

Laveen ADMP Update Report

Prepared For:
Flood Control District
of Maricopa County
Contract FCD 2014C017

PREPARED BY:



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June, 2015

Stantec Consulting Inc.

Project No. 181300440

Laveen ADMP Update

Report

Master CD



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Exp. 6.30.16

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1 Introduction

The Laveen area has been subjected to flooding in August and September of 1999 and 2014. The 1999 event was estimated to be approximately the 5-year event (FCDMC, 1999). Even though the five year event is a small event, homes along 47th Avenue south of Dobbins Road were subject to flooding as depicted in Figures 1.1 through 1.3. Due to the flooding that occurred in 1999, the Laveen Area Drainage Master Plan (ADMP) was initiated by the Flood Control District of Maricopa County (FCDMC). In August and September of 2014 the Laveen area was subject to rainfall events that exceeded the 100-year event. Due to the 2014 events the Laveen ADMP Update was initiated. The following sections describe watershed characteristics and the purpose and location of the study update.

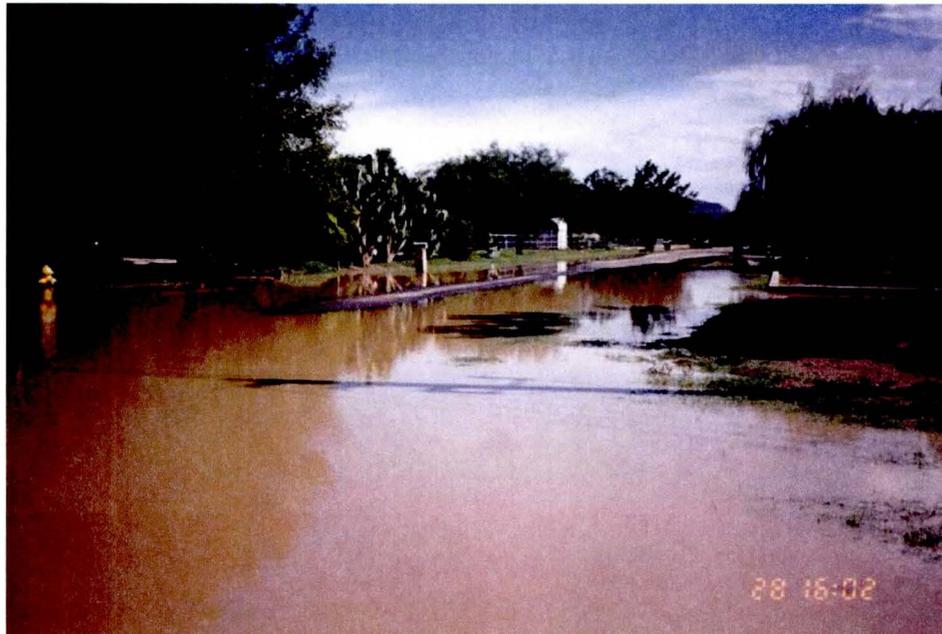


Figure 1.1 – Flooding along La Mirada Street west of 47th Avenue

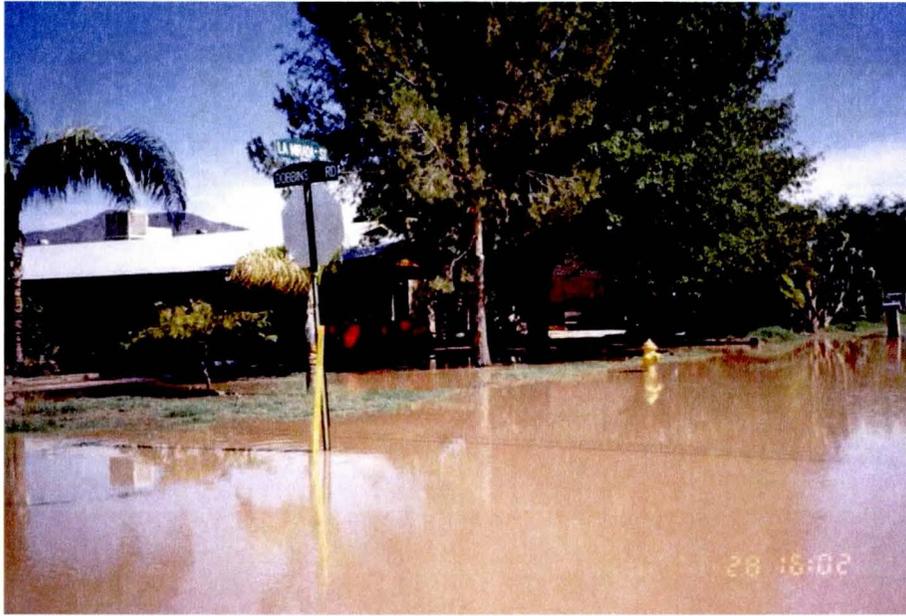


Figure 1.2 – Flooding at the intersection of 47th Avenue and La Mirada Street



Figure 1.3 – Flooding near the intersection of 47th Avenue and La Mirada Street

1.1 Watershed Characteristics

The Laveen ADMP Update Study watersheds are characterized by three major landforms and mixed land uses. The major land forms are; mountain, piedmont and alluvial plains. Predominant land uses in the watersheds consist of; agricultural, residential and open spaces.

The mountainous areas, Carver Hills, and South Mountain form the boundaries of some of the watersheds. These areas are characterized by steep, rocky slopes and small incised washes that form a tributary network until there is a significant change in slope near the transition to the piedmont land form. Typically the conveyance capacity of the tributary network is great enough to convey runoff draining to the tributary channels. Low density residential development occurs on some of the mountain slopes however the majority of the mountainous areas are natural desert open spaces.

The piedmont landform is moderately sloping (1 - 5%) and composed of poorly consolidated alluvial deposits that are bisected by channels with ill-defined banks. The piedmont drainage network is typically distributive channels. In general, the conveyance capacity of the piedmont drainage system diminishes in the downstream direction as channel definition becomes less defined, ultimately giving way to sheet flow. The piedmont is also dissected by numerous manmade features that, in general, redirect flow from historic paths. These manmade features consist of canals, tail water ditches, roadways, and various combinations of culverts, channels, embankments and retention basins. Many of the channels and embankment features are non-engineered. The predominant land use in piedmont landform areas are low and medium density residential with some agriculture.

The alluvial plain located downstream of the piedmont area is comprised of nearly flat uniform terrain. The majority of land uses within this landform are agricultural, low density residential and medium density residential. Master plan communities make up the medium density land use type. The type of drainage network on the alluvial plain is a function of land use. In agricultural and low density land use areas the dominant drainage network is characterized by sheet flow, however agricultural infrastructure and roadways concentrates and redirects flow to adjacent watersheds creating complex split flow conditions. The drainage network in master plan communities is an engineered network comprised of channels, culverts, retention basins and storm drains.

