

**JURISDICTIONAL BOUNDARY DELINEATIONS
AND WATERS OF THE U.S./VEGETATION IMPACT
ANALYSIS FOR THE SPOOK HILL ADMP**



Prepared for:

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Job #21033-1

May 14, 2001

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I. INTRODUCTION

This study has been completed by CMG Drainage Engineering, Inc., on behalf of the Flood Control District of Maricopa County (FCDMC) under Contract #FCD2000C068, *On-call Jurisdictional Delineation and Environmental Permitting Services*. The primary purpose of the study is to develop jurisdictional boundary delineations for waters of the United States, which occur within the boundaries of the Spook Hill Area Drainage Master Plan (ADMP) and to assess the impacts to jurisdictional waters that would occur in conjunction with implementation of the highest rated flood control alternatives. The evaluation of alternatives considers the direct impacts for loss of waters, indirect impacts associated with the decrease in the functions and values to the watercourse areas adjoining the proposed flood control alternatives, and considers the quality and quantity of desert vegetation impacted in conjunction with man-made changes to the watercourses and adjoining upland.

II. DESCRIPTION OF PROJECT AREA

The Spook Hill ADMP study boundaries are identified on Figure 1 of this report. The Spook Hill study area drainage conditions as well as the alternatives analysis and the recommendations are presented in the Level I analysis report *Alternatives Formulation/Preliminary Analysis, Spook Hill Area Master Drainage Plan* prepared by Wood, Patel & Associates, Inc., January 18, 2001. This report documents the results of the Level I analysis - *Alternatives Formulation/Preliminary Analysis Efforts for the Spook*

Hill ADMP. The information given in this report regarding area hydrology, watercourse characteristics, and the scope of each alternative is the basis upon which CMG Drainage Engineering, Inc., has completed its evaluation of impacts to jurisdictional waters and vegetation. The Spook Hill ADMP covers an area of approximately 19 square miles. The study area is located primarily within Township 1 North, Range 7 East, and Township 2 North, Range 7 East, G&SRB&M, Maricopa County. Governmental jurisdictions, which fall within the study area, include the City of Mesa and the Tonto National Forest as well as unincorporated Maricopa County. Elevations within the study area range from approximately 1570 feet above mean sea level (MSL) in the area of the Spook Hill Flood Retarding Structures (FRS) near Brown Road to 2300 feet above MSL at Pass Mountain. There are no predominant drainage features within the study area although numerous small and moderate size alluvial watercourses cross the desert from northeast to southwest. There are several man-made drainage features within the project area such as floodways, canals, and flood retarding structures that interrupt the natural drainage patterns. Much of the area can be described as a sheetflow zone because the washes consist of shallow distributary channels that separate and coalesce across an alluvial plain. These drainage conditions have resulted in widespread flooding throughout areas that were developed prior to adoption of local floodplain management ordinances. Roadway drainage is also a significant problem throughout the project area.

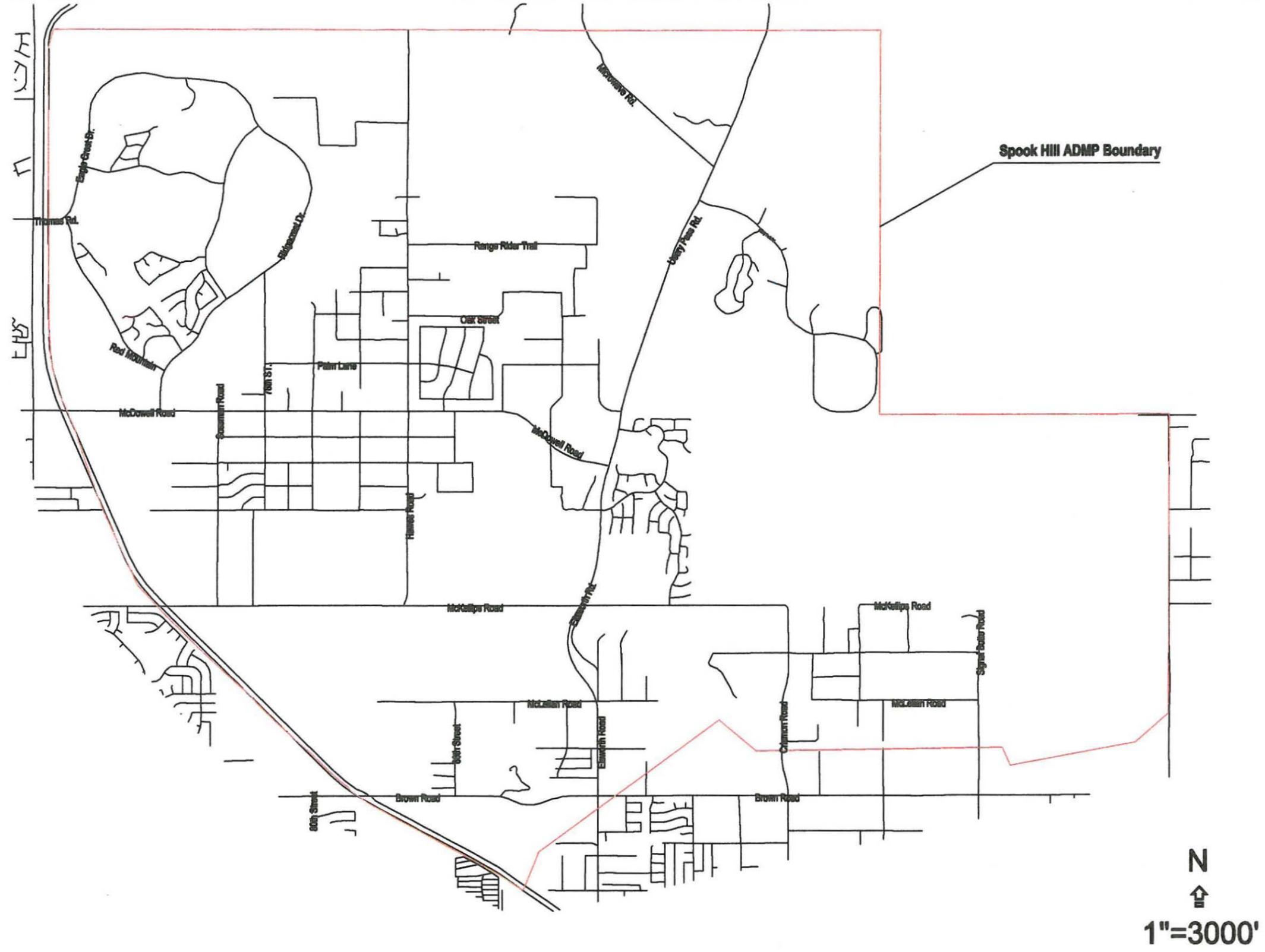


Figure 1: Spook Hill ADMP Project Boundaries

III. JURISDICTIONAL BOUNDARY DELINEATIONS FOR WATERS OF THE UNITED STATES

3.1 Delineation Criteria

Definitions

"Waters of the U.S." is defined under 33 CFR Part 328.3(a), paragraphs (1) through (7).

33 CFR 328.4(2)(c) defines the limits of jurisdiction in non-titled waters as follows:

1. In the absence of adjacent wetlands, the jurisdiction extends to the ordinary high water mark; or
2. When adjacent wetlands are present, the jurisdiction extends beyond the ordinary high water mark to the limits of the adjacent wetlands; and
3. When the waters of the U.S. consist only of wetlands, the jurisdiction extends to the limits of the wetlands.

The term "ordinary high water mark" means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding area.

Regional Criteria

Regional criteria have also been developed by the Corps to suit the requirements for arid southwest desert conditions. These criteria, which should be characterized as general guidelines, consider the average sandy bottom channel width for ephemeral washes and the watercourse hydrology as determined by regionally adopted procedures. These Corps

guidelines establish the minimum width of the sandy bottom channel at about 5 feet. Washes, which do not in general maintain this minimum width, are generally considered by the Corps as non-jurisdictional. The point along a wash at which the 100-year discharge decreases to <100 cfs is generally considered by the Corps as the upstream limit of their jurisdiction under Section 404 of the Clean Water Act.

Isolated Waters

The Supreme Court issued a decision in January 2001 in the case of *Solid Waste Agency of Northern Cook County vs. United States Army Corps of Engineers*, 121 S.Ct. 675 (2001)(SWANCC) relating to a municipality's claim that the Clean Water Act extended only to navigable waters as traditionally understood. The Supreme Court concluded that Congress had intended the Clean Water Act to regulate only truly navigable waters and waters or wetlands inseparably bound to them. The Supreme Court's ruling further invalidated the 1986 migratory bird regulation as well as the Corps' assertion of jurisdiction over all waters except for actually navigable waters, their tributaries, and wetlands adjacent to each. This ruling further suggests that waters, which are isolated from navigable waters by natural or man-made features, do not fall under the jurisdiction of Section 404 of the Clean Water Act.

3.2 Applicant's Determination of Jurisdictional Boundaries

CMG Drainage Engineering, Inc., has rendered the applicant's determination of jurisdictional boundaries for waters of the U.S. within the Spook Hill ADMP study area.

The scope of the area within which the jurisdictional boundaries have been provided

exclude federal lands within the Tonto National Forrest. None of the flood control alternatives are located federal lands nor does Maricopa County have any regulatory authority over these lands.

The jurisdictional boundary delineations also exclude the Spook Hill FRS since the Corps jurisdiction over these flood control facilities has been established as a part of previous applications and CWA Section 404 permits.

In addition to the criteria outlined in Section 3.1 of this report, CMG Drainage Engineering, Inc., has reviewed case files for Corps-adopted jurisdictional delineations within the study area. Most of the previous delineations relate to land development projects that are under design, under construction or already completed. A list of the case files that were reviewed in conjunction with development of the Spook Hill ADMP jurisdictional delineations are outlined in Table 1.

TABLE 1 - CORPS-ADOPTED JURISDICTIONAL DELINEATION CASE NUMBERS WITHIN STUDY AREA

CORPS CASE #	PROJECT NAME	SEC/TSP/RNG
994001400	Walmart	6,T1N,R7E
984041800	Maracay Homes	5,T1N,R7E
984023700	Desert Upland Estates	5,T1N,R7E
974062400	Madrid Subdivision	4,T1N,R7E
974036500	The Fountains	6,T1N,R7E
974027000	Southeast Mesa ADMP	1,3,9,10,11,12,15,16,17,19,20,T1S,R7E 21,27,28,T1S,R7E
974025800	Sierra Heights/Sierra Estates	9&10,T1N,R7E
964054200	Boulder Mt. Highlands Residential Community	3,T1N,R7E
964041700	Saguaro Shadows Subdivision	10,T1N,R7E
964009300	School Site @ McKellips & Ellsworth Rd.	3,T1N,R7E
199916059	Alta Mira Estates	7,T1N,R7E
199916053	Boulder Views	10,T1N,R7E
984022800	Las Sendas	28-32,T2N,R7E
964053600	Red Mt. Freeway from SR 87 to US Route 60	31,T2N,R7E
944091000	Red Mt. Community, Sonoran Land GP Las Sendas	29-32,T2N,R7E
934101300	Maricopa County Dept. of Transportation	Numerous,T2N,R7E
200100184	Range Rider Estates	33,T2N,R7E

The Corps-adopted jurisdictional delineations (where applicable) were used in conjunction with ground surveys and channel width measurements to develop the applicant's determination of the jurisdictional boundaries. Ground photographs of a representative sampling of both natural and man-made watercourses within the Spook Hill ADMP study area are provided in Appendix A of this report. The location of each of these photographs and the measured jurisdictional channel widths are shown on the jurisdictional boundary delineation maps, sheets 1 through 21, in Appendix B of this report. These jurisdictional

boundary delineations are on an aerial photograph dated January 2000 at a scale of 1" = 800'.

The ground surveys of watercourse conditions, review of aerial photographs and related study materials did not identify any wetlands within the boundaries of the Spook Hill ADMP.

IV. VEGETATION ANALYSIS

Novak Environmental, Inc. performed field investigations of the Spook Hill study area in March 2001 in order to identify and characterize existing vegetation types and densities in the vicinity of the highest ranked flood control alternatives identified in the Spook Hill Area Drainage Master Plan (ADMP). This investigation was performed to provide site-specific information that will be used in the evaluation and determination of which alternative will be selected for implementation. Flood control alternatives for Spook Hill ADMP consist of a series of dikes or channels and detention basins in three general areas; Pass Mountain, McDowell Road and McKellips Road.

Based on field investigation, Novak Environmental, Inc has characterized vegetation in the Spook Hill area into 5 different types; 1) undisturbed foothills palo verde and saguaro upland, 2) undisturbed riparian, 3) developed drainage ways with associated landscape, 4) recent development, and 5) disturbed desert. Vegetation density for each of these categories were rated as high, medium or low, where:

High \approx 70% + ground cover with 25-35 trees/ac and 80-100 cacti/ac

Medium \approx 40-70% ground cover with 20 trees/ac and 70 cacti/ac

Low \approx 0-40% ground cover with <10 trees/ac and <50 cacti/ac.

The following describes each type and is accompanied by representative pictures.

