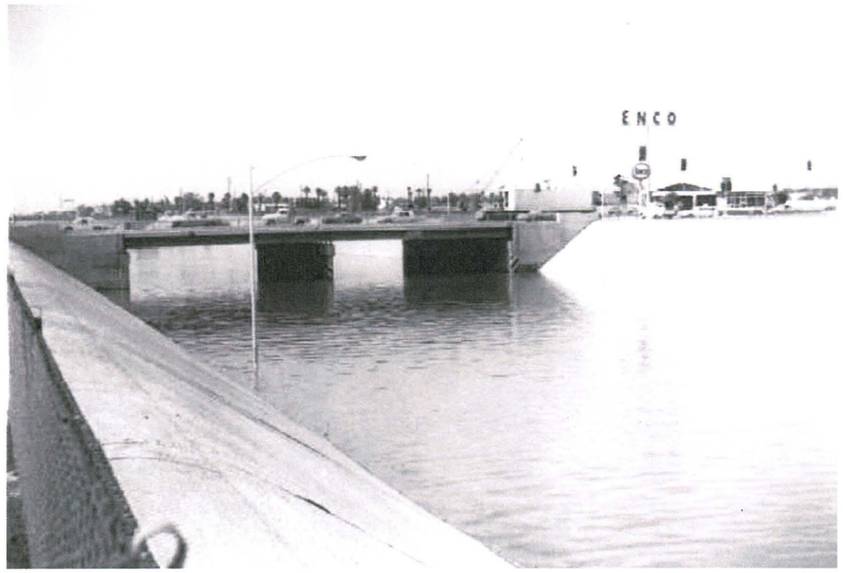
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
PHOENIX, ARIZONA

METRO PHOENIX ADMP
DATA COLLECTION REPORT
FCD 2004C040

1200 Block Jefferson (August 2005)



Interstate 17 (1972)

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OCTOBER 2006

TABLE OF CONTENTS

		Page
SECTION 1: INTRODUCTION		**1**
1.1	**Purpose Of Study**	**1**
1.2	**Purpose Of Report**	**1**
1.3	**Study Area**	**1**
1.4	**Scope Of Work**	**1**
1.5	**Study Contacts**	**2**
1.6	**Stakeholders**	**2**
SECTION 2: AGENCY COORDINATION		**3**
2.1	**City Of Phoenix**	**3**
2.2	**Arizona Department of Transportation**	**3**
2.3	**Salt River Project**	**3**
2.4	**AZPDES**	**3**
SECTION 3: EXISTING FLOODING DATA		**4**
3.1	**FEMA Floodplains**	**4**
3.2	**City Flooding Complaints**	**4**
3.3	**Regional Versus Local Drainage Problems**	**4**
SECTION 4: EXISTING AND PLANNED DRAINAGE INFRASTRUCTURE		**6**
4.1	**Existing Drainage Infrastructure**	
4.1.1	*City Of Phoenix Storm Drains/Channels/Basins*	*6*
4.1.2	*ADOT Drainage Facilities*	*6*
4.1.3	*Old Cross Cut Canal*	*6*
4.2	**Future/Planned Drainage Infrastructure**	**7**
4.2.1	*City Of Phoenix 5-year Storm Drain Plan*	*7*
4.2.2	*24th Avenue and Camelback Road Drainage Improvements*	*7*
4.2.3	*Light Rail (Valley Metro Rail)*	*7*
SECTION 5: EXISTING HYDROLOGY AND HYDRAULICS MODELS		**8**
5.1	**Cave Creek Wash FDS**	**8**
5.2	**24th Avenue and Camelback Road Drainage Improvements**	**8**
5.3	**Inner Loop Storm Drain Summary Report**	**8**
5.4	**Arcadia Area**	**8**
5.5	**Old Cross Cut Canal Watershed**	**8**
5.6	**Durango Area**	**8**
5.7	**Valley Metro Rail**	**8**
5.8	**Other Documents**	**9**
SECTION 6: EXISTING/PLANNED LANDSCAPE ASSESMENT		**10**
6.1	**Existing Landscape Character Assessment**	**10**
6.2	**Future/Planned Landscape Character Assessment**	**10**
6.3	**Preliminary Landscape Character Compatibility Analysis**	**10**
6.4	**Recreational Land Use**	**10**
SECTION 7: REFERENCES		**11**

LIST OF FIGURES

Figure 1	Metro Phoenix Study Area	1

LIST OF APPENDICES

Appendix A	**City of Phoenix Flooding Complaints**
Appendix A.1.1	Solutions being Designed – Central
Appendix A.1.2	Solutions being Designed – Southeast
Appendix A.1.3	Solutions being Designed – Southwest
Appendix A.2.1	Complaints resolved w/solutions under Construction – Central
Appendix A.2.2	Complaints resolved w/solutions under Construction – Southeast
Appendix A.2.3	Complaints resolved w/solutions under Construction – Southwest
Appendix A.3.1	Complaints unresolved or have been found to have insignificant flood hazard – Central
Appendix A.3.2	Complaints unresolved or have been found to have insignificant flood hazard – Southeast
Appendix A.3.3	Complaints unresolved or have been found to have insignificant flood hazard – Southwest
Appendix A.4	Newly Identified Complaints

LIST OF EXHIBITS

Exhibit 1	Study Area Exhibit
Exhibit 2	City of Phoenix Flooding Complaints
Exhibit 3	Existing Drainage Infrastructure (sheets 3-1 through 3-4)
Exhibit 4	100-year Peak Discharge Maps (sheets 4-1 through 4-5)
Exhibit 6	Landscape Character (figures 6-1 through 6-9)

SECTION 1: INTRODUCTION

1.1 Purpose Of Study

To identify and quantify known and potential flooding hazards within the study area and to develop alternative solutions to mitigate the identified concerns.

1.2 Purpose Of Report

The purpose of this report is to organize, review and summarize pertinent data collected for the Metro Phoenix Area Drainage Master Plan (ADMP).

1.3 Study Area

The study area for the Metro Phoenix ADMP is shown in Figure 1. The area is bound by the Arizona Canal Diversion Channel (ACDC) on the north, I-17 on the west, the Salt River on the south, and the ridgeline in the Papago Buttes on the east. Between 44th Street and 60th Street, the study area extends north of the Arizona Canal up to the ridgeline in Camelback Mountain. The total study area encompasses approximately 90 square miles.

The study also includes a portion of the Durango ADMS study area, west of I-17, that encompasses the Cave Creek floodplain and its corresponding watershed (cross-hatched area on Figure 1). This area is bounded by 59th Avenue on the west, I-10 on the north, I-17 on the east and the Salt River on the south. The reason for including this area in the Metro Phoenix ADMP is for the re-study of Cave Creek. The hydrologic model that was developed with the Durango ADMS will be incorporated into the overall hydrologic model.

Significant features within, or adjacent to, the watershed are the Salt River, the Arizona Canal, the Arizona Canal Diversion Channel, the Grand Canal, the Old Cross Cut Canal, State Highways SR-51, SR-143, SR-153 and Loop 202 as well as Interstate Highways I-17 and I-10.

Figure 1. Metro Phoenix ADMP Study Area

1.4 Scope Of This Report

The scope of work for the Data Collection Study includes the following:

Data Collection:

1. Collect mapping, transportation plans, FEMA studies, and reports.
2. Prepare a list of, and document, existing drainage problems.
3. Review planning studies.
4. Collect and review hydrologic/hydraulic studies and models.
5. Review city AZPDES ordinances and regulations.
6. Review landscape character analysis and city's recreation master plan
7. Locate and review historic flooding photographs.

Review of Existing Data: The scope of work includes review of existing data. This data includes previous drainage studies, plans of existing and proposed drainage structures, and collection of documented flooding complaints.

Hydrologic Review: The purpose of the review is to document the current 100-year peak discharges within the study area and to determine the assumptions and methodologies used in the development of the existing hydrology models. The goal is to collect the digital models and be able to incorporate the models that meet the Flood Control District's current standards for hydrologic modeling into the overall model for the Metro Phoenix ADMP.

Agency Involvement: Engineering and Environmental Consultants (EEC) and Flood Control District of Maricopa County (District) staff have met with representatives from the City Of Phoenix (COP or City), Arizona Department Of Transportation (ADOT), Salt River Project (SRP), and Valley Metro Rail (VMR) to make them aware of the progress of the ADMP, solicit their knowledge of existing flooding problems, and determine any specific issues that they would like to have addressed with the ADMP.

1.5 Study Contacts

The following is a list of contacts made to gather existing mapping, studies, reports, infrastructure and flooding complaint data within the study area.

City Of Phoenix:
Engineering Records
200 W Washington, Phoenix, AZ 85003

City Of Phoenix:
Street Transportation Department - Floodplain Management
200 W Washington, Phoenix, AZ 85003
Hasan Mushtaq phone: 602.262.4026

City Of Phoenix:
Street Transportation Department – Programming Section
200 W Washington, Phoenix, AZ 85003

Arizona Department Of Transportation:
Drainage Section
206 S 17th Avenue, Phoenix, AZ 85007-3212
Jeff Beimer phone: 602.712.8609

Flood Control District of Maricopa County
Engineering Library
2801 W Durango Street, Phoenix, AZ 85009
Mona Merkevicius phone: 602.506.1501

Valley Metro Rail
411 N Central Avenue, Phoenix, AZ 85004
Tom Wolf (P, B, Q & D) phone: 602.271.9324
Tom Godbee (C.O.P.) phone: 602.744.5548 (contact for drainage reports)

1.6 Stakeholders

The following is a list of stakeholders for the Metro Phoenix ADMP:

Arizona Department Of Transportation:
Drainage Section
206 S 17th Avenue, Phoenix, AZ 85007-3212
Jeff Beimer phone: 602.712.8609

City Of Phoenix:
Street Transportation Department - Floodplain Management
200 W Washington, Phoenix, AZ 85003
Hasan Mushtaq phone: 602.262.4026

City Of Phoenix:
Street Transportation Department – Programming Section
200 W Washington, Phoenix, AZ 85003
Paul Driver phone: 602.495.2016

City Of Phoenix:
Parks and Recreation
200 W Washington, Phoenix, AZ 85003
Boyd Winfrey phone: 602.262.4925

City Of Phoenix:
Aviation Department
3400 Sky Harbor Boulevard, Phoenix, AZ 85034
David Hensley phone: 602.273.3338

City Of Phoenix:
Planning Department
200 W Washington, Phoenix, AZ 85004
Bob Pikora phone: 602.262.6823

City Of Phoenix:
Planning Department
200 W Washington, Phoenix, AZ 85004
Katherine Coles phone: 602.256.5648

City Of Phoenix:
Planning Department
200 W Washington, Phoenix, AZ 85004
Ambika Adhikari phone: 602.262.4074

City Of Phoenix:
Planning Department
200 W Washington, Phoenix, AZ 85004
Karen Craver phone: 602.534.5829

City Of Phoenix:
Planning Department
200 W Washington, Phoenix, AZ 85004
Susan Sargent phone: 602.262.4065

Maricopa County:
Maricopa County Parks and Recreation
411 N. Central Ave. #470, Phoenix, AZ 85004
Chris Coover phone: 602.506.8719

Salt River Project:
Mail Station PAB106 P.O. Box 52025, Phoenix, AZ 85072
Bob Gooch phone: 602.506.8719

Valley Metro Rail
411 N Central Avenue, Phoenix, AZ 85004
Ray Alamanzar phone: 602.495.8227

Dibble and Associates (Consultant to Aviation Department)
2633 E. Indian School Road #401, Phoenix, AZ 85016
Brian Fry phone: 602.957.1155

Metro Phoenix ADMP
Study Area Exhibit
Exhibit 1

- Study Area Boundary
- Major Streets
- Interstate
- Freeways
- Local Roads
- Railroad
- Index Contours
- Arizona Canal Diversion Channel

FEMA Flood Hazard Boundaries
- Floodplain
- Floodway

- Excluded from Study Area
- Areas with Hydrology Based on Current Methodology

Flood Control District of Maricopa County

N

7000 0 7000 Feet

Scale: 1" = 7,000'

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24th AVE & CAMELBACK
19th Ave
Central Ave
7th St
16th St
24th St
32nd St
40th St
48th St
56th St
64th St
67th Ave
59th Ave
51st Ave
43rd Ave
35th Ave
27th Ave
Glendale Ave
Ocotillo Rd
Bethany Home Rd
Camelback Rd
Grand Canal
Indian School Rd
Thomas Rd
McDowell Rd
Van Buren St
Buckeye Rd
Lower Buckeye Rd
Broadway Rd
Arizona Canal
Cudia City Wash
Lincoln Dr
McDonald Dr
Camelback Mountain
Old Cross Cut Canal
PARADISE VALLEY
ARCADIA
PHOENIX
O.C.C.C. WATERSHED
SCOTTSDALE
DURANGO
AIRPORT
SALT RIVER
SALT RIVER
SALT RIVER
17
10
60
51
143
153
202

SECTION 2: AGENCY COORDINATION

2.1 City Of Phoenix

The primary concern that the COP has in the study area is the Cave Creek floodplain. It impacts hundreds of homes and businesses. They expressed interest in removing or reducing the size of the floodplain. They believe that a re-study of the floodplain, using the more detailed topographic information that the District now has available, could result in a narrower, shallower floodplain. They are also interested in structural solutions that would significantly reduce the floodplain, or eliminate it altogether.

In addition to the Cave Creek floodplain issue, the City has documented 154 flooding complaints located within the Metro Phoenix study area (see Section 3.2).

The City also is interested in the effectiveness of their 2-year storm drain network.

2.2 Arizona Department of Transportation

ADOT expressed interest in the following two issues. First, there have been several closures of I-17 at Buckeye Road where the floodplain crosses I-17, including at least one occurrence since the completion of the Arizona Canal Diversion Channel. Storm water runoff spills into the depressed section of the highway, overtaxing the pump stations, which causes the highway to be closed. Dated photographs indicated that one of those closures was in 1990. There was another partial closure due to the storm of October 2nd, 2005. During this storm, the northbound lanes were closed in the vicinity of Buckeye Road.

The second issue is on SR51. ADOT has experienced flooding problems in the depressed section of SR-51 at Camelback Road where, similar to the I-17 problem, offsite runoff spills into the depressed section of highway overtaxing the storm drain pumping system.

2.3 Salt River Project

SRP is primarily involved due to operations regarding the Old Cross-Cut Canal (OCCC). SRP has the right to discharge 1,000 cfs from the Arizona Canal to the OCCC. This results in the potential to double-count that diverted amount of run-off in storm water modeling. Consultations with SRP are an effort to clarify these diversions and more accurately model flows during storm events.

2.4 Arizona Pollution Discharge Elimination System

The City of Phoenix and Maricopa County have AZPDES permits. The COP has permit number AZ0000003. It was issued in March 1997 and expired in March 2002. The COP applied for a new permit in the legal timeframe and is still waiting for the reissue. The COP is currently under the Administrative AZPDES permit.

The permit requires the applicant (COP) to submit Stormwater Management Programs (SWMP's). There are six minimum pollution control measures:

1. Public Education and Outreach on Storm Water Impacts
2. Public Involvement/Participation
3. Illicit discharge detection and elimination
4. Construction Site Storm Water Runoff Control
5. Post-Construction Storm Water Management in New Development and Redevelopment
6. Pollution Prevention/Good Housekeeping for Municipal Operations

Included in the AZPDES regulatory requirements is a storm water system mapping requirement that helped identify infrastructure for this project.

Nothing within the permit requires special consideration during the installation or construction of a potential solution (i.e., a storm drain or detention basin) from the Metro Phoenix ADMP. By the time a solution were to come out of the Metro Phoenix ADMP, it is likely that a new permit will be in place and standards will have changed.

Currently, Maricopa County has an AZPDES permit similar to that of the COP. The same regulations apply to that of COP.

SECTION 3: EXISTING FLOODING DATA

3.1 FEMA Floodplains

Cave Creek Floodplain - A re-study of the floodplain was done in January 1989 by Cella Barr Associates to account for the mitigating effects of the Arizona Canal Diversion Channel. The re-study included development of a new hydrologic model of the existing conditions, 100-year flood flows. The floodplain delineation is shown on the following FEMA FIRM panels: Community 04013C – panels 1665, 2120, 2130, and 2140. Since the Cella Barr study, the City has processed two Letters of Map Revisions (LOMR's) that have resulted in a reduction of the size of the floodplain upstream of the Grand Canal. Downstream of the Grand Canal, however, the floodplain is unchanged from the 1989 study. There are approximately 3800 properties in the floodplain within the study area (west of I-17, there are an additional 350 or so properties within the floodplain).

Grand Canal Floodplain - The Grand Canal is slightly elevated for its entire length within the study area, resulting in an approximate flood Zone A along its upstream side. The Zone A delineation was based upon the highest adjacent bank elevation. There is a portion between 7th Avenue and 19th Avenue that is Zone AE. There are approximately 1400 properties in this floodplain within the study area.

The COP currently has an Elevation Certificate program. The goal of the program is to remove homes from the floodplain. The program also includes pockets of the downstream Cave Creek floodplain.

Arizona Canal Floodplain – As is the case with the Grand Canal, the Arizona Canal is slightly elevated for its entire length within the study area, resulting in an approximate flood Zone A along its upstream side. The Zone A delineation was based upon the highest adjacent bank elevation. The portion of the floodplain in the study area is between 40th Street and 64th Street. Although this is a small section, approximately 400 homes are in this floodplain.

Shaded Zone X – With the exception of the Cave Creek and the Canal floodplains, most of the rest of the Metro Phoenix area is in a FEMA shaded zone X flood zone. This is described as areas subject to 500-year flooding or areas of 100-year flooding with an average depth less than 1-foot.

Shaded Zone X2 – There are a few small isolated areas within the study area. This is described as areas determined to be outside the 500-year flood.

3.2 City of Phoenix Flooding Complaints

From the COP files and database, there were 154 flooding complaints in their files and databases when the flooding data was collected in 2004. Of these complaints, 30 are being addressed with ongoing studies and/or design projects, 32 have been resolved with construction of drainage improvement projects (or have projects under construction), and 92 are unresolved or have been found to represent an insignificant flood hazard. There are also 15 drainage complaints which were identified from citizens at public meetings or by the study team. Between August 1st and September 14th of 2005, the COP received 109 additional drainage complaints within the study area. Exhibit 2 shows the location and status of each flooding complaint within the study area. Categorization of flooding complaints falls into four broad groups:

- Under Design/Study – COP is evaluating or designing a solution for properties in this group.
- Under Construction/Warranty – COP is or has constructed a solution for these properties.
- Unresolved – These properties have been evaluated by COP but no decision has been made on a solution to the problem.

EEC received the database of drainage complaints from COP. Any additional known drainage problems were then added to the database and included as part of the Identified section. The following is the methodology that was used in this study to document each complaint:

1. Receive and review the COP complaint.
2. Draw approximate contributing drainage area.
3. Visit the site and photograph pertinent physical features.
4. Form opinions and conclusions on the cause and effect of potential flooding to each site.
5. Document each site with a map and a written summary.

See appendix A for the drainage area maps and summaries of each complaint.

During the course of the data collection, there was a series of public meetings held to get public input. Citizens were able to come and share any drainage complaints or concerns with the study team. Some of the citizens also provided the team with historic flooding information dealing with the frequency and severity of flooding.

The study team added the citizen identified problems to the City's list of flooding complaints. Each of these sites was visited during the data collection phase.

Also any additional known drainage problems were added to the database and included as part of the Identified section. The same methodology that was used to document the COP drainage complaints was used for the Identified complaints.

3.3 Regional Versus Local Drainage Problems

During the course of developing the Data Collection Report the goal was to identify the regional flooding issues from the local flooding issues for further study during the upcoming brainstorming session.

Each identified complaint was documented as described in Section 3.2 and assigned a category as either local or regional in nature.

A definition of regional flooding is necessary to help categorize the flooding complaints. For the purposes of this study the following applies:

- Regional flooding is defined as that flooding which occurs due to concentrations of storm water that flow through low lying corridors where relief from flooding cannot occur without assistance.

Regional flooding is not necessarily based upon the size of the contributing drainage area but upon how that runoff is concentrated and where it is conveyed. A few examples follow to help distinguish the difference between local and regional flooding. These examples are intended to give the reader a feel for the differences between local and regional drainage issues and do not cover the entire spectrum of potential drainage problems that could be encountered.

1. A large drainage area where flow does not concentrate but instead sheet flows would be considered local flooding. This type of flooding would likely affect individual structures having low Finished Floor Elevations.
2. However, an area of widespread sheet flow that is restricted to narrow conveyance corridors that cause it to artificially concentrate would be an example of regional flooding. This occurs in the Arcadia area where runoff from Camelback Mountain sheet flows off the mountain slopes and is then forced into the north-south roadways as the only conveyance corridors available. Flooding results as stormwater travels

down these corridors and is forced out onto flat east-west streets causing backwater ponds.

3. A relatively small drainage area can cause a regional flooding problem if the runoff is concentrated and the downstream low flow path passes through developed property. This occurs south of the Arizona Canal in the Arcadia area where runoff from the Arizona Country Club concentrates and flows through a residential neighborhood. This is evident by a number of flooding complains along the low flow path.
4. Situational conditions where the layout is more to blame for the flooding than the amount of storm water getting there. A dead end cul-de-sac with no outlet for storm water is a classic example. These are usually local flooding problems.
5. Flooding behind a canal or roadway embankment having minimal outlet capacity is an example of regional flooding.

To define regional drainage issues the following criteria was reviewed:

- The contributing drainage area
- If the flow is able to concentrate
- The number of properties affected
- Any situational characteristic specific to the location

The overall pattern of flooding complaints was also analyzed by looking for groupings that may constitute a regional problem. From this analysis, the following observations have been made.

1 There is a concentration of complaints in the old Cave Creek floodplain, upstream of the Grand Canal. This is not surprising, since the old floodplain is still an area where runoff concentrates. In contrast to much of the study area, where the general slope of the watershed is to the southwest and excess street flow simply spills overland, floodwaters in the old floodplain area can't spill anywhere; instead, they accumulate, get deeper and follow the historic flow path.

2 Notably, there is a lack of reported flooding complaints along the Cave Creek floodplain, downstream of the Grand Canal. This indicates that there may not be as much flooding as would be expected in the existing floodplain.

3 There are a number of flooding complaints in the Arcadia area between Camelback Mountain and the Arizona Canal. The properties that experience problems tend to lie on the south side, which is the low side of the east-west streets. Runoff in the area flows southerly over a relatively steep hillside gradient and is intercepted by the east-west streets. These streets have little, if any, slope east or west. So the runoff spills from the streets into the adjacent, downstream properties causing yard and house flooding at a number of locations.

4 There are numerous complaints on the upstream side of the Grand Canal. This is because the canal is elevated a couple feet and causes water to pond behind the canal. These complaints are typically one or two streets upstream of the canal.

5 There are a series of flooding complaints along the flow line of a swale that runs east to west between 48th Street and 64th Street, just south of the Arizona Canal. There are 5 documented/reported complaints within this area but it is likely that there are more undocumented flooding problems for homeowners whose properties lie within the swale.

6 There are also drainage complaints in the downtown area. Additional complaints were received for this area after the August 2nd, 2005 storm. The August storm showed how susceptible to flooding the downtown area is. It is a vital area within the city because the government buildings and financial institutions that have offices located in the downtown corridor. The downtown area does not have a very large drainage but the runoff coefficient is large due to the extensive hardscape.

The following table lists all properties that were identified as potential regional flooding problems.

Section	#	Group	Property Address
1.1	5	1	Westwood Area
2.2	13	1	4727 E. Lafayette
3.1	1	1	23rd Av.: Dunlap - Northern
3.1	2	1	2301 W. Northern Av.
3.1	8	1	8140 N. 1st Dr.
3.1	12	1	7101 N. Central Av.
3.1	19	1	6615 N. 10th Av.
3.1	20	1	6516, 6528, 6542 N. 17th Av.
3.1	22	1	1720 W. Bethany Home Rd.
3.1	23	1	24th Av. And Camelback Rd.
3.1	28	1	1735 W. Roma Av.
3.1	29	1	4506 N. 11th Av.
3.1	42	1	525 W. Bethany Home Rd.
3.3	4	2	1707 W. Osborn Rd.
4	3	2	2945 N. 18th Ave.
4	6	2	17th Ave.: McDowell to Encanto
4	8	2	1735, 1739, 1741 West Verde Lane
4	11	2	1717 North 17th Avenue
4	12	2	Laurel Avenue and Palm Lane
4	13	2	15th Avenue and Catalina
4	14	2	15th Avenue to 19th Avenue: Osborn to Thomas
2.2	11	3	2500 N. 52nd Street
3.2	34	3	44th Street and Calle Redonda
3.2	35	3	4501 E. Calle Redonda
3.2	36	3	4742 N. Launfal
3.2	37	3	4835 E. Exeter Blvd.
3.2	38	3	Arcadia Dr. and Calle Del Medio
3.2	39	3	4921 E. Calle Del Norte
3.2	40	3	56th Street and Lafayette
3.2	41	3	6207 E. Calle Redonda
1.1	11	4	Central Avenue: Butler to Bethany Home
1.2	10	4	Minezona - 8th Street to 9th Street
3.1	26	4	1802, 1836 W. Turney Av.
3.1	30	4	505, 585 W. Hazelwood Av.
3.2	14	4	4428 N. 12th St.
3.2	15	4	4532 N. 7th St.
3.2	16	4	4519 N. 8th Pl.
4	4	4	12th Ave. and Campbell Ave.
4	5	4	4th St. to 7th St. along the Grand Canal
4	9	4	4510 North 12th Avenue
4	15	4	4523 N. 8th Street
2.2	6	5	10th Street and Campbell Avenue
3.2	30	5	3200 N. Valencia Ln.
3.2	31	5	60th St. and Hollyhock St.

Table 3.4 Potential Regional Properties

Group 1 – Old Cave Creek Floodplain Area
Group 2 – Cave Creek Floodplain Area
Group 3 – Arcadia
Group 4 – Grand Canal
Group 5 – Swale

SECTION 4: EXISTING AND PLANNED DRAINAGE INFRASTRUCTURE

Exhibit 3, sheets 1 through 4 show the existing drainage infrastructure as well as the alignment and location of planned, future drainage projects. All of the City's existing storm drains were shown for pipe diameters 36" and larger; the data came from the COP GIS storm drain coverage (Reference 12). In the case of the ADOT storm drain system, their entire offsite storm drain system, 36" diameter and larger, is shown on Exhibit 3. However, some of their storm drains that only collect freeway drainage were left off of the maps for purposes of clarity.

4.1 Existing Drainage Infrastructure

4.1.1 City Of Phoenix Storm Drain System

The COP has a well-developed storm drain network with conveyance pipes running north to south in all the mile streets as well as many of the half-mile streets. The City's storm drain GIS coverage was used to develop the map of the storm drain system. A review of the drainage reports collected for this study indicates that the COP storm drain network is, with some exceptions, sized to convey the runoff from the 2-year storm (see Exhibit 3, sheets 1 through 4). The City also has a large number of dry wells located in the downtown area, which are not shown on the drainage infrastructure maps.

For the most part, the COP storm drains discharge directly to the Salt River. However, there are a number of storm drains that discharge to the Old Cross Canal as well as to the ADOT collection systems along the Loop 202 and I-10.

The City's 5-year plan has two new storm drain projects located in the study area. These include new storm drains in 28th Street and 36th Street, which extend north from the Red Mountain Freeway (Loop 202) to Indian School Road (see Exhibit 3, Sheets 2 and 4).

The City also has acquired 28 properties to begin the 24th Avenue and Camelback Road project. The project consists of two phases, Phase A includes a basin at 24th Avenue and Camelback and Phase B is a basin at 20th Avenue and Turney Avenue. These basins will store 32 acre-feet and 40 acre-feet respectively. The phases also include storm drains to collect the flow.

4.1.2 ADOT Drainage Facilities

The ADOT drainage system provides an outfall for many of the COP storm drains. In most instances, their drainage system intercepts offsite flows and conveys them to one of three major outfalls. These outfalls are the East Tunnel, the West Tunnel, and the Old Cross Cut Canal. The tunnels are each 21 feet in diameter and are designed to convey runoff from the 50-year storm. Each tunnel has capacity for approximately 5,000 cubic feet per second (cfs).

Runoff intercepted along the Loop 202 between I-10 and SR143 drains to the East Tunnel. The East Tunnel begins at the traffic interchange of I-10 and the SR-51/Loop 202. It then follows I-10 south to the I-17 interchange and then continues south to the Salt River. Runoff intercepted along I-10 between 15th Avenue and SR51 drains to the West tunnel. The West Tunnel begins at I-10 and 2nd Street and runs south along the 2nd Street/Central Avenue alignment to the Salt River. There are multiple locations along the tunnels where drop shafts convey additional storm water runoff from ADOT collection systems as well as from the COP storm drain system.

4.1.3 Old Cross Cut Canal

The Old Cross Cut Canal (OCCC) is owned by the Bureau of Reclamation, managed by the Flood Control District of Maricopa County and operated by the Salt River Project. The OCCC originally connected the Arizona Canal and the Grand Canal and was used by the Salt River Project to transfer irrigation water from the Arizona to the Grand Canal. The Salt River Project now uses the OCCC during significant runoff events to convey runoff out of the Arizona Canal to prevent it from being overtopped. The Salt River Project retains the right to discharge up to 1,000 cfs into the OCCC under any condition.

In the 1990's, significant improvements were made to the OCCC. These improvements were based upon a 25-year design flood and are documented in a report prepared by Greiner in 1991. The new improvements were designed to accept 3,000 cfs from upstream of Indian School Road. This includes 1,000 cfs from a controlled release by SRP at the Arizona Canal plus 2,000 cfs coming from a planned, future storm drain upstream of the Arizona Canal. The planned upstream storm drain system was never constructed, nor is it any longer in the City's plans. Farther downstream at McDowell Road, the improvements to the OCCC were designed to match the 4,100 cfs capacity at the bridge structure under McDowell.

The upstream end of the new improvements began at Indian School Road. The original earthen channel was replaced with a double barrel 12' by 10' box culvert which continues to Earll Drive where it widens to a double barrel 18' by 10' box culvert. Conveyance is provided through the box culverts as well as in a shallow, grassed lined channel on top of the box culverts. Just upstream of McDowell Road, the tunnel transitions into a rectangular channel that crosses under the bridge structure at McDowell Road. Downstream of McDowell Road, storm water is conveyed in an open channel adjacent to ADOT's SR-143. The channel ultimately discharges to the Salt River east of SR 143, at about 50th Street.

4.2 Future/Planned Drainage Infrastructure

4.2.1 COP 5-Year Storm Drain Plan

The City's 5-year plan has two new storm drain projects located in the study area. These include new storm drains in 28th Street and 36th Street, which extend north from the Red Mountain Freeway (Loop 202) to Indian School Road. The storm drains will be designed to convey the 2-year flood. Both of these storm drains will outfall into ADOT's existing collection system along the Loop 202 highway (see Exhibit 3, sheets 2 and 4).

4.2.2 24TH Ave. And Camelback Rd. Drainage Improvements

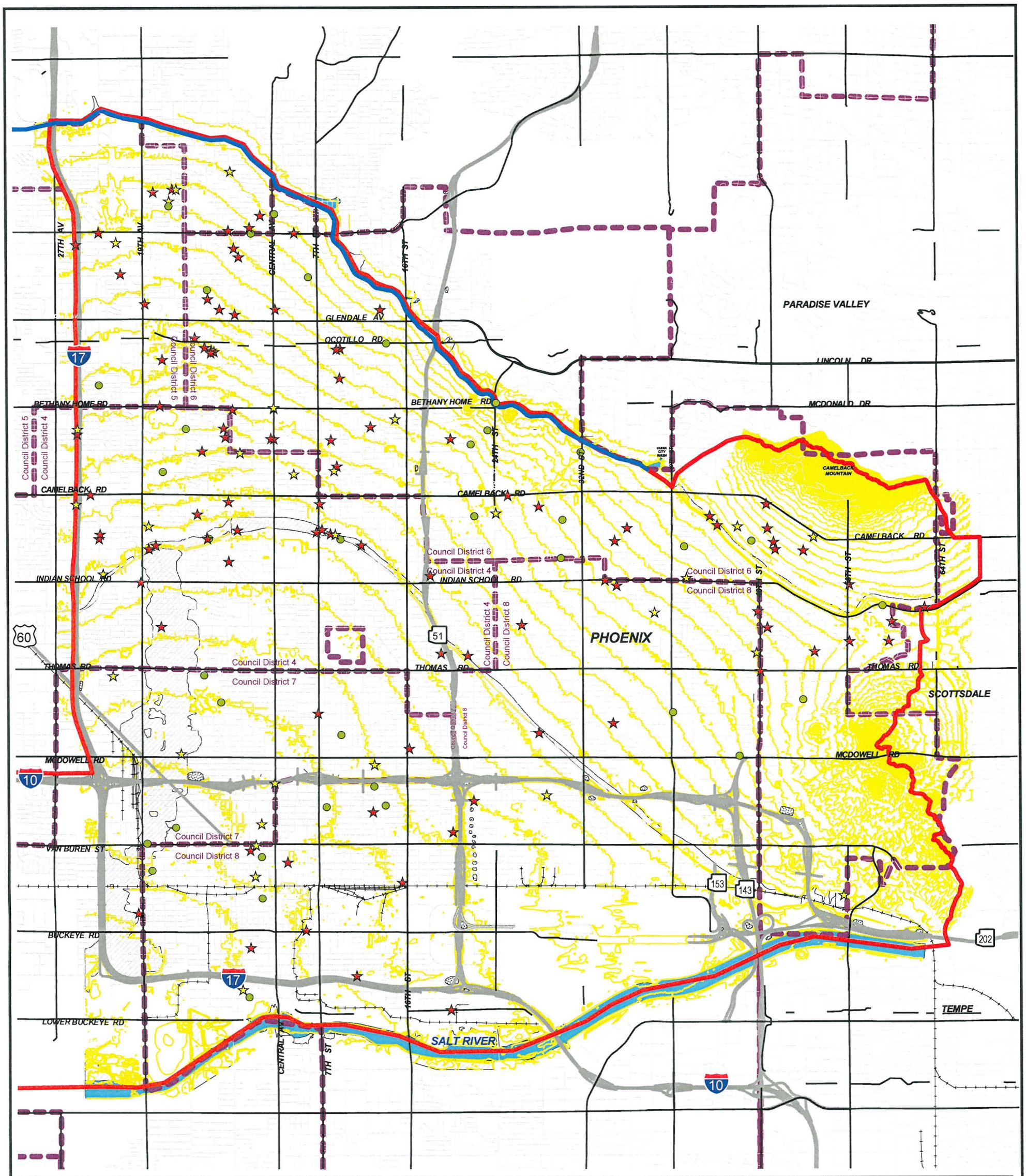
The COP intends to construct a flood control project for this area, which is described in the DCR prepared by Premier Engineering. The recommended plan includes new retention basins to be built in phases as follows:

1. Phase A – 24th Avenue and Camelback Road sized for 32 acre-feet of storage with storm drain collection system.
2. Phase B – A 40 acre-foot basin at the Grand Canal (20th Avenue and Turney Avenue) sized to retain the 10-year storm event for the contributing watershed with a storm drain collection system along 21st Avenue south of Camelback Road.

In addition to the basins, new catch basins and storm drains will be constructed to capture and convey runoff from adjacent streets to the basins.

4.2.3 Light Rail (Valley Metro Rail)

Valley Metro Rail (VMR) is a joint ownership of several cities including Phoenix, Glendale, Tempe and Mesa who are working together to design and build the light rail system. Engineering consultants are currently working on the design of the five initial line segments of the light rail system, four of which are located within the Metro Phoenix ADMP study boundary. Contact with VMR has revealed that the drainage design for the light rail is based on a 2-year flood with maintaining one dry traffic lane in each direction. The 100-year flood is also being analyzed to see if there are any negative impacts, and if so, how to mitigate those impacts. There are 5 drainage reports for the VMR, all of which are completed. Various firms completed the reports. At locations where the drainage appears to be problematic, individual solutions are being investigated to solve those problems.



Metro Phoenix ADMP
City of Phoenix
Flooding Complaints
Exhibit 2

- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Council District
- Index Contours
- Arizona Canal Diversion Channel
- Retention Basins

- Under Study, Under Design or on Hold (32)
- Under Construction or Constructed (37)
- Unresolved Flooding Complaint (99)

FEMA Flood Hazard Boundaries

- Floodplain
- Floodway

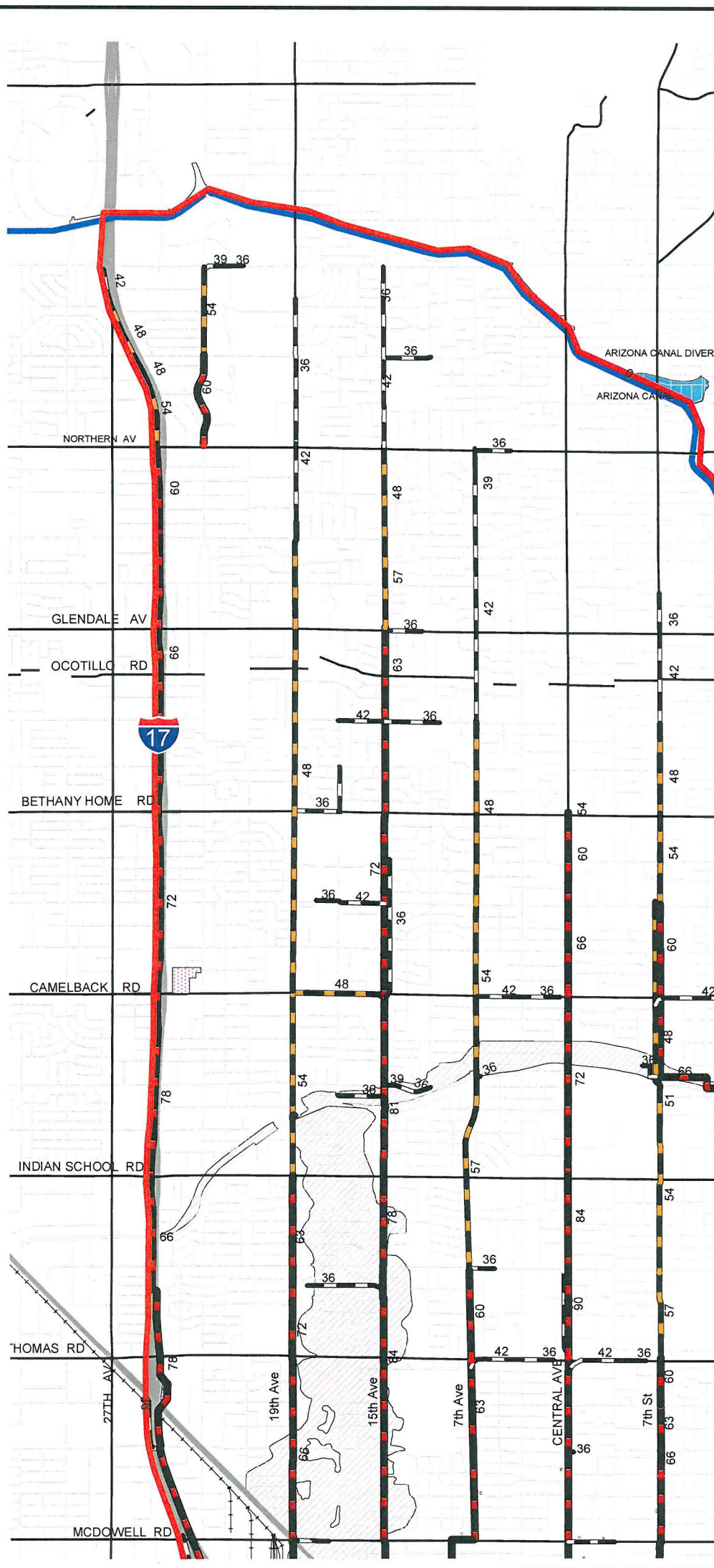
Scale: 1" = 6,000'

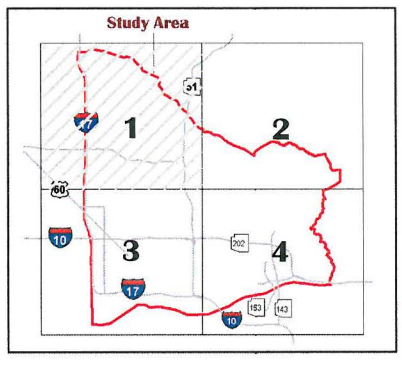
N

Flood Control District of Maricopa County

Engineering and Environmental Consultants, Inc.
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

Metro Phoenix ADMP
Existing Drainage Infrastructure
Exhibit 3
Sheet 1





- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Arizona Canal Diversion Channel
- Retention Basins
- Future Retention Basins (Proposed with 24th Ave. and Camelack Rd. DCR)

Pipe Dimensions (inches)
- 36 - 47
- 48 - 59
- 60 - 252
- Future Storm Drain (COP 5-year Plan)

FEMA Flood Hazard Boundaries
- Floodplain
- Floodway

Scale: 1" = 4,000'

N

Flood Control District of Maricopa County

Engineering and Environmental Consultants, Inc.
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

PHOENIX

PARADISE VALLEY

SCOTTSDALE

16TH ST

GLENDALE AV

BETHANY HOME RD

ARIZONA CANAL

ARIZONA CANAL DIVERSION CHANNEL

24TH ST

32ND ST

40TH ST

CAMELBACK MOUNTAIN

LINCOLN DR

MCDONALD DR

CAMELBACK RD

INDIAN SCHOOL RD

56TH ST

64TH ST

48TH ST

2 - 12' x 10' Boxes

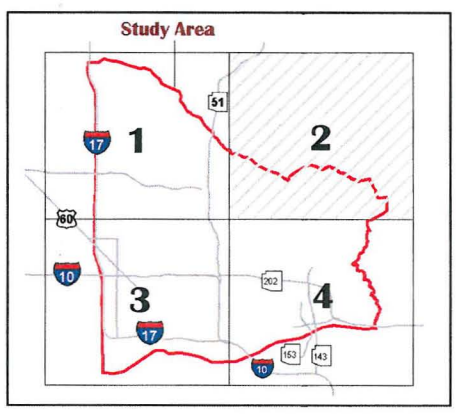
THOMAS RD

OLD CROSS-CUT CANAL

MCDOWELL RD

2 - 18' x 10' Boxes

Metro Phoenix ADMP
Existing Drainage Infrastructure
Exhibit 3
Sheet 2



- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Arizona Canal Diversion Channel
- Retention Basins

Pipe Dimensions (inches)

- 36 - 47
- 48 - 59
- 60 - 252
- Future Storm Drain (C.O.P. 5-year Plan)

FEMA Flood Hazard Boundaries

- Floodplain
- Floodway

Scale: 1" = 4,000'

N

Flood Control District of Maricopa County

Engineering and Environmental Consultants, Inc.
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

INDIAN SCHOOL RD

THOMAS RD

McDOWELL RD

VAN BUREN ST

BUCKEYE RD

LOWER BUCKEYE RD

14' DIAMETER

10' x 10' CBC

GRAND CANA

SALT RIVER

27TH AV

19TH AV

15TH AV

7TH AV

CENTRAL AV

7TH ST

16TH ST

24TH ST

PHOENIX

60

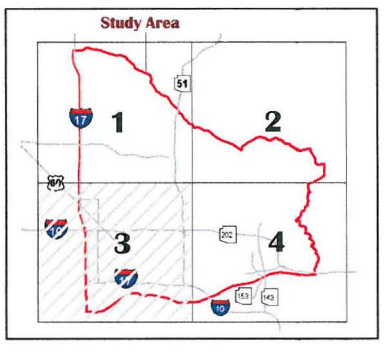
10

17

51

202

Metro Phoenix ADMP
Existing Drainage Infrastructure
Exhibit 3
Sheet 3



- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Retention Basins

Pipe Dimensions (inches)
- 36 - 47
- 48 - 59
- 60 - 252
- Future Storm Drain (COP 5-year Plan)

FEMA Flood Hazard Boundaries
- Floodplain
- Floodway

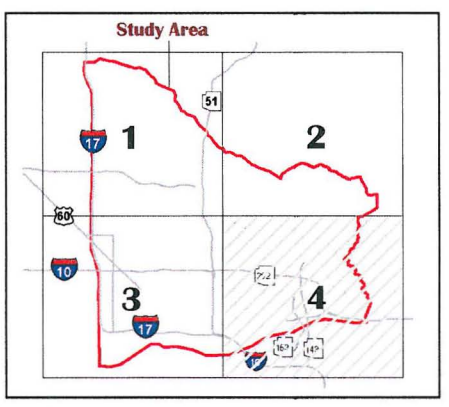
Scale: 1" = 4,000'

N

Flood Control District of Maricopa County

Engineering and Environmental Consultants, Inc.
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

Metro Phoenix ADMP
Existing Drainage Infrastructure
Exhibit 3
Sheet 4



- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Arizona Canal Diversion Channel
- Retention Basins

Pipe Dimensions (inches)
- 36 - 47
- 48 - 59
- 60 - 252
- Future Storm Drain (C.O.P. 5-year Plan)

FEMA Flood Hazard Boundaries
- Floodplain
- Floodway

Scale: 1" = 4,000'

N

Engineering and Environmental Consultants, Inc.
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

SECTION 5: EXISTING HYDROLOGY/HYDRAULIC MODELS

There have been a number of hydrologic models developed for various portions of the study area. Exhibit 4, sheets 1 through 5, presents the 100-year peak discharges from some of the more significant, regionally based studies. None of these studies by themselves, however, are adequate to quantify the flood hazards for the entire study area, nor are they sufficient to assess the adequacy of the City's existing 2-year storm drain system. Some of the hydrology models will be incorporated into the overall hydrology model for the study area.

5.1 Cave Creek FDS

The hydrology for the Cave Creek Flood Insurance Restudy was prepared by Cella Barr Associates in 1989. This study revised the floodplain for Cave Creek downstream of the Arizona Canal, based on the flood mitigation provided by the Arizona Canal Diversion Channel.

The methodology for calculating the peak discharges in the Cella Barr model is no longer in conformance with the District's procedures. The model used the SCS Dimensionless Unit Hydrograph to calculate the flood hydrographs and the SCS Curve Number method to determine rainfall losses. Neither the District nor the City of Phoenix continues to use either of these procedures. The model was, however, very detailed. It included diversions into the City's 2-year storm drain system, it accounted for flood-irrigated lots, and it employed diversions for split flow at major street intersections. The method used in the Cella Barr model to account for the flood-irrigated lots was based upon the report prepared by HNTB entitled *I-10 Inner Loop Drainage* that is further discussed in Section 5.3.

5.2 24th Avenue & Camelback Road Drainage Improvements

The hydrology for this project is included in the Technical Memorandum No.1 to the Final DCR, prepared by Premier Engineering Corporation in October 2005. The purpose of the report was to present the final construction alternative for the 24th Avenue and Camelback Drainage Improvements, COP Project Number ST831220017. This area is located between 19th Avenue and I-17, from the Grand Canal upstream to the ACDC. The final recommended plan includes the construction of two new retention basins that provide enough volume to store the 10-year runoff. These basins are shown on the infrastructure map (Exhibit 3, sheet 1) as planned facilities. Although the hydrologic model for the DCR was developed using current District methods, the Metro Phoenix ADMP includes new hydrology within this part of the watershed. The storage from the proposed basins will be accounted for within the hydrology model.

At the time of this study the City has decided to construct one of the two proposed basins from the Premier Study. The Camelback and 24th Avenue basin will be constructed while the 24th Avenue and Turney basin will not be constructed.

5.3 Inner Loop Storm Drain Summary Report

This report was the culmination of a series of reports prepared for the Arizona Department of Transportation by HNTB that were prepared to size the Inner Loop drainage structures, including the east and west tunnels. ADOT sized the highway facilities to convey the 50-year runoff event. This summary report, prepared in 1988, updates the original hydrology model for I-10 to include the effects of the Loop 202 highway and SR-51. It establishes 100-year peak discharges for nearly the entire Metro watershed, based on one square mile sub basins.

The methodology for calculating the peak discharges in the HNTB model, however, is no longer in conformance with the District's procedures. It utilized the TR-20 computer model, which is based on the SCS Dimensionless Hydrograph procedure and Curve Number to calculate rainfall losses. The model did, however, utilize a technique for reducing contributing drainage area for the flood-irrigated lots that could be used for the Metro Phoenix ADMP watershed model. The percentage of contributing area was based upon the area of streets, sidewalks, driveways and contributing roof sections. The remaining runoff that is captured within the bermed, irrigated lots was omitted from the sub-basin area.

5.4 Arcadia Area

In 1995, Huitt-Zollars, Inc. developed a new hydrologic model of the Arcadia watershed on the north side of the Arizona Canal in order to investigate alternatives to control flooding in the area and to reduce or eliminate the Zone A floodplain along the upstream side of the Canal. None of the alternatives studied were implemented, but the hydrologic model was based on approved District methodology and will be utilized for the Metro Phoenix ADMP hydrologic model.

5.5 Old Cross Cut Canal Watershed

In 1991, Greiner developed a hydrologic model for the Old Cross Cut Canal watershed based on the current District methodology of that time. This was the model used to determine the design capacity of the improvements done to the OCCC described previously. Included with these improvements is an additional conveyance capacity of 2,000 cfs from a future storm drain that would convey flows from the north side of the Arizona Canal. The improvements to the OCCC are finished. However, the future connection to relieve flooding upstream of the Arizona Canal has not been completed.

After the improvements to the OCCC in 1993, the District revised the hydrology for the Arcadia watershed and the OCCC watershed to reflect the channel improvements and to update the model to the current District methodology. This newer, updated model will be incorporated in the Metro Phoenix ADMP.

5.6 Durango Area

The lower portion of the Cave Creek floodplain (west of I-17) passes through the Durango area. This area has been recently studied with the Durango ADMP prepared by Dibble and Associates (September 2001, revised April 2003). The ADMP documents the existing conditions hydrology for the area but did not include any changes to the Cave Creek floodplain.

The Durango area is included in the study boundaries because the existing Cave Creek floodplain passes through it. The hydrologic model developed for the Durango ADMP is based on current District procedures. It should be possible to simply append it to the Metro Phoenix ADMP model in order to develop a complete model of the existing conditions, 100-year flood on Cave Creek from the Grand Canal, downstream to the Salt River.

5.7 Valley Metro Rail

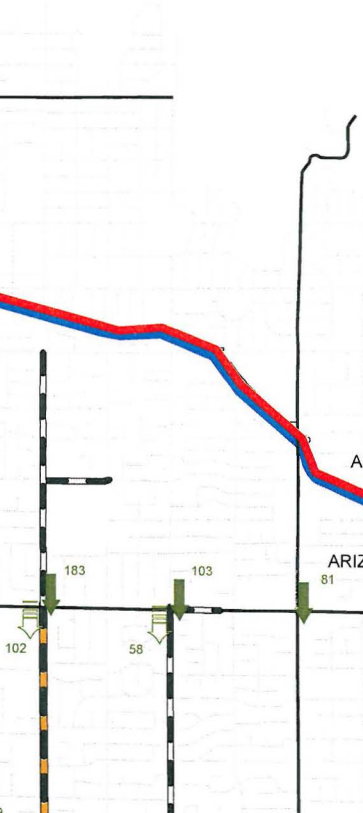
There are five sections of the Valley Metro Rail and each section has a drainage study completed to document the design for the Light Rail project. Line Section 5 is not within the study area so that report was not reviewed. The methodology used for the design criteria was the COP Storm Water Policies and Standards and/or the Maricopa County Drainage Design Manual. Various consultants completed the drainage reports (reference Section 7 for the complete listing of drainage reports).

The design was for a 2-year storm. The general design standards included maintaining a 12' dry lane. The reports also analyzed a 100-year storm to see what impacts the VMR would have on the drainage. In some cases, there was a negative impact which was identified and mitigated.

5.8 Other Documents

As would be expected of a heavily developed watershed, there are many additional drainage studies and design projects located within the study boundaries. The majority of these are local in nature and deal with drainage for specific development sites. These reports were not collected as a part of this Data Collection Study.

Metro Phoenix ADMP
100 Year Peak Discharge Map
Exhibit 4
Sheet 1



- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Arizona Canal Diversion Channel
- Retention Basins
- Future Retention Basins (Proposed with 24th Ave. and Camelback Rd. DCR)
- 65 Surface Discharge (cfs) and Flow Direction
- 95 Stormdrain Discharge (cfs) and Flow Direction

Pipe Dimensions (inches)

- 36 - 47
- 48 - 59
- 60 - 252

FEMA Flood Hazard Boundaries

- Floodplain
- Floodway

I-10 Interloop - Summary Report
HNTB - 1995 (TR-20)

24th Ave & Camelback Road Drainage Improvements
Premier - 2003 (HEC-1)

Flood Insurance Restudy - Cave Creek Wash
Cella Barr - 1989 (HEC-1 / SCS)

Re-delineation of Grand Canal Floodplain between 7th Ave and 19th Ave (LOMR)
EEC Inc. - 2002

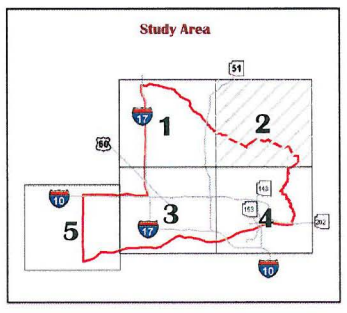
Scale: 1" = 4,000'

N

Flood Control District of Maricopa County

Engineering and Environmental Consultants, Inc
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

Metro Phoenix ADMP
100 Year Peak
Discharge Map
Exhibit 4
Sheet 2



- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Arizona Canal Diversion Channel
- Retention Basins
- 65 Surface Discharge (cfs) and Flow Direction
- 95 Stormdrain Discharge (cfs) and Flow Direction

Pipe Dimensions (inches)

- 36 - 47
- 48 - 59
- 60 - 252
- Future Storm Drain (C.O.P. 5-year Plan)

FEMA Flood Hazard Boundaries

- Floodplain
- Floodway

I-10 Interloop - Summary Report
HNTB - 1995 (TR-20)

Arcadia Area Drainage Report
Huitt - Zollars - Sept 1995 (HEC-1)

Scale: 1" = 4,000'

N

Flood Control District of Maricopa County

Engineering and Environmental Consultants, Inc
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

INDIAN SCHOOL RD

THOMAS RD

MCDOWELL RD

VAN BUREN ST

BUCKEYE RD

LOWER BUCKEYE RD

60

51

202

10

17

GRAND CANAL

SALT RIVER

19th AVE

15th AVE

7th AVE

CENTRAL AVE

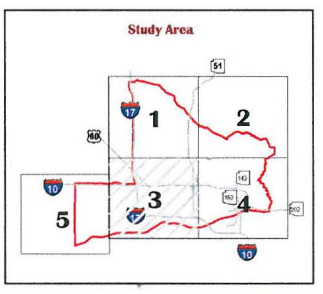
7th ST

16th ST

24th ST

Salt River
169,000 (FIS)
166,000 (Rio Salado)

Metro Phoenix ADMP
100 Year Peak Discharge Map
Exhibit 4
Sheet 3



- Study Area Boundary
- Major Streets
- Interstate / Highway
- Local Roads
- Railroad
- Drainage Tunnel
- Open Channel
- Retention Basins
- 65 Surface Discharge (cfs) and Flow Direction
- 95 Stormdrain Discharge (cfs) and Flow Direction

Pipe Dimensions (inches)

- 36 - 47
- 48 - 59
- 60 - 252

FEMA Flood Hazard Boundaries

- Floodplain
- Floodway

I-10 Corridor Improvement Study
SR-51 to San Tan Freeway
DMJM-Harris - Aug 2003 (HEC-1)

I-10 Interloop - Summary Report
HNTB - 1995 (TR-20)

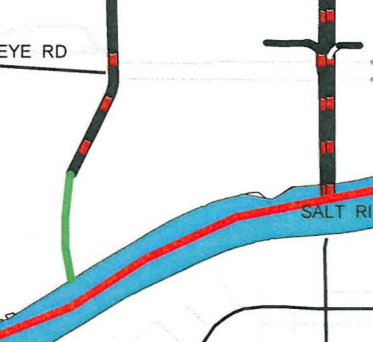
Scale: 1" = 4,000'

N

Flood Control District of Maricopa County

Engineering and Environmental Consultants, Inc.
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

Metro Phoenix ADMP
100 Year Peak Discharge Map
Exhibit 4
Sheet 4



Study Area Boundary
Major Streets
Interstate / Highway
Local Roads
Railroad
Drainage Tunnel
Open Channel
Arizona Canal Diversion Channel
Retention Basins
65 Surface Discharge (cfs) and Flow Direction
95 Stormdrain Discharge (cfs) and Flow Direction

Pipe Dimensions (inches)
36 - 47
48 - 59
60 - 252
Future Storm Drain (C.O.P. 5-year Plan)

FEMA Flood Hazard Boundaries
Floodplain
Floodway

I-10 Interloop - Summary Report
HNTB - 1995 (TR-20)

I-10 Corridor Improvement Study
SR-51 to San Tan Freeway
DMJM-Harris - Aug 2003 (HEC-1)

Scale: 1" = 4,000'
N

Flood Control District of Maricopa County

eec
Engineering and Environmental Consultants, Inc
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

INDIAN SCHOOL RD

THOMAS RD

MCDOWELL RD

VAN BUREN ST

BUCKEYE RD

LOWER BUCKEYE RD

10

60

17

59TH AVE

51ST AVE

43RD AVE

35TH AVE

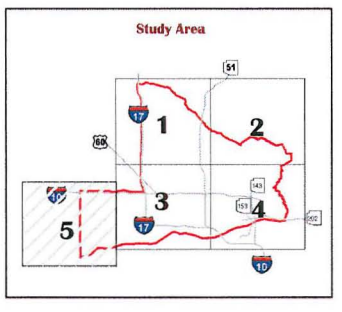
27TH AVE

19TH AVE

15TH AVE

7TH AVE

Metro Phoenix ADMP
100 Year Peak
Discharge Map
Exhibit 4
Sheet 5



Part of Durango ADMP
Study Area Boundary
Major Streets
Interstate / Highway
Local Roads
Railroad
Drainage Tunnel
Open Channel
Retention Basins
65 Surface Discharge (cfs) and Flow Direction
595 Stormdrain Discharge (cfs) and Flow Direction

Pipe Dimensions (inches)
36 - 47
48 - 59
60 - 252

FEMA Flood Hazard Boundaries
Floodplain
Floodway

Durango Area Drainage Master Plan
Dibble and Associates - April 2003 (HEC-1)

I-10 Interloop - Summary Report
HNTB - 1995 (TR-20)

Flood Insurance Restudy - Cave Creek Wash
Cella Barr - 1989 (HEC-1 / SCS)

Scale: 1" = 4,000'

N

Flood Control District of Maricopa County

Engineering and Environmental Consultants, Inc
3003 N. Central Ave Suite 600
Phoenix, Arizona 85012

SECTION 6: EXISTING/PLANNED LANDSCAPE ASSESMENT

6.1 Existing Landscape Character Assessment

The District's report titled "Landscape Character Assessment for Maricopa County" (FCD 2004CO34 - Updated July 13th, 2005) was reviewed and the GIS database from that report was used to generate the Existing Landscape Character Map for the Metro Phoenix ADMP Study area (Figure 6.1).

The District's Landscape Character Assessment report is a study of the existing characteristics that identify, describe and delineate the extent of the landscape character units within the County. The report is a planning tool which breaks the County into a hierarchical system of land classification based on visual, physical, and land use, including character types, subtypes, and physical units.

The study area falls within one character type, three character subtypes, and is comprised of 26 character units. The Sonoran Desert Character Type covers approximately 86 percent of Maricopa County and is associated by the long views across the desert and desert mountains. Subtypes include the Sonoran Mountain Lands, Sonoran Valley Lands, and the Sonoran River Lands.

The majority (59%) of the study area is made up of the Suburban Valley Plain Landscape Character Unit under the Sonoran Valley Landscape Character Subtype. The next two largest character units are the Industrial Valley Plain Unit (10%), located primarily in the southwest one-third of the study area, south of Van Buren Street to the Salt River; and Natural Pastoral Valley Unit (9%), scattered throughout the study area on undeveloped lands, parks, school yards, and golf courses.

With the exception of the Urban Valley Plain Landscape Character Unit, which occurs along the more prominent commercial/business corridors (e.g., Central Corridor and Camelback Corridor), the diversity of the remaining study area units occurs primarily at the low and high ranges of elevation, near the Salt River along the Study's southern boundary, and the mountain/foothill areas of the Phoenix Mountain Preserve along the north and east study area boundaries. The topographical elevation changes from 1000-feet above sea level near the Salt River at the southwest corner of the study area to 2700-feet at the crest of Camelback Mountain.

The diversity in the remaining units is due to the varying natural features, cultural elements, and visual characteristics effected by the extreme ends of the elevation range and land use associated with those extremes, such as the low flood prone areas which are undeveloped and take on different characters, and mountainous areas that have varying levels of residential densities or no development at all.

6.2 Future Planned Landscape Character Assessment

The Future Planned Landscape Character Units Map, again derived from the District's report, consists of 32 units within the study area (Figure 6.2). The increase in the number of units is due to the projected intense urban growth and density changes, which necessitates refinement of the character units. Although there is a diversity of landscape character at the two extreme ends of the area's elevation, as in the Existing Landscape Character Units Map, the majority of the future planned landscape character for the study area is comprised of the Suburban Valley Plain Unit (38%), and Urban Valley Plain Unit (37%). The Suburban Valley Plain Unit decreased from 59% of the study area to 38%, while the Urban Valley Plain Unit increased from 2% to 37%; encompassing land which was previously Suburban Valley, Industrial Valley and Natural Pastoral Valley units.

6.3 Preliminary Landscape Character Compatibility Analysis

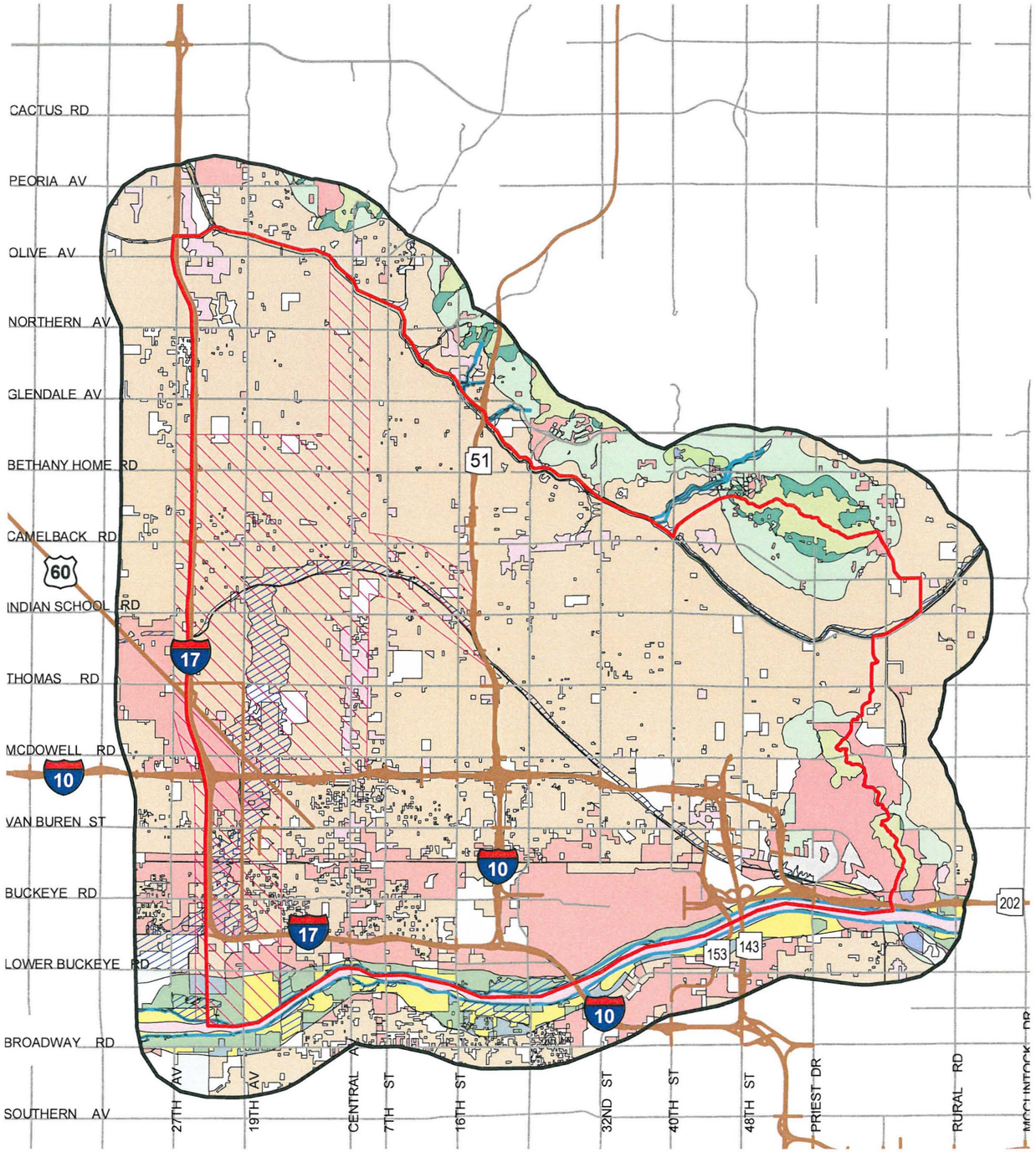
Preliminary Landscape Character Compatibility Analysis and Landscape Compatibility Classes Map were generated using the applications from the District's report titled "Assessing the Relative Ability of Flood Protection Methods to Complement and Achieve Compatibility with the Visual Character of Landscape Settings in Maricopa County" (Revised June14, 2003). Using the County's GIS data for the study area, Figure 6.3 illustrates the complementary and compatibility or incompatibility of the various flood protection methods within the 26 existing landscape character units. The compatibility for the various flood protection methods are also mapped in Figures 6.4 thru 6.8.

The landscape compatibility classes were assigned by comparing the anticipated dominant visual characteristic of each flood control method with the visual characteristics of the physical attributes of each landscape setting or character unit. A professional judgment was made regarding the relative degree of similarity or divergence in the visual characteristics between the two, and a degree of deviation in character that is likely to occur in the landscape setting from imposition of the method.

6.4 Recreational Land Use

Flood control improvements are very often compatible with recreational uses, such as soccer fields located within detention basins. The recreational aspects of possible flood control design alternatives will take into account the existing and proposed recreational land uses. The following documents have been obtained, reviewed, and summarized in Figure 6.9.

- ✓ "Trails", Maricopa County Regional Trail System Plan, August 16, 2004.
- ✓ "MAG Bikeways – Metropolitan Phoenix Area", Maricopa Association of Governments, 2005.
- ✓ "Cycle Arizona Map", Arizona Department of Transportation, 2004.
- ✓ "People Places", City of Phoenix Parks and Recreation, 2005
- ✓ Exploration of the Edge – Recommendations to guide the City of Phoenix policy-making, planning, and design for land at the edge of preserved open space. May 2003
- ✓ Sonoran Preserve Master Plan – An Open Space Plan for the Phoenix Sonoran Desert, City of Phoenix Parks, Recreation and Library Department, February 17, 1998.



