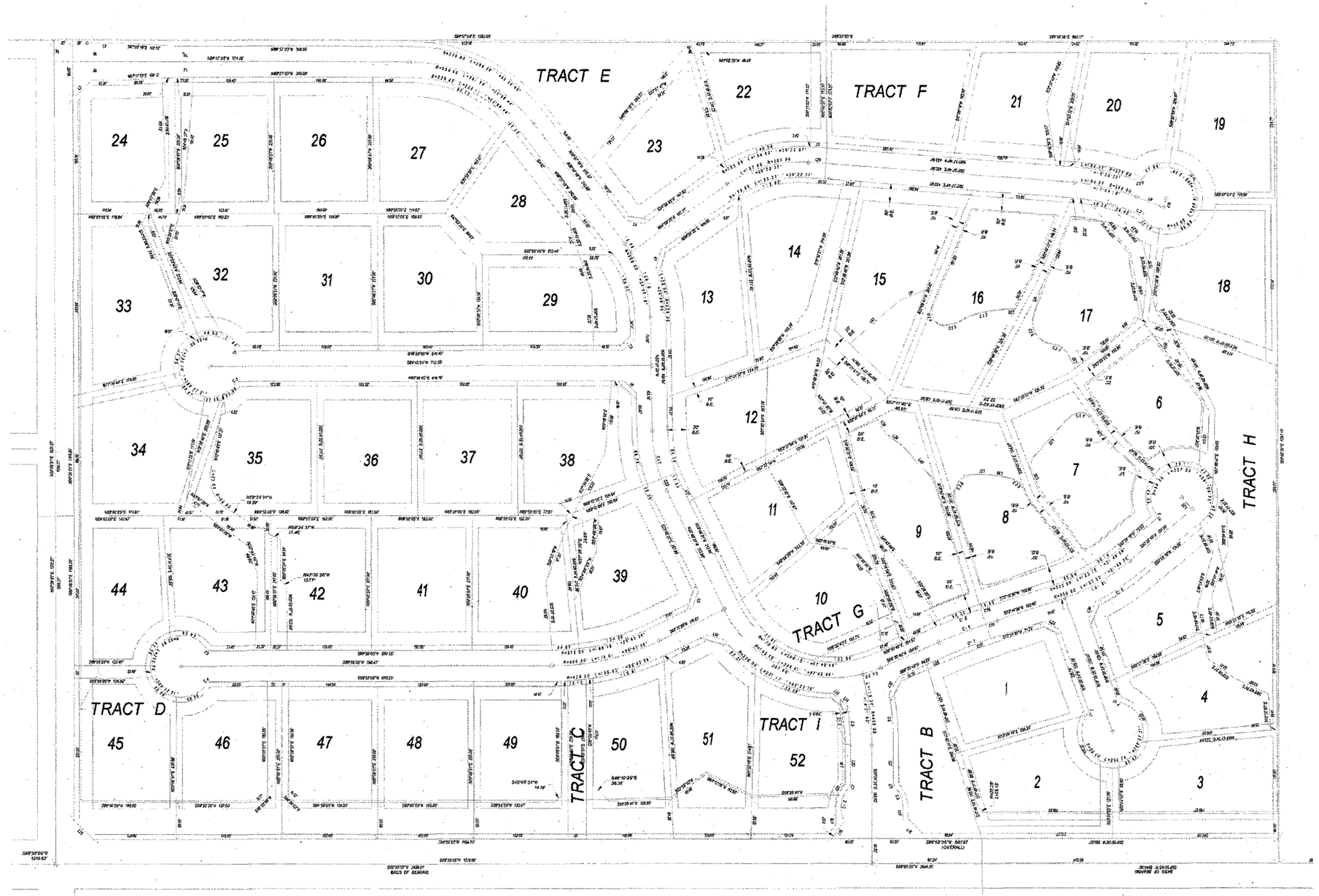


Figure 3-3
Peoria 60 Preliminary Plat

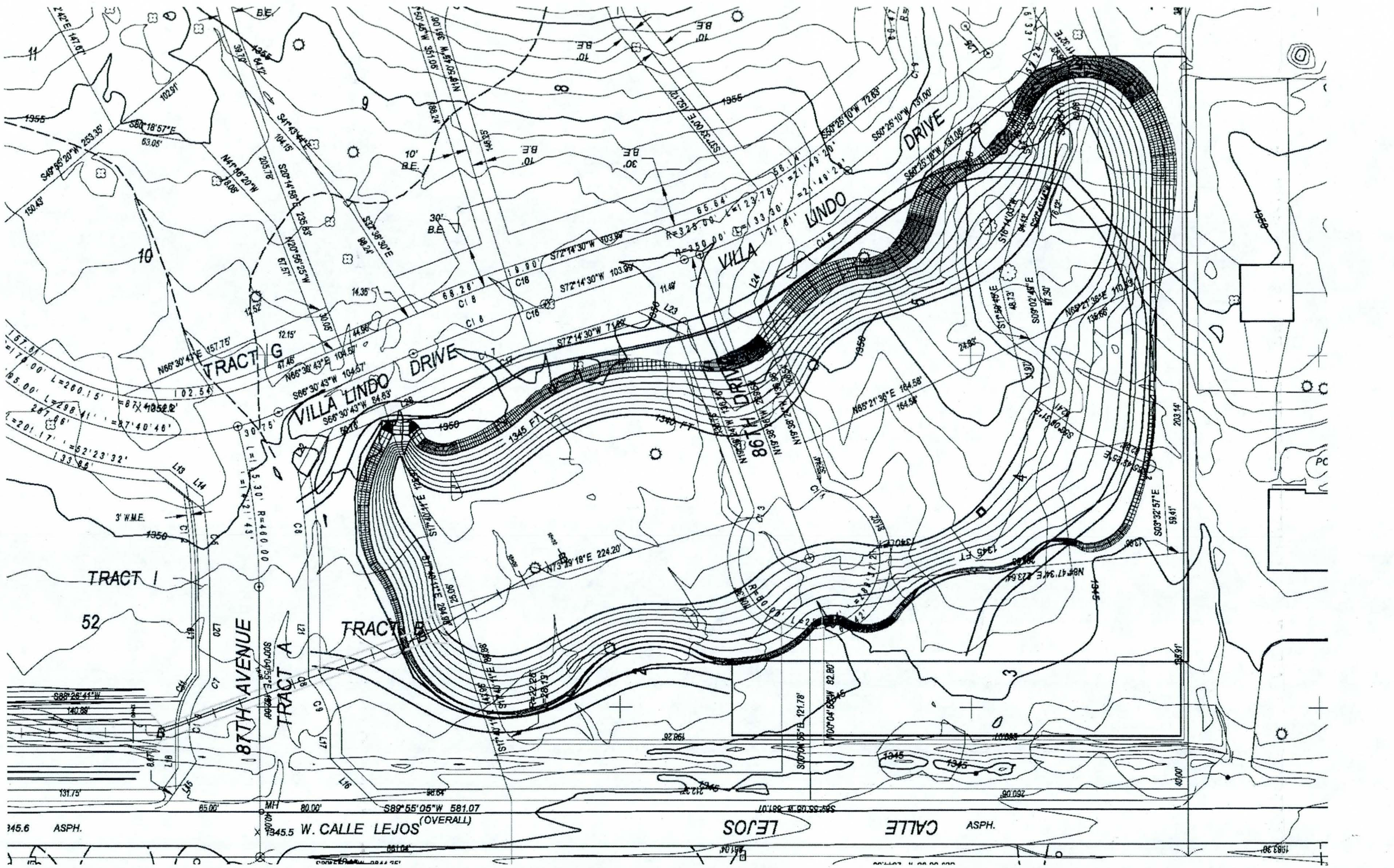


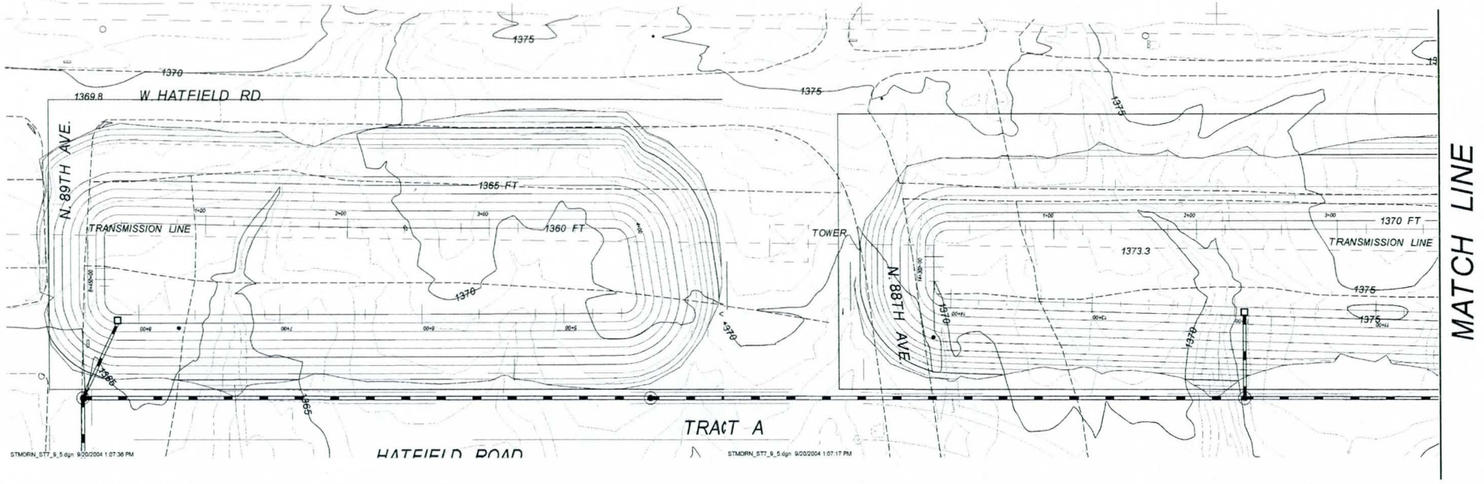
Figure 3-4
ADMP Basin Alternative

3.2 State Lands/SRP Corridor Basin Alternative

North of the Peoria 60 is undeveloped property maintained by the State of Arizona. This parcel is crossed from east to west by SRP overhead electric transmission lines. These facilities lie on a 200 feet wide easement parallel to the Hatfield Road alignment. This alternative includes construction of three separate detention basins on the SRP easement and north of Peoria 60, as shown in Figure 3-5.

These basins will intercept storm water flowing south in natural washes. To construct the basins, it will be necessary to construct an earthen berm across the wash and excavate as needed to provide capacity for the design storm. Due to the topography, the bottom elevation of the most western basin is lowest with the most eastern basin being highest. The three basins will not be connected and will operate independently. A storm drain will be constructed along the south side of the basins and will drain westerly to 89th Avenue, then south to the southwest corner of Peoria 60. At this point the storm drain will discharge into an open channel to be constructed along the northern right-of-way line of Calle Lejos to the southeast corner of Peoria 60. An alternative alignment for the storm drain was along the eastern boundary of Peoria 60 to Calle Lejos. This alignment was shorter but the depths would be excessive. Difficulty in maintaining the storm drain was another reason for recommending the alignment shown in Figure 3-5. Sideslopes of the basins would be 4:1 with basin depths of 6' to 8'. Since no multi-use facilities are planned for this alternative, standard fencing will be included.

Hydrology for this alternative indicates a peak inflow of 222 cfs enters the eastern basin (Subbasin ST7), 63 cfs enters the center basin (Subbasin ST8) and 76 cfs enters the western basin (Subbasin ST9). See Figure 3-6 for these contributing subbasins.