UNDISTURBED FOOTHILLS PALO VERDE & SAGUARO UPLAND

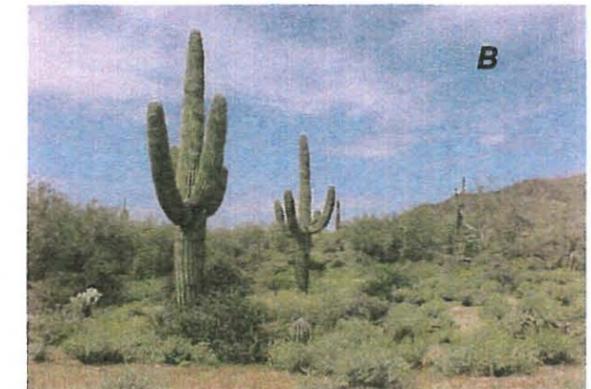
Existing natural vegetation is that which is typically found in the Arizona Sonoran Desert



Upland Scrub Biotic Community, dominated by saguaros (*Carnegiea gigantea*), with an occasional foothill palo verde (*Cercidium microphyllum*) and/or ironwood (*Olneya tesota*) among the canopy. Mid and understories contain jojoba (*Simmondsia chinensis*), catclaw acacia (*Acacia greggii*), ocotillo (*Fouquieria splendens*), desert hackberry (*Celtis pallida*), triangle-leaf bursage (*Ambrosia deltoidea*), barrel (*Ferocactus wislizenii*), cholla and prickly pear (*Opuntia sp.*). Three types of vegetation were found within the Uplands, those with ironwood, those areas without ironwoods and those less dense areas.



Uplands – high vegetation density.



Uplands - high density uplands.

There is a notable distinction between areas of Upland containing ironwood trees (**A**) and those that do not (**B**). Areas with ironwood trees are found mainly in the McDowell Road and McKellips Road areas. Pass Mountain contains very few, if any, ironwoods.



Uplands - medium vegetation density.

Less dense areas within the Uplands contain widely spaced creosote bush (*Larrea tridentate*) with an occasional prickly pear or cholla (**C**). Saguaros are found in these areas in lower densities than either type **A** or **B**.

UNDISTURBED RIPARIAN

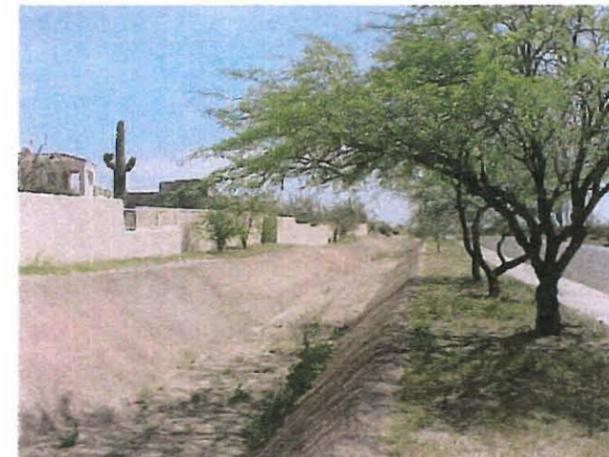
These are shallow, sandy bottom washes that contain essentially the same vegetation as the Undisturbed Foothills Palo Verde & Saguaro Upland (Arizona Sonoran Desert Scrub) with a slight increase in jojoba density and a decrease in saguaros. Slightly higher tree density associated with Undisturbed Riparian category can be discerned on the aerial photo but is less apparent in the field.



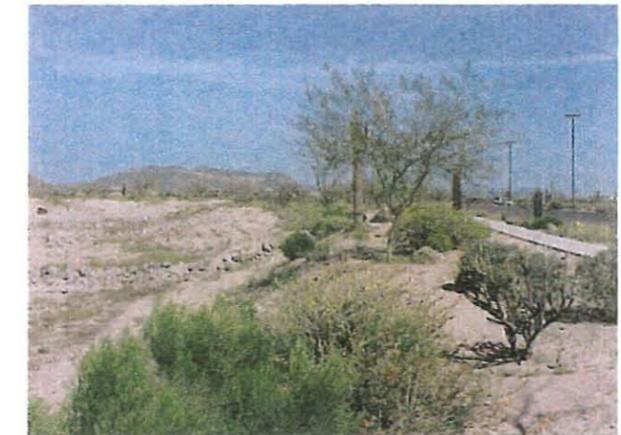
High vegetation density.

DEVELOPED DRAINAGE WAY

These areas are constructed drainage ways that contain associated landscape. The plants are typical native and/or desert adapted vegetation. Plants have typically been planted as part of drainage way improvements.



Low vegetation density.



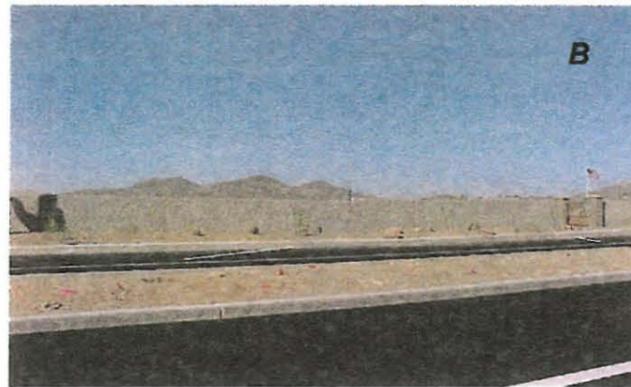
Low vegetation density.

RECENT DEVELOPMENT

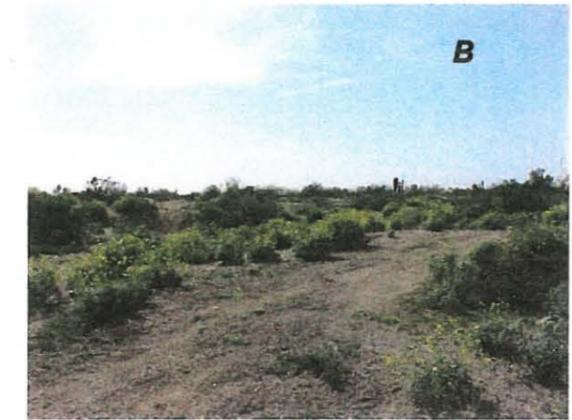
Areas of recent development do not appear on the December 1998 aerial photos but can be seen in the aerial dated January 2000. Development is either large lot custom residential (**A**) or production unit subdivision (**B**). Flood control improvement in these areas would require significant acquisition of newly developed private property



Low vegetation density.



Low vegetation density.

**DISTURBED DESERT**

These are areas of natural desert that have been disturbed and consist of suburban front yards (**A**) or areas disturbed by vehicle traffic (**B**). These disturbed areas contain sparsely spaced native plants (creosote, saguaro or ocotillo) and invasive species such as desert broom (*Baccharis sarothroides*).

V. EVALUATION OF ALTERNATIVES

The flood control alternatives for the Spook Hill ADMP are described in the Level I analysis report *Alternatives Formulation/Preliminary Analysis*, Wood, Patel & Associates, Inc., January 18, 2001. The highest ranked alternatives are shown graphically on the exhibits in Appendix C of this report. Each of these alternatives contains elements such as open channels (earthen or concrete), storm drain pipes, levees, and detention basins which function to divert surface runoff and reduce peak discharge rates. Each of these alternatives results in direct impacts to jurisdictional waters. Some of these alternatives utilize existing man-made drainage features such as channels along McKellips Road, McDowell Road, and Hawes Road. Others require some degree of modification to natural watercourse areas through diversion of flow and construction of detention basins. For the time being, indirect impacts have been assumed to be negligible since the District

proposes use of low water discharge pipes to maintain flows along the segments of wash downstream of proposed flood control structures.

Impacts to vegetation vary significantly from one alternative to the other. Some of the alternatives utilize existing man-made channels as well as highly disturbed lands adjoining existing public roads.

The 1" = 800' aerial photos provided in Appendix D have been annotated to show the scope of flood control improvements proposed by each alternative. These photographs also show the impacts to jurisdictional waters and high-, medium-, or low-density vegetation. Table 2 summarizes the jurisdictional area impacts and vegetation impacts for comparative purposes.

TABLE 2 - SUMMARY OF JURISDICTIONAL WATERS AND VEGETATION IMPACTS FOR EACH ALTERNATIVE

Alternative	Jurisdictional Waters Impact (ac)	Vegetative Impacts High Density (ac)	Vegetative Impacts Medium Density (ac)	Vegetative Impacts Low Density (ac)
MD2E	0.80	20.0	0.0	13.6
MD3E	0.86	21.6	0.0	12.9
MK1E	2.67	8.4	0.0	12.4
MK2E	2.91	18.4	0.0	12.4
PM4E	1.24	9.5	3.0	0.0