Existing Landscape Character Units

- Industrial Bajada
- Industrial Foothills
- Industrial River Channel
- Industrial River Terrace
- Industrial Valley Plain
- Industrial Valley River & Washes
- Natural & Pastoral Bajada
- Natural & Pastoral Foothills
- Natural & Pastoral Mountain
- Natural & Pastoral River Channel
- Natural & Pastoral River Terrace
- Natural & Pastoral Valley Plain
- Natural & Pastoral Valley River & Washes
- Rural Bajada
- Rural Valley Plain
- Rural River Terrace
- Suburban Bajada
- Suburban Foothills
- Suburban Mountain
- Suburban River Channel
- Suburban River Terrace
- Suburban Valley Plain
- Suburban Valley River & Washes
- Urban Bajada
- Urban Valley Plain
- Urban Valley River & Washes

Legend

- Study Area
- Study Area (extent plus 1 mile)
- Highways
- Major Streets
- Flood Hazard Zone
- Floodway
- Scenery Resources Assessment Area of Influence - Study Area for Phase 2

N

1 0 1 2 Miles

Metro ADMP Data Collection Report

Existing Landscape Character Units

Exhibit 6.1

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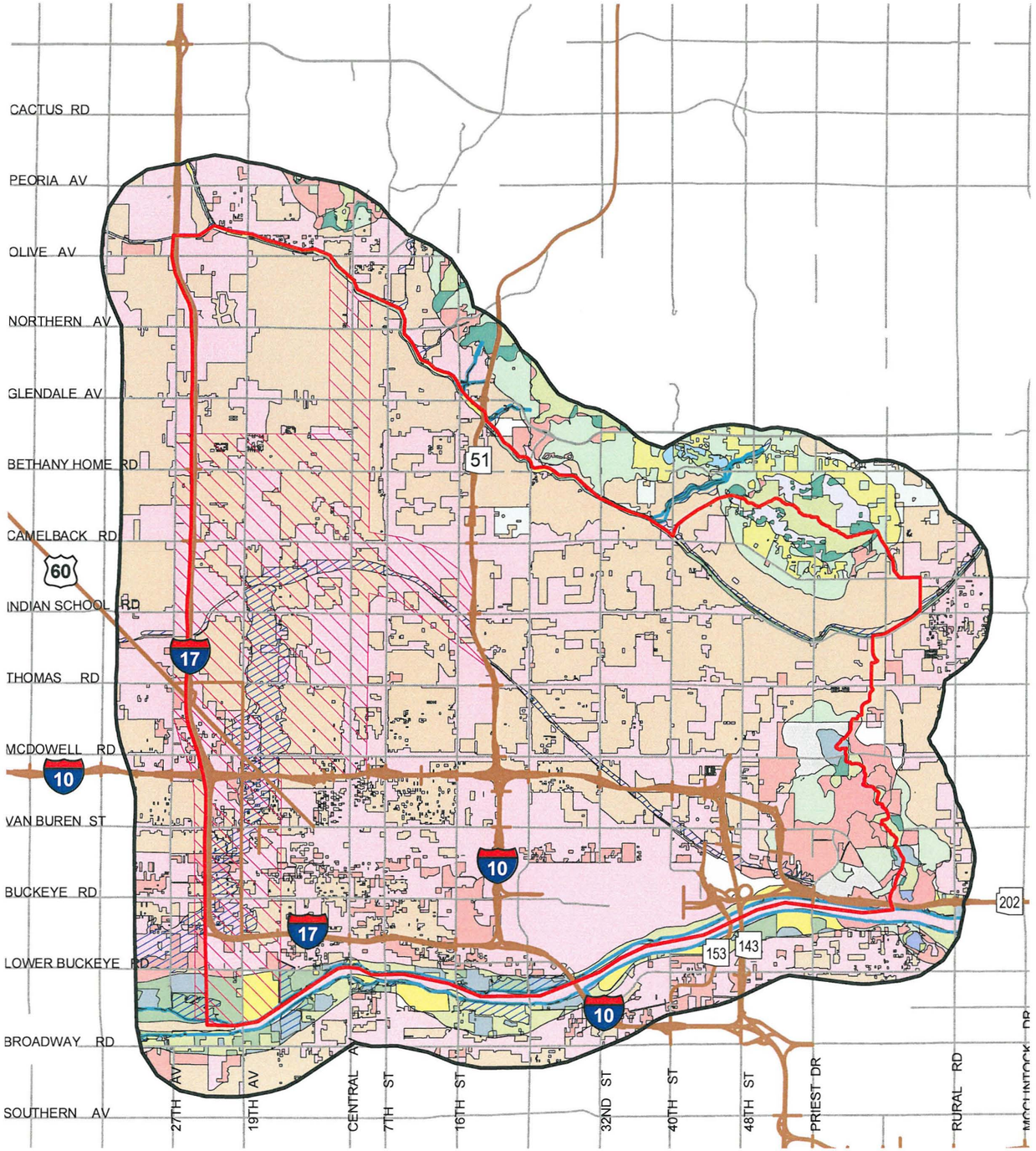

Future Landscape Character Units

- Industrial Bajada
- Industrial Mountain
- Industrial River Channel
- Industrial River Terrace
- Industrial Valley Plain
- Industrial Valley River & Washes
- Natural & Pastoral Bajada
- Natural & Pastoral Foothills
- Natural & Pastoral Mountain
- Natural & Pastoral River Channel
- Natural & Pastoral River Terrace
- Natural & Pastoral Valley Plain
- Natural & Pastoral Valley River & Washes
- Rural Bajada
- Rural Foothills
- Rural Mountain
- Rural Valley Plain
- Rural Valley River & Washes
- Suburban Bajada
- Suburban Foothills
- Suburban Mountain
- Suburban River Channel
- Suburban River Terrace
- Suburban Valley Plain
- Suburban Valley River & Washes
- Urban Bajada
- Urban Foothills
- Urban Mountain
- Urban River Channel
- Urban River Terrace
- Urban Valley Plain
- Urban Valley River & Washes

Legend

- Study Area
- Study Area (extent plus 1 mile)
- Highways
- Major Streets
- Flood Hazard Zone
- Floodway
- Scenery Resources Assessment Area of Influence - Study Area for Phase 2

N

1 0 1 2 Miles

Metro ADMP Data Collection Report

Future Landscape Character Units

Exhibit 6.2

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LANDSCAPE UNIT	Methods of Flood Protection					
		Structural Methods				
	Non-Structural Methods	Soft	Semi-Soft	Semi-Hard	Hard w/ Aesth. Treat.	Hard
Industrial Bajada	C	C	C	C	C	C
Industrial Foothills	C	C	C	C	C	C
Industrial River Channel	C	C	C	C	C	C
Industrial River Terrace	C	C	C	C	C	C
Industrial Valley Plain	C	C	C	C	C	C
Industrial Valley River & Washes	C	C	C	C	C	C
Natural & Pastoral Bajada	C	C	OC	OC	OC	IC
Natural & Pastoral Foothills	C	OC	OC	IC	IC	IC
Natural & Pastoral Mountain	C	OC	OC	IC	IC	IC
Natural & Pastoral River Channel	C	C	OC	IC	IC	IC
Natural & Pastoral River Terrace	C	C	OC	IC	IC	IC
Natural & Pastoral Valley Plain	C	C	OC	IC	IC	IC
Natural & Pastoral Valley River & Washes	C	C	OC	IC	IC	IC
Rural Bajada	C	C	C	IC	IC	IC
Rural River Terrace	C	C	C	OC	IC	IC
Rural Valley Plain	C	C	C	OC	OC	OC
Suburban Bajada	C	C	C	IC	OC	IC
Suburban Foothills	C	C	C	IC	OC	IC
Suburban Mountain	C	C	C	IC	OC	IC
Suburban River Channel	C	C	C	IC	OC	IC
Suburban River Terrace	C	C	C	IC	OC	IC
Suburban Valley Plain	C	C	C	IC	OC	IC
Suburban Valley River & Washes	C	C	C	IC	OC	IC
Urban Bajada	C	C	C	IC	IC	IC
Urban Valley Plain	C	C	C	IC	C	OC
Urban Valley River & Washes	C	C	C	IC	C	OC

C = Complementary and Compatible
OC = Occasionally Complementary and Compatible
IC = Not Complementary and Incompatible

Note: This analysis uses the "Existing Landscape Character Units."

Exhibit 6.1

The following are brief excerpts of descriptions for Methods of Flood Protection taken from the District's report titled "Assessing the Relative Ability of Flood Protection Methods to Complement and Achieve Compatibility with the Visual Character of Landscape Settings in Maricopa County" (Revised June 14, 2003).

Non-Structural Method

This method generally does not introduce structural elements or facilities into the landscape setting. This method retains the existing character and scenic quality of the landscape settings in which they are implemented.

Soft-Structural Method

This method includes construction of flood protection structures, such as conveyance channels, storage basins and flood retarding structures, utilizing earthen materials. The hard structural components of these facilities are either non-existent or are buried or concealed so as not to be visually evident to the average viewer.

Semi-Soft Structural Method

This method is similar to the soft structural method, except for the introduction of visible structural components that are a functional part of the flood protection facility. These structural components can often be designed to remain visually subordinate to, and complement, the desired character of the setting in which they are located through careful placement, material usage, and careful design of their overall form.

Semi-Hard Structural Method without Aesthetic Treatment

This method is similar to the semi-soft structural method, but lacks the inclusion of aesthetic features. Component structures for grade control, energy dissipation, inlets and outlets are characteristically of standard engineering design without the incorporation of aesthetic treatments. The semi-hard structural method incorporates vegetation planting of over-bank areas only to the extent required for erosion control, dust control, or meeting USACE 404 permitting requirements.

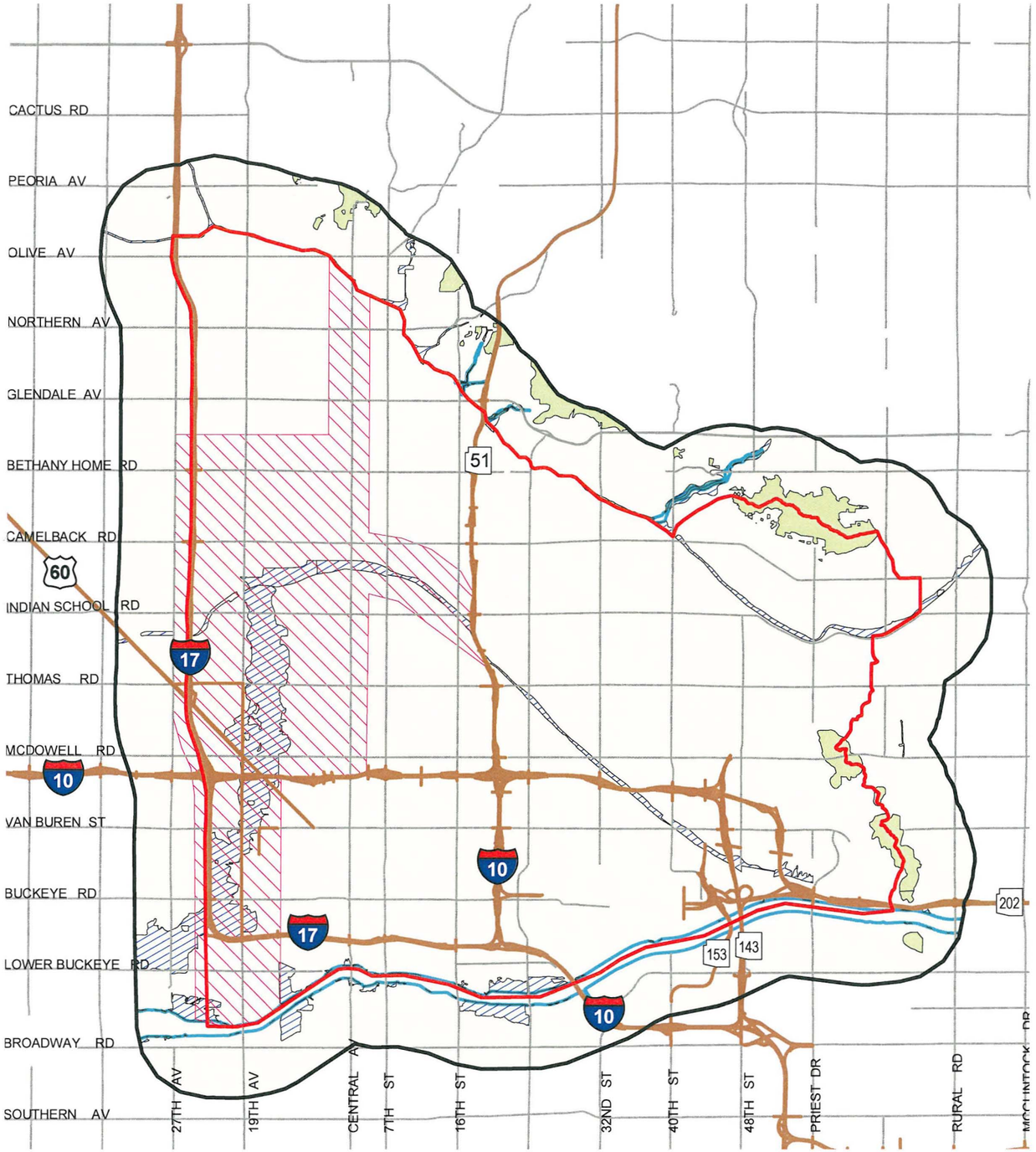
Hard Structural Method with Aesthetic Treatment

This method includes large-scale concrete lined channel facilities and other structural components. This method can include aesthetic treatments such as: meandering the form of a channel in the landscape; use of color, textural patterns, urban art and other architectural embellishments to establish visual and cultural context and unique sense of place within local communities. This method also includes attractive grading and landscape planting of over-bank areas to create an effective visual transition with adjacent properties and streetscapes.

Hard Structural Method

This method includes the construction of heavily armored concrete structures and component facilities without the inclusion of aesthetic treatment measures. This method incorporates vegetation planting of over-bank areas only to the extent required for erosion control, dust control, or meeting USACE 404 permitting requirements.

Figure 6.3



Legend

- Study Area
- Study Area (extent plus 1 mile)
- Highways
- Major Streets
- Flood Hazard Zone
- Floodway
- Scenery Resources Assessment Area of Influence - Study Area for Phase 2

Soft Structural

Flood Protection Method

- Complementary and Compatible
- Occasionally Complementary and Compatible

N

1 0 1 2 Miles

Metro ADMP Data Collection Study

Landscape Character Compatibility Analysis

Exhibit 6.4

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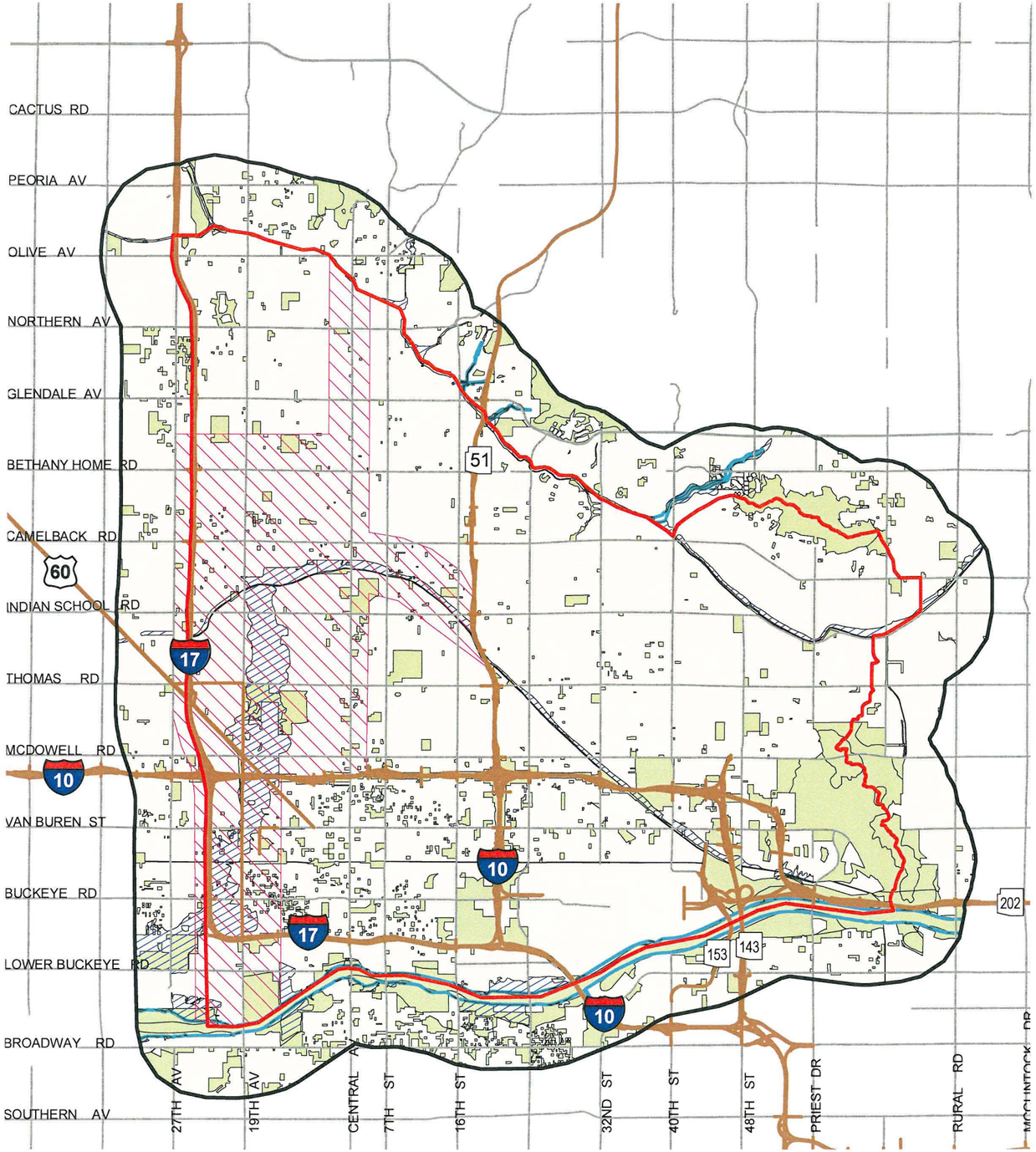

Legend

- Study Area
- Study Area (extent plus 1 mile)
- Highways
- Major Streets
- Flood Hazard Zone
- Floodway
- Scenery Resources Assessment Area of Influence - Study Area for Phase 2

Semi-Soft Structural
Flood Protection Method

- Complementary and Compatible
- Occasionally Complementary and Compatible

N

1 0 1 2 Miles

Metro ADMP Data Collection Report

Landscape Character Compatibility Analysis

Exhibit 6.5

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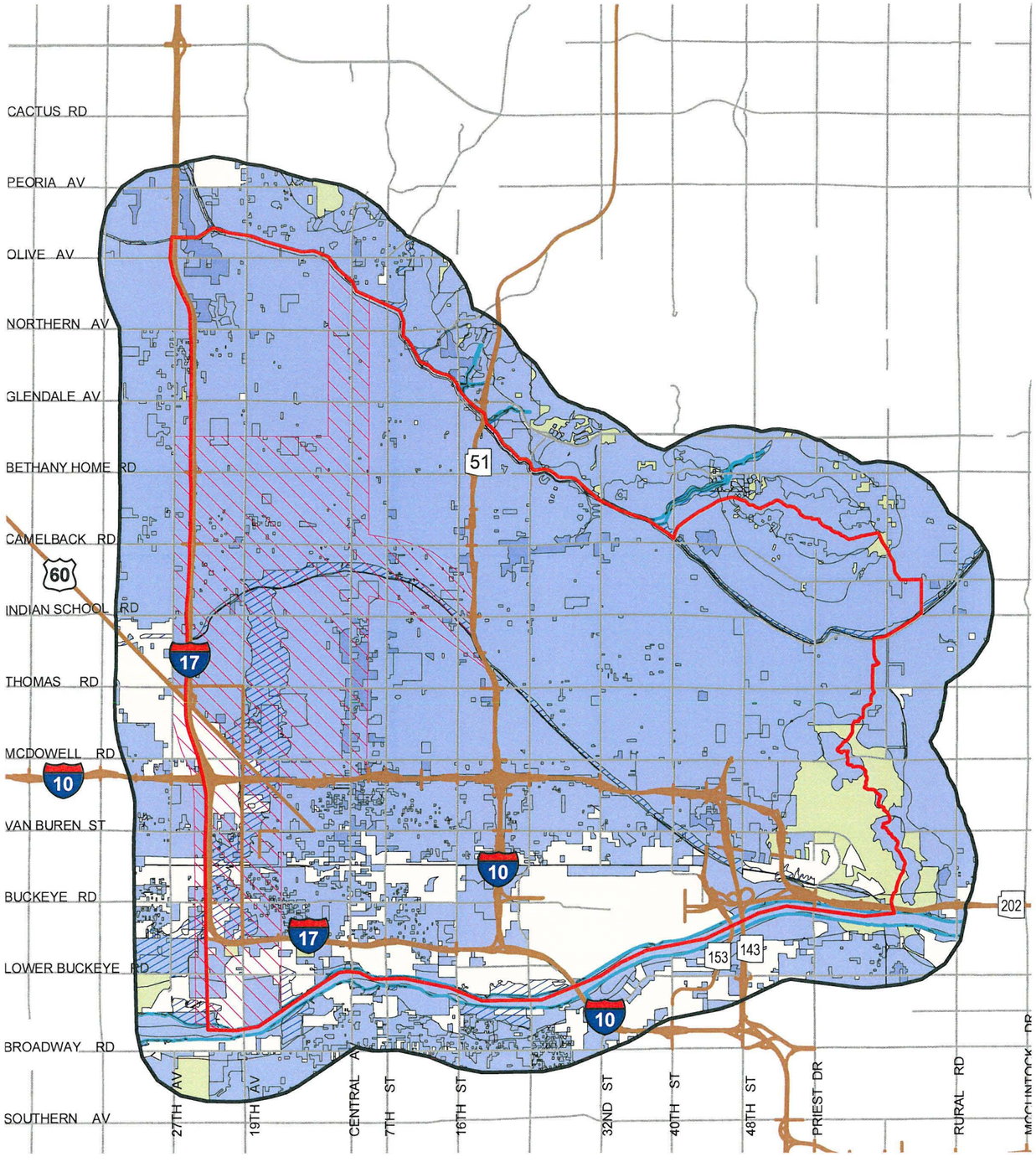

Legend

- Study Area
- Study Area (extent plus 1 mile)
- Highways
- Major Streets
- Flood Hazard Zone
- Floodway
- Scenery Resources Assessment Area of Influence - Study Area for Phase 2

Semi - Hard Structural

Flood Protection Method

- Complementary and Compatible
- Occasionally Complementary and Compatible
- Not Complementary and Incompatible

N

1 0 1 2 Miles

Metro ADMP Data Collection Study

Landscape Character Compatibility Analysis

Exhibit 6.6

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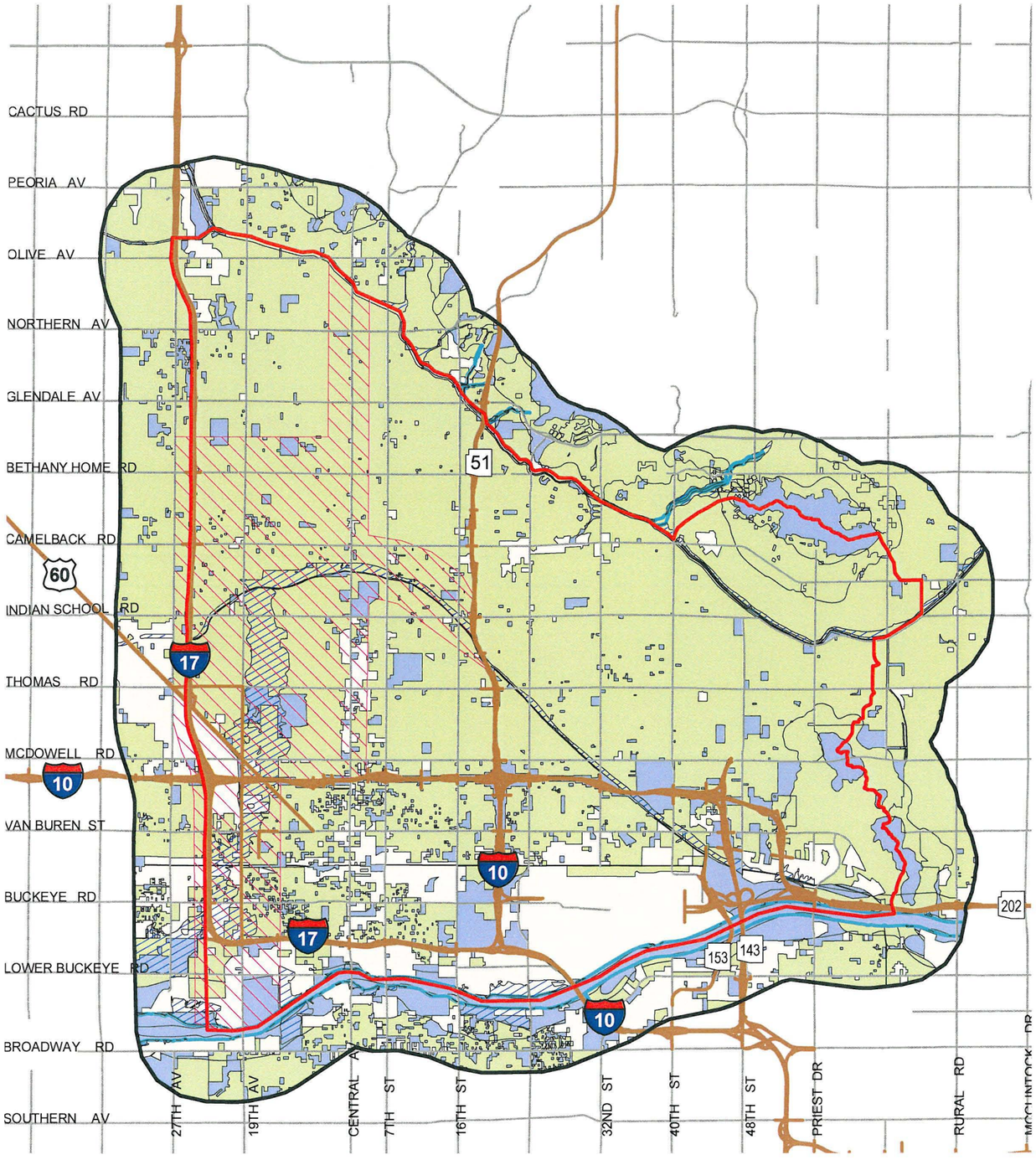

Legend

- Study Area
- Study Area (extent plus 1 mile)
- Highways
- Major Streets
- Flood Hazard Zone
- Floodway
- Scenery Resources Assessment Area of Influence - Study Area for Phase 2

Hard Structural with Aesthetic Treatment

Flood Protection Method

- Complementary and Compatible
- Occasionally Complementary and Compatible
- Not Complementary and Incompatible

N

1 0 1 2 Miles

Metro ADMP Data Collection Report

Landscape Character Compatibility Analysis

Exhibit 6.7

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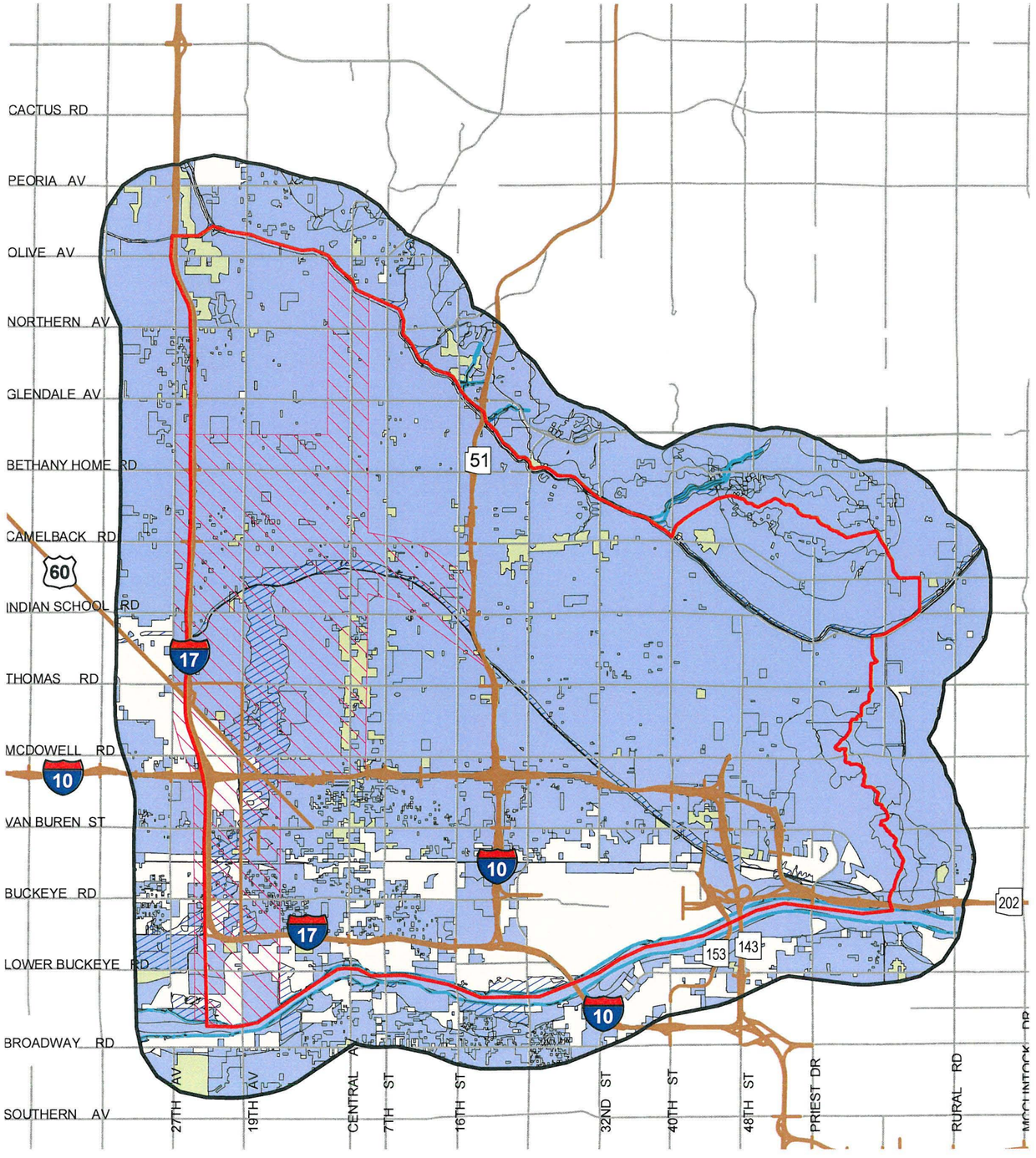

Legend

- Study Area
- Study Area (extent plus 1 mile)
- Highways
- Major Streets
- Flood Hazard Zone
- Floodway
- Scenery Resources Assessment Area of Influence - Study Area for Phase 2

Hard Structural
Flood Protection Method

- Complementary and Compatible
- Occasionally Complementary and Compatible
- Not Complementary and Incompatible

N

1 0 1 2 Miles

Metro ADMP Data Collection Report

Landscape Character Compatibility Analysis

Exhibit 6.8

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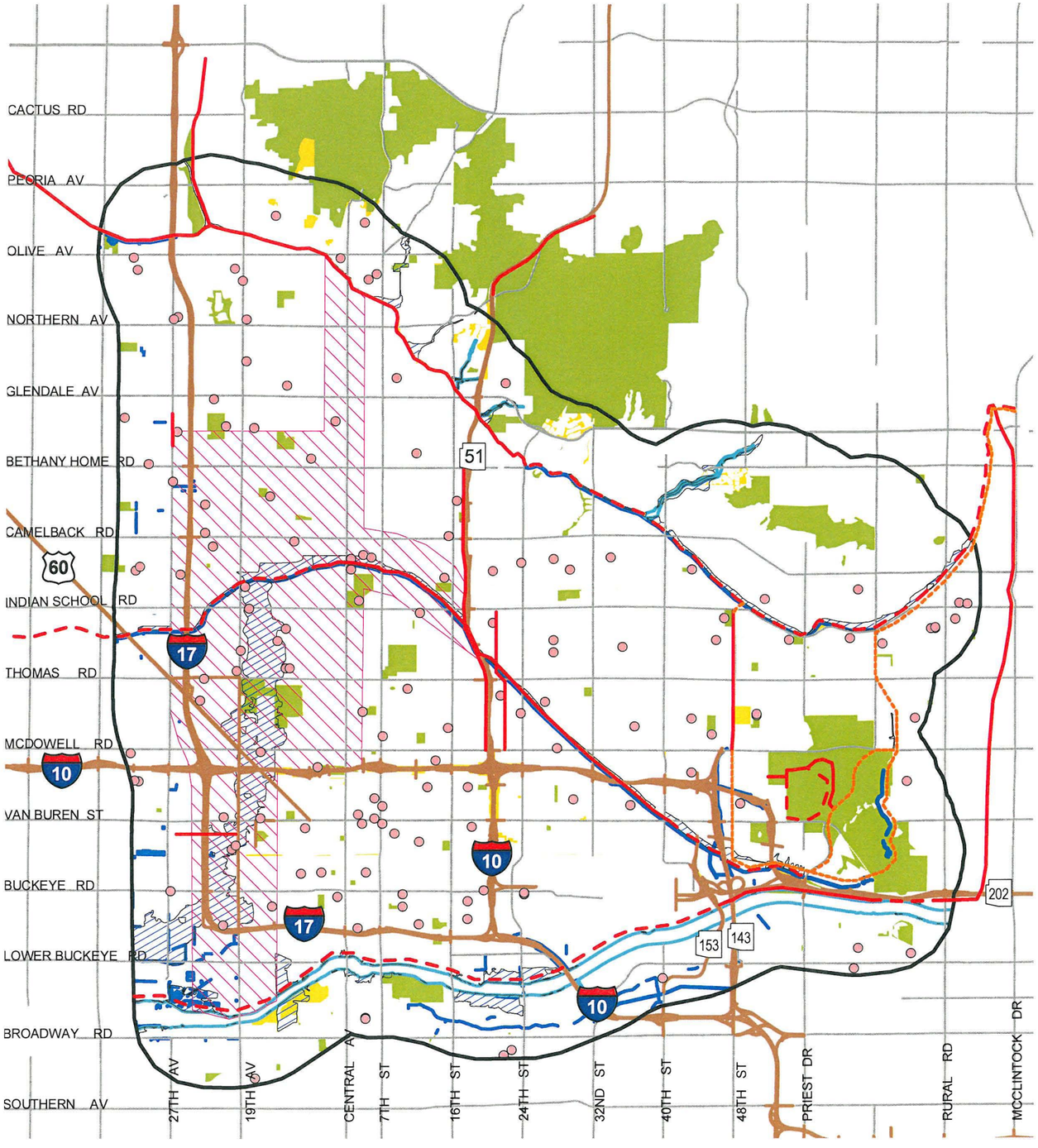

Legend

- Study Area (extent plus 1 mile)
- Schools
- Highways
- Major Streets
- Flood Hazard Zone
- Floodway
- Scenery Resources Assessment Area of Influence - Study Area for Phase 2
- Canals
- Existing Multi-Use Trail (unpaved)
- Existing Paved Multi-Use Path
- Planned Paved Multi-Use Path

Landscape Character Units

- Active Open Space (Includes parks)
- Passive Open Space (Includes mountain preserves and washes)

N

1 0 1 2 Miles

Metro ADMP Data Collection Report

Recreational Land-Use

Exhibit 6.9

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Phoenix, Arizona 85012

SECTION 7: REFERENCES

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Appendix A
FLOODING COMPLAINTS

	Central
1	541 W. Why Worry Lane
2	1541 W. Butler Drive
3	1569 W. El Caminito Drive
4	2121 W. Augusta Avenue
5	Westwood Area
6	1800 Block W. Hazelwood
7	Colter Street Storm Drain @ 2nd Street.
8	Missouri Avenue - 5th to 7th Avenue
9	Oregon Avenue - 9th to 10th Street
10	5906 N. 15th Street
11	Central Avenue: Butler to Bethany Home

	Southeast
1	24th Street and Elm
2	30th Street and Glenrosa Avenue
3	4217 N. 31st Place
4	4119 E. Monterosa Apt. 2
5	3821 E. Whitton Avenue
6	3033 N. 47th Place
7	13th Street and Brill Street
8	1033 N. 28th Place
9	424 S. 56th Street
10	Minezona - 8th Street to 9th Street
11	4601 E. Lafayette
12	5225 E. Camelback

	Southwest
1	2119 W. Edgemont
2	1613 N. Laurel Av.
3	17th and Central Under Pass
4	200 W. Fillmore St.
5	Rehabilitation: 3rd Av. And Van Buren SD
6	3rd Av. And Madison St.
7	2133 S. 5th Av.

Appendix A.1
Under Study/Design

Appendix A.1.1

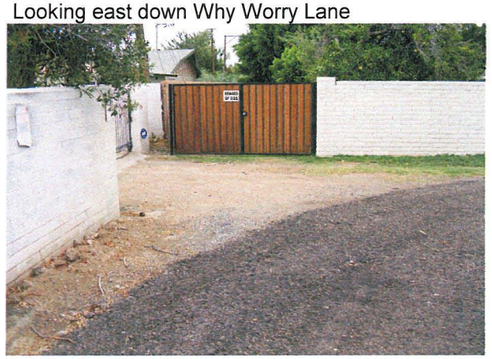
CENTRAL – UNDER DESIGN/STUDY

541 W. Why Worry Lane

Looking north at outlet

Looking east down Why Worry Lane

Looking south at property



Looking west in the alley

Approximate Drainage Area = 12.9 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Flooding issues occur in the front yard where drainage flowing west along Why Worry Lane invades the low lying yard. Drainage problems are also occurring in the back of the property where alley flows invade the backyard." - HDR

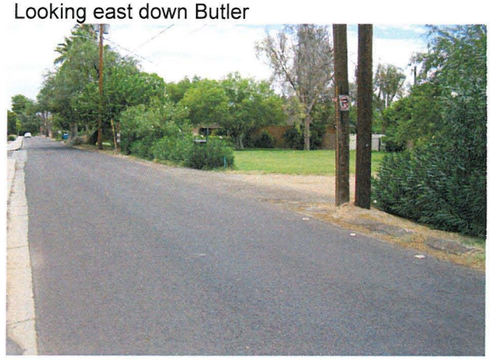
EEC Observations - There is an outlet just to the north of the subject property that drains the homes to the north. Then the alley to the east of the house dead ends at the subject property so flow coming down the alley is forced into the backyard or to Why Worry Lane. The FFE also appears lower than the street elevation. There is currently roll curb in front of the house.

Conclusion - This is local drainage issue. The roll curb is protecting the home from flooding. Once the roll curb is overtopped, the home is susceptible to flooding. The backyard is susceptible to flooding in most storm events.

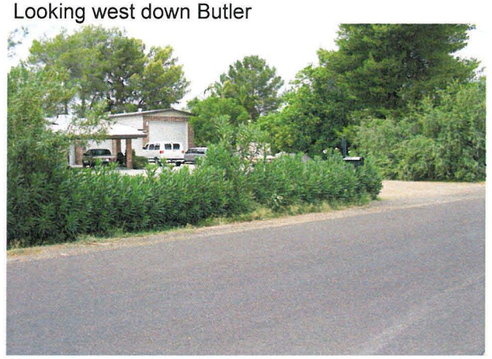
1541 W. Butler Dr.

Looking east down Butler

Looking west down Butler



Looking southeast at driveway

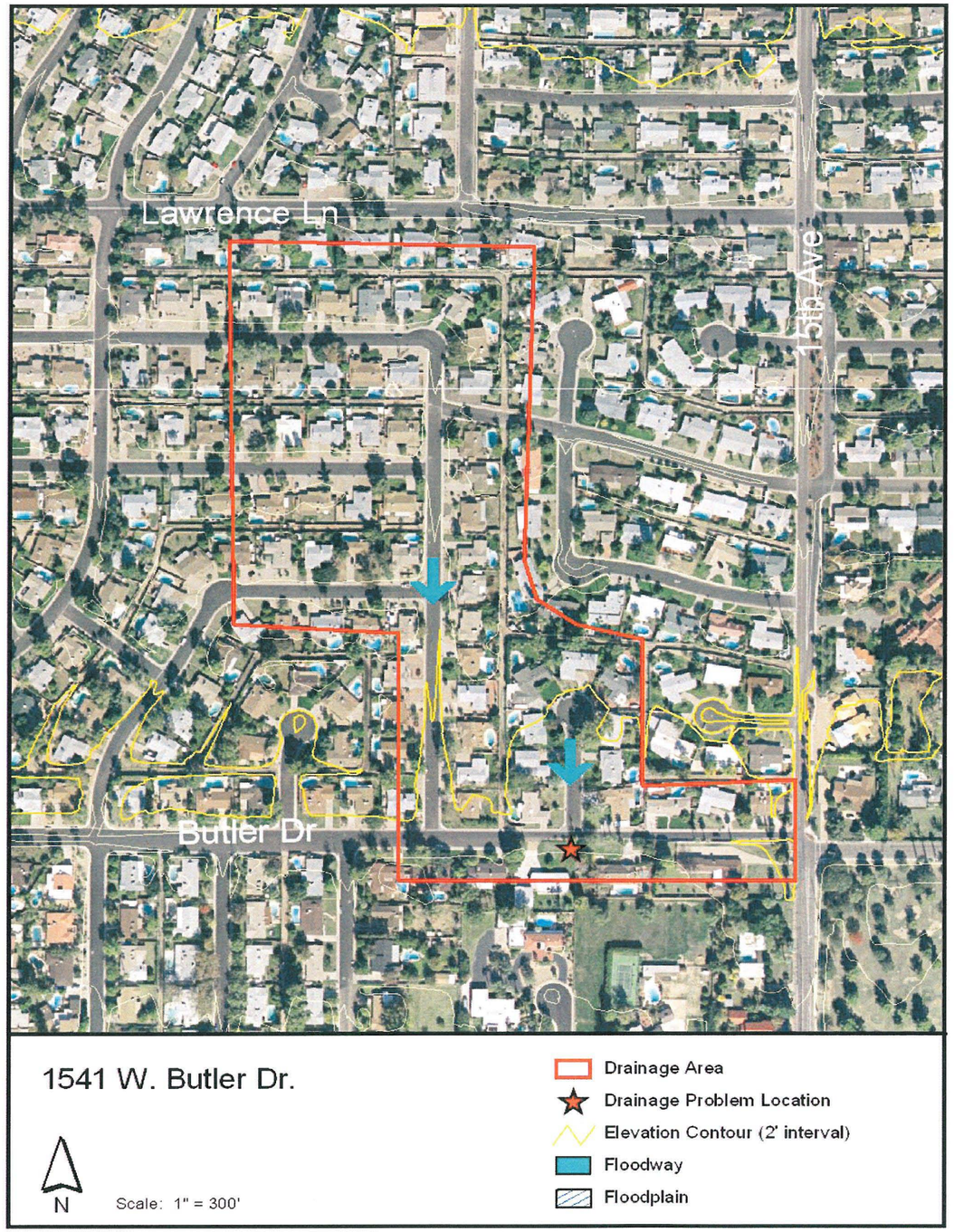


Looking southwest at driveway

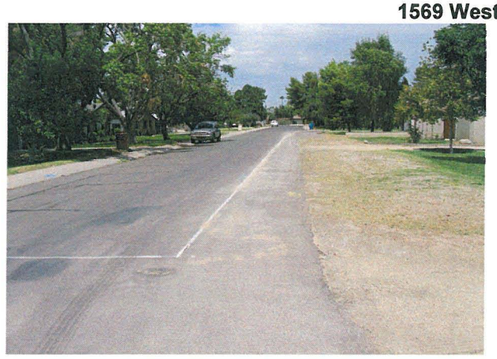
Approximate Drainage Area = 22.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "A low point exists at the north-west end of the property which allows flows coming from the east on Butler Dr., and from the north on 15th Dr., to enter the property. Improvements include a catch basin at the low point, 18" storm drain pipe (220 LF), and a tie-in to an existing catch basin. Also as part of the improvements, vertical curb will be placed along the property's north and east sides." Tri-Core Engineering

EEC Observations - There currently is curb (it is not traditional roll curb, appears to be a small asphalt build up) on the north side of the property to protect it; however, there are also several berms but they are not continuous. The FFE appeared to be low relative to the street elevation.

Conclusion - In most any storm event, it is possible that the front yard will be flooded. The house is susceptible to flooding larger storm events. This is a local drainage issue.

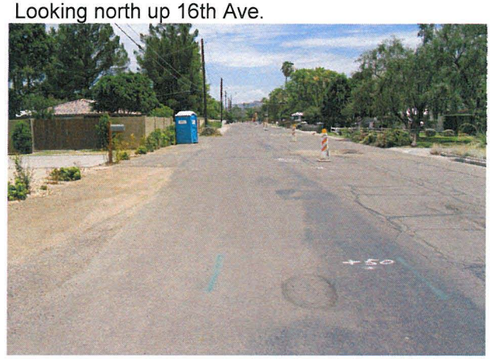


1569 West El Caminito Drive

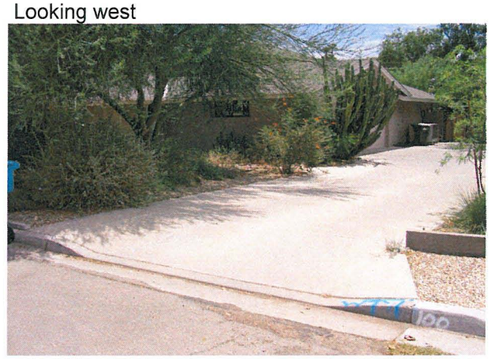


Looking north up 16th Ave.

Looking west



Looking east

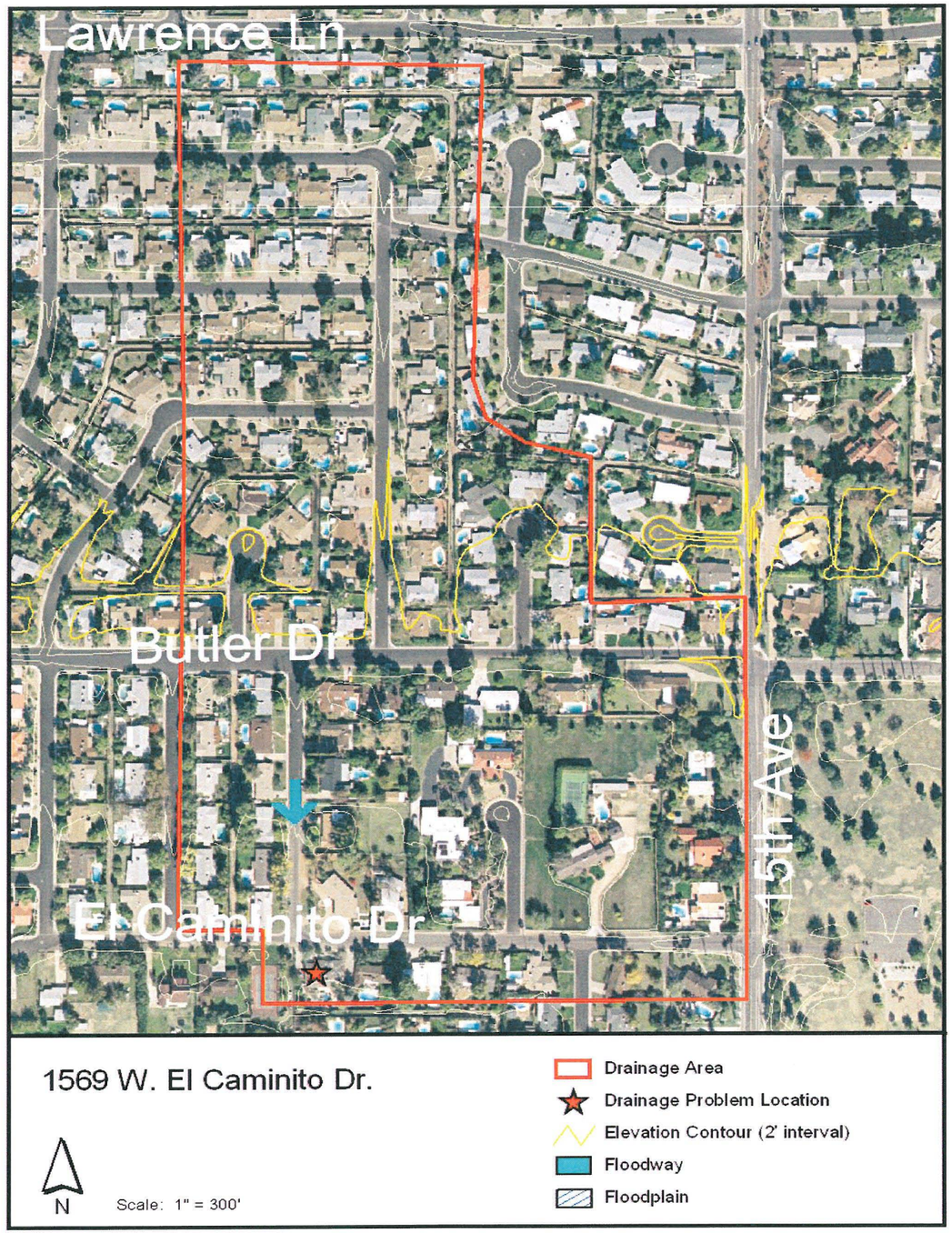


Looking south at property

Approximate Drainage Area = 46.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "The limits are described as West El Caminito Drive, between N. 17th Drive and 15th Avenue." "The project design includes curb inlets, catch basins, manholes and design of a concrete pipe storm drain system." - COP Scope of Work

EEC Observations - There is a new storm drain lateral currently being installed to connect to the 15th Avenue storm drain. It is possible that the driveway would still be overtopped in large storm events. The direction of flow in the area is to the south.

Conclusion - The house is in the area where the previous Cave Creek floodplain existed. Flow is directly south so the property is still susceptible to flooding during large storm events. The new lateral should protect the house from the smaller floods. This is a local drainage problem.



2121 West Augusta Avenue

Looking south at property

Looking east down Augusta to 21st Ave.

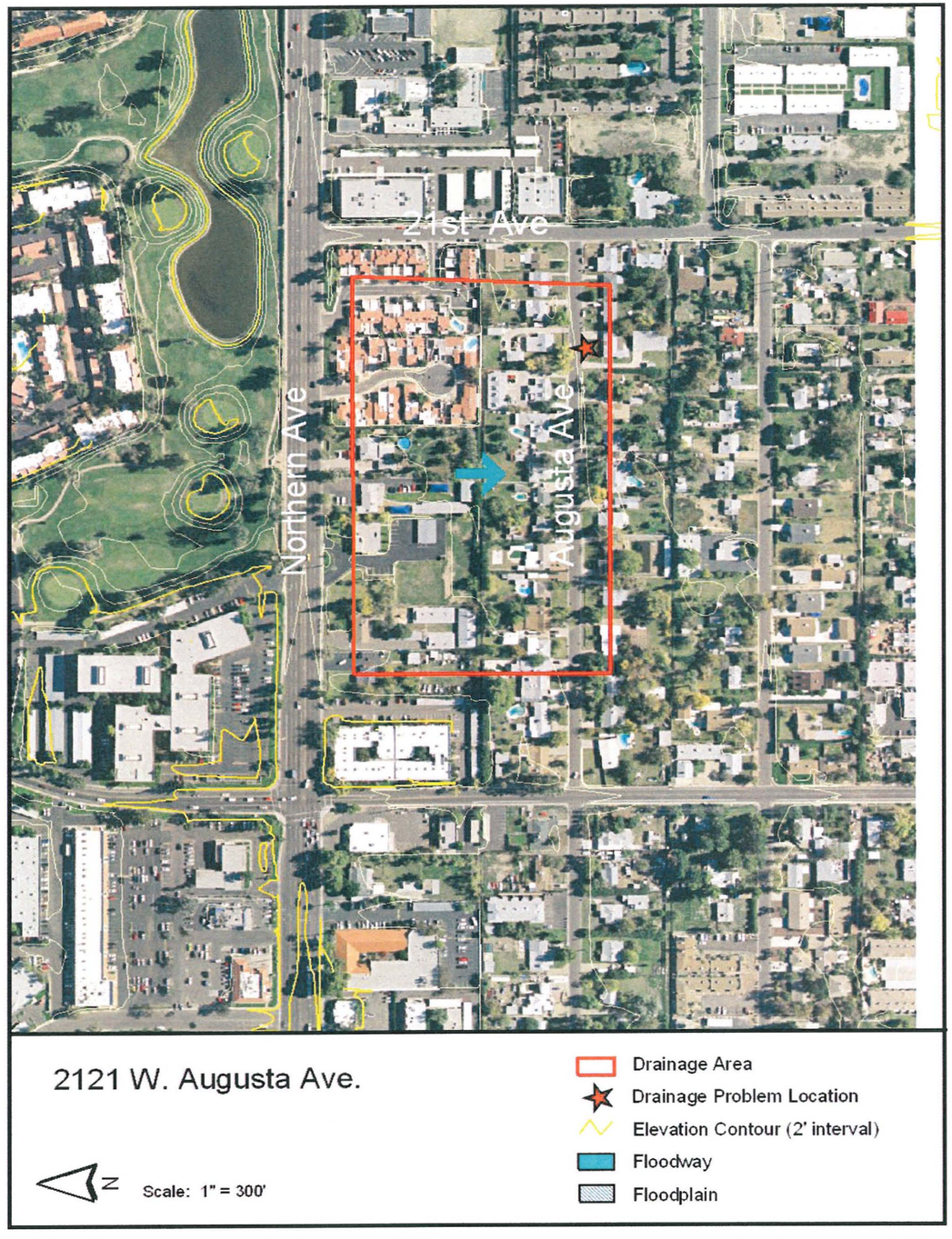
Front yard of property

Looking west down Augusta Ave.

Approximate Drainage Area = 11.7 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Floor plan is lower than the street." COP Street Maintenance

EEC Observations - The FFE appears to be lower than the street elevation. There is roll curb on the north side. From field observations, Augusta Avenue is nearly flat. From the contours, there is a slight grade to the east (there is a 2' drop across approximately 850', slope is approximately 0.0024 ft/ft).

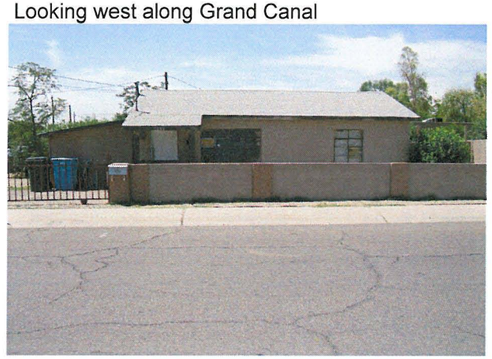
Conclusion - The flatness of the road translates to a limited capacity. The lot and house is susceptible to flooding once the street capacity is exceeded. Due to the size and location of the watershed this appears to be a local flooding problem.



Westwood Area

Looking west along Grand Canal

Looking west at property



Looking south at property

NE corner of 23rd Ave. and Devonshire

Approximate Drainage Area = 3.7 acres
FEMA Floodzone Type - X1

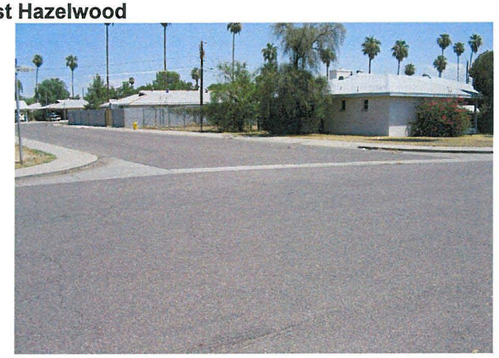
Property Owner Description/Complaint "23rd Ave. is crowned and has open ditches and a few catch basins on the west side of the road. However, there are no catch basins along the east side, south of Campbell Road, consequently, 23rd Ave. quickly fills to capacity. At 23rd Ave and Devonshire, flow overtops the valley gutter and spills east down Devonshire overtopping roll curb and flooding property along Devonshire and 22nd Dr." - Kirkham Micheal Consulting Engineers

EEC Observations - The FFE's appear much lower than the street elevation of 23rd Avenue (verified by looking at contours). There is roll curb around the property to protect the houses from flooding. The property is also behind the Grand Canal so there is nowhere for water to escape to the south.

Conclusion - This could be a regional problem if flow coming south down 23rd Avenue flows into neighborhood via Devonshire. Once the roll curb is exceeded, the houses are susceptible to flooding. This problem may be alleviated to some degree by the City's 24th and Camelback drainage improvements

1800 Block West Hazelwood

Looking east



Looking north

Looking west towards 19th Ave.

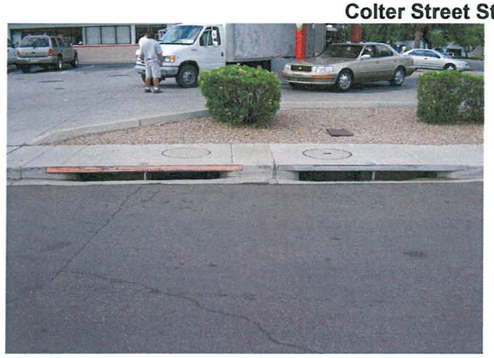
Looking southeast

Approximate Drainage Area = 14.8 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "The owners at the property of 1821 W. Hazelwood have indicated that flooding occurs due to stormwater events." COP Scope of Services

EEC Observations - The FFE's appear to be at or close to the roll curb elevation by visual inspection. There may be flow from 19th Avenue getting to the block. Since there is no continuous wall or barrier, flow will be able to work it's ways through to Hazelwood. There is very little slope east to west based on the contours (the slope is about 0.0025 ft/ft). There may be standing water in the gutters as well.

Conclusion - The properties are susceptible to flooding in large storm events. It appears to be a local problem due to limited inflow and there are conveyance corridors to the east and west (19th and 17th Avenue).

Colter Street Storm Drain at 2nd Street



SE corner of Colter and Central

NE corner of Colter and Central

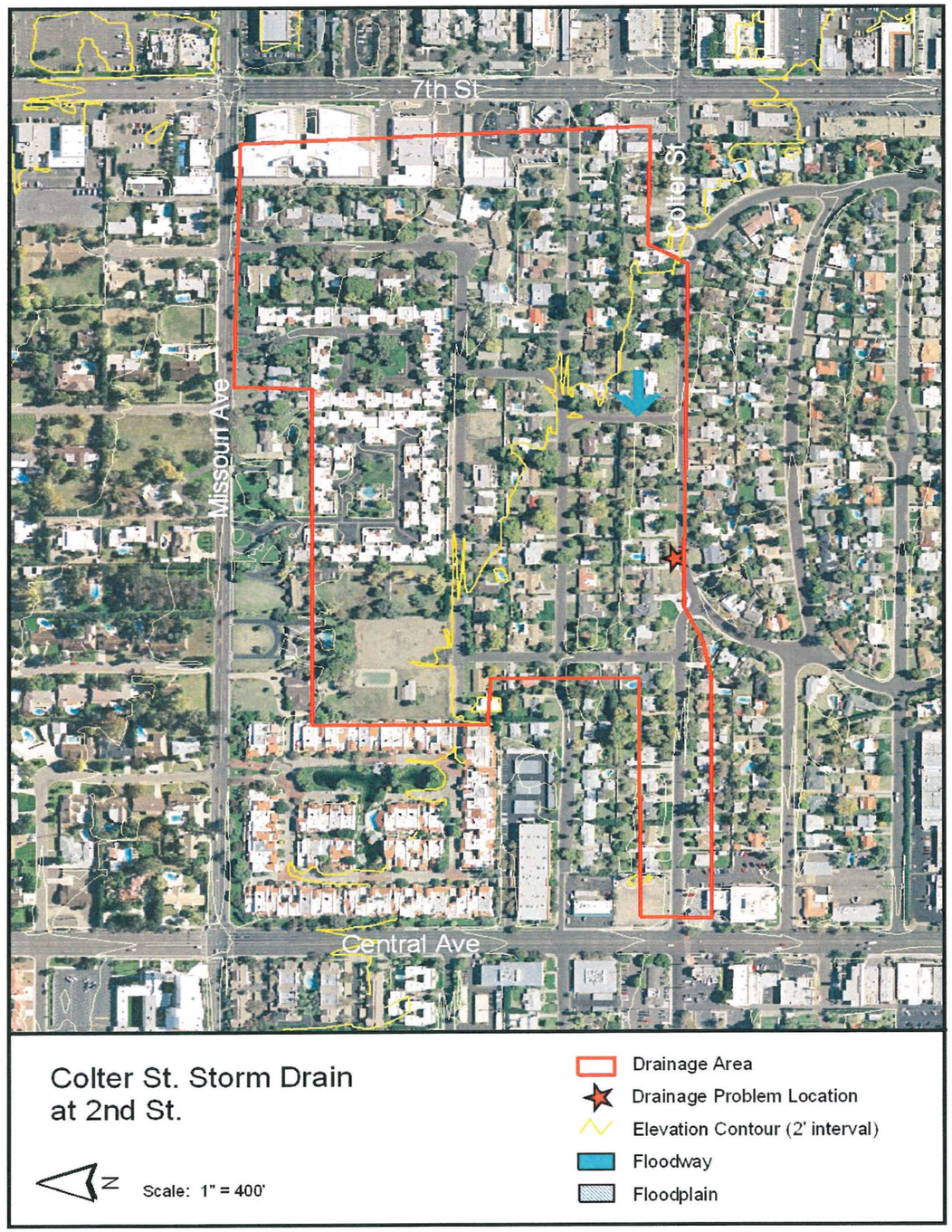
Inlet along Colter at 2nd St.

Inlet along Colter at 3rd St.

Approximate Drainage Area = 50.4 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Problem does not exist at this location." - COP Street Maintenance

EEC Observations - Based on a visual inspection, the FFE's were generally low relative to the curb elevation and there was only roll curb to protect the houses. The houses had flood irrigated lots. There were inlets along Colter, east of Central Avenue. It did appear that flow would leave Central Avenue and flow east along Colter for a short distance before ponding in Colter. The general grade is east to west along Colter.

Conclusion - The houses are susceptible to flooding once the roll curb is overtopped and the flood irrigated lots are filled. This is a local drainage problem.



Missouri Avenue - 5th to 7th Avenue

Looking west from SE corner of 5th Ave. and Missouri

Looking west along Missouri

Looking south across Missouri

Looking SE

Approximate Drainage Area = 15.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Claims that there is a serious flooding problem due to the crowning." "Claims it is a continuous problem with water flooding lot when it rains or during irrigation time." - COP Street Maintenance

EEC Observations - There is curb and gutter on the south side of Missouri, but, by inspection of the contours, there appears to be very little slope in the gutter. The gutter probably has to fill with water to create a hydraulic gradient towards 7th Avenue and 5th Avenue. The FFE's appeared to be above the crown height based upon a visual inspection. There is low capacity in 5th Avenue due to street size.

Conclusion - It seems as though flow should stay below curb elevation for smaller storm events but in large events, the water will be forced south through the lots.

Oregon Avenue - 9th Street to 10th Street

Looking east

Looking southeast

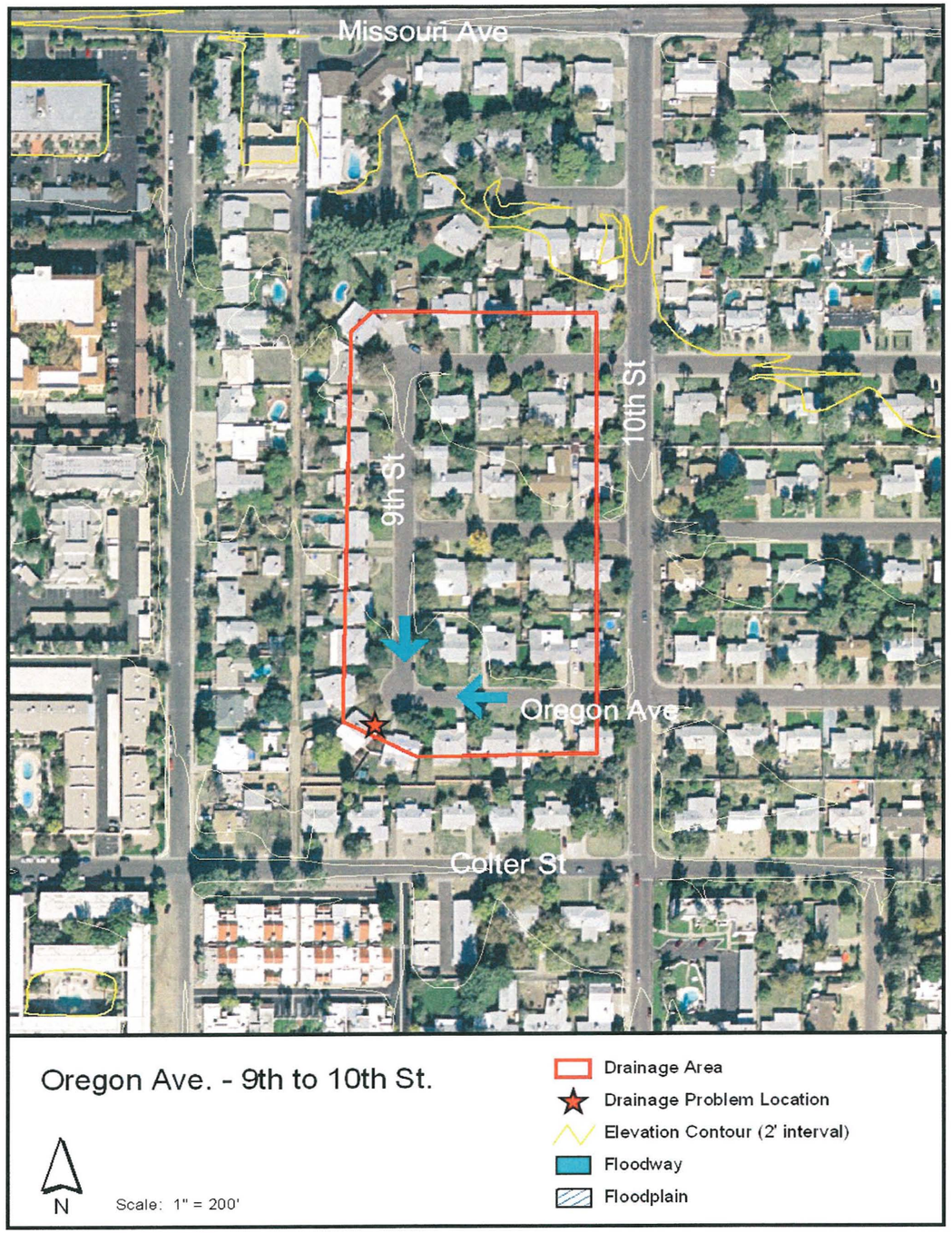
Looking west along valley gutter

Looking west at property

Approximate Drainage Area = 5.7 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Alley will be reshaped to allow drainage to Colter." - COP Street Maintenance

EEC Observations - The concentration point for the neighborhood is at 9th Street and Oregon Avenue. There is a 6" pipe that drains the valley gutter. Based on the contours, it appears that the alley should drain away from the house. It was not able to be determined whether or not the city had completed any work on the alley.

Conclusion - During the site visit, the alley was not accessible. It does not appear as if the house on the corner of 9th Street and Oregon Avenue is in danger of being flooded. The drainage area is small and appears to be only a local drainage issue.



5906 N. 15th Street

Looking south into cul-de-sac

Looking north

Looking south

Looking south

Approximate Drainage Area = 1.3 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Prepare design and plans for any concrete driveway replacement to provide a drainage high point for preventing drainage water entering into the residence. Further more, provide 8" flat single concrete curb around the perimeter of the frontage of the lot to protect the residence from flooding. The above improvements will ensure no drainage water enters into 5906 N. 15th St. The existing inlet at the cul-de-sac has been replaced." - Engineering Alliance

EEC Observations - The FFE appears to be slightly above the street elevation. The house is at the end of a cul-de-sac and the flow has no where to go except through the property. There is also debris and sand from the landscaping on the east side of 15th Street.

Conclusion - Without further investigation and study, it is hard to say whether or not the home will experience flooding. It is susceptible since the flow will be forced through the property in some way. It is a local drainage problem.

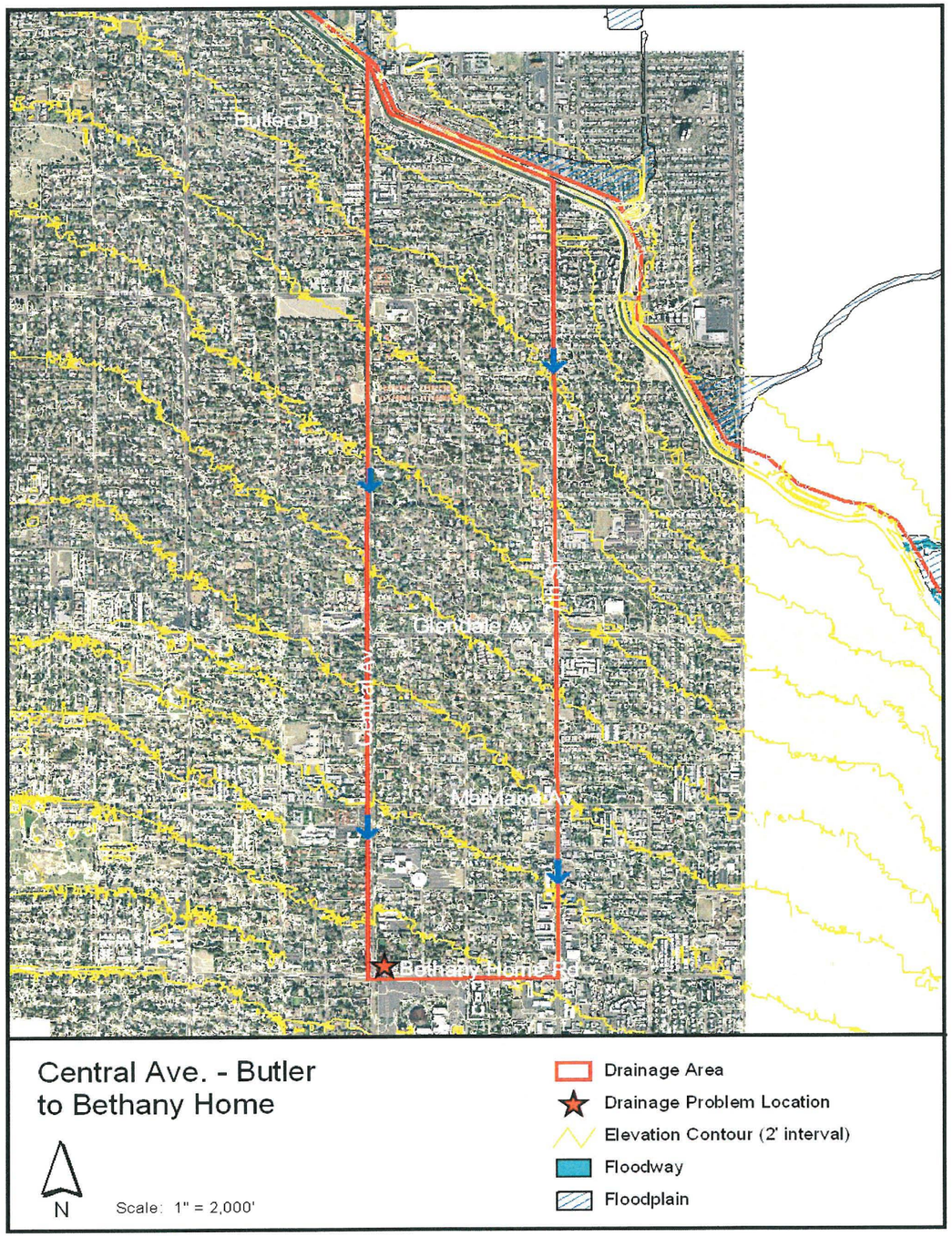
Central Avenue: Butler to Bethany Home

Looking south down Central Ave. on east side of road

Approximate Drainage Area = 812.4 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Asphalt driveways cross the swale which conveys flow for Central Avenue. The driveway owners have complained of damage to their driveways from the flows and have requested help from the City of Phoenix." - Primatech Engineers

EEC Observations - It appears as if Central Avenue is crowned and forces water to the parallel path. The homes along Central would need to be looked at individually as to whether or not they will flood.

Conclusion - There is no curb and gutter along Central Avenue. In any rain event, it is likely the path will become flooded. Driveways need to either dip to continue existing swale or raise the driveway and use culverts to convey flow. There currently is not a storm drain in Central Avenue north of Bethany Home. It appears as if it may be a regional problem.



Appendix A.1.2
SOUTHEAST – UNDER DESIGN/STUDY

24th Street and Elm Street

Looking at property on north side of Elm St.

Looking east down Elm St.

Looking north along 24th Street

Looking north on 24th Place

Approximate Drainage Area = 28.7 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Two options are suggested for the homeowner. One is to raise the front yard of the residence to an elevation of 6-inches above the top of curb at Elm Street. Another is to build a berm along the sidewalk, 6-inches above the top of curb at Elm Street, and regrade the driveway in the front yard to keep storm water from entering the yard."- Primatech Engineers

EEC Observations - The FFE, of the 2406 East Elm residence, appeared to be low from a visual inspection. The flow to the east of 26th Street probably only gets to 24th Street and Elm Street in the large storm events (the dashed line shows where the drainage area would end in small storm events). It also appeared that flow may leave 24th Street and impact the property on the southeast corner of Elm and 24th Street.