1.2 Purpose and Need

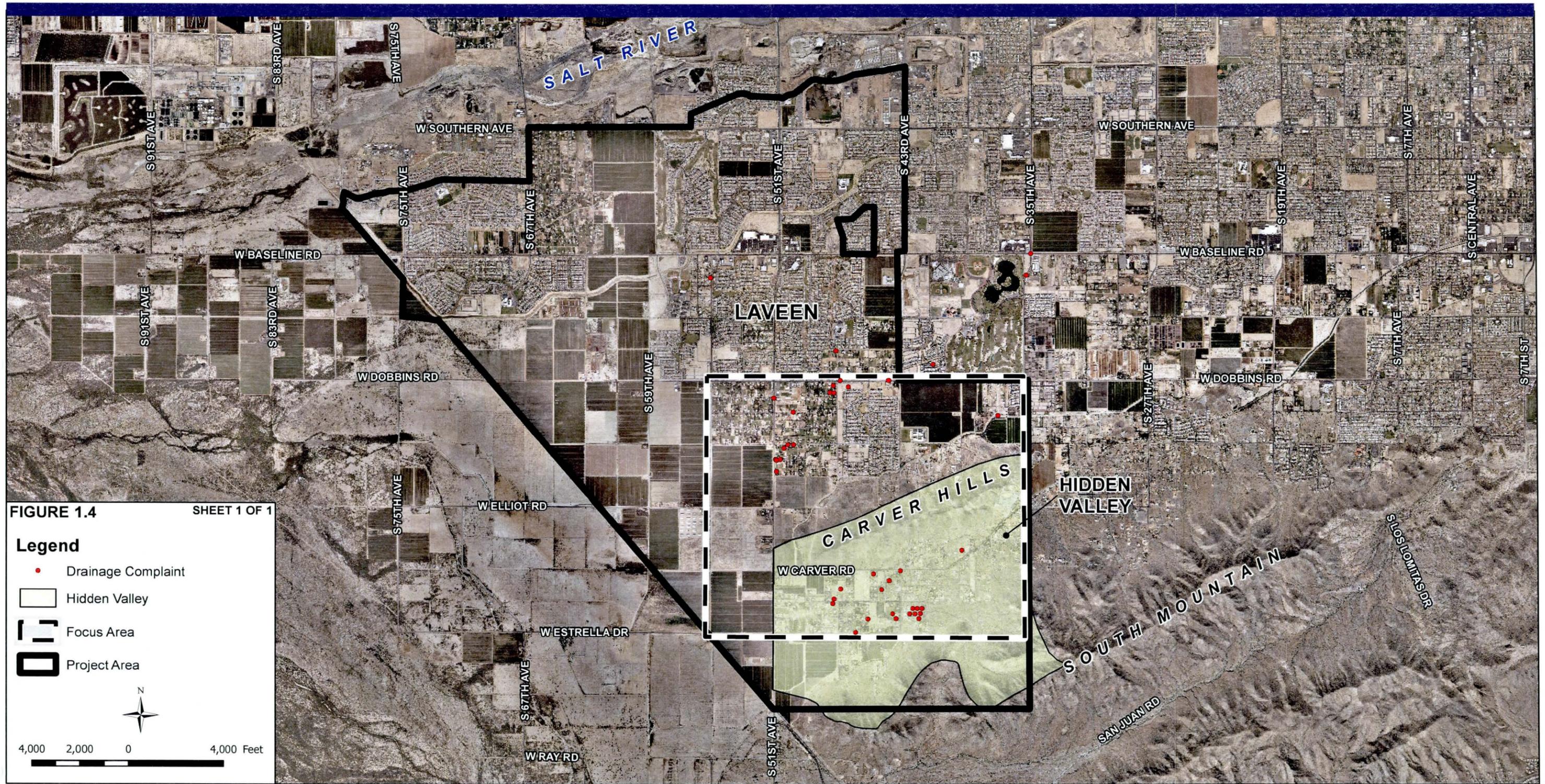
Residents of the Laveen and Hidden Valley areas have experienced flooding due to summer rainfall events. These rainfall events have demonstrated the need for the Laveen ADMP and the Laveen ADMP Update. The objectives of the Laveen ADMP Update are to re-assess the extent of flooding problems identified in the original Laveen ADMP study area, focusing on the areas that were affected by the 2014 summer storms. Qualitative analyses are made to evaluate the Laveen ADMP proposed flood hazard mitigation scenarios and in turn recommend any future technical analysis needed to evaluate potential flood hazard mitigation scenarios that may reduce flood hazard risk to the communities.

1.3 Project Location

Figure 1.4 displays the location of the Laveen ADMP Update project area and the location of the focus area. The focus area is the area where the majority of the drainage complaints were recorded.



Laveen Area Drainage Master Plan Update Vicinity Map



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Flood Control District of Maricopa County, GIS Division, 6/23/2015

2 Qualitative Assessments

2.1 Introduction

The basis of qualitative assessments are comparison evaluations between the location of existing flood control facilities and proposed flood hazard mitigation solutions to the location of flooding issues. Previous drainage studies were reviewed; to understand the magnitude and location of drainage issues; and to determine the capacity and location of flood control facilities. The location of drainage issues were also determined from drainage complaints recorded from the rainfall events in the summer of 2014.

2.2 Site Visits/Data Review

Site investigations were made to become familiar with the areas of drainage complaints as well as to develop an understanding of the type and distribution of the existing drainage facilities in the project area. Site visits observations were validated by comparing observations to drainage facilities described in previous drainage reports. The location of storm drain facilities were obtained from the City of Phoenix (COP). Plate 1 displays the location of drainage facilities, Salt River Project (SRP) Canals, drainage complaints, natural flow paths of washes drainage to flood issue areas and the proposed alignment of the Loop 202. Figure 2.1, Sheets 1 through 8, are detail sheets developed for the focus area displaying the same information presented on Plate 1.

2.3 Drainage Complaints

The sources of drainage complaints and observations of drainage issues are from residents that contacted the COP, FCDMC, emergency centers set up at Fire Stations during and after the summer 2014 storm events, SRP, and agencies that responded to the storm events. These agencies included the COP, FCDMC, SRP and Maricopa County Department of Transportation (MCDOT). Drainage complaints for the Laveen ADMP Update project area can be grouped into three categories, Rural/Agricultural, Low Density Residential, and Master Plan Communities.

2.3.1 Rural/Agricultural Adjacent to Mountain Fronts

Drainage issues in Rural/Agricultural areas located adjacent to mountain fronts are associated with tributary flows that transitions to distributary flows. Distributary flow channels are typically ill defined and may migrate over time. Flow draining from distributary areas transitions to predominantly sheet flow areas. Agricultural and transportation infrastructures influence the concentration and direction of runoff. Runoff draining from the mountains crosses canals and roadways. At some roadway and canal locations split flow conditions develop where a portion of the runoff is directed away from the historic flow path due to the geometry of the canal or roadway. At other locations the combination of canal and roadway profile ponds flow within the roadway.

Figure 2.1, Sheets 5 through 8 depict; the locations of drainage complaints where homes were flooded, roadways and SRP canals for the Hidden Valley area. Sheets 3 and 4 depict the tributary channels on the north side of Carver Hills that drain to the SRP Canal.