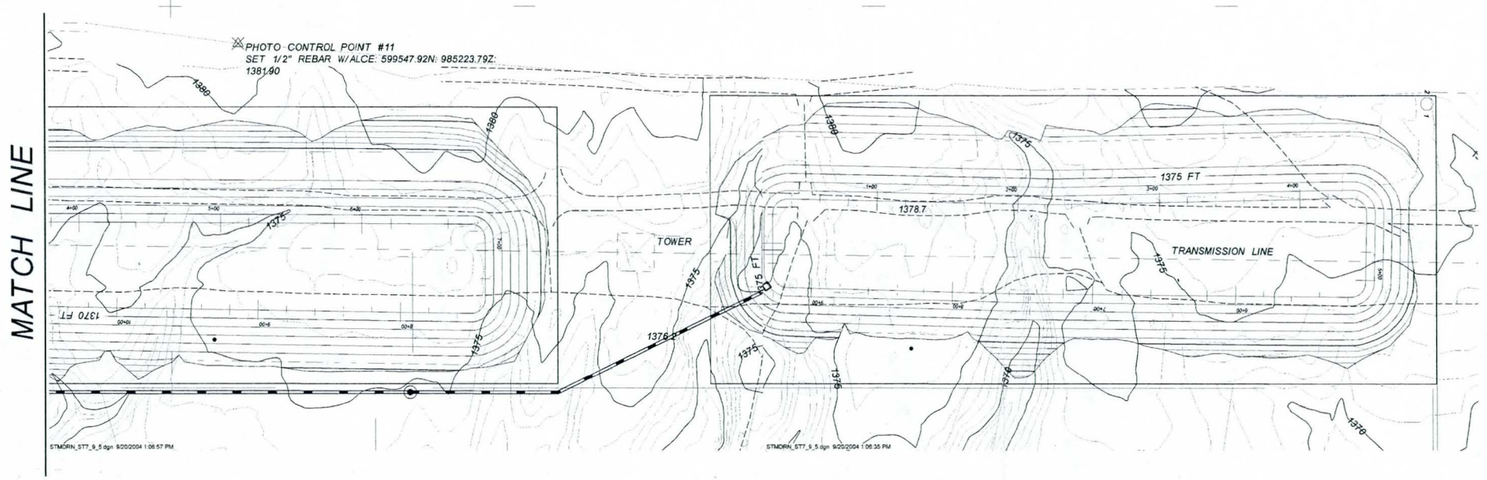


Figure 3-5a
State Lands/SRP Corridor Basin Alternative

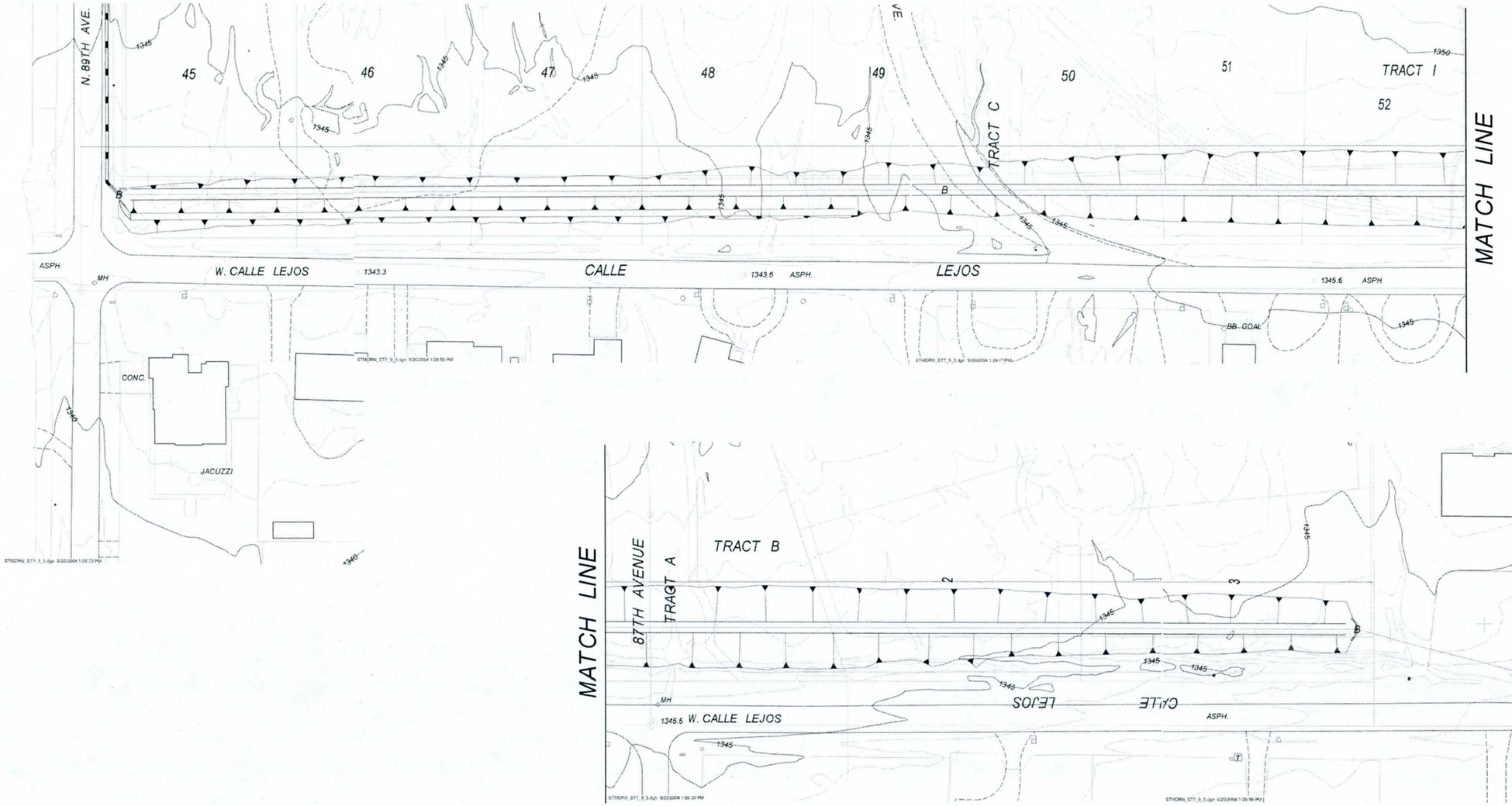
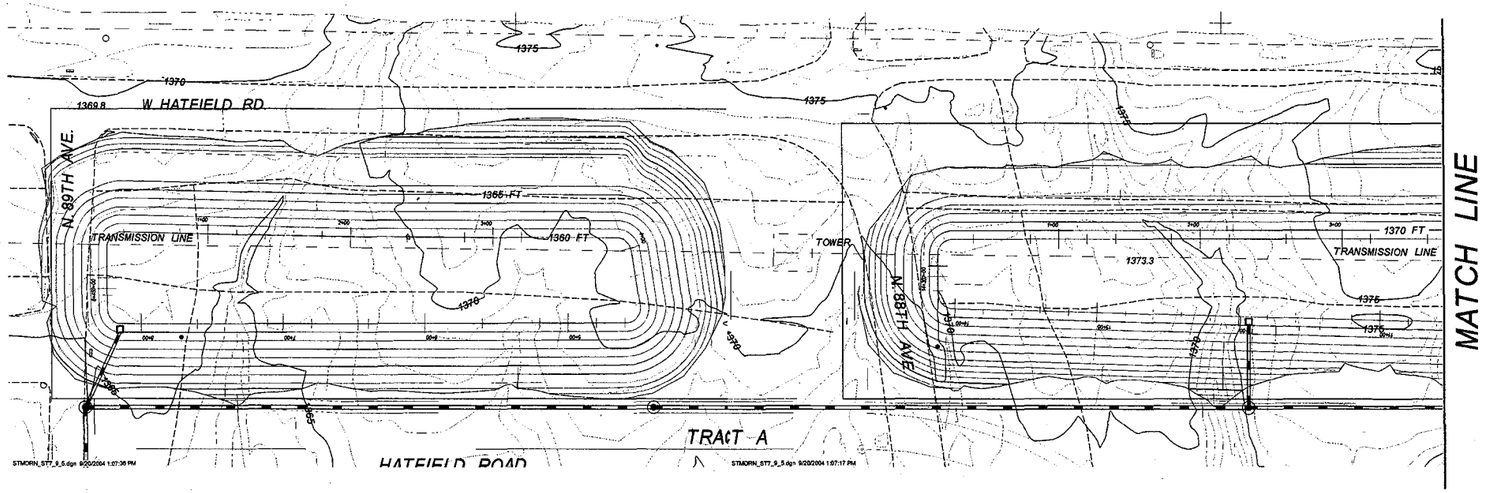


Figure 3-5b
State Lands/SRP Corridor Basin Alternative



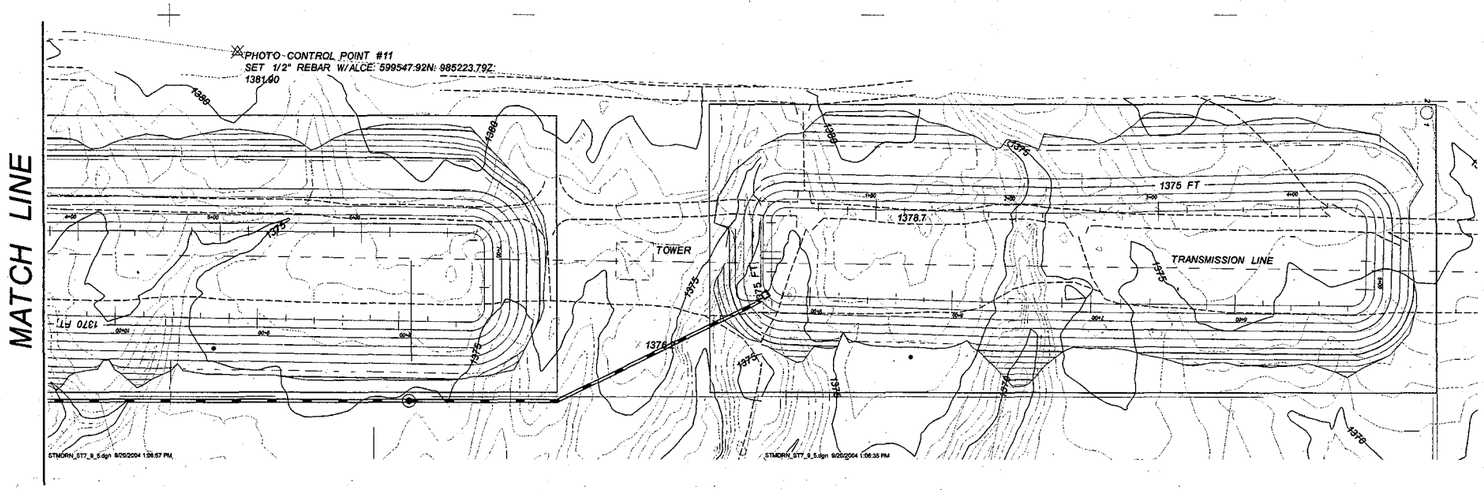


Figure 3-5a
State Lands/SRP Corridor Basin Alternative

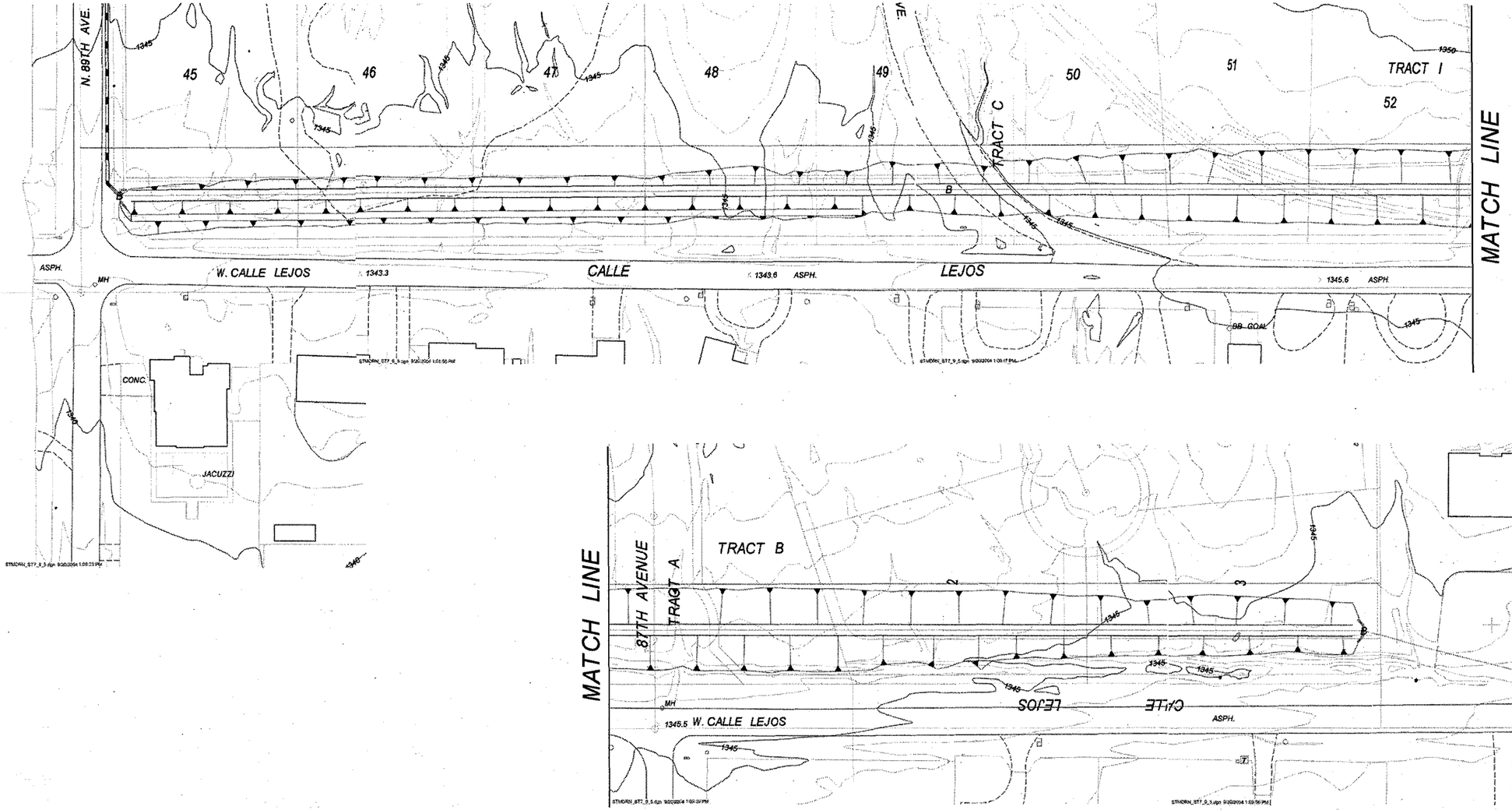


Figure 3-5b
State Lands/SRP Corridor Basin Alternative

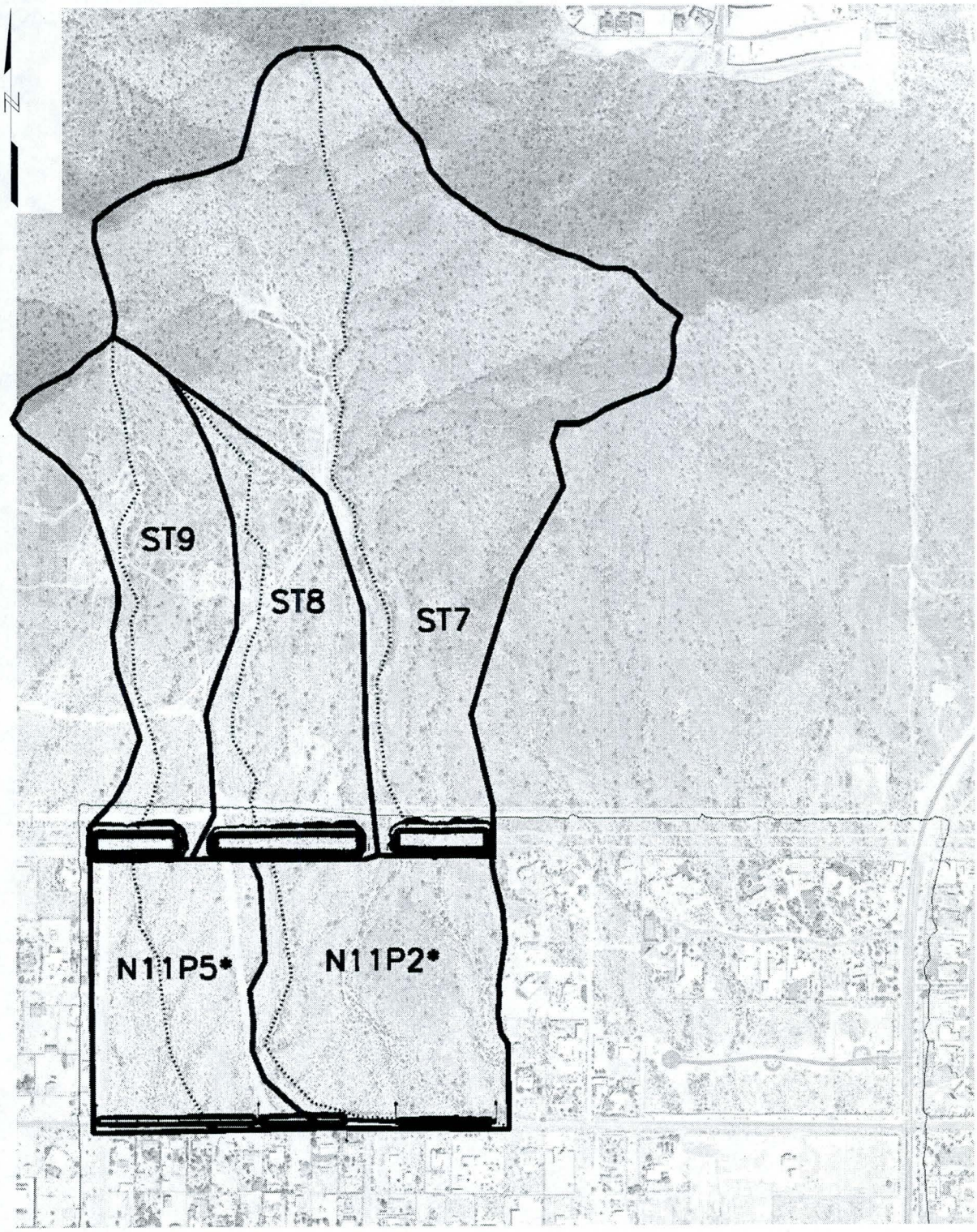
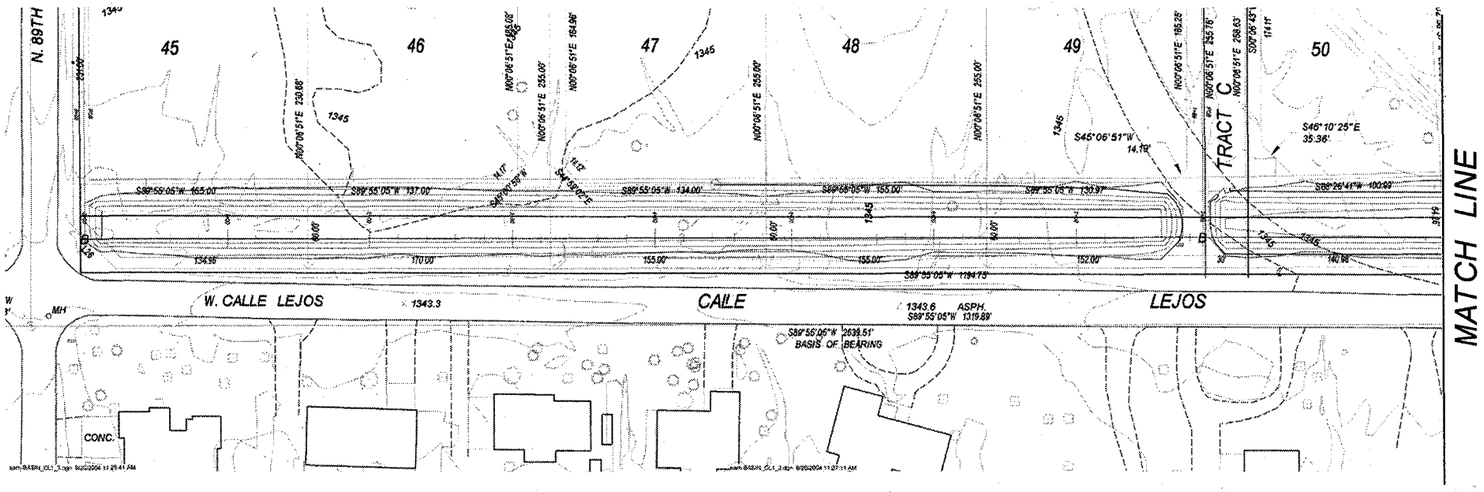


Figure 3-6
State Lands/SRP Corridor Offsite Subbasins

3.3 Peoria 60 Southern Boundary Basin Alternative

The final alternative considered for the Calle Lejos Detention Basin was based on the retention basins planned for the Peoria 60 development along the southern boundary, as shown in Figure 3-7. These basins are identified as DET B2, DET C2, and DET A6 in the Drainage Report for Peoria 60 (Ventana Picachos) by SKG Enterprises, Inc. dated May 20, 2004. Since the basins are planned to be retention facilities, no outlet storm drain has been included. Once the basins are filled excess storm water will spill to the south as sheet flow; therefore, no conveyance facilities are planned for diverting the runoff to 83rd Avenue. It is assumed that these basins will be constructed by the developer at no cost to the District or the City of Peoria. No additional landscaping or multi-use facilities are planned for these basins.