APPENDIX A

GROUND PHOTOGRAPHS OF EPHEMERAL WASHES



FCDMC-1



FCDMC-3



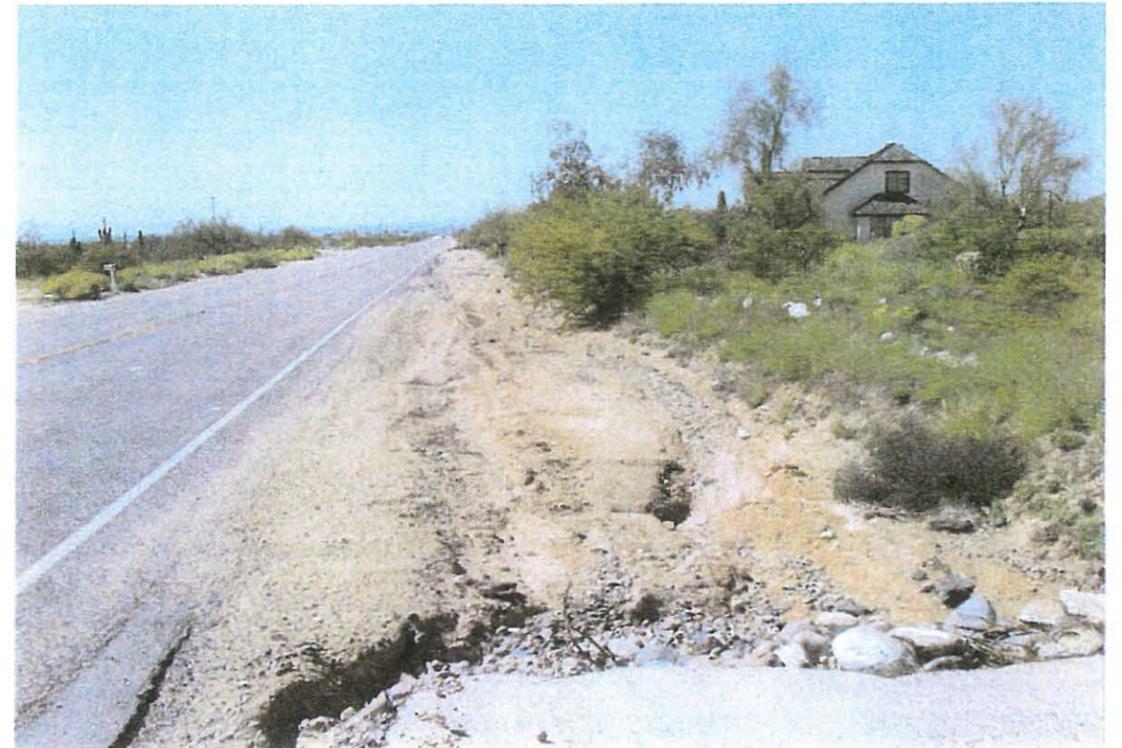
FCDMC-2



FCDMC-4



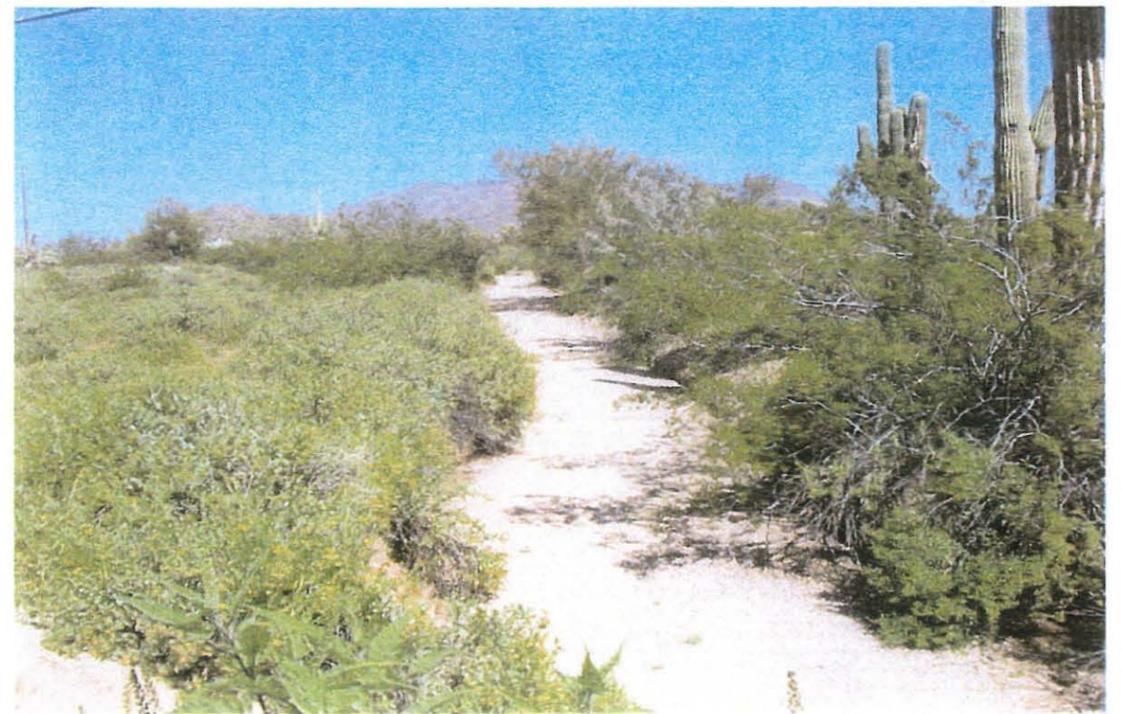
FCDMC-5



FCDMC-7



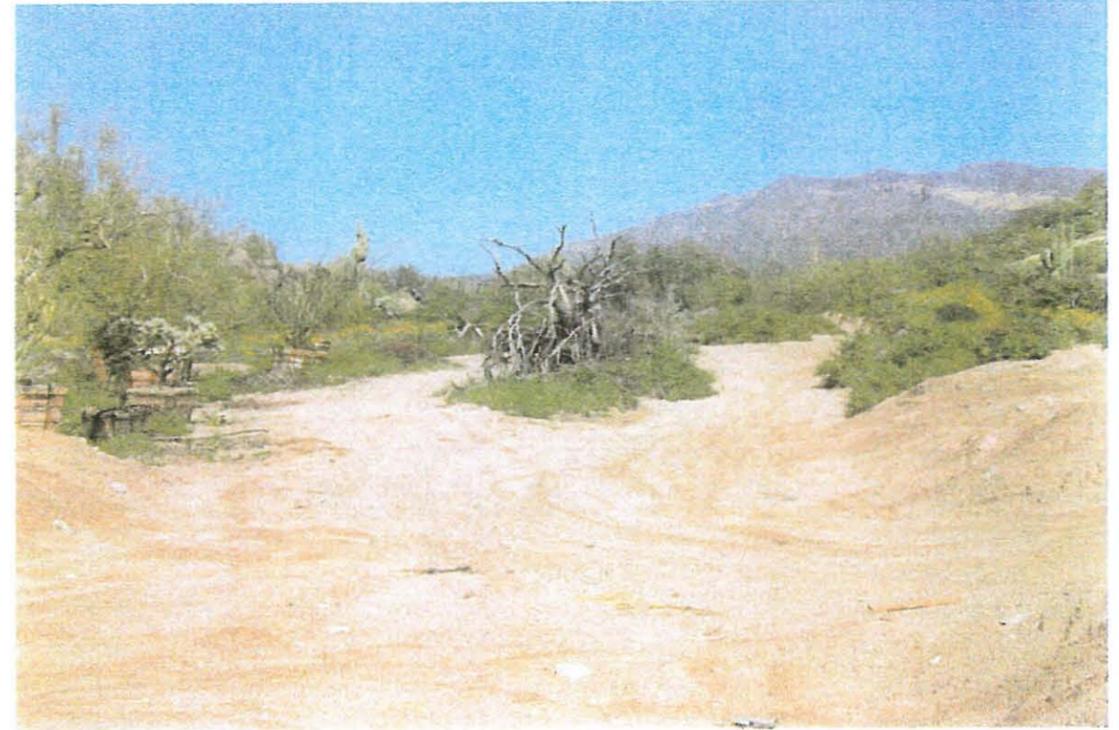
FCDMC-6



FCDMC-8



FCDMC-9



FCDMC-11



FCDMC-10



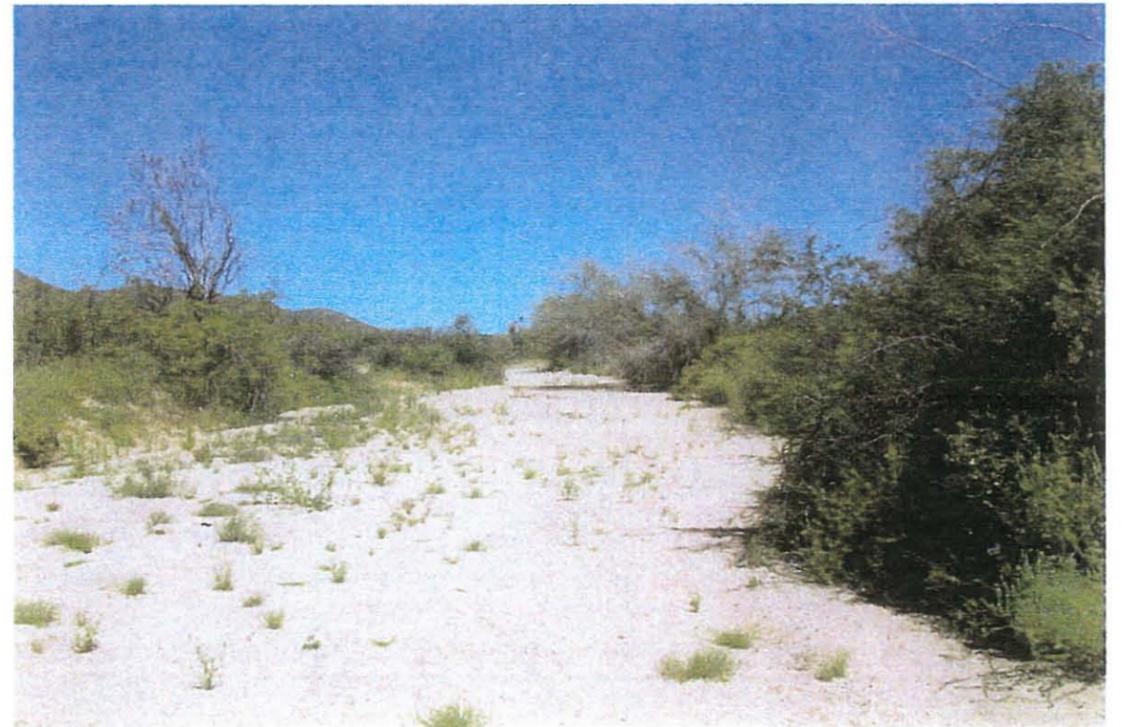
FCDMC-12



FCDMC-13



FCDMC-14



FCDMC-15



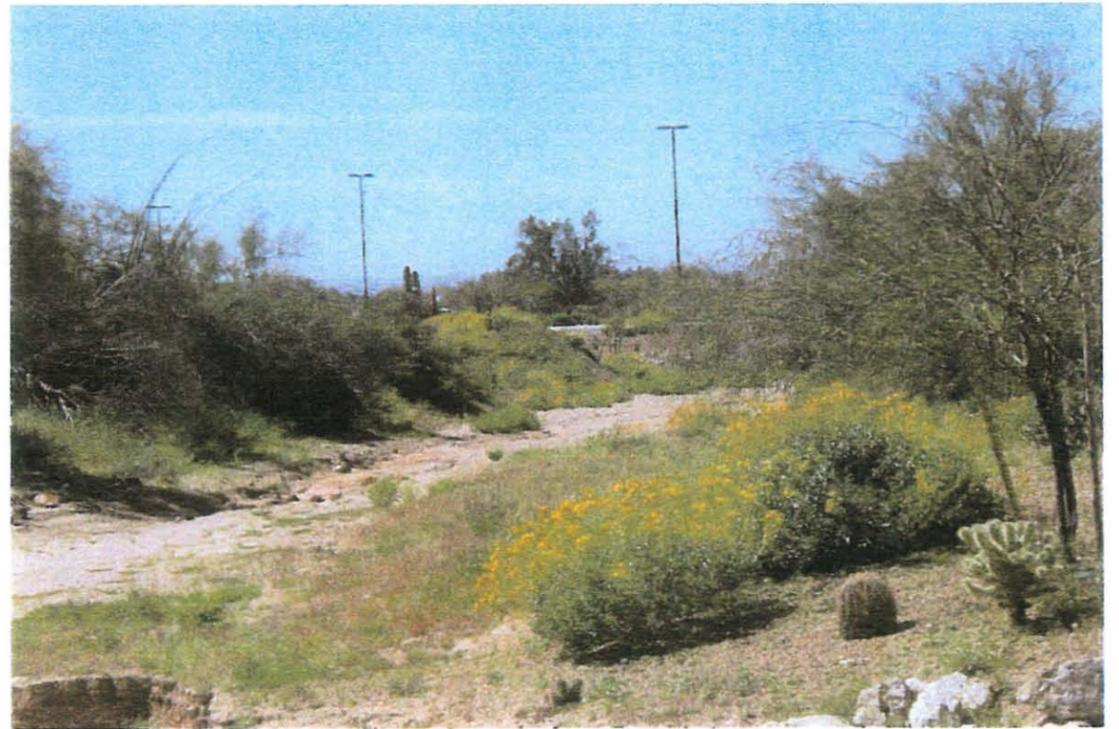
FCDMC-16



FCDMC-18



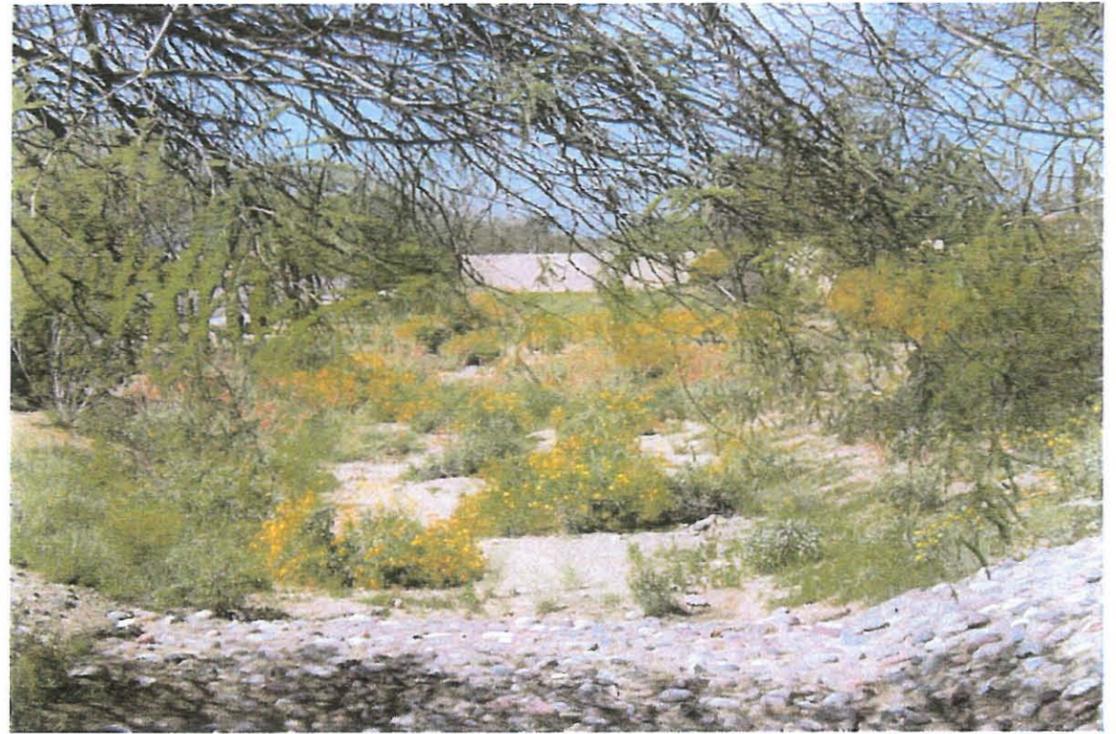
FCDMC-17



FCDMC-19