Laveen Area Drainage Master Plan Update

Existing Drainage Facilities/Drainage Complaints

SHEET LAYOUT

1	2
3	4
5	6
7	8

FOCUS AREA

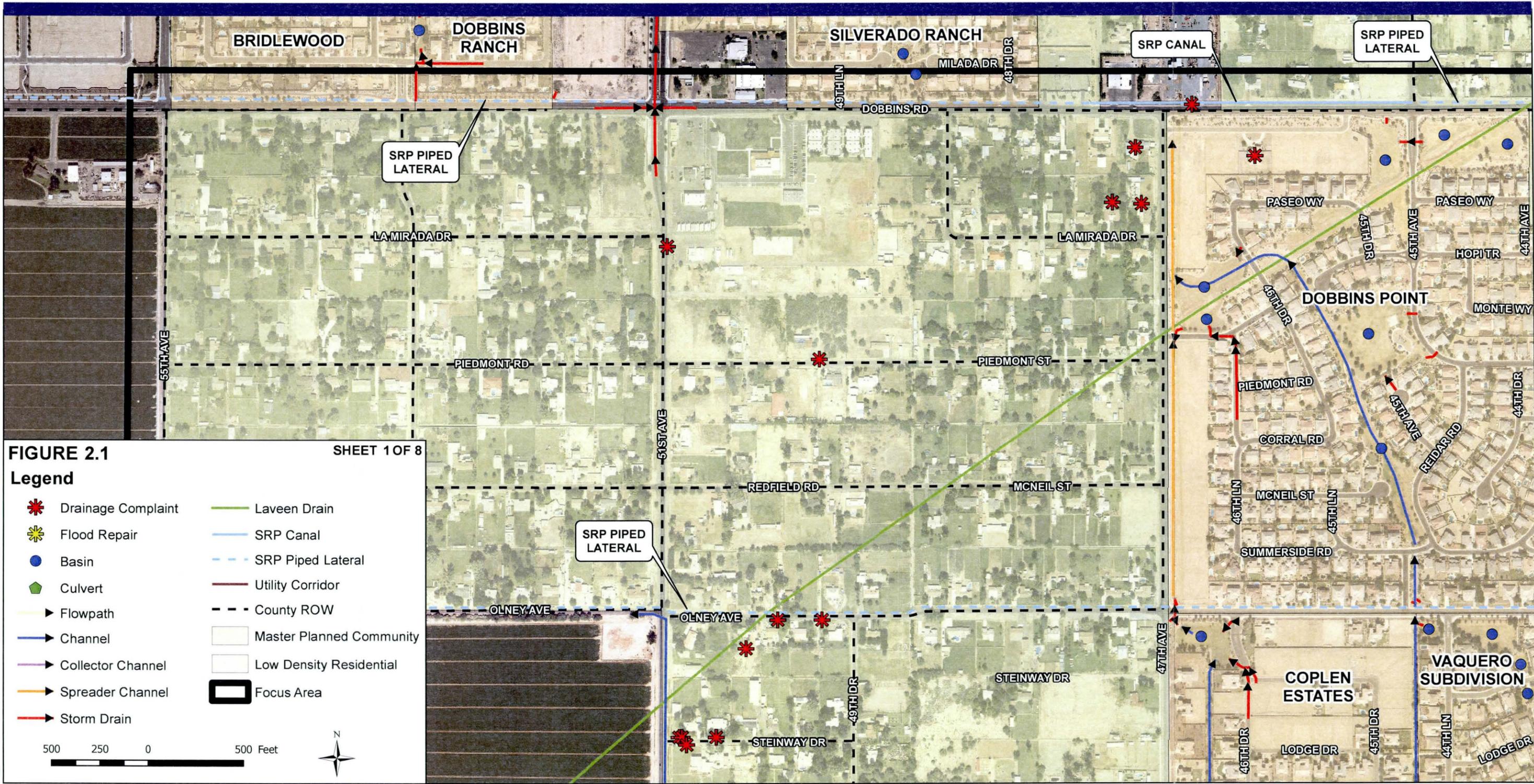


FIGURE 2.1 SHEET 1 OF 8

Document Path: V:\52813\active\1813004\0\gis\worktemp\Dave\mxd\Figure 2.1 Laveen ADMP Existing Drainage Facilities Complaints.mxd

Flood Control District of Maricopa County, GIS Division, 6/22/2015



Laveen Area Drainage Master Plan Update

Existing Drainage Facilities/Drainage Complaints

SHEET LAYOUT

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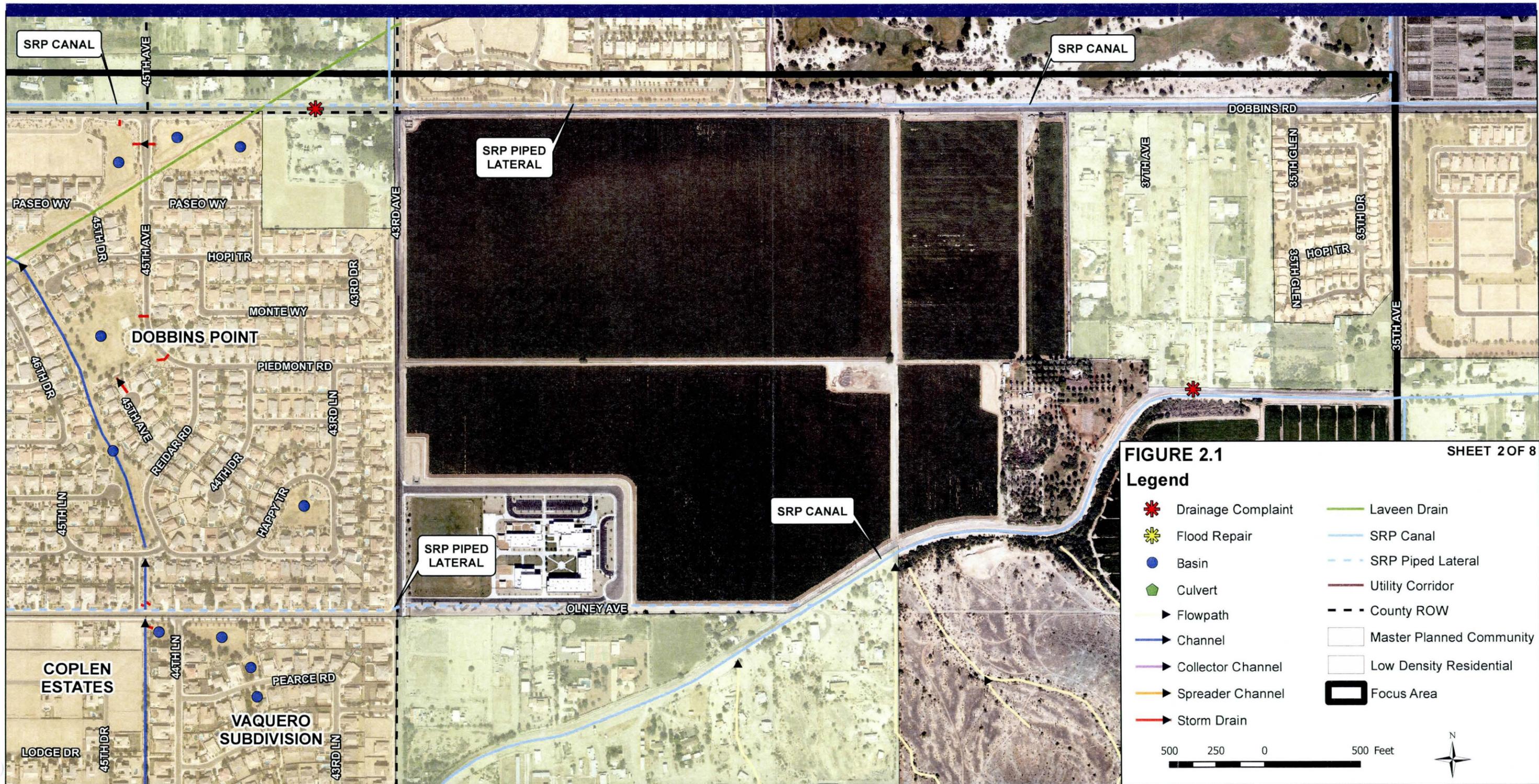


FIGURE 2.1 SHEET 2 OF 8

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Laveen Area Drainage Master Plan Update