Conclusion - The 2406 East Elm residence is susceptible to flooding from two sources. The first is if the roll curb in Elm Street is exceeded and the second is if the vertical curb in 24th Street is exceeded. In either case, once flow overtops the curb, the house is susceptible to flooding. It appears only to be a local drainage issue.

30th Street and Glenrosa Avenue

Looking south along 30th Street

Looking north on 30th Street

Looking NW at property

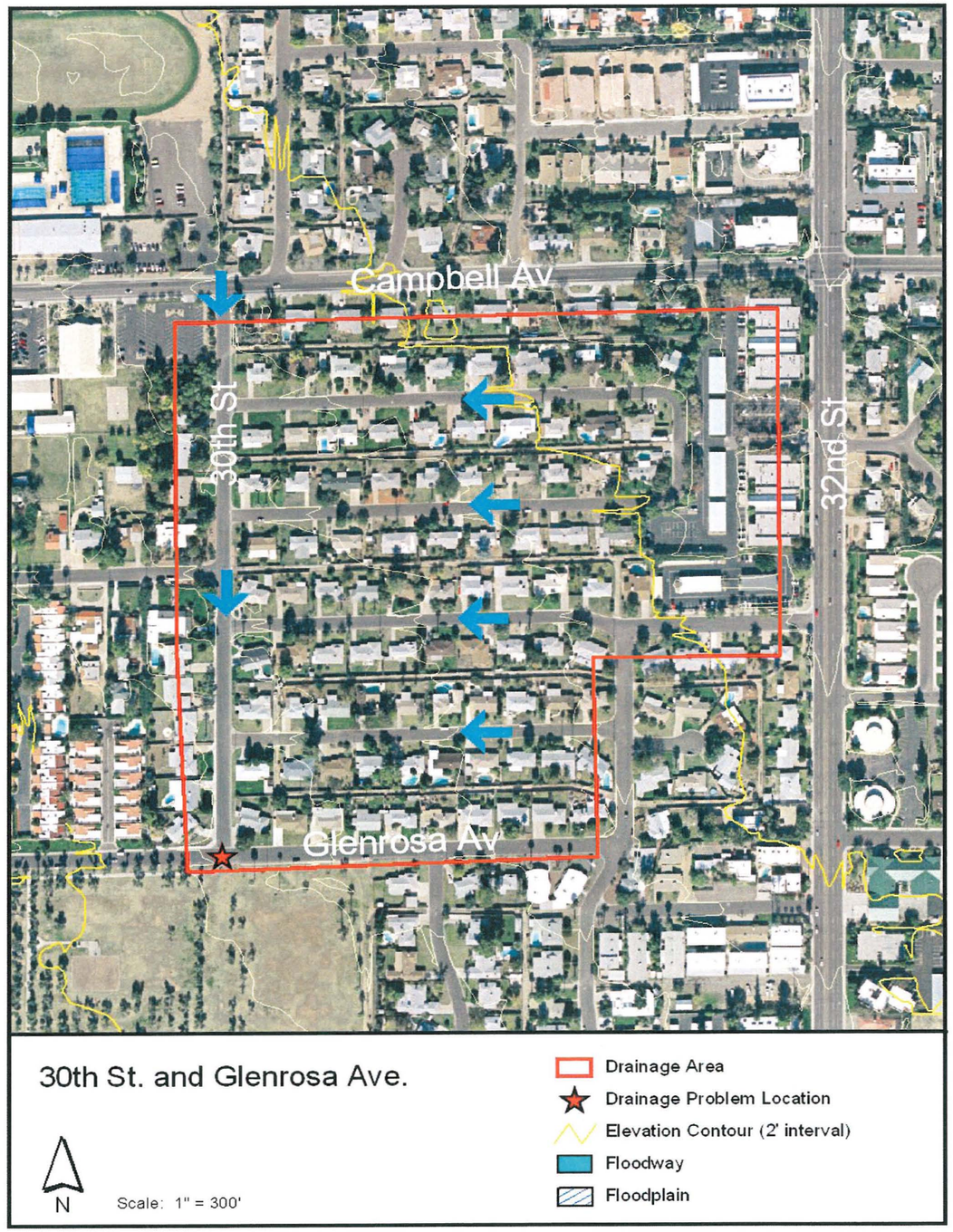
Looking NW along 30th Street

Approximate Drainage Area = 33.8 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Recommendation: The containment wall and berm with sidewalk design for protection from the 100 year storm is the recommended option. The addition of sidewalk at the property will match the rest of the neighborhood and provide useful services to elevated pedestrian traffic levels in the area due to the proximity of Los Olivios Park." - GTA Engineering

EEC Observations - The properties on the west side of 30th Street appear to have low FFE's relative to the street elevation based on a visual inspection and 30th Street has a very flat slope with a correspondingly small conveyance capacity. There appears to be a flow split at Campbell Avenue south down 30th Street. Containment walls and roll curb have been installed in front of the houses.

Conclusion - During the site visit, one resident said that since the containment wall and roll curb has been installed, flooding has been less often and less severe. The walls and roll curb are probably enough to solve the small storm events but not adequate for the large storm events. Since the FFE's appear lower, it would be probable that any flow over the curb will flood yards and houses. The drainage area is small and is only a local issue.



4217 North 31st Place

Looking east at property

Looking south down alley

Looking SE at apartments

Approximate Drainage Area = 1.7 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Flooding occurs from storm water behind resident's homes reaching backyard doorways. A 12' unimproved COP R/W is located at the backside of property which is a strip of land that the city owns but doesn't maintain. The flooding source is partially from an alley to the north and from an apartment complex parking lot to the east. The alley grades e-w at 0.6% grade. The west end apartment complex parking area slopes to the west and towards the unimproved R/W. Grades on the unimproved R/W are also flat. Both the alleyway and unimproved R/W have low spots along with the grades." COP Street Maintenance

EEC Observations - The FFE appeared lower than the alley elevation. The apartments to the east appear to drain the parking lot to the alley. There is also a low spot in the alley just to the northwest of the house.

Conclusion - The front of the house did not appear to have a drainage issue. In the alley, standing water could be an issue. Flooding is certainly an issue in large storm events and in smaller storm events, flooding could still occur. The drainage area is small and the problem is only a local issue.

4119 East Monterosa Apartment #2

Looking south at property

Looking southeast

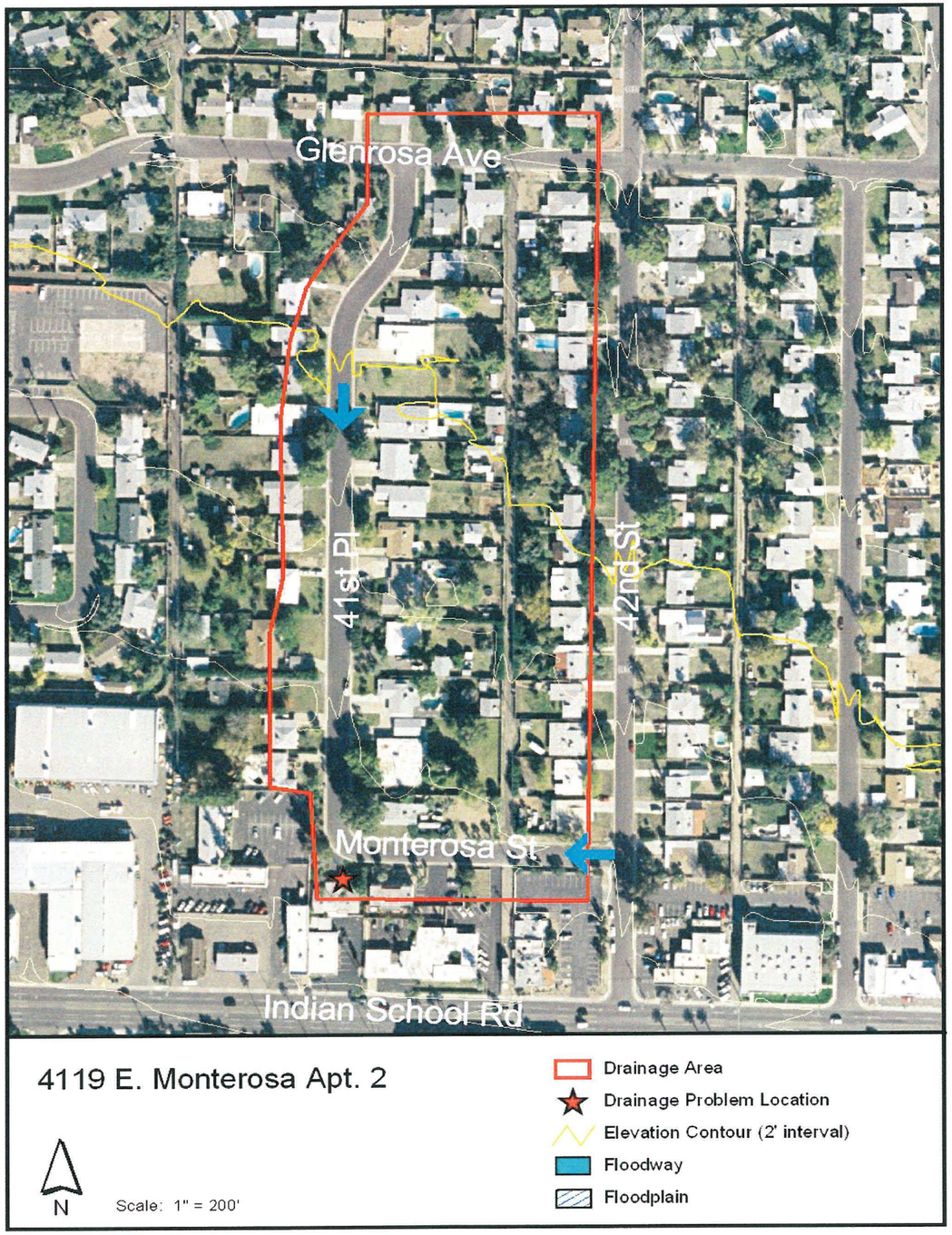
Looking east along Monterosa

Looking north along 41st Street

Approximate Drainage Area = 11.8 acres
FEMA Floodzone Type - X1
Property Owner No information available.
Description/Complaint

EEC Observations - There are currently three inlets in place. The FFE appeared to be around curb height (no survey was taken to verify FFE). The property is subject to flow from the north along 41st Place and from the east along Monterosa Street.

Conclusion - The inlets probably are sized for the 2-year storm. The property is probably not in danger of flooding during small events. In the large events, the property is susceptible to flooding, even with the inlets in place because runoff has to flow through the property since it is the low point. It is a local drainage issue.



3821 East Whitton Avenue

Looking east

Looking west

Looking southwest at property

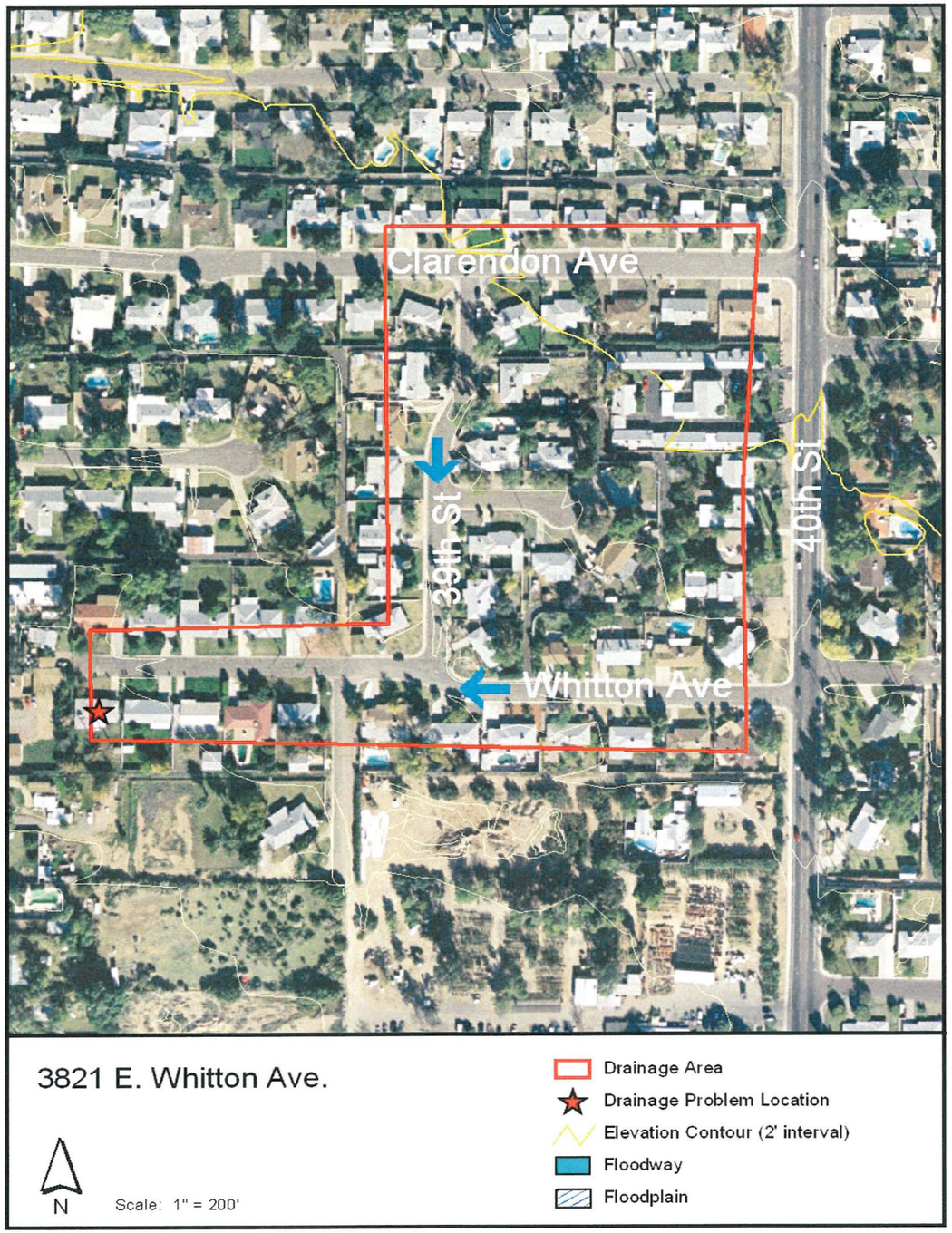
Looking south at property

Approximate Drainage Area = 11.5 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "3821 E. Whitton Ave. Storm drain improvements is a minor drainage project targeted at alleviating flooding and ponding occurring at the Whitton Ave. cul-du-sac. Improvements include catch basins at the end of the cul-du-sac, 18" storm drain pipe, a drainage easement through private property, and a 38th Street bubble up structure." - COP Scope of Work

EEC Observations - There is no outfall for the stormwater. Flow reaches the property from the east along Whitton and has nowhere to go until it ponds and spills south through the property. The FFE's appeared to be at or below curb elevation from a visual inspection (no survey was taken).

Conclusion - Standing water at the end of the cul-du-sac will be an issue in any storm event. It appears that any storm event which is able to overtop the curb could cause flooding. It is a local drainage issue.



3033 North 47th Place

Looking southeast at property

Looking east on Avalon Drive

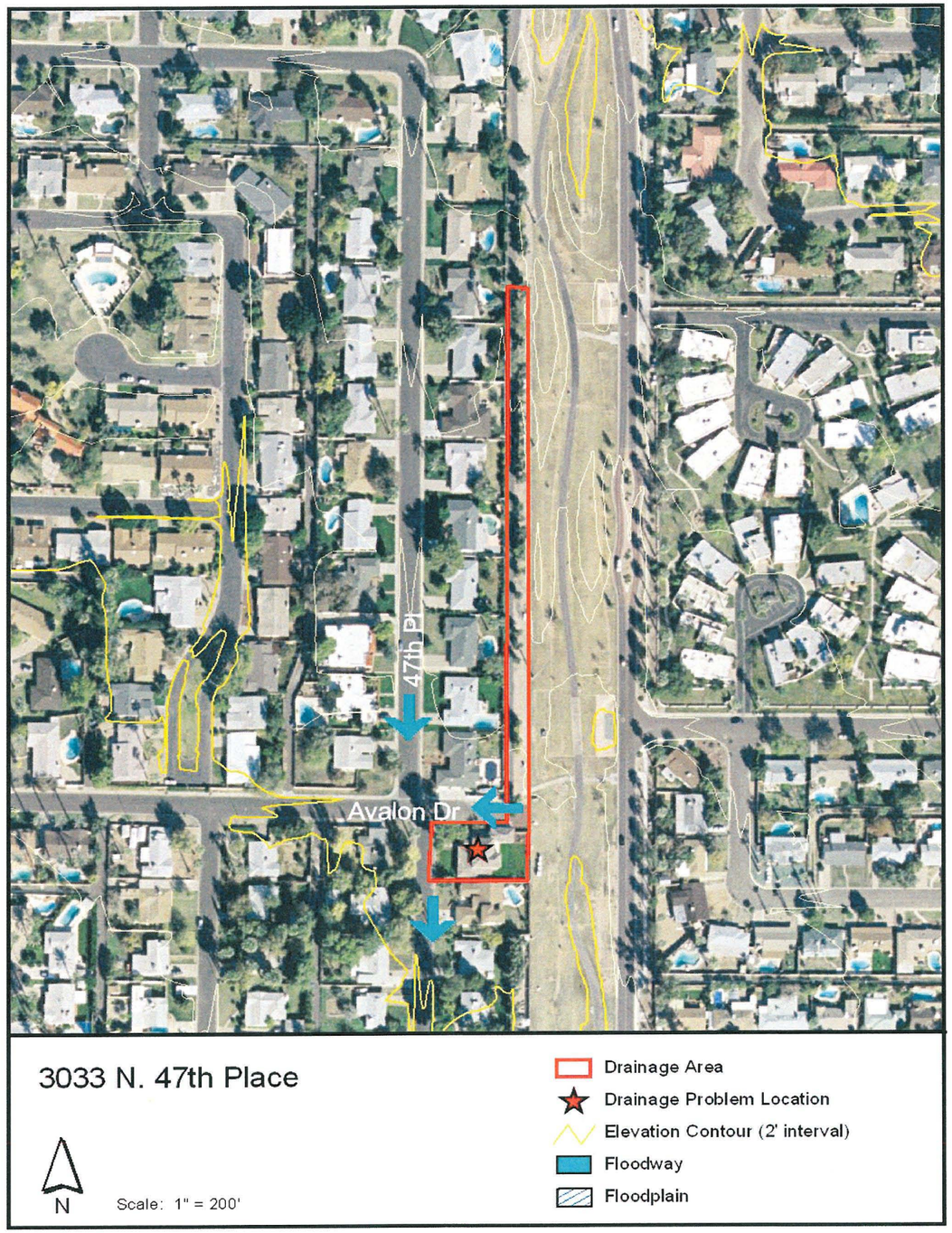
Looking north from garage

Looking southeast at garage

Approximate Drainage Area = 0.9 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "The home builder brought the existing problem (low cul-du-sac) onto himself. Since building of home would require entrance from problem area. Never the less, it is a city issue/problem that needs resolution." - COP Street Maintenance

EEC Observations - The flow from the path on the west side of Old Cross Cut Canal goes south to the driveway of the subject property. The drainage area for the path is small. The capacity of the path flows south directly at the garage of the property.

Conclusion - Ponded water in front of the garage could be a problem in any storm event. In large storm events, the property is susceptible to flooding. It is a local drainage issue although it is adjacent to a major conveyance corridor (the Old Cross Cut Canal).



13th Street and Brill Street

Looking north up 13th Street

Looking west from the end of Brill Street

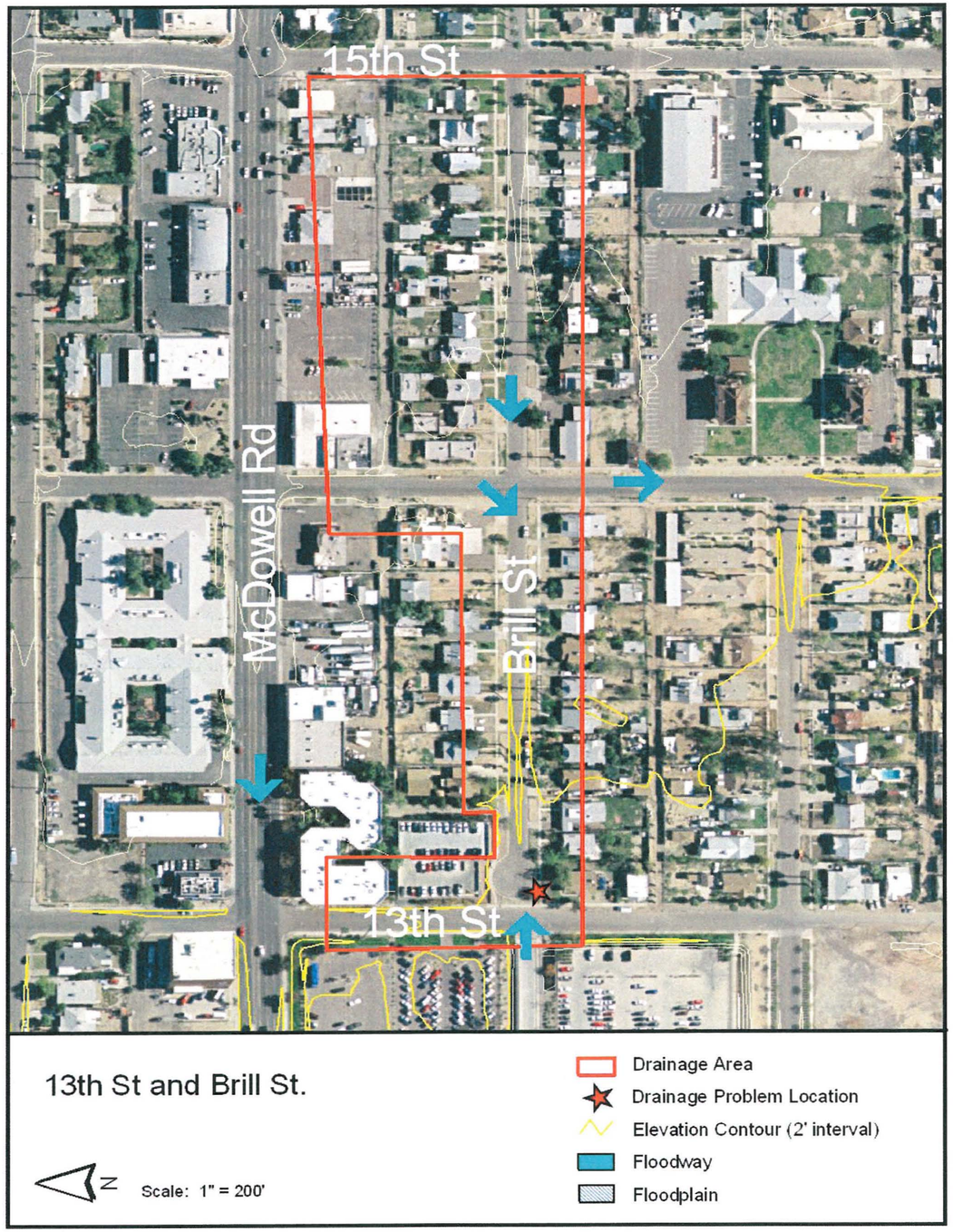
Inlet at the end of Brill Street

Looking east from the end of Brill Street

Approximate Drainage Area = 10.1 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Currently, the catch basin at Brill street outfalls to a nearby dry well, which has failed. New catch basins will collect flows from a second failed dry well at the intersection of 13th Street and Willetta Street. The ADOT catch basin discharges to a 96" ADOT storm drain tunnel that runs along the north side of I-10." - GTA Engineering

EEC Observations - There are curb openings in 13th Street that direct flow to the east to Brill Street. There is currently only one inlet to collect this flow and the flow coming from the east along Brill Street. The FFE's appeared to be higher than the street elevation.

Conclusion - It is unlikely that even in large storm events that properties will be flooded. There would certainly be an issue of street flooding in most storm events. It is a local drainage issue.



1033 North 28th Place

Looking southeast at property

Looking south on 28th Place

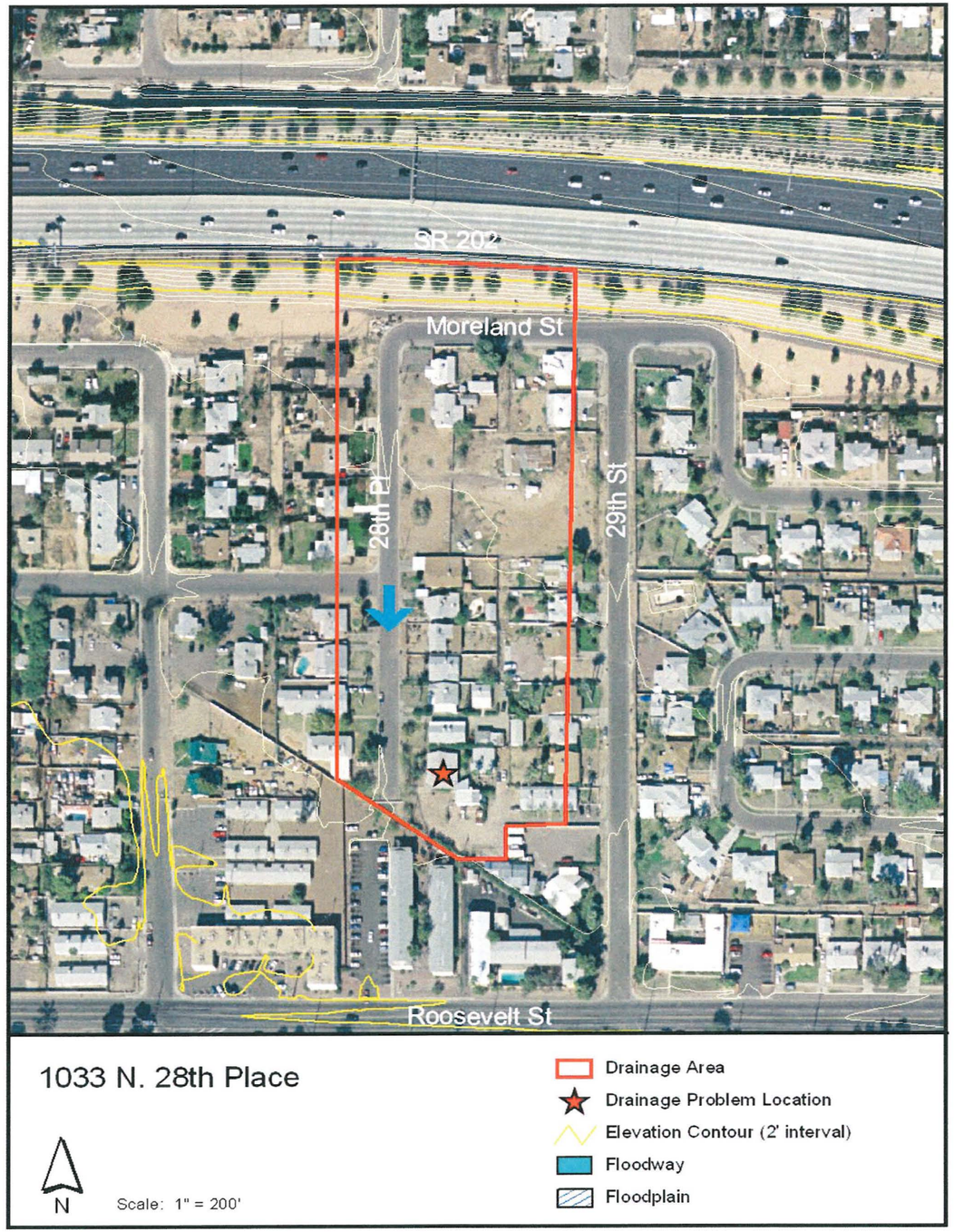
Looking northeast at property

Approximate Drainage Area = 6.8 acres
FEMA Floodzone Type - X1

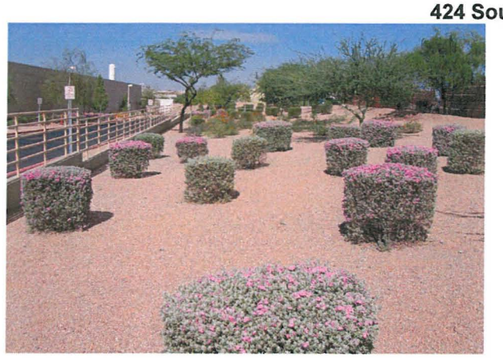
Property Owner Description/Complaint "During any appreciable rain event, water backs up to the property and floods the yard, carport, and portions of the house. The cause of the problem has been attributed to an apartment complex located south of the affected property along the path of the natural drainage route to Roosevelt." - GTA Engineering

EEC Observations - The direction of flow is generally to the south. The apartment complex to the south has a fence on the north side of their property. The water will pond behind the fence in 28th Place and on the property. There are small gaps in the fence in some areas to allow a small amount of water through.

Conclusion - In smaller storm events, there probably will not be enough runoff generated to flood the house. There will still be yard flooding in these smaller events. In the larger storm events, the house is susceptible to flooding. This is only a local issue(the drainage area is small).



424 South 56th Street



Looking west

Looking west along berm

Looking west along berm

Looking southwest

Approximate Drainage Area = 8.0 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Mr. David Little of State Farm documented the erosion problem that occurred during a storm with a video. This video was taken in 2002. From Mr. Little's account and video footage, the problem occurs when an off-site retention basin at the Sunstate Rental property, to the north, overtops and enters State Farm property. The video shows several rills and gullies created by the off-site flow on the slope. The flow then drains to a channel in State Farm's property and onto a large retention basin." - JLK Engineers

EEC Observations - It appeared as if the slope was approximately 2:1. There were shrubs and trees planted on the side slope. There did not appear to be evidence of spill over erosion at the retention basin.

Conclusion - This is a local drainage issue. The basin was likely designed to retain the 100-year, 2-hour storm event (the current onsite retention requirement). In very large storm events, that exceed about 2.5 inches of rain, it would overtop.

Minnezona - 8th Street to 9th Street

Looking south on 8th Street at canal embankment

Looking SE on 8th Street from Minnezona

Looking north on 8th street from Minnezona Ave.

Looking south at canal embankment on 9th Street

Approximate Drainage Area = approximately 3 sq. miles
FEMA Floodzone Type - A
Property Owner Description/Complaint No information provided.

EEC Observations - The subject area is just upstream of the Grand Canal. The watershed area reaches as far north as the Arizona Canal. The canal embankment is higher than the FFE's and water ponds behind the canal. 7th Street is also elevated which further exacerbates the ponding problem. The water will pond to a depth of about 1.5 feet until it overtops the canal which leaves the homes susceptible to flooding.

Conclusion - The ponding behind the canal is a regional problem. The homes are in a low lying area and are susceptible to flooding in any event that exceeds the capacity of the storm drain system.

4601 East Lafayette

Looking south on 48th Street at canal embankment

Looking east on Lafayette

Looking north on 46th Street

Looking west on Lafayette

Approximate Drainage Area = approximately 1 sq. mile
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Surface water flows from Camelback down 46th Street, breaks across crown of the street (Lafayette), and flows into private property. There is a 8' PUE on west side of the property, flow is turned south to a barren alley, from alley flowline toward east 46th Street alley PUE." - COP Street Maintenance

EEC Observations - The subject area is upstream of the Arizona Canal. The watershed reaches up to the peak of Camelback Mountain. Flow in 46th Street reaches the property. The FFE of the house appears to be below the gutterline (survey needed to verify FFE and its relation to the gutterline). There is also very little, if any, slope to the east or west (survey would also be needed to determine if there is any slope east or west).

Conclusion - With the FFE being low relative to the street elevation (survey needed to verify), the house is susceptible to flooding when the driveway is overtopped. Lafayette is crowned so it must first be overtopped. This is a local drainage problem.

5225 East Camelback

Looking northwest

Looking southwest

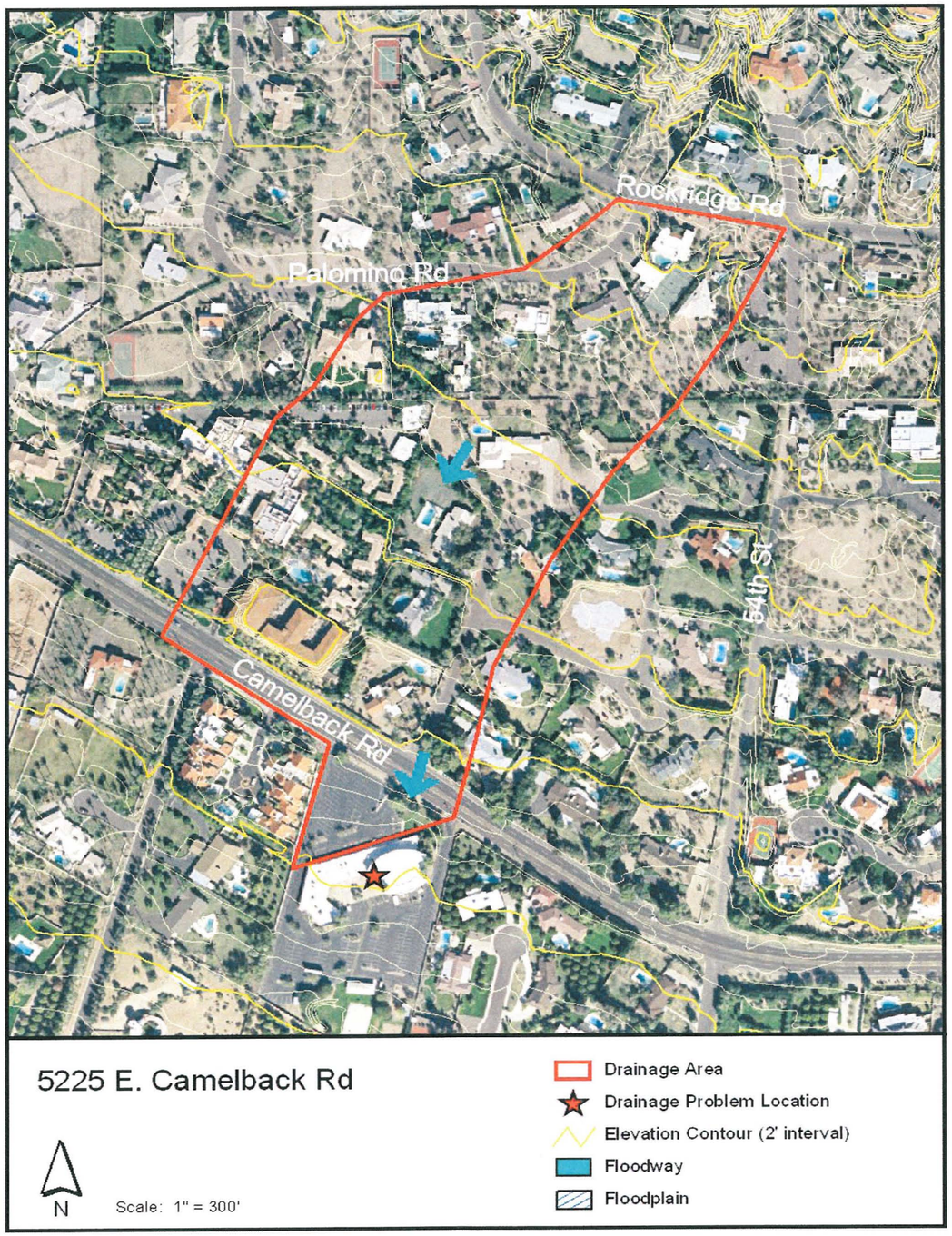
Looking northeast

Looking south at property

Approximate Drainage Area = 21.5 acres
FEMA Floodzone Type - X1
Property Owner No information available
Description/Complaint

EEC Observations - The FFE appeared to be significantly lower than the street elevation. Flow that overtops the curb on Camelback will enter the property. There is very little if any slope to the east or west.

Conclusion - Once flow overtops Camelback, the property is susceptible to flooding. It is a local drainage issue.



Appendix A.1.3
SOUTHWEST – UNDER DESIGN/STUDY

2119 West Edgemont

Looking northwest

Looking at subject property

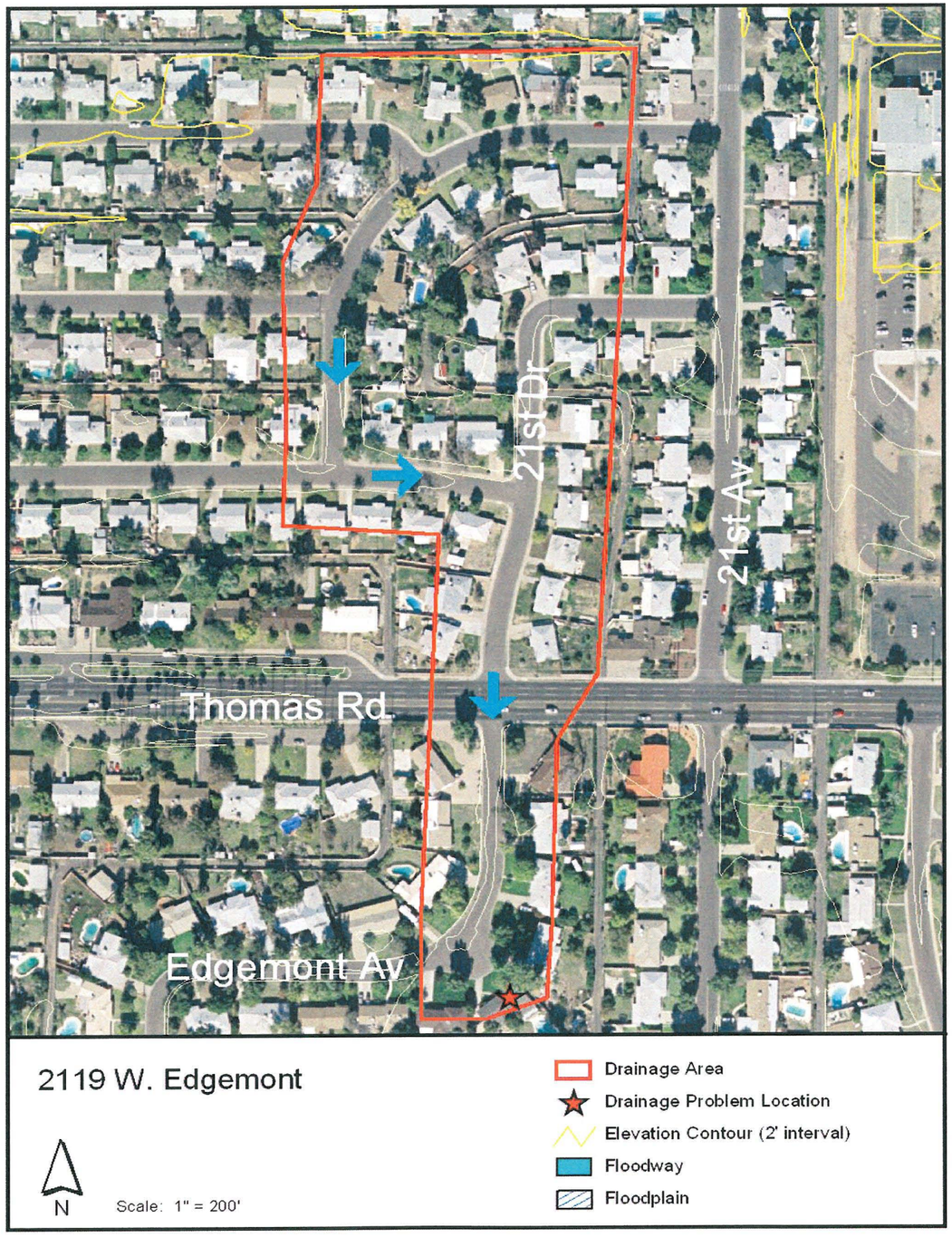
Looking west of subject property

Approximate Drainage Area = 11.5 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "During periods of extended or intense rainfall, water ponds in the cul-de-sac and floods property to the south and east of the intersection. The resident has since constructed a drainage ditch along the side of his property to convey water through the property and into the backyard." - Kirkham Michael Consulting Engineers

EEC Observations - There is a storm drain currently under construction. With the on-going construction, it was not possible to determine the drainage pattern at the end of the cul-de-sac.

Conclusion - It is assumed that the house would be protected from smaller storm events (the storm drain is likely a 2-year design) but would still be susceptible to flooding in large events. It is a local drainage issue.



1613 North Laurel Avenue

Looking east

Looking northwest at garage

Looking north at garage

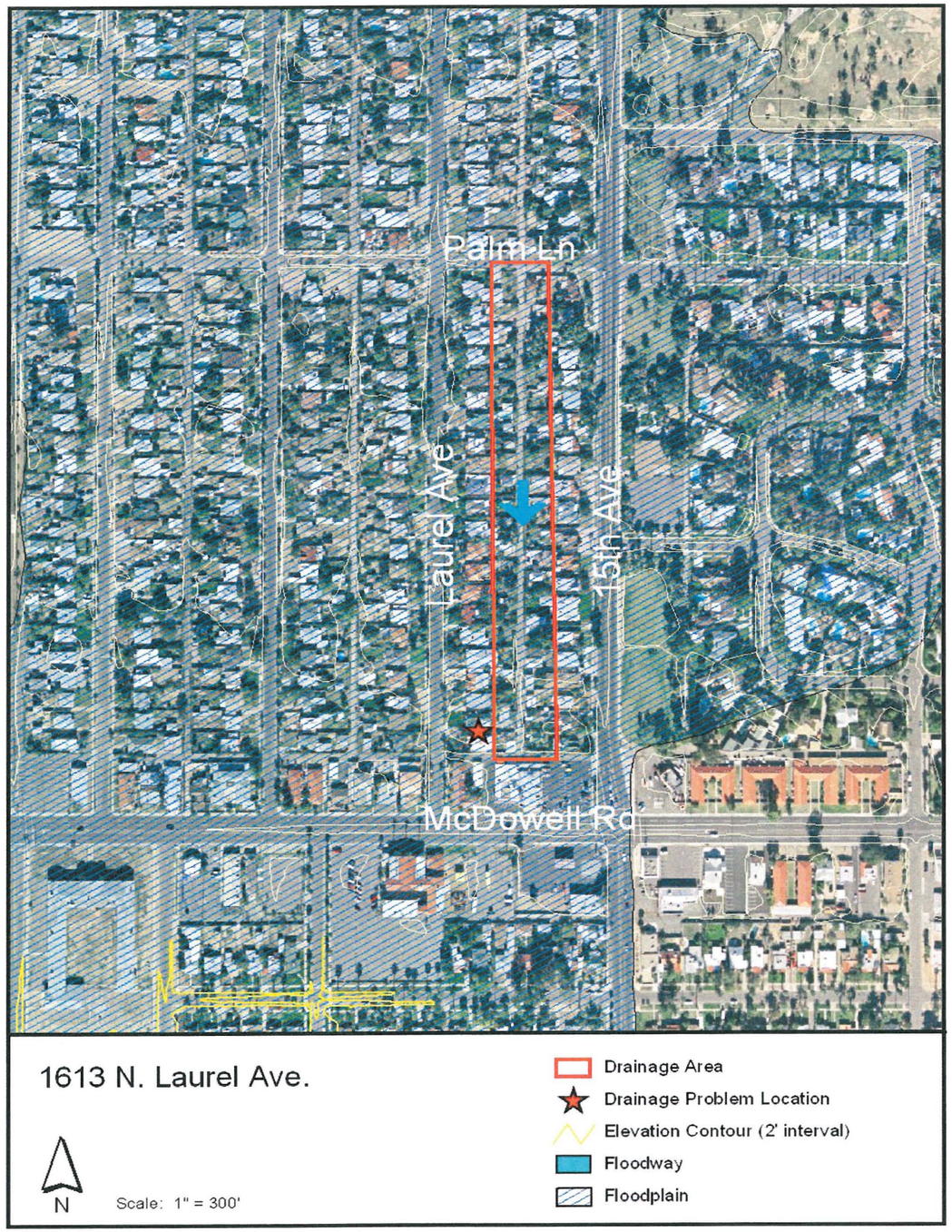
Looking west along garage

Approximate Drainage Area = 3.4 acres
FEMA Floodzone Type - AE

Property Owner Description/Complaint "The garage is located at the rear of 1613 N. Laurel Avenue at the northwest corner of the intersection of the alleys north of McDowell Road and east of Laurel Avenue. The floor of the garage is seven (7) inches lower than the high crown in the north south alley east of Laurel Avenue. Storm water runs off the ally into the garage." - Steele Engineering

EEC Observations - The subject property is not subject to flooding in the front yard, only the garage is susceptible on the east side. The FFE of the garage appeared to be lower than the alley elevation. It also appeared that the parking lot south of the house was higher than the alley elevation (based only on a visual inspection, no survey was taken).

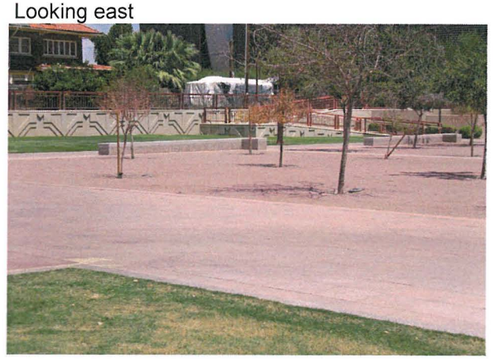
Conclusion - The garage is likely flooded in any storm event that produces runoff. Even though the property is in a floodplain, it is only a local drainage problem.



Central Avenue Underpass

Looking east

Looking southeast



Looking northeast

Approximate Drainage Area =
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Pump at this location is working at this time but is outdated, unable to get parts if it goes down again." - COP Street Maintenance

EEC Observations - There appears to be no flooding issue.

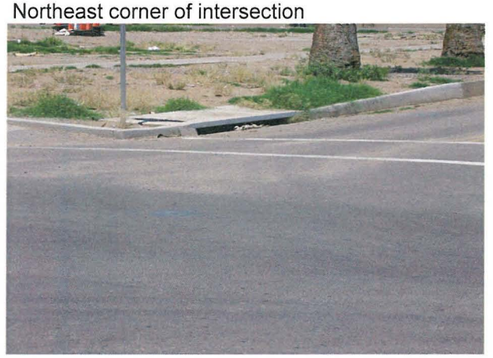
Conclusion - If there is an outdated pump, it is likely the only issue.

200 West Fillmore Street

Looking north, west of intersection

Northeast corner of intersection

Southwest corner of intersection

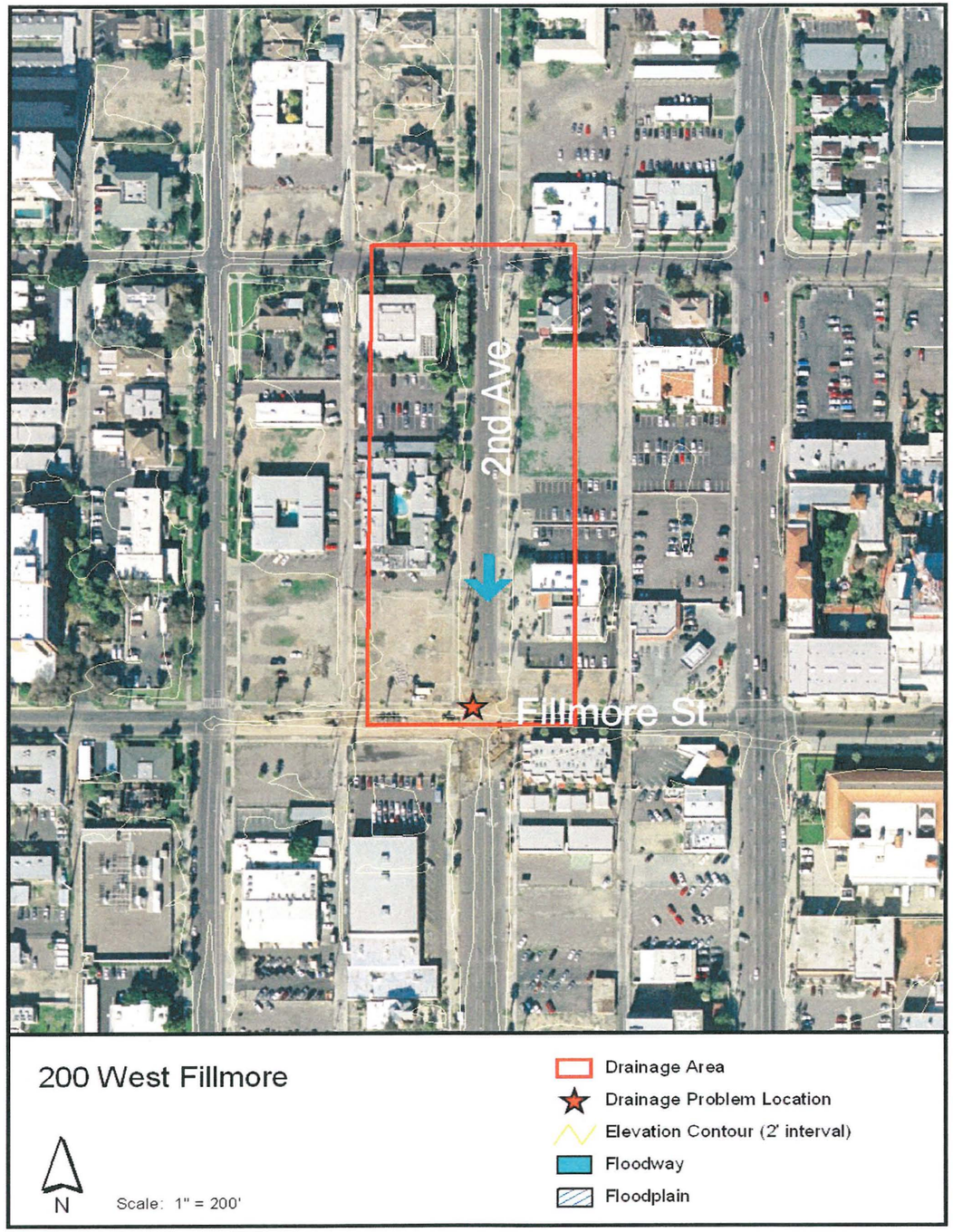


Northwest corner of intersection

Approximate Drainage Area = 5.1 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Apartment complex is located next to an alley which has a drywell once it fills the alley floods. During heavy rains, the basement of the complex may get flooded. We routinely pump the drywell after any rainfall." - COP Street Maintenance

EEC Observations - There is no 200 W. Fillmore. Catch basins have recently been added to all four corners of the intersection.

Conclusion - There should not be a flooding issue in the smaller storms but there is still a possibility in large storm events that 2nd Avenue could convey more flow than the catch basins could handle. It appears as if it is only a local drainage issue that has been corrected with the addition of new catch basins.



Rehabilitation: 3rd Avenue and Van Buren Storm Drain

Looking north along 3rd Avenue

Looking west along Van Buren

Looking south along 3rd Avenue

Looking east along Van Buren

Approximate Drainage Area = 5.8 acres
FEMA Floodzone Type - X1
Property Owner No information available.
Description/Complaint

EEC Observations - There is a drywell on the southeast corner of the intersection. There are no inlets along Van Buren. Depending on the slopes, there could be an issue of street flooding.

Conclusion - It is possible that this is an area of concern for street flooding. Street flooding could occur in smaller storm events. It is only a local drainage issue.

3rd Avenue and Madison

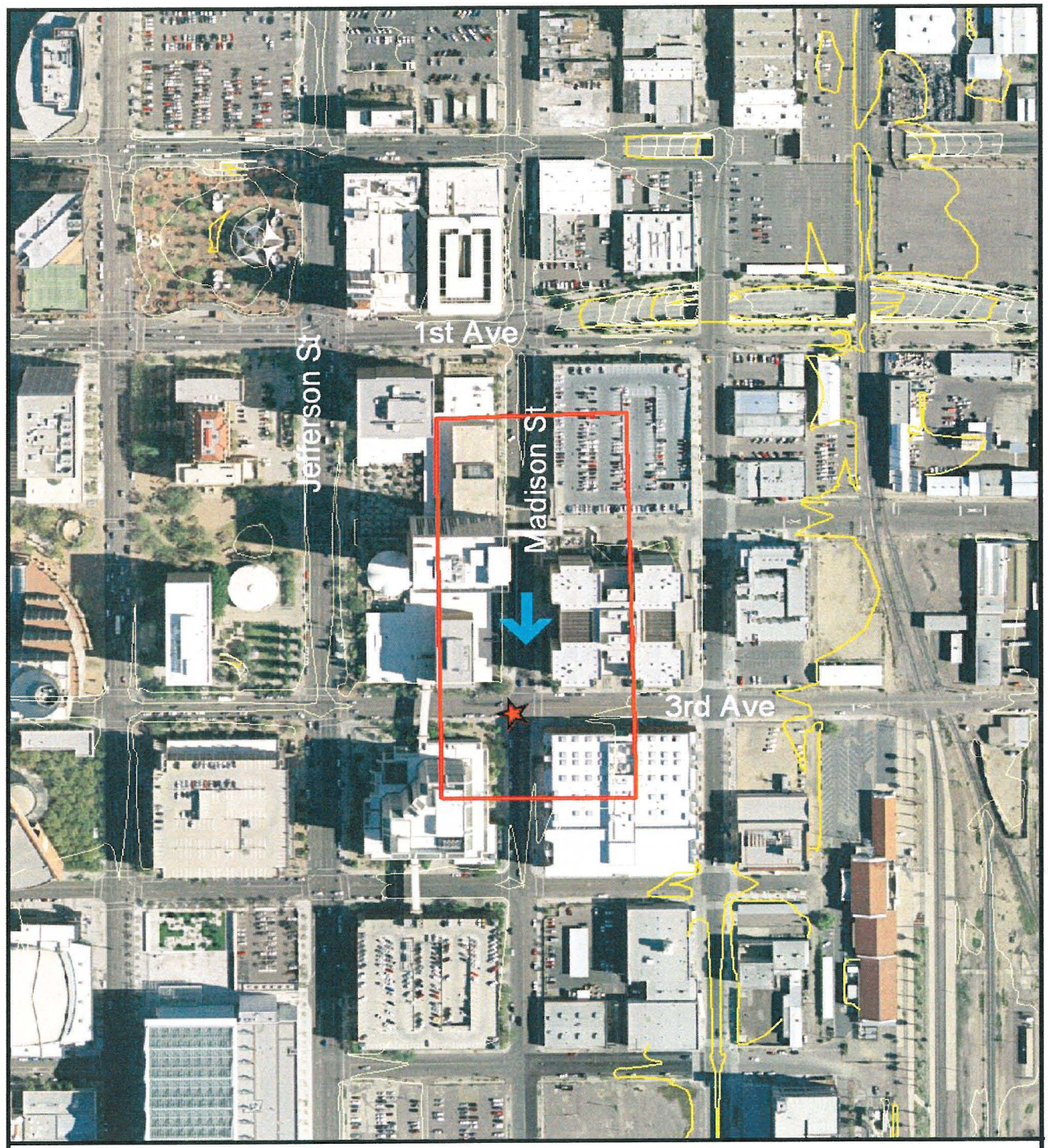
Looking southeast

Looking northeast

Approximate Drainage Area = 7.0 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Needs inlet." - COP Street Maintenance

EEC Observations - There are two curb openings, one on the northeast corner and one on the southwest corner. The inlets were likely sized for the 2-year storm and there could still be street flooding large storm events.

Conclusion - There may be a street flooding issue but there does not appear to be an issue of buildings flooding. If there is a drainage issue, it is only a local drainage issue.



2133 South 5th Avenue

Looking at subject property

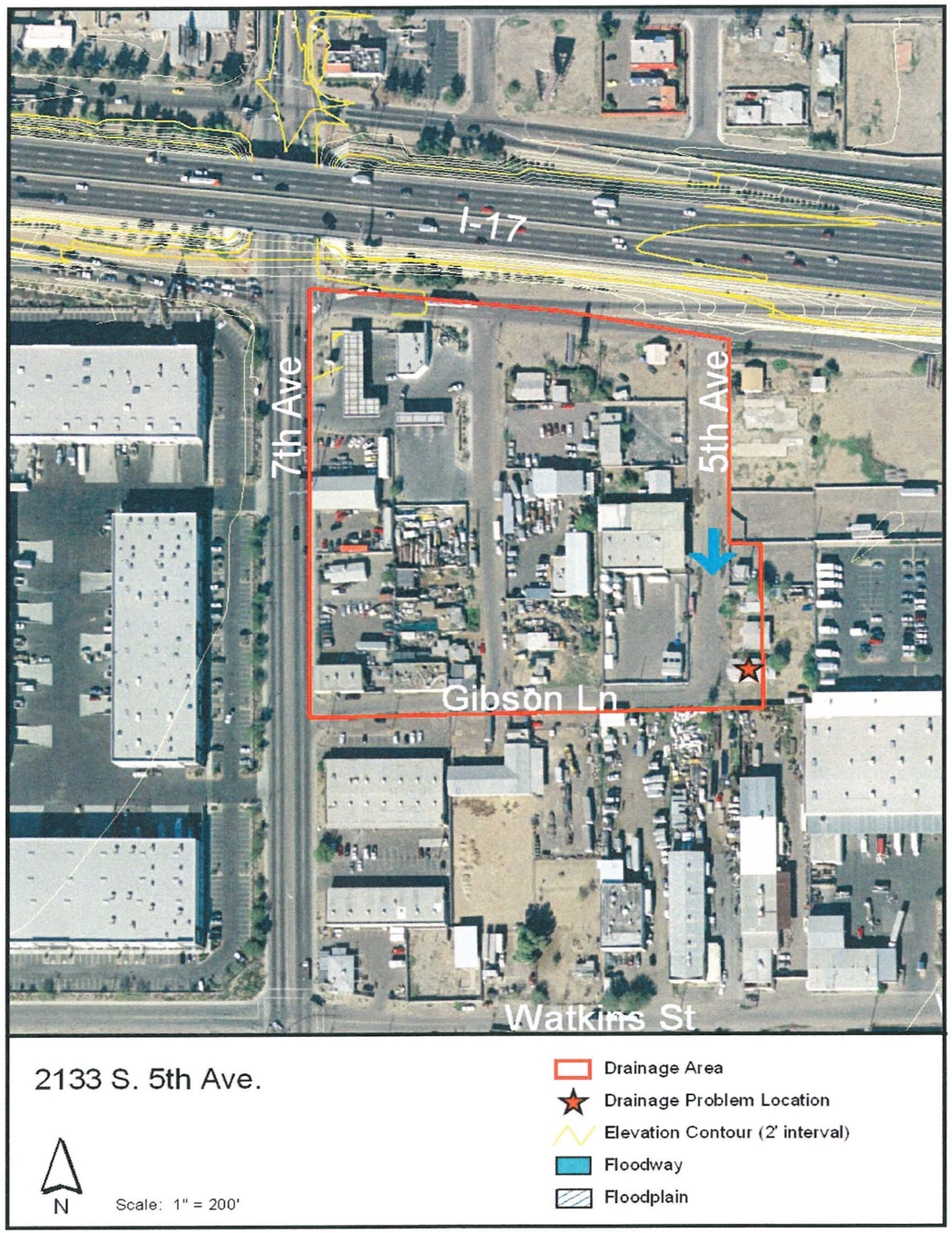
Looking north along 5th Avenue

Looking west

Approximate Drainage Area = 9.0 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint Notice to Proceed - Gives no information

EEC Observations - The FFE appeared to be nearly at street elevation (there was no step at the doorway but survey would be needed to verify). Also, there is no curb to protect the property. If water flows from the street to the dirt shoulder, it is possible that the property will be flooded.

Conclusion - It is possible that the property experiences flooding in most storm events. The building has no protection from runoff leaving 5th avenue. The drainage area is small and it is only a local drainage problem.



	Central
1	1617 Las Palmaritas
2	11th Avenue and Myrtle
3	2301 W. Rose Lane
4	Nile Neighbor Storm Drain
5	11th Avenue and Campbell
6	Montebello: 12th to 15th Avenue
7	604 E. Orangewood Avenue
8	8050 N. 3rd Avenue
9	8141 N. Central Avenue
10	1407 E. Ocotillo Road
11	21st Street and Marshall Avenue

	Southeast
1	Garfeild St - 7th to 9th Street
2	10th Street n/of Palm Avenue
3	Mooreland Storm Drain - 12th to 13th Street
4	14th Street and Garfield Street
5	22nd Street and Highland
6	10th Street and Campbell Avenue
7	40th to 44th Street - Oak St. to Thomas Rd.
8	30th Place and Coolidge Street
9	4111E. Roma Avenue
10	5929 E. Indian School
11	2500 N. 52nd Steet
12	46th Street and Mcdowell Road
13	4727 E. Lafayette

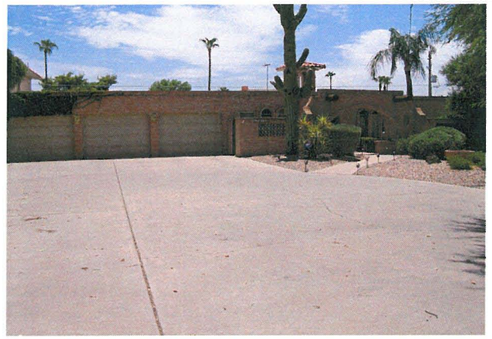
	Southwest
1	Watkins SD: 6th - 2nd Av.
2	2nd Av. And Lincoln Drainage Study
3	18th Av. And Jefferson
4	Adams St. Pullout: 3rd - 2nd Dr.
5	Van Buren St.: 10th - 20th Av.
6	16th Av. And Taylor St.
7	Lewis and Virginia SD: 8th - 7th Av.
8	Edgemont: 8th - 15th Av.

Appendix A.2
Under Construction/Warranty

Appendix A.2.1

CENTRAL – UNDER CONSTRUCTION/WARRANTY

1617 Las Palmaritas Drive



Looking south at properties

Looking west

Inlet in driveway

Looking east up Las Palmaritas Dr.

Approximate Drainage Area = 32.3 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "...neighbors located along the private drive alignment have been complaining that storm water ponds at a low spot located in the private drive just west of Las Palmaritas Drive." - Geotechnical and Environmental Consultants

EEC Observations - The subject property is in the flow path. The wall blocks flow causing ponding to the north of the wall. If there is local runoff at the east end of the cul-de-sac, it appeared that flow would spill away from the houses but without survey, it is unknown.

Conclusion - It is likely that there is nuisance water after most storm events. This seems to be the main problem. The houses may be susceptible to flooding in large storm events. It is a local drainage issue.

11th Avenue and Myrtle Avenue

7138 N. 11th Ave.

Looking west down Myrtle Ave.

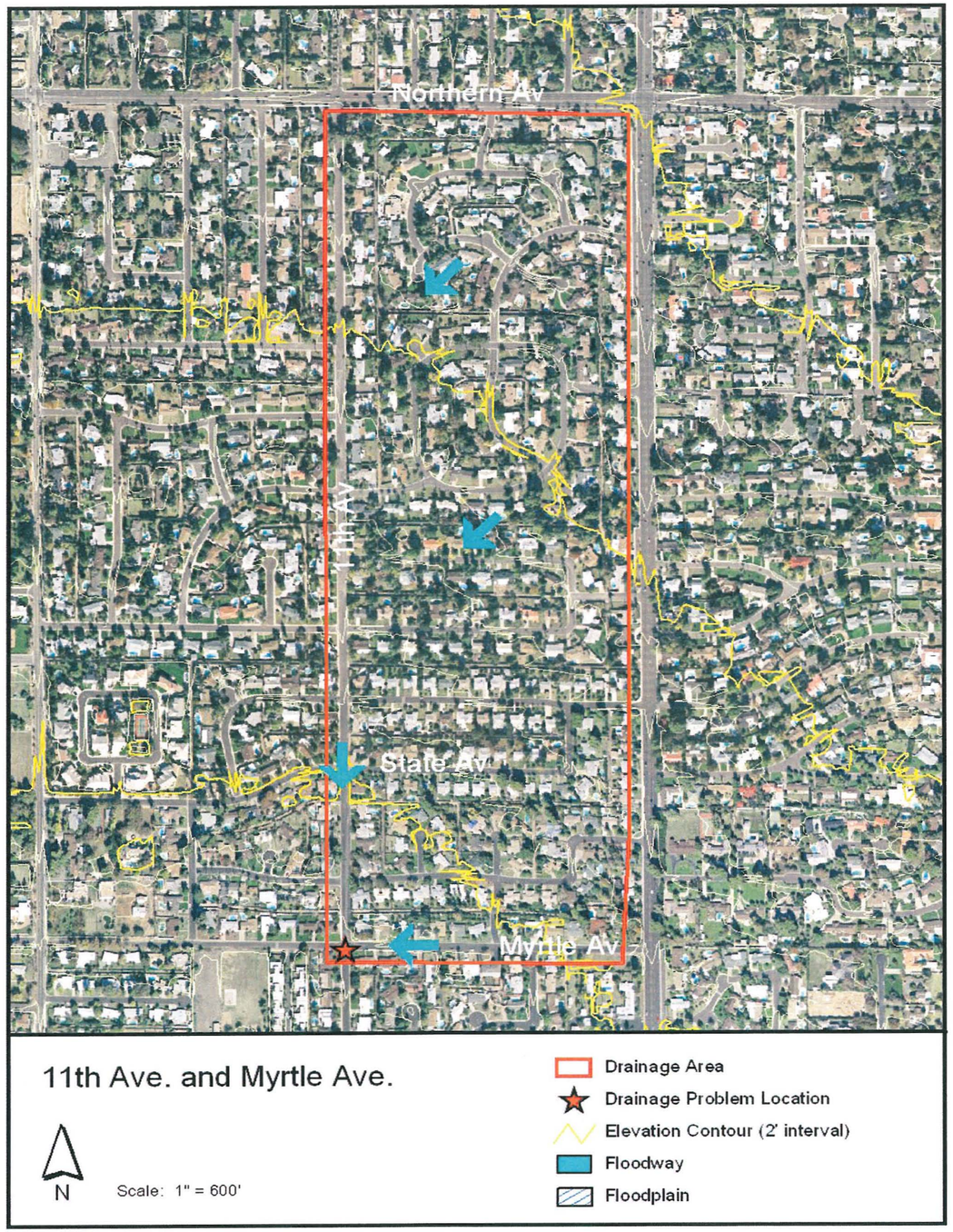
Looking east down Myrtle Ave.

Looking south down 11th Ave.

Approximate Drainage Area = 119.7 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Valley gutter and driveway curb repaired. This has solved the problem." - COP Street Maintenance

EEC Observations - 7138 North 11th Avenue is susceptible to flooding. The lots are flood irrigated so they will provide some storage if the curb is overtopped. If the FFE's are high, then the house will be safe from flooding.

Conclusion - It is likely in small events all the houses are safe from flooding (certain front yards could be flooded). In large storm events, it is possible that the house will flood depending on the FFE. It is a local drainage issue caused by small street capacities and low FFE's.



2301 West Rose Lane

Looking north on 23rd Ave.

Looking at subject property

Looking at intersection

Approximate Drainage Area = 4.1 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Catch basin at nw corner of 23rd Ave. and Rose Ln. doesn't drain properly. Pipe is higher at the end than at the beginning. Pipe also drains into SRP irrigation line. Tape shows the pipe was built wrong or has changed shape." - COP Street Maintenance

EEC Observations - By visual inspection, the FFE appears to be above the crown of 23rd Avenue and Rose Lane; however, it is close (no survey was done to verify). There is no catch basin as described in the description/complaint on the northwest corner.

Conclusion - It does not appear as though there is a drainage issue. If there is a drainage issue, the drainage area is small and it is only a local issue. The valley gutter should convey flow across the intersection.

Nile Neighbor Storm Drain

Looking southwest on Colter St. from 17th Ave.

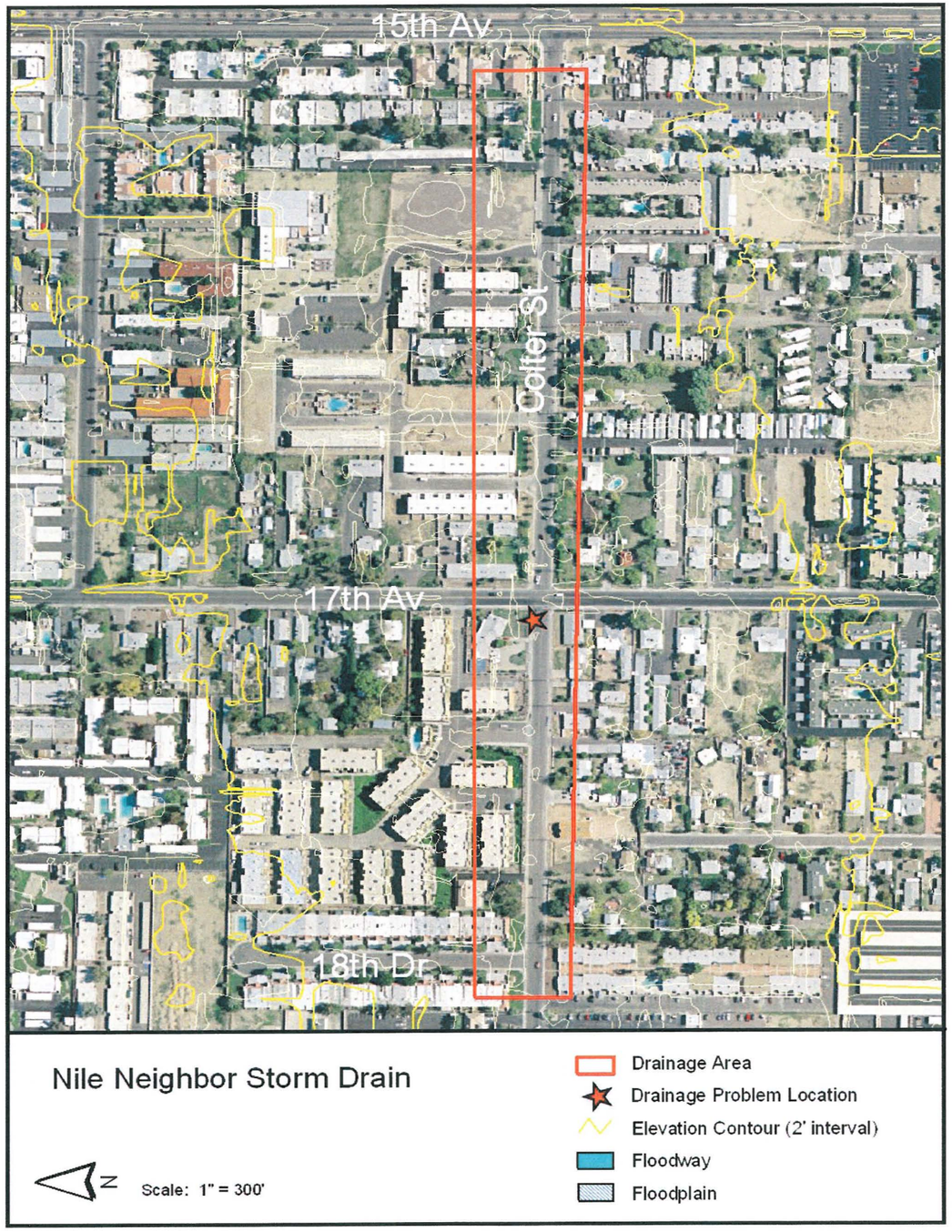
Storm Drain Manhole in Colter St. between 17th & 18th Ave

Looking northeast on Colter, east of 19th Ave.