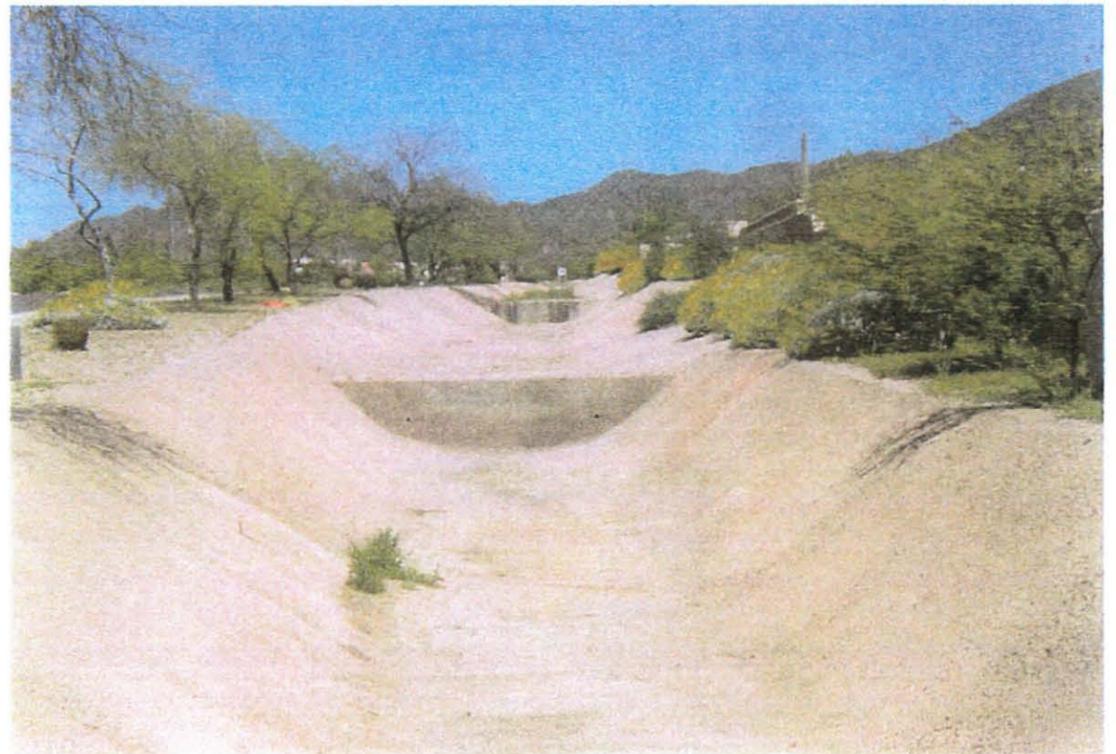
FCDMC-20



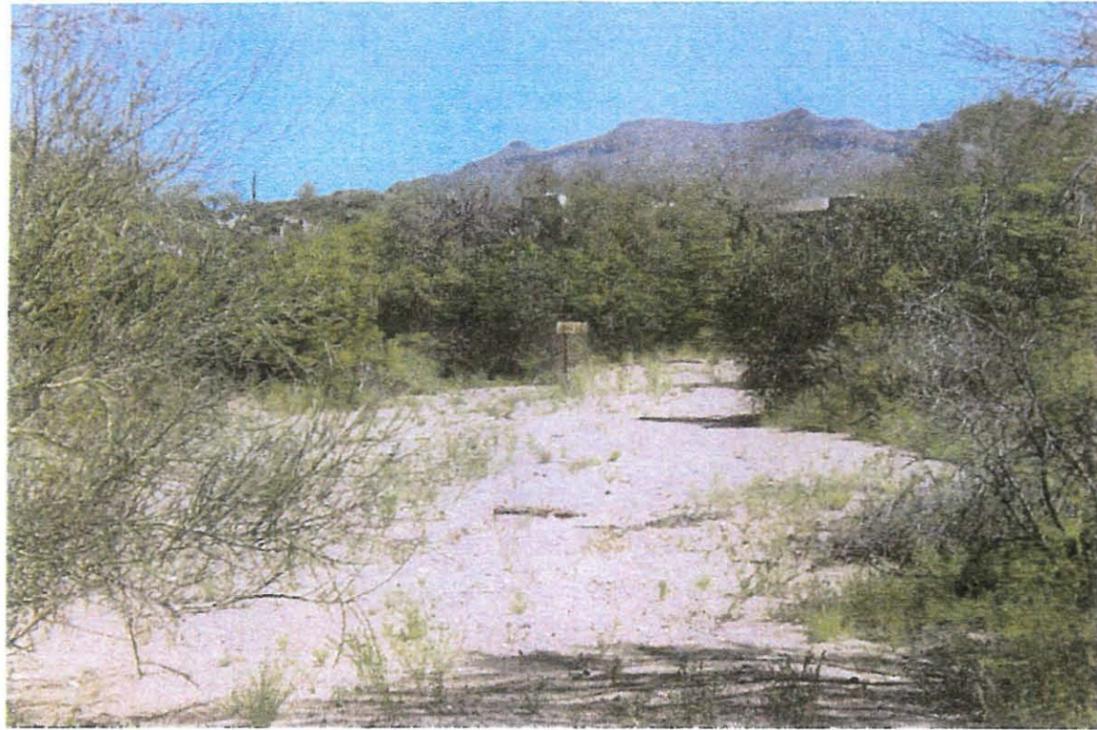
FCDMC-22



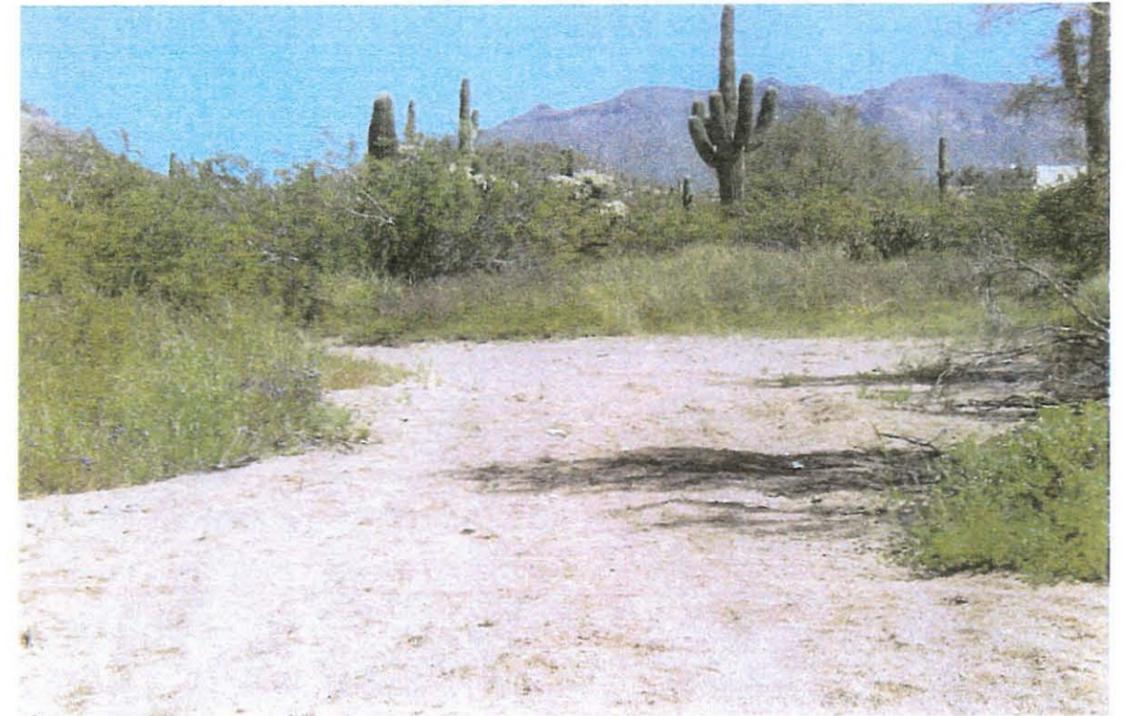
FCDMC-21



FCDMC-23



FCDMC-24



FCDMC-26



FCDMC-25



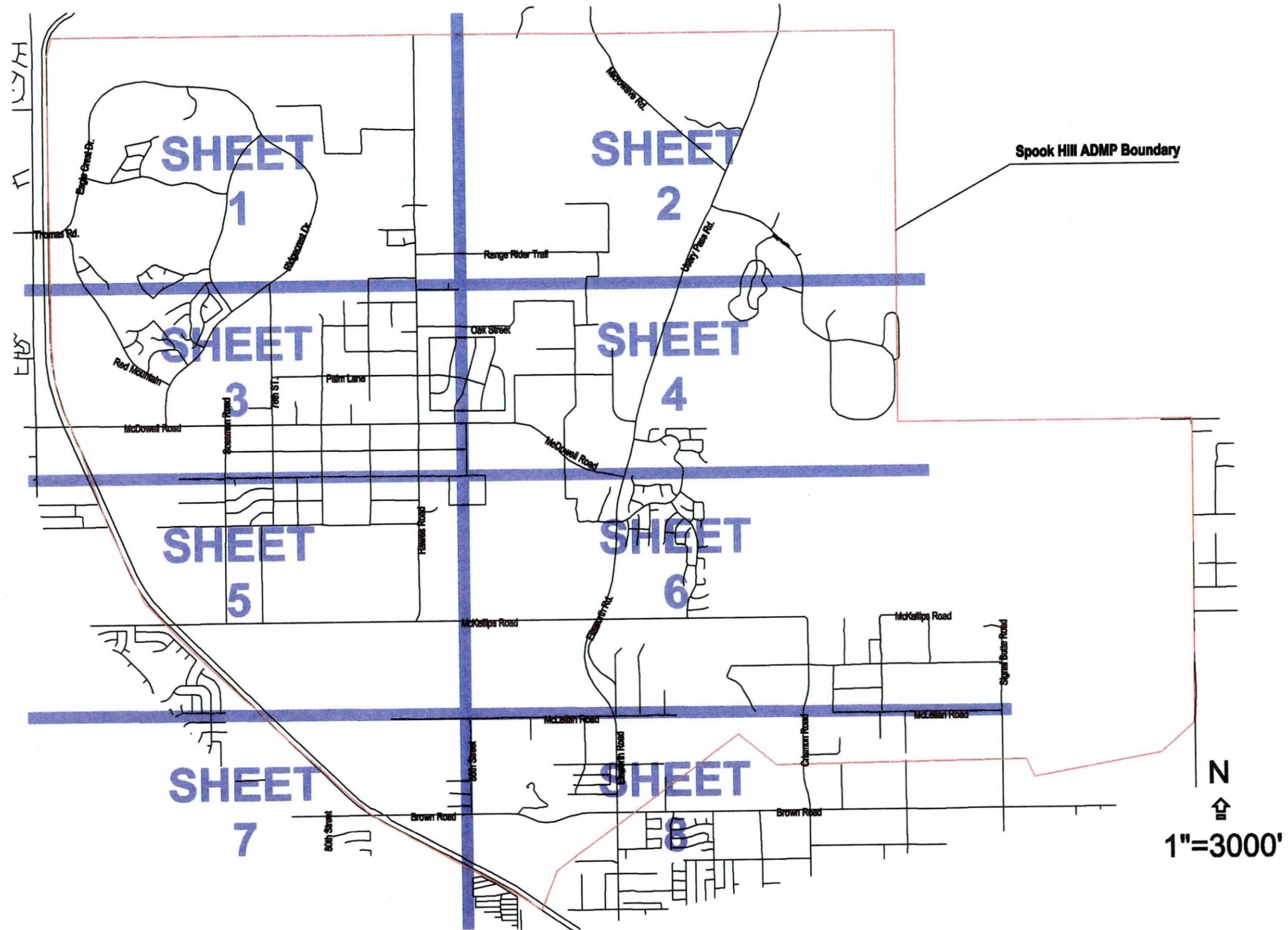
FCDMC-27

APPENDIX B

JURISDICTIONAL BOUNDARY DELINEATIONS

SHEET INDEX

TO 800-SCALE CWA SECTION 404 JURISDICTIONAL BOUNDARY MAPS





Aerial Photo Flown 1/28/00



Scale: 1" = 800'

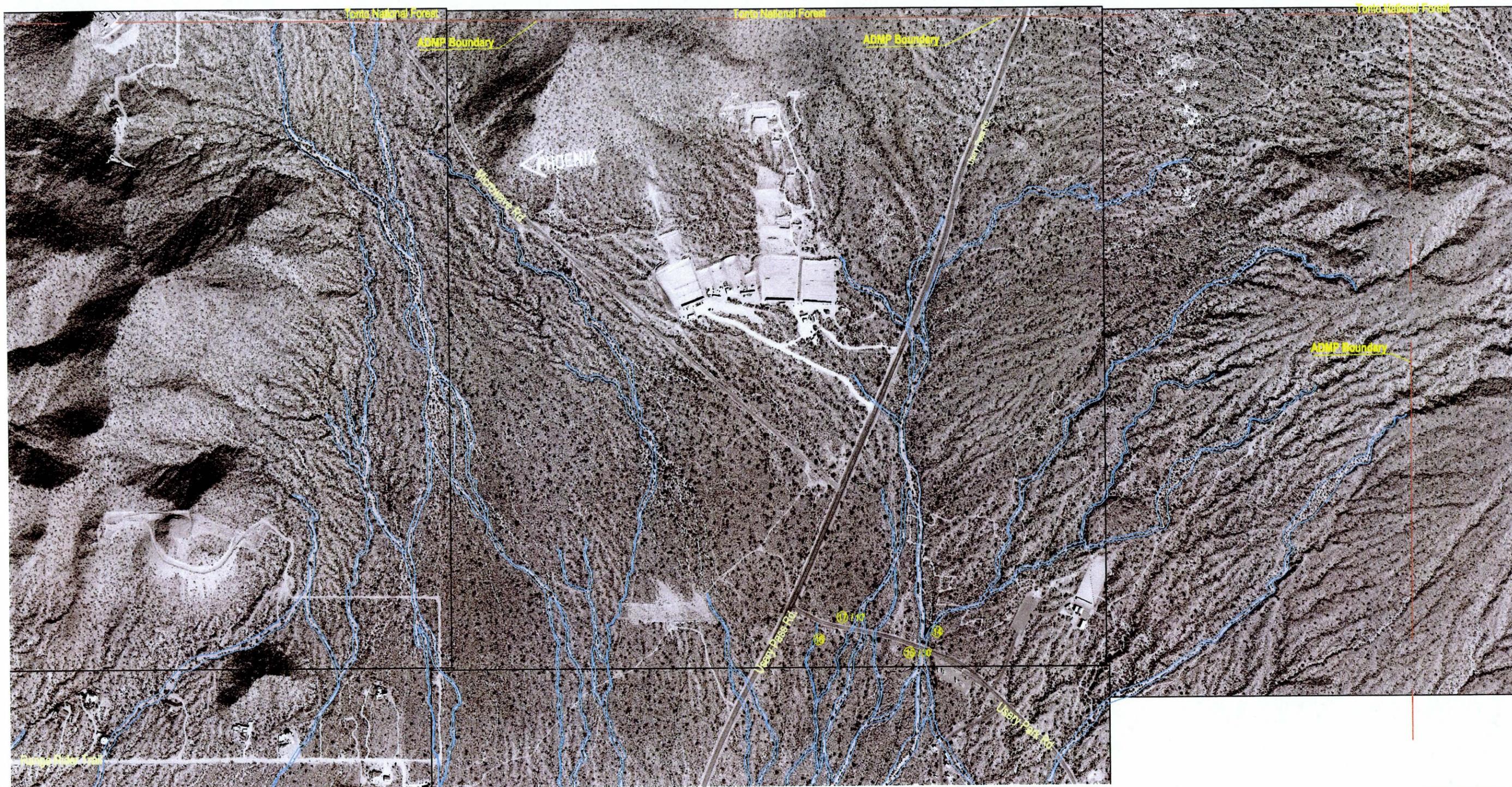
Spook Hill CWA Section 404 Jurisdictional Boundaries