Existing Drainage Facilities/Drainage Complaints

SHEET LAYOUT

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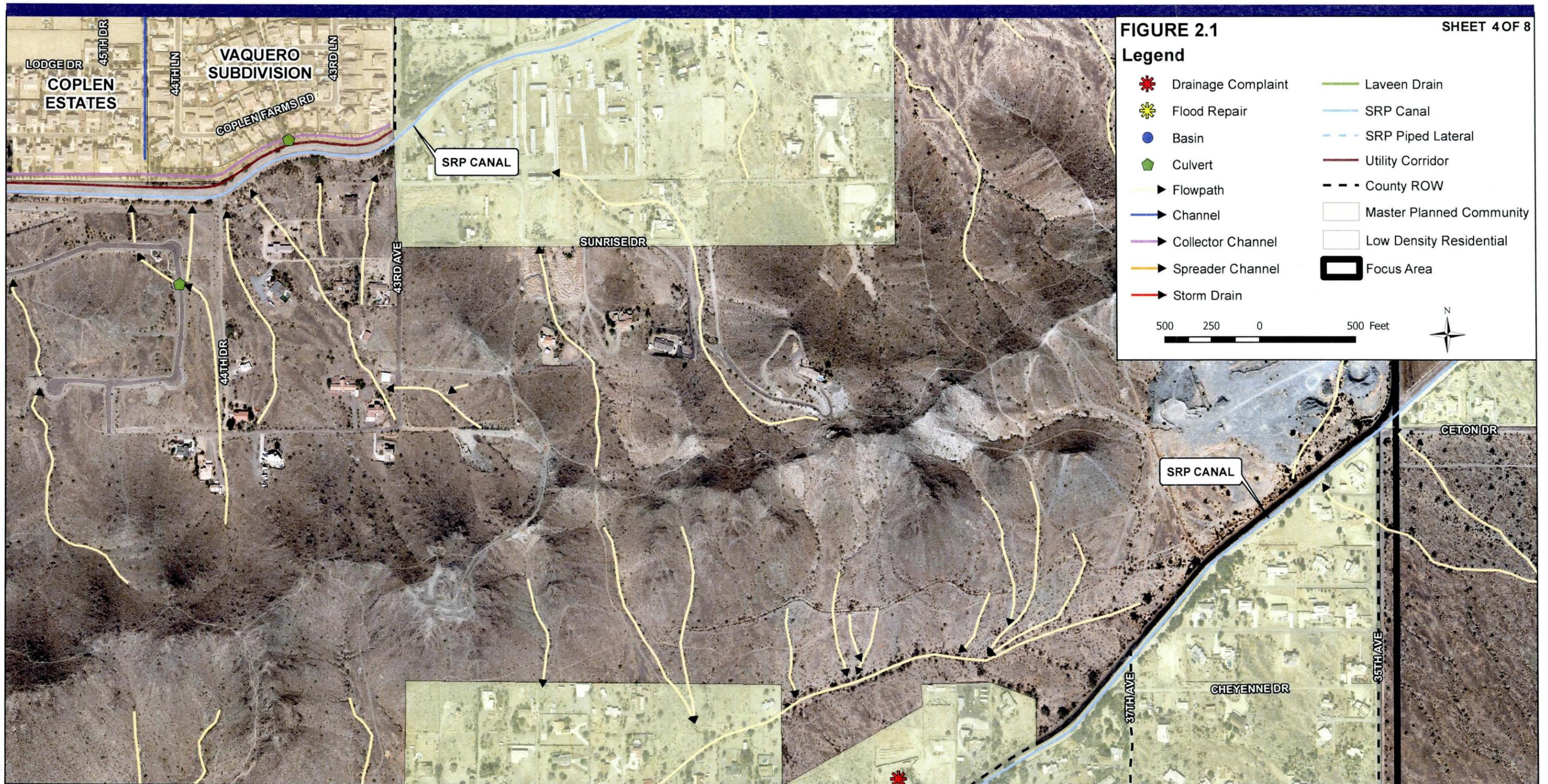
Laveen Area Drainage Master Plan Update

Existing Drainage Facilities/Drainage Complaints

SHEET LAYOUT

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FOCUS AREA





Laveen Area Drainage Master Plan Update

Existing Drainage Facilities/Drainage Complaints

SHEET LAYOUT

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3	4
5	6
7	8

FOCUS AREA



Document Path: V:\52813\active\181300440\gis\worktemp\Dave\mxd\Figure 2.1 Laveen ADMP Existing Drainage Facilities Complaints.mxd