Approximate Drainage Area = 7.7 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "I have no information at this location." - COP Street Maintenance. Complaint initiated by local citizen, COP evaluated flooding complaint on 1-15-02.

EEC Observations - There are inlets between 19th and 17th Avenue but there are no inlets between 17th and 15th Avenue along Colter. However, there are storm drain manholes in Colter St. between 15th and 17th Avenues.

Conclusion - There does not appear to be a flooding problem at this location. The storm drain is likely sized for the 2-year storm event. If there is a drainage issue, it is only a local drainage issue.



11th Avenue and Campbell

Looking north up 11th Ave.

Curb opening inlet

Inlet

Looking SW at property

Approximate Drainage Area = very large, approximately 3.5 sq. miles
FEMA Floodzone Type - AE

Property Owner Description/Complaint First, the existing levee located to the south and running parallel to the Grand Canal causes flood waters to back up, thereby completely inundating the site and adjacent properties. Second, the flow in 11th Ave. exceeds the roadway's conveyance capacity and the property becomes flooded. The property is lower than the existing curb. Flood waters which overtop the curb onto the property cannot flow back to the roadway. The street does not have the capacity to convey the 2-year storm." - COP Street

EEC Observations - The water shed is large and extends north from the Grand Canal up to the Arizona Canal. The City's description of the flooding problem is accurate.

Conclusion - It is likely that the property experiences flooding regularly for both reasons. The ponding behind the canal is a regional issue but the issue of flow from the north is a local drainage issue.

Montebello: 12th Avenue to 15th Avenue

Looking north at inlet at 12th and Montebello

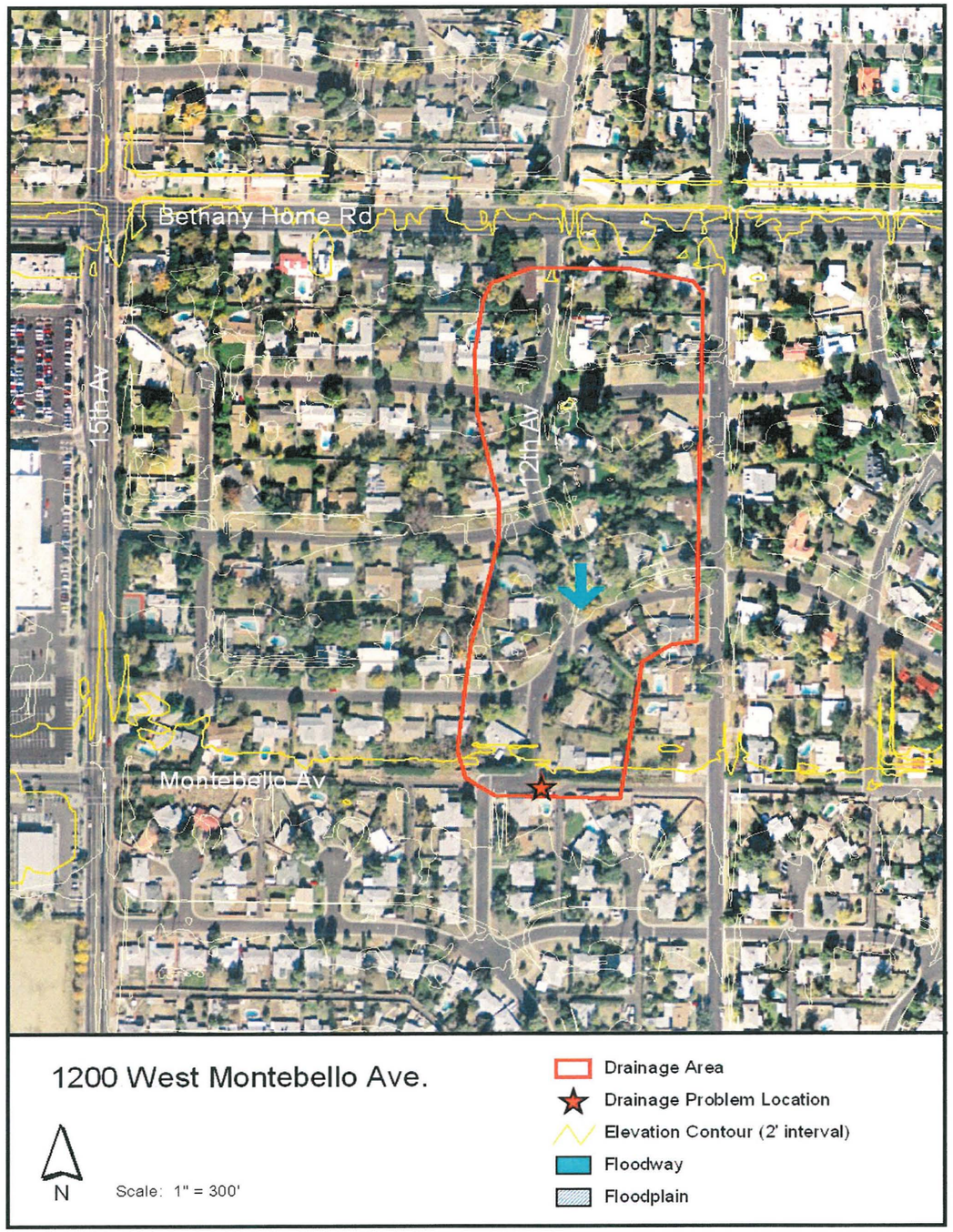
Looking west from 12th and Montebello

Approximate Drainage Area = 12.2 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "The scope of work includes placing a storm drain pipe from this intersection, along Montebello Ave. to the intersection of 15th Avenue and Montebello Avenue. The 12th Avenue and Montebello Avenue intersection will need to be reconstructed with the placement of new pavement and curb. In addition, Montebello will be paved from 12th Avenue to 15th Avenue." - LaMarca Engineering

EEC Observations - There is an existing valley gutter at 12th Avenue that drains to a curb opening inlet. It is assumed that the connector pipe drains back to the storm drain in 15th Avenue. Montebello is not paved between 15th Avenue and 12th Avenue.

Conclusion - It appears as if this was only a local drainage issue that was solved with the addition of a new storm drain inlet. The lateral is probably sized for the 2-year storm.



604 E. Orangewood Avenue

Looking north on 6th Pl.

SE corner Orangewood and 6th Pl.

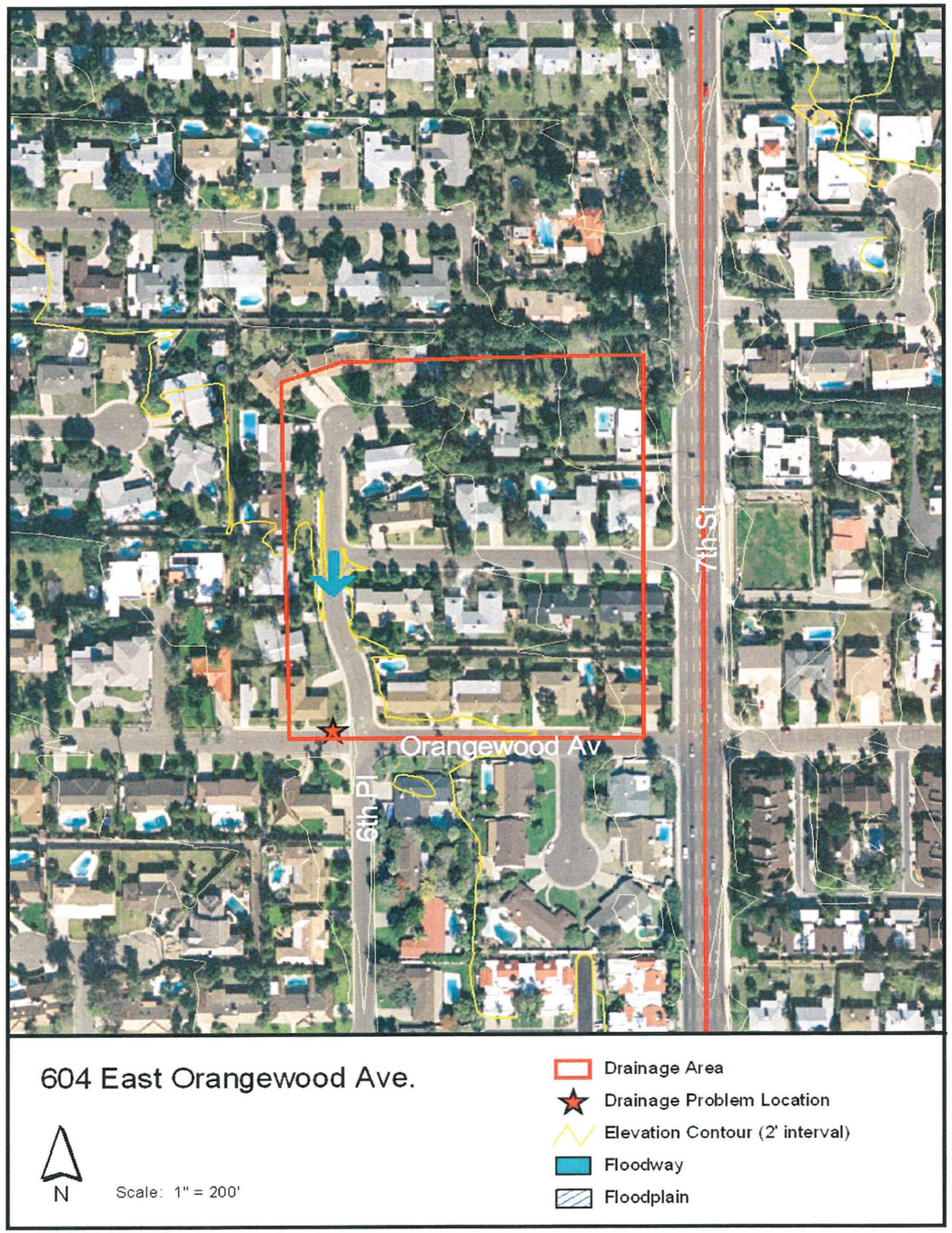
Northside of Orangewood

NW corner Orangewood and 6th Pl.

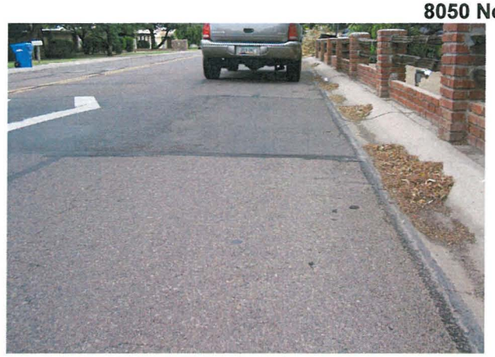
Approximate Drainage Area = 7.0 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Flow from the adjacent area travels to the 6th Place and Orangewood Ave. intersection and ponds at the NW corner along Orangewood Ave. to the west. The flow overtops the curb along Orangewood Ave. and floods the adjacent property at 604 E. Orangewood Ave. The street crown of Orangewood Ave appears to be higher than the adjacent properties." - Primatech

EEC Observations - Based upon visual inspection, the FFE appears to be above the street elevation of Orangewood but the FFE may be below the street elevation of 6th Place. There is vertical curb on the south side and roll curb on the east side. The south side is also protected by a berm. The valley gutter appears to be new.

Conclusion - The house would be susceptible to flooding in a large storm event and could flood in a smaller storm event if the roll curb were overtopped. The new valley gutter was installed to convey storm water toward the grated catch basin inlet and appears that it solved the ponding problem. It is a local drainage issue.



8050 North 3rd Avenue



Looking south down 3rd Ave.

Looking north up 3rd Ave.

Looking west at property

Approximate Drainage Area = 5.9 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Citizen stated when contractor installed speed hump in front of house, the water backs up onto her property. July 14th, heavy rain went in her house and ruined baseboard and wood floor. We need to see if we can get the speed hump shortened about 3" on each side, this will allow the water to flow better." - COP Street Maintenance

EEC Observations - It appears as if a section of the speed hump approximately 6'-8' wide was removed. The FFE of the house appears to be lower than the street elevation. The only protection provided to the house is the roll curb.

Conclusion - The house is susceptible to flooding once the roll curb overtops. The house could flood in large storm events. It is a local drainage issue.

8141 North Central Avenue

Looking south across Griswold

Looking east into parking lot

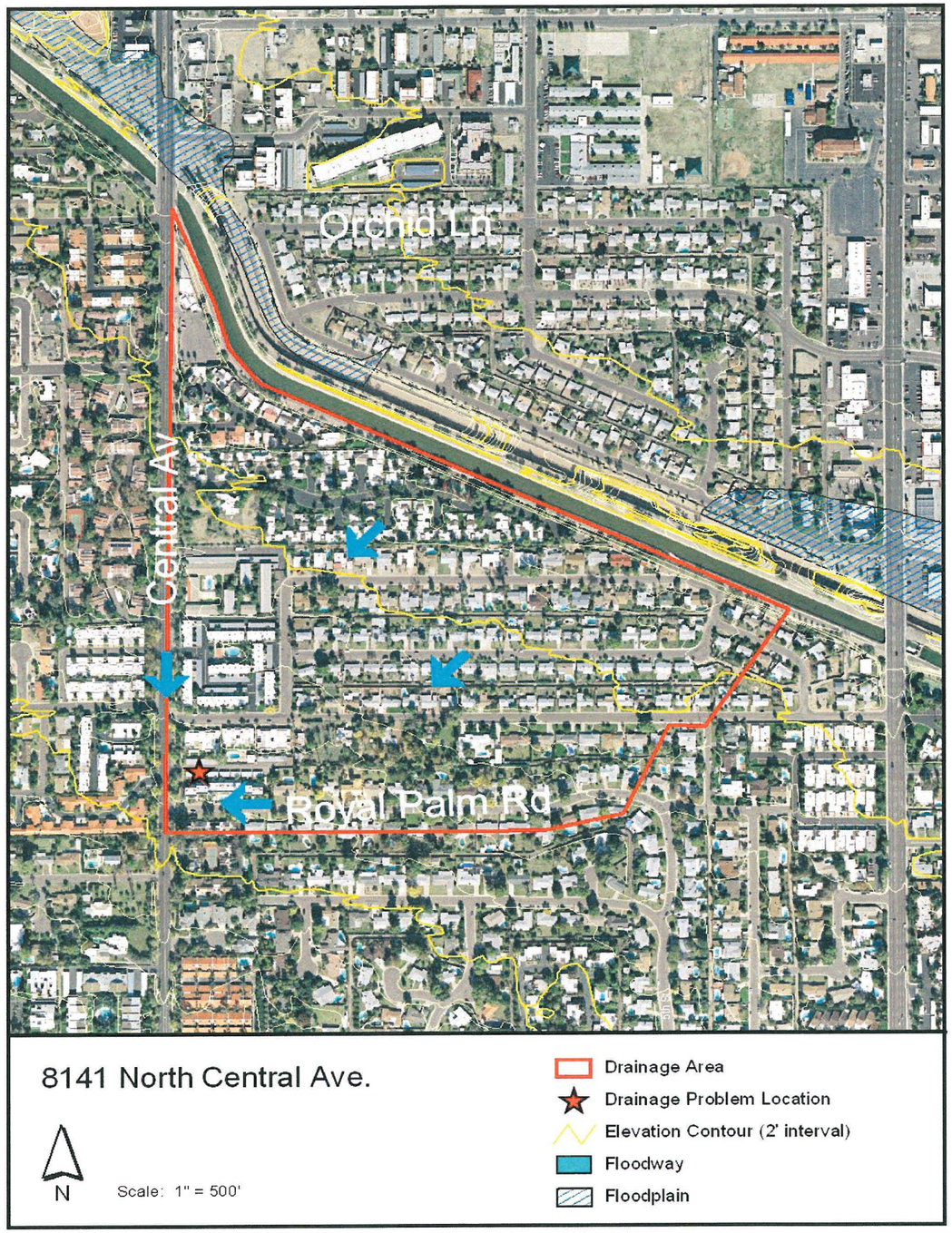
Looking east along Royal Palm Ave.

Looking north across Royal Palm Ave.

Approximate Drainage Area = 65.9 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Apartments flooding." - COP Street Maintenance

EEC Observations - On the north side of the apartments, Griswold Avenue has vertical curb protecting the complex. On the south side along Royal Palms Avenue, the apartments are protected by roll curb. Between the two buildings, the driveway has a sag in it. Pot holes and standing water is an issue within the parking lot.

Conclusion - Once the roll curb on the south side is overtopped, the apartments are in danger of flooding. It is unlikely, even in a large storm event that the apartments will flood from the north side. In any storm event, the parking lot will have an issue of standing water. If water is spilling from Central Avenue into the parking lot, it is part of the regional issue. If it is local runoff overtopping the curb, it is a local drainage issue.



1407 East Ocotillo

Looking south at subject property

Looking south at subject property

Looking east at grate inlets

Looking south at curb opening

Approximate Drainage Area = 35.6 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "From the meeting, it is our understanding that the storm water flowing south on 14th St. crosses Ocotillo Road and jumps over the curb into the driveway at 1407 E. Ocotillo Road, which floods the front yard." - Engineering Alliance

EEC Observations - The FFE appears to be at or below street grade by visual inspection. The intersection is a concentration point for a large drainage area. There are existing grated inlets across 14th Street. There is also a grated inlet at the northeast corner of 14th Street and Ocotillo. On the south side of Ocotillo to the east of the subject property, there is a curb opening inlet.

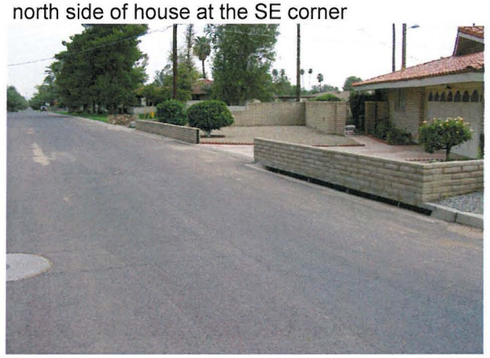
Conclusion - There is potential for flooding during large storm events. However, the numerous inlets should provide protection in smaller storm events. If enough storm water gets to the driveway to overtop it, then the house is susceptible to flooding. The drainage area is not insignificant but it is still only a local drainage issue.

22nd Street and Marshall Avenue

Looking east down Marshall to 22nd Street

north side of house at the SE corner

Looking north up 22nd Street



East side of house at the SE corner

Approximate Drainage Area = 100 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "The key problem causing the flooding is the lack of enough conveyance capacity in 22nd Street and Marshall Ave. The pavement replacement in 22nd Street worsens the flooding problem." - Primatech

EEC Observations - There are curb openings on the east and north side of the property. There are also walls built in front of the property to protect the house. Flow travels west along Marshall Avenue and south down 22nd Street.

Conclusion - Depending on the capacity of 22nd Street, there may be enough flow reaching the intersection to cause a flooding problem even with the inlets and walls in place. There is a possibility that a large drainage area reaches the intersection but it still appears to only be a local drainage issue.

Appendix A.2.2

SOUTHEAST – UNDER CONSTRUCTION/WARRANTY

Garfield Street - 7th Street to 9th Street

Inlet on south side of Garfield

Looking north on 8th St.

Looking east on Garfield

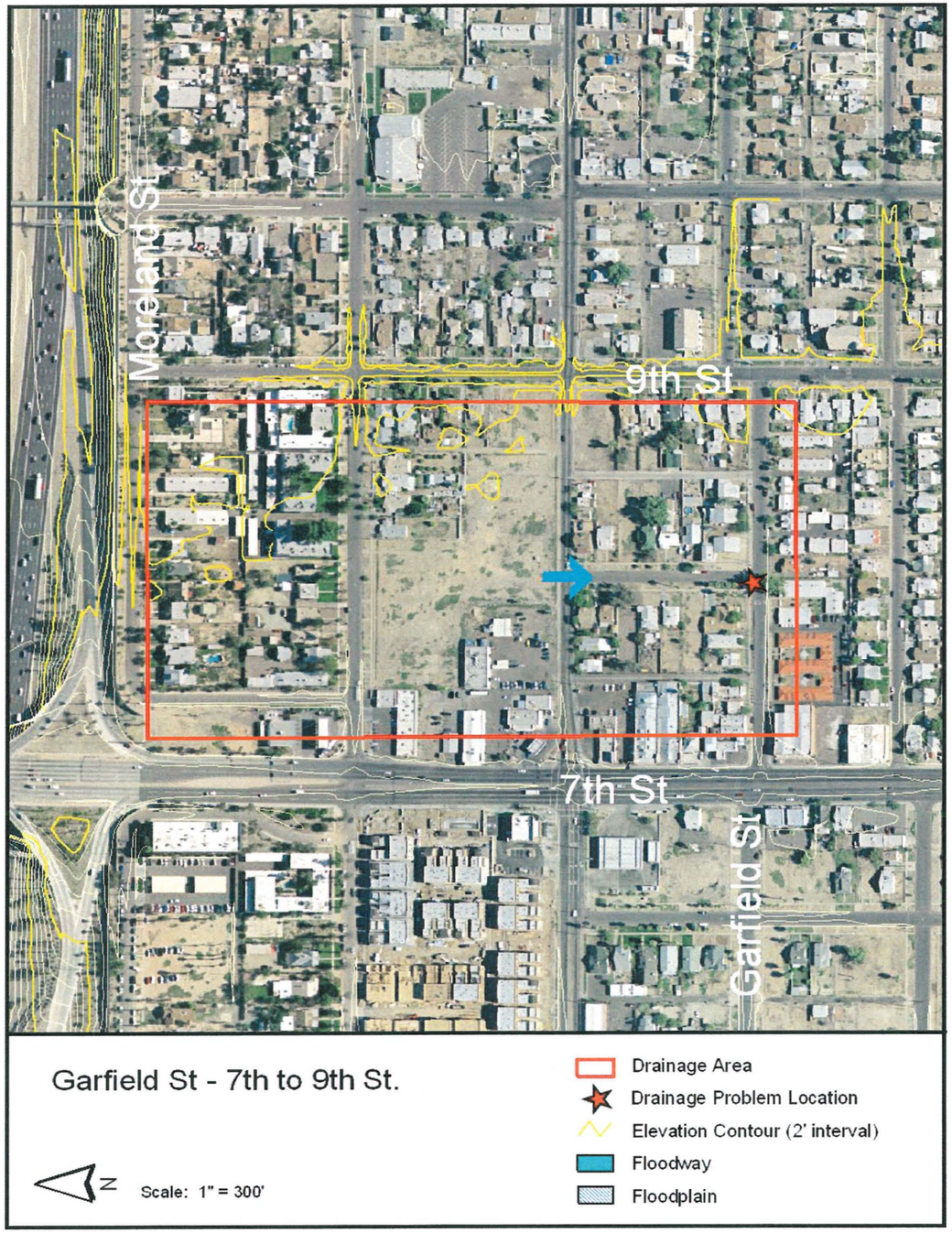
Looking west on Garfield

Approximate Drainage Area = 25.2 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "The north half of this intersection becomes inundated due to existing conditions. 8th St. is lower than Garfield Rd. where these two streets intersect. Garfield St. flows to the west at this location. The sump condition caused by the low 8th St. receives street runoff from the north (8th St.) and to the east (north half of Garfield St.). A dry well system exists at this intersection to alleviate the sump condition. This system is old and worn out and no longer functions as it was designed." - PEC

EEC Observations - Three combination grate/curb opening inlets collect storm water runoff at the intersection of 8th and Garfield Streets. There is no evidence of a connected storm drain system so it is believed that these inlets connect to a dry well. The FFE's of the surrounding residences appear to be much higher that the street elevation. The contours indicate a slight gradient, to the west, towards 7th Street, however there is a speed hump located west on Garfield which will reduce the street capacity.

Conclusion - With inlets and drywell functioning properly, small storms shouldn't cause flooding problems. However, it is believed that the drywell isn't functioning properly so that any storm that generates sufficient runoff to fill the drywell chamber and the inlets would then flood the low lying intersection and perhaps flood the front yards of the adjacent properties. The residences seem to be above the flooding due to high FFE's (survey is needed). This is considered a local drainage issue.



10th Street North of Palm Avenue

South inlet

North inlet

Looking east along north side

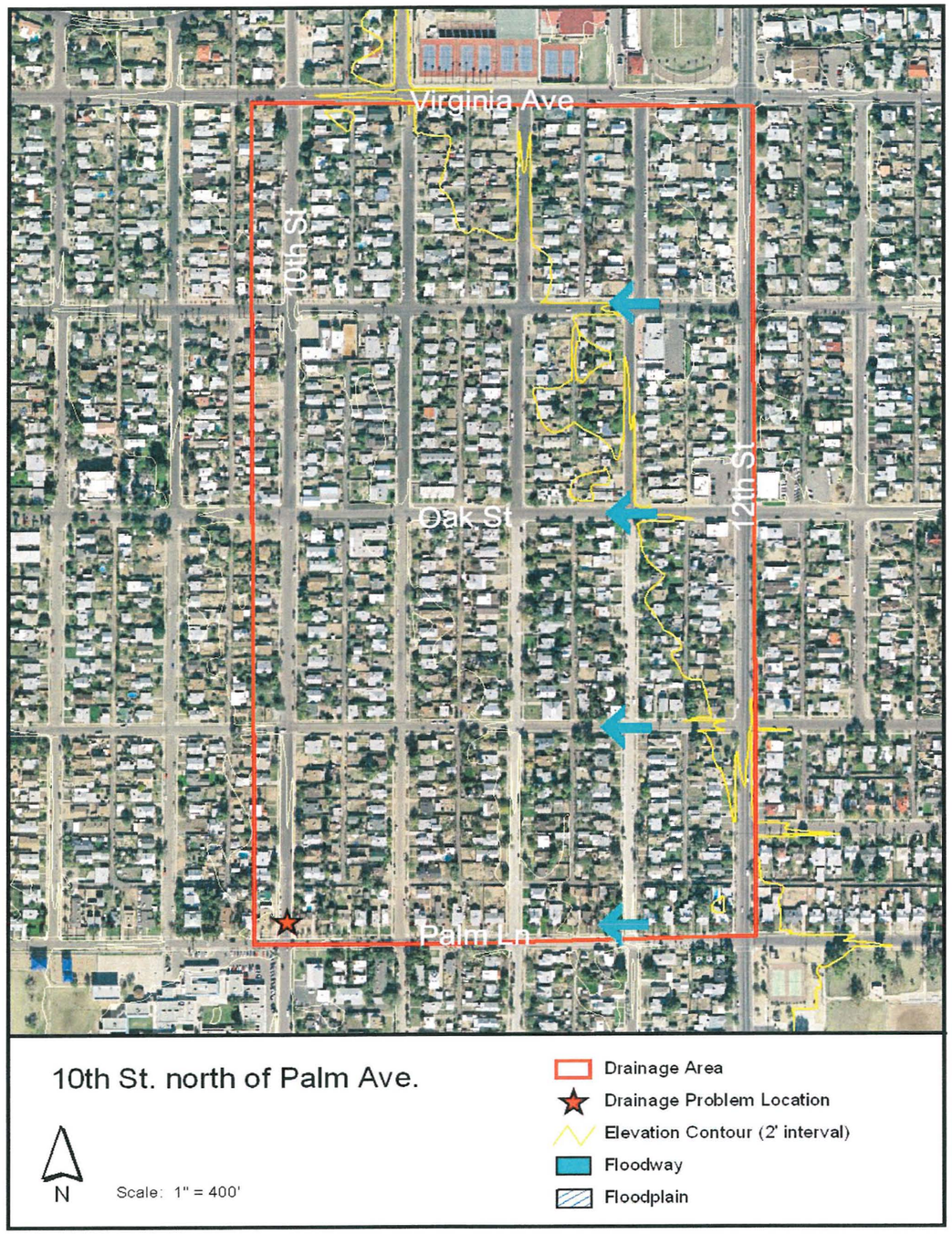
Looking east along south side

Approximate Drainage Area = 14.5 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Single grate inlet catch basins are located at the sump locations. The catch basins connect to dry wells and not to a dedicated storm drain system. During storm events the sump locations rapidly reach their capacity and flood. For most storm events water ponds to just over the top of curb. The adjacent curb is ten (10) inches high." - Premier

EEC Observations - 10th Street is very flat with sumps at some locations. The FFE's appeared to be at or above curb height. The two dry wells probably are not functioning as well as they once did.

Conclusion - It is only a local drainage issue. It is unlikely that water would be able to overtop the curb in a small event. In any storm event, there may be standing water at the two dry wells. Once water overtopped the curb, certain houses could be susceptible to flooding.



Mooreland Storm Drain - 12th Street to 13th Street

Inlet just east of 13th St on north side

Inlet just east of 13th St on south side

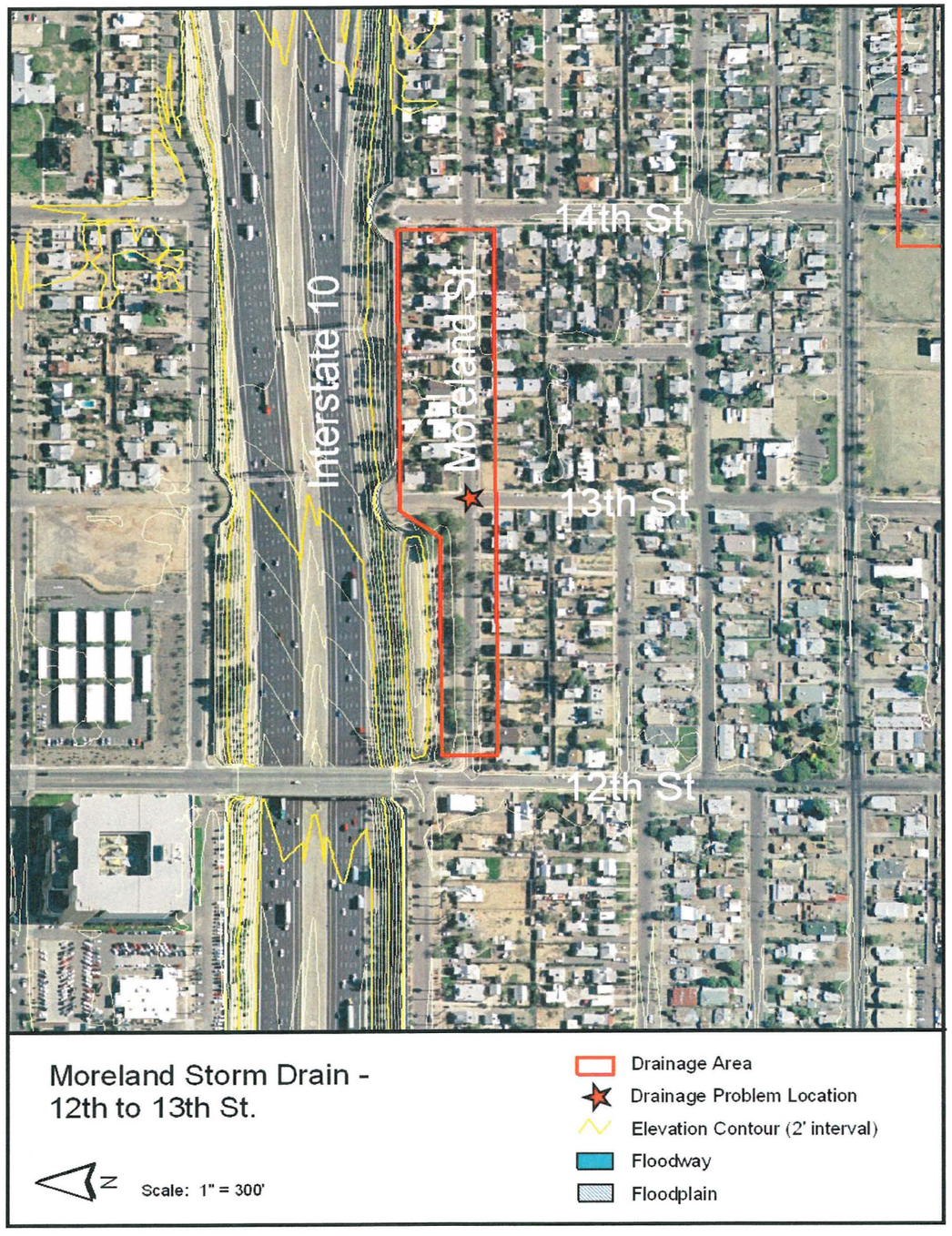
Looking west

Looking east

Approximate Drainage Area = 4.8 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint No information available.

EEC Observations - There are inlets just east of 12th Street and 13th Street. There is vertical curb and humped driveways along Mooreland. The FFE's appeared to be above curb height as well.

Conclusion - It is unlikely that houses get flooded in the smaller storm events. In the large storm events, it is possible but unlikely that there will be any house flooding. Since the drainage area is small there does not seem to be a regional drainage problem.



14th Street and Garfield Street

Looking north on 14th St.

Looking northeast

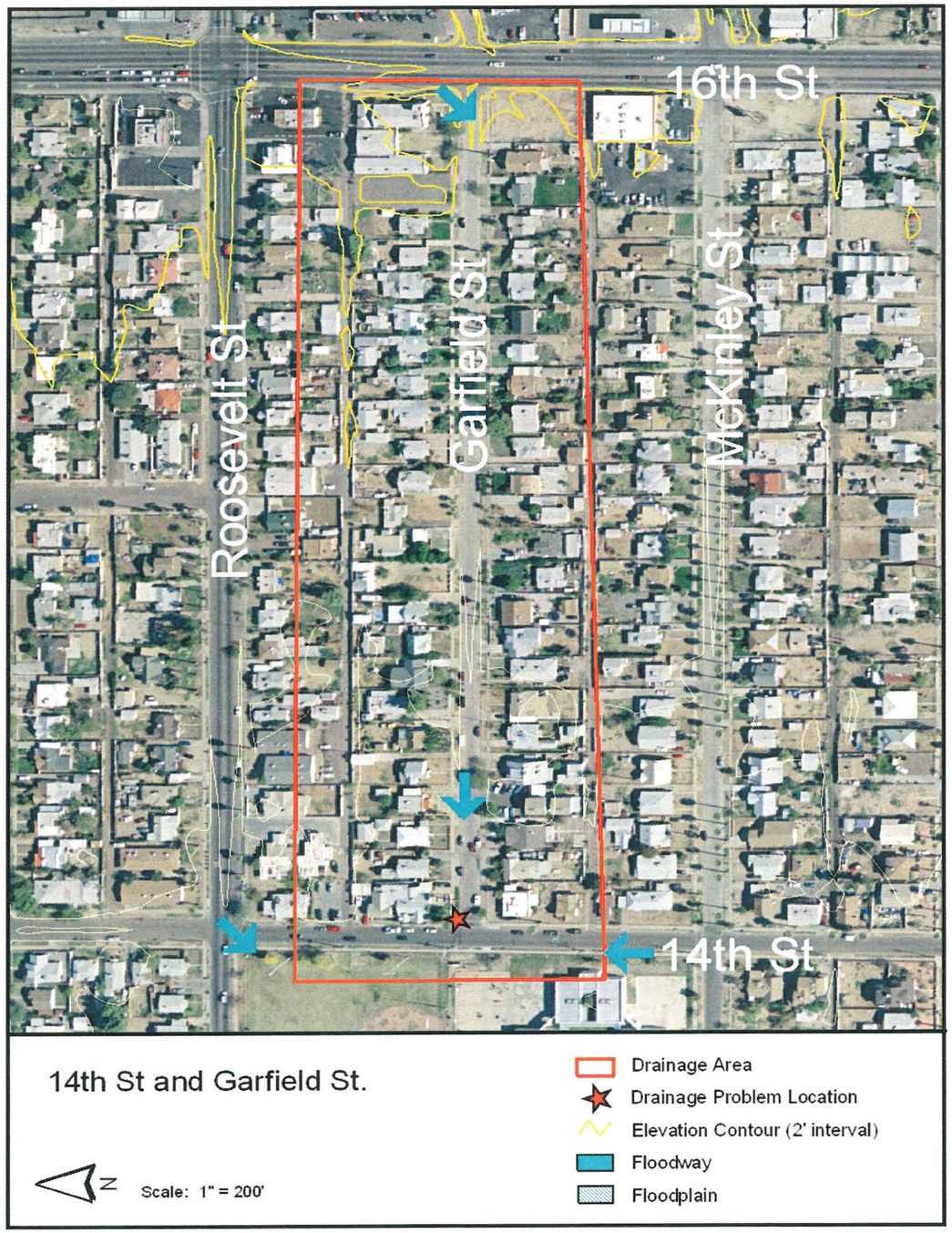
Looking east on Garfield Street

Inlet in front of restaurant

Approximate Drainage Area = 13.7
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Street runoff collects at this intersection from the north, south, and east. It appears that most of the runoff into the intersection is from the north, as street flow from Roosevelt. A dual catch basin and drywell system is existing to the east and the south. The existing system is not relieving the storm water fast enough. The restaurant at the northeast corner of the intersection is flooded when storm flows are large enough to fill the intersection." - Project Engineering Consultants (PEC)

EEC Observations - See above description of problem.

Conclusion - Once the curb is overtopped, the restaurant can be flooded. The drainage problem is only a local issue.



22nd Street and Highland

Looking north at NE corner

Looking north up 22nd St.

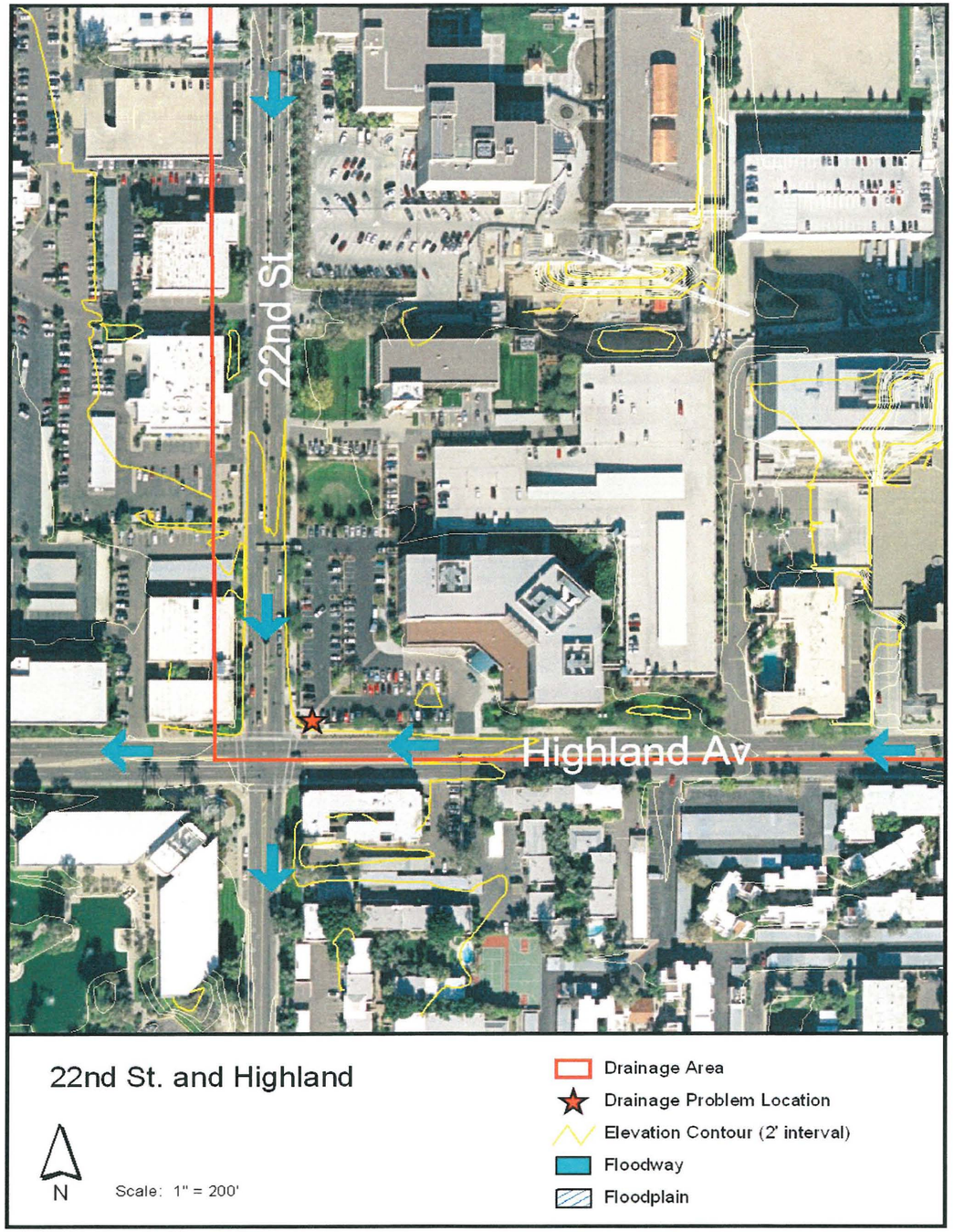
Looking east down Highland

Approximate Drainage Area = large, approximately 240 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "The northeast corner of the intersection of 22nd St. and Highland Av. ponds after every rainfall event since drainage is trapped by the intersecting crowns of the two streets, flooding a handicap ramp and crosswalk, as well as hindering the flow of traffic on a busy street which feeds the Squaw Peak Freeway. The use of the handicap ramp at that corner is compromised until the ponded water is pumped out or evaporates." - GTA Engineering

EEC Observations - The site was visited on August 8th after a small amount of rain had fallen. There was no standing water. Contours indicate that the drainage area is potentially very large extending north to the Arizona Canal. 22nd Street is a north to south conveyor of storm water runoff. The reported standing water is at the NE corner of 22nd Street's intersection with Highland Avenue. The crown in Highland may be causing the ponded/standing water in the NE curb return.

Conclusion - Without survey, a depth of ponded water could not be determined. This site is considered a local drainage issue and could be solved by lowering the crown in Highland or by installing a valley gutter or storm drain system.



10th Street and Campbell Avenue

Inlet

Curb opening

Looking southwest at canal

Approximate Drainage Area = very large, approx. 3.5 square miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Routine maintenance to keep top of drain free of debris: Catch basin constructed with Minnezona I.D. - Monitor and evaluate." - COP Street Maintenance

EEC Observations - There is a grated inlet in a sump condition and a curb opening catch basin. The area is subject to flooding when water begins to pond behind the canal embankment.

Conclusion - The location is behind the canal embankment and is subject to flooding from water backing up behind the canal. This is a regional drainage issue.

40th Street to 44th Street and Oak Street to Thomas Road

Looking southwest on Oak St. at SE corner of 40th St.

Looking west on Wilshire toward 40th St.

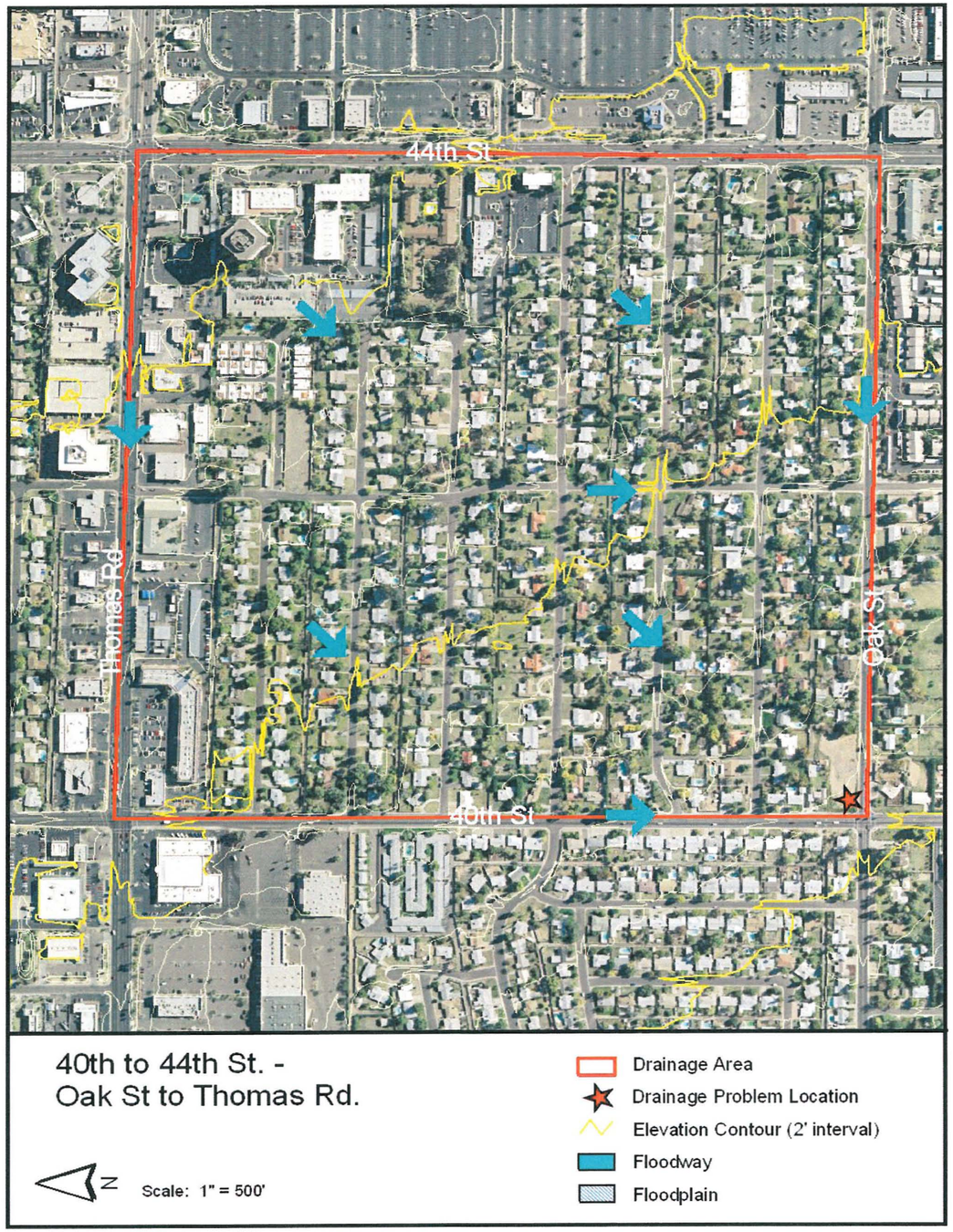
Looking northeast at corner of Wilshire and 40th St.

Approximate Drainage Area = 159.9 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "As indicated on the project area map, the NE quadrant between 42nd St. and 44th St. and north of Wilshire, all drains to 44th St. at Wilshire, along with the southeast and southwest quadrants, south of Wilshire, which drains to 44th St. along the east-west streets... The other three quadrants are served by 2 catch basins... The combined capacity of the two catch basins is 14 cfs. The calculated surface runoff from the 120 acres draining to 44th St. south of Wilshire is 153 cfs for the 10-year storm." - Hustead Engineering

EEC Observations - Inlets and storm drain were observed in the field.

Conclusion - The inlets and storm drains are most likely designed for the 2-year storm, so the area is still susceptible to larger floods. It is likely a local issue to deal with street flooding.



30th Place and Coolidge Street

Looking west on Coolidge Street

NW corner of 30th Pl. and Coolidge

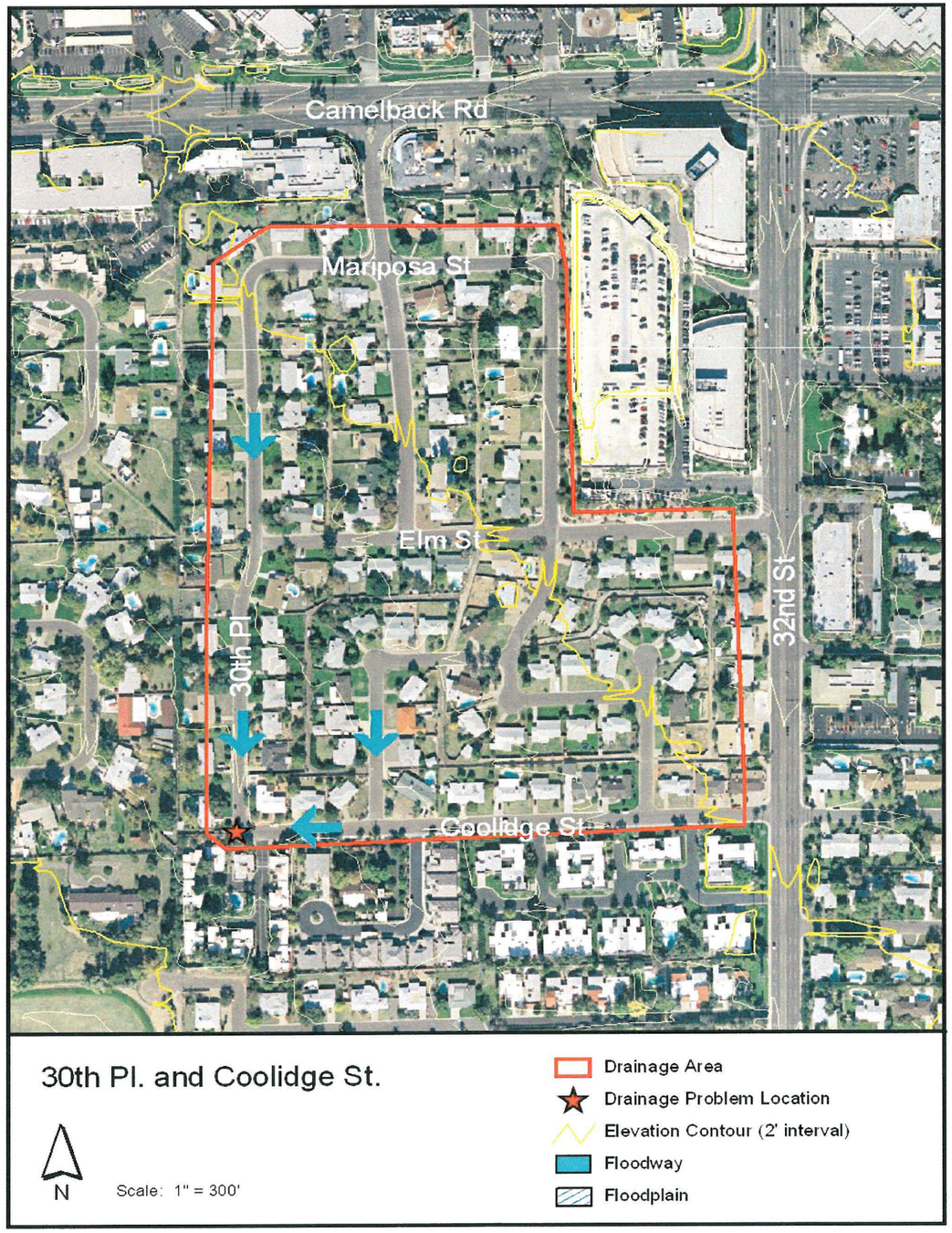
Looking south into Los Escondidos

Approximate Drainage Area = 31.9 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "…the storm water did overtop the curb and gutter and flood the property. There is an existing grate inlet catch basin in front of the property that is the concentration point for the majority of the subdivision. Mr. Juarez also indicated that this catch basin and the catch basin across the street both clog regularly... These neighbors indicated that they were also being impacted by flooding in the road adjacent to their homes during certain storm events." - Dibble and Associates

EEC Observations - The intersection of Coolidge Street and 30th Place is the concentration point for the entire neighborhood. There are two inlets to accept flow. The flow in the southern half of Coolidge Street will flow south into the Los Escondidos development.

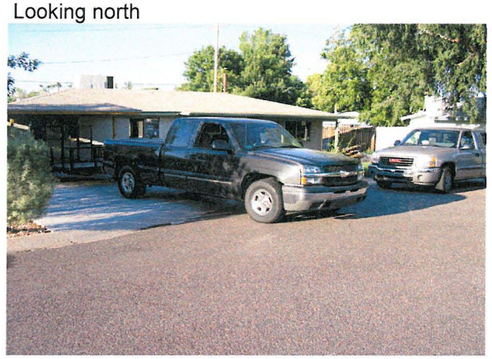
Conclusion - The house should be protected in smaller storm events but without anywhere for the flow to go, the house is susceptible to flooding in large events. It is a relatively small drainage area associated with a local drainage issue.



4111 East Roma Avenue

Looking north

Looking east



Looking SW at property

Looking south

Approximate Drainage Area = 6.2 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Sewer rim elevations in the vicinity of her home indicate or confirm that the slope is in a southwesterly direction. Ms. Petrich's property is at or adjacent to the low point of her block, drainage is conveyed through an undetermined size pipe or channel between two lots where it outfalls to the alley. ...blockage consists of oleanders being planted in the 5' easement along with fencing that impedes the flow." - COP Drainage Complaint Report

EEC Observations - The house is subject to flow from the east on Roma Avenue and from the north along 41st Street. The drainage area is small but there is no place for the flow to outfall to. There is roll curb protecting the house from flooding. The FFE appeared to be at or slightly above curb elevation.

Conclusion - Since there is no outfall, standing water will be an issue in any storm event. It is unlikely that a small storm event could generate enough flow to flood the house but larger storm events likely would flood the house. The drainage area is very small and it is localized flooding issue.

5929 East Indian School Road

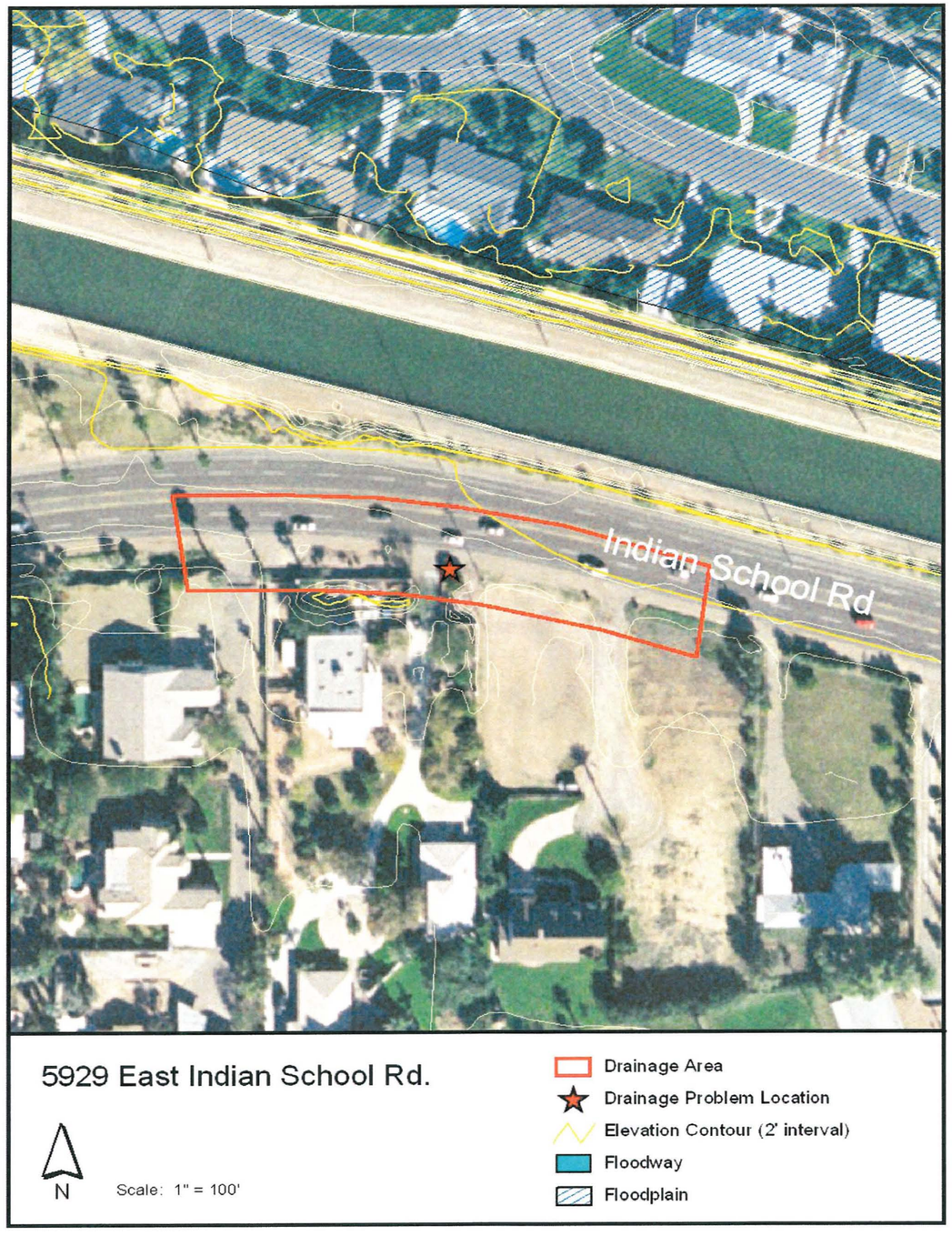
Looking west along Indian School

Looking east along Indian School

Approximate Drainage Area = 0.6 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint Blades maintained flow line on south side of Indian School from 60th St. to 5807 E. Completed on 04-02-01." - COP Street Maintenance

EEC Observations - If flow overtops the canal, the property would be subject to larger flows. As long as the canal is not overtopped, the property is only subject to street runoff.

Conclusion - This does not appear to be a flooding issue. It appears that it is a maintenance issue for the dirt shoulder. If there is flooding issue, it is a local issue.



2500 North 52nd Street

Looking west at properties

Looking west at properties

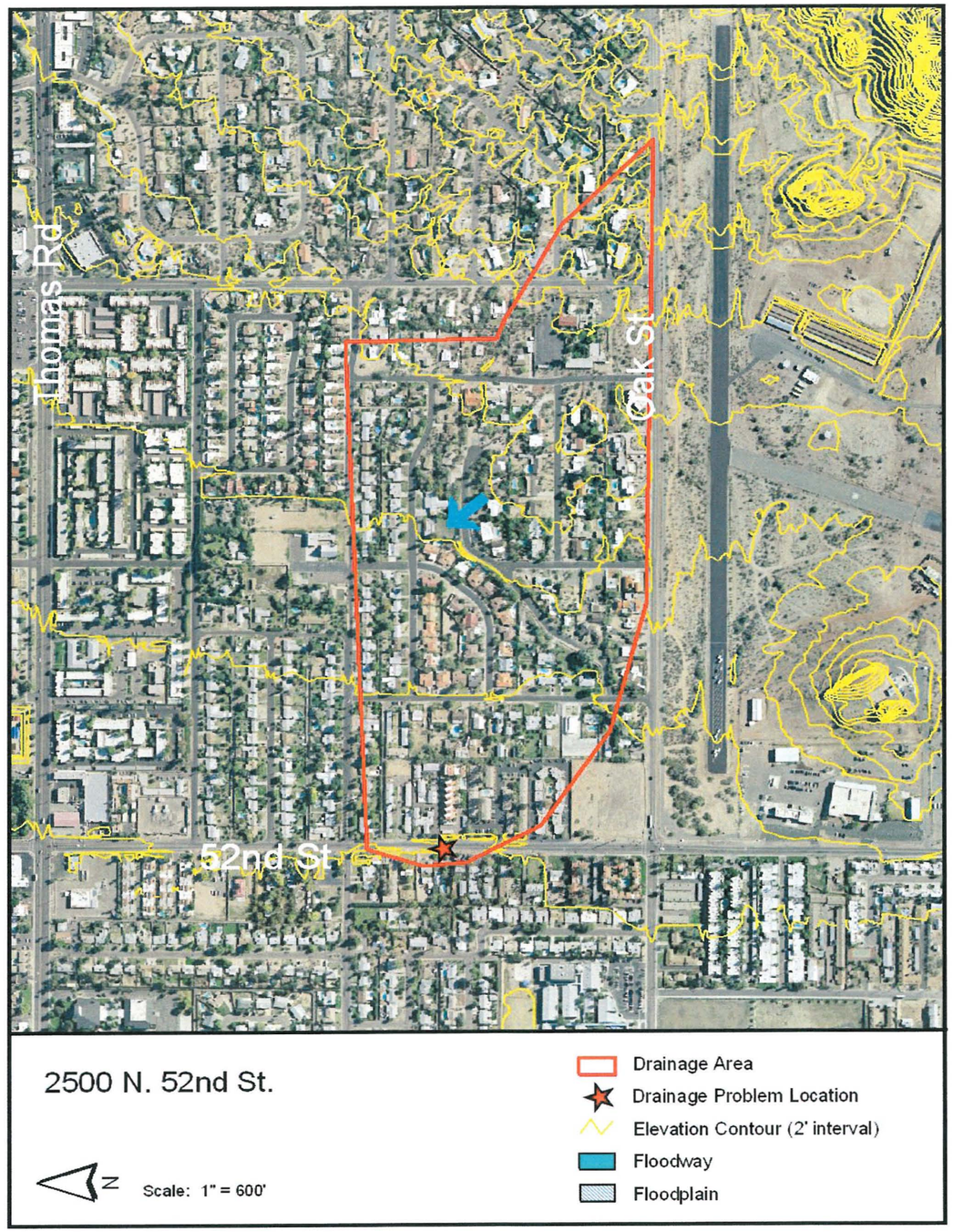
Looking northwest

Looking north along properties

Approximate Drainage Area = 72.3 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Several homes along the west side of 52nd St., between Oak St. and Virginia, have a history of drainage and flooding problems. One particular home at 2508 N. 52nd St. has flooding problems almost every time that it rains. It appears to be at the lowest point in the drainage path of a 73-acre watershed. Runoff from the watershed, east of 52nd St., surface flows over the roadway and through the yards en route to the Old Cross Cut Canal." - EEC

EEC Observations - See above description of problem.

Conclusion - A storm drain was installed and the residences built berms in their front yards but they are still susceptible to flooding in large storm events. This could be considered a regional drainage issue.



46th Street and McDowell Road

Looking west at house along 46th St.

Looking north along 46th St.

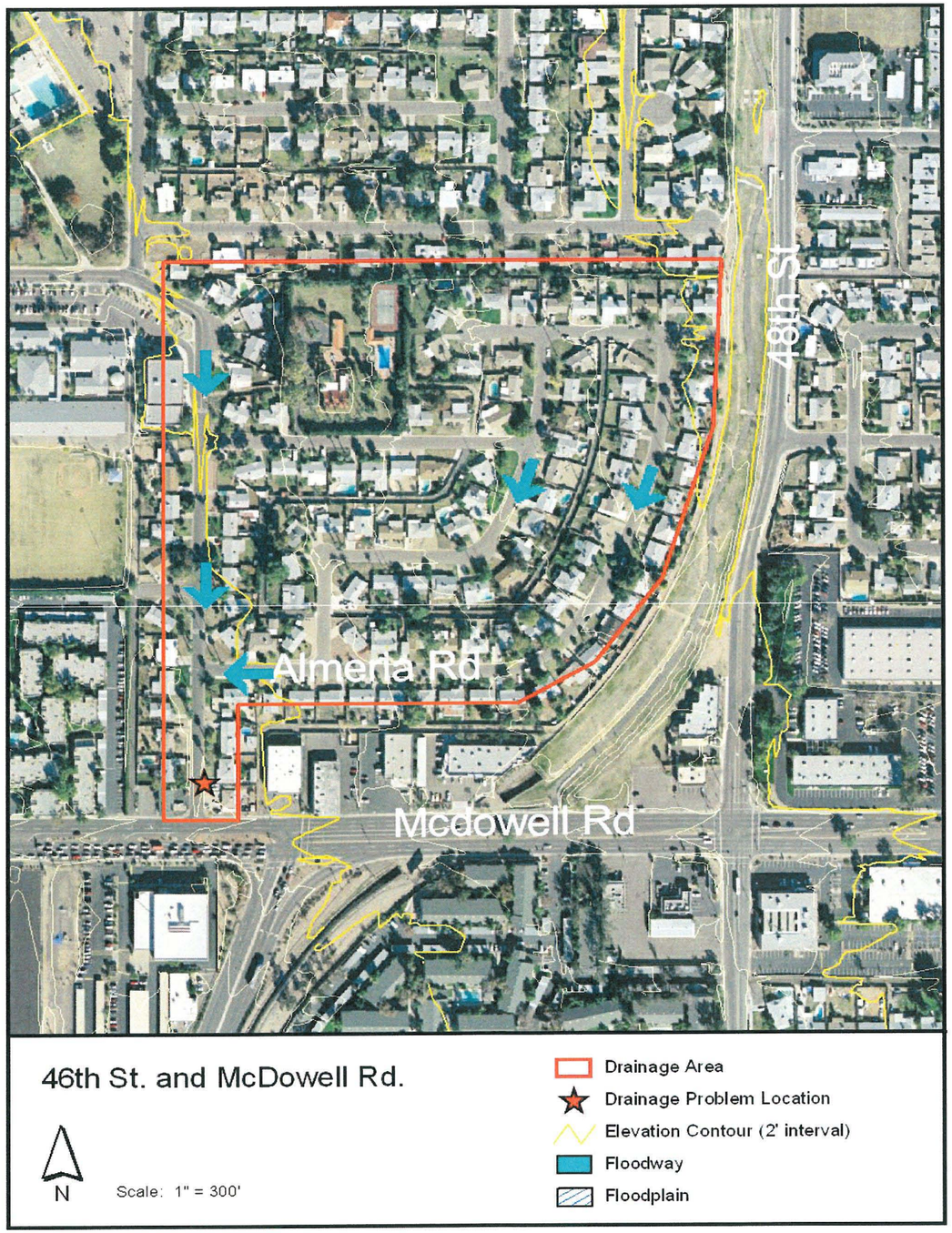
Looking at inlet on west side of 46th St.

Looking north

Approximate Drainage Area = 27.3 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "The finished floors of these homes appeared to be nearly level with the top of the existing curb. This was verified with a survey that the City performed that found the floor elevation at the 1614 house to be just 0.06 feet above the top of curb. The existing curb is 4-inch roll curb that provides a fairly small conveyance capacity before being overtopped. Since the floor elevations are low, the storm water that overtops the curb presents a flood hazard." - EEC

EEC Observations - Storm drains have been installed. It is assumed these storm drains were designed for the 2-year storm event. Flow travels south down 46th Street and west in Almeria Road. 46th Street and McDowell is the concentration point for the entire watershed.

Conclusion - The storm drains will lessen the severity and frequency of flooding. The houses could still be flooded in large storm events. The drainage area is small so it is only a localized drainage problem.



4727 East Lafayette

Looking west

Looking south at property

Looking east

Looking northeast

Approximate Drainage Area = 20.1 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Issue resolved through a development agreement with Villa Lafayette." - COP Street Maintenance

EEC Observations - The property is on the south side of the road and the FFE appears to be lower than the gutter elevation. There is very little slope east or west (without survey, it is not possible to tell if flow would go east or west). The property may be in a low point.

Conclusion - Once the road is overtopped, flow continues going south until it overtops the curb and flows into the property. Once the curb is overtopped, the property is susceptible to flooding. This is a common occurrence in the Arcadia area where the east-west streets have very little slope resulting in drainage problems for the properties that lie on the downstream side of the east-west streets. This could be considered a regional problem.

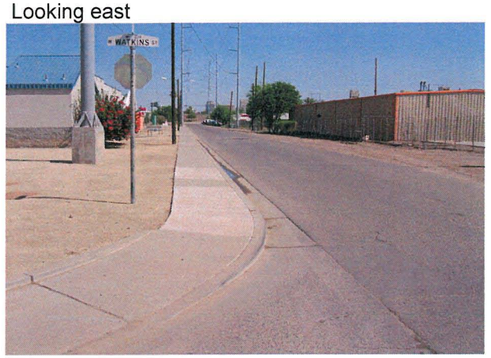
Appendix A.2.3

SOUTHWEST – UNDER CONSTRUCTION/WARRANTY

Watkins Storm Drain: 6th Avenue to 2nd Avenue

Looking east

Looking west



Looking north

Approximate Drainage Area = 44.3 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "R/W issues. On hold." - COP Street Maintenance

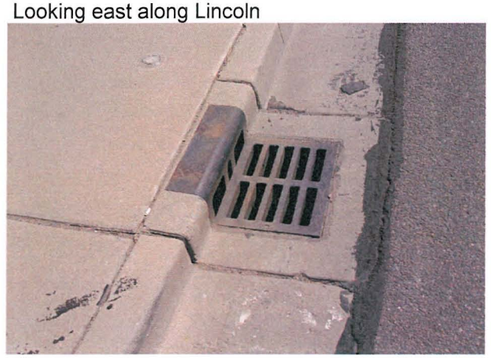
EEC Observations - Flow travels south between 6th Avenue and 2nd Avenue to Watkins Street. It appears as if the properties and lots on the south side of Watkins are higher than on the north. If this is the case, standing water could be the issue. Depending on the FFE's on the north side of Watkins, flooding could also be an issue. Watkins Street is nearly flat (the slope from east to west calculated from the contours is approximately 0.0012 ft/ft), so the capacity is very limited.

Conclusion - In small storm events, the issue appears to be ponded water and in the large storm events, there is a potential for flooding. It is small drainage area; hence, it is a localized flooding issue.