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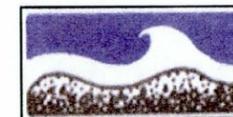


Aerial Photo Flown 1/28/00

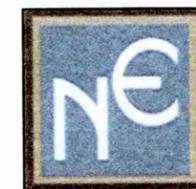
Spook Hill CWA Section 404 Jurisdictional Boundaries



Scale: 1" = 800'



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Aerial Photo Flown 1/28/00



Scale: 1" = 800'

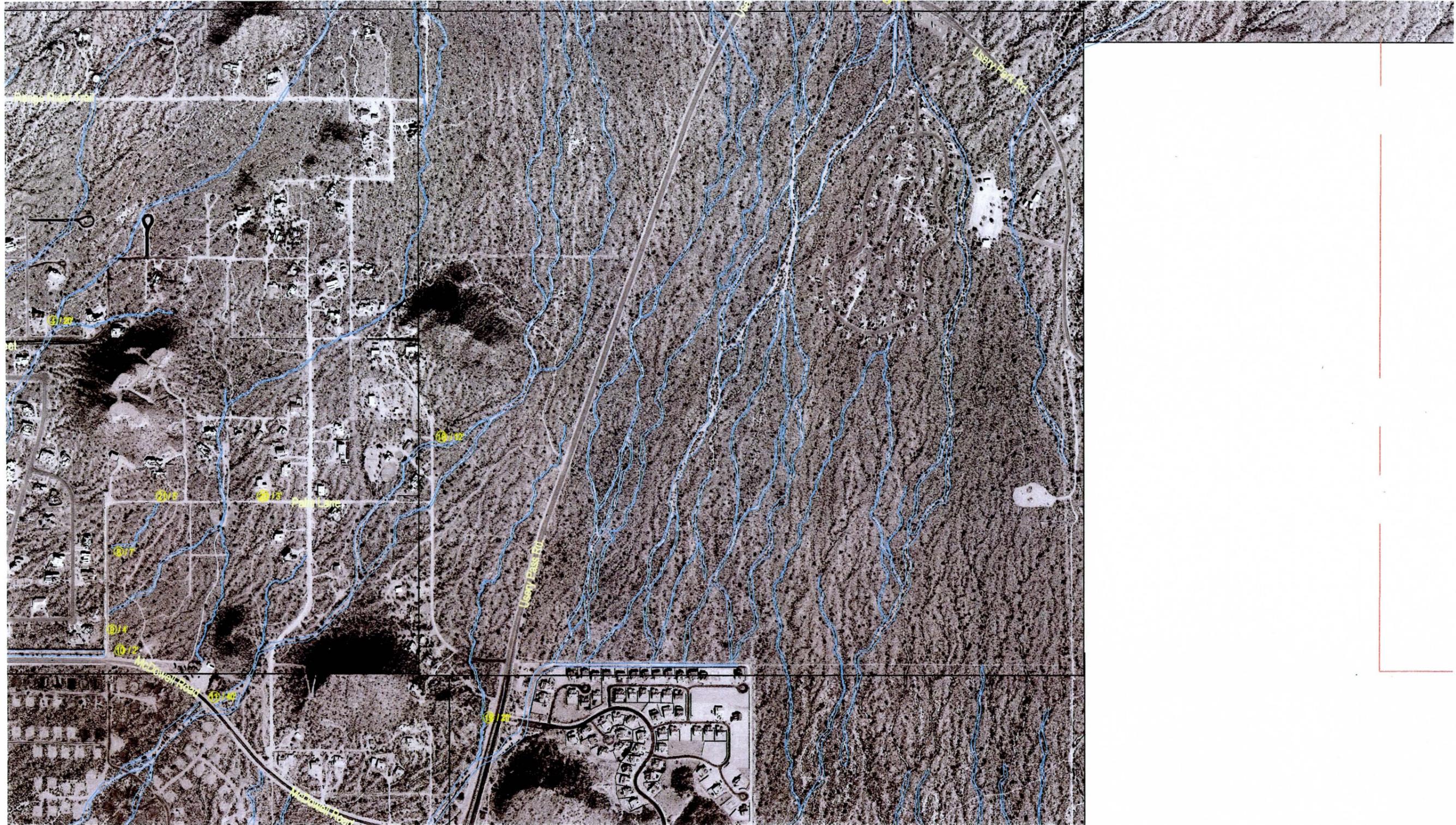
Spook Hill CWA Section 404 Jurisdictional Boundaries



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May 2001 Sheet 3 of 8



Aerial Photo Flown 1/28/00



Scale: 1" = 800'

Spook Hill CWA Section 404 Jurisdictional Boundaries



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Aerial Photo Flown 1/28/00



Scale: 1" = 800'

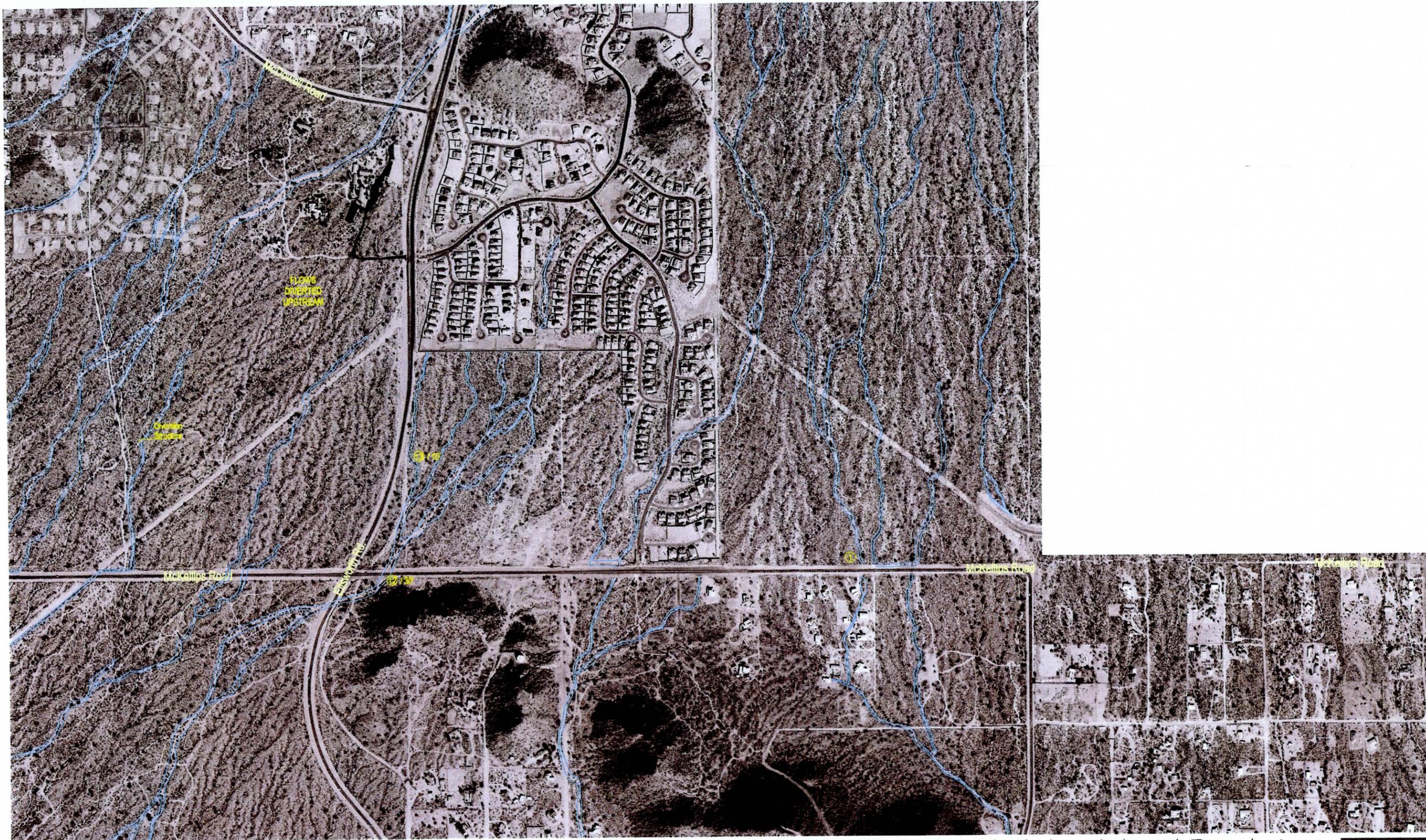
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Spook Hill CWA Section 404 Jurisdictional Boundaries

Aerial Photo Flown 1/28/00



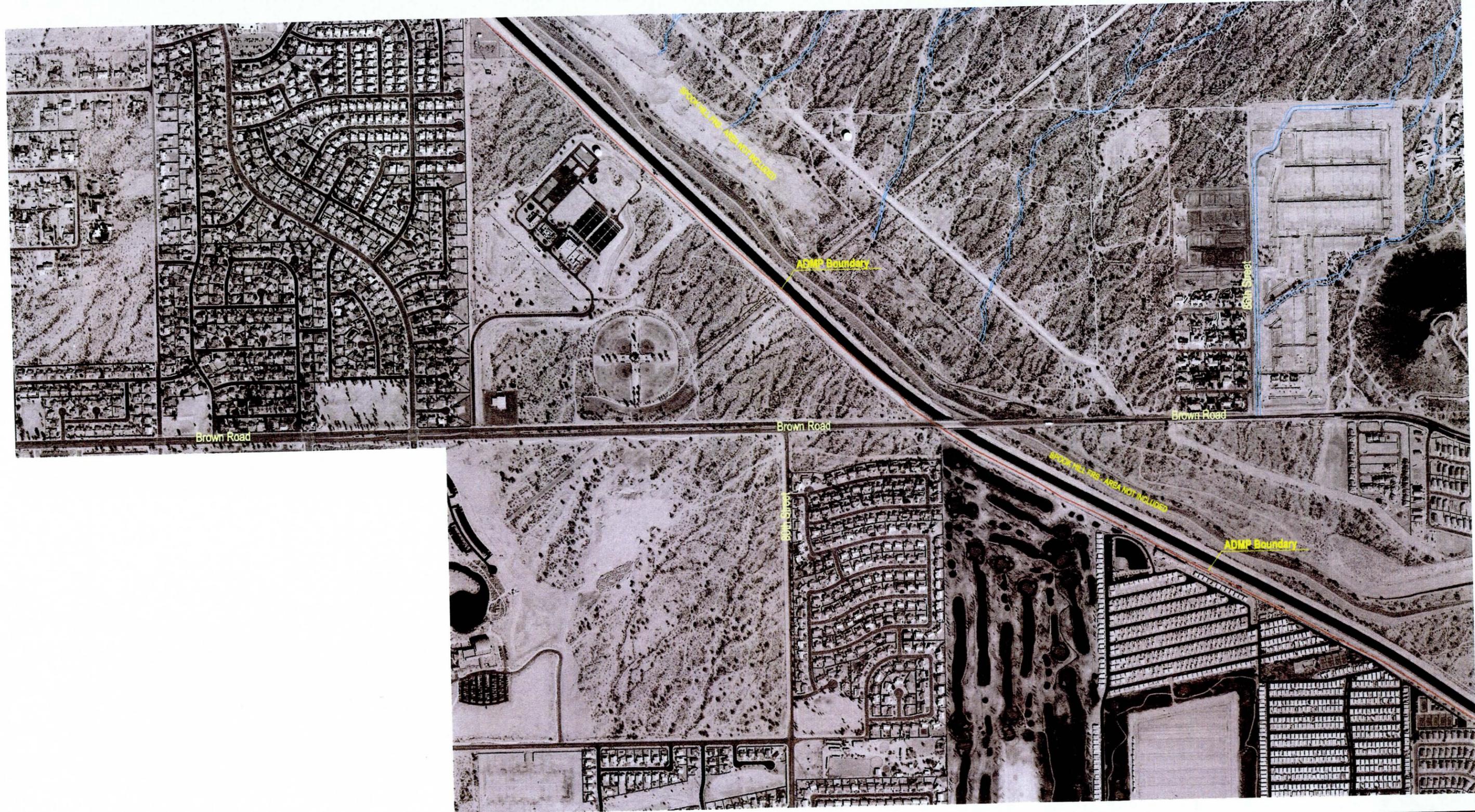
Scale: 1" = 800'



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Spook Hill CWA Section 404 Jurisdictional Boundaries

Aerial Photo Flown 1/28/00



Scale: 1" = 800'



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Aerial Photo Flown 1/28/00



Scale: 1" = 800'