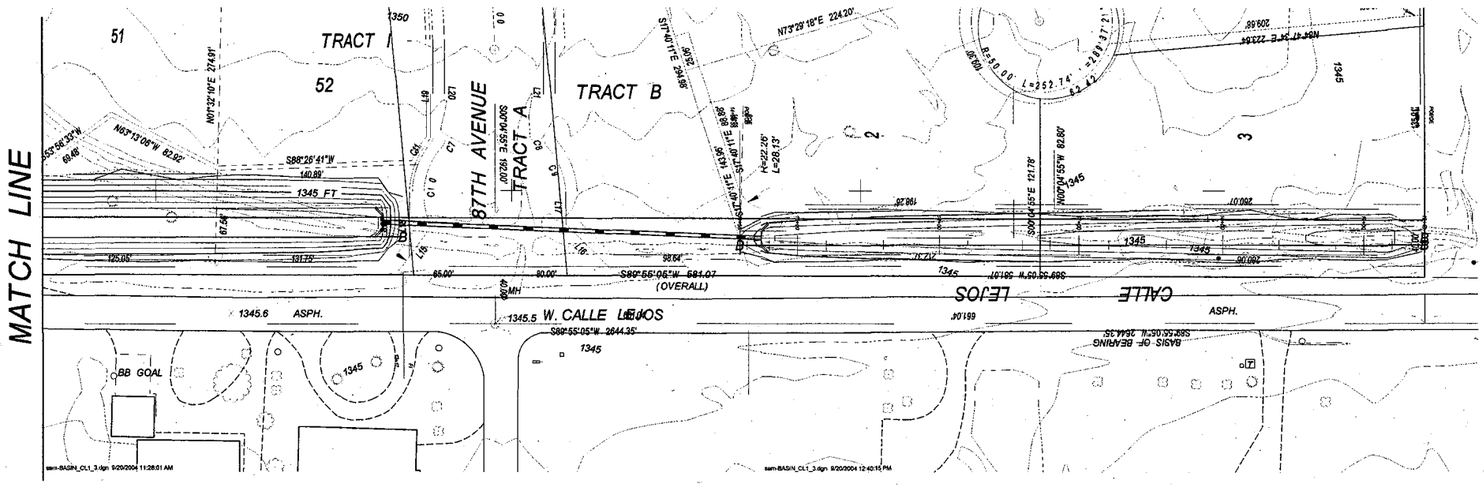


Figure 3-7
Peoria 60 Southern Boundary Basin Alternative

3.4 Alternative Analysis

The three alternatives for the Calle Lejos Basins have been evaluated for several criteria. This review provides a basis for selection of an alternative in a balanced manner. All project improvements downstream of Calle Lejos were considered to be the same for all alternatives and were not included in the analysis. It was assumed that the Peoria 60 development was not constructed except for the retention basins in the Peoria 60 Southern Boundary Basin Alternative. After evaluating each alternative for the various criteria, the results were summarized in the evaluation matrix as shown in Section 3.4.8.

3.4.1 Design Storm

To prepare the HEC-1 models for each alternative, stage-storage and stage-discharge relationships were developed for the various basins. Although freeboard will be provided in the final design, it was assumed this preliminary analysis would not include that factor.

HEC-1 models were prepared using the data shown in Appendix A and used to analyze the hydrologic/hydraulic benefits of each alternative. Since the design criteria established for the project included 100 year storm protection, proposed improvements for the ADMP Basin Alternative and State Lands/SRP Corridor Basin Alternative have a 100 year design storm. Maximum discharge to the outlet storm drain was limited to the rate identified in the ADMP. To determine the flood protection provided by the Peoria 60 Southern Boundary Basin Alternative, the 100 year storm event was used in the HEC-1 model. A review of these results indicated this storm would result in a discharge in excess of the maximum discharge rate identified in the ADMP. See Appendix A for the print outs of all HEC-1 runs. Rainfall data for these analyses was taken from the ADMP HEC-1 model after being checked for accuracy.

3.4.2 Right-of-Way and Utility Impacts

Acquisition of property and easements for the ADMP Basin Alternative may involve significant effort if the property owner is unwilling to negotiate a quick transaction. Although every effort has been made to minimize the impact on the Peoria 60 development, many issues will have to be considered in any discussions with the property owner. Loss of revenue producing lots is an obvious impact to the developers. Other issues include the introduction of public facilities to a gated community, construction of a collector channel along the south boundary, type of perimeter fence around the detention basin, and potential impacts to utilities on 87th Avenue by the collector channel storm drain. Since the Peoria 60 schedule is not known at this time, construction of the collector channel storm drain could impact the developer's construction schedule. Although it is expected the negotiations will have no affect to the project schedule, there is always a possibility that delays could be encountered.

Property requirements for the ADMP Basin Alternative include acquisition of 5.7 acres for the detention basin construction. An additional 2.2 acres of drainage easement or land acquisition would be necessary for the collector channel extending to 89th Avenue.

Property and easement acquisitions requirements for the State Lands/SRP Corridor Basin Alternative are considered to be less difficult. The basins will be located on State Lands which will make acquisition straightforward. During that process it will be necessary to address any potential impact to the SRP facilities on their easement. Storm drains required for draining the detention basins will be located on State Lands or the 89th Avenue right-of-way. A collector channel is proposed to be constructed along the north side of Calle Lejos. Therefore, the property requirements for this alternative are 9.1 acres of drainage easement on State Lands for the detention basins and dewatering storm drain. Along Calle Lejos, 3.4 acres of drainage easement or land acquisition would be necessary for the collector channel. Since few utilities exist along those streets, utility impacts are expected to be minimal.

No property or easements are expected to be required for the Peoria 60 Southern Boundary Basin Alternative. These drainage facilities will be constructed by the developer on property within the Peoria 60 development.

3.4.3 Aesthetics and Multi-Use Opportunities

The City of Peoria has indicated a need for another neighborhood park in the Calle Lejos vicinity. As further described in Sections 5 and 6 of this report, the ADMP Basin Alternative offers significant opportunities for aesthetically pleasing landscaping features and multi-use opportunities. Having a location adjacent to Calle Lejos provides good accessibility for public use of these facilities. This alternative enables the District to meet its goals of providing flood protection facilities that are 'kinder and gentler' than traditional designs.

The aesthetic design for the Calle Lejos basin will center on blending the basin improvements with the surrounding natural setting. The City of Peoria would ultimately like to have a future neighborhood park constructed at this proposed basin. As discussed in Section 2.0, the lack of park space within this neighborhood could be mitigated with the construction of a park at this location. The park improvements, however, will not be constructed as a part of this 83rd Avenue/Pinnacle Peak Road Drainage Improvement project. These amenities would be constructed by the City of Peoria at a future date. To accommodate these planned improvements, the detention basin and associated drainage improvements will include appropriate landscape and aesthetic features. See Figure 3-8.

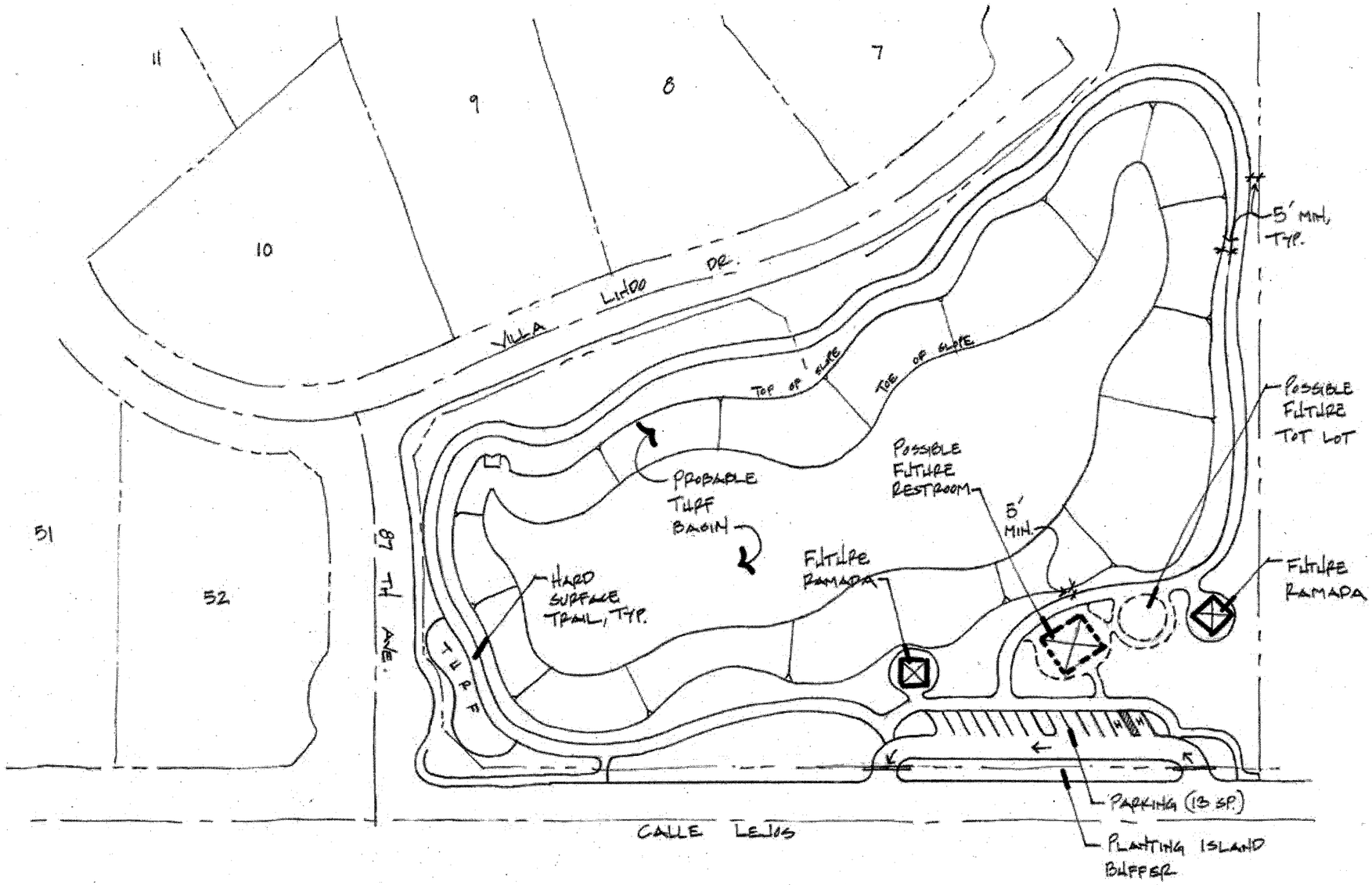


Figure 3-8
Calle Lejos Basin Treatments
Conceptual Neighborhood Park

In terms of aesthetics, the Calle Lejos Basin is located in a very scenic area of the project. The design will need to reflect these surroundings. With the natural bajada landscape character zone just to the north of the basin area, in addition to the Sunrise Mountain views, the scenic quality is outstanding. There is also a very aesthetic landform/boulder outcropping located within close proximity to the proposed Calle Lejos basin. The Peoria 60 development, if constructed, will most likely preserve this outcropping feature. This allows the aesthetics of the future park here to play off of this view. The Calle Lejos Basin aesthetic design should use materials and color schemes that will fit the natural, rugged features of the site. This could be achieved by utilizing large surface-select boulders within the site, as well as by specifying native looking ¼"-minus decomposed granite to give a natural feel to the ground-plane.

The basin improvements, as part of this project, will focus on utilizing a native hydroseed mix within the basin area, along with containerized trees and shrubs accenting this zone. The trees and shrubs will be designed to fit the natural project site, as well as to blend in with the developer's planting scheme for the proposed Peoria 60 subdivision entry. In keeping with City of Peoria standard planting policy, no thorny trees will be used within close proximity to current or future pedestrian travelways. In addition, any drainage structures or headwalls will be stained to a natural color or veneered with native-looking rock or stone veneer to blend with the surroundings. For future park improvements, the ramadas and restroom building should use materials and color schemes that fit with the subdivision theme and surrounding environment. It is anticipated that turf will most likely be used in some capacity for a play zone within the basin when the park is constructed by the City of Peoria. A future tot lot play zone and 13 space parking lot may also be constructed with the future park development.

The construction of a neighborhood park at the Calle Lejos Basin site provides an excellent multi-use opportunity. Until the future park project is constructed, the basin site will be graded and planted as part of this drainage improvement project. The ground-plane landscape treatment will be either hydroseeding with containerized tree/shrub planting, or ¼"-minus decomposed granite treatment with containerized tree/shrub planting. Therefore, until the future park project is built, the basin site will serve as an open space area.

Due to the configuration and location of the State Lands/SRP Corridor Alternative public access would be difficult and therefore no multi-use opportunities are anticipated. The Peoria 60 Southern Boundary Alternative will have aesthetic treatments provided by the developer but no multi-use opportunities exist due to the configuration of the basins.

3.4.4 Environmental Impacts

A Phase I Environmental Site Assessment for the proposed detention basins and associated areas was prepared by URS on September 21, 2004. The Phase I ESA was

performed in accordance with ASTM Standard E 1527-00. It was conducted to identify recognized environmental conditions associated with the project. The following conclusions were indicated in the report.

Based on a review of regulatory information and applicable documentation, no historical Recognized Environmental Conditions were identified at the subject property. Based on the site reconnaissance and a review of regulatory information, no onsite Recognized Environmental Conditions were identified that would environmentally impact the subject property. Based on the site reconnaissance and review of regulatory information, no offsite Recognized Environmental Conditions was identified that would environmentally impact the subject property.

Based on other site reconnaissance, the following other environmental considerations were identified on the subject property.

URS observed several large piles of dirt mounded on a portion of the subject property along 83rd Avenue south of Calle Lejos. The mounds were littered with some construction debris (broken up cement). The exact source of the dirt piles could not be determined. URS did not observe any chemical containers, stained soil, or petroleum odors within or surrounding the dirt piles. URS also observed one small area of asphalt debris along 83rd Avenue south of Pinnacle Peak Road.

A Cultural Resource Survey for Geotechnical Investigations was prepared by URS in July, 2004. The intensive survey identified one historic trash scatter, which was evaluated to have no significant historic values worthy of preservation. Because the site is on private land, it is not governed by the Arizona Antiquities Act, as are the parts of the project on land owned by local governments. Nevertheless, it was recommended that the geotechnical investigations avoid the site until the Arizona State Museum completes review of the report. The three boreholes on the private lot are outside of the site boundary, and they recommended the test pits be located to avoid disturbance of the site. As the design of the project continues, it was recommended that additional surveys be conducted to inventory all areas that could be affected by construction of the project.

No additional consideration of cultural resources is warranted before proceeding with the geotechnical testing. In the event that cultural resources or human remains and associated objects were unexpectedly discovered during drilling or excavation, the District should stop work immediately at that location and take reasonable steps to secure the preservation of those resources. In accordance with the Arizona Antiquities Act, the District should notify the Arizona State Museum and make arrangements for evaluation of the find, assessment of project effects, and development of treatment, if warranted.

A Supplemental Cultural Resource Survey for the project was prepared by URS in September, 2004. The report Conclusion and Recommendations included the following observations. The intensive survey identified only one isolated occurrence of artifacts, which is evaluated as having no significant historic values worthy of preservation. The Phase I survey and Phase 2 survey did not identify any properties recommended for

inclusion in the Arizona Register of Historic Places. Supplemental survey might be required if the State Lands/SRP Corridor Basin Alternative is selected and a flood channel is needed to connect the basin to other elements of the project, or for any other project modifications that might be made as the final design for the project is completed. Otherwise, no additional consideration of cultural resources prior to construction is recommended. In the unlikely event that previously unidentified cultural resources or human remains were to be encountered during project construction, the District should stop work immediately at that location and take reasonable steps to secure the preservation of those resources. In accordance with the Arizona Antiquities Act, the District should notify the Arizona State Museum, and make arrangements for professional evaluation of the find, assessment of project effects, and if warranted, development and implementation of a treatment plan.

3.4.5 Maintenance

The ADMP Detention Basin Alternative would require extensive maintenance for the recreational facilities. Maintenance of the drainage facilities would require periodic cleaning of the collector channel and box culvert under 87th Avenue. Drainage improvements downstream of the detention basin are expected to require similar maintenance efforts and costs; therefore, these impacts have not been included in the Pre-Design Study.

Maintenance requirements for the State Lands/SRP Corridor Basin Alternative are expected to be minimal for the detention basins. Since no multi-use opportunities exist, the basins will have native landscaping and standard fencing requirements. An extensive storm drain system will be necessary to drain the basins and convey the storm water to the Calle Lejos collector channel. Since the runoff is coming from undeveloped land, considerable amounts of sediment and debris is expected to enter the system.

The Peoria 60 Southern Boundary Basin Alternative will be constructed and maintained by the site developers. Therefore, no maintenance cost will be accrued by the Flood Control District or City of Peoria.

3.4.6 Relative Cost

To evaluate the three detention basin alternatives, it was assumed that the costs of all improvements downstream of Peoria 60 are equal. Therefore it would not be necessary to include those costs in this analysis. Since the relative cost is being determined, an extensive study of the unit costs was not included. The unit costs in this report were derived from previous similar drainage projects by the District. Also, other costs including administrative, testing, and public involvement costs were considered to be approximately equal for the three alternatives. The relative cost for the ADMP Basin Alternative was estimated to be $ 2,135,864, as shown in Table 3-1.