2nd Avenue and Lincoln Drainage Study

Looking east along Lincoln

Looking north along 2nd Avenue



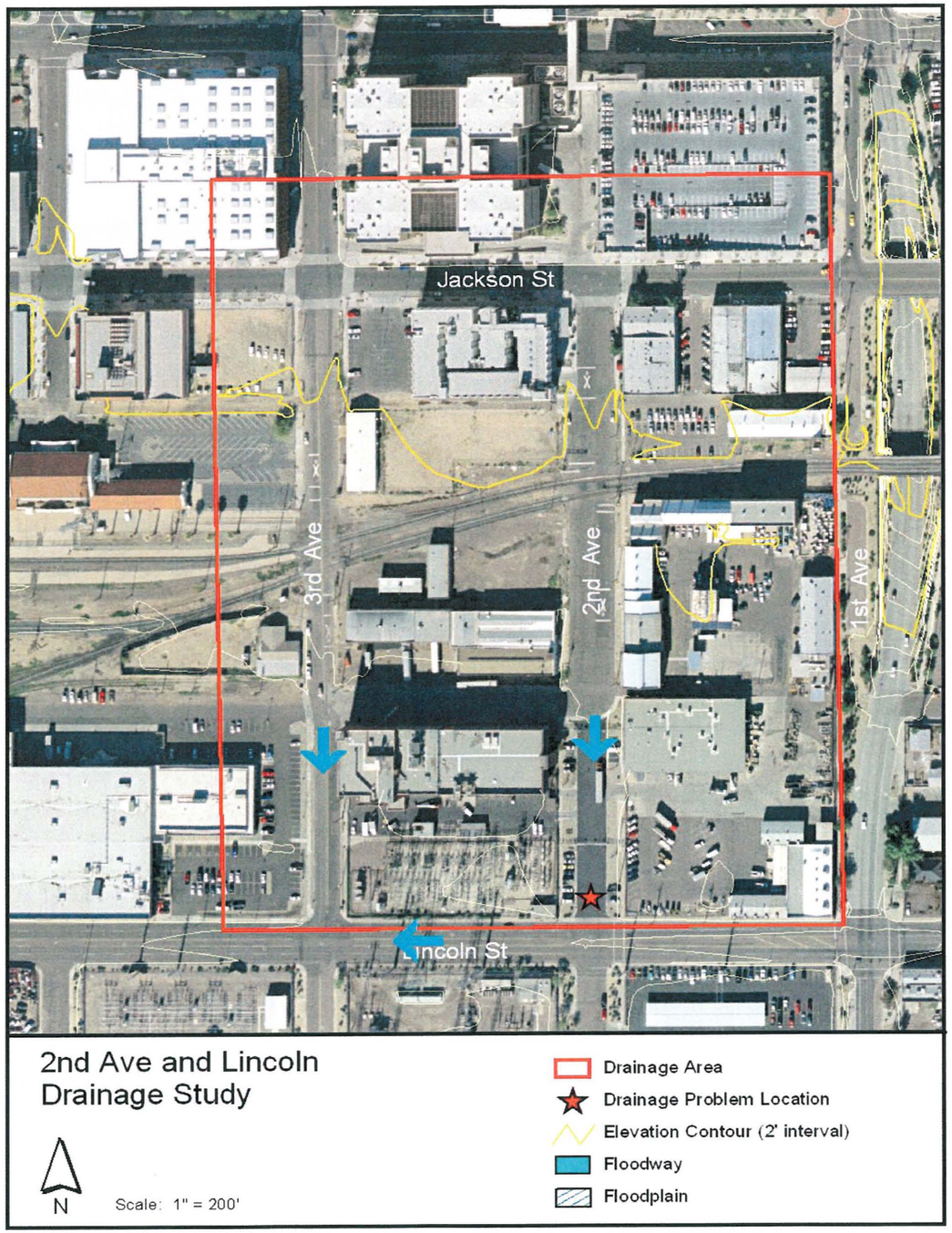
Inlet on northside of Lincoln, just east of 2nd Ave.

Looking west along Lincoln

Approximate Drainage Area = 24.0 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Sumps that need replaced. Might be 2nd Ave. and Buchanon" - COP Street Maintenance

EEC Observations - There does not appear to be any flooding issue. The FFE's appear to be much higher than street elevation. The slope along 2nd Avenue from north to south is approximately 0.0040 ft/ft and the slope along Lincoln Street from east to west is approximately 0.0030 ft/ft.

Conclusion - If there is any issue, it is street flooding and survey would be necessary to determine the slopes more accurately and if there are sumps along Lincoln Street causing ponding in certain areas. It is a local drainage issue.



18th Avenue and Jefferson

Southwest corner

Northeast corner

Looking west along Jefferson

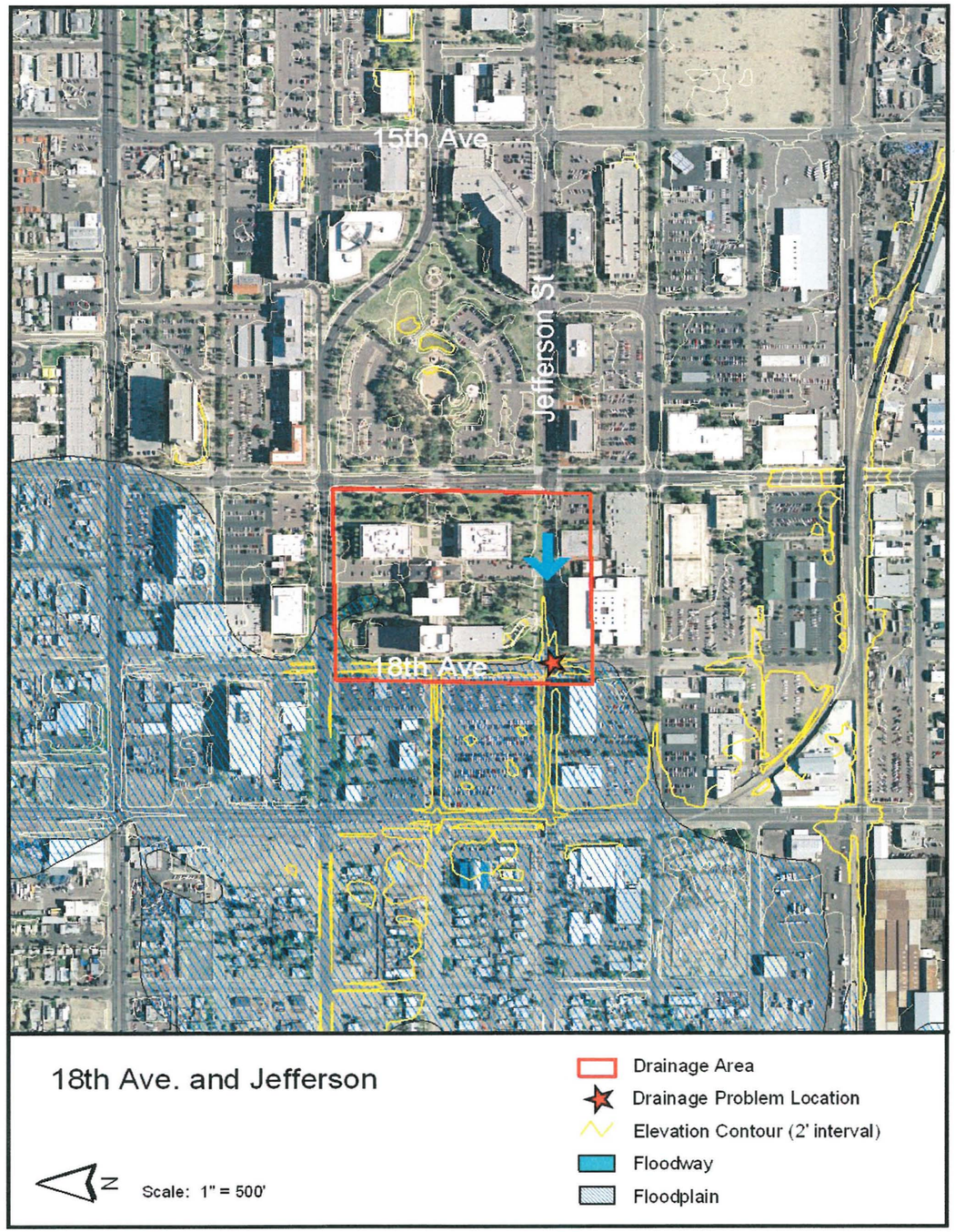
Looking east along Jefferson

Approximate Drainage Area = 17.5 acres
FEMA Floodzone Type - AE

Property Owner Description/Complaint "The intersection is the outfall for an approximately 5.1-acre drainage area and experiences localized ponding near the four curb returns during rainfall events. There are nearly three drywells located on the northwest, northeast, and southeast corners that do not adequately drain the intersection. The roadway cross section allows water to collect within the outside travel lanes and not drain to the curb line. There are no drywells or catch basins within the outside travel lane or near the intersection to intercept the flow." - Wood/Patel

EEC Observations - The FFE's appeared to be higher than the street elevation. Jefferson appeared to be in a sag condition at 18th Avenue. Water will pond at the intersection until it spills to the south or west. New catch basin inlets have been installed to reduce the ponding of storm water.

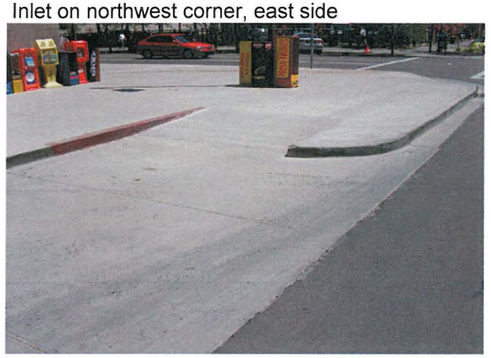
Conclusion - This appears to only be an issue of street flooding which has been corrected with the installation of new storm drain inlets. Street flooding could occur in small storm events depending on the capacity of the inlets. The drainage area is small and it is a localized drainage issue.



Adams Street Pullout: 3rd Drive to 2nd Drive

Inlet on northwest corner, east side

Inlet on northwest corner, south side

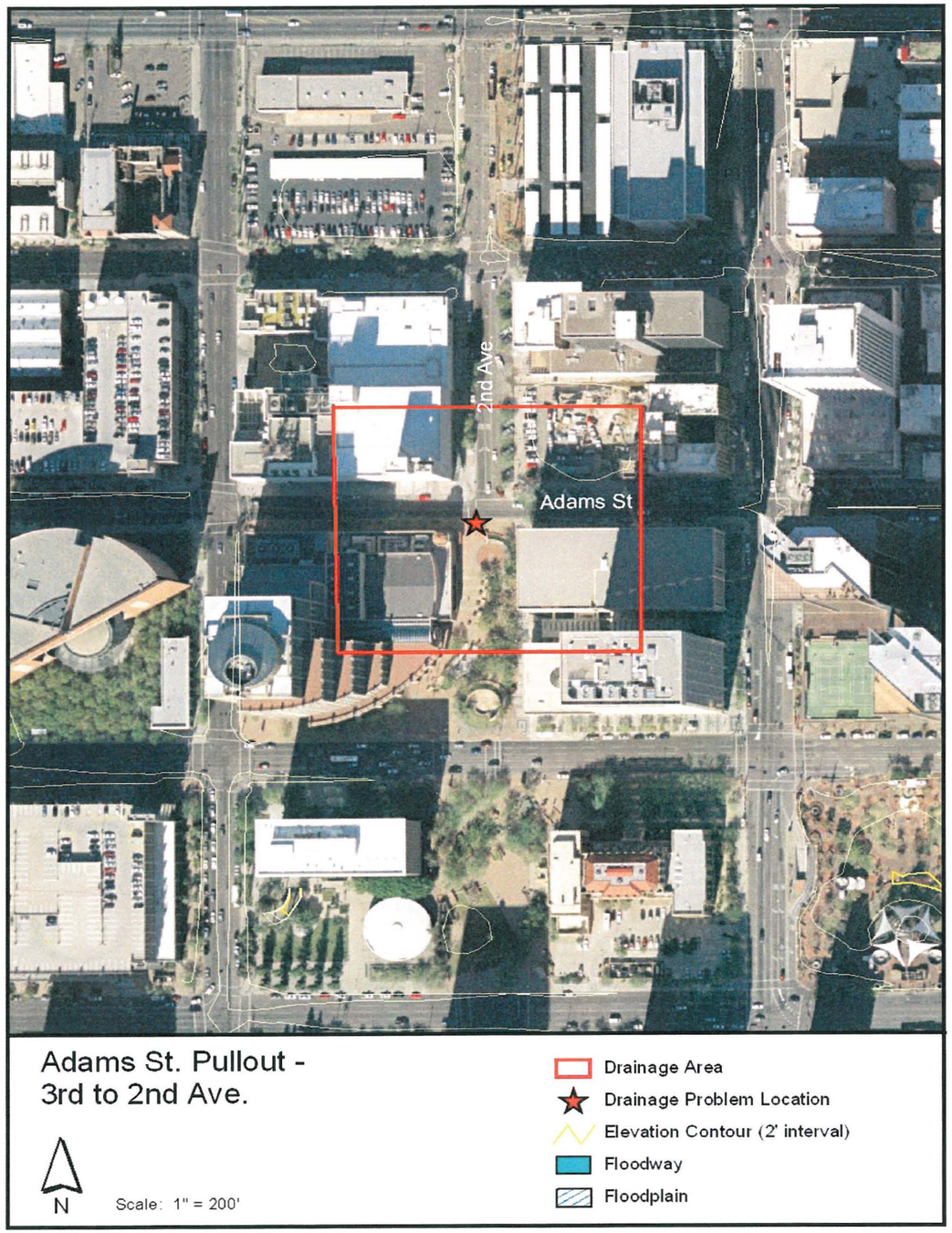


Northwest corner

Approximate Drainage Area = 3.9 acres
FEMA Floodzone Type - X1
Property Owner No information available.
Description/Complaint

EEC Observations - There are inlets and curb and gutter in the surrounding area. Flooding is likely not an issue.

Conclusion - If there is a drainage issue at this location, it is only a local drainage issue.

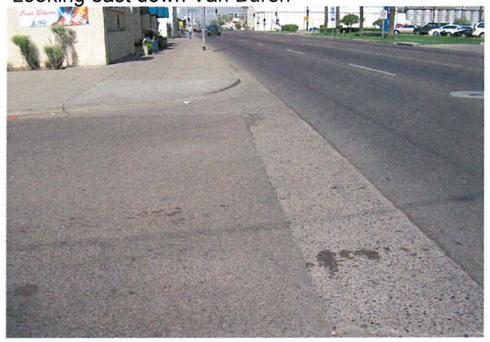


Van Buren Street: 18th Avenue to 19th Avenue

Drywell on NW corner of 18th Ave and Van Buren

Looking east down Van Buren

Looking west down Van Buren

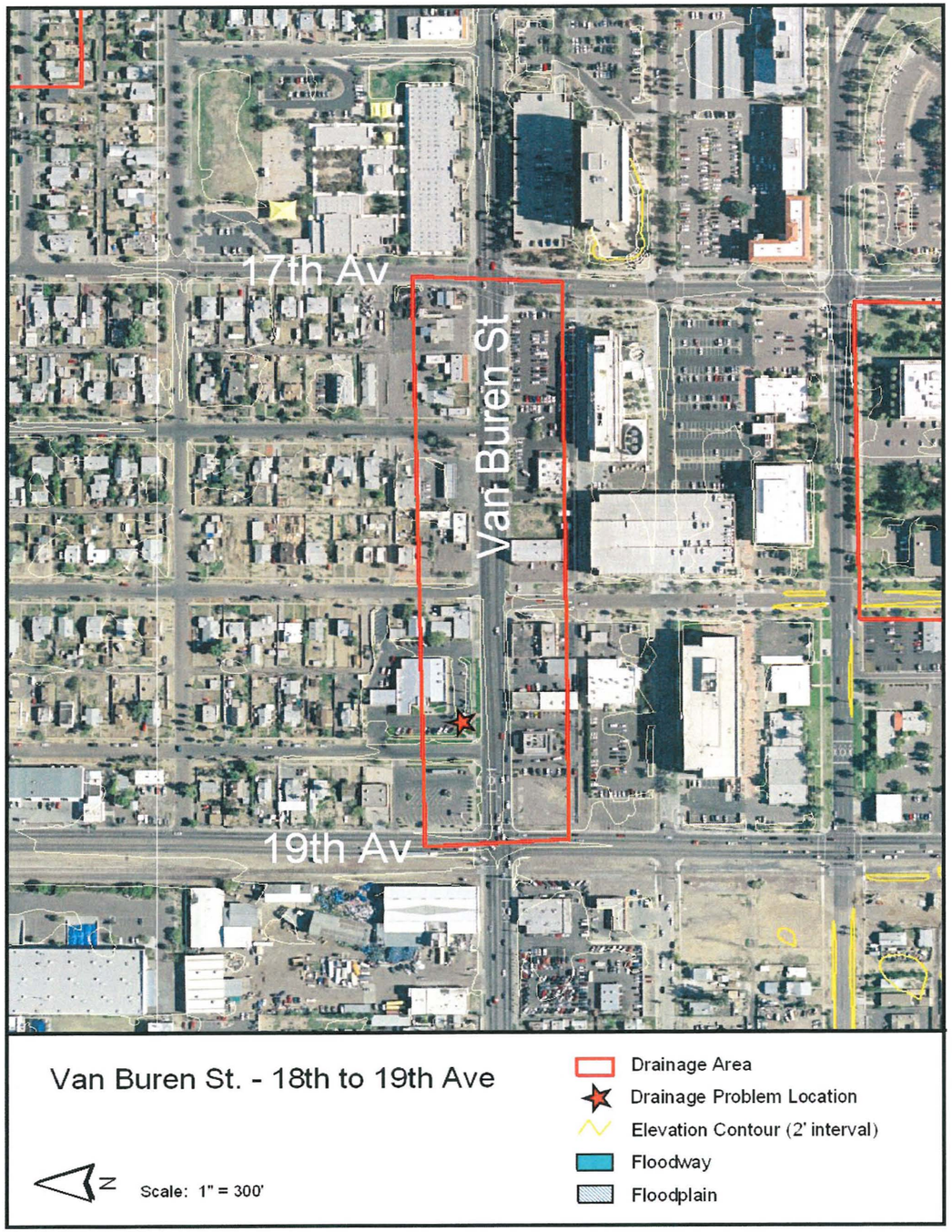


Looking west down Van Buren

Approximate Drainage Area = 9.6 acres
FEMA Floodzone Type - AE
Property Owner Description/Complaint "Typical surface flow in the area goes around 18th Ave. and Van Buren St. is to the southwest. The existing gutter slope along the north side of Van Buren St. is minimal to the west. Two locations exist between 18th and 19th Ave. in which water stands in the gutter. Storm water ponding is contained within the curbs. A storm drain exists in 19th Ave., and a branch of this system extends to the east of 19th Ave. in Van Buren St." - PEC

EEC Observations - Van Buren has a high crown and high vertical curb. Water could pond at the intersections of Van Buren with 18th Drive and 18th Avenue. It appears only to be a street flooding issue.

Conclusion - In any storm event, the street could become flooded and water could pond. It is a local drainage issue.



16th Avenue and Taylor Street

Looking north along 16th Avenue

Inlet on northeast corner

Looking north along 16th Avenue

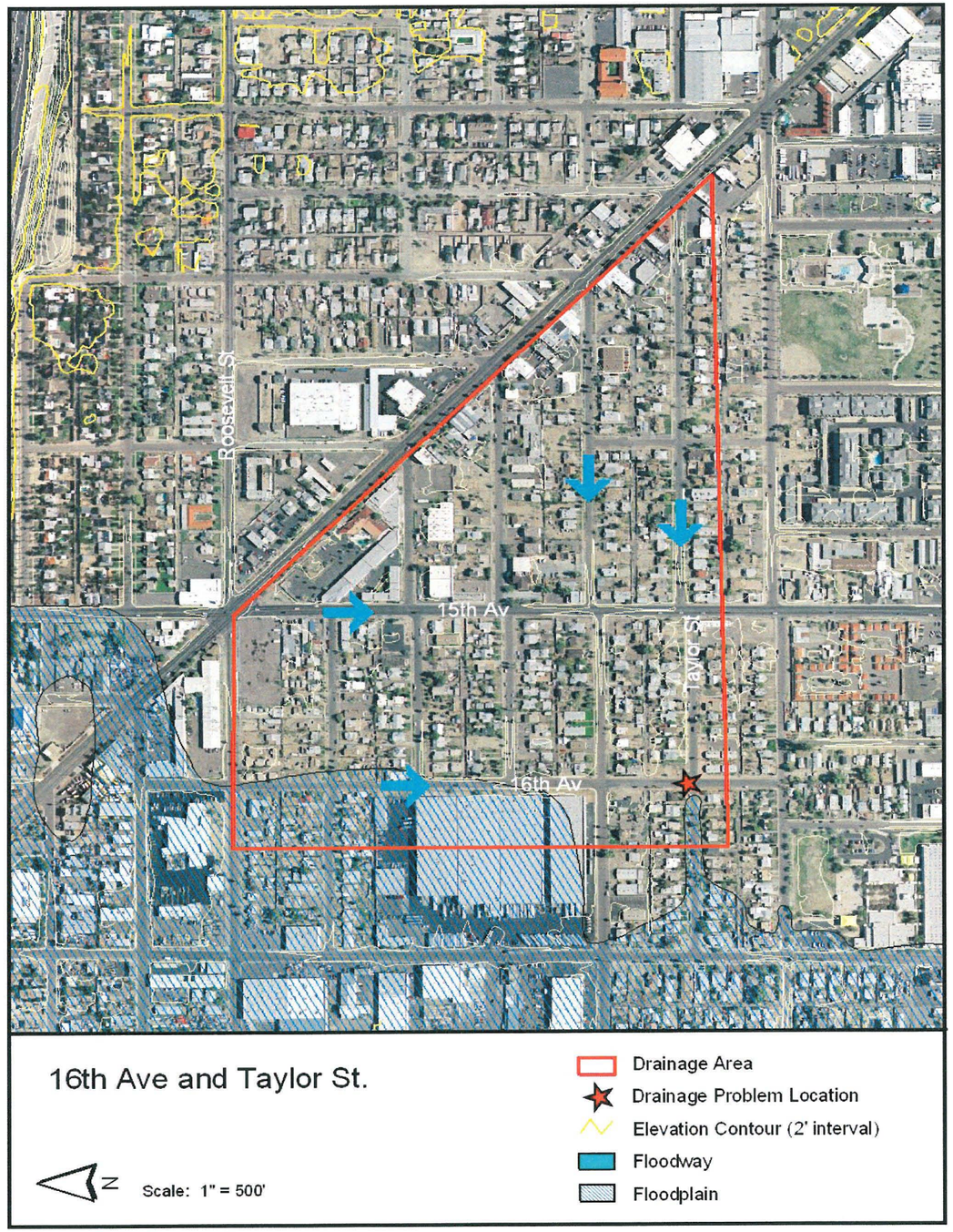
Inlet west of 16th Avenue on southside of Taylor

Approximate Drainage Area = 71.4 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "The study area consists of 55 acres and contribute storm runoff from the northeast. The study area is bound on the north by Roosevelt and to the east by 15th Ave. Storm runoff from the drainage area converges at the intersection of 16th Ave. and Taylor. The calculated peak runoff from this drainage area is 55 cfs. Due to the asphalt overlays on 16th Ave, a sump condition exists to the east of this intersection. Drainage of this sump condition is inadequate and floods the entire road width." - PEC

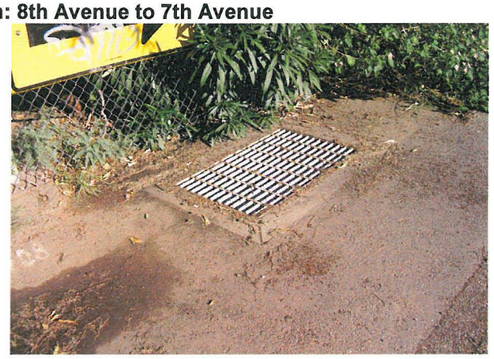
EEC Observations - There is vertical curb in front on the homes and the FFE's appear to be above the curb elevation (no survey was taken to verify this). It appears to be an issue of street flooding. New catch basin inlets were installed to relieve the ponding of stormwater. The inlets are believed to be connected to the 15th Avenue storm drain via a new lateral pipe.

Conclusion - Street flooding and nuisance water appear to be the only issue in this area which seem to have been solved with the installation of the new storm drain inlets. Although it is a large drainage area, it is a localized drainage issue by nature.

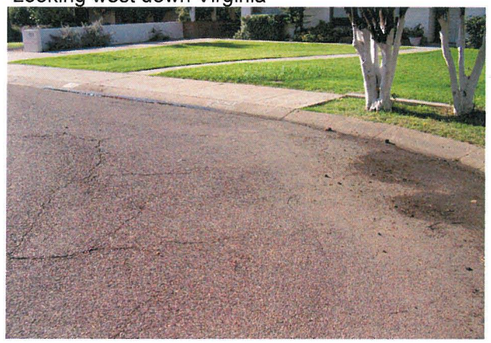


Lewis and Virginia Storm Drain: 8th Avenue to 7th Avenue

Looking west down Virginia



Looking at grated inlet



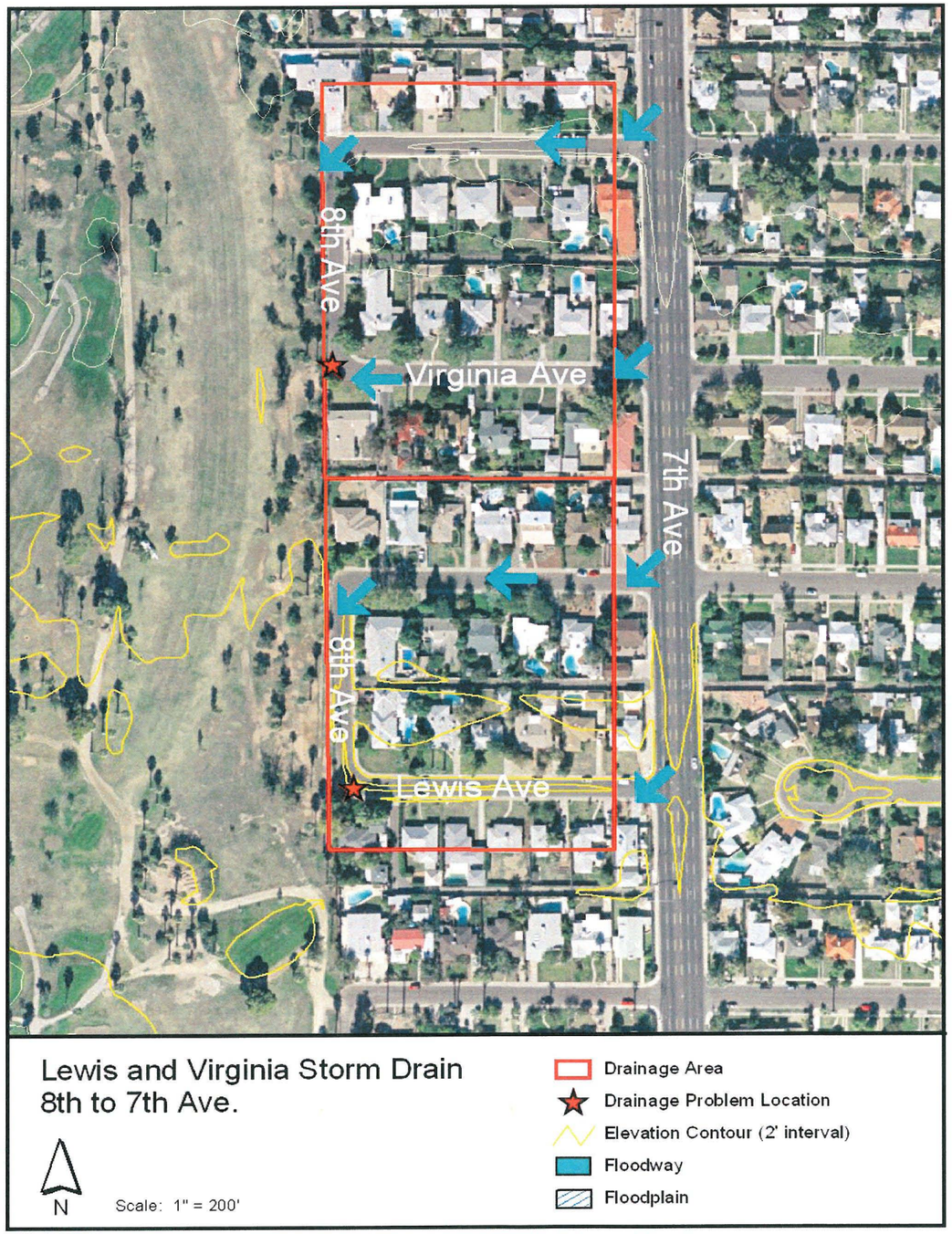
Looking southeast

Looking north

Approximate Drainage Area = 6.0 acres (Virginia Ave); 5.5 acres (Lewis Ave)
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Old dry well does not work and will flood property. Water also comes out of well on a clear day and resident is concerned of health hazard. Also will flood yard when it is not raining." - COP Street Maintenance

EEC Observations - There is roll curb along both Lewis and Virginia. The FFE's appear to be at or above curb elevation. Both Lewis and Virginia dead end at Encanto Golf Course. The grated inlet (drywell) does have potential to clog and cause street flooding but water appeared as if it would spill into Encanto Golf Course (survey would be needed to verify this). No evidence of new construction was observed in the field, therefore, we are assuming this falls under new construction due to refurbishing or replacing of the existing drywell.

Conclusion - The flooding and nuisance water could be alleviated with some regrading of Encanto Golf Course to allow drainage to leave the subdivision. The drainage areas are small and are a local drainage issue.

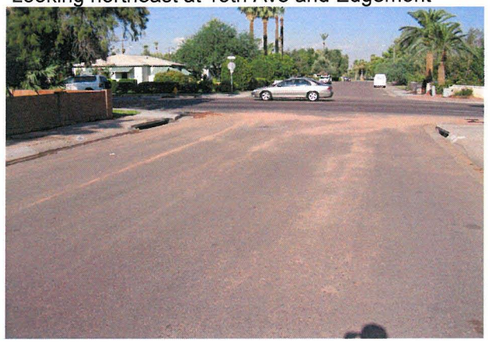


Edgemont Avenue: 8th Avenue to 15th Avenue

Looking east along Edgemont

Looking northeast at 13th Ave and Edgemont

Looking west along Edgemont



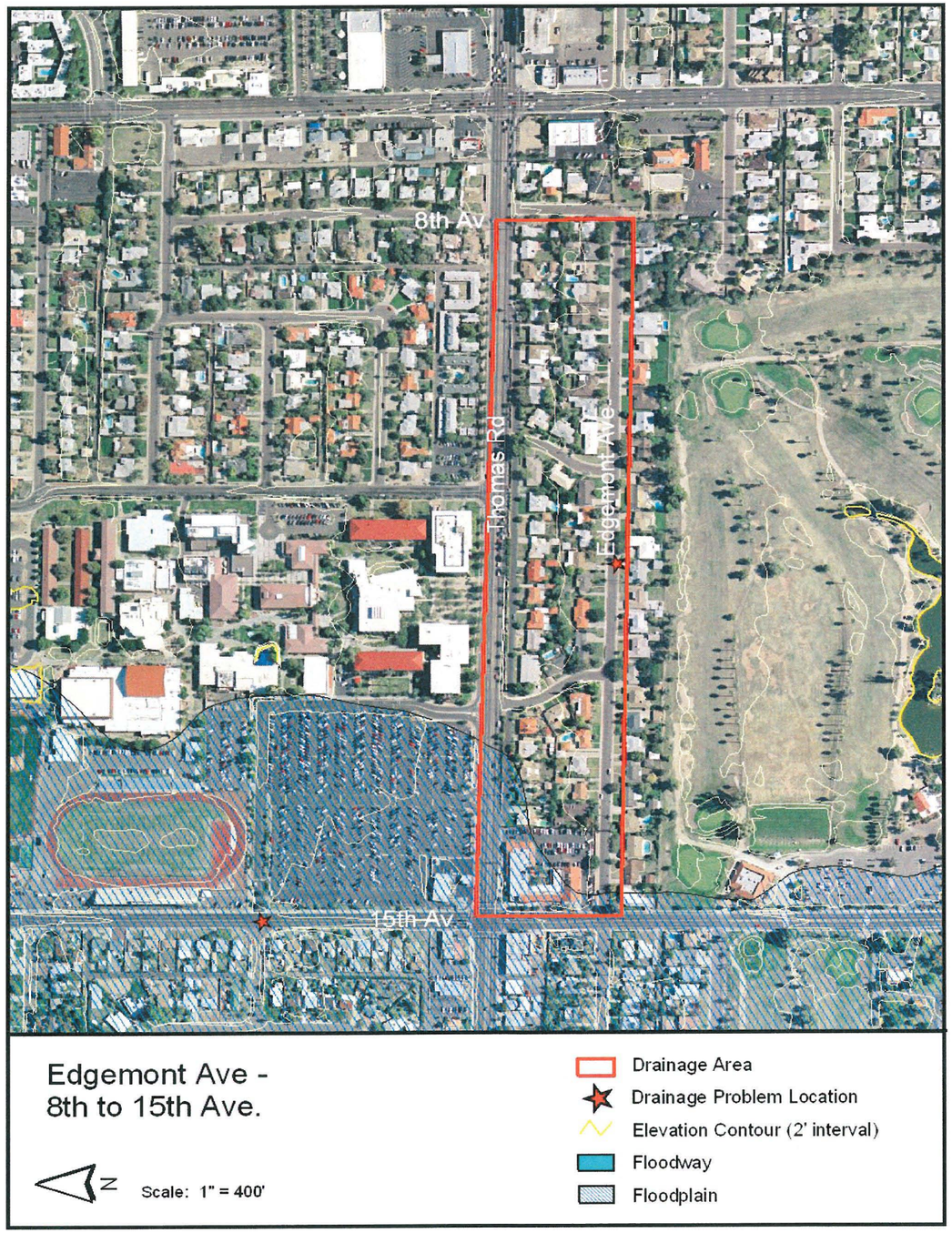
Looking west at Edgemont and 15th Avenue

Approximate Drainage Area = 20.2 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "The field survey shows that Edgemont rises slightly just east of 15th Ave. and then slopes down to a low point just west of 11th Ave. There is then a slight upgrade to 8th Ave. and Thomas. The street connections to Thomas drain south to Edgemont. There is a low point and existing catch basin in Thomas just west of 8th. A valley gutter across 8th and a rise in the curb returns to the south keep most flows in Thomas. 11th Ave. connects Thomas at a crest point in Thomas and flows in Thomas drain away from the intersection." - Ritoch Powell

EEC Observations - There is roll curb along Edgemont Avenue and the FFE's appear to be higher than the roll curb elevation. There were new inlets along the roll curb. The drainage issue is in the east portion of the floodplain as well as just east of the Cave Creek floodplain.

Conclusion - For smaller storms, the houses should be protected by the combination of the roll curb and storm drains. In larger events, there is potential to overtop the curb but the yards should protect the houses (unless the FFE is below the curb elevation). It is a local drainage issue that appears to have been solved with the installation of a new storm drain.



	Central		
1	23rd Av.: Dunlap - Northern	22	1720 W. Bethany Home Rd.
2	2301 W. Northern Av.	23	24th Av. And Camelback Rd.
3	1559 W. Butler Dr.	24	23rd Av.: Campbell - Turney Av.
4	1756 W. Echo Ln.	25	4515 N. 23rd Av.
5	8024 N. 7th Av.	26	1802, 1836 W. Turney Av.
6	525 W. Hayward Av.	27	635 W. Glenrosa Av.
7	7644 N. 5th Av.	28	1735 W. Roma Av.
8	8140 N. 1st Dr.	29	4506 N. 11th Av.
9	312 W. Loma Ln.	30	505, 585 W. Hazelwood Av.
10	7508 N. 21st Av.	31	1219 W. Elm
11	1014 W. Myrtle Av.	32	4821 N. 7th St.
12	7101 N. Central Av.	33	12th Av. And Missouri Av.
13	7108 N. 13th Pl.	34	37 W. San Juan Av.
14	7125 N. 19th Av.	35	719 W. San Miguel
15	7050 N. 8th Av.	36	807 W. Solano
16	7015 N. Barbados Pl.	37	5608 N. 9th St.
17	1307 W Lawerence Rd.	38	25th St. and Camelback
18	11th Av. And Tuckey Ln.	39	San Juan Av. E/o 20th St.
19	6615 N. 10th Av.	40	5806 N. 14th Pl.
20	6516, 6528, 6542 N. 17th Av.	41	525 W. Bethany Home Rd.
21	917 W. McLellan Blvd.	42	10th St. and Tuckey Ln.

	Southeast		
1	20th St. and Universtiy Dr.	21	3006 N. 21st Pl.
2	1120 E. Durango St.	22	3402 N. 26th Pl.
3	424 E. Buckeye Rd.	23	3501 E. Amelia Av.
4	1555 E. Jackson Rd.	24	34th St. and Indian School Rd.
5	2nd St. and Washington	25	Meadowbrooke Av. And 39th St.
6	409 N. 20th St.	26	4453 N. 35th St.
7	13th St. and McKinley St.	27	3037 N. 53rd St.
8	Roosevelt St.: 21st - 23rd St.	28	4839 E. Osborn Rd.
9	1717 N. 16th St.	29	3802 N. 48th St.
10	2102 N. 28th St.	30	3200 N. Valencia Ln.
11	Oak St.: 5th - 7th St.	31	60th St. and Hollyhock St.
12	1901 E. Avalon Av.	32	3022 N 26th St.
13	4147 N. 18th St.	33	44th Street and Calle Redonda
14	4428 N. 12th St.	34	4501 E. Calle Redonda
15	4532 N. 7th St.	35	4742 N. Launfal
16	4519 N. 8th Pl.	36	4835 E. Exeter Blvd.
17	7th St. and Meadowbrooke	37	Arcadia Dr. and Calle Del Medio
18	28th St.: Highland - Camelback	38	4921 E. Calle Del Norte
19	35th St. and Monte Vista Rd.	39	56th Street and Lafayette
20	Old Cross Cut Canal	40	6207 E. Calle Redonda

	Southwest
1	3rd Av.: Papago St. - Yuma St.
2	1919 W. Sherman St.
3	Monroe St. and 4th Av.
4	1707 W. Osborn Rd.

Appendix A.3
Unresolved

Appendix A.3.1

CENTRAL – UNRESOLVED FLOODING COMPLAINTS

23rd Avenue: Dunlap to Northern

Looking north

Looking south

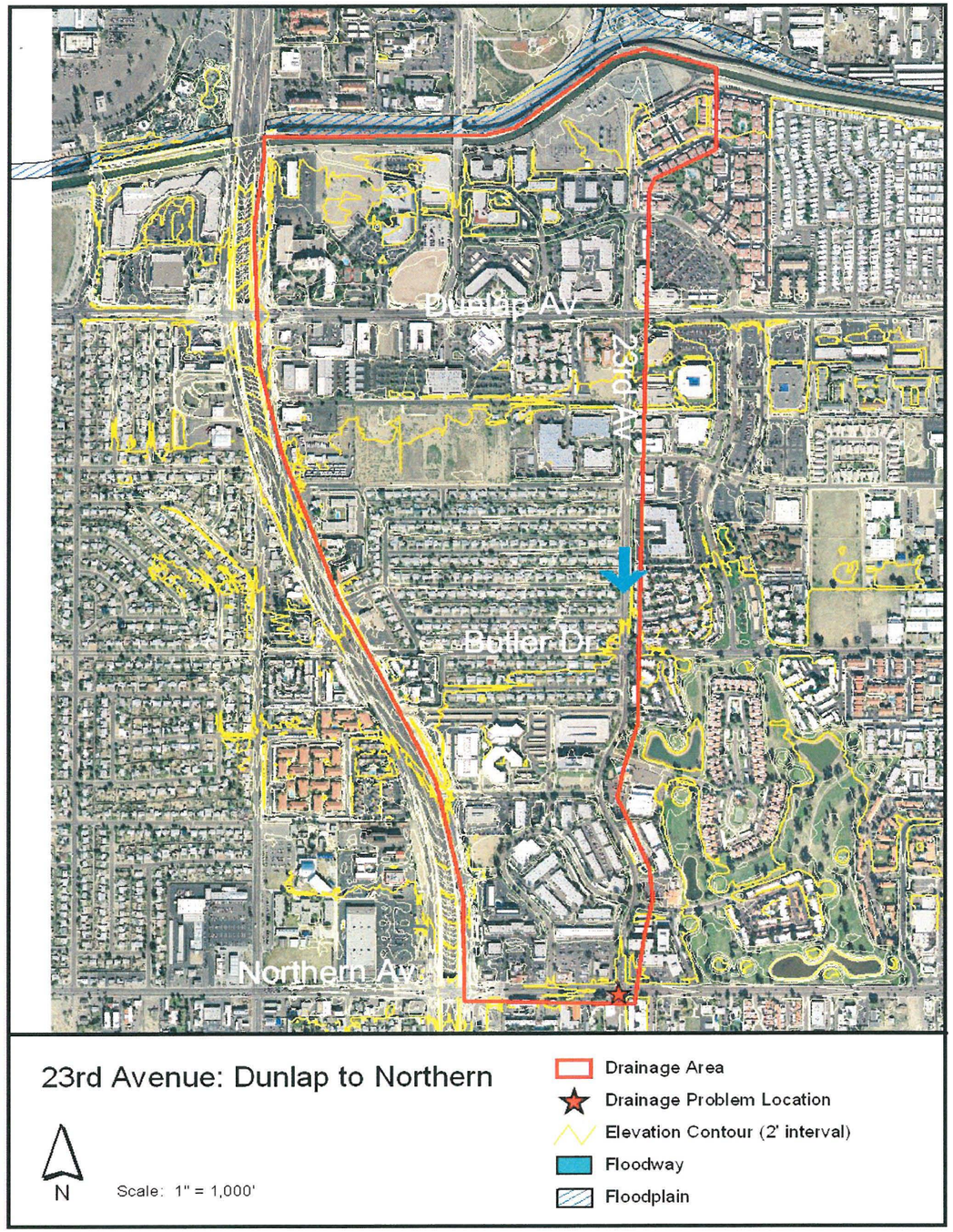
Looking north

Looking south

Approximate Drainage Area = 348.0 acres
FEMA Floodzone Type - X1
Property Owner No information
Description/Complaint

EEC Observations - There are no inlets along 23rd Avenue to intercept flow. The road appears to maintain capacity with flow going to the south. There was significant debris along the curb in 23rd Avenue. During review of the City's storm drain maps it was discovered that a 66-inch storm drain (from AS-BUILT) in 23rd Avenue terminates at Northern Avenue.

Conclusion - This appears to be only a street flooding and possibly a maintenance issue along 23rd Avenue. There currently is a disconnected section of storm drain in 23rd Avenue. This may be a regional problem if there is enough runoff generated in 23rd Avenue to cause flooding or until the City completes the extension of the 23rd Avenue storm drain.



2301 West Northern Avenue

Looking north along 23rd Ave.

Looking southwest at property

Looking west along Northern

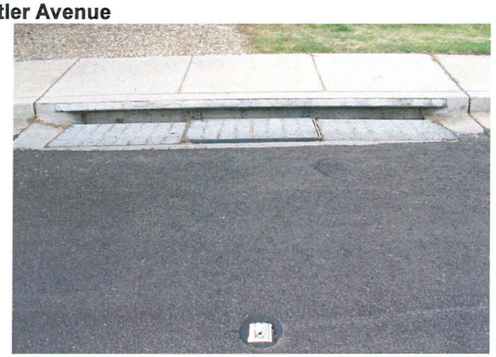
Approximate Drainage Area = Approximately 350 acres (see 23rd Avenue: Dunlap to Northern)
FEMA Floodzone Type - X1
Property Owner No information.
Description/Complaint

EEC Observations - The FFE appeared to be at or close to crown elevation (no survey was taken). There is a split at the intersection of Northern and 23rd Avenue. The general flow direction is to the south down 23rd Avenue. Flow also travels east along Northern.

Conclusion - Once the curb/driveway is overtopped, the property is susceptible to flooding. The property is susceptible on the north side from the flow going east down Northern and from the east side from flow going south down 23rd Avenue. It likely floods in the large storm events. If the FFE is lower than the parking lot, then it could flood anytime the curb is overtopped. It could be considered a regional issue since 23rd Avenue, upstream of Northern doesn't have any inlets and produces a significant surface flow.

1559 West Butler Avenue

Looking SE at property



Inlet

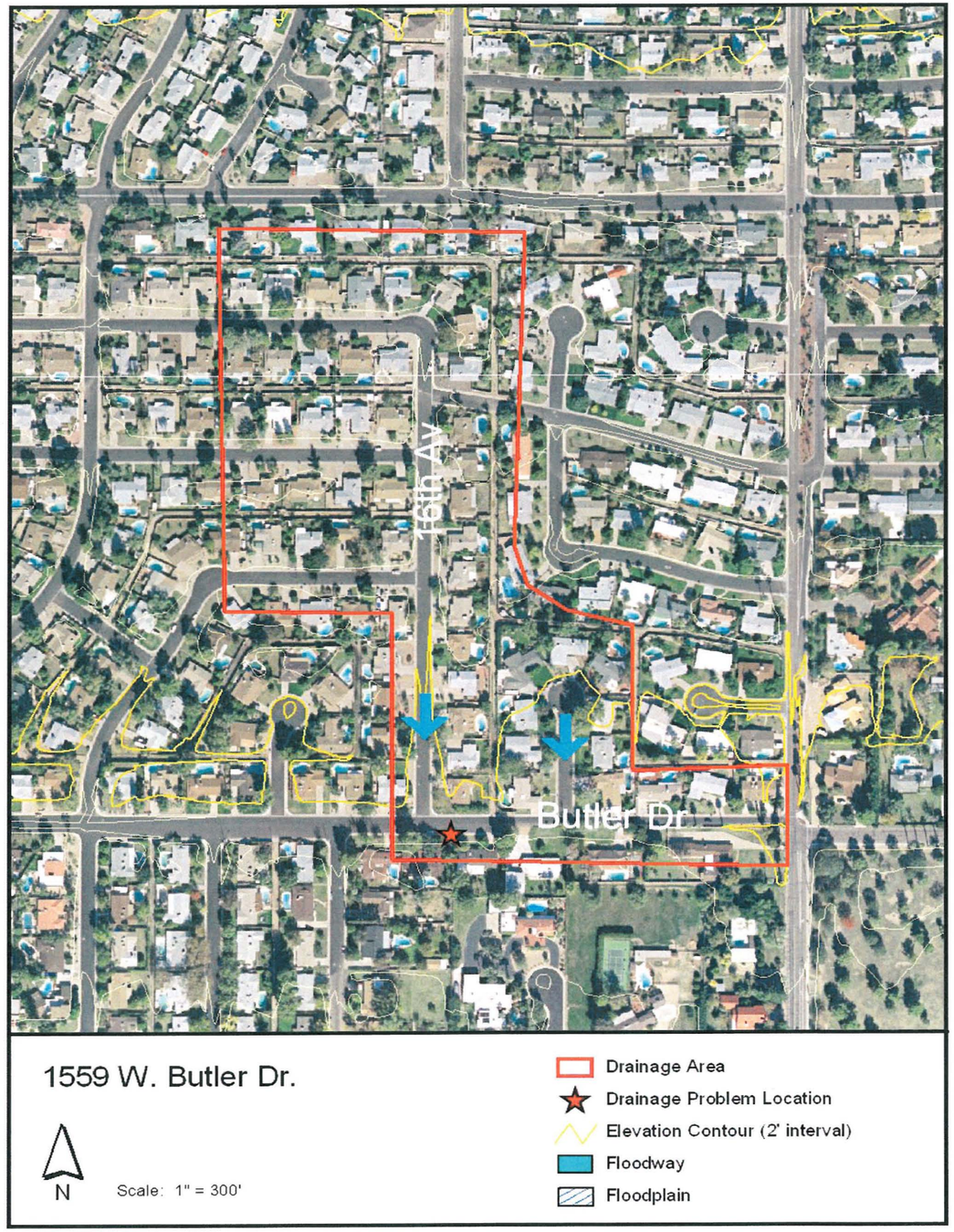
Looking north

Approximate Drainage Area = 21.9 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Information contained in the file focused on weeds well away from the complaint address, in fact the two complaints in the area seem to involve parkway maintenance. The specific complaints of tall weeds on the east side of 15th Ave. lead me to believe that this may be a Zoning Enforcement matter instead of a street transportation dept. issue. Due to the fact that the adjacent property owners have the responsibility to maintain the adjacent improvements in the right of way including the sidewalk." - Local Drainage Preliminary Investigation Findings

EEC Observations - The FFE is close to or at street elevation based on a visual analysis. The property appears to be in a low point. There is an existing triple type "N" inlet with a curb opening. It appears that the inlet would handle the 2-year event. However, since the property is in a low point, even with the inlet functioning properly, it is susceptible to flooding in a larger event.

Conclusion - The smaller storm should not flood the property but it is susceptible to flooding in large events. The inlet should lessen the severity of flooding during large events. This is a local drainage issue.



1756 West Echo Lane

Looking at property

Looking north

Looking at property

Approximate Drainage Area = 1.3 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "The complaint may have also complained about weeds within the right of way well away from their residence similar to 1559 W. Butler complaint. Another possibility is that drainage to the south and west of the subject address may have been impaired by weed growth in a drainage easement. Drainage in this subdivision was handled through a drainage conveyance between lots and out to 19th Ave., not a good prospect. Field verification is warranted to determine if that is a problem." - Local Drainage Preliminary Investigation Findings

EEC Observations - The house is approximately 24-36 inches higher than the road based on visual analysis. It does not appear to be a flooding issue.

Conclusion - If there is a drainage issue, it is a local drainage issue associated with puddling in the cul-de-sac

FCD JOB NO. FCD2004C040
EEC JOB NO. 305008

DRAINAGE PROBLEM

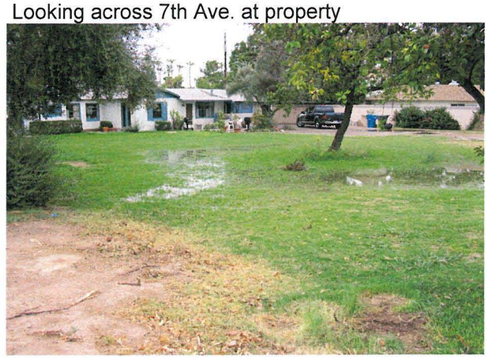
METRO PHOENIX ADMP

8024 North 7th Avenue

Looking at driveway

Looking across 7th Ave. at property

Looking north up 7th Ave.



Adjacent property to south

Approximate Drainage Area = large, approximately 300 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "This property sits lower than street and sidewalk. Depressed driveway entrances are original design but may need to be raised to keep some street water off property. We will not remove driveway approach because of hazard this would present on driveway pad." - COP Street Maintenance

EEC Observations - The driveway appears to have been reconstructed to prevent street flow from entering the property. From a visual analysis, it appeared that the FFE was lower than street elevation. The flow travels south down 7th Avenue.

Conclusion - In any case, if the flow overtops the curb and/or driveway, the house could flood because it appeared as if the FFE was lower than the street elevation. This is a local drainage issue that appears to have been solved for curb high flows in 7th Avenue.

525 West Hayward

Looking west at end of cul-de-sac

Looking east towards 5th Ave.

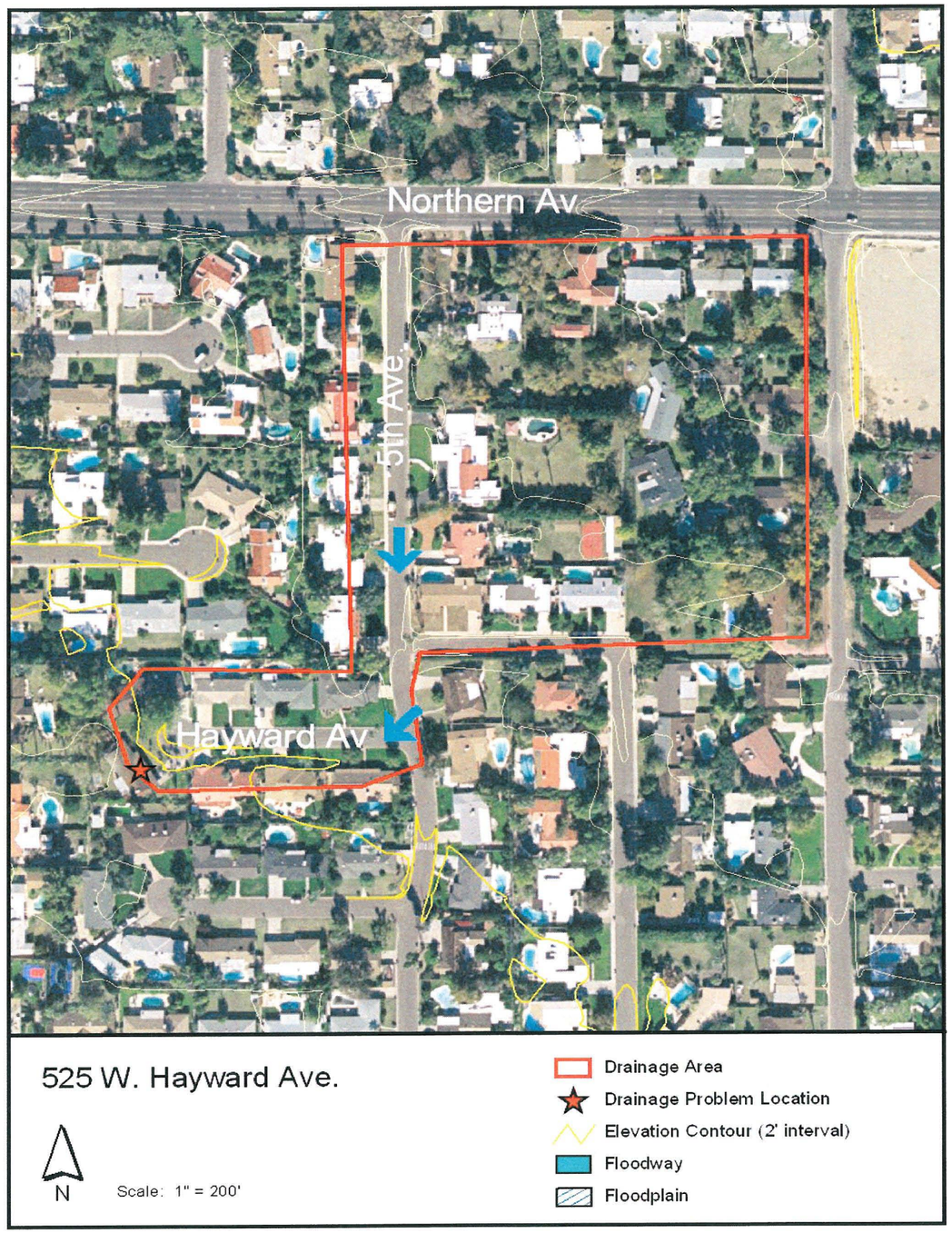
Looking west at end of cul-de-sac

Inlet pipe

Approximate Drainage Area = 11.5 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Storm waters generated in 5th Ave. and Hayward Ave. collect in the cul-de-sac in front of 525 W. Hayward Ave. They drain onto this property through a 4-inch steel pipe located in the curb and pond in the yards. During periods of heavy rainfall, the storm waters threaten to flood the house." - Preliminary Study of Local Drainage Problems

EEC Observations - The FFE appears to be low (unable to determine in visual analysis if FFE is lower than the street). In any storm event, if the roll curb is overtopped, the house would be susceptible to flooding. The 4-inch steel pipe only allows water in the gutter to drain into the yard; avoiding a ponding issue in the street.

Conclusion - The house is at the end of a cul-de-sac that doesn't drain properly. It is susceptible to flooding once the curb is overtopped. This is a local drainage issue.



7644 North 5th Avenue

Looking west along Friar

Looking SW at property

Looking NE

Looking NW at driveway

Approximate Drainage Area = 20.0 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Citizen stated that during rain, the water flowed over the roll curb and flooded into his house. Speed hump west of 5th Ave. on Friar maybe restricting the flow." - COP Street Maintenance

EEC Observations - 5th Avenue is humped up just south of Friar. If 5th Avenue is overtopped, there is still fall to the south to carry flow away from property. On the north side of the property to the west of 5th Avenue, there is only roll curb protecting the house and the south curb appears lower than the north curb, which forces the water to the south side of the street. Once the roll curb overtopped, the house is susceptible to flooding. The house to the east also appeared susceptible to flooding.

Conclusion - If the roll curb is overtopped, the houses are susceptible to flooding. Since the drainage area is small, the property could be susceptible to flooding in intense concentrated storm events. This is only a local drainage issue.

8140 North 1st Drive

Inlet

Looking north along 1st Dr.

Looking north along 1st Dr.

Looking west

Approximate Drainage Area = 9.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "There is a small catch basin that gets covered with debris but after it is cleaned will allow all of the standing water to drain." - COP Street Maintenance

EEC Observations - There is a small catch basin with approximately a 24" pipe. There is a potential for flow from Central Avenue reaching the drainage area. If that were the case, the pipe and catch basin could be drastically undersized. The FFE did appear to be above the street elevation.

Conclusion - The inlet is likely sized for the 2-year storm event. The house is still flood prone in the larger events. It is a local drainage issue, but flow could be diverted from Central Avenue which would make it more of a regional issue.

312 West Loma Lane

Looking north at property

Looking north at property

Looking west down easement

Looking west at the entrance to easement

Approximate Drainage Area = 55.8 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Resident would like berms built along fence line in the 10' easement. Claims that water rushes down the easement and floods their backyard. The resident has been advised of her responsibility." - COP Street Maintenance

EEC Observations - Storm water is confined to 3rd Avenue until it overtops the curb then runoff could flow west through the drainage easement. The easement may need maintenance. There is a driveway in place of a curb at the easement entrance with a irrigation box in the gutter which diverts flow in the gutter toward the west.

Conclusion - The house does not appear to be in danger of flooding even if the backyard flooded. This is a local drainage issue.

7508 North 21st Avenue

Looking north up 21st Ave.

Looking south down 21st Ave.

Subject property

Looking south down west side of 21st Ave.

Approximate Drainage Area = 1.0 square mile
FEMA Floodzone Type - X1
Property Owner Description/Complaint "No information available. Repetitive flooding." - COP Street Maintenance

EEC Observations - The property is subject to flooding from flow in 21st Avenue. The driveway appears lower than the top of curb and allows water to enter the property. Orangewood appeared to be higher than 21st Avenue. There are inlets at the northeast and northwest corners of Orangewood and 21st Avenue, but it appears that the house is located at a sag on 21st Avenue, north of the inlets. The FFE also appeared to be close to street elevation. If the curb were overtopped, water could get to the house.

Conclusion - If the stormwater does not overtop the curb, the house will not be flooded. Once water overtops the curb, the house is susceptible to being flooded. This appears to be a local drainage issue associated with a low point in 21st Avenue.

1014 West Myrtle Avenue

Looking northeast at subject property

Looking NE

Looking east down Myrtle Ave.

Looking east down Myrtle Ave.

Approximate Drainage Area = 280 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Repairing the valley gutter and driveway curb resolved the problem." - COP Street Maintenance

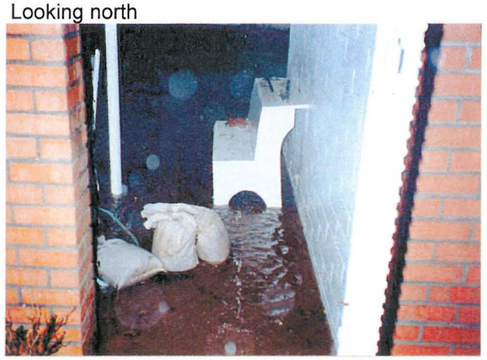
EEC Observations - The valley gutter across 11th Avenue appeared to be relatively new. The FFE elevation is close to curb height based on a visual analysis. It appeared as if smaller storm events had enough slope away from the house that it would not flood. Based on contours, the slope is about 0.0040 ft/ft. It is certainly possible in large storm events that the house could flood.

Conclusion - It is unlikely that the property is flooded in small storm events. In large events, the house is susceptible to flooding if the curb is overtopped. The drainage issue is only a local issue and appears to have been solved with the construction of a new valley gutter across 11th Avenue.

7101 North Central Avenue

Looking north

Looking east



Flooding during storm event

Looking southeast

Approximate Drainage Area = approximately 1.5 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint Parks reshaped the bridal path but water still floods on her property. This area needs a drainage system to resolve flooding along Bridal Path Butler to Bethany. Lynn has been flooded here for years she commented." - COP Street Maintenance

EEC Observations - The FFE appeared lower than the street elevation. Once flow overtops Central and the path, it flows to the front yard. There is no storm drain in Central Avenue north of Bethany Home Road.

Conclusion - Once the path is overtopped, the house is susceptible to flooding. It is likely that most storm events could flood the yard. This appears to be a regional issue associated with the lack of storm drainage in Central Avenue.

7108 North 13th Place

Looking south at end of cul-de-sac

Looking north up 13th Pl.

Looking south at end of cul-de-sac

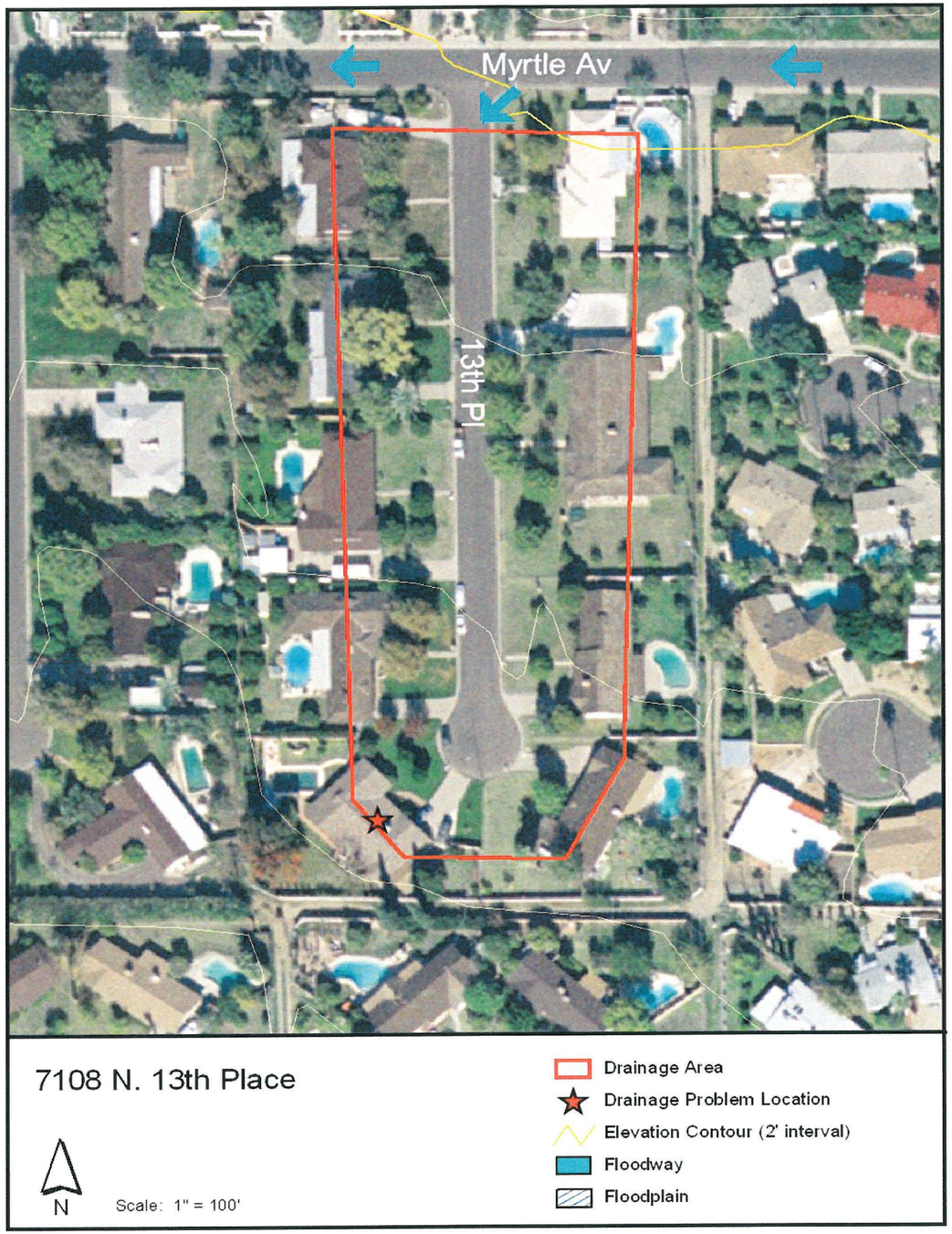
Looking south at end of cul-de-sac

Approximate Drainage Area = 2.6 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "We are suppose to have a 4' dedicated drainage easement between 7107 N. 13th Pl. and 7108 N. 13th Pl. The water is flooding into her garage. The flooding will continue until we have our easement again. I am going to refer this to our investigator Bryan Farnsworth as well. One or both of the property owners have built a berm and blockwall on easement." - COP Street Maintenance

EEC Observations - The drainage area is small but there is likely flow leaving Myrtle Avenue and going south down the cul-de-sac. The FFE appeared be at or below curb elevation (survey is needed to verify FFE). There is no positive drainage way to dewater the cul-du-sac.

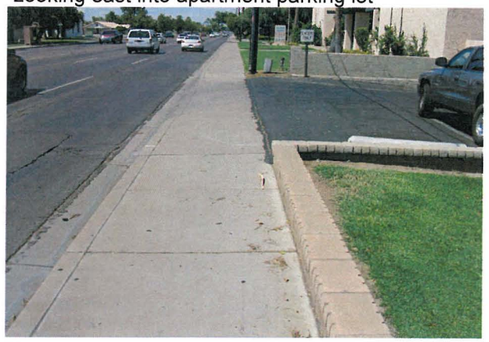
Conclusion - Once the roll curb is overtopped, the house is susceptible to flooding. The front yard will provide some storage before the house is flooded. Even though there is flow leaving Myrtle Avenue, it is still a local drainage issue associated with the lack of a drainage way to dewater the cul-du-sac.



7125 North 19th Avenue

Looking east into apartment parking lot

Looking east into apartment parking lot



Looking north along 19th Ave.

Looking west out of parking lot

Approximate Drainage Area = 4.1 acres (not including flow from 19th Avenue)
FEMA Floodzone Type - X1

Property Owner Description/Complaint This property has good drainage, drywells, etc. The flooding occurs during heavy rain. Rain water from 19th Ave. enters property. Water flows over driveway entrances. It would take a lot of water for this to occur. 2-13-03 was enough to have this occur. Street Maintenance can't fix problem. Unpreventable." - COP Street Maintenance

EEC Observations - The FFE of the property appears to be 2' to 3' lower than street elevation (survey needed to verify this assumption). The adjacent properties all appear to have higher FFE and may be draining to the apartments. Flow coming south down 19th Avenue that overtops the curb appears to be the largest issue

Conclusion - The apartments could be flooded with a small localized storm or a large regional storm. If 19th Avenue is overtopped, the apartments could be flooded. Or if there is enough local runoff in the parking lot, the apartments could flood if the drywells failed or inlets became clogged. Nuisance water is likely an issue after all storms. Even if the flow flooding the apartments is from 19th Avenue, it is still a local drainage issue associated with the apartments low elevation relative to 19th Avenue.

7050 North 8th Avenue

Looking west at property

Looking east

Looking west

Approximate Drainage Area = 2.2 acres (not including flow from 7th Avenue)
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Driveway sits lower than sidewalk when a good rain comes water flows over roll curb and floods driveway. This area does have a good water flow but can't handle a lot of water at one time." - COP Street Maintenance

EEC Observations - Flow can overtop 7th Avenue and flow into Glenn Drive. It appears that the flow would stay in the north half of Glenn Drive. The roll curb is then protecting the house from flooding. From a visual inspection, the FFE is close to or at curb elevation. It does not appear to be in danger of flow entering from the alley.

Conclusion - In any event that produces enough runoff to overtop the curb, the house is susceptible to flooding. This appears to be a local drainage issue.

7015 North Barbados

Looking south

Looking north

Looking southwest

Looking east at property

Approximate Drainage Area = 0.9 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "This development was constructed in the early 70's, during that period there were many similar developments with similar construction in the area that experienced flooding due to non-city reasons. A few flooded because the patios were not given proper outfall, water would fill the patio and flood the house. I suggest until there are specifics to deal with we not invest much more time into it." - Local Drainage Complaint Investigation

EEC Observations - The drainage area for the house is small. The flow in Barbados Place is split between the east and west halves of the street. The water will pond in the street infront of the subject property before it begins to spill to the southwest. If the roll curb is higher than the spill elevation, in the gutter to the southwest, then the house would not be in serious danger of flooding (unable to determine from a visual inspection). Standing water after the storm could be a problem.

Conclusion - If the roll curb is higher than the spill elevation in the gutter to the southwest, then the house would not be in serious danger of flooding (unable to determine from a visual inspection). Standing water could also be an issue. It is a local drainage issue within a development.

1307 West Lawrence

Looking east

Looking southwest at hump

Looking south at property

Looking south at property

Approximate Drainage Area = 7.0 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Lawrence Road slopes from 14th Ave. to the east and ends at a cul-de-sac. The house located at 1307 W. Lawrence Rd. has the lowest pad elevation among all the houses in the cul-de-sac. Discharges from Glendale Ave. spill into a fire/service alley and drain southerly to the site as well as into 14th Ave., which connects to the site from the west." - Preliminary Study of Local Drainage Problems

EEC Observations - It appeared as if it had the lowest FFE of the cul-de-sac based upon a visual inspection. Lawrence Road is humped up (roll curb high) just to the east of 14th Drive preventing flows below curb high from flowing east on Lawrence Road. Flow from the alley to the east of 14th Drive also can contributes flow to the cul-de-sac. It is possible that flow diverts out of the alley and flows across the 2007 West Lawrence property into the cul-de-sac. The alley normally follows two 90-degree bends and discharges to Ocotillo Road but there is nothing to stop the flow from diverting across the 2007 parcel. There were no signs of flow leaving the alley but a large enough storm could generate runoff that could get to the subject property.