Spook Hill CWA Section 404 Jurisdictional Boundaries



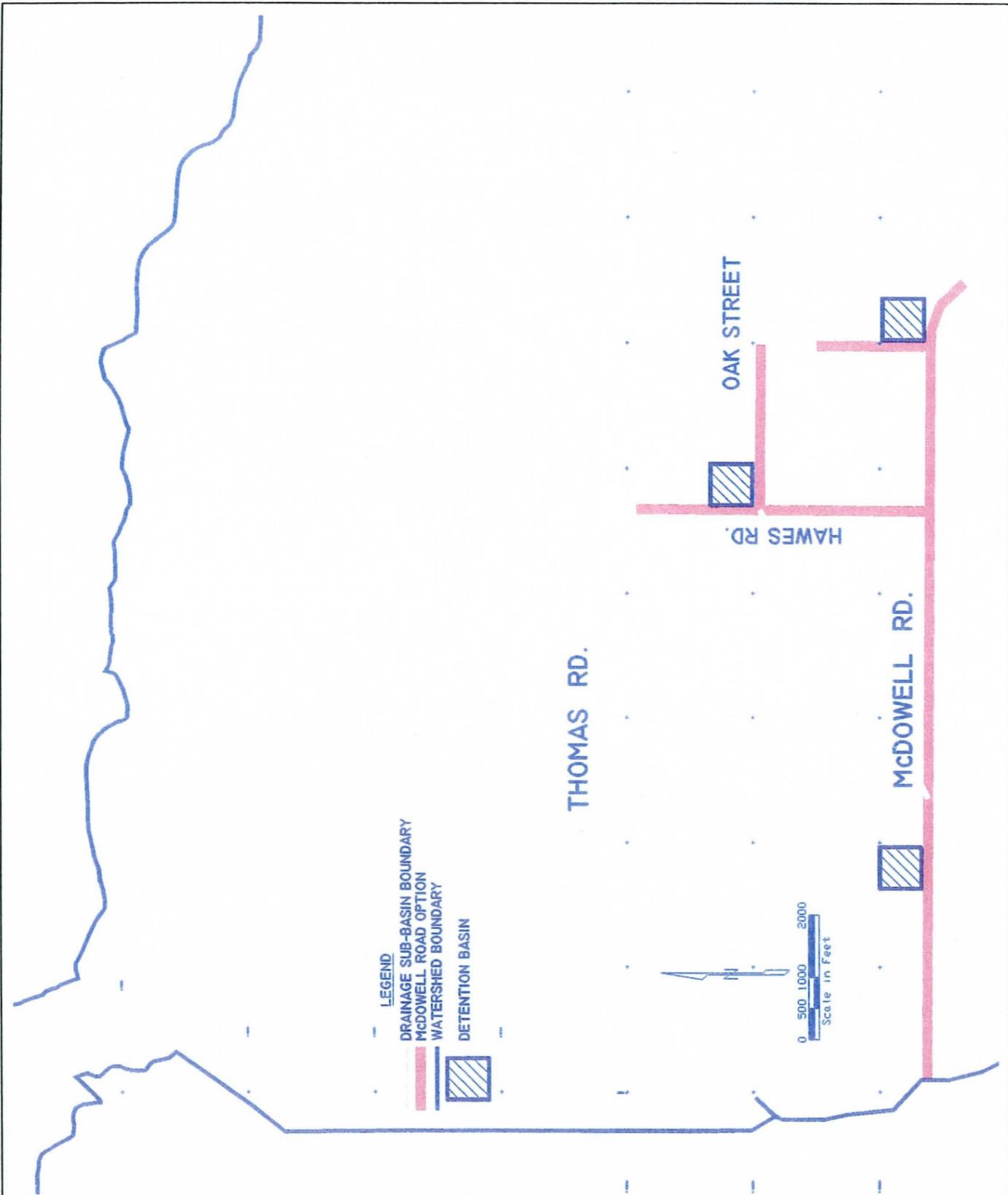
CMG Drainage Engineering, Inc.
(520) 882-4244



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APPENDIX C

**CONCEPT PLANS FOR HIGHEST RANKED
FLOOD CONTROL ALTERNATIVES**

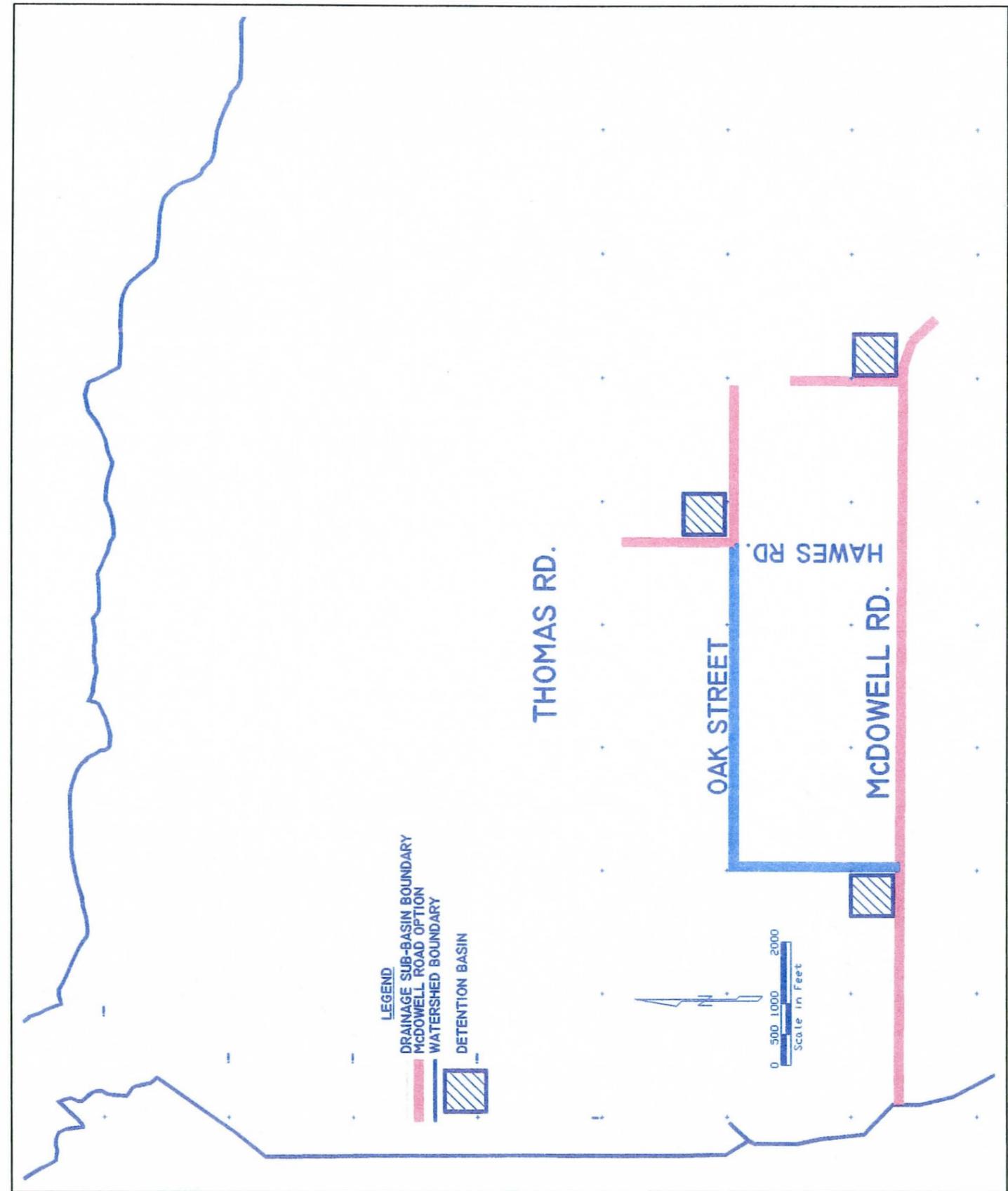


SPOOK HILL A.D.M.P. UPDATE
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

Spook Hill

WOOD, PATEL & ASSOCIATES, INC.
 2051 WEST NORTHERN, SUITE 100
 PHOENIX, ARIZONA (602) 335-8500

McDOWELL ROAD ALTERNATIVE		spkh1-mcdowell12E-C	
	BY	DATE	DRAWING NO.
DESIGNED	R. HINER	12/00	spkh-mcdowell12E-C.dwg
DRAWN	S. CAMPBELL/C. COLE	12/00	SHEET OF
CHECKED	A. PATEL	12/00	2 6

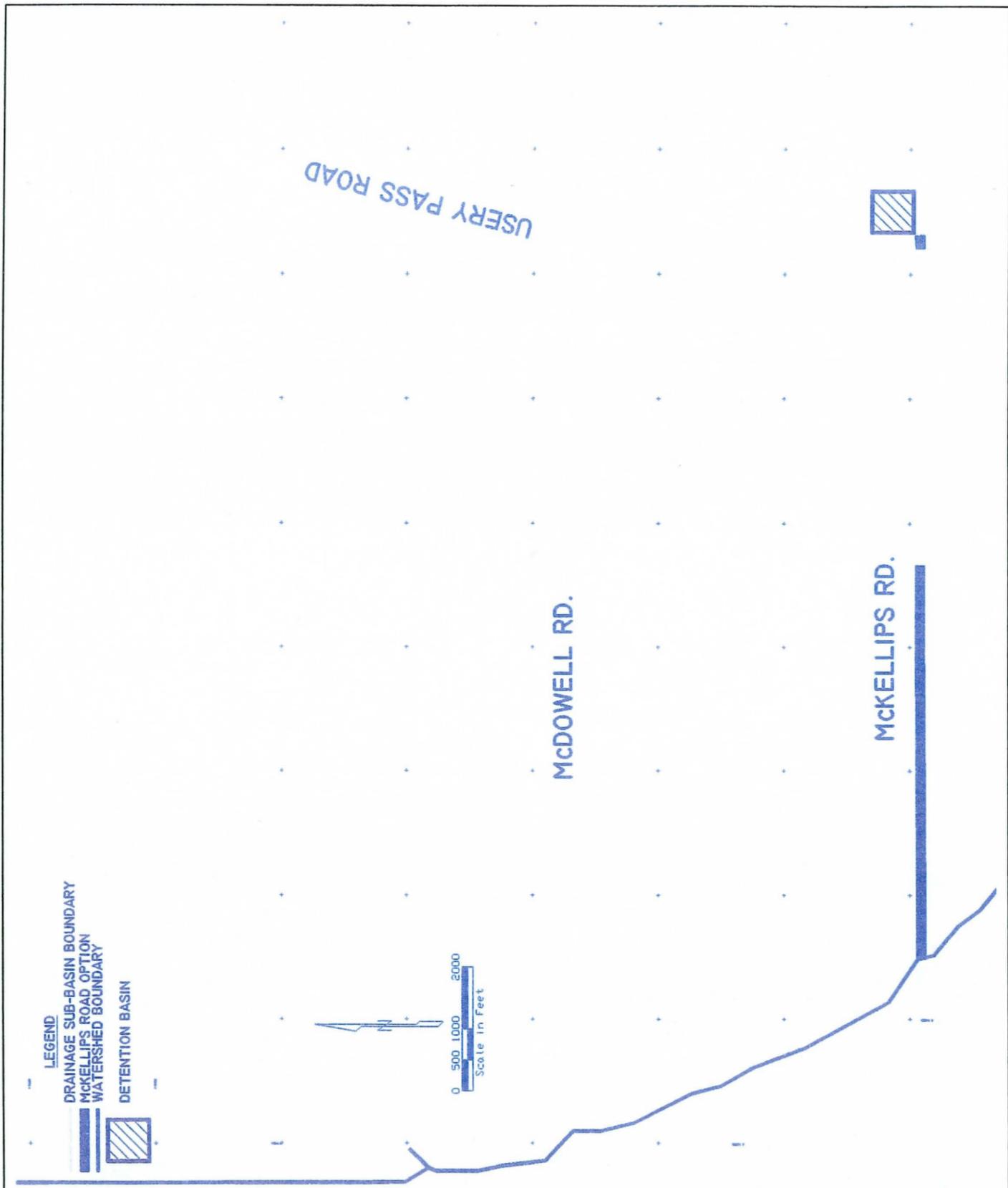


SPOOK HILL A.D.M.P. UPDATE
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY

Spook Hill

WOOD, PATEL & ASSOCIATES, INC.
 2051 WEST NORTHERN, SUITE 100
 PHOENIX, ARIZONA (602) 335-8500

McDOWELL ROAD ALTERNATIVE		spkh1-mcdowell13E-C	
	BY	DATE	DRAWING NO.
DESIGNED	R. HINER	12/00	spkh-mcdowell13E-C.dwg
DRAWN	S. CAMPBELL/C. COLE	12/00	SHEET OF
CHECKED	A. PATEL	12/00	3 6