Table 3-1
ADMP Basin Alternative Relative Cost

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Excavation - Detention Basin	CY	32,135	$5	$160,675
Excavation - Channel	CY	23,800	8	190,400
Embankment	CY	360	12	4,320
Class "A" Concrete	CY	245	500	122,500
Reinforcement Steel	LB	33,844	3	101,532
24" Reinforced Concrete Pipe	LF	0	50	0
30" Reinforced Concrete Pipe	LF	288	60	17,280
Basin Discharge Structure	EA	1	5,000	5,000
Headwall	EA	0	1,500	0
4' Diameter Manhole	EA	1	3,000	3,000
Concrete Spillway	SY	308	40	12,320
Perimeter View Wall	LF	1,850	30	55,500
Concrete Walkway	SY	1,473	3	4,419
AC Pavement	SY	1,884	3	5,652
Curb and Gutter	LF	1,000	20	20,000
Landscaping	LS	1	100,000	100,000
	Construction Subtotal			**$802,598**
	Contingencies @ 20%			160,520
	Mobilization @ 10%			96,312
	Construction Survey @ 2%			19,262
	Erosion Control @ 1%			9,631
	Quality Control @ 2%			19,262
	Water Supply & Dust Palliative @ 2%			19,262
	Estimate Construction Cost			**$1,126,848**
	Land Acquisition, 173,360 sf @ $4.50			780,120
	Drainage Easement, 61,039 sf @ $3.75			228,896
	Total Relative Cost			**$2,135,864**

For the State Lands/SRP Corridor Basin Alternative, the relative cost was estimated to be $ 2,719,877 as shown in Table 3-2. The unit price for excavation was higher than the ADMP Alternative due to the geological conditions in the area. Land acquisition costs were provided by the District real property appraiser as in the case of the ADMP Alternative.

Table 3-2
State Lands/SRP Corridor Alternative Relative Cost

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Excavation - Detention Basin	CY	36,145	$12	$433,740
Excavation - Channel	CY	36,782	8	294,256
Embankment	CY	2,392	12	28,704
Class "A" Concrete	CY	0	500	0
Reinforcement Steel	LB	0	3	0
24" Reinforced Concrete Pipe	LF	788	50	39,400
30" Reinforced Concrete Pipe	LF	2,093	60	125,580
Basin Discharge Structure	EA	3	5,000	15,000
Headwall	EA	1	1,500	1,500
4' Diameter Manhole	EA	7	3,000	21,000
Concrete Spillway	SY	0	40	0
Perimeter View Wall	LF	4,725	30	141,750
Concrete Walkway	SY	0	3	0
AC Pavement	SY	0	3	0
Curb and Gutter	LF	0	20	0
Landscaping	LS	1	125,000	125,000
	Construction Subtotal			**$1,225,930**
	Contingencies @ 20%			245,186
	Mobilization @ 10%			147,112
	Construction Survey @ 2%			29,422
	Erosion Control @ 1%			14,711
	Quality Control @ 2%			29,422
	Water Supply & Dust Palliative @ 2%			29,422
	Estimate Construction Cost			**$1,721,206**
	Land Acquisition, 396,396 sf @ $1.84			729,369
	Land Acquisition, 55,845 sf @ $4.50			251,302
	Drainage Easement, 4,800 sf @ $3.75			18,000
	Total Relative Cost			**$2,719,877**

The Peoria 60 Southern Boundary Basin Alternative has no relative cost since all improvements will be paid by the developer.

3.4.7 Geotechnical Investigations

Speedie and Associates were retained by Jacobs Civil to perform a geotechnical investigation for the project site. A draft Report on Geotechnical Evaluation was submitted on August 16, 2004. This section provides a summary of the results from those investigations.

The proposed detention basins are located in undeveloped areas with moderate to thick native desert vegetation. The State Lands/SRP Corridor Basin, which has more pristine desert conditions, is located in an area where several medium sized washes traverse the terrain in a southerly direction. The ADMP Basin is located within several undeveloped lots, surrounded by residential neighborhoods and streets. The area appears to be relatively flat with a slight slope to the south. Several minor washes were noted at this site.

Subsoil conditions generally consist of clayey sand and sandy clay with occasional zones of silty sand, poorly graded sand, and clayey gravel. These soils generally become harder with depth and are comprised of moderate to strong calcareously cemented silty sand and clayey sand. Occasional layers with varying amounts of gravel were encountered. Borings placed in the State Lands/SRP Corridor Basin area indicate a strong calcareously cemented layer of silty clayey sand with gravel and likely cobble at a depth between 5 and 12 feet on which auger refusal was encountered.

No groundwater was encountered during this investigation. Depending on the time of year, groundwater and floodwaters may be an issue near the washes. Based on visual and tactile observation, the soils were in a dry or dry to moist state at the time of the investigation.

A total of 20 borings were drilled from July 15, 2004 to July 23, 2004. This included 12 borings in the channel and storm drain areas and 8 borings in the proposed detention basin areas. Laboratory testing consisted of moisture content, dry density, moisture-density relationships, consolidation tests, grain size distribution, and plasticity tests for classification purposes. Laboratory minimum resistivity, soluble sulfate and pH tests were conducted for corrosivity analysis and several agronomic analyses were performed to ascertain the suitability of the areas for landscaping vegetation.

Laboratory testing indicates in-situ dry densities of the upper soils on the order of 90 to 123 pounds per cubic foot with a range of 3.6 to 6.5 percent moisture at the time of investigation. Liquid limits ranged from "non-plastic" to 42 percent. Plasticity indices range from "non-plastic" to 25 percent. The fraction finer than the No. 200 sieve ranges from 12 to 69 percent. Laboratory resistivity tests indicated results ranging from 1074 to 8,723 ohm-cm in the saturated state and pH values of 7.2 to 8.6. Sulfate contents ranged from 0.0009% to 0.0026%. Chloride contents ranged from 0.0007% to 0.0219%. All field and laboratory date were presented in the draft report.

Recommendations were made with respect to pipe bedding, backfill and fill in non-building areas. Soil corrosion potentials were also addressed. For excavations, it was determined that the State Lands/SRP Corridor Basin area would require very aggressive excavation means for cuts deeper than 5 feet. At the ADMP Basin area, more aggressive excavation would be required for depths more than 10 feet. These characteristics have been reflected in the unit prices for excavation at the particular location.

3.4.8 Evaluation Matrix

To provide a meaningful and objective means to evaluate the three alternatives, an evaluation matrix was prepared, shown in Table 3-3. The first task was to establish pertinent criteria on which the alternatives would be scored. Meetings with the District, City of Peoria and other stakeholders resulted in six criteria to be evaluated: design storm, relative cost, right-of-way and utility impacts, environmental impacts, maintenance, and aesthetics and multi-use opportunities. Since each criteria was considered to have a different relative value, discussions with the stakeholders were held to rank the criteria by importance. These relative values were established as follows.

Design Storm	35%
Relative Cost	25%
Right-of-Way and Utility Impacts	5%
Environmental Impacts	20%
Maintenance	5%
Aesthetics and Multi-Use Opportunities	10%
Total	100%

Since the purpose of this project is flood protection, the design storm or level of protection was considered to be the most important. The goal of the project is to provide a facility design to accommodate the 100 year storm event. Occasionally it is not possible for that goal to be attained, so the District has participated in projects with a design storm of 50 years or less. Projects with a level of protection less than 10 years are considered to be local improvements traditionally constructed and maintained by the jurisdictional government.

Relative cost is another extremely important issue. Funds from the District and City of Peoria are limited. It is crucial that the available funding is used to maximize the benefits to citizens. As costs rise, the number of projects and size of projects are decreased. In evaluating the alternatives it was not possible to develop the total project costs. By estimating the relative cost of each alternative, the budgetary impacts will be given the necessary consideration.

Right-of-way impacts are limited to the difficulty in acquiring the needed property and the impact this effort may have on the schedule. The cost of right-of-way has been included in the relative cost and is not considered here. Utility impacts can relate to service interruptions to users, relocation costs to be borne by the utility and its users, and

restrictions to utility facilities. Although this issue is important, it was determined to be significantly less important than other criteria.

Table 3-3
Alternative Evaluation Matrix

Criteria / Weighted Value	Design Storm 35%	Relative Cost 25%	Right-of-Way and Utility Impacts 5%	Environmental Impacts 20%	Maintenance 5%	Aesthetics and Multi-Use Opportunities 10%	Total Score 100%
Alternative 1 - ADMP	5	3	3	3	3	5	3.9
Alternative 2 - State Lands	5	1	1	1	4	1	2.6
Alternative 3 - Peoria 60	0	5	5	5	5	1	2.9

Scoring Methodology

Design Storm
Level of flood protection provided by alternative

- 5 - 100 year Protection
- 3 - 50 year Protection
- 1 - 10 year Protection

Relative Cost
Includes land acquisitions and improvements to detain storm water and convey to southeast corner of Peoria 60 property

- 5 - Lowest Cost
- 3 - Median Cost
- 1 - Highest Cost

Right-of-Way and Utility Impacts
Difficulty of acquistions and/or utilities may cause delays to project schedule

- 5 - No Acquisitions Required and/or No Utility Impacts
- 3 - Average Acquisitions Effort and/or Minimal Utility Impacts
- 1 - Difficult Acquisitions and/or Major Utility Impacts

Environmental Impacts
Includes cost of mitigation, archeological and biological impacts and potential hazardous materials

- 5 - No Environmental Impacts
- 3 - Minimal Environmental Impacts
- 1 - Severe Environmental Impacts

Maintenance
Includes expected maintenance costs and ease of maintenance and ooperations and maintenance access issues

- 5 - Maintenance Efforts Minimal
- 3 - Average Maintenance Expected
- 1 - High Levels of Maintenance Required

Aesthetics and Multi-Use Opportunities
Public access, area recreational needs, aesthetics for users and neighbors

- 5 - Attractive Improvements with Multi-Use Facilities
- 3 - Attractive Improvements with no Multi-Use Facilities
- 1 - Minimal Aesthetics and no Multi-Use Facilities

3.5 Recommendations

As shown in the evaluation matrix, the ADMP Basin Alternative is clearly the best option. Since the Peoria 60 Alternative provides no flood protection, it cannot be considered a viable choice. Between the ADMP Basin Alternative and the State Lands/SRP Corridor Basin Alternative, the ADMP Basin Alternative is superior in every category except maintenance. Even in that area, the State Lands/SRP Corridor Alternative is only slightly more favorable. That option does not have the recreational facilities to be maintained, but the basins are less accessible and the lengthy storm drain pipe will require considerable inspection and cleaning.

Based on this Pre-Design Study, the ADMP Basin Alternative was found to provide 100 year flood protection with less cost, fewer property impacts and greater aesthetics with multi-use opportunities. It is recommended that final design be initiated with this alternative.

Section 4
Pinnacle Peak Detention Basin

The Pinnacle Peak detention basin was included in the ADMP recommendation. The location of the basin was identified as being the northwest corner of Pinnacle Peak Road and 83rd Avenue. The ADMP concluded that this basin should be an off-line facility. The basin is projected to be approximately 10 foot in depth and provide 58 acre-ft of capacity.

Storm water would be conveyed to the basin by storm drains on the west side of 83rd Avenue and the north side of Pinnacle Peak Road. Side weir diversion structures will discharge peak flows to the basin while low flows would bypass the basin in 36" diameter storm drains. A 12" diameter storm drain will dewater the basin after the storm event to a junction structure at 83rd Avenue and Pinnacle Peak Road. This junction structure would also be connected to the 36" diameter bypass storm drains. Storm water from the junction structure would enter a 48" diameter storm drain to be constructed on the west side of 83rd Avenue. This storm drain would outlet into the 83rd Avenue channel at Deer Valley Estates.

4.1 Preliminary Layout

The Pinnacle Peak Detention Basin will be located on a 6.2 acre parcel owned by the City of Peoria at the northwest corner of 83rd Avenue and Pinnacle Peak Road. This tract is adjoined by single family residences to the northwest and by Camino De Oro to the north. The initial layout provided a 20 foot access area on the perimeter and 4:1 slopes to the bottom with a 10 foot depth. Project landscape architects have identified a potential opportunity for an equestrian staging facility. To accommodate that use, side slopes were flattened and a raised area in the center developed so that a dry section would be available during low flow conditions. As shown in Figure 4-1, access to the equestrian facilities would be from Pinnacle Peak Road. See Figures 4-2 and 4-3 for proposed basin treatments.

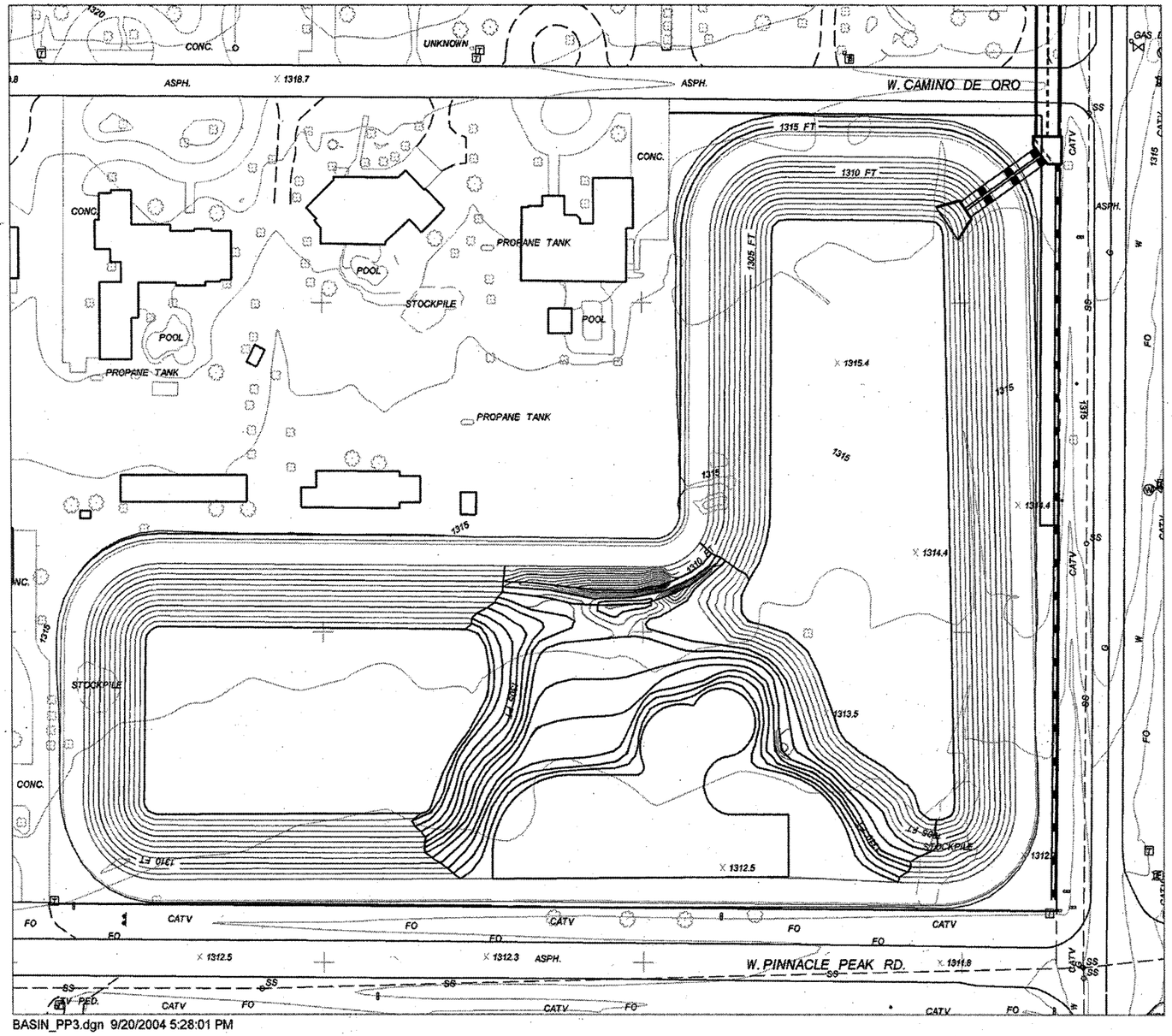


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Figure 4-1
Pinnacle Peak Road Basin Layout