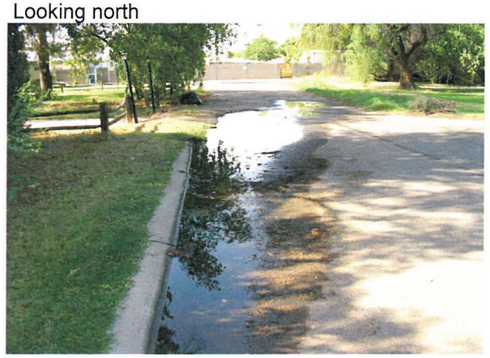
Conclusion - If the roll curb is overtopped, the front yard and the house are susceptible to flooding. It is a local drainage issue that may have been resolved with the hump in Lawrence.

11th Avenue and Tuckey Lane

Looking west

Looking north

Looking east



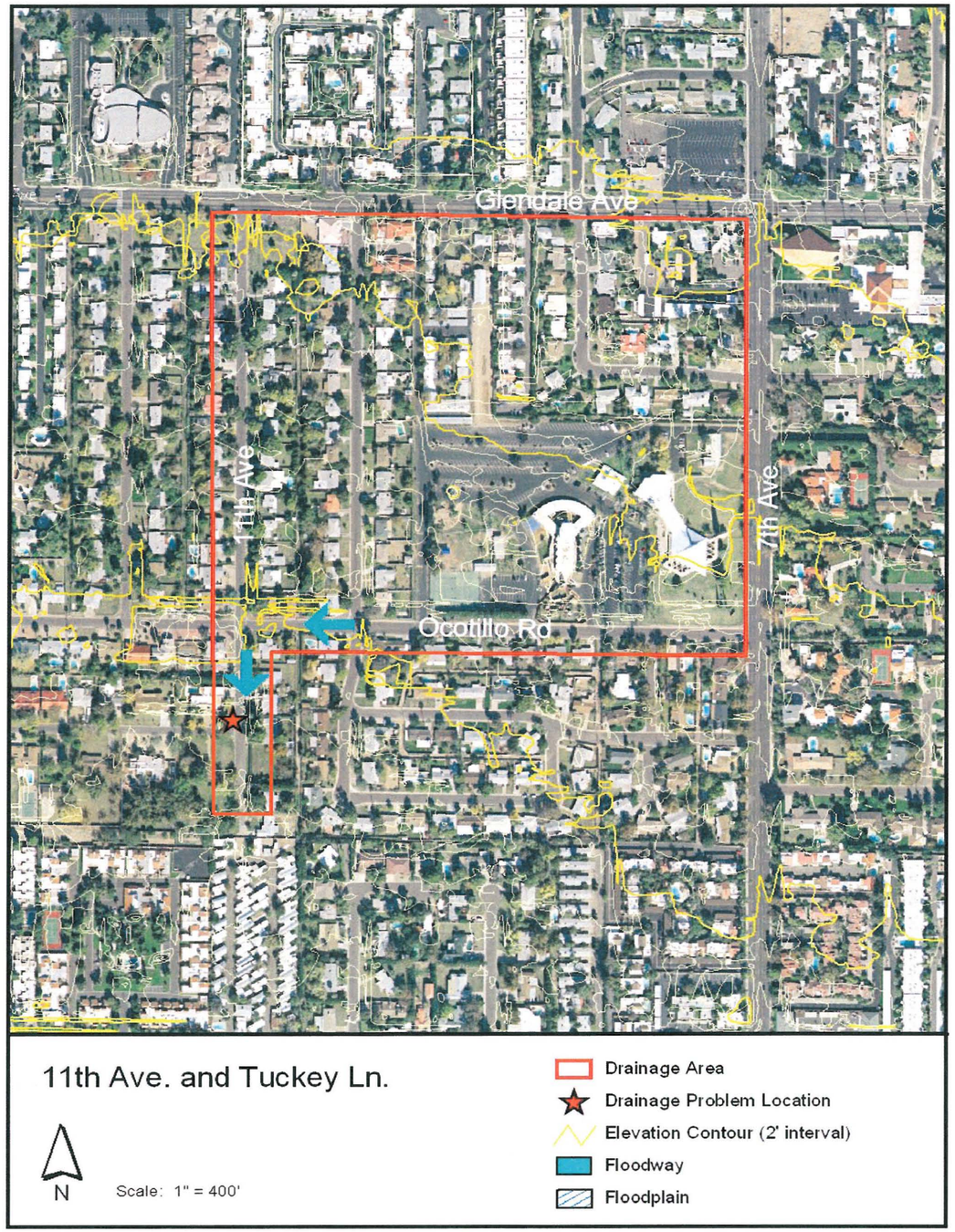
Looking south

Approximate Drainage Area = 50.0 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Flooding in this area occurs when discharges exceed the capacities of the existing drainage pipe and flows back up the existing headwall. Three properties immediately adjacent to the ditch are affected by the flooding: a mobile home park and two private residences." - Preliminary Study of Local Drainage Problems

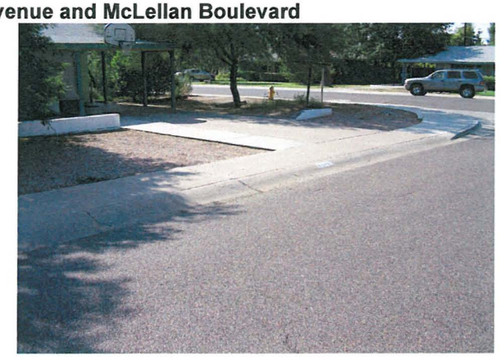
EEC Observations - There is a channel that runs south along the east side of the street. It is possible that the channel may need regrading. While at the site on 8-02-05, Kurt Stinson stated that the channel also needs regular maintenance. There is also an issue of standing water for 2-3 days after storms.

Conclusion - It is a localized flooding problem that could be solved by regrading the channel. Standing water is an issue after any storm. The houses are probably only susceptible to flooding in the large storm events.



6615 North 10th Avenue, 10th Avenue and McLellan Boulevard

Looking south



Looking southeast

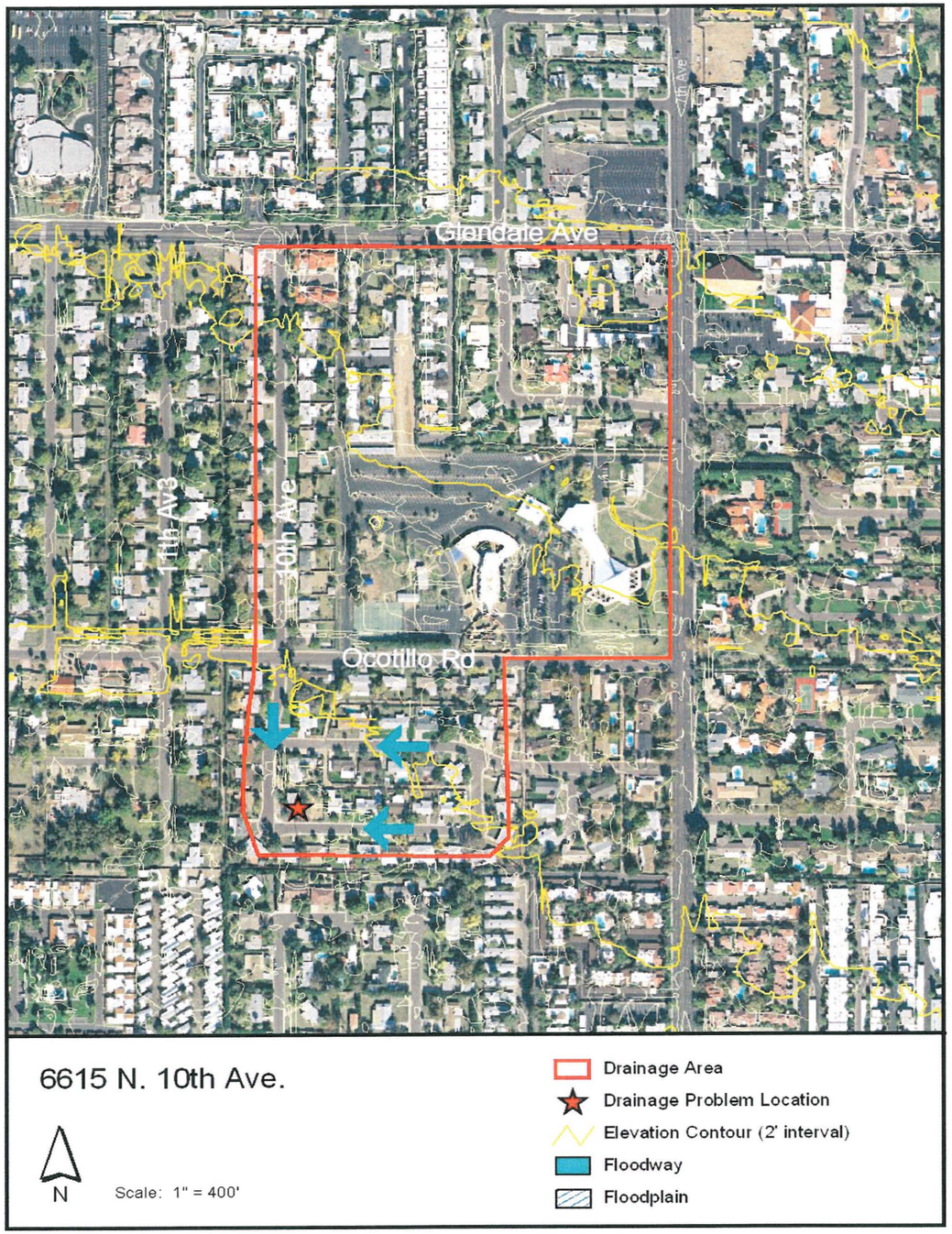
Looking southwest

Looking southwest

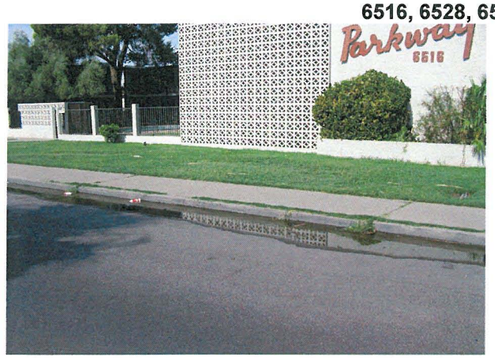
Approximate Drainage Area = 45.6 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "This was a one time flooding problem. Catch basin south of address was dirty, cleaned the same day." - COP Street Maintenance

EEC Observations - Flow comes south down 10th Avenue. If the roll curb is overtopped, then flooding becomes an issue. The FFE was close to the curb elevation based on a visual analysis. There are two existing inlets. 911 and 917 West McLellan Avenue are dealing with this flooding problem as well.

Conclusion - There is a small drainage area that flows to the intersection of 10th Avenue and McLellan. If the inlets are functioning properly, they likely protect the houses from the small storm events. However, if the inlets are exceeded, the houses are susceptible to flooding because there isn't a surface flow outlet. It is a local drainage issue.



6516, 6528, 6542 North 17th Avenue



Looking west

Looking south

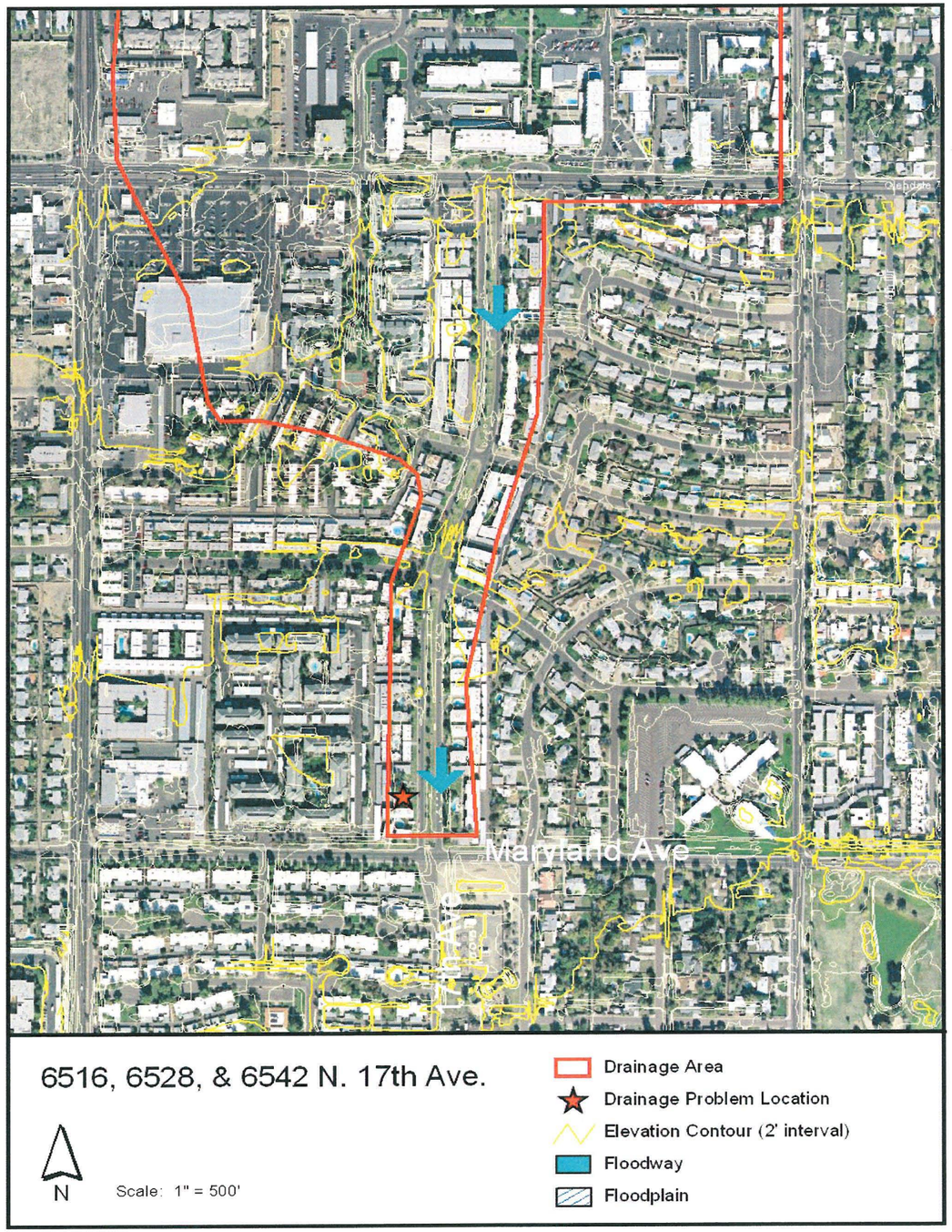
Looking north

Looking southwest

Approximate Drainage Area = 1.25 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Flooding of the apartments occurs when water flows from Glendale Ave. to Maryland Ave. along 17th Ave. The water overtops the sidewalk curb on the west side of 17th Ave. and floods several apartments. Water is also believed to flow from the alley behind the complex into the apartments. The finished elevation of the apartments is lower than that of the sidewalk and alley so that water flows into the apartments from both the alley and the street." - Preliminary Study of Local Drainage Problems

EEC Observations - The FFE's are all lower than the street elevation based on a visual analysis. There is vertical curb along the west side of 17th Avenue. Without survey, it is not possible to tell if flow leaves the alley and gets to the apartments.

Conclusion - Once the flow overtops the roll curb, the apartments are susceptible to flooding. 17th avenue has a median which could be utilized to increase conveyance. 17th Avenue is a conveyance corridor for a large area and this issue could constitute a regional drainage issue.



917 West McLellan Boulevard

Approximate Drainage Area = 52 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint Repetitive flooding.

EEC Observations - Flow comes south down 10th Avenue. If the roll curb is overtopped, then flooding becomes an issue. The FFE was close to the curb elevation based on a visual analysis. There are two existing inlets. 911 and 917 West McLellan Avenue are dealing with this flooding problem as well.

Conclusion - There is a small drainage area that flows to the intersection of 10th Avenue and McLellan. If the inlets are functioning properly, they likely protect the houses from the small storm events. However, if the inlets are exceeded, the houses are susceptible to flooding because there isn't a surface flow outlet. It is a local drainage issue.

1720 West Bethany Home Road

Looking north

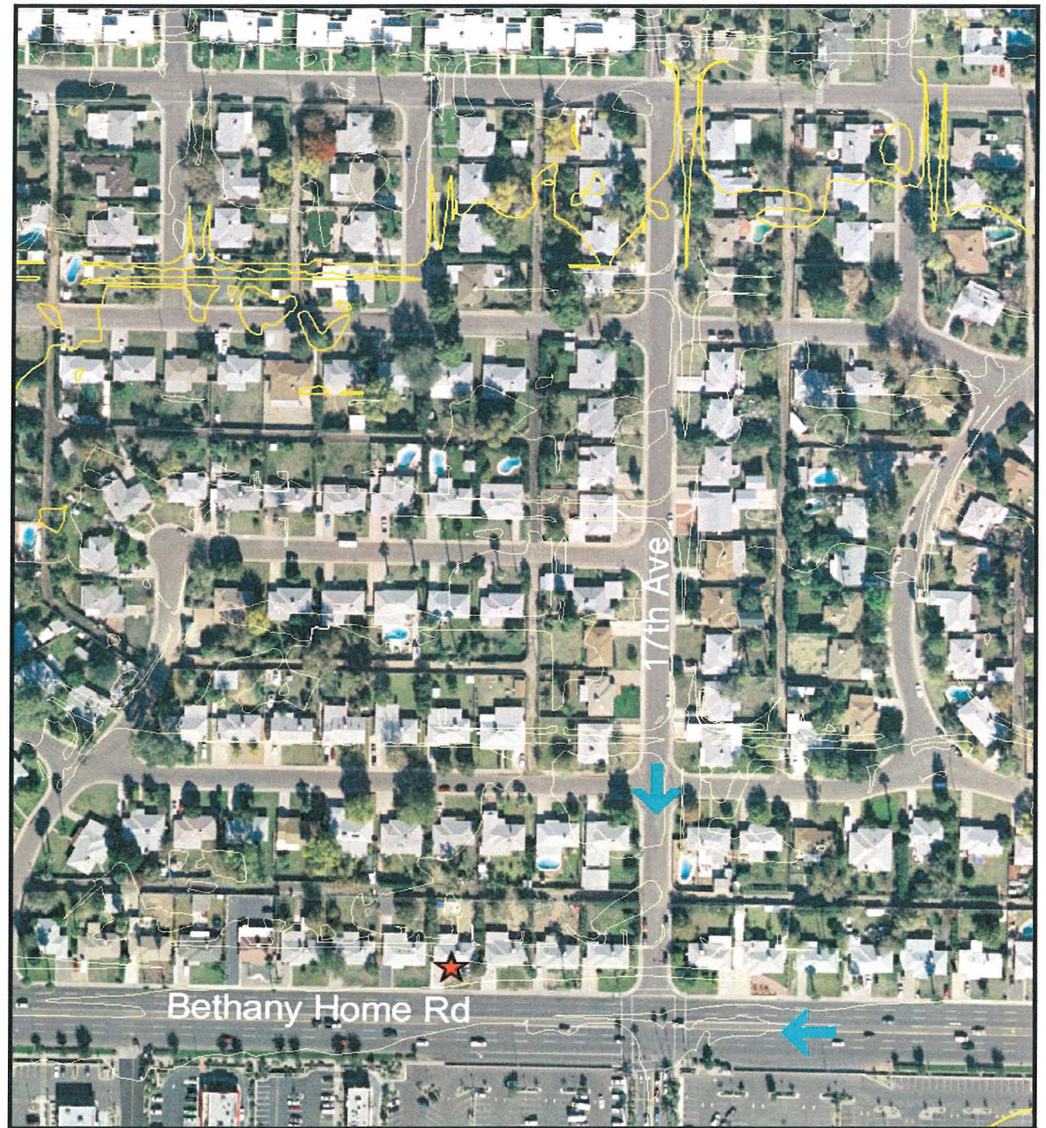
Looking east

Looking west

Approximate Drainage Area = approximately 320 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Storm drain functions properly." - COP Street Maintenance

EEC Observations - East of 17th Avenue, there are multiple type "n" inlets. Between 17th Avenue and the subject property, there are no catch basins. The FFE appeared to be close to the crown height of Bethany Home Road from a visual inspection. On the south side of Bethany Home, Spectrum Mall prevents flow from going south. Once the roll curb is overtopped, the property is subject to flooding.

Conclusion - The property is only protected from flooding by the roll curb. It is likely that Bethany Home exceeds capacity and floods the property in large storm events. This problem may constitute a regional issue. That is, this area is the old Cave Creek floodplain where there is little east-west conveyance, and since Spectrum Mall prevents flow going south, the water that exceeds the storm drain capacity tends to spill over the curb.

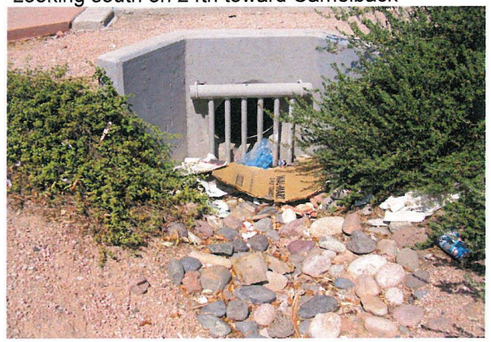


24th Avenue and Camelback Road

Looking north on 24th Ave

Looking south on 24th toward Camelback

Looking west

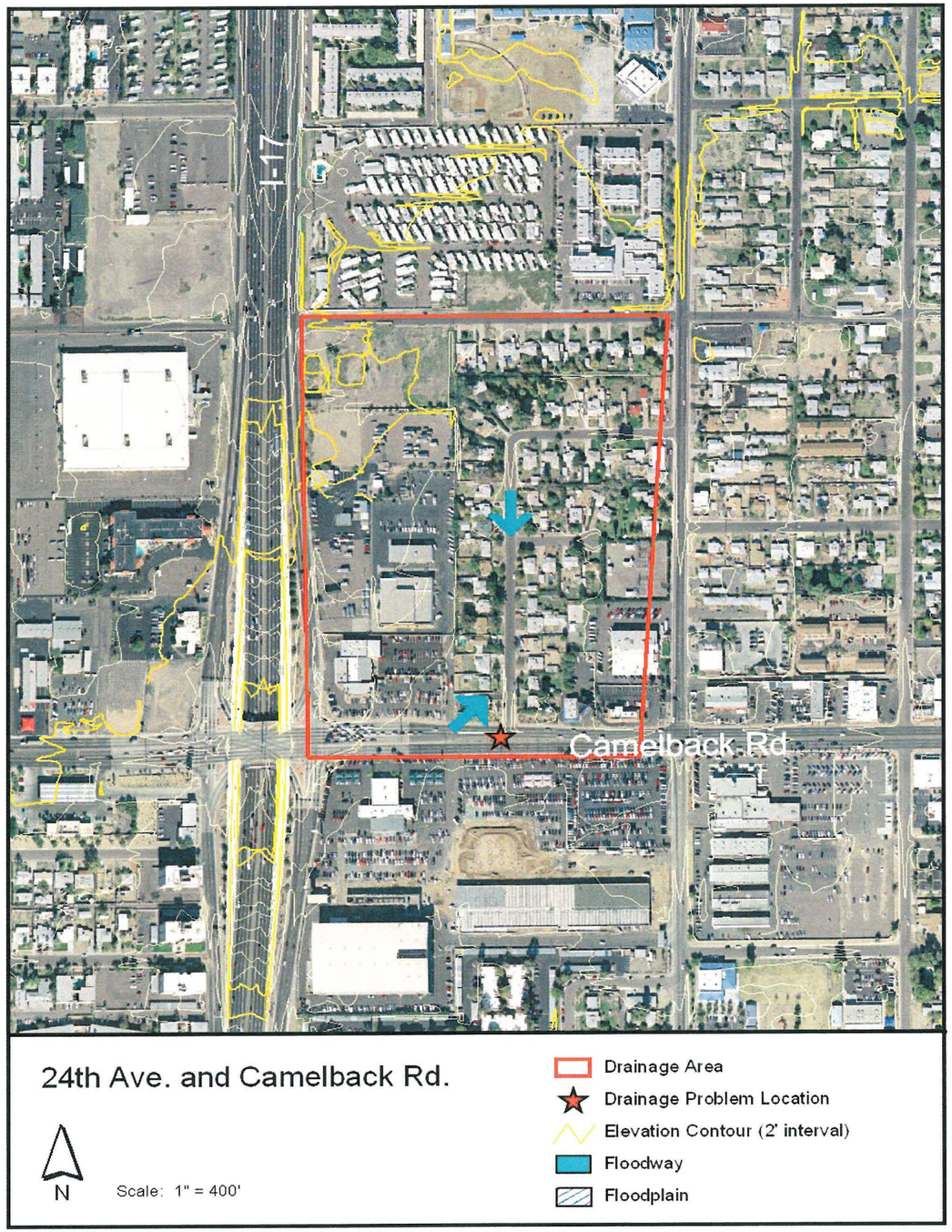


Outlet

Approximate Drainage Area = 31.8 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "The houses and properties beginning at Camelback and extending north on both sides of 24th Ave. regularly flood during storm events. Flooding may be caused by three situations at this location. First the flows generated within the drainage area exceed the interception capacity of the existing catch basins. Second, the hydraulic gradeline of the main line storm drain in Camelback is higher than the ground at the existing catch basin and flows bubble out. Camelback may be in a sag condition, causing flows to drain back into 24th Ave. where they pond." - Report

EEC Observations - There are low FFE's within this area. Flow could also drain back to the subdivision from Camelback

Conclusion - The description from the complaint is accurate. The intersection is a low point with a relatively large offsite drainage area. There is currently a project underway in this area to purchase homes and create detention basins. This is a regional drainage issue that should be improved with the City's detention basin project.



23rd Avenue: Campbell to Turney

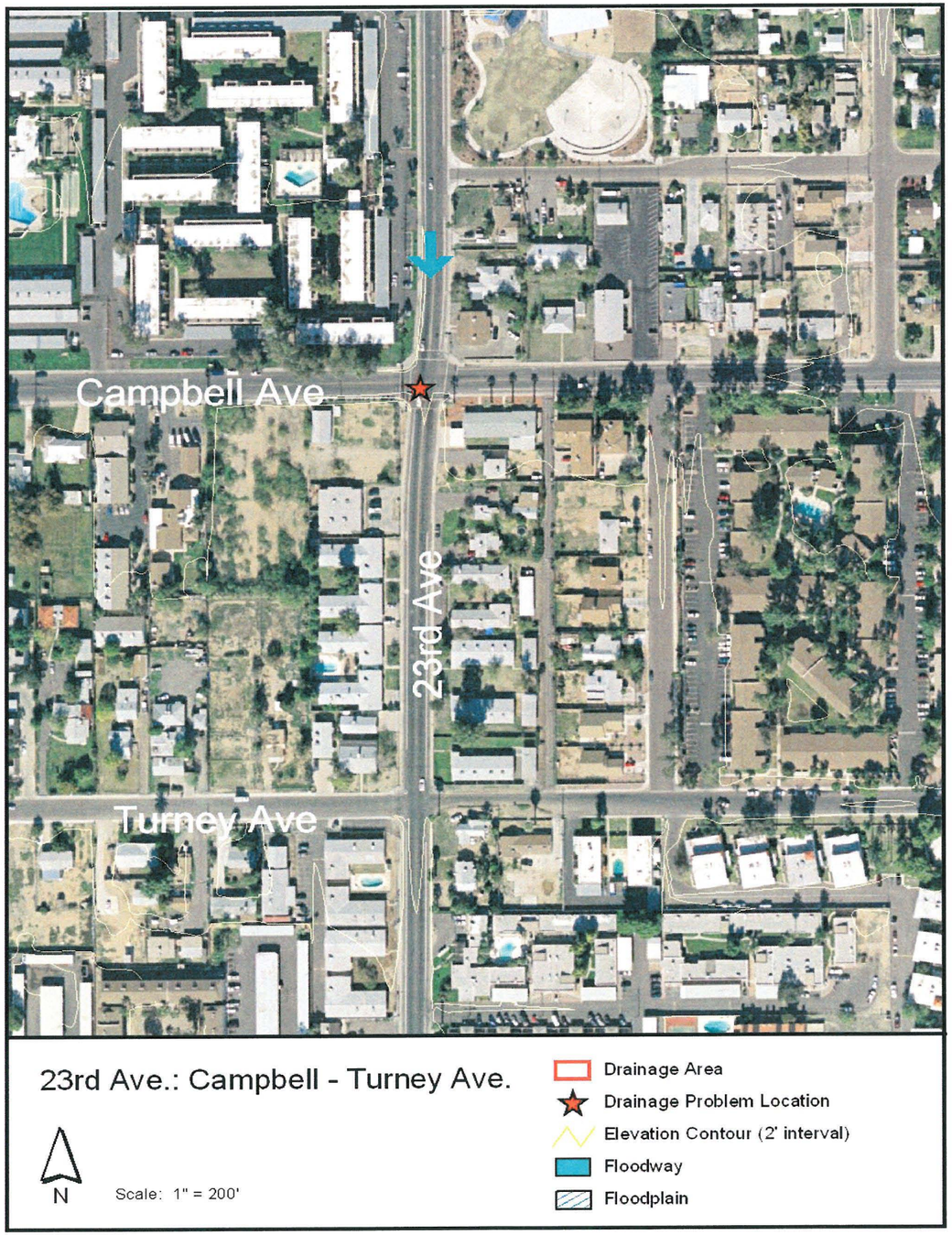
Inlet

Looking south on 23rd Ave.

Approximate Drainage Area = 2.5 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Storm water and discharges during irrigation, floods street, drains after irrigation complete." - COP Street Maintenance

EEC Observations - There are some inlets along 23rd Avenue to pick up the flow travelling south down 23rd Avenue. From a visual inspection, there does not appear to be any sag along 23rd Avenue (survey was not taken). The pipe may be undersized along 23rd Avenue.

Conclusion - The pipe and/or inlets may be undersized. It also appears to only be a street flooding issue and, therefore, is a local drainage issue.



4515 North 23rd Avenue

Looking NE at property

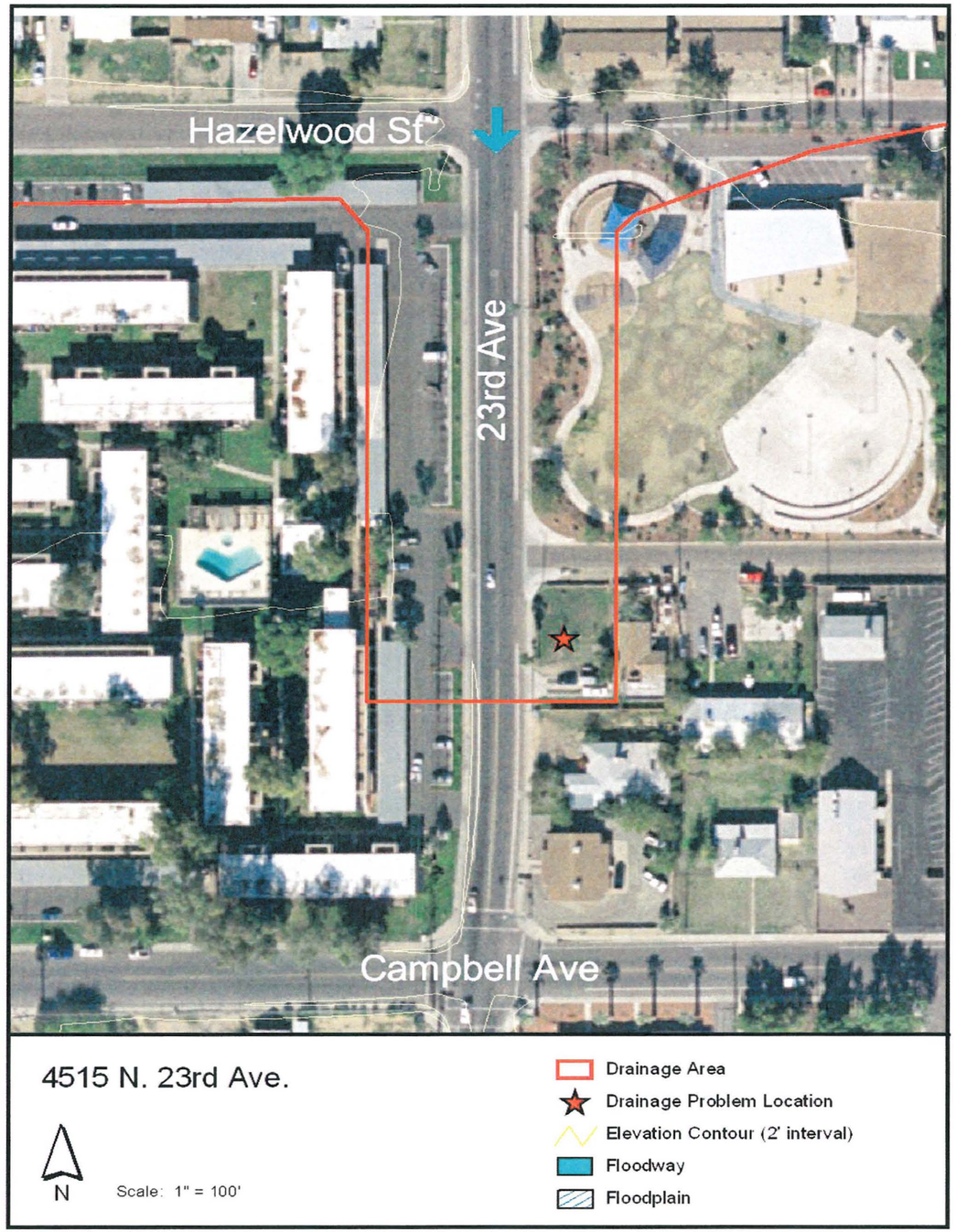
Looking east across 23rd Ave.

Looking south down 23rd Ave.

Approximate Drainage Area = 2.5 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint "2-13-03 rain storm. 23rd Ave. could not handle the flow of water all at once. Overflowed onto property. May need catch basin at 23rd Ave. and Minnezona. This flooding seems to only occur during heavy rains." - COP Street Maintenance

EEC Observations - The property appears to have a low FFE, but there does not appear to be any problem. The flow goes south down 23rd Avenue and it appears that it will continue flowing south past the property, although there may be a shallow low spot in the gutter near the property.

Conclusion - If the roll curb is overtopped, the property is susceptible to flooding. The large storm events could overtop the curb. It is only a local drainage issue.



1802, 1836 West Turney Avenue

Looking east along Turney

Looking northwest

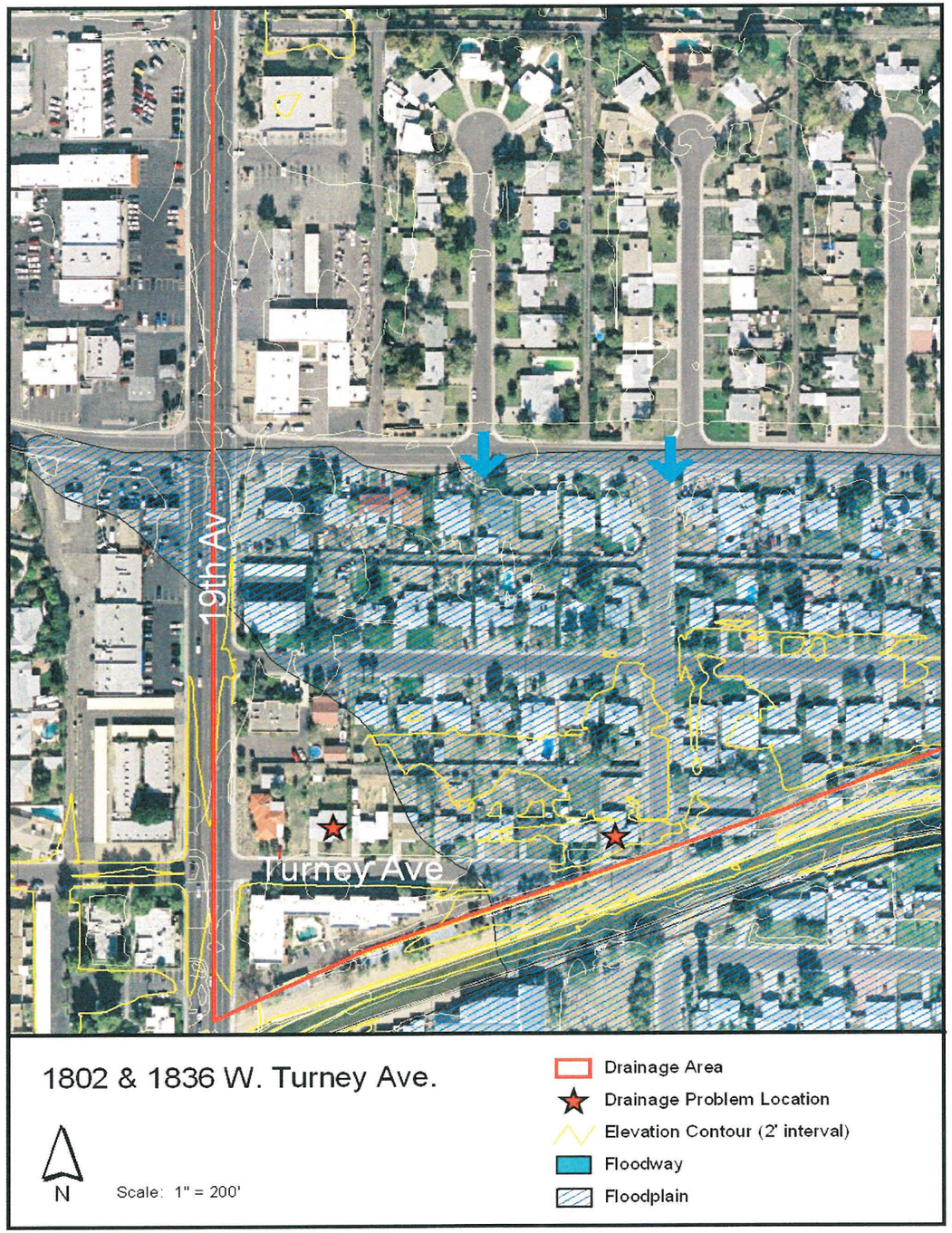
Looking west along Turney Ave.

Parking lot between canal and properties

Approximate Drainage Area = approximately 7.5 sq. miles
FEMA Floodzone Type - AE
Property Owner Description/Complaint "No recent RFS's reflooding at 1836 W. Turney Ave. Only during heavy rains." - COP Street Maintenance

EEC Observations - There is ponding behind the Grand Canal. The FFE's appeared to be lower than the canal embankment.

Conclusion - Survey could be completed to verify the assumption that the FFE's are lower than the canal embankment. The properties are in a floodplain where there is known ponding behind the canal embankment. The properties could flood in most any storm events. The ponding behind the canal is a regional problem.



635 West Glenrosa Avenue

Looking east towards property

Looking west from property

Looking east from property

Looking north

Approximate Drainage Area = 26.6 acres
FEMA Floodzone Type - X1
Property Owner No information.
Description/Complaint

EEC Observations - The property is subject to flooding from the east, west and north. The flow from the west is likely only a small portion and could be intercepted by the inlet at the corner of 7th Avenue. The flow from the north is likely the majority of the runoff getting to the property.

Conclusion - It appears that this is a local drainage issue even though there may be flow from the north, east, and west impacting the property. The potential drainage area is relatively small, unless runoff spills over the Grand Canal.

1735 West Roma Avenue

Looking south at property

Approximate Drainage Area = 15.6 acres
FEMA Floodzone Type - AE
Property Owner Description/Complaint No information. "Score 107" - COP Street Maintenance

EEC Observations - There is ponding behind the Grand Canal. The FFE appeared to be lower than the canal elevation.

Conclusion - Survey could be completed to verify the assumption that the FFE's are lower than the canal embankment. The property is in a floodplain where there is known ponding behind the canal embankment. This is a regional issue with ponding behind the canal.

4506 North 11th Avenue

Looking north up 11th Ave.

Curb opening inlet

Inlet

Looking SW at property

Approximate Drainage Area = approximately 2.5 sq. miles
FEMA Floodzone Type - AE

Property Owner Description/Complaint First, the existing levee located to the south and running parallel to the Grand Canal causes flood waters to back up, thereby completely inundating the site and adjacent properties. Second, the flow in 11th Ave. exceeds the roadway's conveyance capacity and the property becomes flooded. The property is lower than the existing curb. Flood waters which overtop the curb onto the property cannot flow back to the roadway. The street does not have the capacity to convey the 2-year storm." - COP Street Maintenance

EEC Observations - The City has installed new inlets that will help alleviate the problem described above, but in larger storm events, the homes will still be susceptible to flooding.

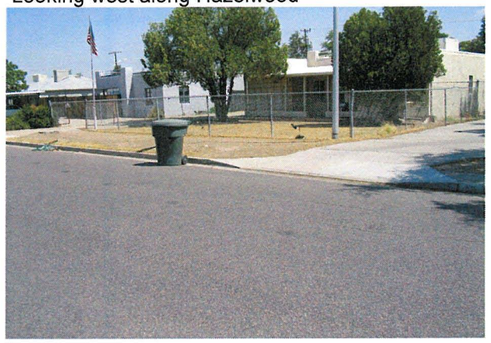
Conclusion - The ponding behind the canal is a regional issue, but the issue of flow from the north exceeding the street capacity is a local drainage issue that has been solved with the addition of new inlets.

505, 585 West Hazelwood Avenue

Looking south

Looking west along Hazelwood

Looking east



Looking south

Approximate Drainage Area = approximately 2.5 sq. miles
FEMA Floodzone Type - A
Property Owner Description/Complaint "Standing water, no inlets." - COP Street Maintenance

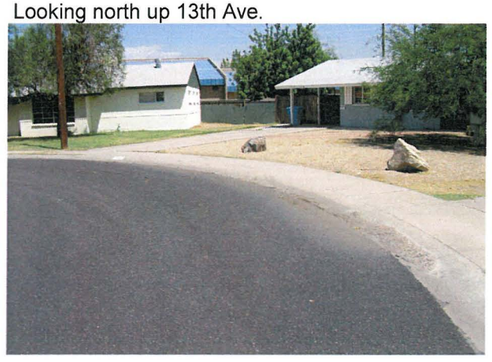
EEC Observations - The FFE's appear to be lower than the Grand Canal embankment elevation. Water that ponds behind the canal could flood the property. There may also be standing water in the street due to a very flat street slope in the east-west direction.

Conclusion - Survey could be completed to verify the assumption that the FFE's are lower than the canal embankment. The property is in a floodplain where there is known ponding behind the canal embankment. This is a regional issue, although the regular standing water problem in the street is a local problem that could be resolved with the addition of a storm drain lateral.

1219 West Elm Lane

Looking north up 13th Ave.

Looking southeast at property

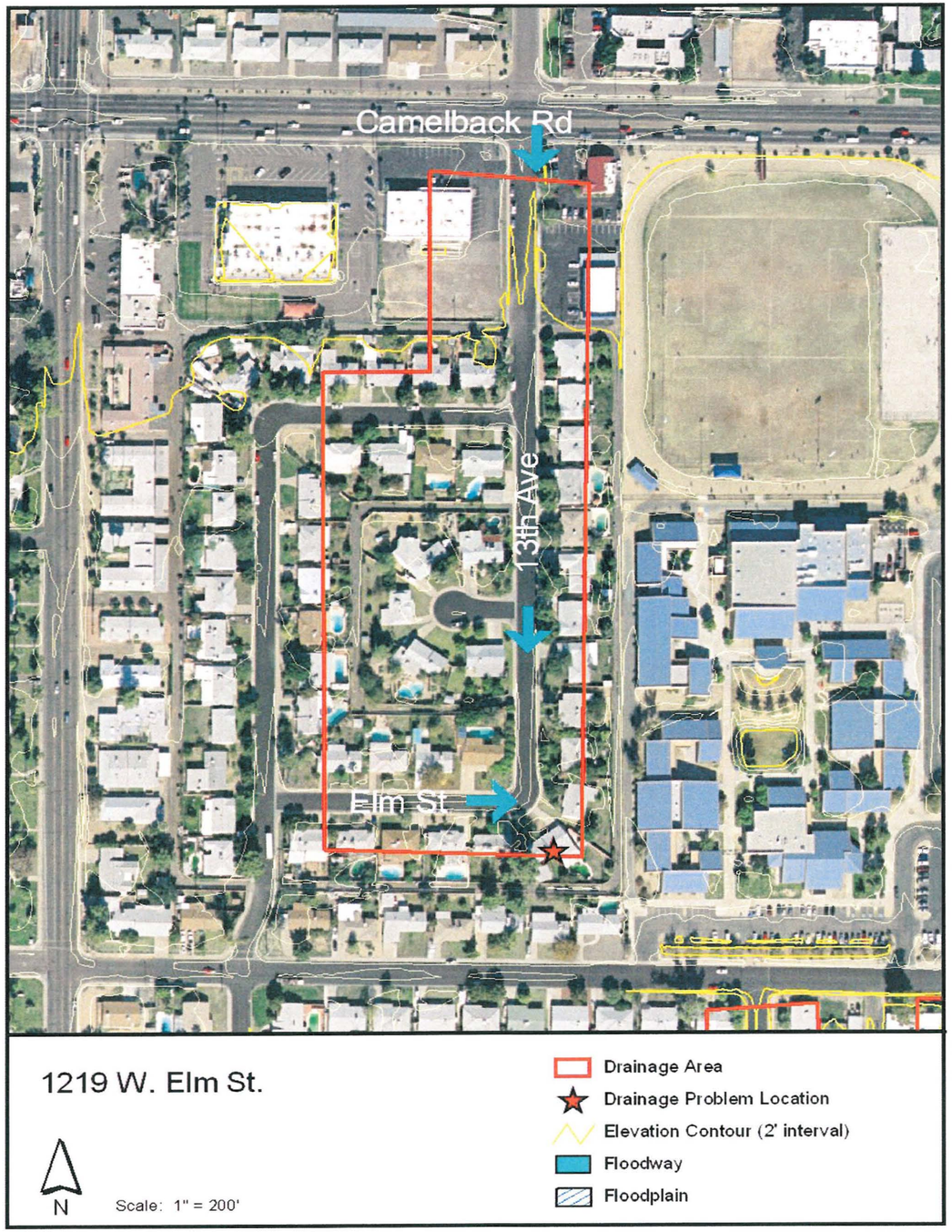


Looking east at property

Approximate Drainage Area = 8.1 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Guest house flooded after July 14th rain. Water flows around radius. Too much water at one time. Water flows over roll curb. May need a catch basin or sump in the radius at 1219 W. Elm." - COP Street Maintenance

EEC Observations - FFE does not appear to be much higher than roll curb (survey was not taken to verify this assumption). Flow goes south down 13th Avenue and east down Elm Lane, once this point is reached there is nowhere for it to flow to so it ponds.

Conclusion - If the roll curb is overtopped, the house is susceptible to flooding. This is only a local drainage issue.



4821 North 7th Street

Looking south along 7th St. (east side)

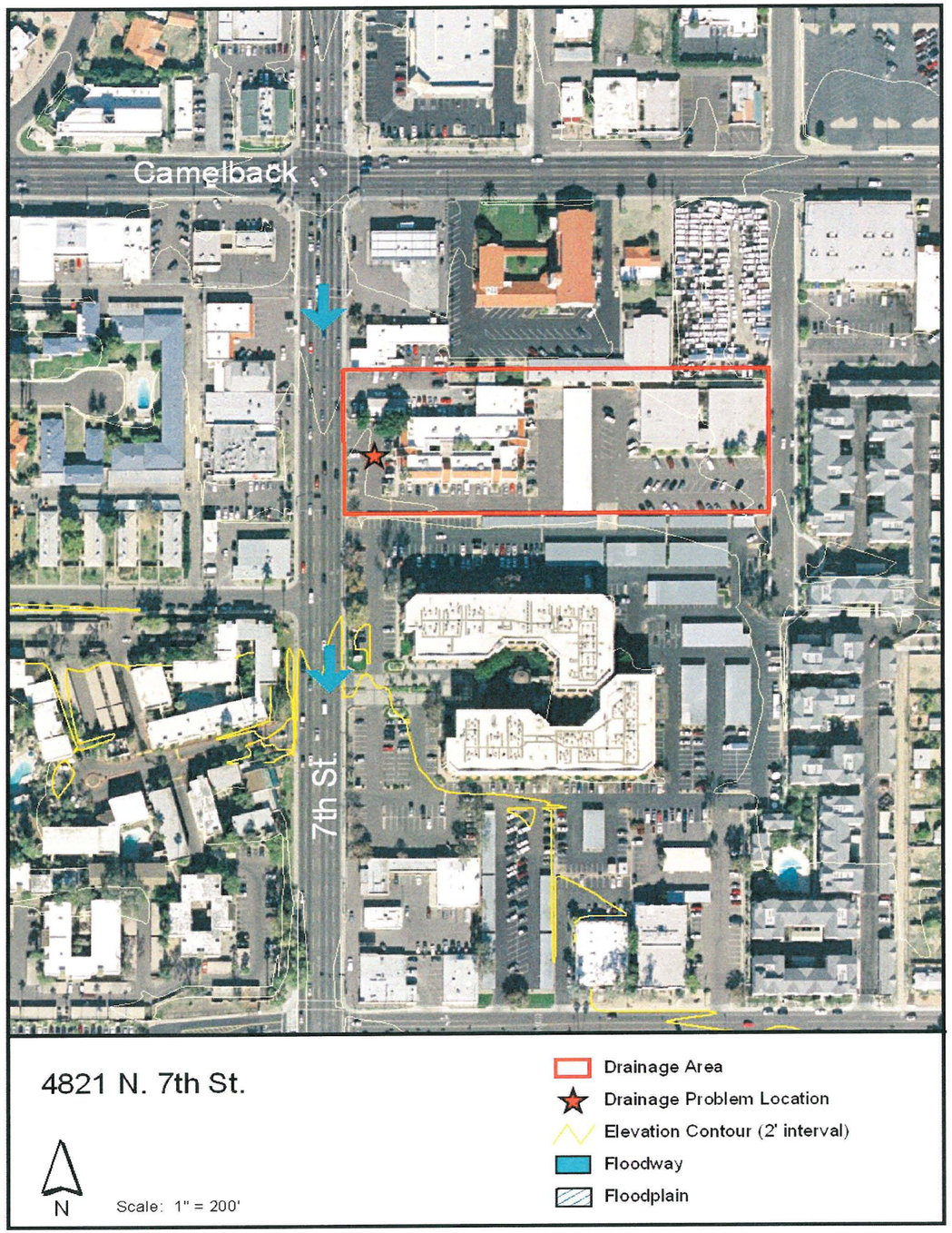
Looking north along 7th St. (east side)

Parking lot of adjacent southern business

Approximate Drainage Area = 3.5 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Repetitive flooding." - COP Street Maintenance

EEC Observations - Unable to locate 4821 but assumed to be 4811. There was evidence of parking lot flooding that appeared to have been from onsite runoff. It is unlikely, even in large storm events, that 7th Street will overtop the humped driveway and flood the business.

Conclusion - It does not appear that there is any drainage problem other than the parking lot runoff ponding onsite after a storm. This is a local drainage issue.



12th Avenue and Missouri Avenue

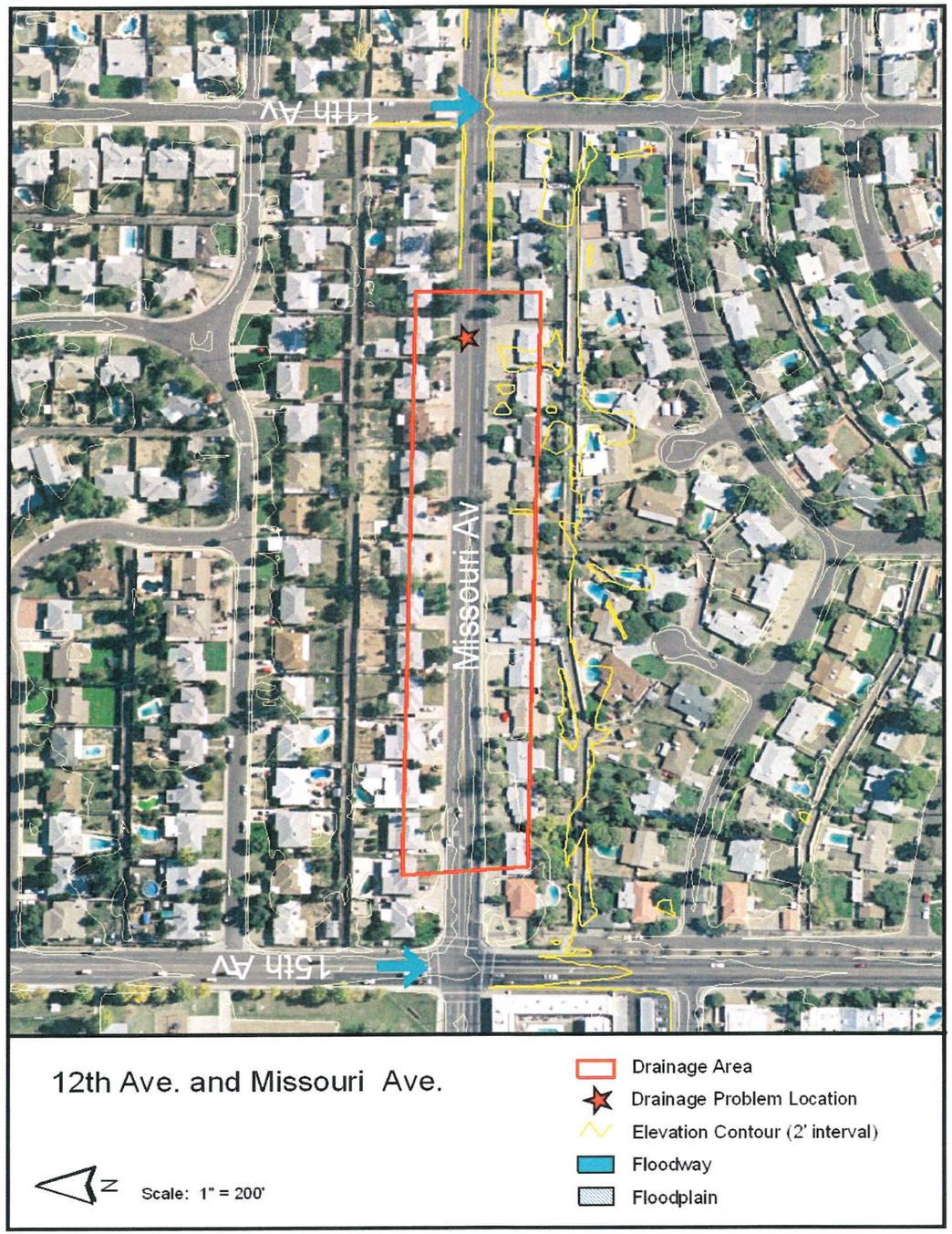
Looking west along Missouri

Looking east along Missouri

Approximate Drainage Area = 4.1 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "There are no catch basins at this location; this was a street problem only. Also see 12th Avenue and Montebello." - COP Street Maintenance

EEC Observations - The FFE's appear to be above crown height (based only on a visual inspection, no survey was taken). It appeared that flow would be able to get to either 15th or 11th Avenue then continue to flow south, although the east-west street slope is relatively flat.

Conclusion - This appears to be a local drainage issue associated with the flat gutter slope.



37 West San Juan Avenue

Looking west

Looking east towards Central

Looking east towards Central

Approximate Drainage Area = 2.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint No information available.

EEC Observations - From approximately 75'-100' west of Central, San Juan drains west to the end of the cul-de-sac. Standing water after storms could be an issue at the end of the cul-de-sac.

Conclusion - It is unlikely in smaller events that there are any problems other than street flooding and standing water. In large events, there may not even be house flooding (the FFE's appeared to be significantly above curb height but survey would be needed to verify this). This is a local drainage issue associated with inadequate drainage at the end of the cul-de-sac.

719 West San Miguel

Looking east along San Miguel towards 7th Ave.

Looking west along San Miguel

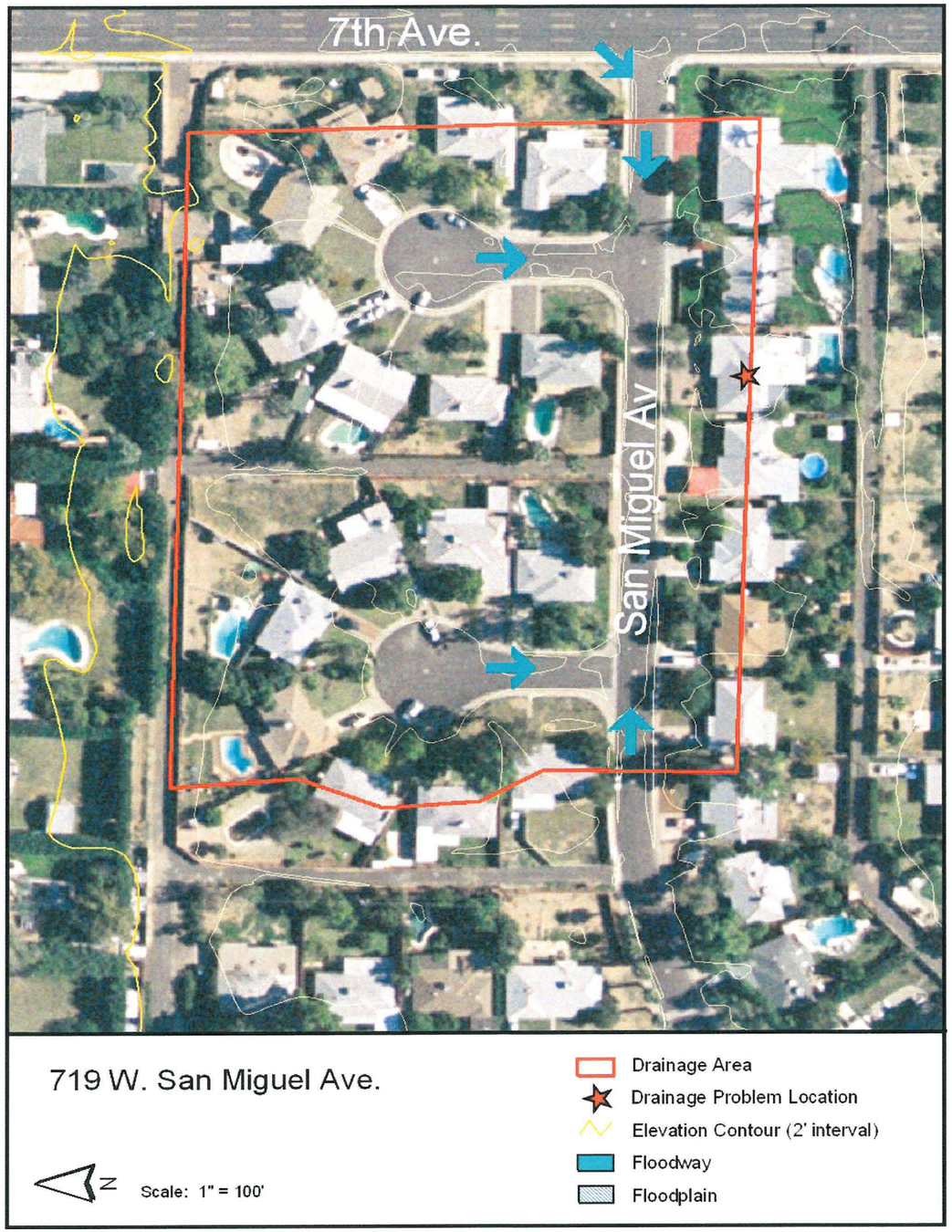
Looking south across San Miguel

Looking south across San Miguel

Approximate Drainage Area = 4.8 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Valley gutter in street. Curb and gutter is really flat in area. Water runs from north to south in valley gutter. Water sits at the south end and ponds. Cars drive by and force water onto driveway. You need to have a consultant look at this." - COP Street Maintenance

EEC Observations - There is a valley gutter that runs south directly to the subject property. There is no where for the flow to go at that point. The roll curb is the only protection for the property from flooding. At the end of the valley gutter, it appears as if this is a ponding area due to visible watermarks.

Conclusion - Even though the drainage area is small, the property is susceptible to flooding in small events. It is a very localized drainage issue associated with low points in the gutter on San Miguel.



807 West Solano

Looking at NW corner of 10th Ave. and Solano

Looking south at property

Looking at NE corner of 10th Ave. and Solano

Looking southeast at property

Approximate Drainage Area = approximately 0.5 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Property is set lower than the street. During rain, the water jumps the roll curb and floods yard. This street takes a lot of water from the west toward 10th Ave. This is the second time his yard has flooded." - COP Street Maintenance

EEC Observations - The FFE appears to be lower than the crown of the street. There is a split at 10th Avenue which would require survey to accurately define the split. The subject property could be the low point between 7th Avenue and 10th Avenue.

Conclusion - The house/yard will experience flooding once the roll curb is overtopped. The drainage area is relatively small and it is a local drainage issue.

Central Avenue and San Juan Avenue

OMITTED

Approximate Drainage Area = 100.7 acres
FEMA Floodzone Type - X1
Property Owner No information.
Description/Complaint

EEC Observations - See 37 West San Juan Avenue.

Conclusion -

5608 North 9th Street

Looking east

Looking south

Subject property

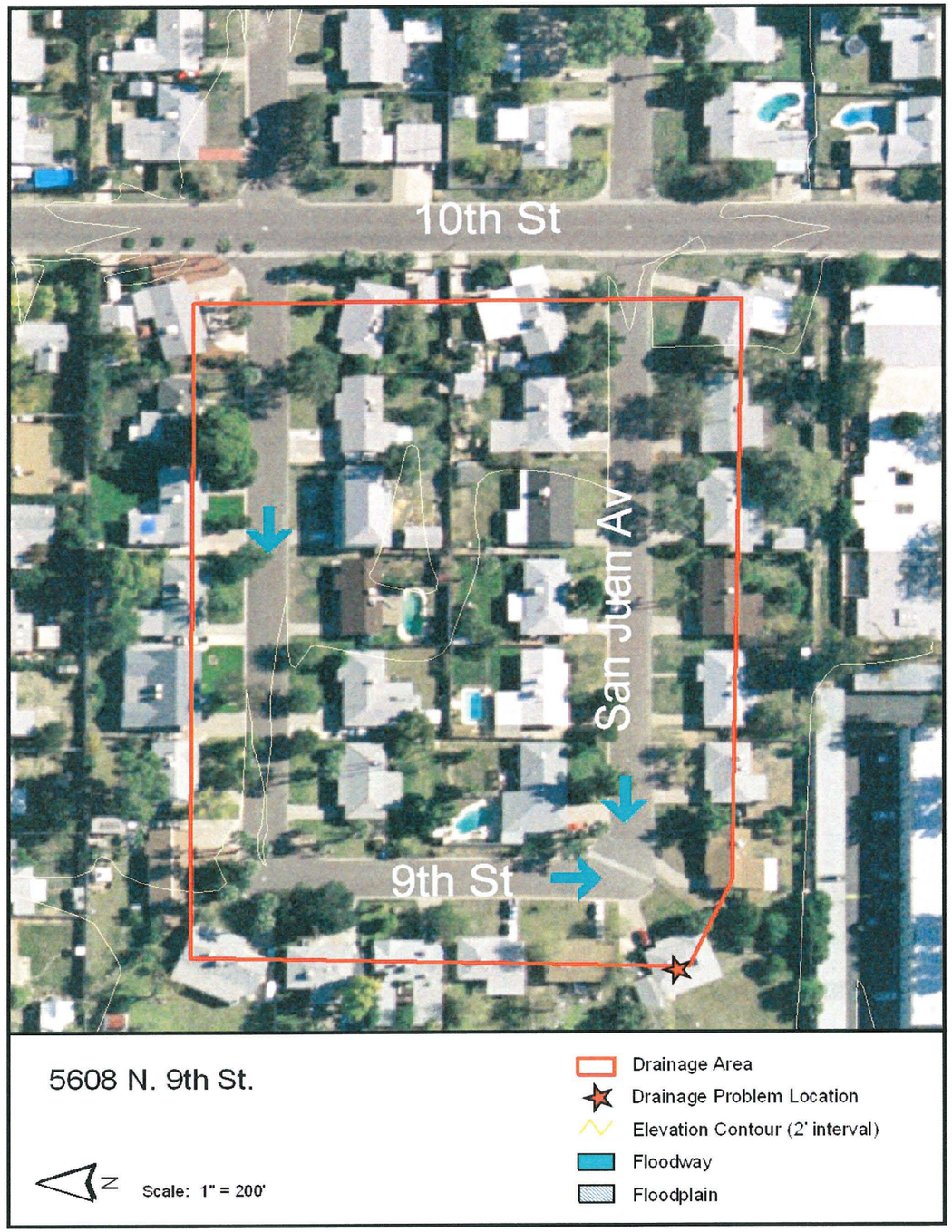
Looking north

Approximate Drainage Area = 4.6 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "An inlet grate is located in the curb at the front edge of the property. The catch basin below the grate is connected to a drain pipe which terminates at a grated outlet located in the parking lot of an apartment complex behind the property at 800 E. Missouri. The water flows through the complex parking lot to Missouri Ave. Debris clogs the grate, preventing the local drainage from exiting the site and resulting in flooding of the property on 9th St." - Preliminary Study of Local Drainage Problems

EEC Observations - The drainage area is small. The subject property is the concentration point for the entire drainage area. The house appeared to have a low FFE from a visual inspection (no survey was completed to see if the FFE was below the street elevation).

Conclusion - It is likely there is ponded water during any storm event. Once the roll curb is overtopped, the property is susceptible to flooding. It is a localized drainage issue.



25th Street and Camelback Road

Looking south across Camelback

Looking south across Camelback

Approximate Drainage Area = approximately 0.5 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint "There is no flooding issue at this location. J. Gonzales mentioned valley gutters to solve the problem of corner ponding. Fred Flores of SE Maintenance district will assume construction of valley gutters." - COP Street Maintenance

EEC Observations - There are significant curb openings for drainage.

Conclusion - There appears to be no flooding problem at this location.

San Juan Avenue, East of 20th Street

Looking east across 20th St.

Looking north

Looking east

Garage of Property on NE corner

Approximate Drainage Area = 39.7 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Has been studied, and is currently on hold to see if the issue was resolved." - COP Street Maintenance

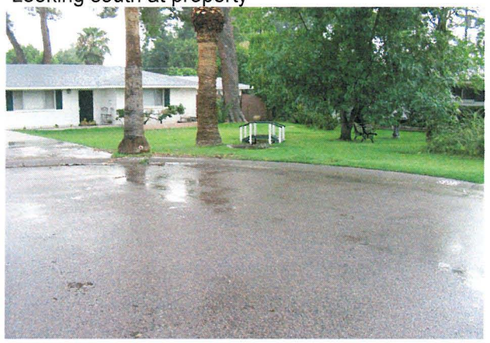
EEC Observations - The intersection has a relatively large drainage area. It is subject to flow from both 20th Street and San Juan Avenue. The home on the northeast corner is the most susceptible to flooding. There was a small amount of standing water and a large amount of dirt and debris on the corner. The problem appears to be a standing water issue.

Conclusion - It is unlikely that there is any house flooding in the smaller events but in the large events it is possible that houses with low FFE's could flood. This appears to be a local drainage issue associated with standing water at the corner.

5806 North 14th Place

Looking south at property

Looking north



Looking south at property

Approximate Drainage Area = 2.4 acres
FEMA Floodzone Type - X1
Property Owner No information available.
Description/Complaint

EEC Observations - The drainage area is small although it is possible that flow may be going south into the cul-de-sac from Bethany Home Road. The FFE appeared to at or near street elevation. There is only roll curb protecting the house. The primary problem is that once flow gets to the end of the cul-de-sac, it has nowhere to go so it ponds until it overtops the roll curb.

Conclusion - This a local drainage issue. The house is susceptible to flooding once the roll curb overtops.

525 West Bethany Home

Looking south across Bethany Home

Looking north across Bethany Home

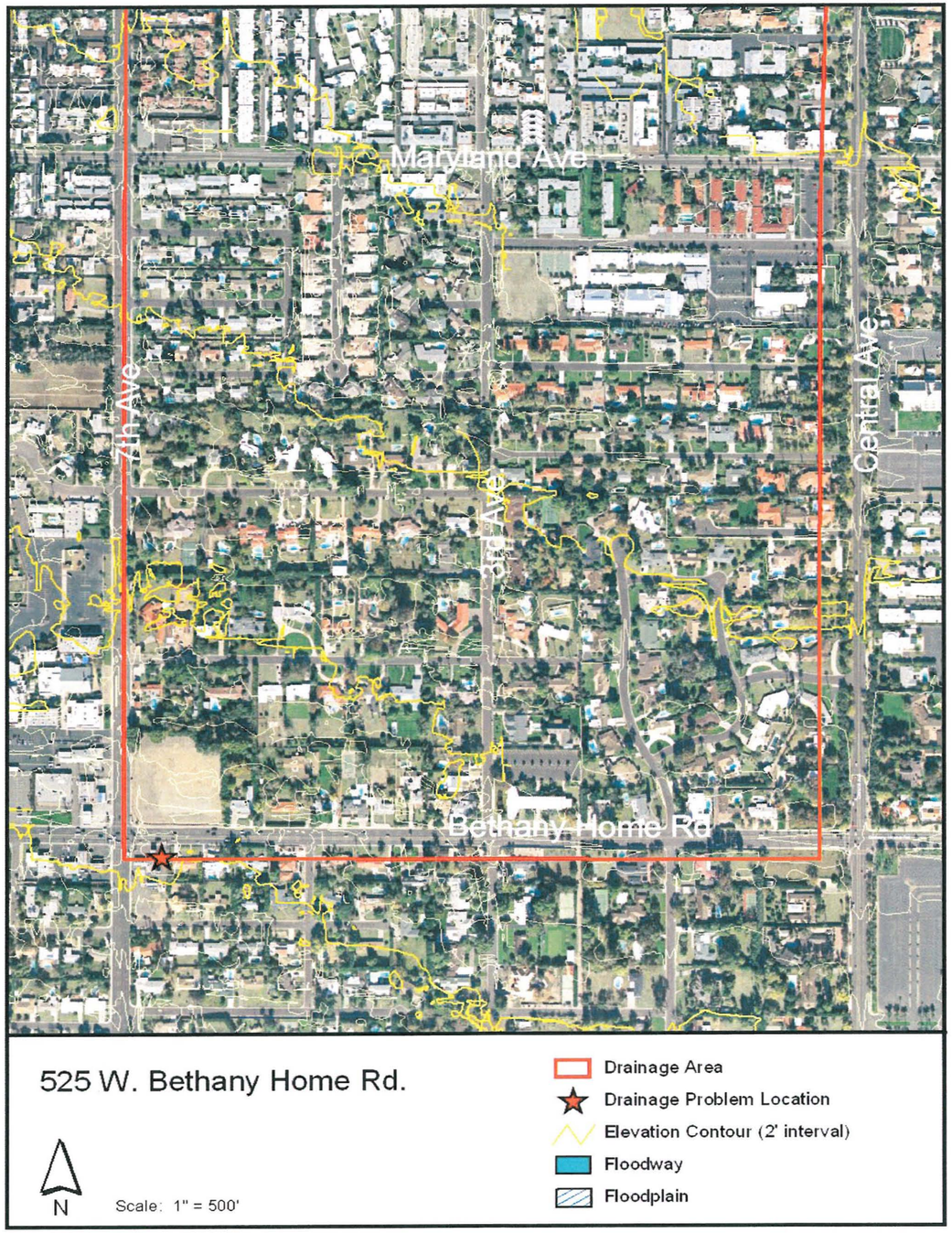
Looking west

Looking east

Approximate Drainage Area = 1.5 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Mr. Tower was explained to by Bill Camarena, Supervisor at Central Services, that his dwelling lays in the Cave Creek Wash floodplain area. This has been an on-going problem with the previous owner and neighbor as explained. Also per Jeff Van Skike." - COP Street Maintenance

EEC Observations - The gutter on Bethany Home Road is relatively flat in the east to west direction. There is a berm built in the front yard and the FFE of the structure appeared to be low relative to the curb. Flow also splits from 7th Avenue and reaches the property.