Flood Control District of Maricopa County, GIS Division, 6/22/2015



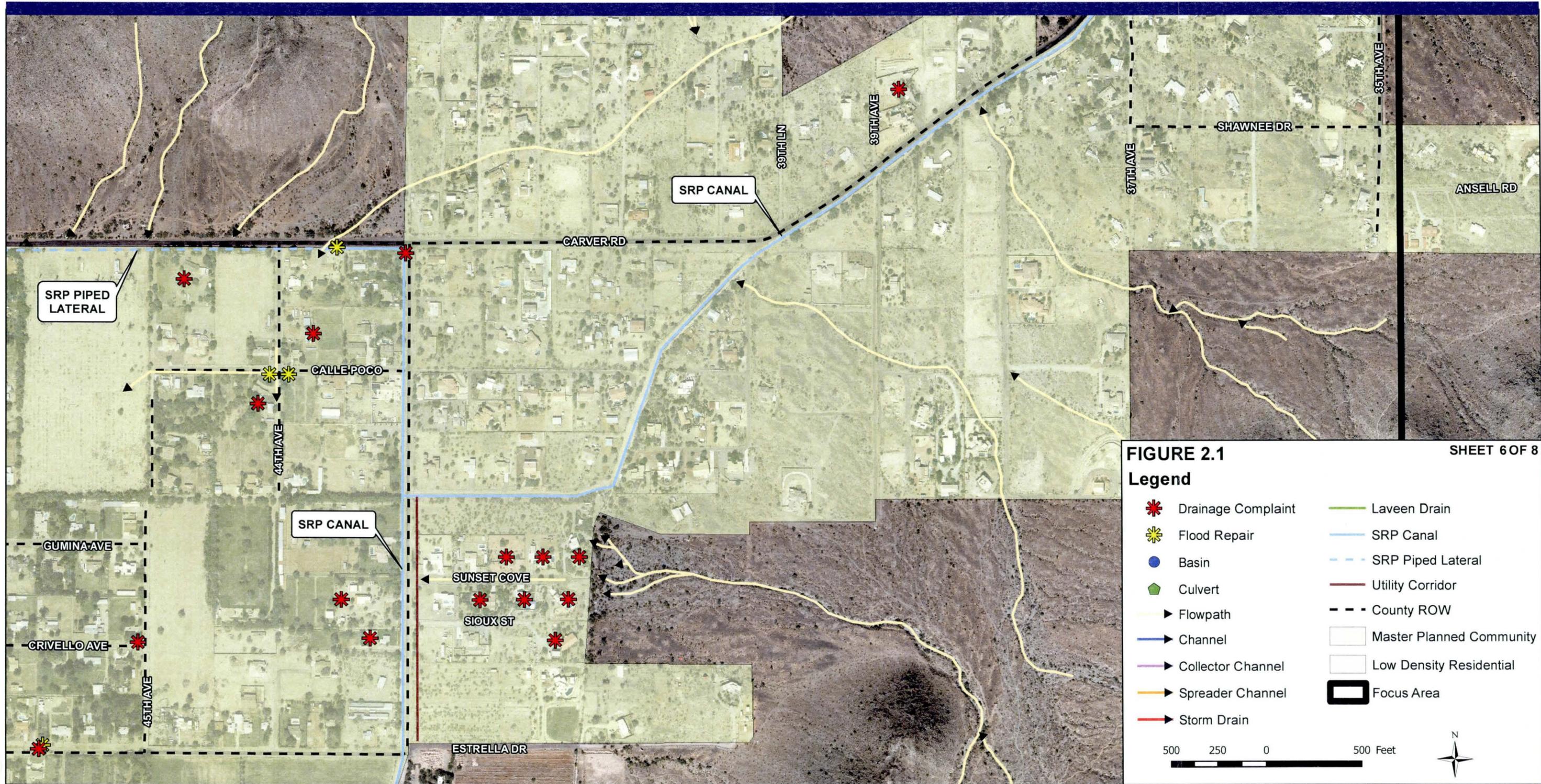
Laveen Area Drainage Master Plan Update

Existing Drainage Facilities/Drainage Complaints

SHEET LAYOUT

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FOCUS AREA





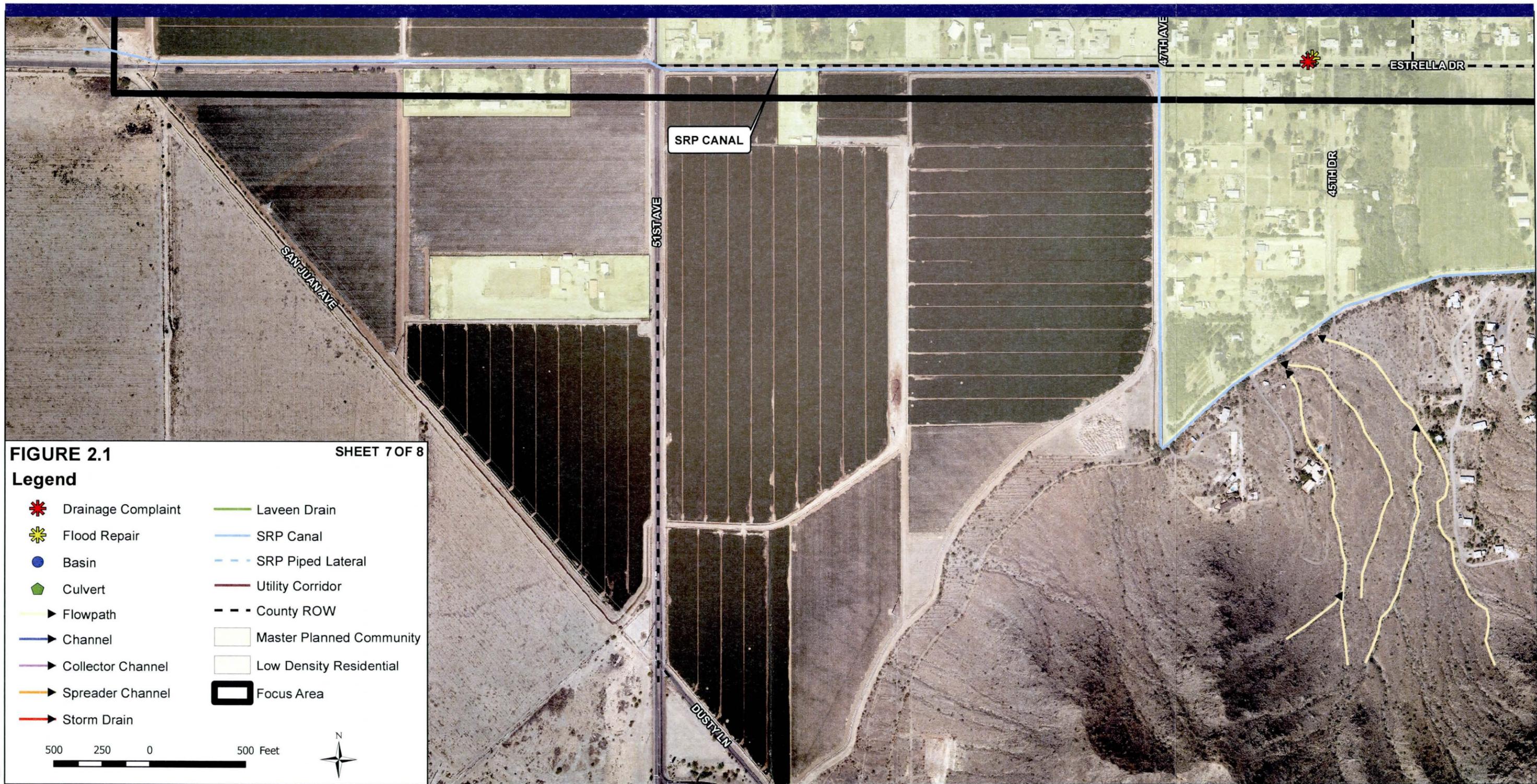
Laveen Area Drainage Master Plan Update

Existing Drainage Facilities/Drainage Complaints

SHEET LAYOUT

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FOCUS AREA





Laveen Area Drainage Master Plan Update

Existing Drainage Facilities/Drainage Complaints

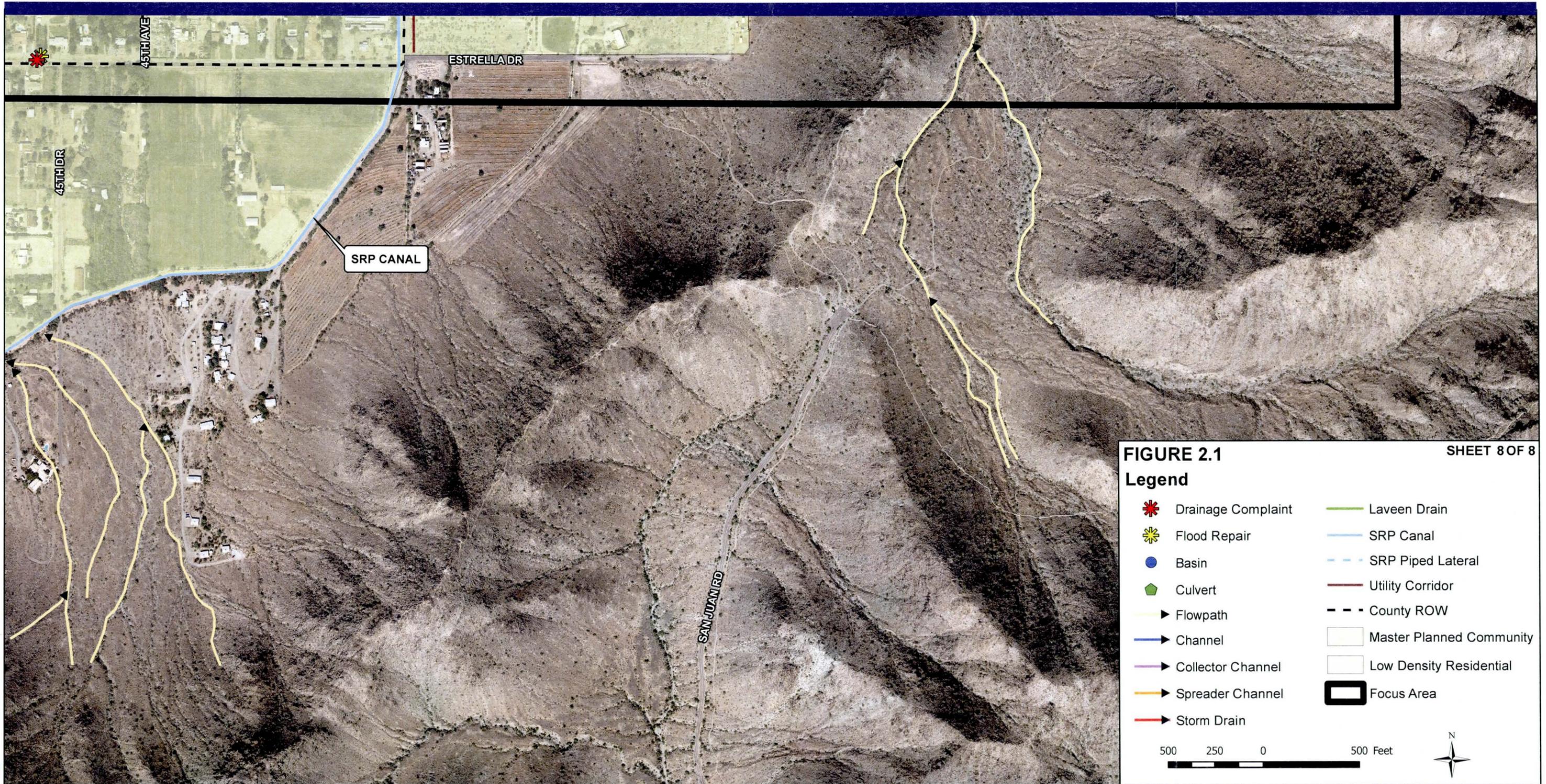
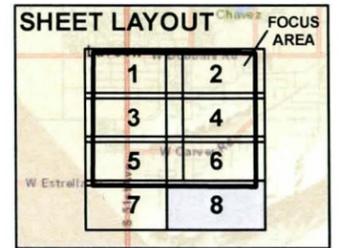