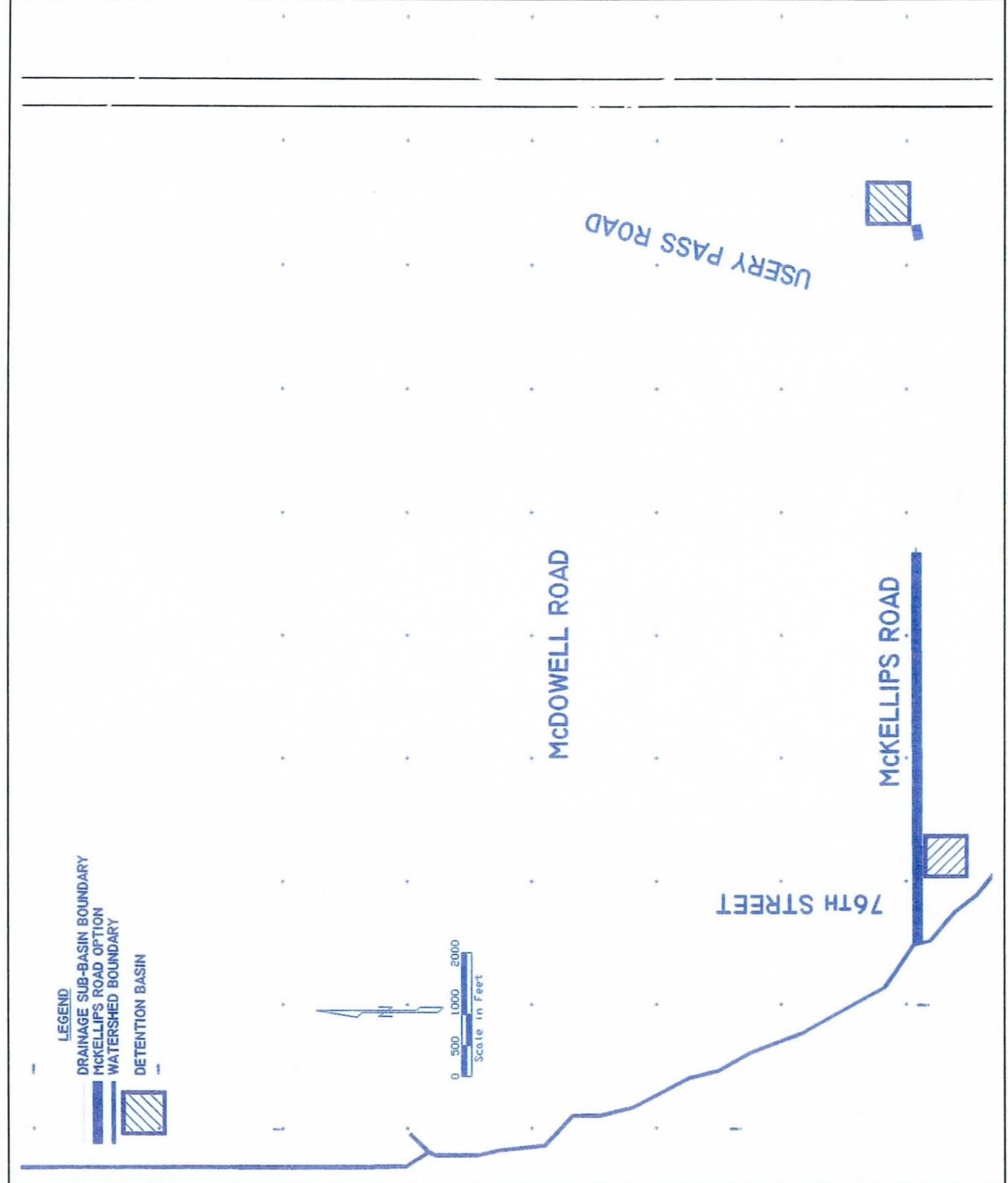


**SPOOK HILL A.D.M.P. UPDATE
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY**

Spook Hill

WOOD, PATEL & ASSOCIATES, INC.
2051 WEST NORTHERN, SUITE 100
PHOENIX, ARIZONA (602) 335-8500

MCKELLIPS ROAD ALTERNATIVE		spkhl-mckellips1E-C	
	BY	DATE	DRAWING NO.
DESIGNED	R. HINER	12/00	spkhl-mckellips1E-C.dwg
DRAWN	S. CAMPBELL/C. COLE	12/00	SHEET OF
CHECKED	A. PATEL	12/00	1 3

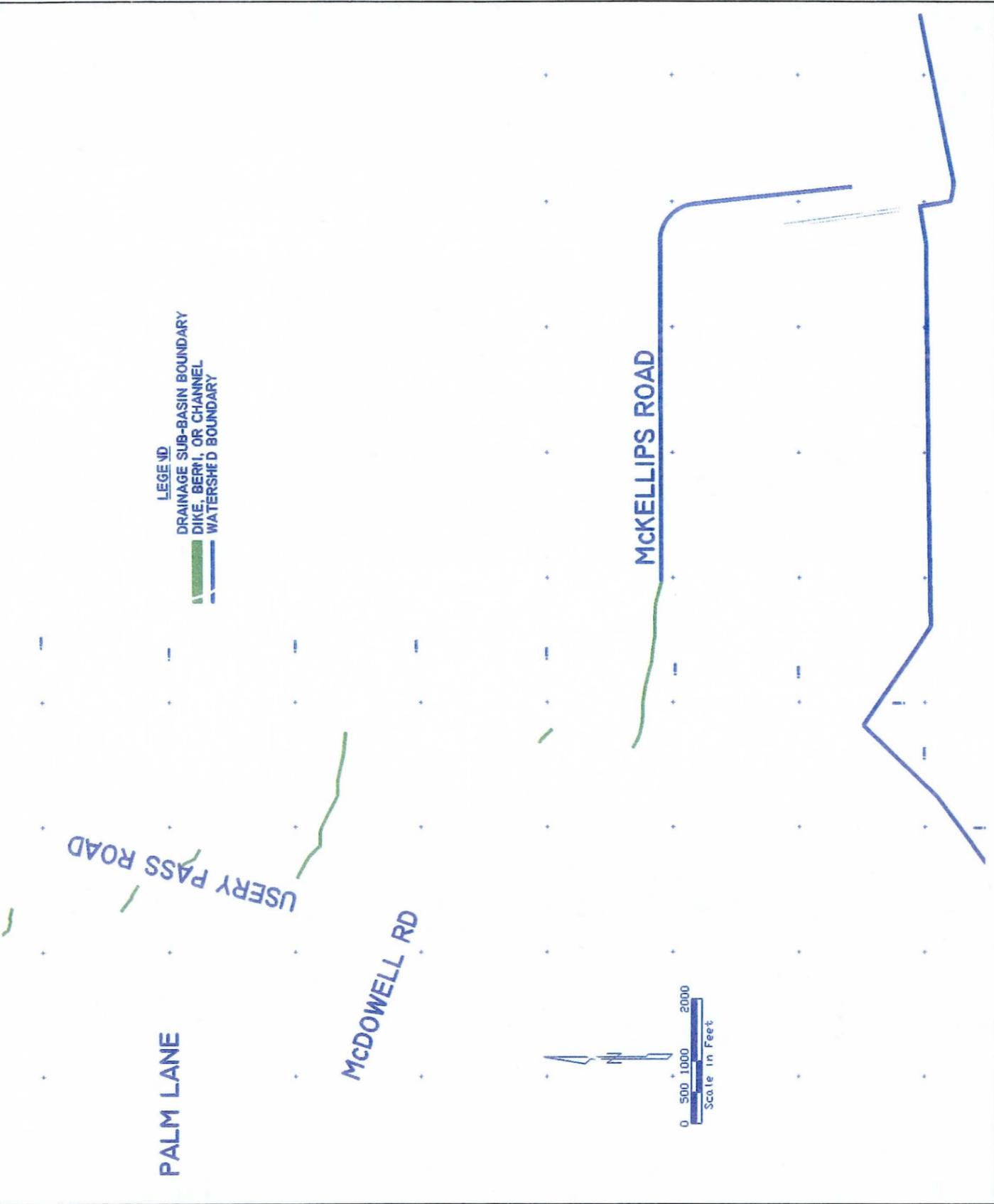


**SPOOK HILL A.D.M.P. UPDATE
FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY**

Spook Hill

WOOD, PATEL & ASSOCIATES, INC.
2051 WEST NORTHERN, SUITE 100
PHOENIX, ARIZONA (602) 335-8500

MCKELLIPS ROAD ALTERNATIVE		spkhl-mckellips2E-C	
	BY	DATE	DRAWING NO.
DESIGNED	R. HINER	12/00	spkhl-mckellips2E-C.dwg
DRAWN	S. CAMPBELL/C. COLE	12/00	SHEET OF
CHECKED	A. PATEL	12/00	2 3



SPOOK HILL A.D.M.P. UPDATE
 FLOOD CONTROL DISTRICT
 OF MARICOPA COUNTY



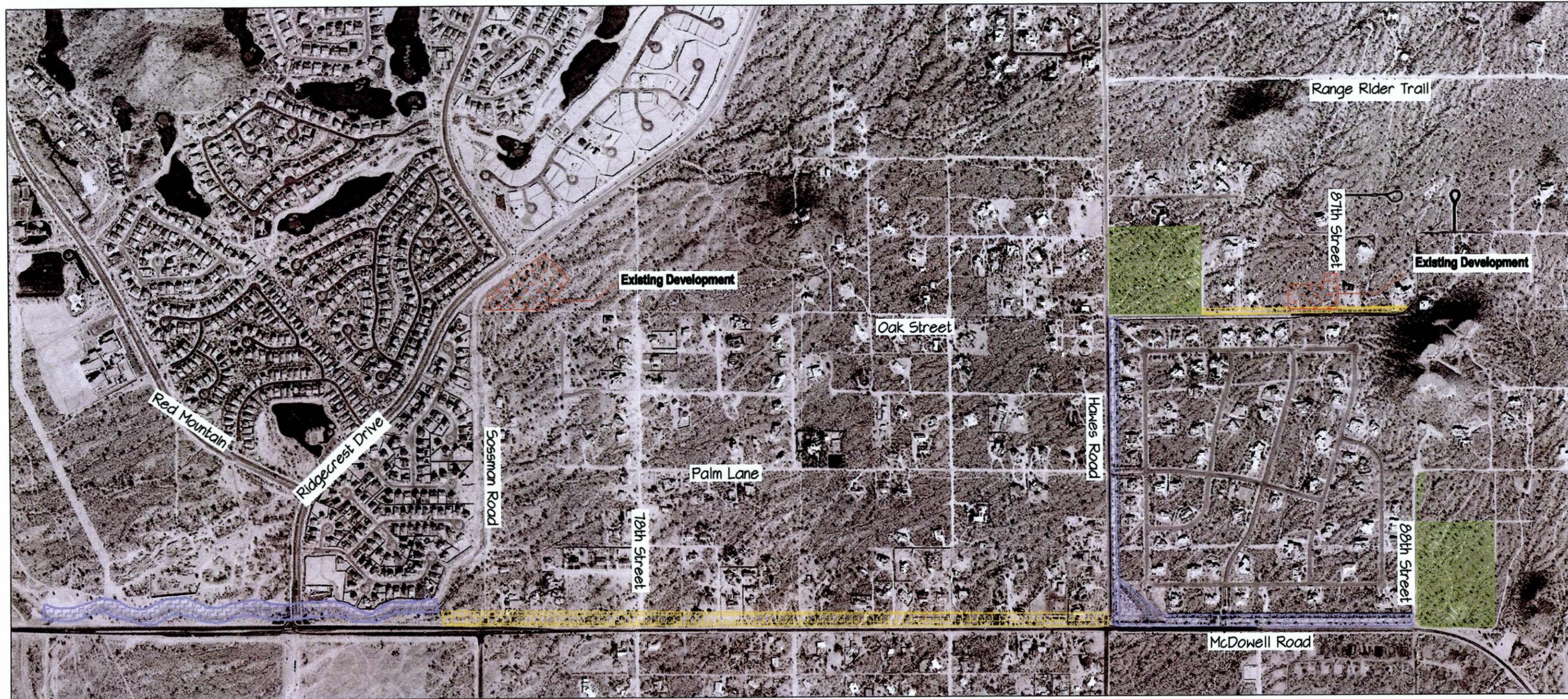
PASS MOUNTAIN ALTERNATIVE spkhl-passmntn4E

WOOD, PATEL & ASSOCIATES, INC.
 2051 WEST NORTHERN, SUITE 100
 PHOENIX, ARIZONA (602) 335-8500

	BY	DATE	DRAWING NO.
DESIGNED	R. HINER	12/00	spkhl-passmntn4E.dwg
DRAWN	S. CAMPBELL/C. COLE	12/00	SHEET OF
CHECKED	A. PATEL	12/00	3 4

APPENDIX D

PHOTOGRAPHS SHOWING
VEGETATION IMPACTS FOR EACH ALTERNATIVE



Aerial Photo Flown 1/28/00

Direct Impact to Jurisdictional Waters-0.80 Acres

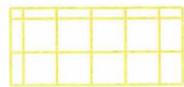
Scale: 1" = 800'



Vegetation Types Impacted by Project Features



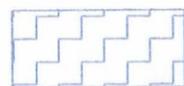
HIGH DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (with and with Ironwood)
 -Undisturbed Riparian Habitat



LOW DENSITY VEGETATION
 -Recent Development
 -Suburban Front Yard
 -Disturbed Desert



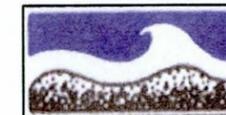
MEDIUM DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (creosote dominate)



EXISTING DRAINAGEWAYS
 -Development Channels
 -Public Drainageways
 -No Impact to Existing Vegetation

Project Impacts by Vegetation Density (Acres)		
High Density	Medium Density	Low Density
20.0	0.0	13.6