Conclusion - The house is probably protected from the small flooding events. In the large flooding events when the curb is overtopped, the house may be susceptible to flooding. It is a regional drainage issue associated with it's close proximity to the Cave Creek thalweg.



10th Street and Tuckey Lane, 929 East Tuckey Lane, and Tuckey Lane: 8th Place to 10th Street

Looking southwest

Looking west

Looking south

Looking west at hump

Approximate Drainage Area = 1.1 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "This flooding problem no longer exists." - COP Street Maintenance

EEC Observations - Tuckey Lane is humped at 10th Street to force flow to the south. If there was previously flow splitting from 10th Street to the west to Tuckey Lane, it no longer takes place with the hump.

Conclusion - It appears this drainage problem was solved with the addition of the berm that prevents flow from 10th Street from entering Tuckey Lane.

Appendix A.3.2

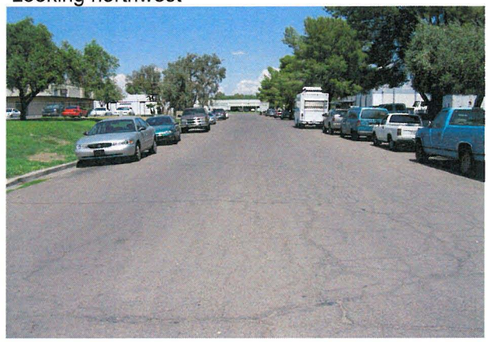
SOUTHEAST – UNRESOLVED FLOODING COMPLAINTS

20th Street and University

Looking east along University

Looking northwest

Looking south across University

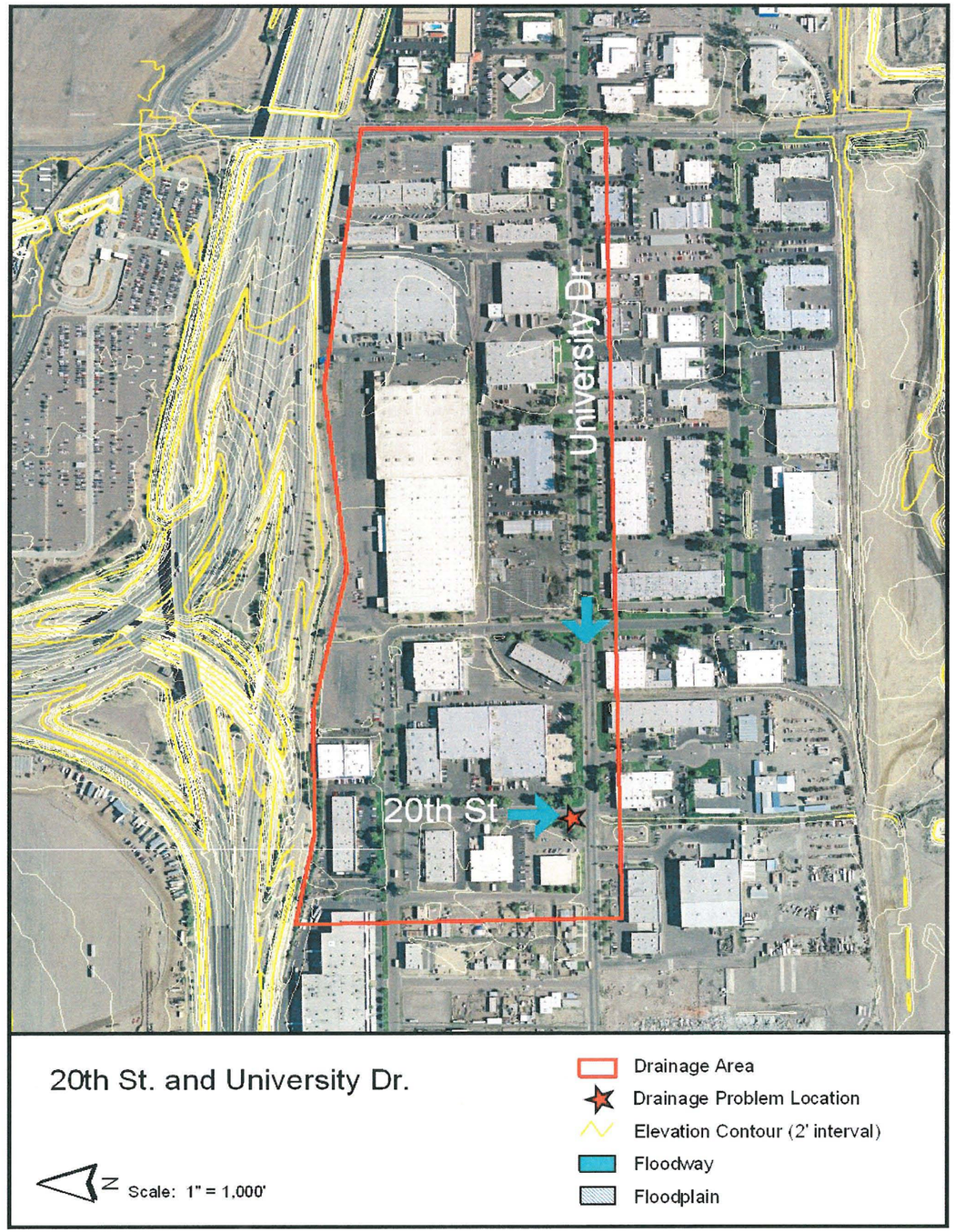


Looking north along 20th St.

Approximate Drainage Area = 72.1 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint No information.

EEC Observations - It appears as if the channel that flows south from University could handle a large flow. The complaint may be a maintenance issue with the channel since it was overgrown with large vegetation. There could also be an issue of standing water along University.

Conclusion - There does not appear to be a significant drainage issue but if there is, it is a local drainage issue since the drainage area is small.



1120 East Durango Street

Looking south

Looking north at property

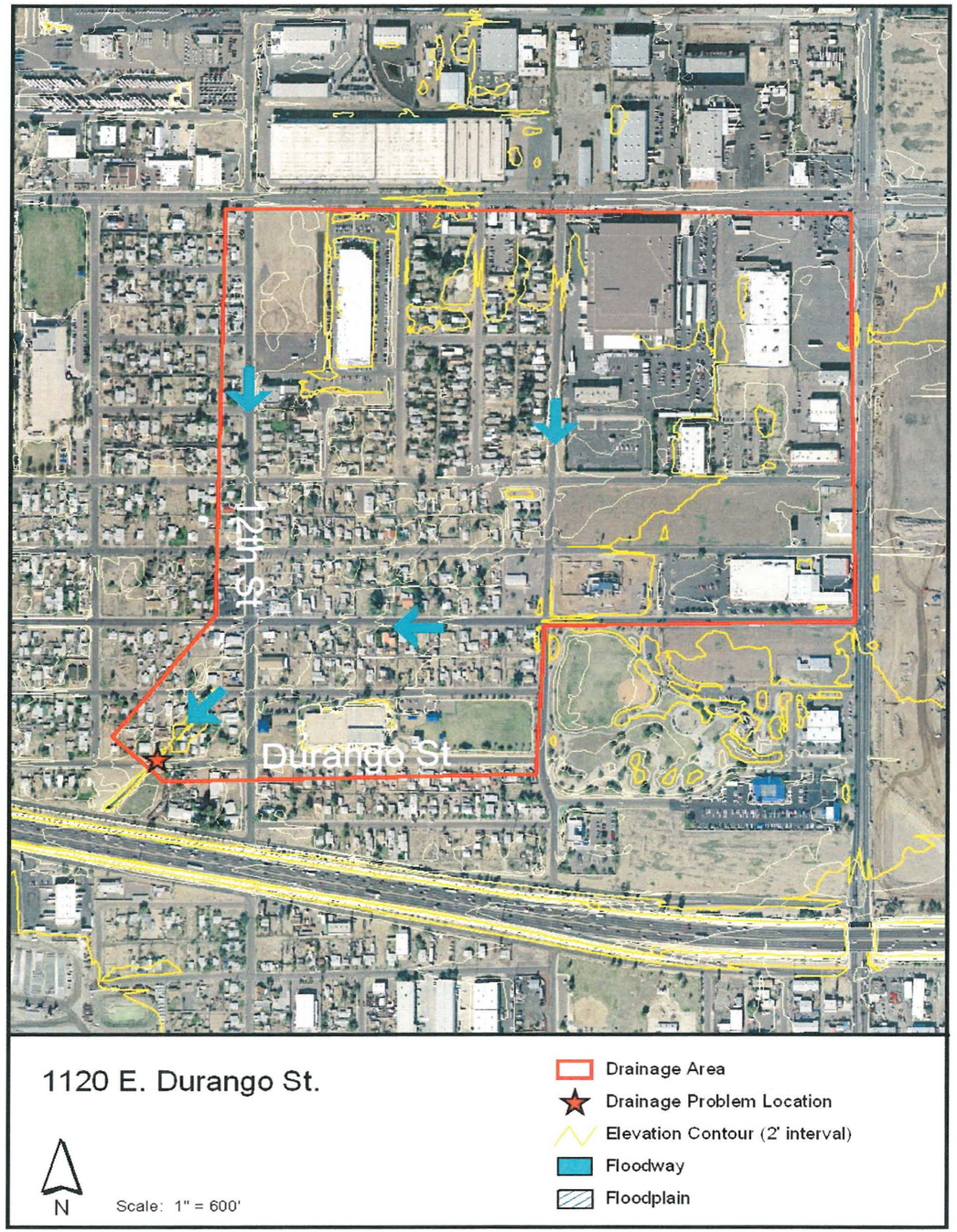
Looking north at property

Wash upstream of property

Approximate Drainage Area = 148.3 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Has flowline, no possible flooding at this time." - COP Street Maintenance

EEC Observations - The front yard is in the flow line. The FFE is much higher than front yard (based on a visual inspection). There is a pipe in the front yard to convey flow south across the street to the channel. The houses between 11th Street and 12th Street are in a low point. There are also more houses to the north in the flow line which should be considered part of this drainage issue.

Conclusion - The homes and yards are susceptible to flooding. In any storm event, the yards will be flooded. In large storm events, it is possible that several of the houses in the flowline will be flooded. 1120 E. Durango appeared to have the highest FFE and would be the least susceptible to flooding. Since the drainage issue effects several homes and the drainage area is fairly large, it could be considered a regional problem



424 East Buckeye Road

Looking north at property

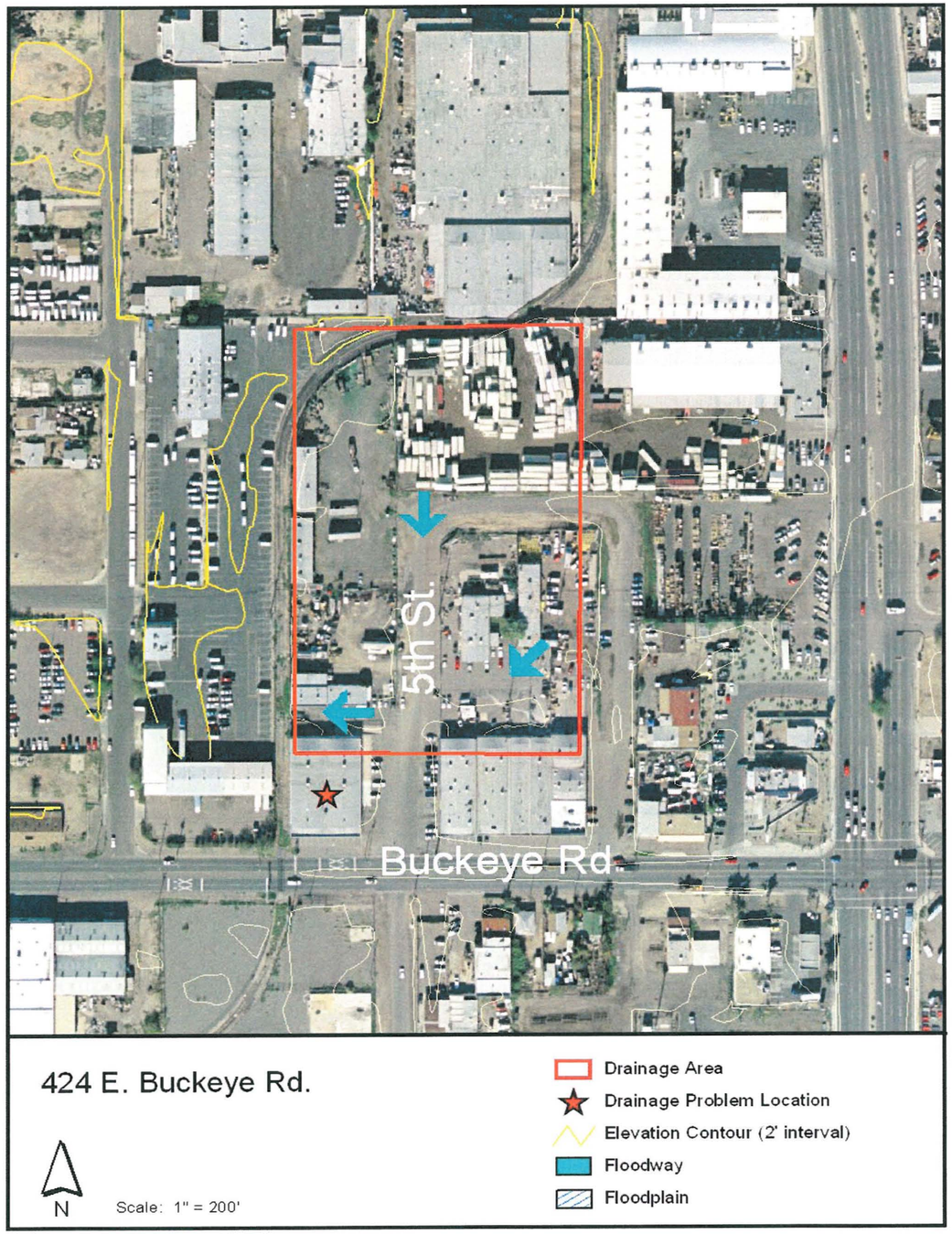
Looking west at property

Looking north of property

Approximate Drainage Area = 6.3 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Minor repairs were made to improve drainage, nothing else can be done without improving the whole area." - COP Street Maintenance The adjacent railroad tracks are higher and causes water to back up into the building.

EEC Observations - The problem does not appear to be at the front of the property along Buckeye. It appears as if flow will spill south before it is able to pond deep enough to flood the property. On the north side of the property, the stormwater will flow west until it is blocked by the railroad tracks. It then will pond until it is deep enough to spill over the tracks.

Conclusion - The severity of the flooding will depend on the FFE of the building. It is likely that ponded water is an issue in every storm event. It is very localized drainage issue.

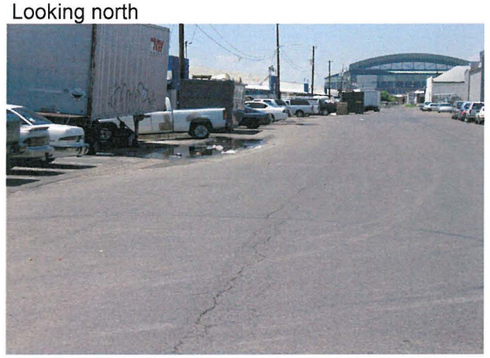


1555 East Jackson Street

Looking south

Looking north

Looking east

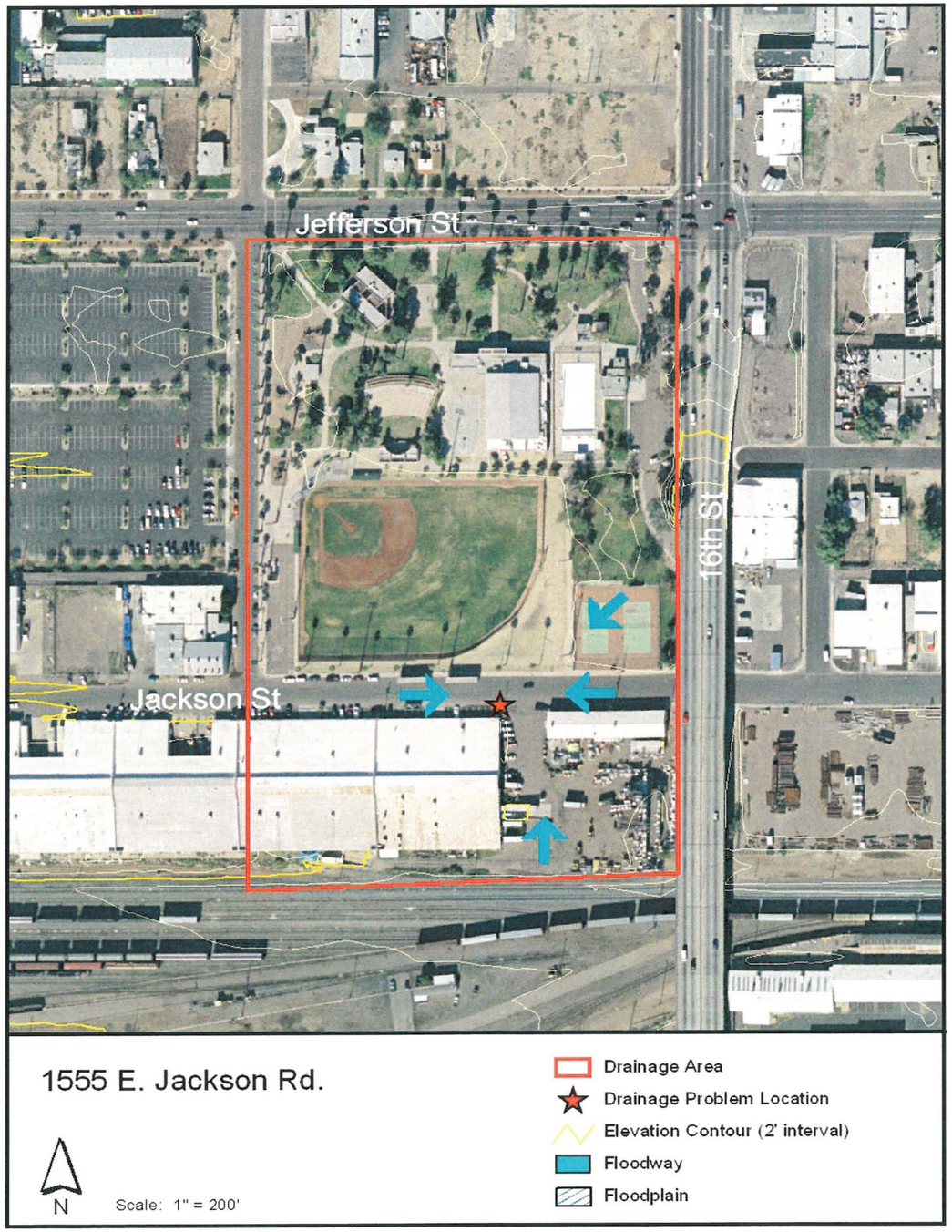


Looking west

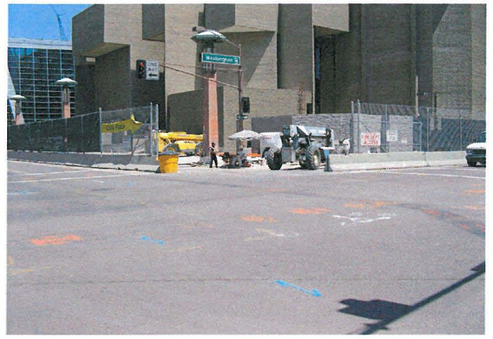
Approximate Drainage Area = 14.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "There is a storm drain 25 ft w/of 16th St. and Jackson and one 25 ft s/of Jackson on 16th St. No repeated of flooding at location in question. If flooding occurs, it is on private property not due to flowline problems. Private parking lot has low areas due to heavy traffic." - COP Street Maintenance

EEC Observations - The FFE appeared to be at or close to the street elevation. Water could also back up from the tracks into the parking lot causing a problem. The flow from the 2 tennis courts to the northeast of the property may be causing more flow than expected at the location since all rainfall would runoff of the courts.

Conclusion - In the smaller storm events, it is likely that standing water is the only issue. If the FFE were higher, flooding would not be an issue at this location. The drainage area is very small and is part of a local drainage issue.



2nd Street and Washington Street



Looking at NE corner

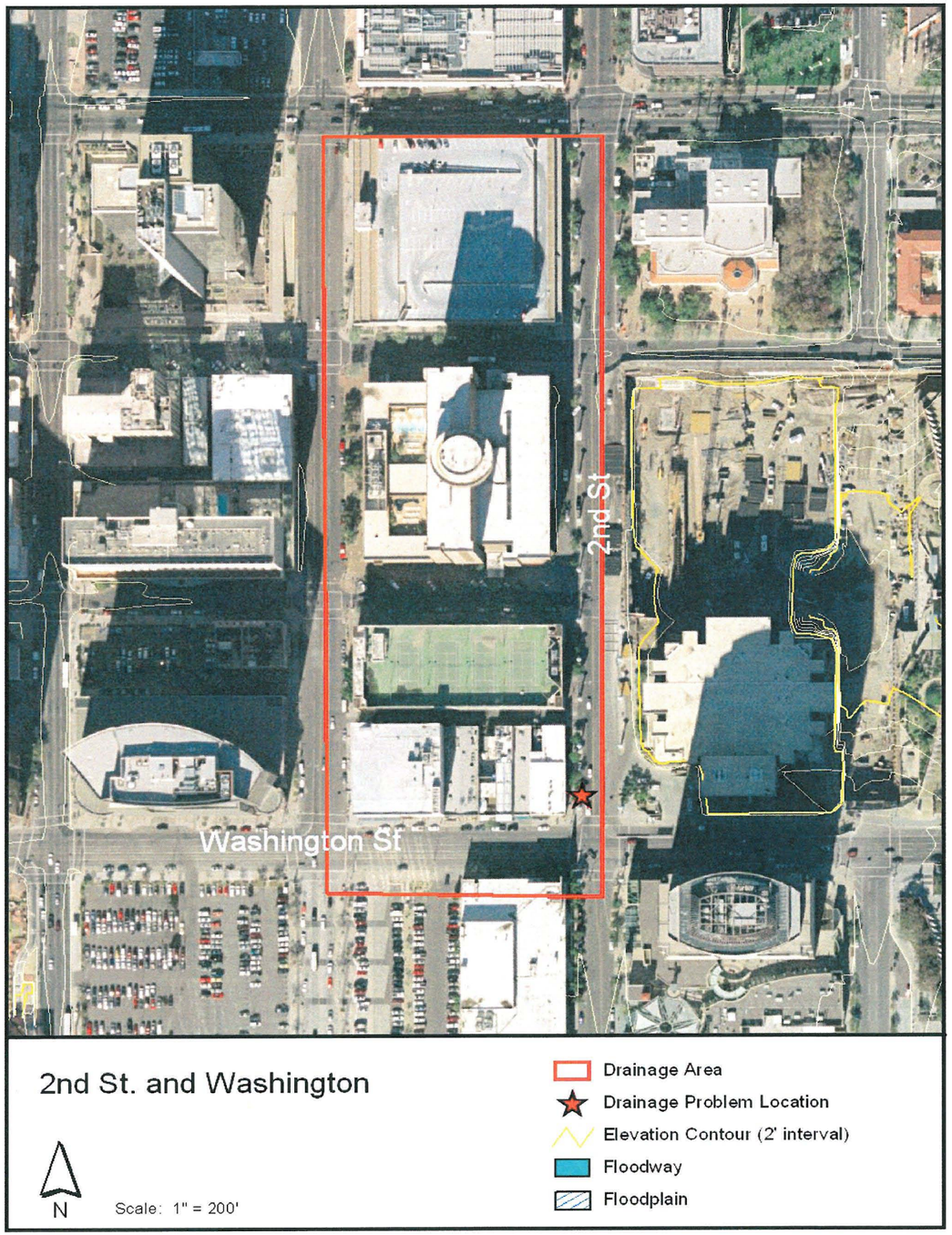
Looking north along west side

Looking east

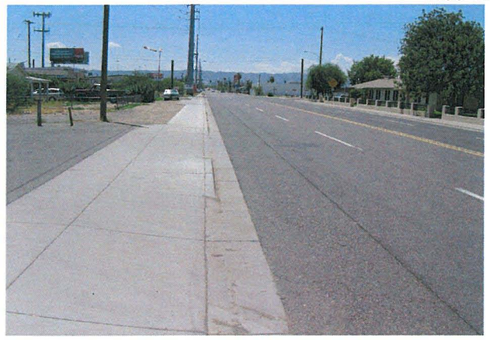
Approximate Drainage Area = 10.8 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Problem has been corrected." - COP Street Maintenance Appeared to be an issue of ponded water possibly solved by the addition of a catch basin.

EEC Observations - There is a catch basin on the northeast corner. It is assumed that this was the catch basin that was added. The catch basin is likely designed to pick up the smaller storm events so large storms could still flood the intersection.

Conclusion - There does not appear to be a flooding problem at this location.

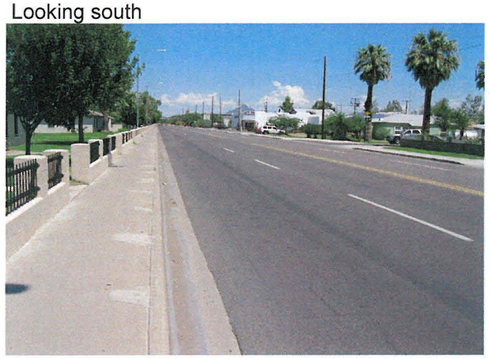


409 North 20th Street

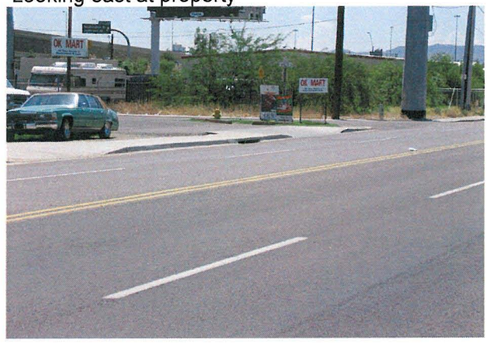


Looking south

Looking east at property



Looking north

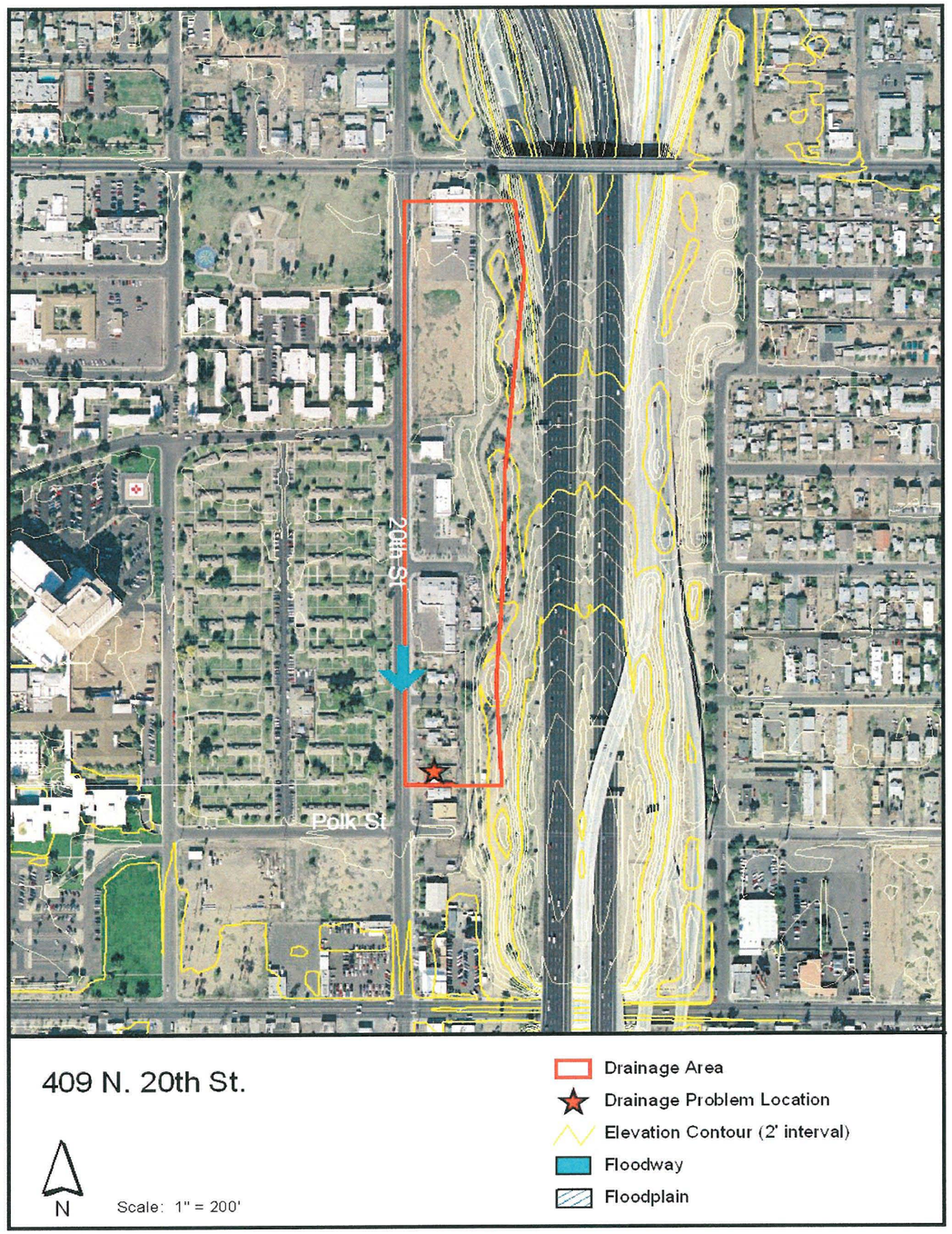


Inlet

Approximate Drainage Area = 12.3 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Street has been reconstructed, drainage problem corrected." - COP Street Maintenance

EEC Observations - The house is subject to the street capacity of 20th Street. There is vertical curb and a humped driveway protecting the house from flooding. It appears that the FFE is below the curb elevation.

Conclusion - If the curb overtops, the subject property is subject to flooding. There is not a significant drainage area associated with the complaint so it is a local drainage issue.



13th Street and McKinley Street

Looking north up 13th Street

Looking south

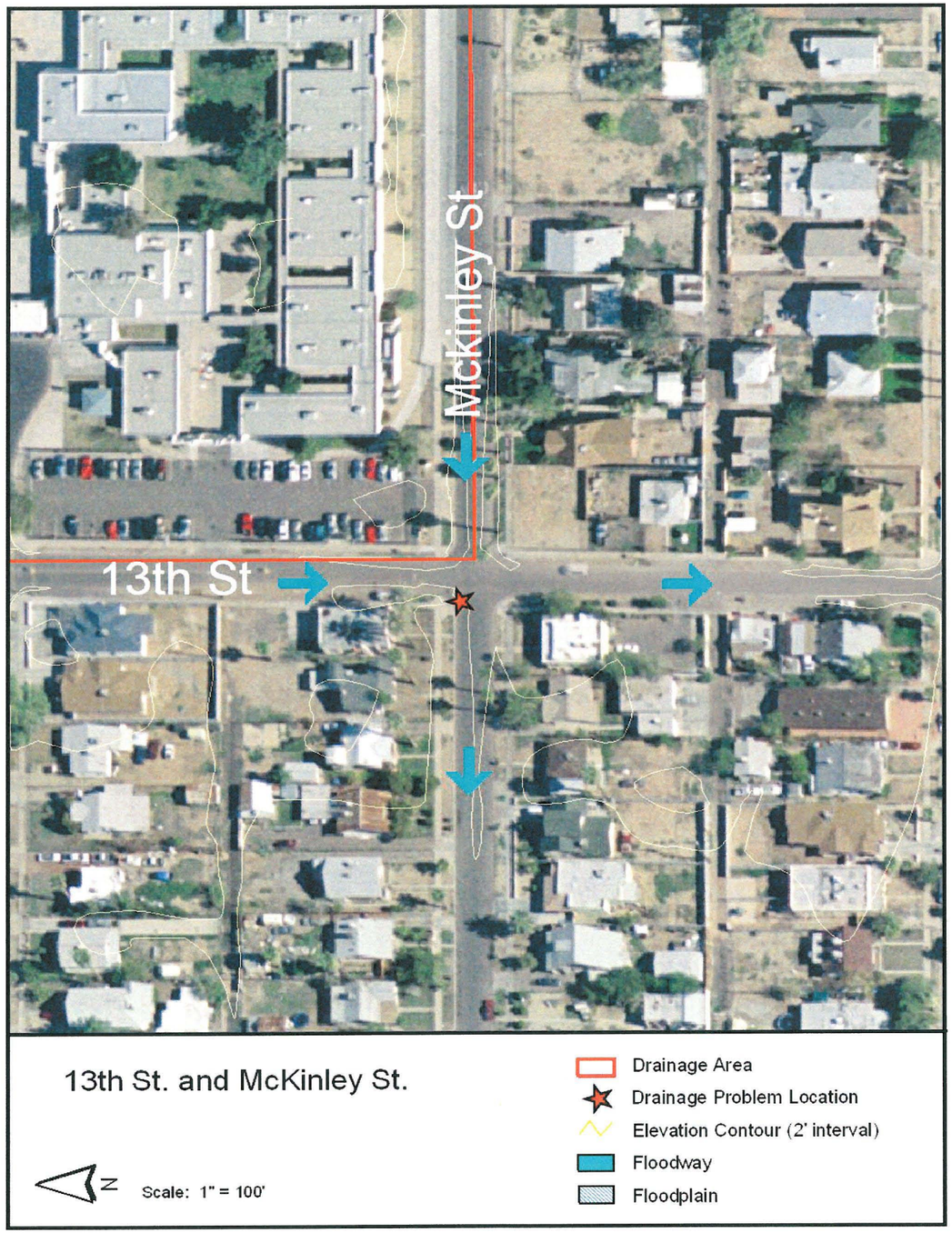
Looking northeast at corner

Looking southwest at corner

Approximate Drainage Area = 195 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Overland flow at this location is conveyed to the southwest. The original streets in this neighborhood were concrete. 13th St. has been overlaid with asphalt but McKinley is still the original concrete. This situation has caused a blockage of the westerly water flow in McKinley. A dry well has been placed to the east of this intersection but it currently does not drain the ponded water. The entire width of McKinley becomes flooded before water overtops 13th." - PEC

EEC Observations - Both McKinley and 13th Street are covered with asphalt. 13th Street has slope to the south and McKinley has slope to the west. The northeast corner of the intersection is low and water has to pond up several inches before it will flow west and/or south.

Conclusion - This appears to be an issue of standing water at the northeast corner of 13th Street on McKinley. Flooding does not appear to be an issue. This is a local drainage issue.



Roosevelt Street: 21st Street to 23rd Place

Looking east

Looking east

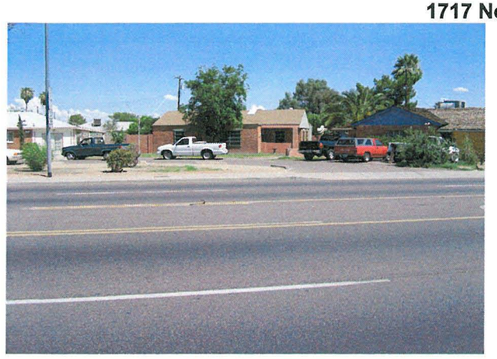
Looking north up 23rd St.

Approximate Drainage Area = 37.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Dirt shoulder holds water." - COP Street Maintenance

EEC Observations - There is dirt and debris in the north shoulder of Roosevelt. Water flows south down 21st Street and 23rd Street to Roosevelt where the dirt and debris remain.

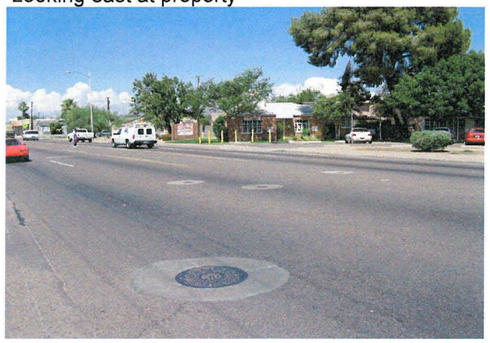
Conclusion - The issue is localized and does not appear to be a flooding issue. It appears to be an issue of dirt and debris in the road.

1717 North 16th Street

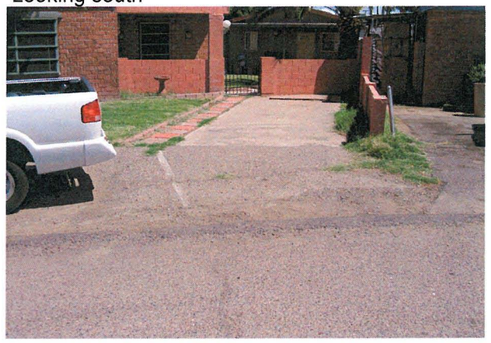


Looking east at property

Looking south



Looking north



Driveway of property

Approximate Drainage Area = 1.7 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "No reports of flooding in the past. Asphalt crew instructed that Ruben Leon would handle job, water flow slows on s/side of property toward alley. Property has low floor plan causing storm water to s/e, not towards 16th St. Asphalt crew is going to install temporary berm to divert flow off property." - COP Street Maintenance

EEC Observations - The driveway is humped up to prevent flow from entering the property. The FFE of the property appears to be lower than street elevation. There does not appear to be a drainage issue with flow reaching the back of the property.

Conclusion - Once water overtops the driveway, the property is susceptible to flooding. This is a localized drainage issue.

2102 North 28th Street

Looking south at property

Looking west at property

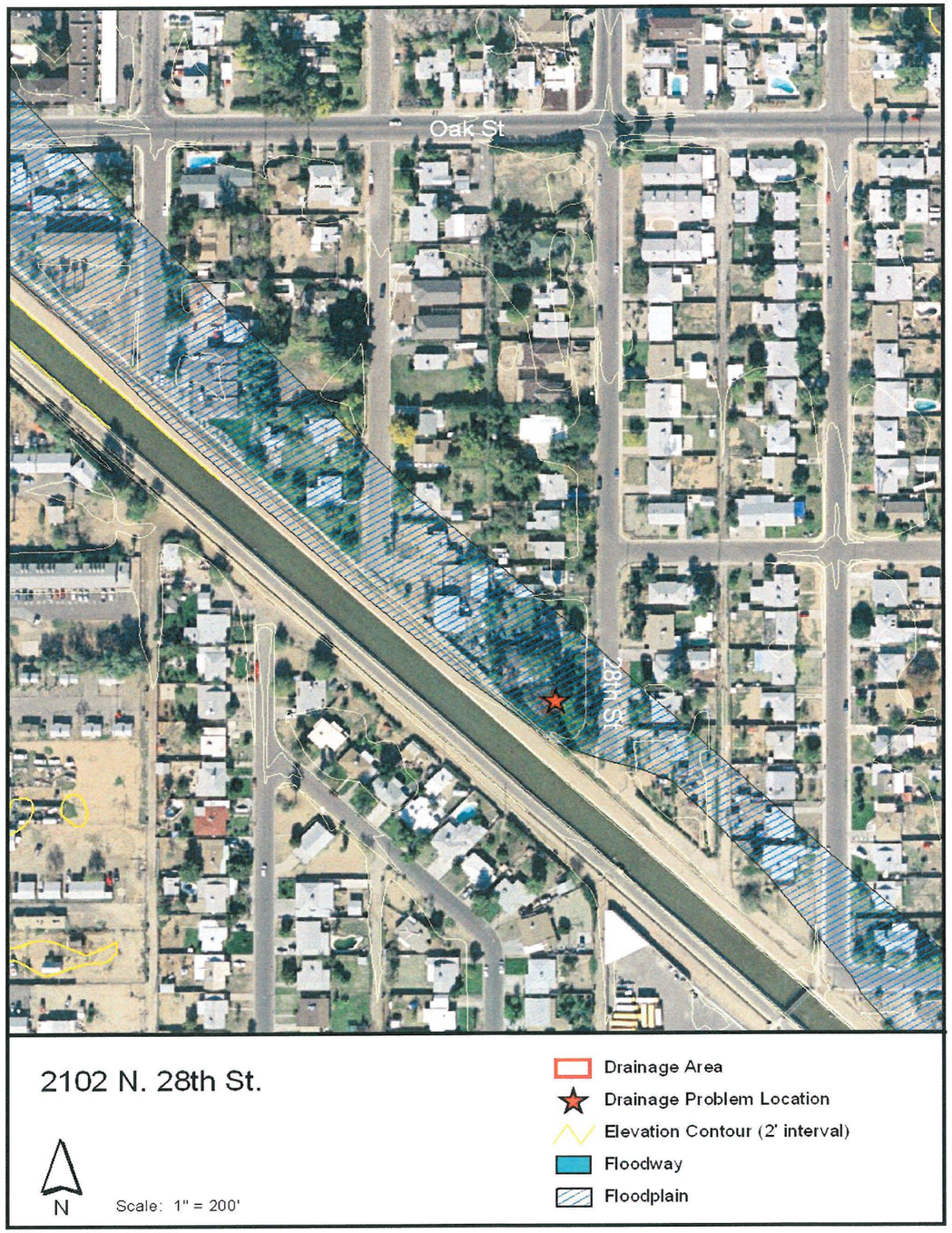
Looking north up gutter

Looking west along channel parallel to embankment

Approximate Drainage Area = 5.5 square miles
FEMA Floodzone Type - A
Property Owner Description/Complaint "Concrete gutter installed behind barricade." - COP Street Maintenance

EEC Observations - There is a concrete gutter installed which drains to the south to a channel that runs parallel to the canal. The property is in the floodplain behind the canal. It is subject to ponded water behind the canal.

Conclusion - Aside from the water backing up behind the canal, it does not appear to be a flooding issue. If the issue is ponding behind the canal flooding the house, then it is a regional issue. From the information presented in the complaint, it appears to be a local drainage issue of water in the street.



Oak Street: 5th Street to 7th Street

Looking north up 7th St.

Looking west along Oak St.

Looking north across Oak St.

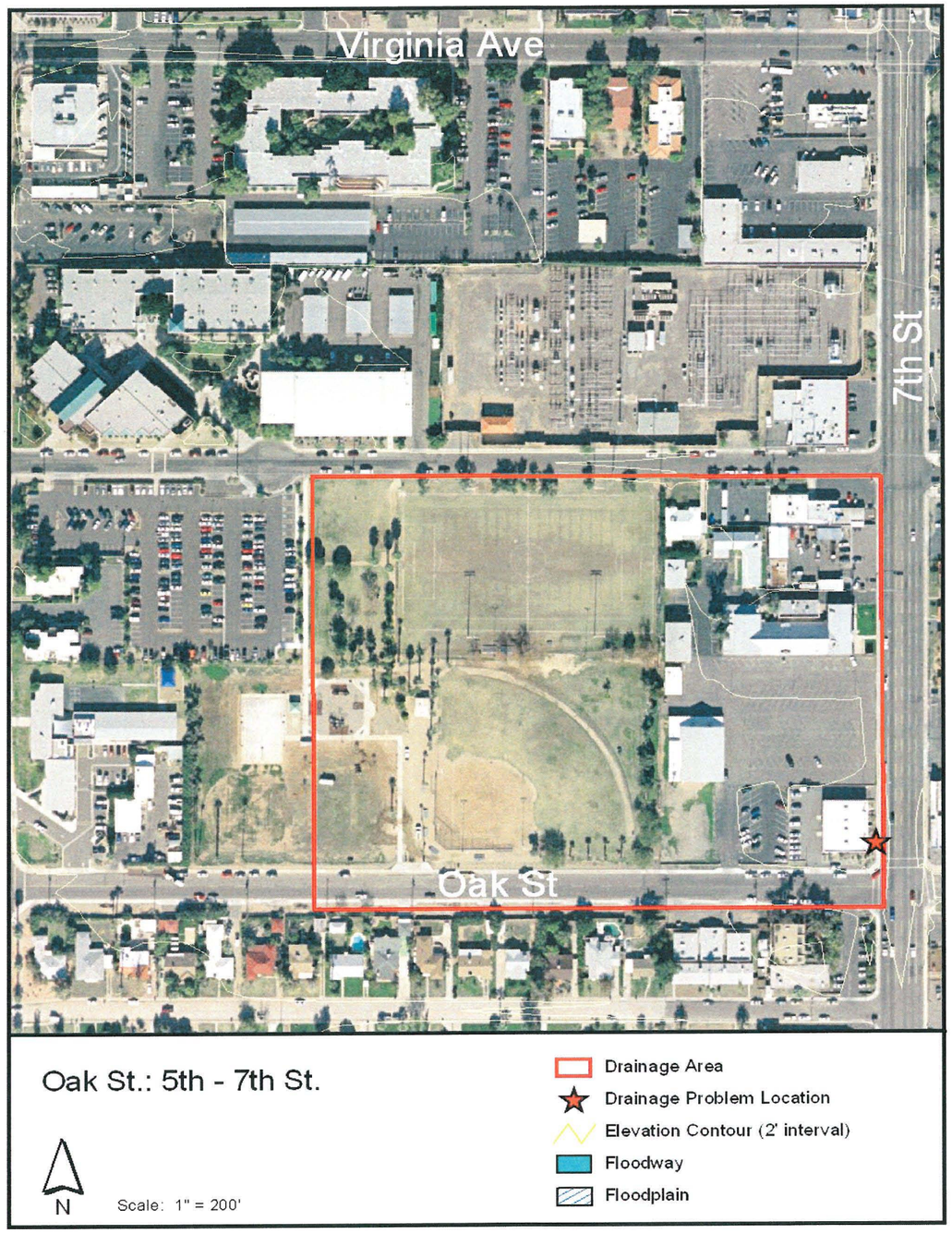
Looking northwest

Approximate Drainage Area = 12.7 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Approximately 250 feet west of 7th St., there exists a sump condition on the north side of Oak. At this location, Oak does not have curb and gutter. This street is crowned to the west of the problem area and the north side runoff simply runs off the pavement and onto the dirt shoulder. Runoff from the west side of 7th St. and from the north side of Oak collects in the sump which eventually spreads across Oak. There is no existing out for this sump water. There is a 24" storm drain in Oak that is connected to the 7th St. storm drain." - PEC

EEC Observations - There is curb and gutter along Oak Street between 5th and 7th Street. The driveways are humped. Without survey, it appears as if Oak Street is nearly flat between 3rd Street and 7th Street. Water may be forced to pond on the north side of Oak until it overtops the crown and spills south.

Conclusion - The drainage area is small and seems to be only a local issue. It appears as if this might only be a street flooding issue.

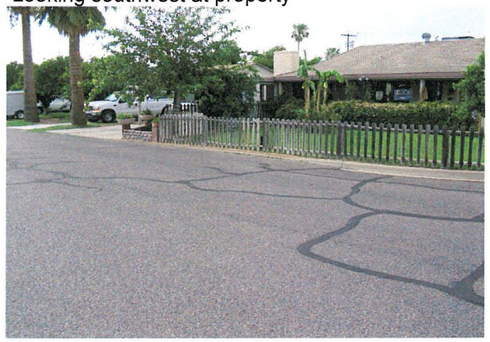


1901 East Avalon Avenue

Looking west

Looking southwest at property

Looking south



Looking southeast at property

Approximate Drainage Area = 2.0 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "We have no records of prior calls on file." - COP Street Maintenance

EEC Observations - The FFE appeared to be slightly above the street elevation. The drainage area is small. There is vertical curb on the west side of the property and nothing on the north side. The property experiences flow going west down Avalon and south down 19th Street.

Conclusion - It is unlikely that the house is subject to flooding from 19th Street. The flow in Avalon may spill into the driveway before it spills into 19th Street. Since the drainage area is small, this is a local drainage issue.

4147 North 18th Street

Front of house

Looking south down 18th St

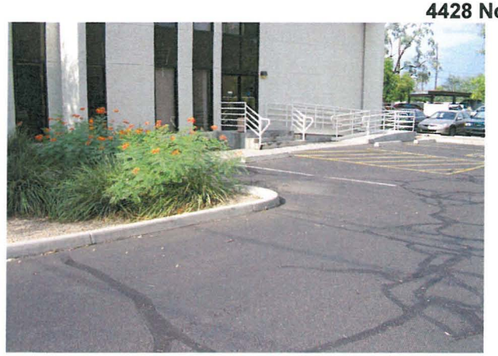
Rental property

Approximate Drainage Area = 0.8 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "The residents at 4147 N. 18th St. have converted their garage at the back of their lot into a rental apartment. This separate building abuts the alley along the back edge of the property. Runoff from the alley collects at the concrete parking area adjacent to the apartment. If this water depth exceeds a couple of inches, it flows back into the rental building. The yard to the residence is irrigated from the back of the lot and is graded to drain towards the front. As with most irrigated yards, there exists a small berm around the perimeter which keeps runoff out and irrigation in." - PEC

EEC Observations - The drainage area is localized. The only drainage that reaches the structure of concern is the alley drainage. The FFE of the garage/rental apartment appeared much lower than the alley elevation. Any flow going south down the ally could spill into the rental property.

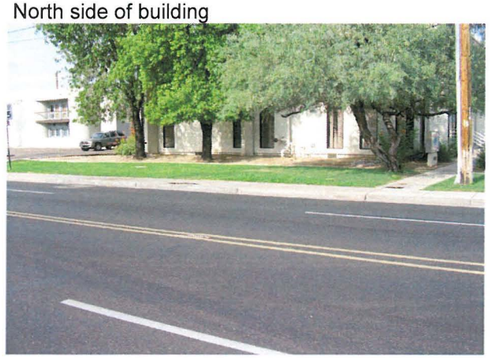
Conclusion - Since the FFE appeared lower than the alley grade, it could get flooded in any storm event. It is local drainage problem caused by a low FFE.

4428 North 12th Street



North side of building

East side of building along 12th St



Looking west across 12th St.

Adjacent building's parking lot

Approximate Drainage Area = 2.1 square miles
FEMA Floodzone Type - A
Property Owner Description/Complaint "Repetitive flooding." - COP Street Maintenance

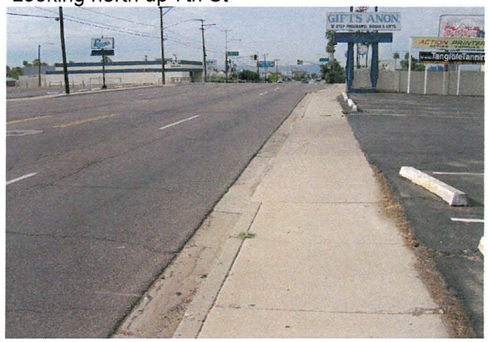
EEC Observations - The FFE appeared to be higher than the street elevation along 12th Street. There appeared to be no parking lot flooding problems either. In the adjacent parking lot at 4408 North 12th Street, there were standing water concerns (as seen in the photographs above). The flow should be able to continue south down 12th Street until it begins to pond behind the canal. Inlets were in the sag to remove ponded water.

Conclusion - The property is in the floodplain behind the Grand Canal. Once the ponding behind the canal is deep enough, the property is subject to flooding. The ponding behind the canal is a regional drainage issue.

4532 North 7th Street

Looking north up 7th St

Looking west across 7th St.



Looking south down 7th St.

Looking west across 7th St.

Approximate Drainage Area = 3 sq. miles
FEMA Floodzone Type - A
Property Owner Description/Complaint "Repetitive flooding." - COP Street Maintenance

EEC Observations - The driveway has been bermed up along 7th Street to prevent flow from entering the property. The FFE appeared lower than the street elevation from a visual inspection. The property is just north of the Grand Canal and subject to flooding from water ponding behind the canal.

Conclusion - The berm is most likely only a solution for the small storms. The larger storms would likely flood the property. It is a regional drainage problem caused by water backing up at the canal.

4519 North 8th Place

Looking east at property

Looking NE at property

Looking north up 8th Pl.

Approximate Drainage Area = 3 sq. miles
FEMA Floodzone Type - A
Property Owner Description/Complaint "Repetitive flooding." - COP Street Maintenance

EEC Observations - The subject area is just upstream of the Grand Canal. It's watershed area reaches as far north as the Arizona Canal. The canal embankment is higher than the FFE's and water ponds behind the canal. 7th Street is also elevated which further exacerbates the ponding problem. The water will pond to a depth of about 1.5 feet until it overtops the canal which leaves the homes susceptible to flooding.

Conclusion - The ponding behind the canal is a regional problem. The homes are in a low lying area and are susceptible to flooding in any event that exceeds the capacity of the storm drain system.

7th Street and Meadowbrooke

Looking west toward 7th St.

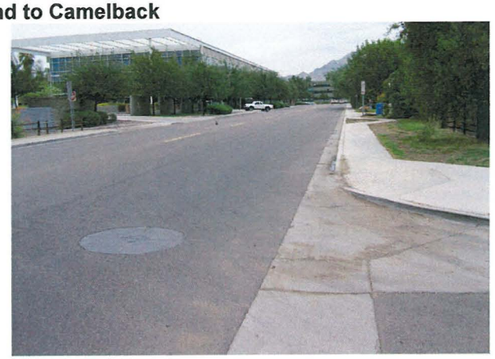
Approximate Drainage Area = 3 sq. miles
FEMA Floodzone Type - A
Property Owner Description/Complaint "East of 7th Street, 100 ft. South side of street." - COP Street Maintenance

EEC Observations - There is a sump in Meadowbrooke just east of 7th Street. The morning after a rain storm, the site was visited and there was still a large amount of standing water. The intersection is in the floodplain behind the Grand Canal. Water ponds up until it spills into the 7th Street storm drain.

Conclusion - This appears to only be an issue with standing water and street flooding. The road could be regraded to eleviate the problem but water will still pond behind the canal in the event of a large storm.

28th Street: Highland to Camelback

Looking south down 28th St.



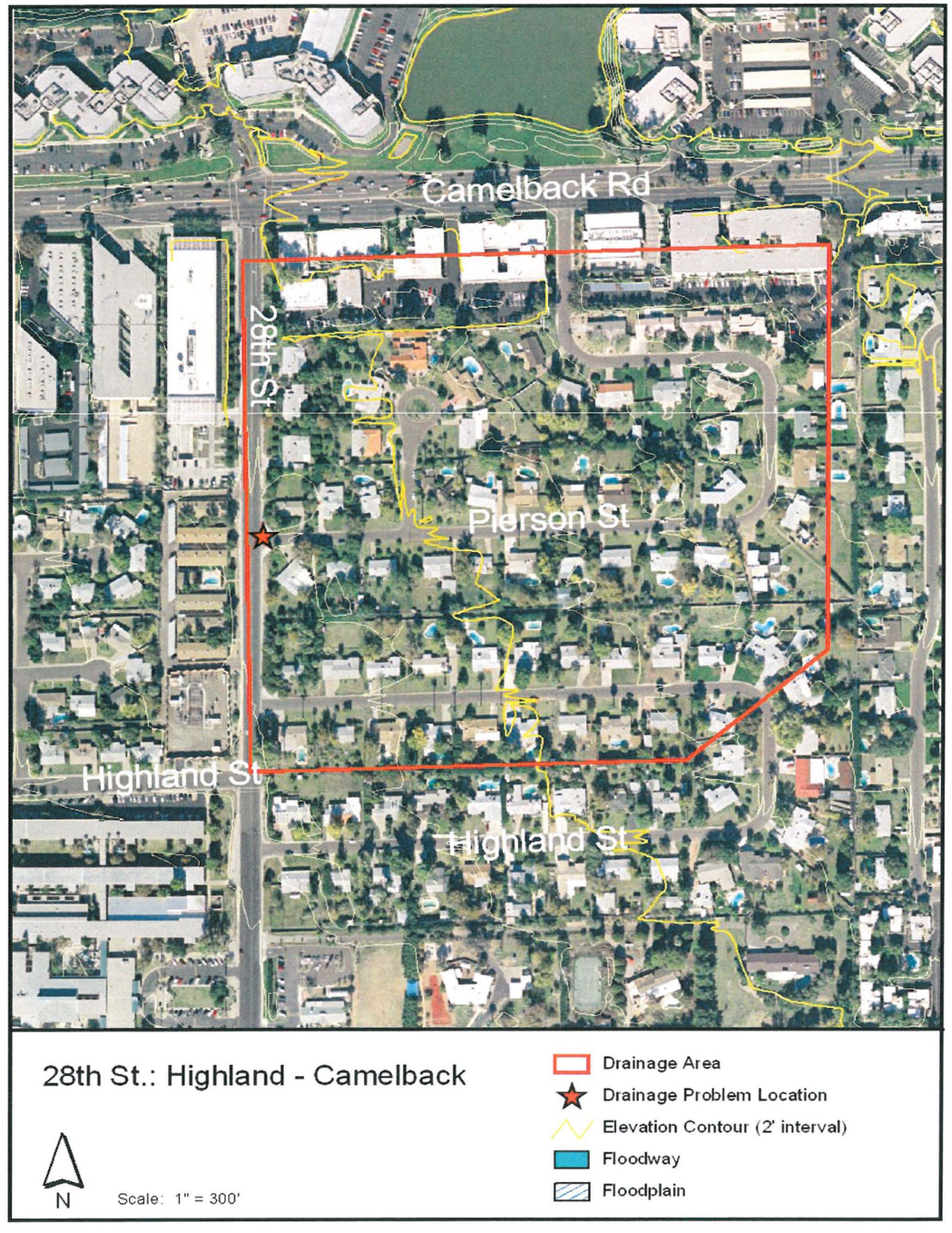
Looking north up 28th St.

Valley gutter

Approximate Drainage Area = 33.8 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint No information available.

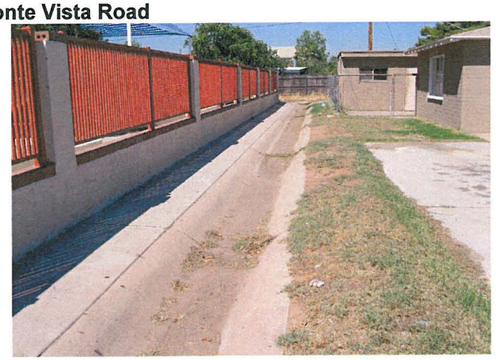
EEC Observations - There is curb and gutter along 28th Street. It appears as if flow will continue south along 28th Street. There was some sediment in the gutters which may indicate that standing water is the issue.

Conclusion - This is a localized drainage issue. The dirt and debris at some of the intersections may be an issue.



35th Street and Monte Vista Road

Looking southwest



Looking west

Looking west at property

Looking north up 35th St.

Approximate Drainage Area = 10.1 acres
FEMA Floodzone Type - X1

Property Owner Description/Complaint "Runoff entering this intersection is designed to flow into a drainage easement to the west. The easement contains a four foot wide concrete channel which carries the storm water to Hubbell St. where it is transported to the 32nd St. storm drain. The capacity of this channel is insufficient to drain the intersection of 35th St and Monte Vista Rd. The property at the entrance of this drainage channel is flooded quite frequently." - PEC

EEC Observations - See above description. The FFE appears to be only slightly above the curb elevation.

Conclusion - There appears to be more flow getting to the intersection than it can handle. The channel may have been built to convey only the smaller storms. If the driveway is overtopped, the house could flood. The drainage area is small and it is considered to be a localized drainage problem.

Old Cross Cut Canal

Looking south

Looking north

Looking north

Looking west

Approximate Drainage Area =
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Nothing on file for this location." - COP Street Maintenance

EEC Observations - The Old Cross Cut Canal can handle a 50-year storm. The flow is to the south and the flow in the canal outlets at the Salt River.

Conclusion - There does not appear to be a drainage issue with the Old Cross Cut Canal.

3006 North 21st Place

Looking northwest

Looking at property

Looking south

Looking north

Approximate Drainage Area = 77.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Alley drainage problem." - COP Street Maintenance

EEC Observations - It appeared that the channel needed maintenance. There may be blocked pipes or collapsed pipes. The flow travels to the south along the alley until it reaches the canal (the property is not in the floodplain behind the canal so it is assumed ponded water behind the canal is not causing the flooding). The FFE's appeared to higher than the alley elevation (survey is necessary to verify the assumption).

Conclusion - The drainage area to the alley is very small; therefore, it is a local drainage issue. It is possible that only the alley and yards are flooding. A large event may generate enough flow to cause house flooding.

FCD JOB NO. FCD2004C040
EEC JOB NO. 305008

DRAINAGE PROBLEM

METRO PHOENIX ADMP

3402 North 26th Place

Looking west at property

Looking west

Looking north at garage

Looking south

Approximate Drainage Area = 5.2 acres (on 26th Place)
FEMA Floodzone Type - X1
Property Owner Description/Complaint No information available.

EEC Observations - There is a wall constructed on the east side of the property. There is roll curb on the east side as well. Flow travels west down Osborn and south down 26th Place. There was debris in front of the wall which may be part of the issue.

Conclusion - Flow would have to overtop the driveway or the roll curb on 26th Place to cause any flooding. The drainage area is small and it is only a local drainage problem.

3501 East Amelia Avenue

Looking east

Looking west at property

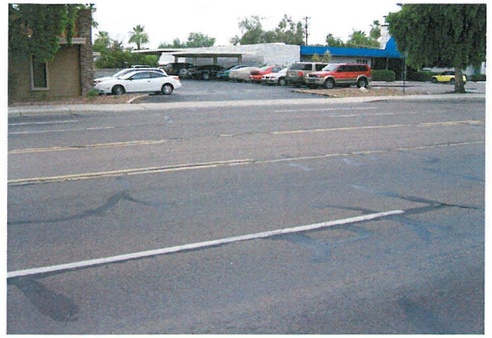
Looking west at property

Approximate Drainage Area = 1.9 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint No information available.

EEC Observations - The subject property is at the end of a cul-de-sac. Flow travels west down the cul-de-sac and has nowhere to continue to so it ponds at the end of the cul-de-sac until it overtops the curb and floods the property. The FFE appears to be below the street elevation (no survey was taken to confirm this).

Conclusion - It is likely that there is nuisance water after every storm event. Once the roll curb in front of the house is overtopped, the house is susceptible to flooding. The drainage area is very small and it is only a local drainage issue.

34th Street and Indian School



Looking south across Indian School

Looking south across Indian School

Approximate Drainage Area =
FEMA Floodzone Type - X1
Property Owner Description/Complaint "The business has reconstructed their driveway to prevent flood, should take care of problem." - COP Street Maintenance

EEC Observations - Flow travels west along Indian School past 34th Street. If flow is able to overtop the berm/humped driveway, there is potential for parking lot flooding and for property flooding.

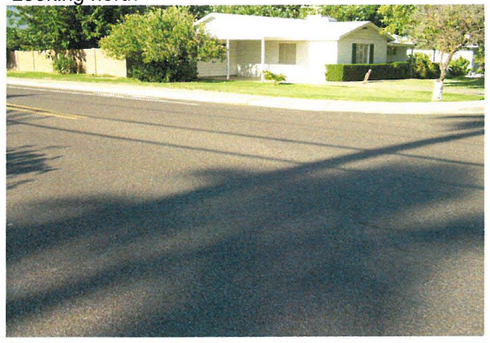
Conclusion - There probably isn't any concern for flooding in smaller storm events. In the larger flooding events, it is likely that there is parking lot flooding. The FFE's of the structures will determine if there is flooding of each individual structure. It appears to be a local drainage issue even though Indian School is a major conveyance corridor.

Meadowbrooke and 36th Street

Looking south

Looking north

Looking northeast



Looking southwest

Approximate Drainage Area = 200 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Could not locate. Only location on record is 36th St. and Meadowbrooke. Clogged drain, standing water." - COP Street Maintenance

EEC Observations - There does not appear to be any drainage issue. There is curb and gutter along 36th Street and there are also inlets. If an inlet became clogged, there could be a drainage problem.

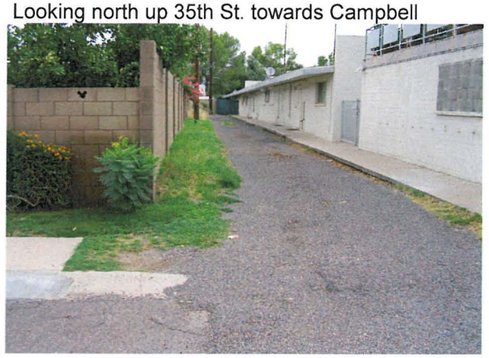
Conclusion - There does not appear to be any drainage problem and if there is, it is only a local drainage issue. Flow should be able to continue in the gutters and not cause a flooding issue.

4435 North 35th Street

Looking southeast

Looking north up 35th St. towards Campbell

Looking east



Looking north up alley adjacent to property

Approximate Drainage Area = 1.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Very small amount of standing water, nuisance water. No flooding concern." - COP Street Maintenance

EEC Observations - There is a split flow south down 35th Street from Campbell Avenue. There is also a small amount of local drainage from the alley that flows to the subject property. The southwest corner of the property is where the water would pond in the street.

Conclusion - There does not appear to be a flooding concern. The FFE appeared to be higher than the crown from a visual inspection. There is nuisance water that will pond at the corner. The drainage area is very small and indicative of a local drainage issue.

3037 North 53rd Street

Looking southeast

Looking north at Earl

Looking south

Looking at SE corner of Earl and 53rd St.

Approximate Drainage Area = 45.3 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Drainage easement at 5314 E. Avalon flooding the property behind it. Can be corrected in-house by P.M. Section will generate a work request." - COP Street Maintenance

EEC Observations - The end of the cul-de-sac is higher than Earl so flow will not back up and pond at the end of the cul-de-sac. The area to the east and south of the property drains to the alley. The alley also appeared to have suitable drainage (may have been regraded recently to allow for better drainage).

Conclusion - This appears to be a local drainage issue that was solved with alley grading. The drainage area to the alley isn't large. The majority of the flow should be in Earl Drive headed west.

4839 East Osborn Street

Looking west

Looking east

Looking south at property

Approximate Drainage Area = 105 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint Suffered damage in storm. COP paid claim.

EEC Observations - Flow travels west towards the Old Cross Cut Canal. There was curb and humped driveways along the street to convey flow west. It appeared as if the FFE was at or below curb elevation. The only protection from flooding is the humped driveway and the roll curb.

Conclusion - Once the roll curb or driveway is overtopped, the house is susceptible to flooding. It is a local drainage issue associated with a low FFE.

3802 North 48th Street

Approximate Drainage Area = 3.2 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "No problem at this location." - COP Street Maintenance

EEC Observations - Could not locate property.

Conclusion -

3200 N. Valencia Lane

Inlet on Valencia

Looking south along Valencia

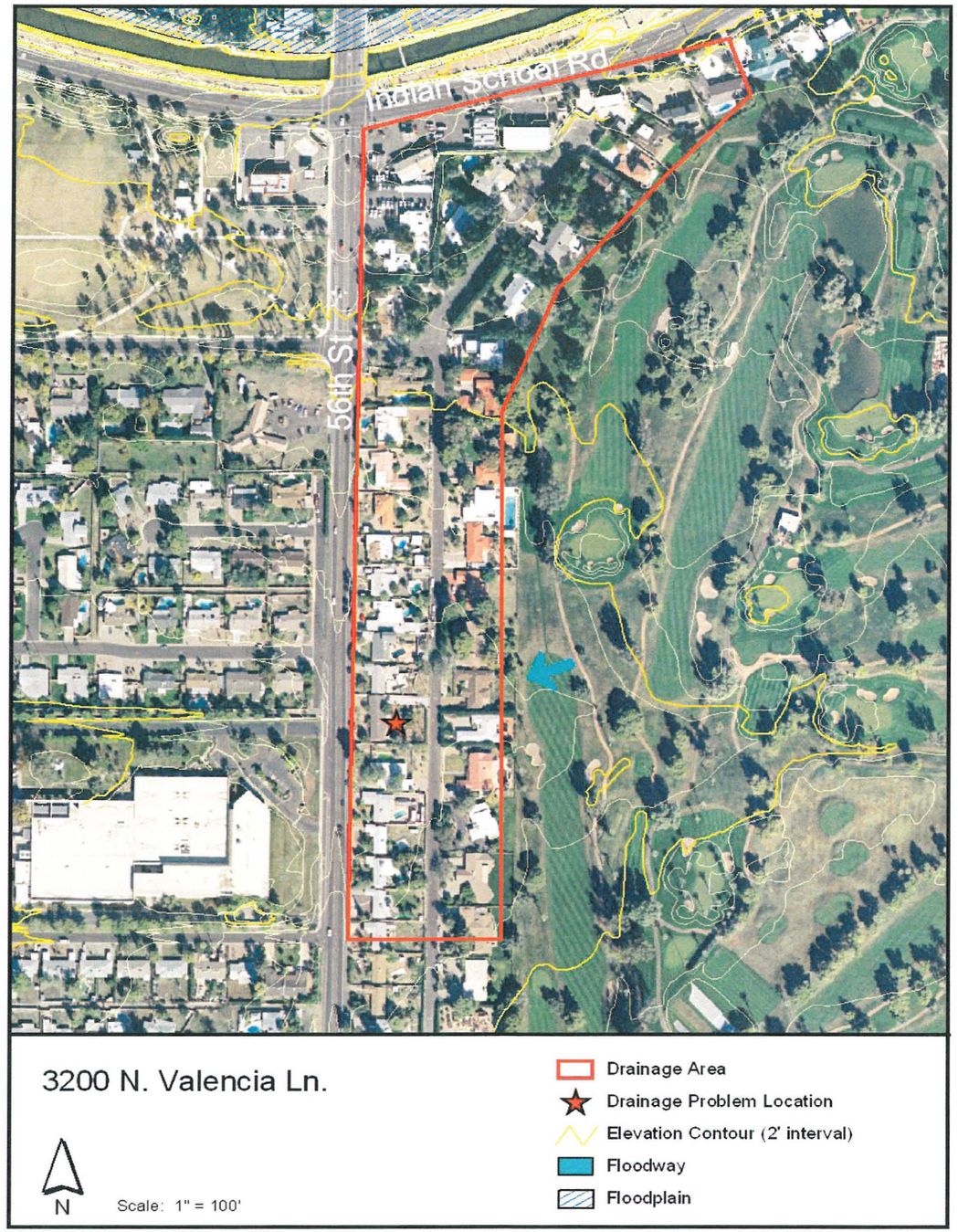
Looking north along 56th Street

Looking southeast along 56th Street

Approximate Drainage Area = 18.5 acres (not including flow from golf course)
FEMA Floodzone Type - X1
Property Owner Description/Complaint No information available.