FIGURE 2.1

Legend

- Drainage Complaint
- Flood Repair
- Basin
- Culvert
- Flowpath
- Channel
- Collector Channel
- Spreader Channel
- Storm Drain
- Laveen Drain
- SRP Canal
- SRP Piped Lateral
- Utility Corridor
- County ROW
- Master Planned Community
- Low Density Residential
- Focus Area

500 250 0 500 Feet



Figures 2.2 through 2.8 are flood photographs from the summer of 2014 rainfall events. Photographs are from the Hidden Valley area.



Figure 2.2 – Flood flows at 47th Avenue north of Gumina Avenue.



Figure 2.3 – Flood flow at 47th Avenue north of Gumina Avenue.

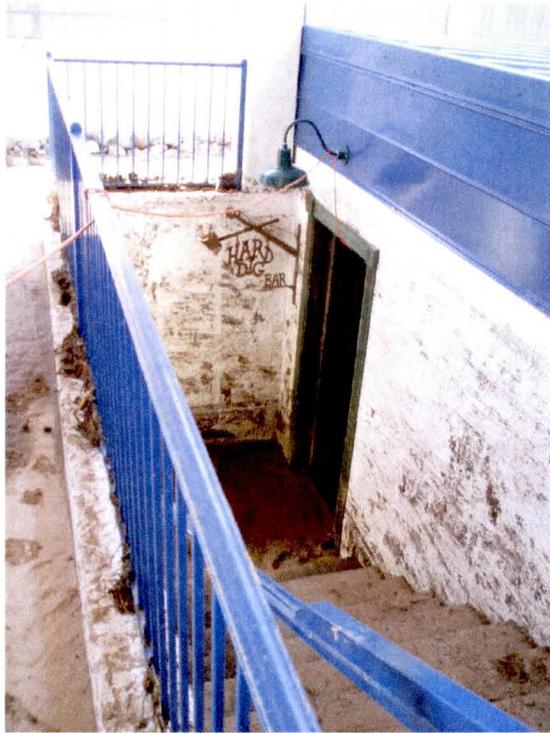


Figure 2.4 – Basement flooding along Sunset Cove Road



Figure 2.5 – Sediment deposits from mountain tributaries upstream of Sunset Cove Road



Figure 2.6 – Erosion along Sunset Cove Road



Figure 2.7 – Storm Water in house along Sunset Cove Road



Figure 2.8 – Sediment deposits in Sunset Cove Road and 43rd Avenue

2.3.2 Low Density Residential

Drainage issues in Low Density Residential areas are characterized by shallow sheet flooding with some concentrated flow. The flood risks in these areas are a function of finish floor elevations being lower or equal to the top of private irrigation canals or roadways. Offsite flow from mountain fronts and master plan communities drain to Low Density Residential areas. Figure 2.1, Sheets 1 through 8 depict; the locations of drainage complaints where homes were flooded, roadways and SRP canals for the area north of Carver Hills. Low Density Residential areas are typically 1 acre lots. Figures 2.9 through 2.11 are flood photographs in Low Density Residential areas from the summer of 2014 rainfall events.



Figure 2.9 – Flooding near Olney Ave and 51st Avenue



Figure 2.10 – Flooding near Olney Ave and 51st Avenue



Figure 2.11 – Damaged property, at Sunrise and 51st Avenue

2.3.3 Master Plan Communities

Drainage facilities within Master Plan Communities appeared to have functioned well during the 2014 summer storm events. The only complaints that were recorded were the neighborhood west of 47th Avenue just to the South of Dobbins Road. There is a spreader channel located south of Dobbins along the east side of 47th Avenue within the Dobbins Point subdivision. The spreader channel was designed to convey off site runoff impacting the southern boundary of the Dobbins Point subdivision to its historic flow path which crosses 47th Avenue. Runoff then drains to the west through low density residential property. Residents to the west of 47th Avenue complained about the spreader channel. See Figure 2.1, Sheets 1 and 2 for the locations of complaints and drainage facilities.

The source of offsite runoff impacting the Dobbins Point subdivision is from watersheds located along the north side of Carver Hills. Runoff drains to and overtops the SRP Canal. Flow that overtops the canal drains to the west and north. Some of the flow draining to the north is collected by the Coplen Estates collector channel whereas the rest of the flow drains to the west impacting the low density residential area between 47th and 50th Avenues. Flow collected by the Coplen Estates collector channel is conveyed in a channel to the Spreader channel. Figure 2.12 depicts the SRP canal at a location where flow overtopped the canal. The fresh looking concrete is where the canal was repaired. Figure 2.13 depicts the collector channel located along the southern boundary of Coplen Estates and Figure 2.14 depicts the spreader channel along 47th Avenue.



Figure 2.12 – SRP Canal upstream of Coplen Estates subdivision.



Figure 2.13 – Collector Channel along southern boundary of Coplen Estates subdivision