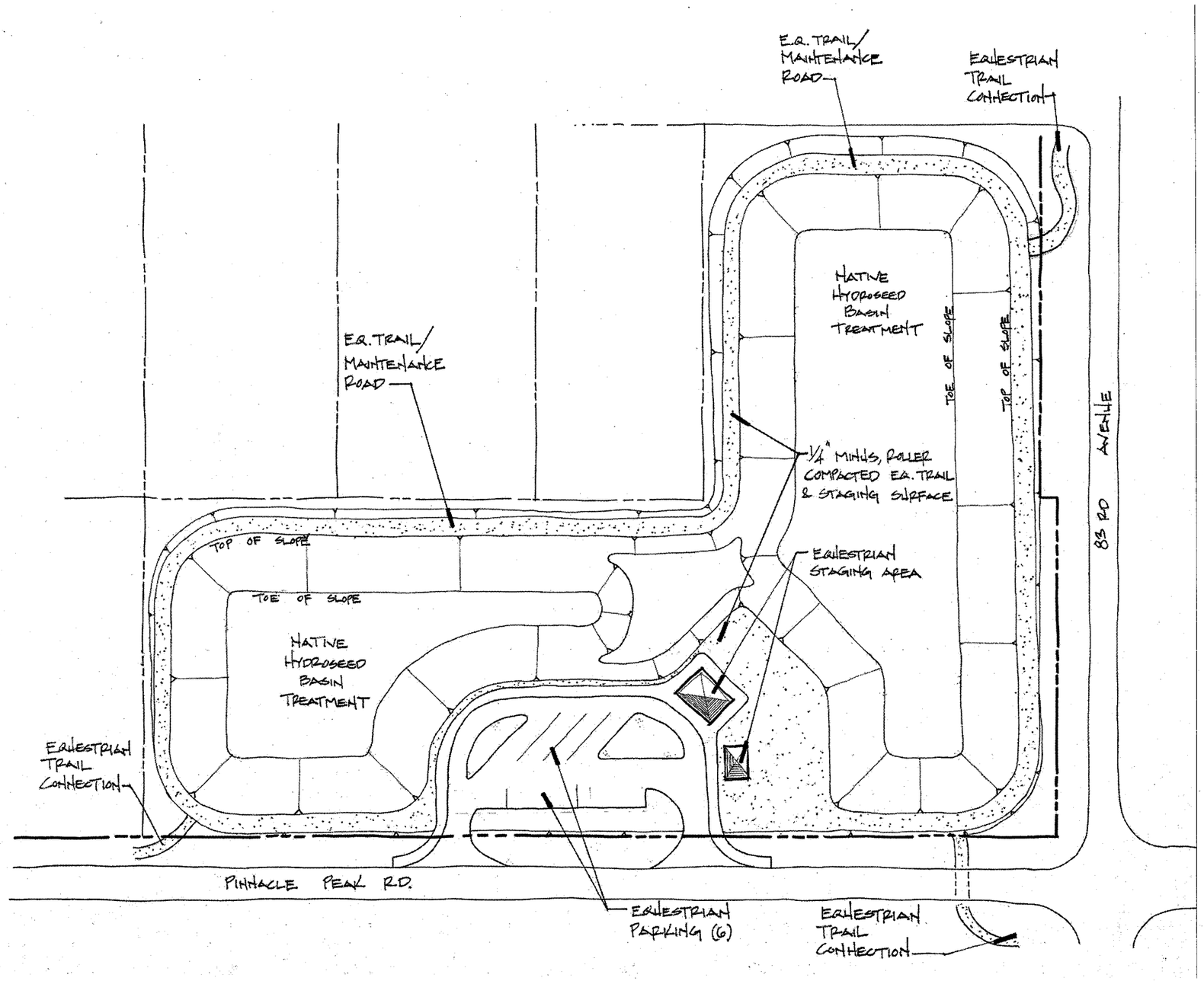


Figure 4-2
Pinnacle Peak Road Basin Treatments
Conceptual Equestrian Facility

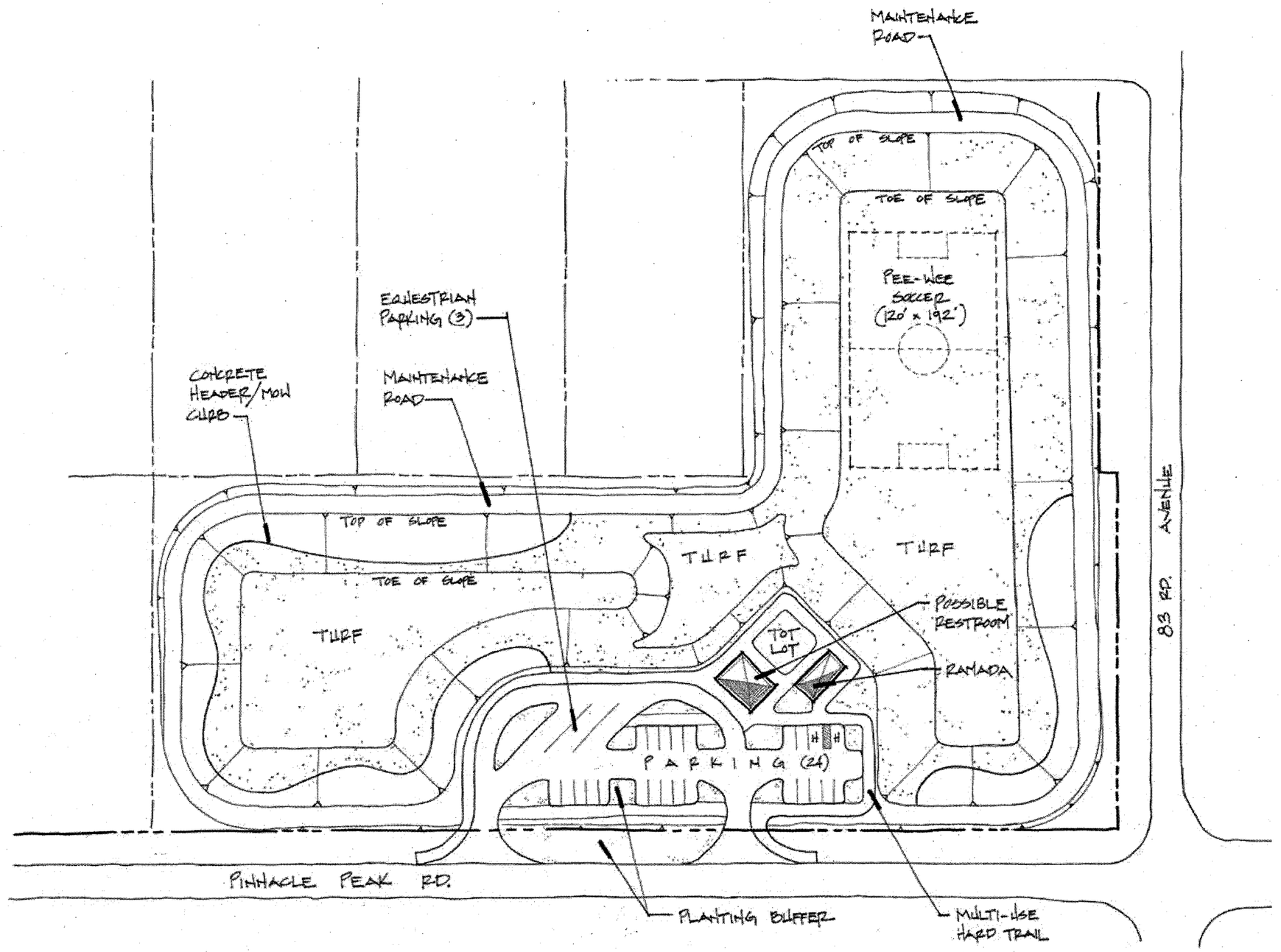


Figure 4-3
Pinnacle Peak Road Basin Treatments
Conceptual Neighborhood Park

4.2 Capacity

This basin layout will provide 41.1 acre-ft of storage between elevations 1313 MSL and1301 MSL. Since this provides more capacity than is necessary, additional landscaping requirements and freeboard should easily be accommodated.

4.3 Hydrology and Hydraulic Features

The Pinnacle Peak Road detention basin is an offline basin designed to collect storm water flows that are routed along 83rd Avenue and Pinnacle Peak Road. The offline basin configuration was chosen to minimize the required volume size and to prevent nuisance flows from entering the basin.

The basin inflow points are located on the west and the north ends of the detention basin. At the north a 1-8'x4' concrete box culvert connects to a junction structure. The junction structure acts to split the inflows between a 36" diameter bypass storm drain and the detention basin. The bypass conduit is reinforced concrete pipe with a 1% slope and full capacity estimated to be 70 cfs. Excess flows are diverted with a weir and spillway into the basin bottom.

The west side inflow is conveyed through two 60" diameter storm drains. These pipes will connect to a similar splitter structure at the west end of the basin. A 36" diameter pipe acts to divert flows up to 70 cfs while excess flows are conveyed with a weir and spillway. The detention basin shall be drained after the event through a grate inlet and 12" diameter reinforced concrete pipe. The basin shall be designed to drain within the required 36 hours.

Flows diverted by the 36" diameter pipes shall be routed to another junction structure downstream. The junction structure shall be drained with a 48" diameter reinforced concrete pipe and will outfall at the Deer Valley Estates 83rd Avenue channel, south of Williams Road. The specific configuration will be refined during the design phase of this project.

4.4 Aesthetics and Multi-Use Opportunities

The City of Peoria has indicated that it intends to construct an equestrian staging area at the Pinnacle Peak Basin. Later when this area is annexed into the City of Peoria, the City will construct a neighborhood park at this site. Neither the equestrian facility, nor the park, however, will be constructed with this current drainage improvement project.

In terms of multi-use opportunities, the possibility of the City of Peoria constructing a neighborhood park or equestrian facility at this site provides an excellent multi-use scenario. The Pinnacle Peak Basin, being located adjacent to an existing equestrian trail east of 83rd Avenue, makes this basin an excellent site for an equestrian staging area that will allow linkages to equestrian trails to the north along the 83rd Avenue and Hatfield Road alignments and immediately to the west along Pinnacle Peak Road. The City of Peoria has expressed interest for an ultimate build-out of the Pinnacle Peak Basin to a neighborhood park that would accommodate both equestrian and pedestrian uses. Until the future equestrian staging area is constructed by the City of Peoria, the basin site will be graded and planted as part of this drainage improvement project. The ground-plane landscape treatment will be either hydroseeding with containerized tree and shrub planting, or ¼"-minus decomposed granite treatment with containerized tree and shrub planting. The landscape theme will be a Sonoran Desert-based xeriscape planting theme that will also incorporate some of the lush stylized suburban landscape character of the adjacent subdivision developments in order to blend with the developments aesthetically.

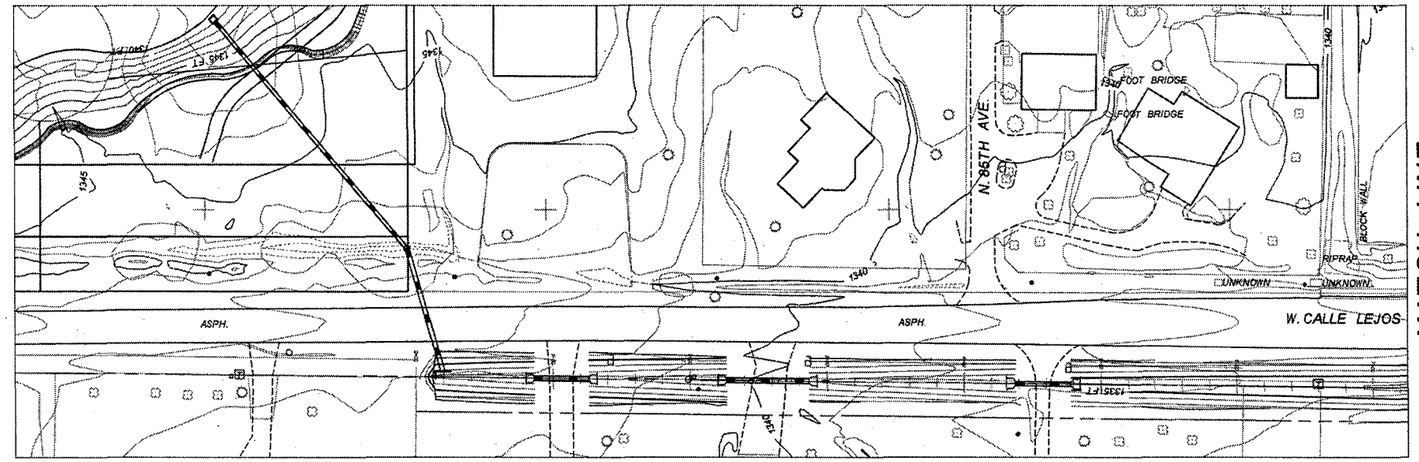
The future equestrian parking lot and associated trails will be constructed of a material such as roller-compacted ¼" minus decomposed granite or stabilized decomposed granite. Both of these surfaces make for an acceptable equestrian surface, and will allow the aesthetics to blend in with the scenic character of the project area. Any hard surface multi-use trail for pedestrians, bicycle riders, etc. will be concrete or asphalt. At the time of the future potential neighborhood park build-out, the proposed architecture of ramadas and restroom facilities will be unobtrusive and of a style and color to blend with the adjacent developments.

Section 5
Open Channels and Closed Conduit System Analyses

To convey runoff from and to the detention basins, a number of storm drains will be required. An alternative to these storm drains is construction of open channels. The primary segments to be evaluated are Calle Lejos between Peoria 60 and 83rd Avenue, 83rd Avenue between Calle Lejos and Avenida Del Sol and Pinnacle Peak Road between 87th Avenue and 83rd Avenue. In each of these segments, issues to be considered include cost, right-of-way requirements and acquisitions, aesthetics, hydraulic capabilities, and utility conflicts.

5.1 Calle Lejos Storm Drain

Review of the area hydrology indicated the need to intercept runoff flowing south across Calle Lejos between Peoria 60 and 83rd Avenue. This storm water contributes to the flooding conditions downstream, particularly at Avenida Del Sol. The two alternatives considered include an open channel with depth to drain the Calle Lejos detention basin system and capacity to convey this discharge and the intercepted runoff from the north to 83rd Avenue. The second alternative is a storm drain pipe with a series of catch basins to intercept the flows from the north. A small V-ditch would be constructed between the catch basins to convey minor flows not directed toward the catch basins. Both alternatives would have a capacity of 48 cfs at Peoria 60 and 307 cfs at 83rd Avenue. These alternatives have been shown in Figure 5-1.



Open Channel Alternative

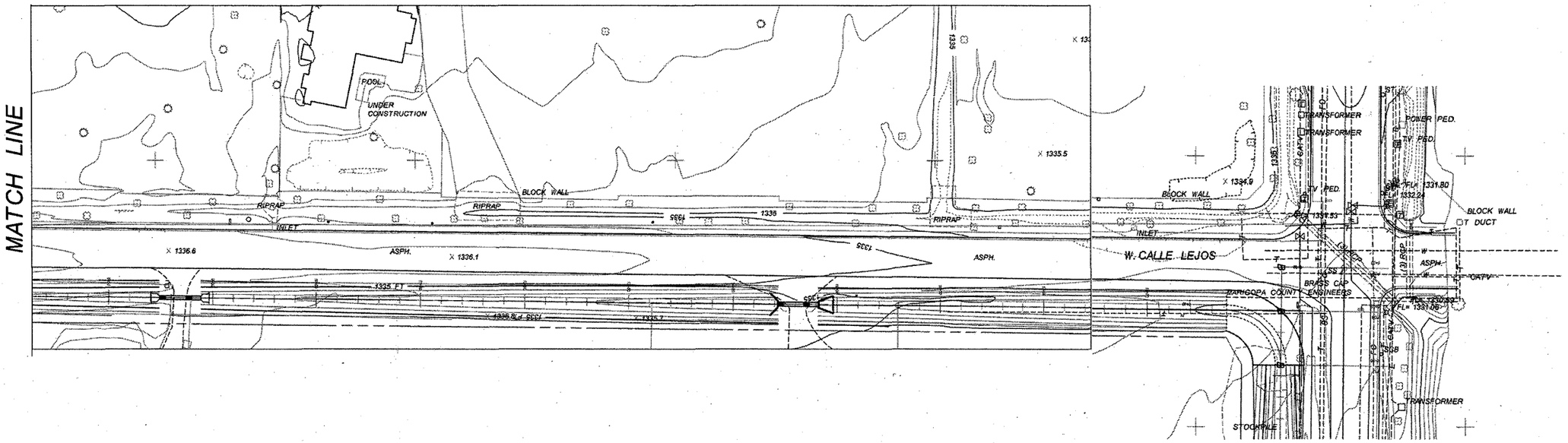
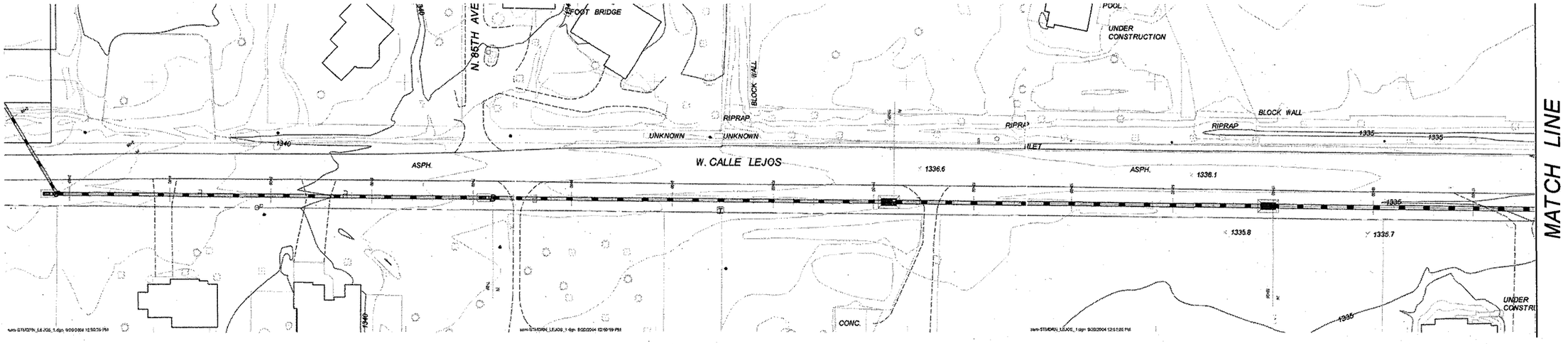