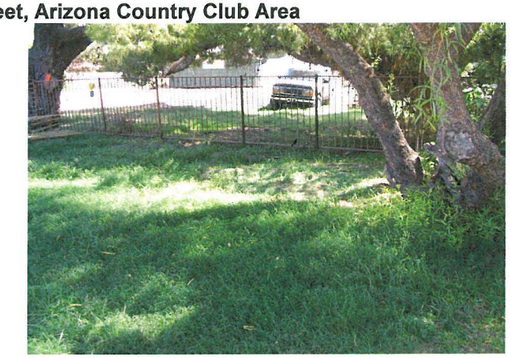
EEC Observations - Contact was made with a local homeowner who had been flooded 3 times since 1989 (in 1990, 1996, and 2002). The homeowners who were flooded sued the golf course and lost. The golf course has been regraded since the 2002 flooding according to the homeowner. The area is in a sag. The natural flow is to the west. The homeowner says the inlet clogs frequently during storms. There is a storm drain in 56th Street.

Conclusion - If the adjacent golf course releases stormwater according to natural flow path, there is a large drainage area. This appears to be a regional drainage problem.



60th Street and Hollyhock Street, Arizona Country Club Area

Looking west



Looking east

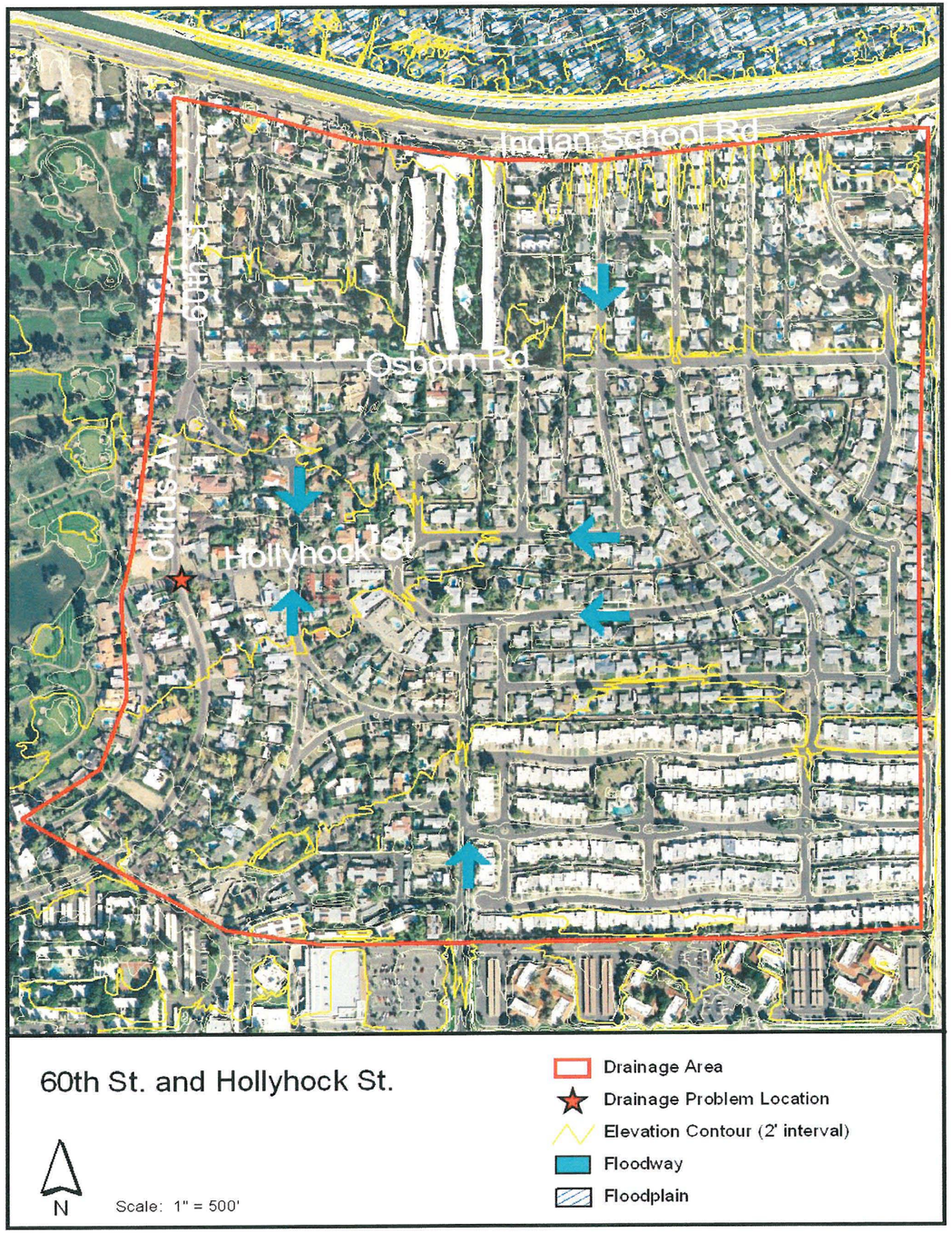
Looking west

Looking west

Approximate Drainage Area = 202 acres
FEMA Floodzone Type - X1
Property Owner No information.
Description/Complaint

EEC Observations - There is currently a project under construction (the details of the project are unknown). The intersection is the low point of a swale.

Conclusion - The property is in a swale. There is a large drainage area but if the flow is not blocked at the golf course, there should be no flooding problem since the FFE appeared to be high relative to the street. This is part of a regional drainage issue associated with the swale.



Arizona Country Club Area

DO NOT INCLUDE, ADDED TO PREVIOUS SHEET

Approximate Drainage Area =
FEMA Floodzone Type - X1
Property Owner See 60th Street and Hollyhock Street.
Description/Complaint

EEC Observations -

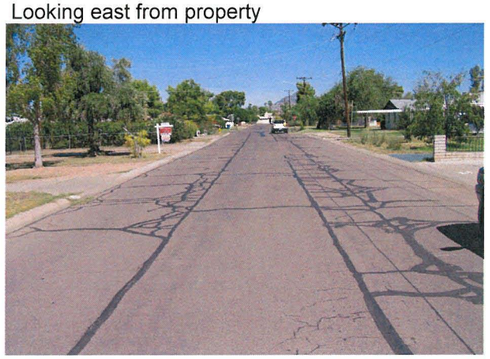
Conclusion -

3022 North 26th Street

Looking southwest at property

Looking east from property

Looking west at property

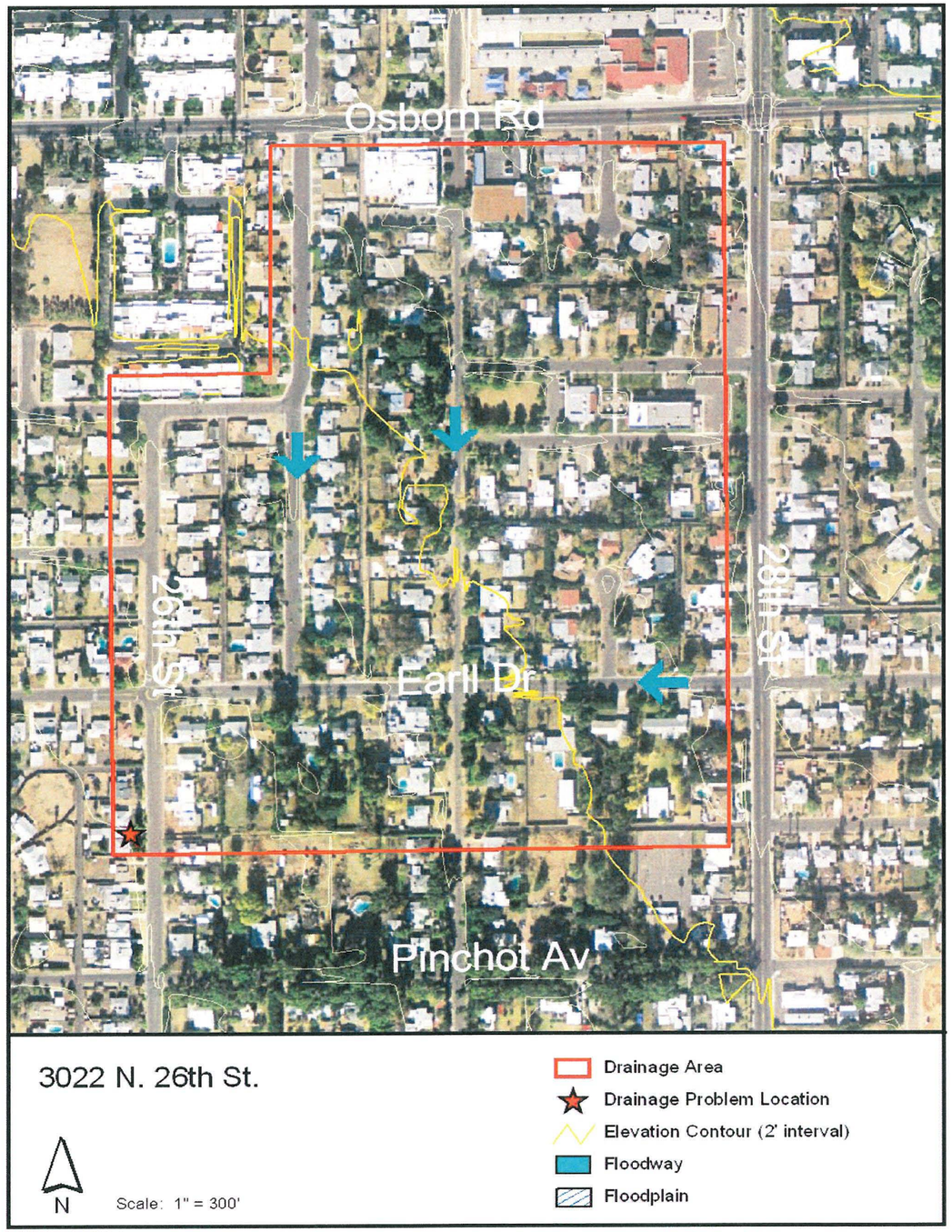


Looking north along 26th Pl.

Approximate Drainage Area = 46.2 acres
FEMA Floodzone Type - X1
Property Owner No information available.
Description/Complaint

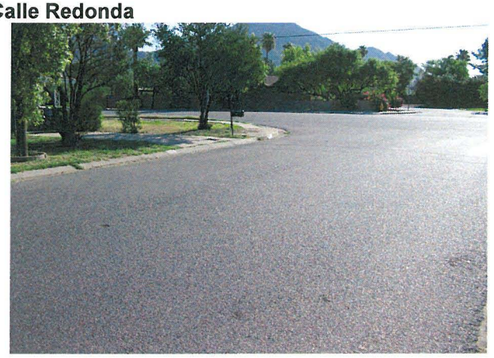
EEC Observations - There appears to be flow headed west in the easement across from the house. The house is subject to that flow and any local runoff from 26th Street. There are two triple grated inlets in front of the house. These inlets are likely designed to intercept the smaller storm events.

Conclusion - The property is probably protected from the smaller storm events but is probably still susceptible to flooding in large storm events, once the storm drain capacity is exceeded. This appears to be a local drainage issue.



44th Street and Calle Redonda

Looking west



Looking east northwest corner

Northwest corner

Approximate Drainage Area = 210 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "The project has been put on hold. No work to be done." - COP Street Maintenance

EEC Observations - It appeared as if nuisance water could pond at the northwest corner. It also appeared that water would stand between Calle Feliz and 44th Street along Calle Redonda (based only on a visual analysis, no survey was taken).

Conclusion - It appears that the complaint is a street flooding issue, which makes it a local flooding issue. It is likely in any storm event, there is nuisance water afterwards. However, in the large storm events, runoff will pool behind the Arizona Canal and flood Calle Redonda, which is a regional issue.

4501 East Calle Redonda

Looking northeast

Looking southwest

Looking southwest

Looking northwest

Approximate Drainage Area = 55 acres
FEMA Floodzone Type - A
Property Owner Description/Complaint "Property has been damaged in previous storms causing the city to pay damages." - COP Street Maintenance

EEC Observations - There is a valley gutter that flows south towards property. There is a COP park adjacent to the property. The house is subject to flow from the east and north.

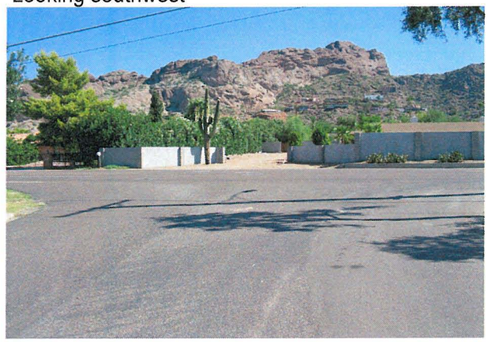
Conclusion - It is likely that the adjacent yard is flooded in most events. The frequency of the house flooding depends on the FFE. With the park adjacent to the property, flow could be diverted to the west into the park. This is a regional drainage issue associated with ponding behind the Arizona Canal.

4742 North Launfal

Looking west

Looking southwest

Looking west along Camelback

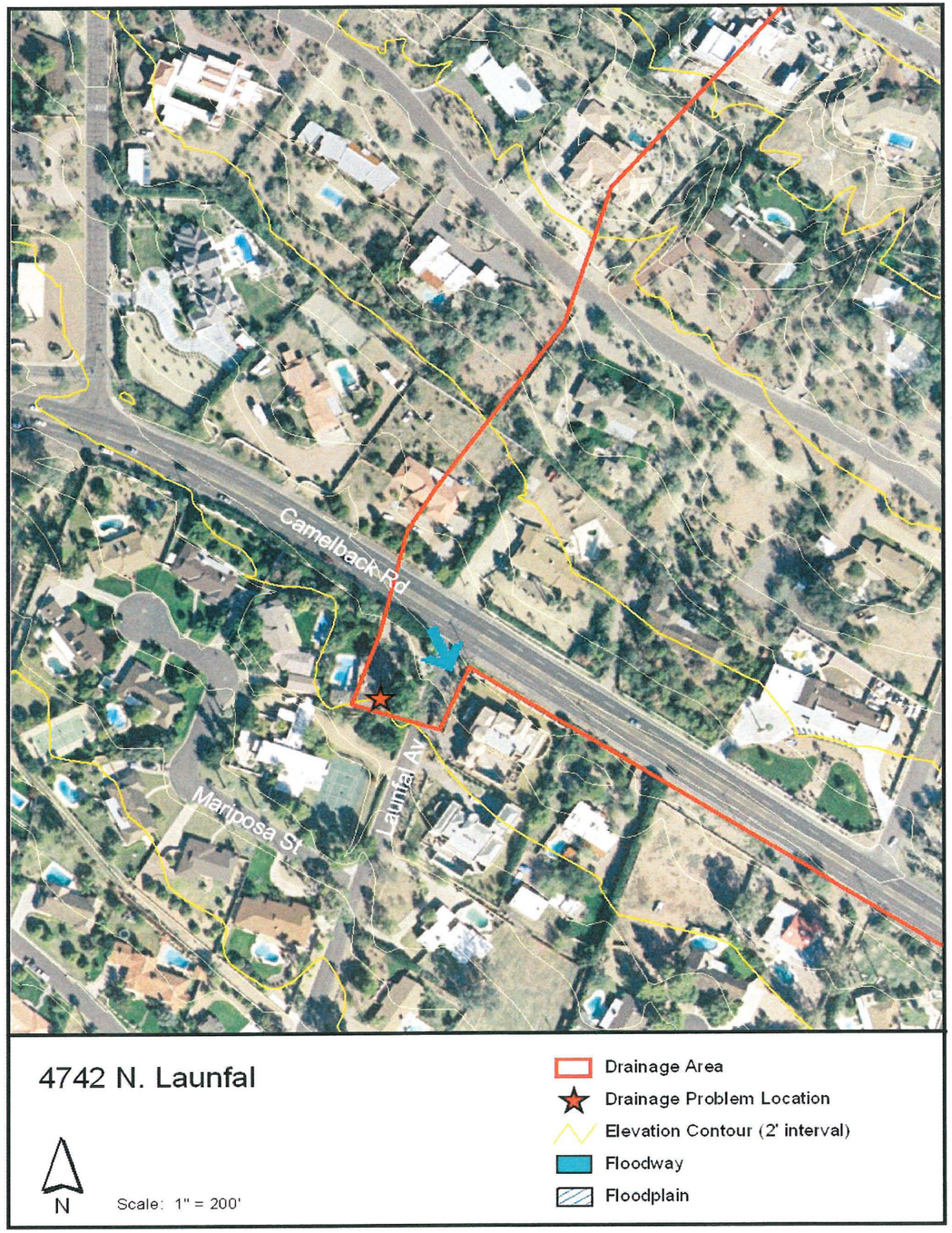


Looking north

Approximate Drainage Area = 110 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint No comments on Local Flooding Input Prioritization Coding Form.

EEC Observations - The property is subject to the amount of stormwater that overtops Camelback and flows south on Launfal. There is roll curb along the east side of the property. There is slope to south to carry water away from the property.

Conclusion - Once the roll curb is overtopped, the house and yard are subject to flooding. This appears to be part of a larger, regional issue where the flows from the hillside areas of Camelback Mountain are not properly conveyed through the neighborhoods.



4835 East Exeter Boulevard

Looking north

Looking southeast at property

Looking south at property

Looking west

Approximate Drainage Area = 100 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint No comments on Local Flooding Prioritization Input Coding Form.

EEC Observations - The FFE appeared to be low. Any flow that overtops Exeter will flow south to the property. Survey would be needed to determine if the property is in a low point along Exeter Boulevard.

Conclusion - It is likely that the house/yard is subject to storm water in most any storm event. This appears to be part of a larger, regional issue where the flows from the hillside areas of Camelback Mountain are not properly conveyed through the neighborhoods.

Arcadia Drive and Calle Del Medio

Southwest corner

Northeast corner

Southeast corner

Northwest corner

Approximate Drainage Area = 200 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Work has been (done) at this intersection which has helped greatly." - COP Street Maintenance

EEC Observations - It appears as if water could pond on the southeast and southwest corners. It also appeared as if the ponded water would spill south. The adjacent homes on the south side of the road have low FFE's and most are flood irrigated lots.

Conclusion - It appears to be an issue of street flooding. However, the homes are susceptible to flooding in larger events. This appears to be part of a larger, regional issue where the flows from the hillside areas of Camelback Mountain are not properly conveyed through the neighborhoods.

4921 East Calle Del Norte

Looking south at property

Looking at driveway

Looking east

NW corner of Calle Del Norte and Arcadia

Approximate Drainage Area = 150 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint No comments on Local Flooding Prioritization Input Coding Form.

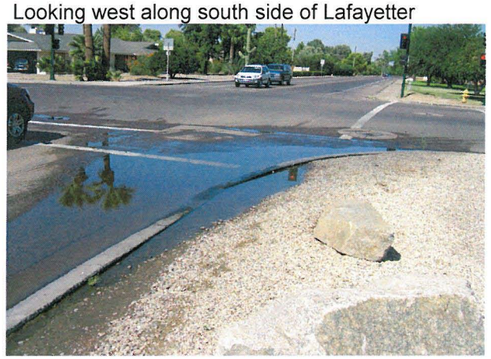
EEC Observations - Flow leaves the west side of Arcadia and flows to the west along Calle Del Norte. The FFE appeared to be significantly lower than the gutter elevation (survey is needed to verify this assumption made off of a visual analysis). There is a humped driveway and roll curb containing the flow. The yard is flood irrigated and will provide some storage.

Conclusion - Once the roll curb and/or driveway is overtopped, the house is susceptible to flooding. This appears to be part of a larger, regional issue where the flows from the hillside areas of Camelback Mountain are not properly conveyed through the neighborhoods.

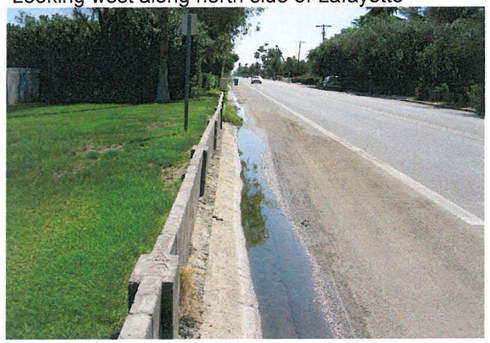
56th Street and Lafayette

Looking west along south side of Lafayetter

Looking west along north side of Lafayette



Looking southwest at corner



Looking east along north side of Lafayette

Approximate Drainage Area = 400 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Standing water at ne corner daily, water caused asphalt to break up. Constant calls for potholes at location. PM could not mill due to high crown in street. Traffic hazard if milled." - COP Street Maintenance

EEC Observations - When visited on 8-19-05, there was standing water on the northeast corner. Water backed up Lafayette for over 100'. There was dirt and debris in the shoulder as well.

Conclusion - It is an issue of street flooding. There is likely nuisance water in every storm event and the road likely becomes hard to pass going west on Lafayette during storms. This appears to be part of a larger, regional issue where the flows from the hillside areas of Camelback Mountain are not properly conveyed through the neighborhoods.

6207 East Calle Redonda

Looking west along Calle Redonda

Looking west along Calle Redonda

Looking south from 62nd Street

Looking north up 62nd Street

Approximate Drainage Area = 280 acres
FEMA Floodzone Type - A
Property Owner Description/Complaint No comments on Local Flooding Prioritization Input Coding Form.

EEC Observations - There are two small inlets adjacent to the property. The house is at the intersection of 62nd Street and Calle Redonda so it is subject to flow from the north and the east. There is roll curb in front of the house. The house is also subject to flooding caused by water ponding behind the canal.

Conclusion - Once the driveway and roll curb is overtopped, the house could be flooded. Survey is needed to determine the FFE and its relation to the curb elevation (the FFE appeared to be close to curb elevation). The drainage concentration point is at the end of a cul-de-sac and doesn't have an adequate outfall. The frequent flooding problem is probably a local drainage issue associated with street flood but this problem is also a regional issue for larger floods that pool behind the canal.

Appendix A.3.3

SOUTHWEST – UNRESOLVED FLOODING COMPLAINTS

3rd Avenue and Papago Street

Looking west down Papago

Looking southwest

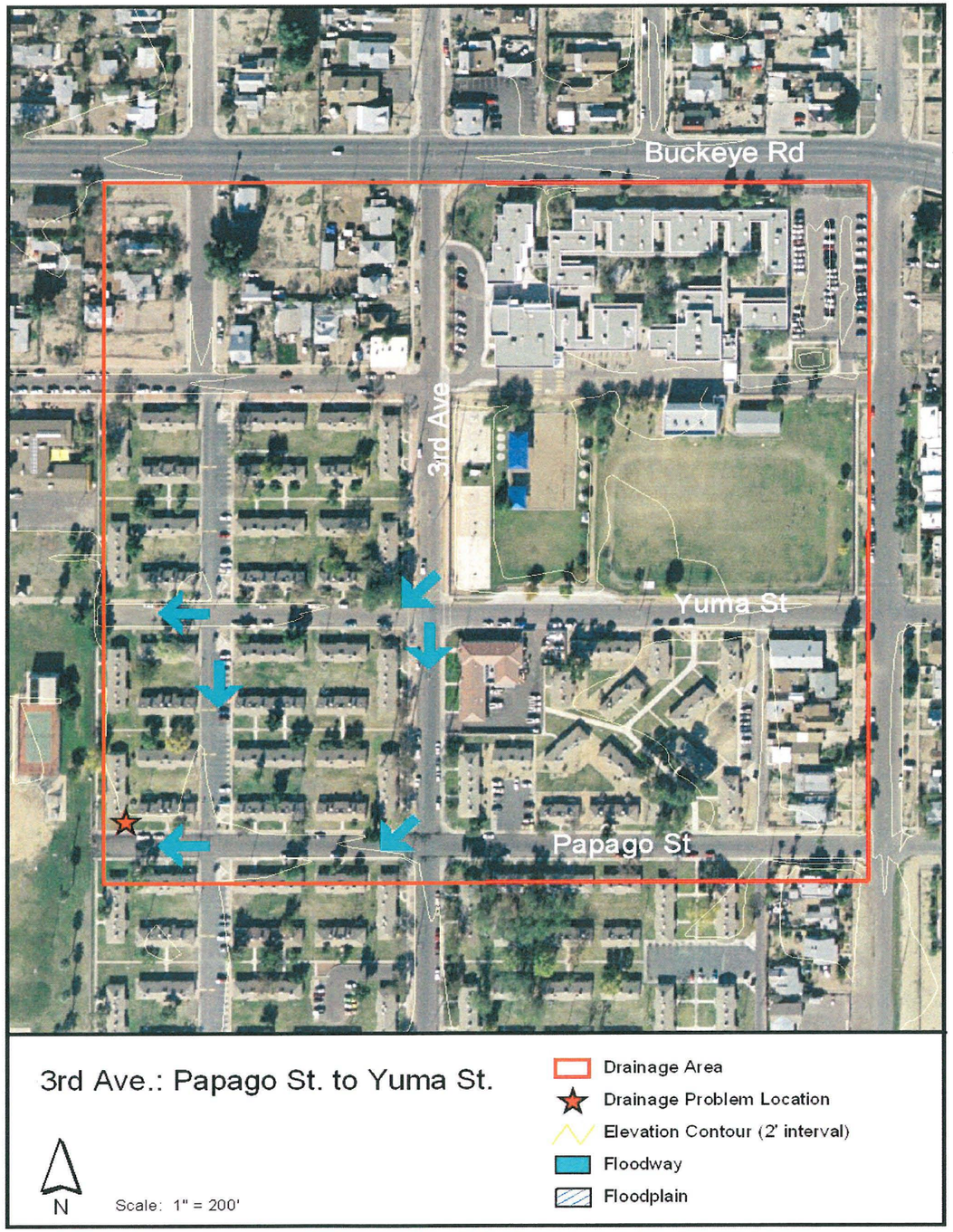
Northeast corner

Looking east along south side of Papago

Approximate Drainage Area = 27.6 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Street runoff flows to the west on Papago St. down the dead end to the west of 3rd Ave. Papago ends at the boundary of Harmon Park. Storm water collected is designed to enter two catch basins which are drained with the use of a dry well. Heavy use has clogged this dry well with silts. Nuisance water causes the maintenance department to pump the water out of these catch basins twice a week. The closest storm drain present is in 7th Ave." - PEC

EEC Observations - Yuma and Papago have the same flooding issue. Water travels to the west down Yuma and Papago Street and then ponds at the dead ends. There are existing dry wells in place but they no longer function properly.

Conclusion - The cul-de-sacs dead end next to Harmon Park so the logical solution to the local drainage issue is to get the ponded water into the park and let it pond there. There is curb in place and the FFE's appeared to be slightly higher than curb elevation so there is a chance the apartments might not be flooded in large storm events. In any storm event, there will be nuisance water. This is local drainage issue.

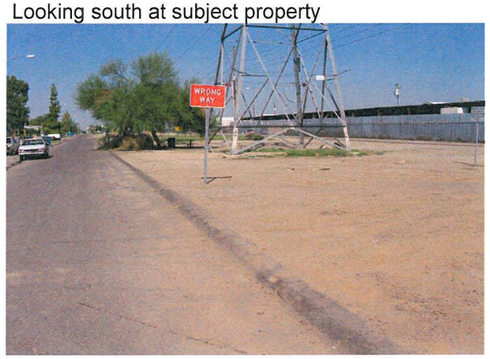


1919 West Sherman Street

Looking west along south side

Looking south at subject property

Looking northeast at corner



Looking west along north side

Approximate Drainage Area = 2.7 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint "Small 6" storm line full of roots. Repetitive flooding." - COP Street Maintenance

EEC Observations - There is a catch basin on the southwest corner of Sherman and 19th Avenue. There is roll curb along the south side of Sherman Street. The FFE is at or below curb elevation (no survey was taken to confirm the visual inspection). Flow may also be splitting out from 19th Avenue down Sherman Street. There may be an issue of dirt flowing into Sherman from the north.

Conclusion - Once the roll curb is overtopped, the house is susceptible to flooding. This is a local drainage issue. The drainage area is very small.

Monroe and 4th Avenue

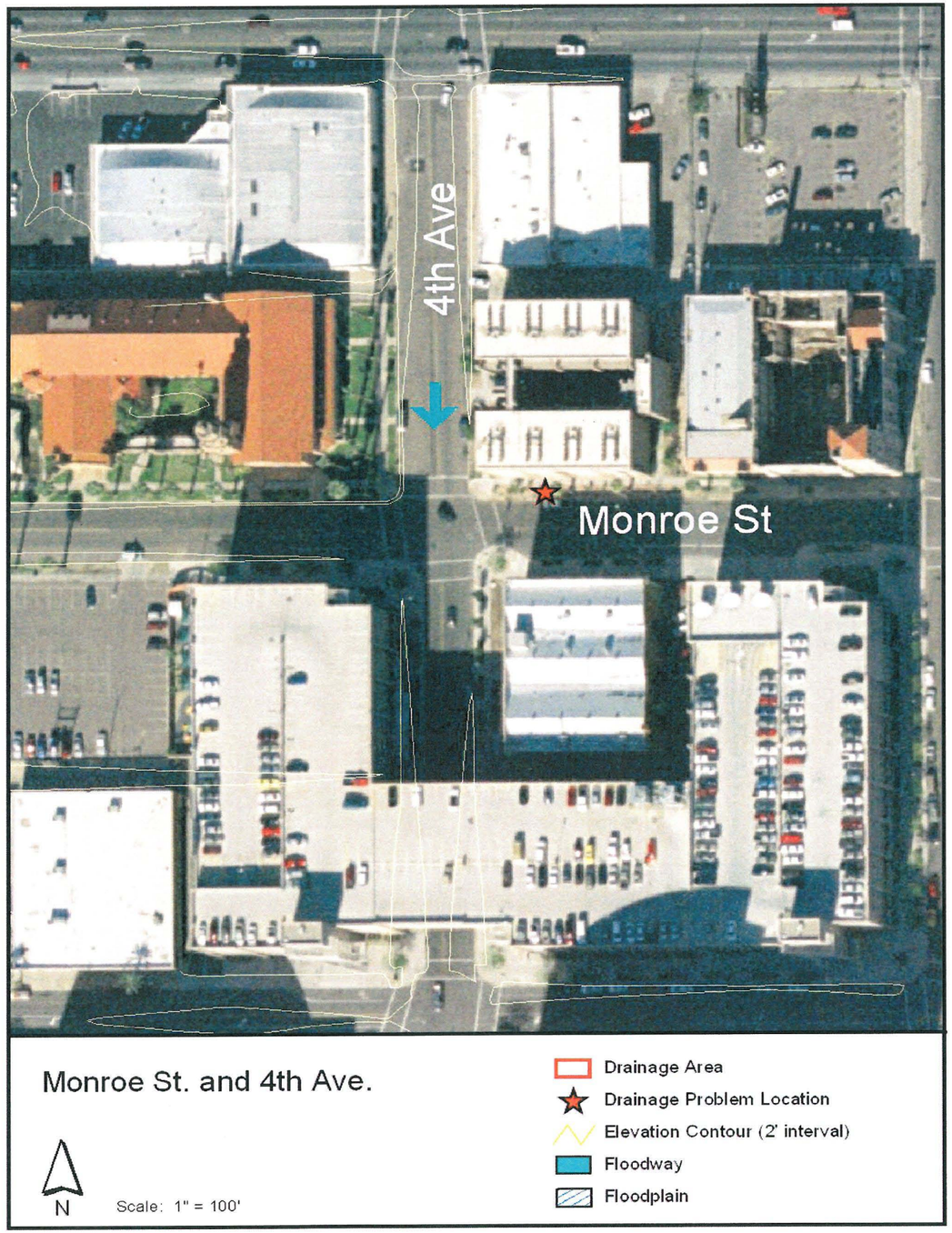
Looking northeast at catch basin

Looking northwest

Approximate Drainage Area = 2 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint "New catch basin installed." - COP Street Maintenance

EEC Observations - There is a new catch basin on the northeast corner of the intersection.

Conclusion - This is a local drainage issue that appears to have been solved with the installation of a new catch basin.



FCD JOB NO. FCD2004C040
EEC JOB NO. 305008

DRAINAGE PROBLEM

METRO PHOENIX ADMP

1707 West Osborn Road

Looking south at subject property

Looking west along Osborn

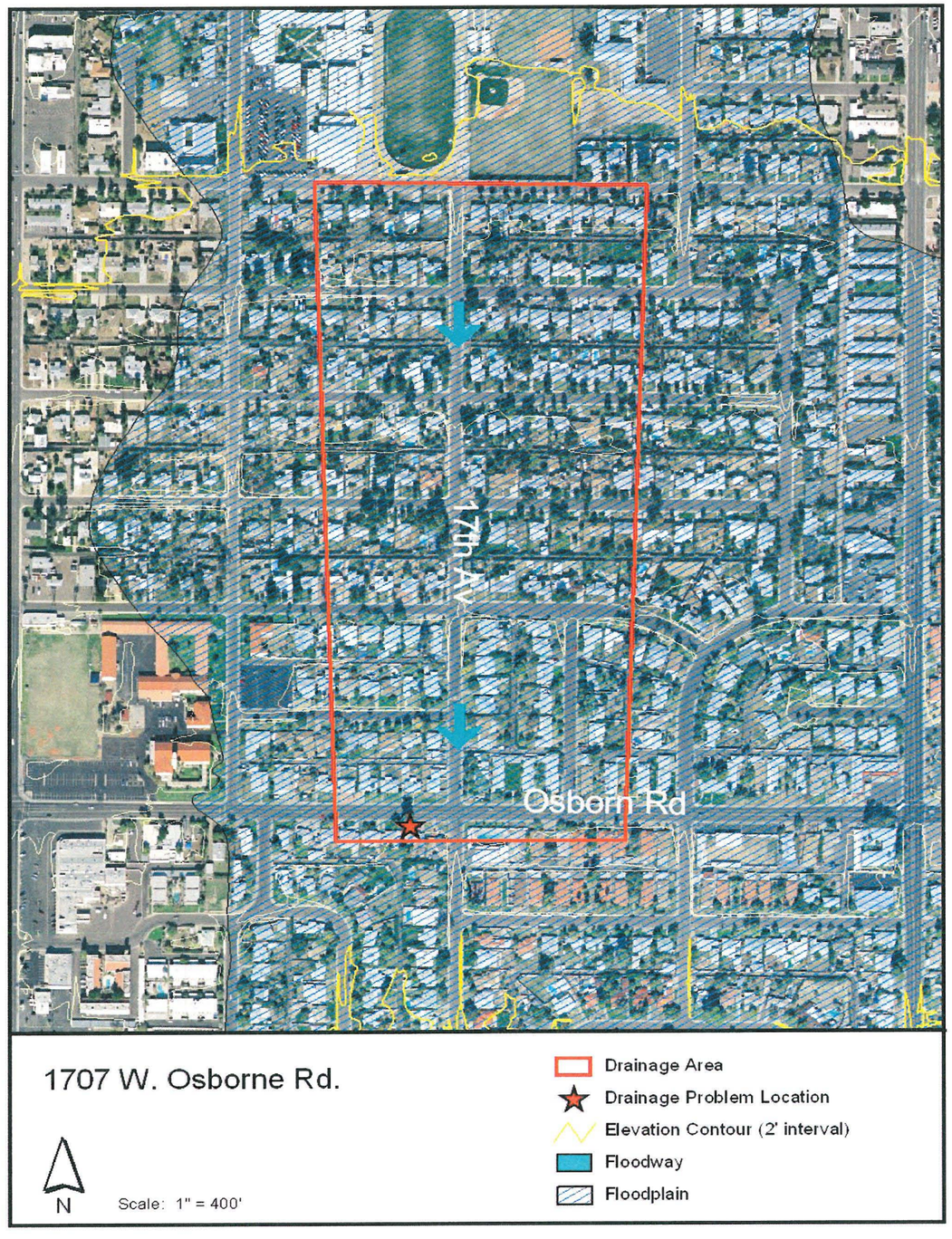
Looking south at subject property

Looking east along Osborn

Approximate Drainage Area = 42.3 acres
FEMA Floodzone Type - AE
Property Owner Description/Complaint "Property lower than street. Residence at this address is in a low line area which is lower than street grade. Storm drains are in area, regardless of additional installation of drain, property will retain water." - COP Street Maintenance

EEC Observations - The subject property is located in the Cave Creek floodplain. There is very little slope east or west so flow is forced to go south where there is good slope. The FFE appeared to be lower than curb (survey would be necessary to verify this).

Conclusion - Once the curb is overtopped, the house is susceptible to flooding. At a minimum, the yard will flood anytime the curb is overtopped. The problem is part of a larger, regional issue associated with the Cave Creek floodplain.



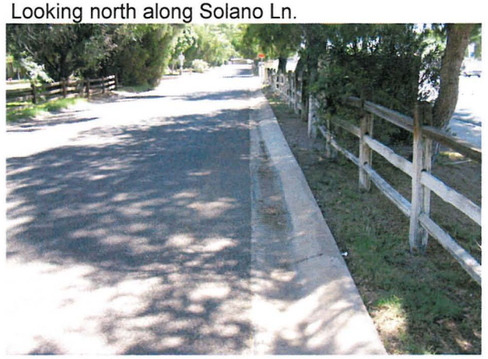
	Identified
1	5713 N. Solano Ln.
2	4004 N. 7th St.
3	2945 N. 18th Ave.
4	12th Ave. and Campbell Ave.
5	4th St. to 7th St. along the Grand Canal
6	17th Ave.: McDowell to Encanto
7	49th Street and Portland Street
8	1735, 1739, 1741 West Verde Lane
9	4510 North 12th Avenue
10	940 West Palm Lane
11	1717 North 17th Avenue
12	Laurel Avenue and Palm Lane
13	15th Avenue and Catalina
14	15th Avenue to 19th Avenue: Osborn to Thomas
15	4523 N. 8th Street

Appendix A.4
Identified

5713 North Solano Lane

Looking north along Solano Ln.

Looking south along Solano Ln.



Looking south along west side of Solano Ln.

Looking east at property

Approximate Drainage Area = 13.1 acres (not including flow from 7th Avenue)
FEMA Floodzone Type - X1
Property Owner Description/Complaint Frontage road overtops and floods yard, garage, and house.

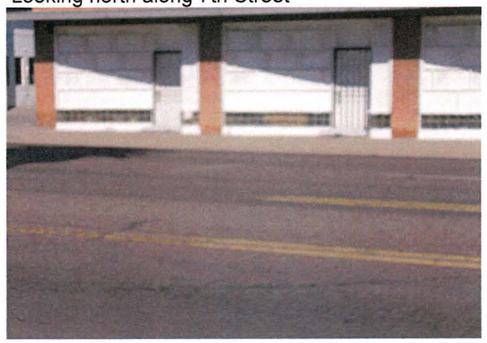
EEC Observations - The flow travels south down Solano to the property. There appears to be enough fall to the south of the house that the issue could be resolved. There is a small hump in front of the driveway that may be blocking flow from going south. The other issue is that water may flow from the east side of 7th Avenue into Solano (without survey it was not possible to determine).

Conclusion - This is a local drainage problem. It is possible that the property could flood in most storm events.

4004 North 7th Street

Looking north along 7th Street

Looking east at property



Looking east at property

Looking east at property

Approximate Drainage Area = 3.5 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint Street overtops and floods office.

EEC Observations - It appears as though flow could pond in 7th Street and be forced onto the sidewalk by oncoming traffic. Based on the contours, there is about 0.0030 ft/ft slope to south. The street capacity is limited due to the slope. There is currently a storm drain in 7th Street but there were no inlets adjacent to the property. This also could be an issue of a local sump that needs to be regraded.

Conclusion - It is possible that in small storm events, there could be flooding because the flow in 7th Street will be in the gutter and traffic could force it over the sidewalk. In addition, the FFE is just slightly above the top of curb. This a local drainage problem even though the flow is from a major conveyance corridor.

2945 North 18th Drive

Looking east at property

Looking east

Looking east at property

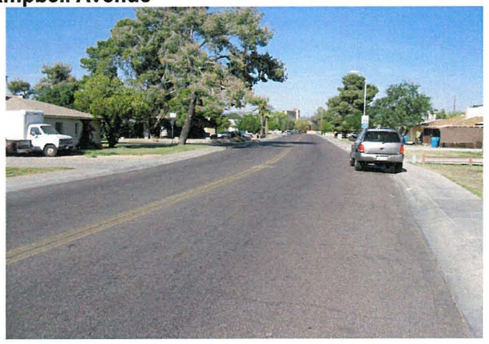
Approximate Drainage Area = approximately 6 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint Street flooding and the homes close to Thomas Road flood.

EEC Observations - There is roll curb along 18th Drive. The flow travels south down 18th Drive to Thomas. Based on contours, the slope is approximately 0.0030 ft/ft. The street capacity is limited due to the flat slope and the roll curb. The homes are not set close to the street.

Conclusion - The yards/homes are susceptible to flooding when the roll curb overtops. The problem is part of the larger, regional Cave Creek floodplain problem.

12th Avenue and Campbell Avenue

Looking north along 12th Ave.



Looking east down Campbell

Looking west down Campbell

Approximate Drainage Area = 2.5 sq. miles
FEMA Floodzone Type - A
Property Owner Description/Complaint Street flooding.

EEC Observations - There is roll curb to protect the properties along 12th Avenue from being flooded. The slope along 12th Avenue based on the contours is only 0.0015 ft/ft. Since there is very little slope, the street capacity is limited. Campbell runs parallel to the Grand Canal and there is very little conveyance capacity along Campbell.

Conclusion - If the flooding is caused by local flow from 12th Avenue, then it is a local drainage issue. It is more likely flooding caused by water backing up behind the Grand Canal. The complaint falls in the Grand Canal floodplain and it is likely a regional drainage problem.

4th Street to 7th Street along the Grand Canal

Looking at the south along 4th St.

Looking south along 5th St.

Looking west along Meadowbrooke Ave.

Looking south at canal embankment

Approximate Drainage Area = 2.0 sq. miles
FEMA Floodzone Type - AE
Property Owner Description/Complaint Drainage flow down 7th Street and flows west along Grand Canal because it is blocked by the canal.

EEC Observations - The general flow direction is to the southwest. Once water reaches the canal embankment, it ponds behind the canal until it spills over the canal.

Conclusion - The ponding behind the canal is a regional drainage issue.

17th Avenue: McDowell to Encanto

Looking north along 17th Ave.

Looking at northeast corner

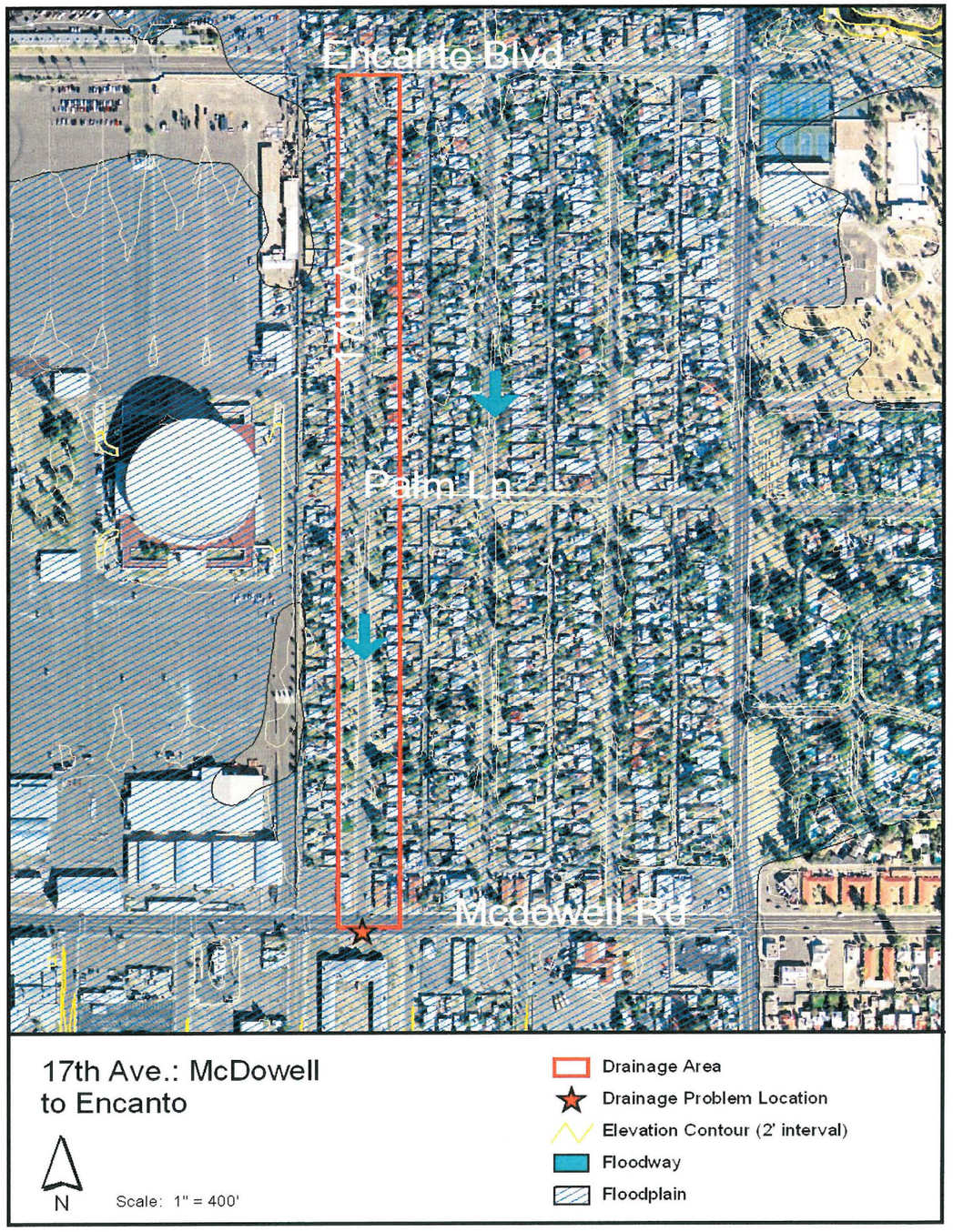
Looking west along Palm Lane

Looking southwest

Approximate Drainage Area = 8.0 sq. miles
FEMA Floodzone Type - X1
Property Owner Description/Complaint Localized street flooding.

EEC Observations - Flow travels south down 17th Avenue. There is a slope of approximately 0.0077 ft/ft. The area is in a floodplain but there is roll curb and gutter to protect the properties. The street clearly had suffered damage. The frequent flooding problem appears to only be an issue of street flooding.

Conclusion - There appears to be a street flooding issue but it does not appear that properties are suffering any damage. This problem is part of the larger, regional issue associated with the Cave Creek floodplain.



49th Street and Portland Street

Looking east toward 49th St. and Portland St.

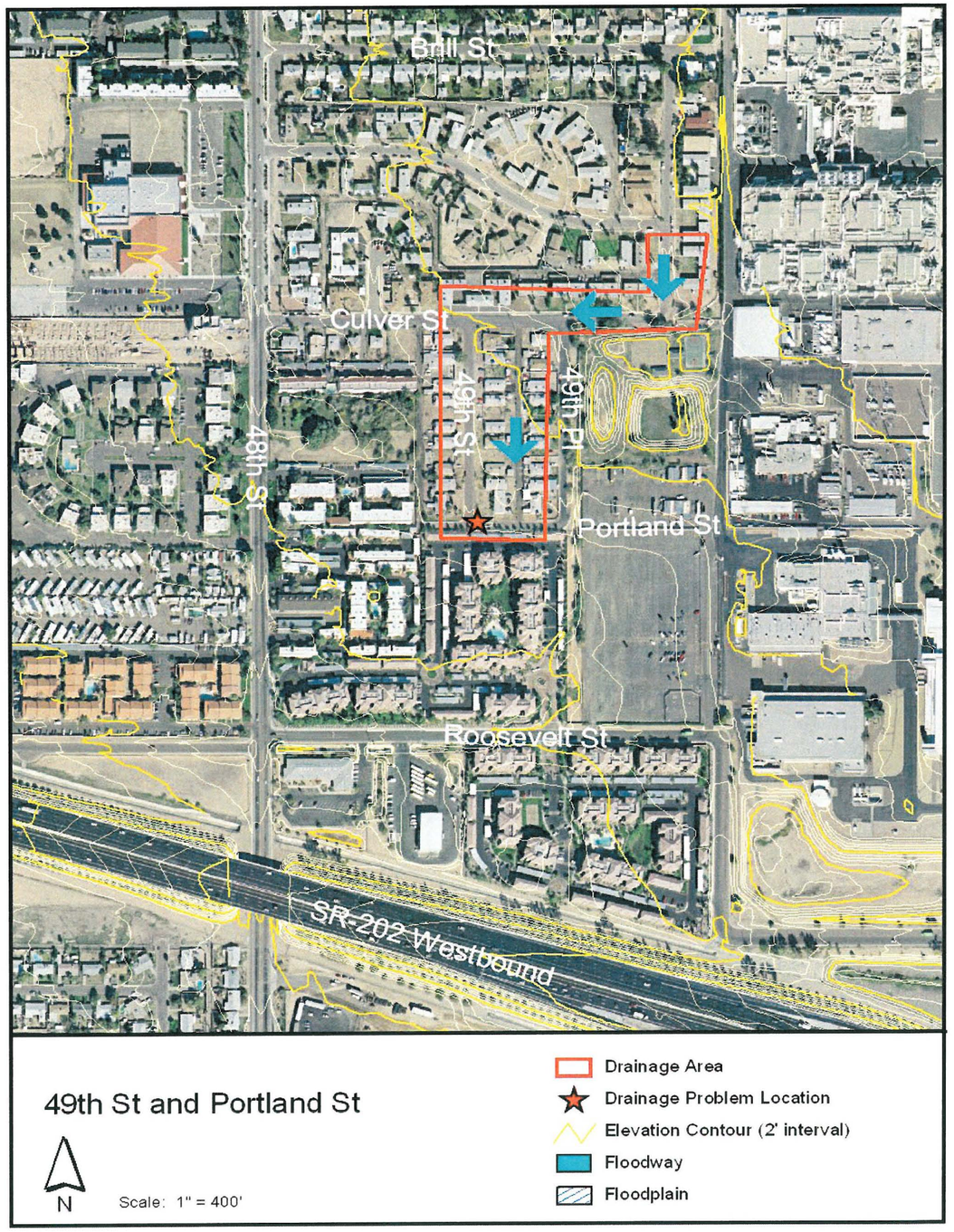
Entrance to Apartment complex on Portland, west of 49th St.

Looking west into Apartment complex

Approximate Drainage Area = 6 acres
FEMA Floodzone Type - X1
Property Owner No information.
Description/Complaint

EEC Observations - No observed flood hazard at 49th and Portland. Runoff would flow west toward the apartment complex. The houses along 49th Street appear to be sufficiently higher than the gutter so that runoff in the street should not cause a flooding problem. Street slope of 49th Street is approximately 0.6 percent.

Conclusion - The limited size of the drainage area indicates this to be a local flooding problem.

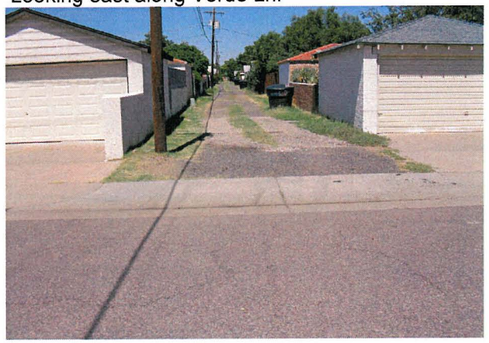


1735, 1739, 1741 West Verde Lane

Looking south at property

Looking east along Verde Ln.

Looking southeast at property



Looking north up alley

Approximate Drainage Area = 3.5 sq. miles
FEMA Floodzone Type - A
Property Owner Description/Complaint Street and house flooding from Thomas and 18th Avenue north to Verde Lane and east to 3rd house from 18th Avenue (south side only). Heavy rain only from 0-5 times each year for at least last 25 years.

EEC Observations - It appears that the houses have low FFE's relative to the street. There is 4" curb in place to protect the houses. Flow could reach the properties from the north, east, and west. The three houses in question could be in a low spot. There is very little if any slope across Verde Lane so the capacity of the road is probably very small.

Conclusion - The properties are in the Cave Creek floodplain. If flow were able to leave Verde Lane and head south on 18th Avenue to Thomas, the houses would not flood as frequently and the severity would be lessened. However, this problem is still associated with the Cave Creek floodplain problem.

4510 North 12th Avenue

Looking north along 12th Ave.

Looking west at property

Approximate Drainage Area = 2.5 sq. miles
FEMA Floodzone Type - A
Property Owner Description/Complaint House flooding.

EEC Observations - The property is subject to flow coming south down 12th Avenue and to flow that ponds behind the canal. There is roll curb to protect the properties from being flooded. The FFE also appeared to be low relative to the street elevation. The slope along 12th Avenue based on the contours is only 0.0015 ft/ft. Since there is very little slope, the street capacity is limited.

Conclusion - When the property is being flooded from the flow travelling south down 12th Avenue, it is a local drainage issue. When the property is being flooded due to ponded water behind the canal, then it is a regional drainage issue associated with the floodplain behind the canal.

940 West Palm Lane

Looking west along Palm Ave.

Looking north at property

Looking at existing inlet

Looking north along 11th Ave.

Approximate Drainage Area = 35.0 acres
FEMA Floodzone Type - X1
Property Owner Description/Complaint No information available.

EEC Observations - Flow travels south to Palm Lane from the houses to the north, the flow then travels west down Palm Avenue. There is vertical curb to protect the house from flooding. It also appeared that the FFE was much higher than the street elevation. It is likely that this is an issue of street flooding or standing water.

Conclusion - It does not appear that house flooding is the issue. It is possible that there is street flooding and standing water during smaller storm events which makes this a local flooding issue.

1717 North 17th Avenue

Looking southeast at property

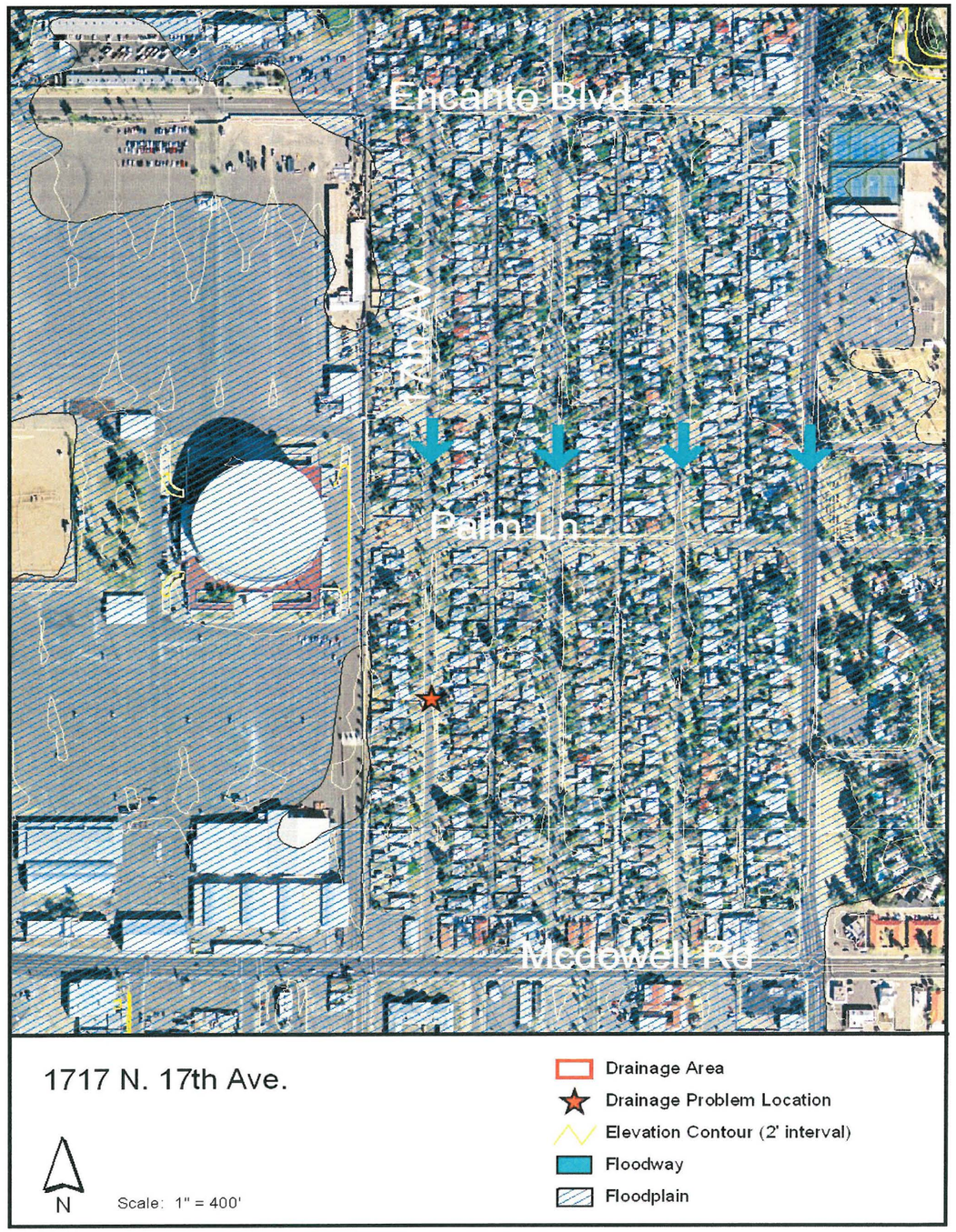
Looking north along 17th Ave.

Looking south along 17th Ave.

Approximate Drainage Area = 6.5 sq. miles
FEMA Floodzone Type - A
Property Owner No information available.
Description/Complaint

EEC Observations - Flow travels south down 17th Avenue. There is a slope of approximately 0.0077 ft/ft. The area is in a floodplain but there is roll curb and gutter to protect the properties. The street clearly has suffered damage. This appears to only be an issue of street flooding.

Conclusion - There appears to be a street flooding issue but it does not appear that properties are suffering from any damage. It is also in a floodplain which makes it part of the larger, regional issue associated with the Cave Creek floodplain.



Laurel Avenue and Palm Lane

Looking at the southwest corner

Looking north along Laurel Ave.

Looking south along Laurel Ave.

Approximate Drainage Area = 6.5 sq. miles
FEMA Floodzone Type - A
Property Owner Description/Complaint It was assumed that it was a street flooding issue at the corner of Laurel Avenue and Palm Lane.

EEC Observations - Flow travels south down Laurel Avenue. There is a slope of approximately 0.0075 ft/ft. The area is in a floodplain but there is roll curb and gutter to protect the properties. The street clearly has suffered damage. This appears to only be an issue of street flooding.

Conclusion - There appears to be a street flooding issue but it does not appear that properties are suffering from any damage. It is also in a floodplain which makes it part of the larger, regional issue associated with the Cave Creek floodplain.

15th Avenue and Catalina

Looking south on 15th Ave toward Catalina Dr.

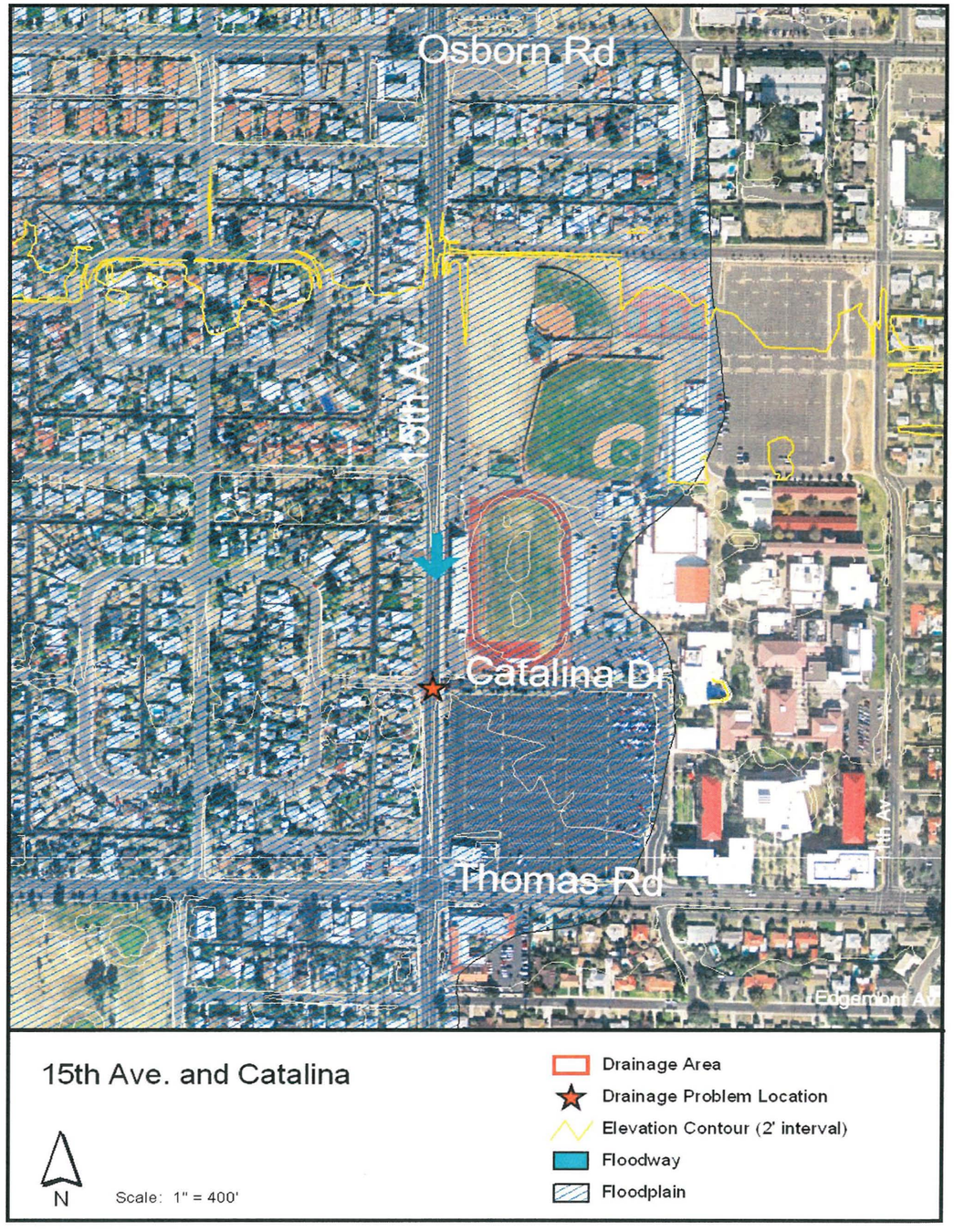
Looking west across 15th Ave at Catalina Dr.

Looking south on east side of 15th Ave

Approximate Drainage Area = 6.0 sq. miles
FEMA Floodzone Type - A
Property Owner
Description/Complaint

EEC Observations - Flow travels south down 15th Avenue. There is a slope of approximately 0.0075 ft/ft. The area is in a floodplain but there is 6" roll curb and gutter to protect the properties on the west side of 15th Avenue. The street clearly had suffered damage. This appears to only be an issue of street flooding.

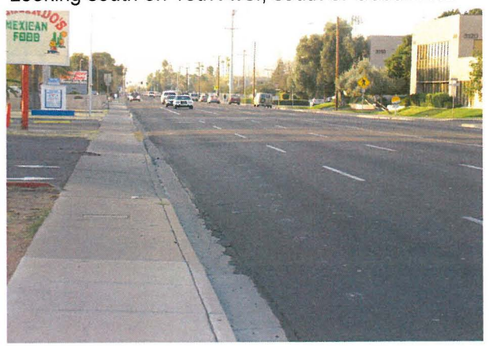
Conclusion - There appears to be a street flooding issue but it does not appear that properties are suffering from any damage. It is also in a floodplain which makes it part of the larger, regional issues associated with the Cave Creek floodplain.



15th Avenue to 19th Avenue: Osborn to Thomas

Looking south on 15th Ave., south of Osborn Rd

Looking South on 17th Ave., north of Thomas Rd.



Looking South on 19th Ave., south of Osborn Rd.

Looking south on 19th Ave., north of Thomas Rd.

Approximate Drainage Area = 6.0 sq. miles
FEMA Floodzone Type - A
Property Owner
Description/Complaint

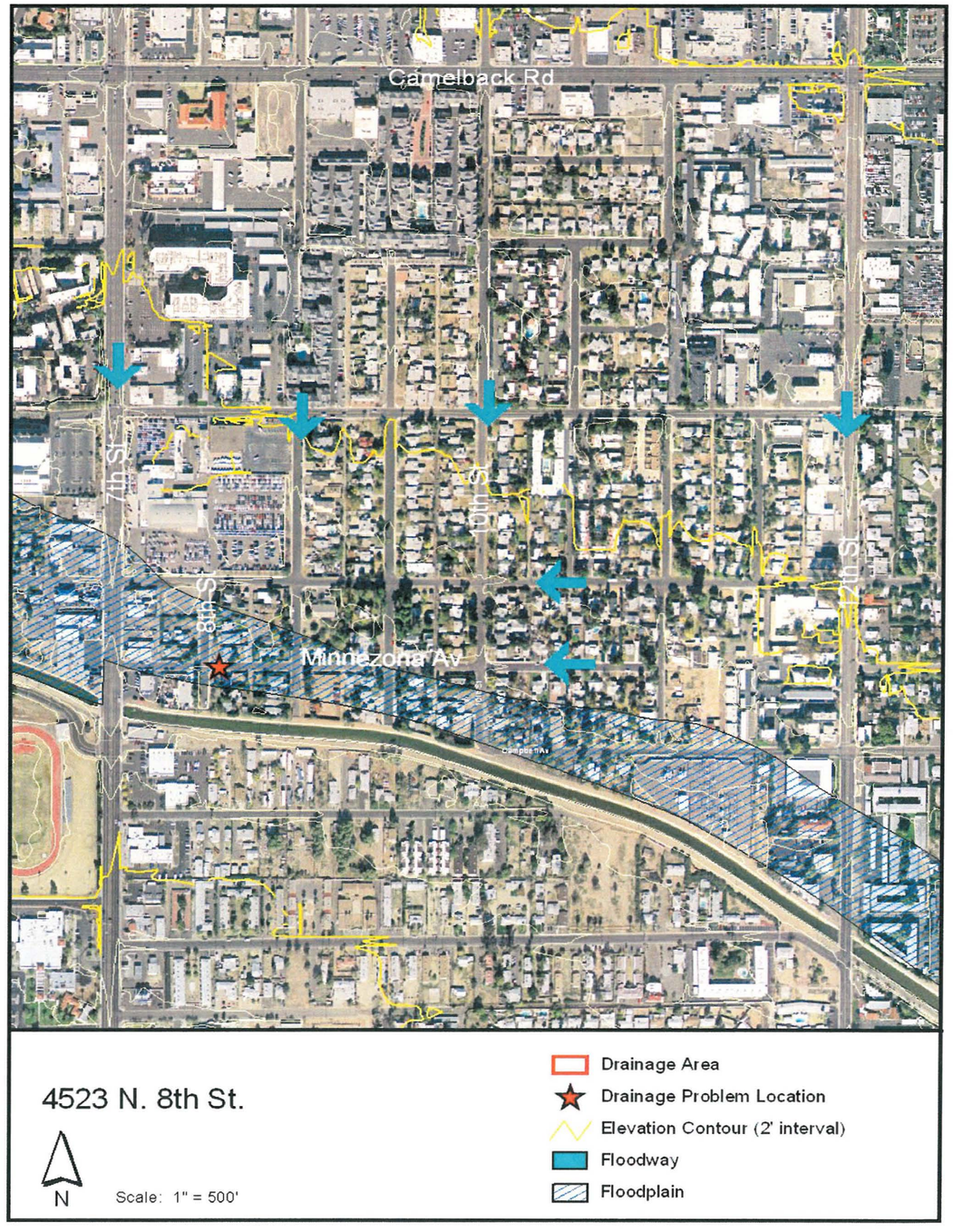
EEC Observations - Flow travels south down 15th, 16th, 17th, 18th and 19th Avenues. There is a slope of approximately 0.0075 ft/ft. The area is in a floodplain but there is curb and gutter to protect the properties.

Conclusion - This area is in a floodplain where all the north-south streets convey storm water runoff which makes it part of the larger, regional issues associated with the Cave Creek floodplain.

4523 North 8th Street

Looking northeast at property

Approximate Drainage Area = 3 sq. miles
FEMA Floodzone Type - A
Property Owner No information available.
Description/Complaint

EEC Observations - The subject area is just upstream of the Grand Canal. It's watershed area reaches as far north as the Arizona Canal. The canal embankment is higher than the FFE's and water ponds behind the canal. 7th Street is also elevated which further exacerbates the ponding problem. The water will pond to a depth of about 1.5 feet until it overtops the canal which leaves the homes susceptible to flooding.

Conclusion - The ponding behind the canal is a regional problem. The homes are in a low lying area and are susceptible to flooding in any event that exceeds the capacity of the storm drain system.