Figure 2.14 – Spreader Channel along 47th Avenue to the south of Dobbins Road

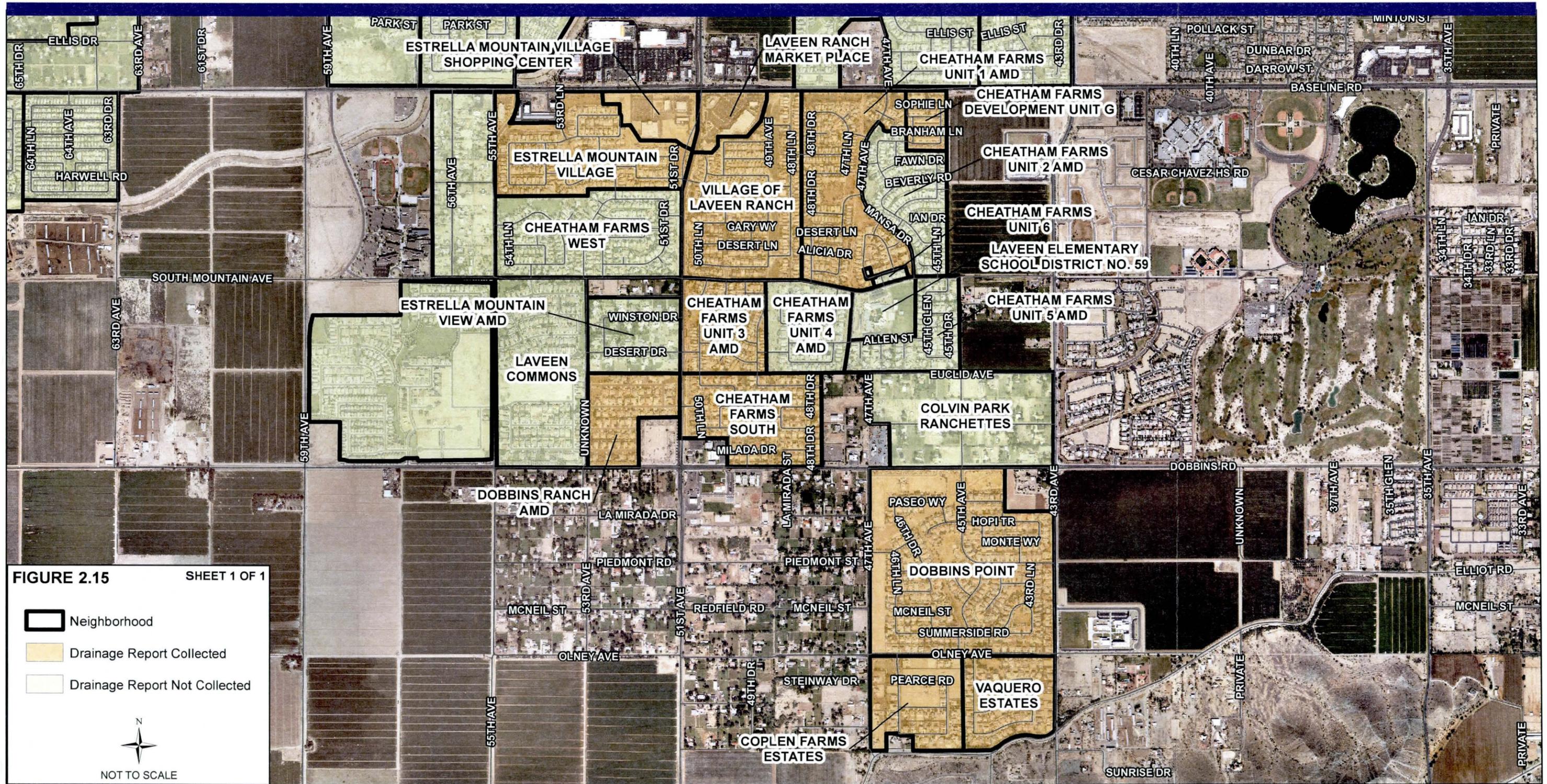
2.4 Previous Drainage Studies

Previous drainage studies reviewed include area drainage master studies and area drainage master plans developed by the FCDMC and subdivision drainage reports developed by developer's engineers. The initial hydrologic analyses for the Laveen area was conducted as part of the Laveen Area Master Drainage Study (Cellar Barr Associates, Revised November, 1991) and was modified to model proposed flood control alternatives as part of the Laveen Area Drainage Master Plan (HDR, November, 2001). Available subdivision drainage studies were obtained from the City of Phoenix. Figure 2.15 depicts the location of subdivisions in which drainage reports were reviewed. Appendix A provides a CD containing PDF files of the drainage studies obtained.



Laveen Area Drainage Master Plan Update

SUBDIVISION DRAINAGE REPORTS COLLECTED FROM THE CITY OF PHOENIX



2.4.1 Drainage Facilities

Subdivision drainage reports and the Laveen Area Drainage Master Plan (HDR, 2001) were reviewed to become familiar with the type and distribution of proposed and existing drainage facilities. Subdivision drainage facilities generally include retention basins, channels, culverts and storm drain networks. The type of drainage facilities within subdivisions will vary depending on whether or not off site flow impacts the subdivision and how that flow is conveyed to downstream properties. Channels may include collector channels which collect offsite flow and spreader channels which spread collected and conveyed off site flow to historic flow paths. Subdivision retention basins were typically designed for the 100-year, 2-hour storm event, however the design assumption was that flow from a greater event such as the 100-year, 6-hour event would drain to a historic outfall location. No analyses were completed to determine peak discharges of the 100-year, 6-hour (or larger) event that would drain from the subdivision. The location of subdivision drainage facilities are located on Plate 1 and Figure 2.1. Drainage facilities evaluated in the original Laveen ADMP (FCDMC, 2001) consisted of detention basins, channels and storm drains. Several alternatives were developed to estimate the size of a facility relative to its location and function. Alternatives that were evaluated and presented in the Laveen ADMP report, were Alternative 2A, Alternative 4, Alternative 6 and the Recommended Alternative. The locations of facilities for each alternative were reviewed to qualitatively assess whether or not the facility would have reduced or eliminated the flooding experienced in the summer of 2014. The locations of proposed drainage facilities for Alternative 2A, Alternative 4, Alternative 6 and the Recommended Alternative are depicted on Figures 2.16, 2.17, 2.18 and 2.19, respectively.

Figures 2.20, Sheets 1 through 8 are detailed figures showing the location of the recommended drainage facilities along with existing drainage facilities and drainage complaints. Based on the spatial relationships between flooding complaints and proposed drainage facilities the following observations were made:

- The proposed drainage facilities depicted on Sheets 1 and 2 would not have had a significant impact on flooding experienced in 2014. The proposed facilities are located downstream of the drainage complaints.
- The proposed drainage facilities depicted on Sheets 3 and 4 would have reduced the flooding experienced by the home owners in the low density residential area located to the west of 47th Avenue, however they would not have eliminated the flood risk. Runoff generated locally and in the agricultural fields located to the south of Sunrise Drive would drain through the area. The proposed channel along the SRP canal terminates at 43rd Avenue. Flow overtopping the canal to the east of 43rd Avenue would impact property to the north of the SRP Canal.
- The proposed retention basin located on Sheets 5 and 6 would have reduced flooding from runoff draining from the Carver Hills that was experienced west of 44th Avenue but would not have eliminated it. Runoff draining from the South Mountains that is conveyed along Sunset Cove and Sioux streets, where extensive flood damage was recorded would continue to the west across the 44th Avenue alignment.

- Drainage facilities that would have had a benefit to the flooding experienced in the summer of 2014 for all alternatives are the proposed channel in the SRP right-of-way located along the Elliot Road alignment, the detention basin located adjacent to the Elliot Road alignment east of 51st Avenue and the detention basin located adjacent to Carver Road and west of 43rd Avenue. These facilities would have reduced the degree of flooding that was experienced.