Figure 5-1a
Calle Lejos Storm Drain Alternatives



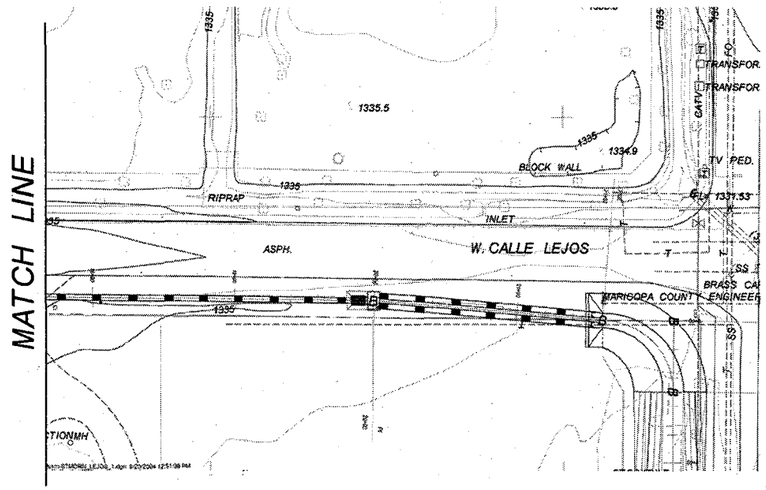


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Figure 5-1b
Calle Lejos Storm Drain Alternatives

The relative cost of the open channel is $259,345 with the closed conduit system being $252,327, as shown in Tables 5-1 and 5-2. To accommodate the channel, an additional 25' of right-of-way or 1.1 acres would be required. Construction would require adjustments to driveways, fences, sidewalks, and landscaping. The channel alternative would have significantly more impact on adjoining properties. The closed conduit system would be comprised of reinforced concrete pipe in sizes from 36" to 48" diameter. It is expected the storm drain pipe and catch basins could be located on existing right-of-way. Pleasing aesthetics would be more difficult for the open channel alternative. The depth of the channel would be approximately 4 feet creating a significant challenge to produce an attractive landscape theme. Headwalls and culverts would be required at each driveway. For hydraulic performance, the open channel would clearly be preferable. Identifying the location of concentration points for the runoff from the north would not be as critical. The closed conduit system would be vulnerable to clogging by debris at catch basins; however, site visits indicated that little debris was present and the type of catch basins proposed are designed to be less impacted by debris. Since the only utilities along Calle Lejos in this vicinity are along the north side of the street, utility conflicts would be limited to water service lines to existing residences. It is expected the conflicts would not be more difficult for one alternative over the other.

Based on this analysis, the closed conduit system is preferable because it is essentially the same cost but is much less disruptive to properties and allows for more pleasing aesthetics.

Table 5-1
Calle Lejos Open Channel Alternative

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Excavation - Detention Basin	CY	0	$5	$0
Excavation - Channel	CY	5,577	8	44,616
Embankment	CY	0	12	0
Class "A" Concrete	CY	0	500	0
Reinforcement Steel	LB	0	3	0
36" Reinforced Concrete Pipe	LF	140	65	9,100
42" Reinforced Concrete Pipe	LF	40	70	2,800
48" Reinforced Concrete Pipe	LF	40	80	3,200
Basin Discharge Structure	EA	0	5,000	0
Headwall	EA	3	2,000	6,000
4' Diameter Manhole	EA	0	3,000	0
Concrete Spillway	SY	0	40	0
Perimeter View Wall	LF	0	30	0
Concrete Walkway	SY	0	3	0
AC Pavement	SY	0	3	0
Curb and Gutter	LF	0	20	0
Landscaping	LS	1	20,000	20,000
	Construction Subtotal			**$85,716**
	Contingencies @ 20%			17,143
	Mobilization @ 10%			10,286
	Construction Survey @ 2%			2,057
	Erosion Control @ 1%			1,029
	Quality Control @ 2%			2,057
	Water Supply & Dust Palliative @ 2%			2,057
	Estimate Construction Cost			**$120,345**
	Land Acquisition, 0 acres @ $50,000			0
	Drainage Easement, 1.1 acres @ $126,364			139,000
	Total Relative Cost			**$259,345**

Table 5-2
Calle Lejos Closed Conduit Alternative

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Excavation - Detention Basin	CY	0	$5	$0
Excavation - Channel	CY	0	8	0
Embankment	CY	0	12	0
Class "A" Concrete	CY	0	500	0
Reinforcement Steel	LB	0	3	0
36" Reinforced Concrete Pipe	LF	832	65	54,080
42" Reinforced Concrete Pipe	LF	380	70	26,600
48" Reinforced Concrete Pipe	LF	738	80	59,040
Basin Discharge Structure	EA	0	5,000	0
Headwall	EA	0	1,500	0
4' Diameter Manhole	EA	5	3,000	15,000
Concrete Spillway	SY	0	40	0
Catch Basin, Std C-15.90	EA	5	3,000	15,000
Concrete Walkway	SY	0	3	0
AC Pavement	SY	0	3	0
Curb and Gutter	LF	0	20	0
Landscaping	LS	1	10,000	10,000
	Construction Subtotal			**$179,720**
	Contingencies @ 20%			35,944
	Mobilization @ 10%			21,566
	Construction Survey @ 2%			4,313
	Erosion Control @ 1%			2,157
	Quality Control @ 2%			4,313
	Water Supply & Dust Palliative @ 2%			4,313
	Estimate Construction Cost			**$252,327**
	Land Acquisition			0
	Drainage Easement			0
	Total Relative Cost			**$252,327**

5.2 83rd Avenue Storm Drain

Review of the area hydrology indicated the need to intercept runoff flowing south across Calle Lejos at its intersection with 83rd Avenue in addition to the storm water being conveyed by the Calle Lejos storm drain. The two alternatives considered include an unlined open channel with sufficient capacity for the runoff. The second alternative is a concrete box culvert with a series of catch basins to intercept the flows from the northwest. A small V-ditch would be constructed between the catch basins to convey minor flows not directed toward the catch basins. These alternatives have been shown in Figure 5-2.

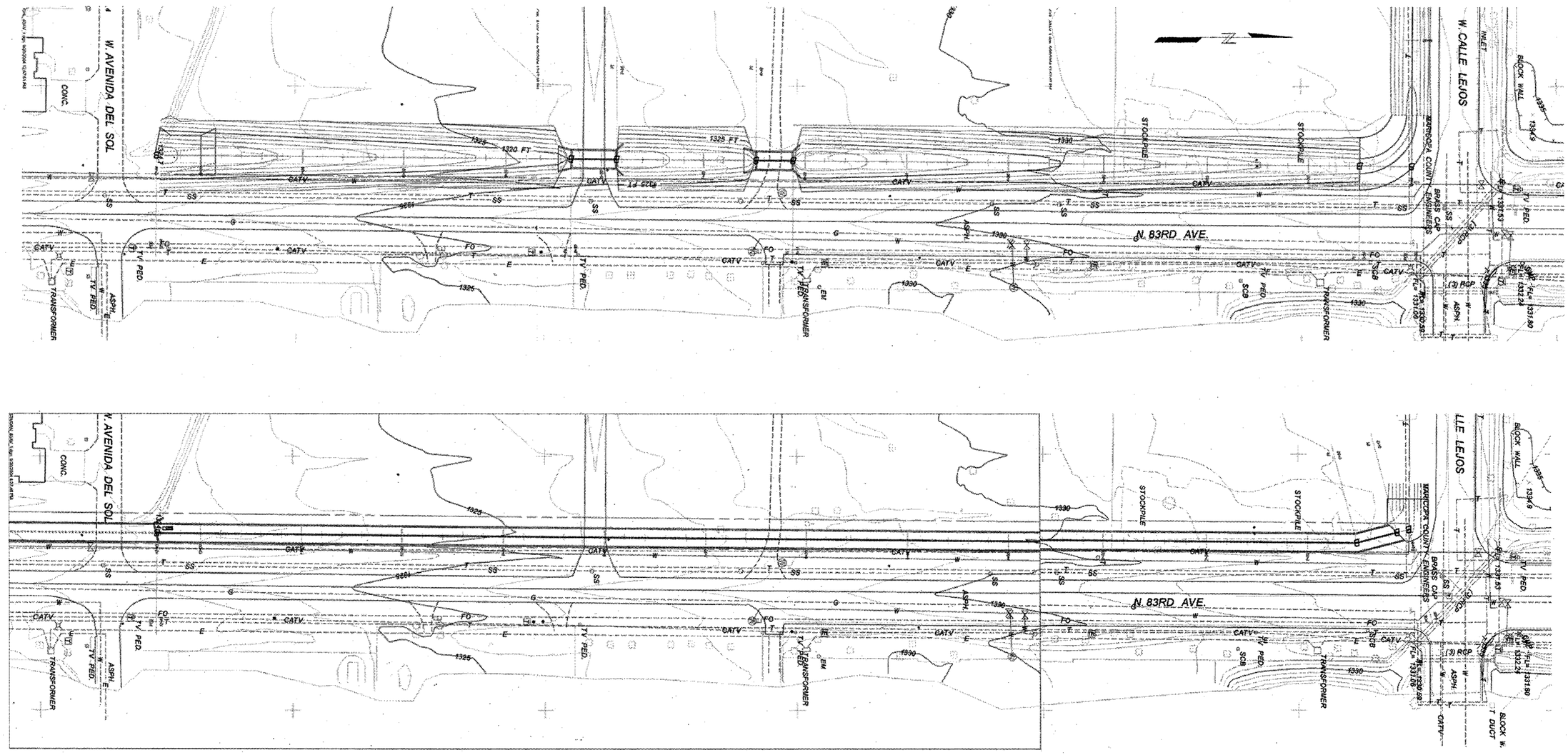


Figure 5-2
83rd Avenue Storm Drain Alternatives

As shown in Tables 5-3 and 5-4, the relative cost of the open channel is $1,269,892 with the closed conduit system being $1,821,939. To accommodate the channel, an additional 60' of right-of-way or 1.8 acres would be required; however, the size of these lots would require total takes. Construction would not require adjustments to driveways, fences, sidewalks, and landscaping because the adjoining properties are undeveloped. The closed conduit system would be comprised of a 1-8'x4' concrete box culvert. It is expected the box culvert and catch basins could be constructed on the existing right-of-way but utility relocations would be more costly and disruptive to users. Pleasing aesthetics would be more difficult for the open channel alternative. The depth of the channel would be approximately 6 feet creating a significant challenge to produce an attractive landscape theme. Headwalls and culverts would be required at Mariposa Grande and the new street to the south. For hydraulic performance, the open channel would clearly be preferable; however, the runoff in the area is predominantly flowing to the south with relatively small amounts being directed toward 83rd Avenue. This condition will be even less in magnitude with construction of upstream drainage improvements to intercept the runoff. The closed conduit system would again be vulnerable to clogging by debris at catch basins. Since the proposed improvements for each alternative are planned to be located away from existing utilities, it is expected the conflicts would not be more difficult for one alternative over the other.

Based on this analysis, it is recommended that the open channel alternative be implemented.

Table 5-3
83rd Avenue Open Channel Alternative

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Excavation - Detention Basin	CY	0	$5	$0
Excavation - Channel	CY	8,025	8	64,200
Embankment	CY	0	12	0
Class "A" Concrete	CY	184	500	92,000
Reinforcement Steel	LB	22,718	3	68,154
36" Reinforced Concrete Pipe	LF	0	65	0
42" Reinforced Concrete Pipe	LF	0	70	0
48" Reinforced Concrete Pipe	LF	0	80	0
Basin Discharge Structure	EA	0	5,000	0
Headwall	EA	0	1,500	0
4' Diameter Manhole	EA	0	3,000	0
Concrete Transition Channel	SY	370	40	14,800
Catch Basin, Std C-15.90	EA	0	3,000	0
Concrete Walkway	SY	0	3	0
AC Pavement	SY	0	3	0
Curb and Gutter	LF	0	20	0
Landscaping	LS	1	30,000	30,000
	Construction Subtotal			**$269,154**
	Contingencies @ 20%			53,831
	Mobilization @ 10%			32,298
	Construction Survey @ 2%			6,460
	Erosion Control @ 1%			3,230
	Quality Control @ 2%			6,460
	Water Supply & Dust Palliative @ 2%			6,460
	Estimate Construction Cost			**$377,892**
	Land Acquisition			892,000
	Drainage Easement			0
	Total Relative Cost			**$1,269,892**

Table 5-4
83rd Avenue Closed Conduit Alternative

ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Excavation - Detention Basin	CY	0	$5	$0
Excavation - Channel	CY	0	8	0
Embankment	CY	0	12	0
Class "A" Concrete	CY	1,120	500	560,000
Reinforcement Steel	LB	169,559	3	508,677
36" Reinforced Concrete Pipe	LF	0	65	0
42" Reinforced Concrete Pipe	LF	0	70	0
48" Reinforced Concrete Pipe	LF	0	80	0
Basin Discharge Structure	EA	0	5,000	0
Headwall	EA	0	1,500	0
Manhole Lid & Riser	EA	4	500	2,000
Concrete Spillway	SY	0	40	0
Catch Basin, Std C-15.90	EA	4	3,000	12,000
Concrete Walkway	SY	0	3	0
AC Pavement	SY	0	3	0
Curb and Gutter	LF	0	20	0
Utility Relocations	LS	1	200,000	200,000
Landscaping	LS	1	15,000	15,000
	Construction Subtotal			**$1,297,677**
	Contingencies @ 20%			259,535
	Mobilization @ 10%			155,721
	Construction Survey @ 2%			31,144
	Erosion Control @ 1%			15,572
	Quality Control @ 2%			31,144
	Water Supply & Dust Palliative @ 2%			31,144
	Estimate Construction Cost			**$1,821,939**
	Land Acquisition, 0 acres @ $50,000			0
	Drainage Easement, 0 acres @ $15,000			0
	Total Relative Cost			**$1,821,939**

5.3 Pinnacle Peak Road Storm Drain

Storm water runoff from the area between Calle Lejos and Pinnacle Peak Road and between 89th Avenue and 83rd Avenue flows in a southerly direction. Much of this runoff is sheetflow or small concentrated drainageways. As part of the Pre-Design Study, current detailed aerial mapping and topographic surveys were provided by Wilson & Company. Review of this data along with site visits and interviews of residents, it was determined that runoff was primarily concentrated at a number of locations. It appears that 89th Avenue and 87th Avenue carry a large portion of the runoff. An open channel along the north right-of-way of Pinnacle Peak Road would be able to intercept all of the storm water. For the closed conduit alternative, it is recommended that storm drains be extended north along 89th Avenue and 87th Avenue to Camino De Oro with catch basins located on the east side of each street. These storm drains would discharge into a larger storm drain and concrete box culvert to be constructed along the center of Pinnacle Peak Road. This alignment would minimize utility conflicts and make the storm drain available for use in the future to drain the street if a curb and gutter section is built. This alternative would have a series of catch basins to intercept the flows from the north. A small V-ditch would be constructed between the catch basins to convey minor flows not directed toward the catch basins. These alternatives have been shown in Figure 5-3.