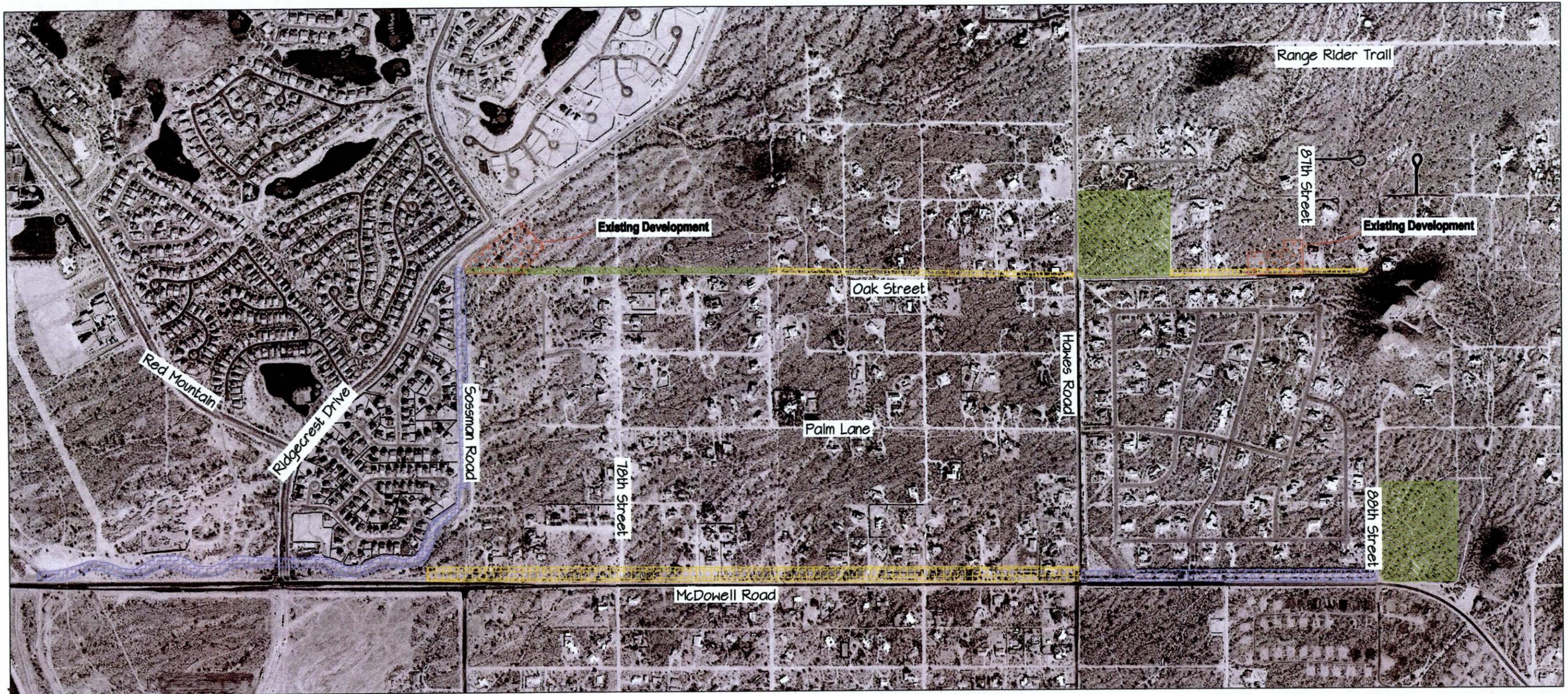
Spook Hill Vegetation Analysis
 McDowell Road Alternative Option MD2E
 Prepared for Flood Control District of Maricopa County



CMG Drainage Engineering, Inc.
 (520) 882-4244



Novak Environmental, Inc.
 (520) 206-0591
 May 2001



Aerial Photo Flown 1/28/00

Direct Impact to Jurisdictional Waters-0.86 Acres

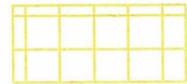
Scale: 1" = 800'



Vegetation Types Impacted by Project Features



HIGH DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (with and with Ironwood)
 -Undisturbed Riparian Habitat



LOW DENSITY VEGETATION
 -Recent Development
 -Suburban Front Yard
 -Disturbed Desert



MEDIUM DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (creosote dominate)



EXISTING DRAINAGEWAYS
 -Development Channels
 -Public Drainageways
 -No Impact to Existing Vegetation

Project Impacts by Vegetation Density (Acres)

High Density	Medium Density	Low Density
21.6	0.0	12.9

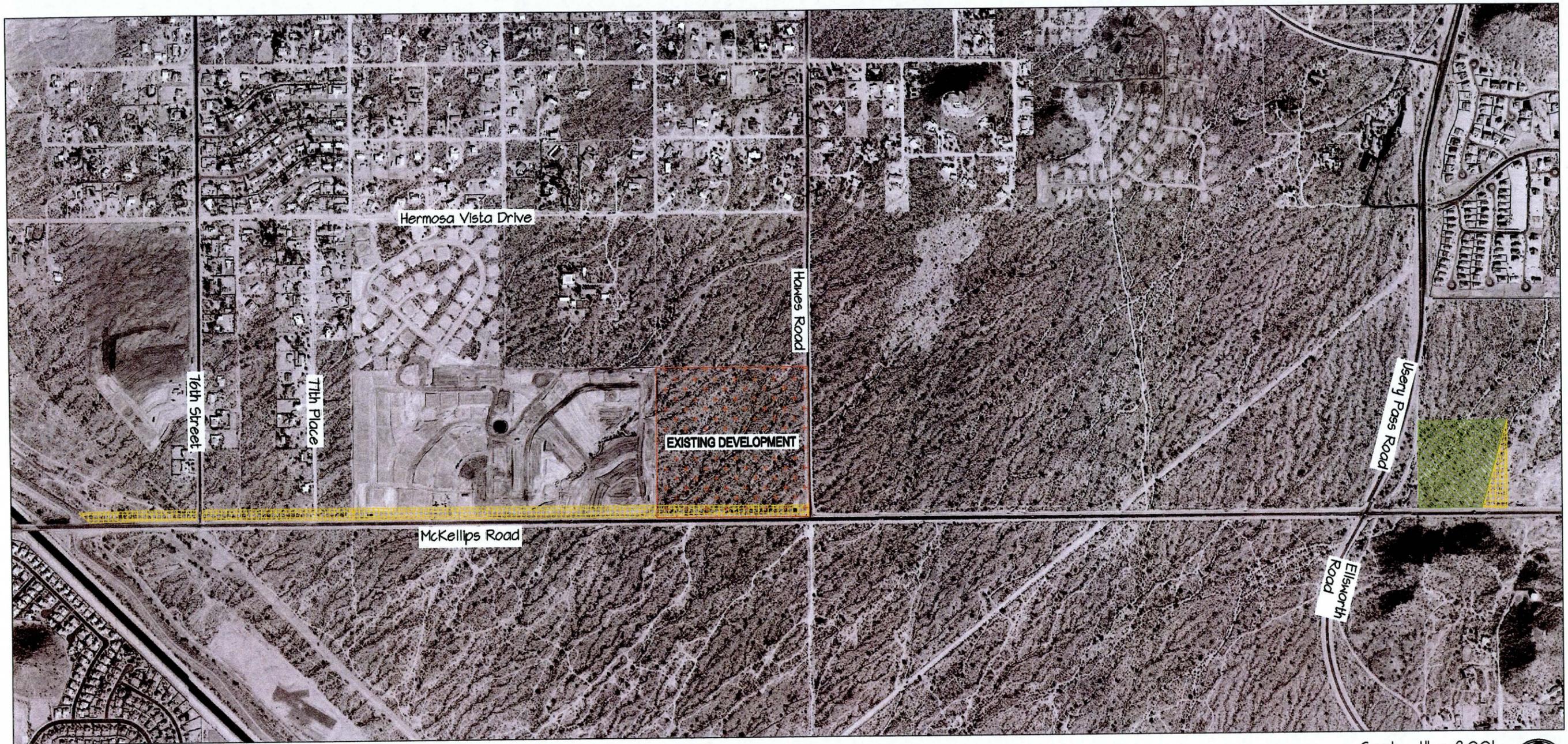
Spook Hill Vegetation Analysis
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 Prepared for Flood Control District of Maricopa County



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Aerial Photo Flown 1/28/00

Direct Impact to Jurisdictional Waters-2.67 Acres

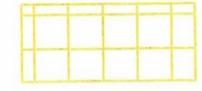
Scale: 1" = 800'



Vegetation Types Impacted by Project Features



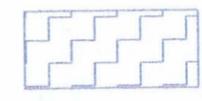
HIGH DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (with and with Ironwood)
 -Undisturbed Riparian Habitat



LOW DENSITY VEGETATION
 -Recent Development
 -Suburban Front Yard
 -Disturbed Desert



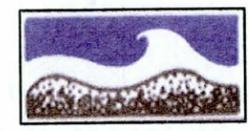
MEDIUM DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (creosote dominate)



EXISTING DRAINAGEWAYS
 -Development Channels
 -Public Drainageways
 -No Impact to Existing Vegetation

Project Impacts by Vegetation Density (Acres)		
High Density	Medium Density	Low Density
8.4	0.0	12.4

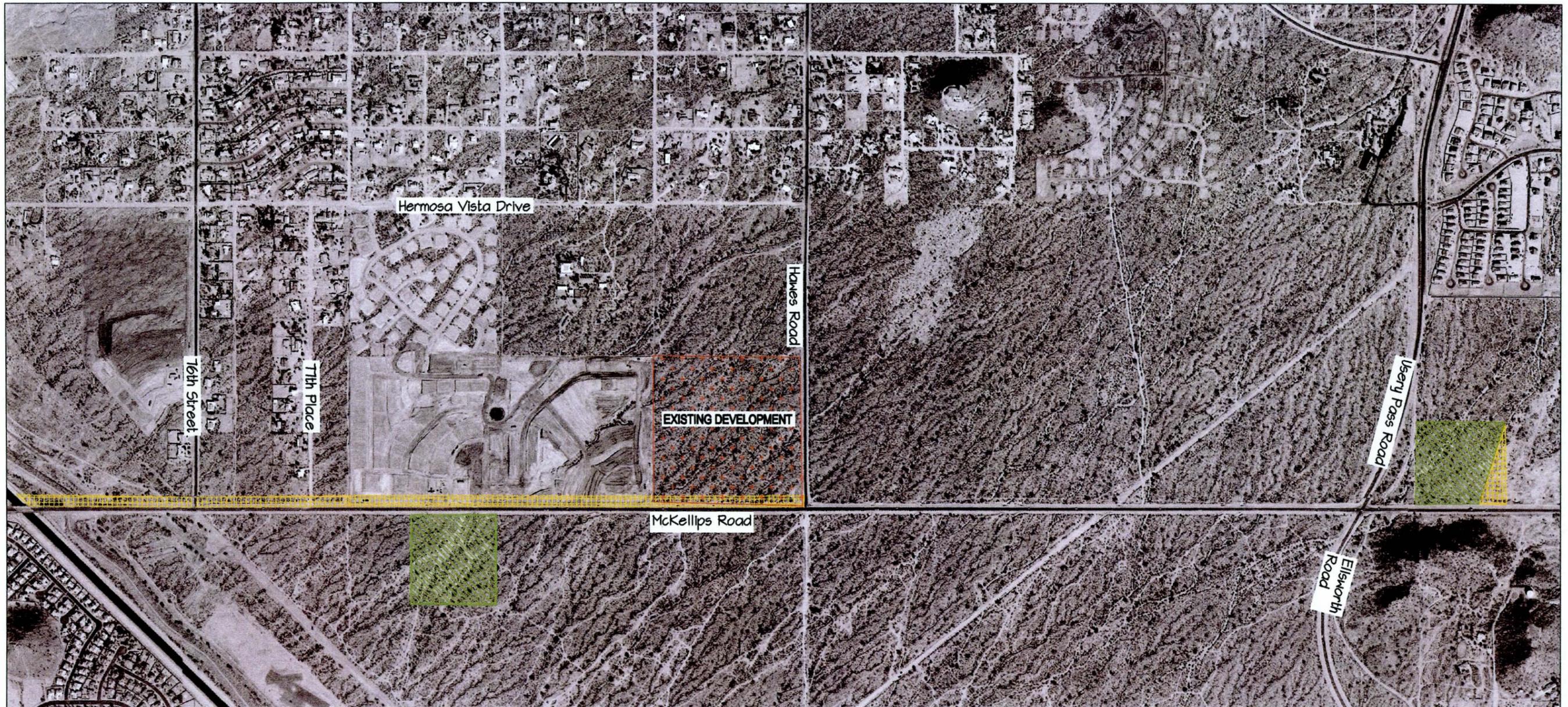
Spook Hill Vegetation Analysis
 McKellips Road Alternative Option MKIE
 Prepared for Flood Control District of Maricopa County



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Aerial Photo Flown 1/28/00

Direct Impact to Jurisdictional Waters-2.91 Acres

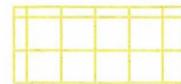
Scale: 1" = 800'



Vegetation Types Impacted by Project Features



HIGH DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (with and with Ironwood)
 -Undisturbed Riparian Habitat



LOW DENSITY VEGETATION
 -Recent Development
 -Suburban Front Yard
 -Disturbed Desert



MEDIUM DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (creosote dominate)

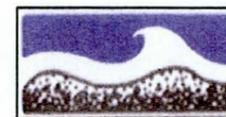


EXISTING DRAINAGEWAYS
 -Development Channels
 -Public Drainageways
 -No Impact to Existing Vegetation

Project Impacts by Vegetation Density (Acres)

High Density	Medium Density	Low Density
18.4	0.0	12.4

Spook Hill Vegetation Analysis
 McKellips Road Alternative Option MK2E
 Prepared for Flood Control District of Maricopa County



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Aerial Photo Flown 1/28/00

Direct Impact to Jurisdictional Waters-1.24 Acres

Scale: 1" = 800'



Vegetation Types Impacted by Project Features



HIGH DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (with and with Ironwood)
 -Undisturbed Riparian Habitat



LOW DENSITY VEGETATION
 -Recent Development
 -Suburban Front Yard
 -Disturbed Desert



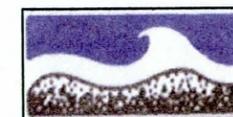
MEDIUM DENSITY VEGETATION
 -Undisturbed Foothills Palo Verde & Saguaro Upland (creosote dominate)



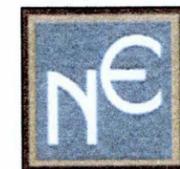
EXISTING DRAINAGEWAYS
 -Development Channels
 -Public Drainageways
 -No Impact to Existing Vegetation

Project Impacts by Vegetation Density (Acres)		
High Density	Medium Density	Low Density
4.5	3.0	0.0

Spook Hill Vegetation Analysis
 Pass Mountain Alternative Option PM4E
 Prepared for Flood Control District of Maricopa County



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 May 2001