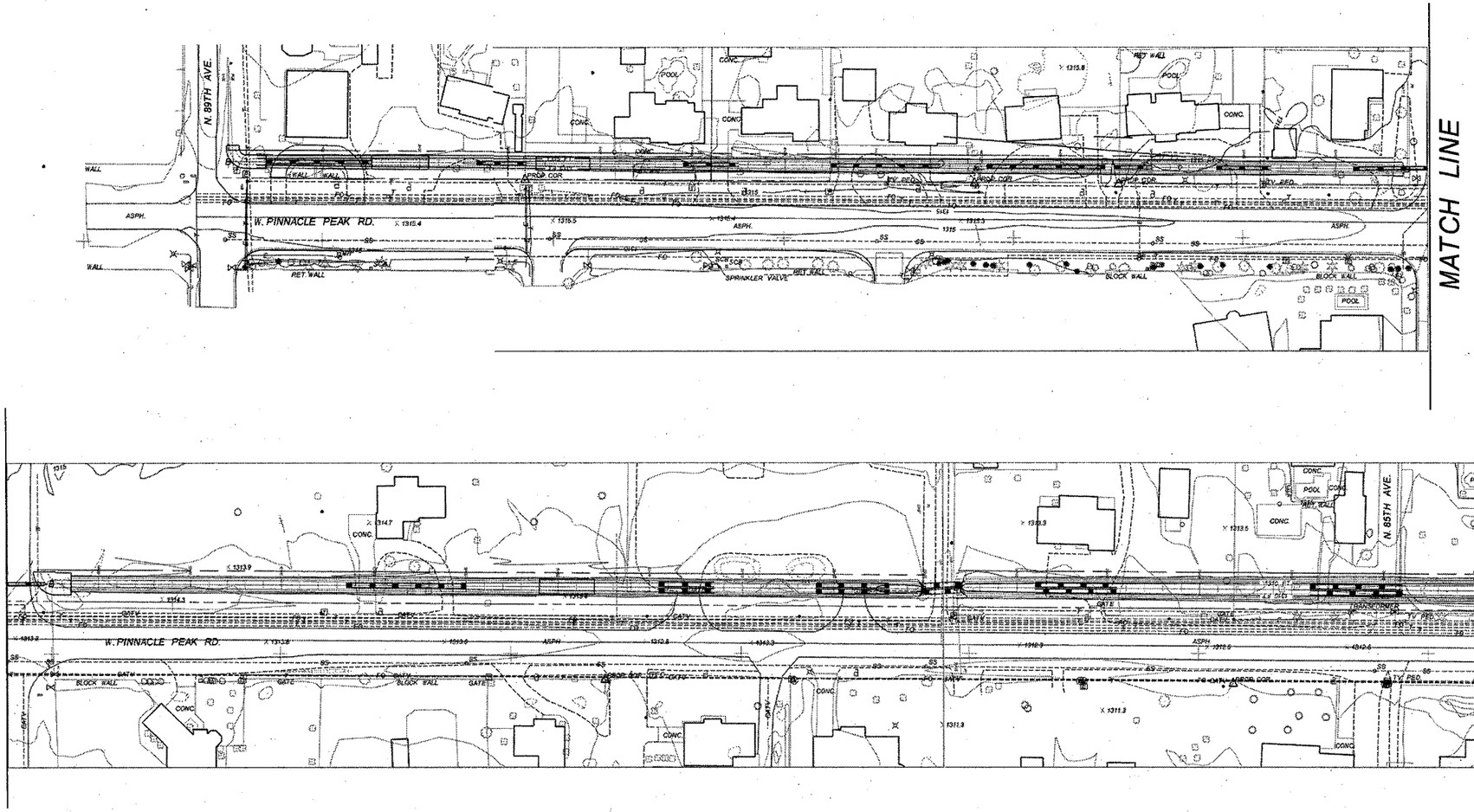


Figure 5-3a
Pinnacle Peak Road Storm Drain Alternatives

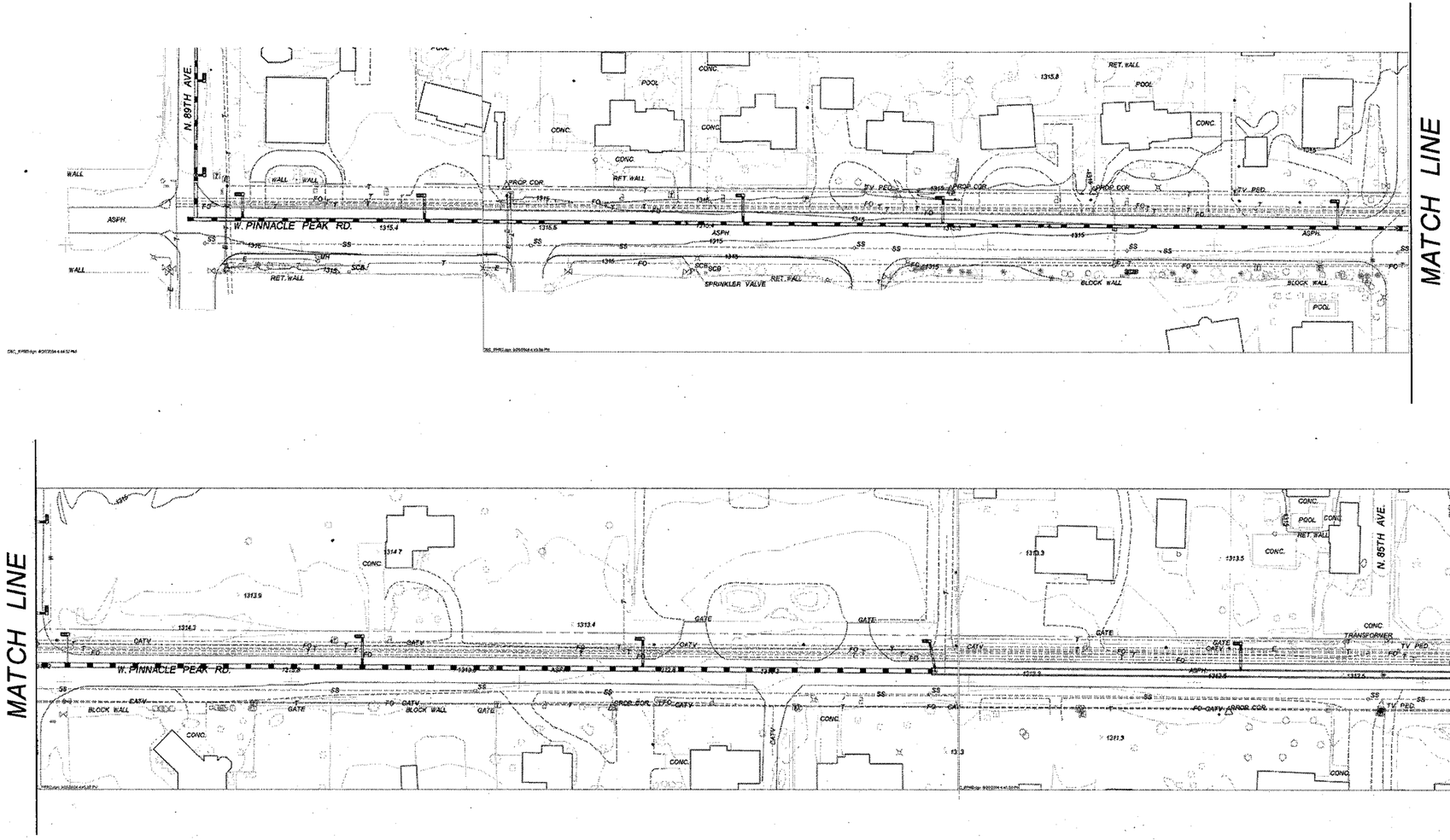


Figure 5-3b
Pinnacle Peak Road Storm Drain Alternatives

The relative cost of the open channel is $847,234 with the closed conduit system being $931,638, as shown in Tables 5-5 and 5-6. To accommodate the channel, an additional 25' of right-of-way or 1.1 acres would be required. Construction would require adjustments to driveways, fences, sidewalks, and landscaping. The channel alternative would have significantly more impact on adjoining properties. The closed conduit system would be comprised of reinforced concrete pipe in sizes from 24" to 60" in diameter. It is expected the storm drain pipe and catch basins could be located on existing right-of-way. Pleasing aesthetics would be more difficult for the open channel alternative. The depth of the channel would be approximately 6 feet creating a significant challenge to produce an attractive landscape theme. Headwalls and culverts would be required at each driveway. For hydraulic performance, the open channel would clearly be preferable. Identifying the location of concentration points for the runoff from the north would not be as critical. The closed conduit system would be vulnerable to clogging by debris at catch basins. Although site visits did not reveal concentrations of sediment or debris. Since the only utilities along Calle Lejos in this vicinity are along the north side of the street, utility conflicts would be limited to water service lines to existing residences. It is expected the conflicts would not be more difficult for one alternative over the other.

The closed conduit system is only slightly more expensive than the open channel alternative and the impact to adjoining properties is much less. Based on this analysis, it is recommended that the closed conduit alternative be implemented.

Table 5-5
Pinnacle Peak Road Open Channel Alternative

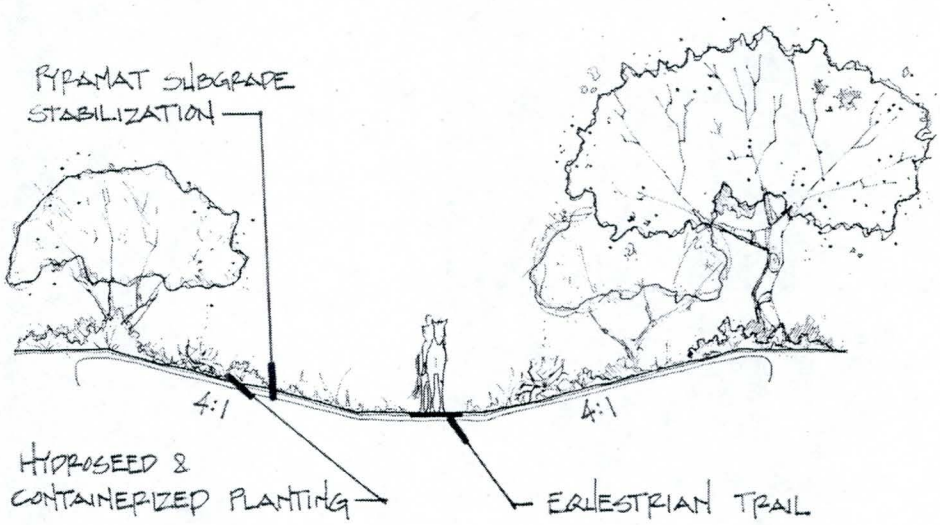
ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Excavation - Detention Basin	CY	0	$5	$0
Excavation - Channel	CY	3,782	8	30,256
Embankment	CY	0	12	0
Class "A" Concrete	CY	319	500	159,450
Reinforcement Steel	LB	18,515	3	55,545
42" Reinforced Concrete Pipe	LF	699	70	48,930
60" Reinforced Concrete Pipe	LF	1,166	150	174,900
Basin Discharge Structure	EA	0	5,000	0
Headwall	EA	0	1,500	0
4' Diameter Manhole	EA	0	3,000	0
Concrete Spillway	SY	445	40	17,787
Catch Basin, Std C-15.90	EA	0	3,000	0
Concrete Walkway	SY	0	3	0
AC Pavement	SY	0	3	0
Curb and Gutter	LF	0	20	0
Landscaping	LS	1	35,000	35,000
	Construction Subtotal			**$521,868**
	Contingencies @ 20%			104,374
	Mobilization @ 10%			62,624
	Construction Survey @ 2%			12,525
	Erosion Control @ 1%			6,262
	Quality Control @ 2%			12,525
	Water Supply & Dust Palliative @ 2%			12,525
	Estimate Construction Cost			**$732,702**
	Land Acquisition, 0 acres @ $50,000			0
	Drainage Easement, 114,532 sf @ $4.00			114,532
	Total Relative Cost			**$847,234**

Table 5-6
Pinnacle Peak Road Closed Conduit Alternative

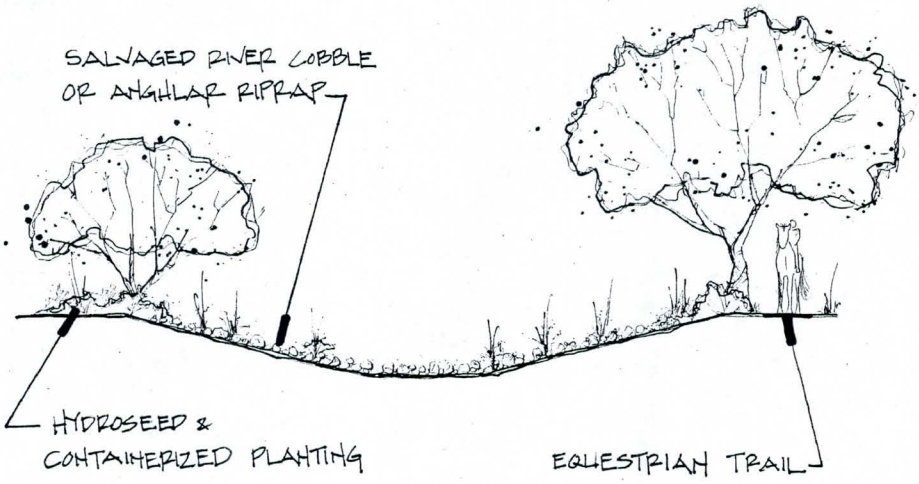
ITEM	UNIT	QUANTITY	UNIT PRICE	TOTAL
Excavation - Detention Basin	CY	0	$5	$0
Excavation - Channel	CY	0	8	0
Embankment	CY	0	12	0
Class "A" Concrete	CY	10	500	5,000
Reinforcement Steel	LB	2,000	3	6,000
24" Reinforced Concrete Pipe	LF	288	50	14,400
30" Reinforced Concrete Pipe	LF	213	60	12,780
36" Reinforced Concrete Pipe	LF	200	65	13,000
42" Reinforced Concrete Pipe	LF	1,439	70	100,730
48" Reinforced Concrete Pipe	LF	0	80	0
60" Reinforced Concrete Pipe	LF	2,831	150	424,650
Basin Discharge Structure	EA	0	5,000	0
Headwall	EA	0	1,500	0
4' Diameter Manhole	EA	7	3,000	21,000
Concrete Spillway	SY	0	40	0
Catch Basin, Std C-15.90	EA	17	3,000	51,000
Concrete Walkway	SY	0	3	0
AC Pavement	SY	0	3	0
Curb and Gutter	LF	0	20	0
Landscaping	LS	1	15,000	15,000
	Construction Subtotal			**$663,560**
	Contingencies @ 20%			132,712
	Mobilization @ 10%			79,627
	Construction Survey @ 2%			15,925
	Erosion Control @ 1%			7,963
	Quality Control @ 2%			15,925
	Water Supply & Dust Palliative @ 2%			15,925
	Estimate Construction Cost			**$931,638**
	Land Acquisition			0
	Drainage Easement			0
	Total Relative Cost			**$931,638**

Section 6
Landscape Aesthetics and Multi-Use Opportunities

As previously described, open channels are a viable alternative for the conveyance of storm water to the Calle Lejos Basin and Pinnacle Peak Basin. As shown in Figure 6-1, there is an opportunity to create an aesthetically pleasing channel that can serve the duel purpose of water conveyance and equestrian trail system. One possible channel treatment would be to line the channel with a Pyra-mat type product and hydroseed over that with a native hydroseed mix for channel stabilization. The hydroseed mix can also be enhanced by containerized shrub and tree planting. This option of channel treatment would allow for equestrian access through the bottom of the channel. The other possible aesthetic treatment would be to utilize salvaged river cobble, river rock, from the basin excavation to line the bottom and sides of the channel for stabilization. The top of the channel can then be enhanced with containerized planting of shrubs and trees. This aesthetic treatment would move the soft surface equestrian trail from the bottom of the channel to run parallel along the top bank of the channel. An alternative to the river cobble would be to use angular rock mulch riprap, which could be specified to match adjacent decomposed granite groundcover color for aesthetic harmony.



OPEN CHANNEL CONCEPT 'A'
N.T.S. - CHANNEL DEPTH & WIDTH VARIES



OPEN CHANNEL CONCEPT 'B'
N.T.S. - CHANNEL DEPTH & WIDTH VARIES

Figure 6-1
Open Channel Landscape Aesthetics

Section 7
Future Public Facilities Opportunities

The creation of the Calle Lejos Basin and the Pinnacle Peak Basin provides an opportunity for enhanced multi-use recreation facilities for the neighboring community. The Pinnacle Peak Basin, being located adjacent to an existing equestrian trail, makes an excellent site for an equestrian staging area. This will also allow linkages to equestrian trails north along the Hatfield alignment and immediately to the west along Pinnacle Peak Road. The City of Peoria has expressed interest in modifying the Pinnacle Peak Basin into a neighborhood park that would accommodate both equestrian and pedestrian uses. The Calle Lejos Basin could serve as a neighborhood park to the Calle Lejos area. This future park could have complimentary park amenities to the Pinnacle Peak Basin.

7.1 Potential Users and Activities

Potential users of the Calle Lejos Basin neighborhood park would be the residents in the immediate vicinity of the basin and the surrounding subdivisions. The Calle Lejos Basin could be a passive park, offering hard surface walking trails, playground facilities, restroom facilities, ramada covered picnic area, and open turf play areas. The Pinnacle Peak Basin could serve two different user groups, equestrian and pedestrian. Equestrian users would have access to a staging area for the adjoining equestrian trails system. The park would also offer hard surface walking trails, a restroom facility, playground facilities, ramada covered picnic areas, open turf play areas, and space for pee-wee soccer or tee ball.

7.2 ADA Implications

Since both parks will be developed within storm water drainage basins, accessibility issues will have to be addressed. Grading of the basins will have to accommodate ADA accessible trails and walkways to access on-site facilities. This can be accomplished by offering multi-level terraces to create the necessary access so that all users can experience the space. The Pinnacle Peak Basin concept utilizes a terraced grading plan that would maintain most facilities on the upper dry terrace. This basin could have an open turf play area on a lower terrace and then the soccer/tee ball turf zone in the bottom of the basin. The Calle Lejos Basin concept wraps the hard surface trail around the park and allows ADA access around the perimeter along with access to onsite facilities located at the top of slope of the basin in the dry area. Hard-surface and future park improvements at both basin sites will need to be designed to adhere to the ADA accessibility standards.

7.3 Material Selections

Material selection, both plant and hardscape, helps to define the visual interest of a site and lends to the site users overall experience. The Pinnacle Peak Basin, since it is being planned and designed in phases, will go through several material changes. Its first use as an equestrian only staging area will mean that the parking lot will be of a permeable nature. A material such as roller-compacted ¼" minus decomposed granite makes an ideal surface for the equestrian parking lot and associated trails. Stabilized decomposed granite also makes for an acceptable equestrian surface. Any hard surface multi-use trail for pedestrians and bicyclists would be concrete or asphalt. The basin itself, during this equestrian-only phase, would be hydroseeded with a native seed mix that would allow stabilization of the basin slopes, and provide some seasonal naturalized aesthetic value. Trees, such as Blue Palo Verde, Palo Brea, Desert Willow, Ironwood, and Native Mesquite, will be planted to blend with the surrounding neighborhood plant materials and the native Sonoran desert to the north. When the transition to neighborhood park occurs, most of the native grass mix would be removed from the bottom of the basin and be replaced with a turf grass. The parking lot expansion will require some of the equestrian parking to be converted to standard parking with asphalt paving. The proposed future architecture of the ramada and restroom facilities will need to be unobtrusive and be of a style and color to blend with the adjacent developments.

The Calle Lejos basin will be treated in a similar fashion to that of the Pinnacle Peak Basin, with the exception that the plant palette will be selected mostly from the surrounding desert environment. This will help blend the basin design with the surrounding aesthetics. Again, the initial basin will be hydroseeded with a native grass mix to promote soil stabilization. Later, when the proposed neighborhood park comes into fruition, turf grass will most likely replace some of the native grass mix in the basin to provide an open space play area for this site. As with the Pinnacle Peak Basin, the proposed future architecture of any ramada or restroom facilities will need to be unobtrusive with a style and color to blend with the adjacent development as well as to blend with the natural bajada landscape character to the north.

7.4 Public Access and Staging Areas

Vehicular public access into the Pinnacle Peak Basin will occur from Pinnacle Peak Road. The equestrian trails will tie into the Pinnacle Peak Basin at the north end along 83rd Avenue and at the west end along Pinnacle Peak Road. An equestrian crossing will need to be located on Pinnacle Peak Road at the 83rd Avenue intersection in order to connect the existing equestrian trail on the south side of Pinnacle Peak Road to the staging area. Pedestrians would access the site by sidewalks that would be constructed with future street improvements to 83rd Avenue and Pinnacle Peak Road. Vehicular access into the Calle Lejos Basin will occur from Calle Lejos. Pedestrian access would be provided by sidewalks constructed with future street improvements to Calle Lejos, or from future sidewalks associated with the Peoria 60 development.

7.5 Equestrian Users

Equestrian users will eventually be utilizing the Pinnacle Peak Basin as a staging area. Future and existing equestrian trails along Pinnacle Peak Road and will have a connection to the Pinnacle Peak Basin. Equestrian trails are also proposed to be constructed along 83rd Avenue from Pinnacle Peak Road to the Hatfield Road alignment. Equestrian users will require special facilities such as hitching posts, wash racks, and soft surface trails in order for the Pinnacle Peak Basin to meet the needs of this user group. These specialized facilities will not be a part of this drainage improvement project.

7.6 Trail Systems

Trail systems will be developed around the City of Peoria master trails plan. Linkage will be provided to both basin parks by future street improvements.

7.6.1 Pedestrian Trails

Hard surface ADA accessible pedestrian trails will be concrete or asphalt. These multi-use trails will eventually be constructed by the City of Peoria in both of the basin parks. Sidewalk improvements that are a part of future street improvements will provide connectivity to surrounding neighborhoods by providing pedestrian access to the basin parks.

7.6.2 Equestrian Trails

A soft surface equestrian trail will loop around the Pinnacle Peak Basin and provide access to current or future equestrian trails. This drainage improvement project will provide the grading and area necessary for the City of Peoria to later construct equestrian improvements.

Section 8
Grading and Earthwork Opportunities

Grading for the detention basins and open channels will have to meet the guidelines and policies of the District and City of Peoria. Since these facilities are proposed to be unlined, the following objectives should be met.

8.1 Overall Grading Assumptions and Objectives

For safety the detention basins may require inlets that minimize the velocity of incoming water. Also, handrailing or fencing should be provided at the top of structural walls. Within the storm water storage facility, safety concerns increase with an increase in potential water depth. A facility with a potential water depth of 2 to 3 feet (less than the head height of most users) is typically less dangerous than a facility with a potential water depth of 5 to 6 feet, or more. For those reasons, potential water depth in the detention basins should be kept to a minimum. When possible, a potential water depth of 3 feet or less is recommended for small storm water storage basins immediately next to residential areas. In flood-prone areas, slopes of 4:1 or flatter should be implemented. In addition to slopes, consideration should be given to bottom conditions in flood-prone areas. Soils that provide firm footing when saturated are safer than soils that do not. In severe cases of unsuitable soils, partial or total removal may be necessary. In addition to gentle slopes, routes out of flood-prone areas should be provided. Barriers that could trap a user in a flood-prone area should be avoided. Safe, well-signed exit routes that are negotiable under wet conditions should be developed. All hard surface trails and sidewalks shall have a gradient less than 5% to comply with ADA guidelines.

User safety should be of primary concern with the design of outlets or drains. They should be designed so that it is not possible for a user to be trapped during wet or dry conditions. This is particularly important when considering children using the outlet structures as a playground. A properly designed trash rack can prevent clogging by debris as well as prevent a person from being swept into the outlet structure and pipeline. In addition, where hydraulic conditions at the outlet structure can lead to the formation of a vortex, the design should include anti-vortex protection. It is important to note that an outlet structure is not a safe structure during flood conditions, whether it is a horizontal pipe outlet or a riser type structure mounted to a horizontal pipeline. Powerful inlet velocities can draw a person underwater at the outlet structure regardless of the existence of a trash rack or grate. Signage is important to alert the public of this danger. In addition, trash racks should be designed to prohibit, to the extent practical, a small child being forced through the openings.

All site furnishings, such as benches, trash receptacles, and picnic tables should be secured to prevent them from becoming waterborne-debris that could clog the outlet structure. Safety should also be considered downstream of outlet structures. Release flows, even though they may be controlled, can present a hazard. Specific conditions

downstream of an outlet should be evaluated in terms of safety. To protect the public, structural walls should have fencing or railing along the top of an outlet structure.

The use of embankments for storm water storage is not recommended. Whenever possible, storm water storage facilities should be constructed with the storage volume located entirely below the natural ground surface adjacent to the basin. However, in some instances this may not be possible, and embankments may be necessary to provide the required storage volume. Since the use of embankments may create a potential downstream flood hazard due to failure of the embankment, the considerations included in the Drainage Design Manual of the Flood Control District of Maricopa County will be followed.

There are two major components to the maintenance of a storm water storage facility. The first is to design a facility that is maintainable, and the second is the physical work required to keep the facility operating as designed and constructed. Maintenance of a storm water storage facility falls into two categories; scheduled and unscheduled. Scheduled maintenance includes those activities such as mowing, pruning, and trash removal. These activities can be predicted and can be performed on a regular basis.

Unscheduled maintenance will involve the repair of facilities after storms and flooding. The frequency and scope of this type of maintenance cannot be predicted. Some examples of unscheduled maintenance are:

- Embankment repair to keep erosion or rock riprap or earth fill sloughing from weakening the dam structure.
- Debris removal during and following storms.
- Inlet and outlet channel repairs to halt erosion and maintain hydraulic capacity.
- Inlet and outlet structure repair so that the facility will function as intended.

To facilitate maintenance of storm water storage facilities proper access must be maintained. Access roads for service and maintenance vehicles should be provided to allow for equipment access to the facility, whenever needed. Access control gates should be provided if restricted access is required. Other design criteria are as follows.

- Access ramps into the facility shall be graded at 10 percent or less.
- Turning radii shall be 50 feet or greater.
- Access ramps shall be designed for vehicle wheel capacities not less than 12,000 lbs.
- Service drives and gates shall be located in readily accessible, but inconspicuous, locations so as to not encourage unauthorized use.

- Access control gates and adjacent areas shall be as secure as economically feasible. Initial expenditures for access control can save significant costs for future repairs.

The open channels should be designed to meet the following guidelines. The design should incorporate uniform channel properties, such as gradient and cross sectional geometry, as much as possible. Sharp and closely spaced curves should be avoided. Other design criteria to be met are described in the following.

- The minimum flow velocity allowable in channels is 2 feet per second. See Table 6.1 from the Drainage Design Manual.
- The maximum flow velocity used in an unlined channel is 5.0 feet per second in a channel with desert landscaping, fine gravel, or similar side slope landscaping treatments.
- Riprap lining will be used where velocities equal or exceed 5 feet per second.
- All riprap lining will be installed over geotextile fabric to further control erosion.
- Concrete spillway/lined channels are recommended at lateral inflow points.
- Concrete lined channel lining is recommended at major bends in the channel with greater than 15-degree deflections.
- The normal depth flow condition is used with the 100 year peak flow.
- The typical channel side slope used is 4:1.
- The freeboard used in the channel design will be the greater of calculated freeboard or one foot.
- The water surfaces will be designed to be below the existing ground level. This will eliminate the need for levees.
- Streambed slopes will be set to maintain a subcritical flow regime in all of the channels.
- Channel curvature will be set at 3 times the calculated top width at the upstream channel.
- Additional bank lining height will be provided at channel curves.

This provides a summary of grading objectives to be met; however, other issues will be encountered during the design process and will require the implementation of good engineering judgment.

8.2 River Cobble Salvage and Re-Use Opportunities

With the locations of the proposed basins being in close proximity to New River and other seasonal washes, the possibility exists of unearthing significant amounts of river cobble during basin excavation. If river cobble is found to be prevalent at the basin sites, it would be to the stakeholder's advantage to recycle the river cobble on this project. The river cobble can be used for bank reinforcement, channel lining, as riprap around outlet structures, or as a natural veneer on drainage outlet structures. This would help in reducing the cost of earthwork by minimizing the amount of waste material that must be removed from the construction site. It would also add an aesthetic feature to the project by giving a different aesthetic texture to the ground surface and drainage structures.

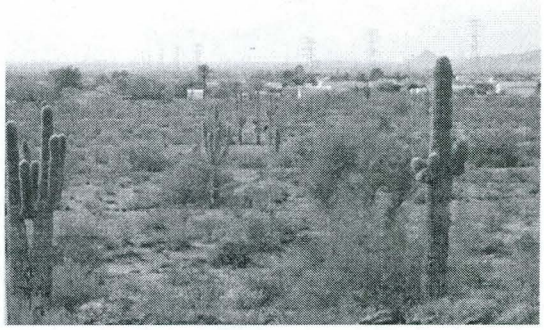
Section 9
Concept and Site Development

9.1 Landscape Theme

As discussed in Sections 3.0 and 4.0, the aesthetic design for the basins will center on blending the basin improvements with the surrounding setting. Both basins will initially utilize a native hydroseed mix within each basin area along with containerized trees and shrubs accenting each site.

At the Pinnacle Peak Basin, the landscape theme will be a Sonoran Desert-based xeriscape planting theme, but it will also incorporate some of the lush stylized suburban landscape character of the adjacent subdivision developments. The adjacent lush planting themes generally consist of ornamental plant materials such as Willow Acacia trees, Thornless Mesquite trees, Evergreen Elm trees, Mondell Pine trees, Leucophyllum shrubs, Red Bird of Paradise shrubs, Oleander shrubs, Lantana and Acacia groundcover, Deer Grass accents, Desert Spoon accents, and Red Yucca accents. Although not all of these lush-type plant materials will be used, there will be a blending of some of these with standard Sonoran Desert plants in order to tie the overall theme together. In addition to the plant materials, surface-select boulders will also be used, as well as native-looking ¼"-minus decomposed granite to give a natural feel to the ground-plane. In keeping with City of Peoria standard planting policy, no thorny trees will be used within close proximity to current or future pedestrian travelways.

Stylized Suburban Landscape



Native Sonoran Desert Landscape

At the Calle Lejos Basin, the landscape theme will be designed to fit the natural project site, as well as to blend in with the planting scheme for the proposed Peoria 60 development. The landscape will be mostly a Sonoran Desert theme, with some ornamental shrubs and accents to fit the subdivision. The Sonoran Desert plants will

most likely be Blue Palo Verde and Foothills Palo Verde trees, Desert Willow trees, Ironwood trees, Native Mesquite trees, and Creosote shrubs, Ruellia shrubs, Encelia shrubs, and Saguaro and Barrel Cactus accents. The ornamental accents will be coordinated with the subdivision landscape. The ground-plane landscape treatment will most likely be either hydroseeding with containerized tree/shrub planting, or ¼"-minus decomposed granite treatment with containerized tree/shrub planting.

For the proposed open channel corridors along Calle Lejos and 83rd Avenue, the design team intends to utilize a planting design theme that will blend in well with the surrounding developments. This theme may need to transition from a lush theme to a Sonoran theme to a hybrid of both types in particular areas, depending on the existing adjacent conditions. It is anticipated that a native hydroseed mix will be used in some capacity along the banks of the open channels. Containerized shrubs and groundcover may also be used, depending on the capacity of these channels.

9.2 Aesthetic Enhancements

Various aesthetic enhancements will be utilized to help blend the drainage improvements in with their surrounding environment. Drainage structures or headwalls will be stained or painted with a natural color or veneered with native river rock or stone veneer to blend the improvements with the surroundings. For the future park improvements at the basins, ramadas and restroom buildings should use materials and color schemes that fit with the adjacent subdivision themes and surrounding environment. Where fencing or guardrails are required, the design, color scheme, and materials should be in harmony with other similar materials adjacent to the project.

Slope treatments will be designed to be aesthetically pleasing and look naturalized where possible. The design team will make every attempt to vary slopes in the basins, to undulate sideslopes and make the drainage improvements appear less intrusive on the landscape. In locations where slopes cannot undulate or vary, due to capacity requirements, planting design will be used to naturalize the slopes.

Section 10
Pre-Design Summary and Recommendations

The Pre-Design Study recommendations are based on current design data and assumptions. Should conditions change, the following recommendations should be reviewed and revised as necessary.

The Calle Lejos detention basin should be located in the southeast portion of the proposed Peoria 60 development. More specifically, Lots 1 to 5, Tract B and part of Tract H should be acquired for this project. The collector channel to the west of the basin should be located within the proposed 60' drainage easement shown on the Peoria 60 preliminary plat. A concrete box culvert should be located under the proposed 87th Avenue entrance to Peoria 60. Grading of the basin site will have to accommodate a future neighborhood park. Interim landscaping will be in accordance with the recommendations listed in Section 3.4.3.

A storm drain system is recommended to dewater the Calle Lejos detention basin and to collect runoff between the basin and 83rd Avenue. It is recommended that a closed conduit system with catch basins and a small, unlined V-ditch be included in the final design.

The outfall of the Calle Lejos storm drain will be an unlined, open channel located on the west side of 83rd Avenue. Drainage under Mariposa Grande and the new additional side streets will be conveyed through concrete box culverts. At Avenida Del Sol the open channel will end and storm water will enter a concrete box culvert and flow to the Pinnacle Peak detention basin. The proposed channel should have 4:1 side slopes and be landscaped in accordance with the recommendations of this Pre-Design Report.

Runoff flowing to Pinnacle Peak Road between 83rd Avenue and 89th Avenue should be collected by catch basin inlets and routed by a closed conduit storm drain system. This system will consist of reinforced concrete pipe, catch basins and manholes. Storm drains in 89th Avenue and 87th Avenue should extend to Camino De Oro. A series of catch basins will need to be included at the end of the extensions. The main storm drain in Pinnacle Peak Road should be aligned near the centerline with laterals extending to the north side of the right-of-way to collect offsite flows. This closed conduit storm drain system will outlet at the Pinnacle Peak detention basin.

The Pinnacle Peak detention basin will be an offline facility located at the northwest corner of 83rd Avenue and Pinnacle Peak Road. The basin will be graded to accommodate an equestrian recreation site and ultimately a neighborhood park. Interim landscaping will be in accordance with the recommendations listed in Section Bypass storm drains will carry low flows past the basin to a junction structure at the corner of 83rd Avenue and Pinnacle Peak Road. This structure will also collect the discharges of the basin dewatering system. Storm water will be conveyed in a 48" diameter storm

drain south in 83rd Avenue to the system outlet at Deer Valley Estates south of Williams Road. Alignment of the storm drain and location of street crossings will be determined during design after potholing activities have been completed.

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City of Peoria

Pre-Design Report
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Appendix A

HEC-1 Analyses

Appendix B

Photograph Inventory