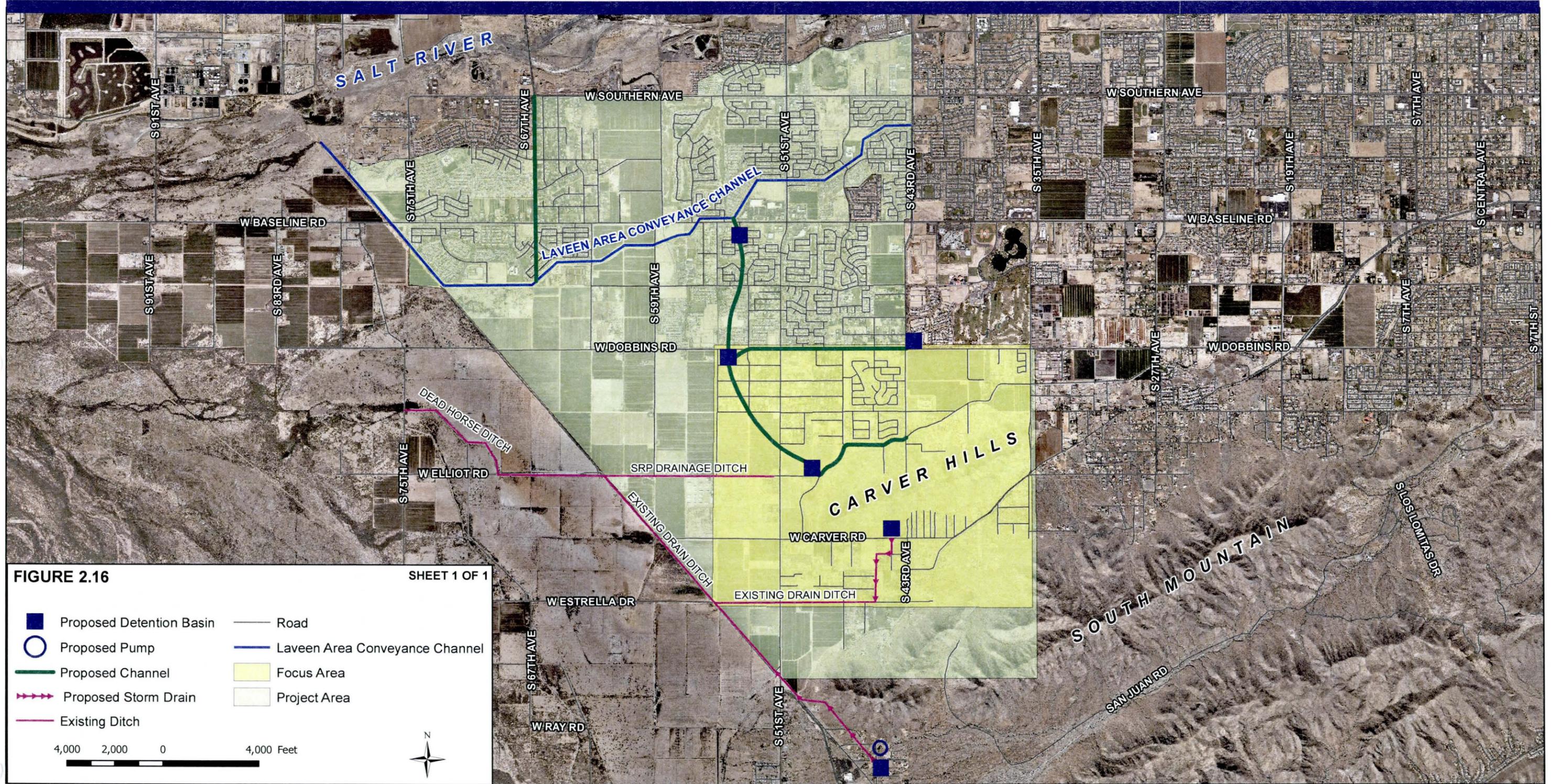
2.4.2 Flood Hazard Mitigation Brainstorm Ideas

Brainstorm meetings were held in the field and at the FCDMC offices to formulate flood hazard mitigation solutions that could be applied to the project area. The Brainstorm Team consisted of operation and maintenance staff and/or engineers from the, FCDMC, COP, SRP, MCDOT, and engineering consultants. The team, taking into consideration right of way, potential utility conflicts, location of drainage complaints and existing drainage infrastructure formulated possible flood hazard mitigation ideas. The ideas were grouped into three categories; Near Term, Mid Term, and Long Term. Near Term Solutions are solutions that potentially, could be started before or during the 2015 monsoon season. Mid Term Solutions are small scale solutions that can be implemented within a year or two, may require, utility relocations, right of way acquisitions and hydrologic and hydraulic analysis to develop construction plans. Long Term Solutions are solutions that can be implemented as part of a regional solution. These solutions would require utility relocations, right of way acquisitions and hydrologic and hydraulic analysis to develop construction plans. Tables 2.1, 2.2, and 2.3 list the final flood mitigation ideas; for the Near Term, Mid Term, and Long Term solutions, respectively. Figure 2.21 sheets 1 through 8 depicts the locations of brainstormed ideas.



Laveen Area Drainage Master Plan Update

Laveen ADMP Alternative 2A



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Laveen Area Drainage Master Plan Update

Laveen ADMP Alternative 4

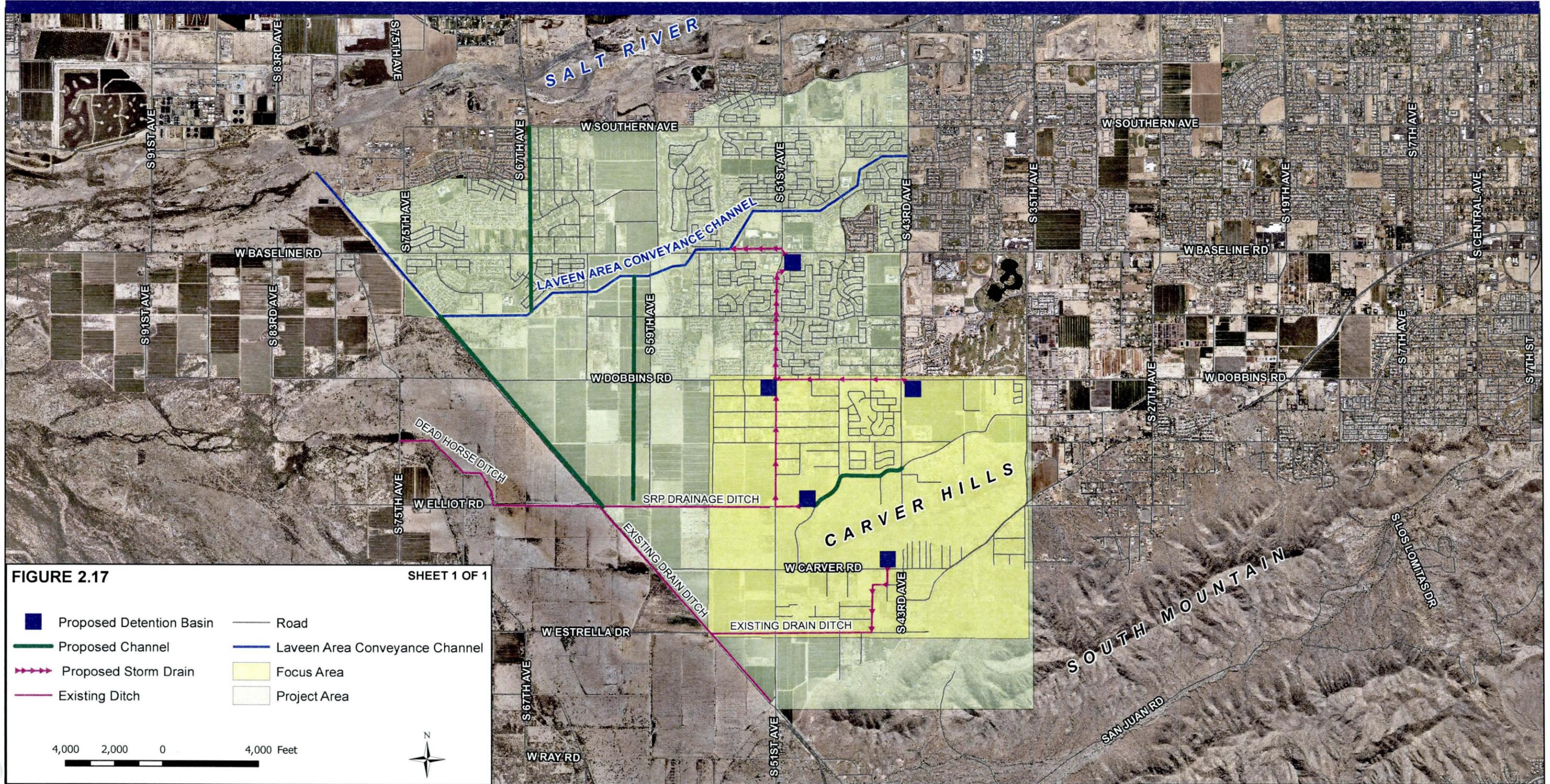


FIGURE 2.17 SHEET 1 OF 1

	Proposed Detention Basin		Road
	Proposed Channel		Laveen Area Conveyance Channel
	Proposed Storm Drain		Focus Area
	Existing Ditch		Project Area

4,000 2,000 0 4,000 Feet

N

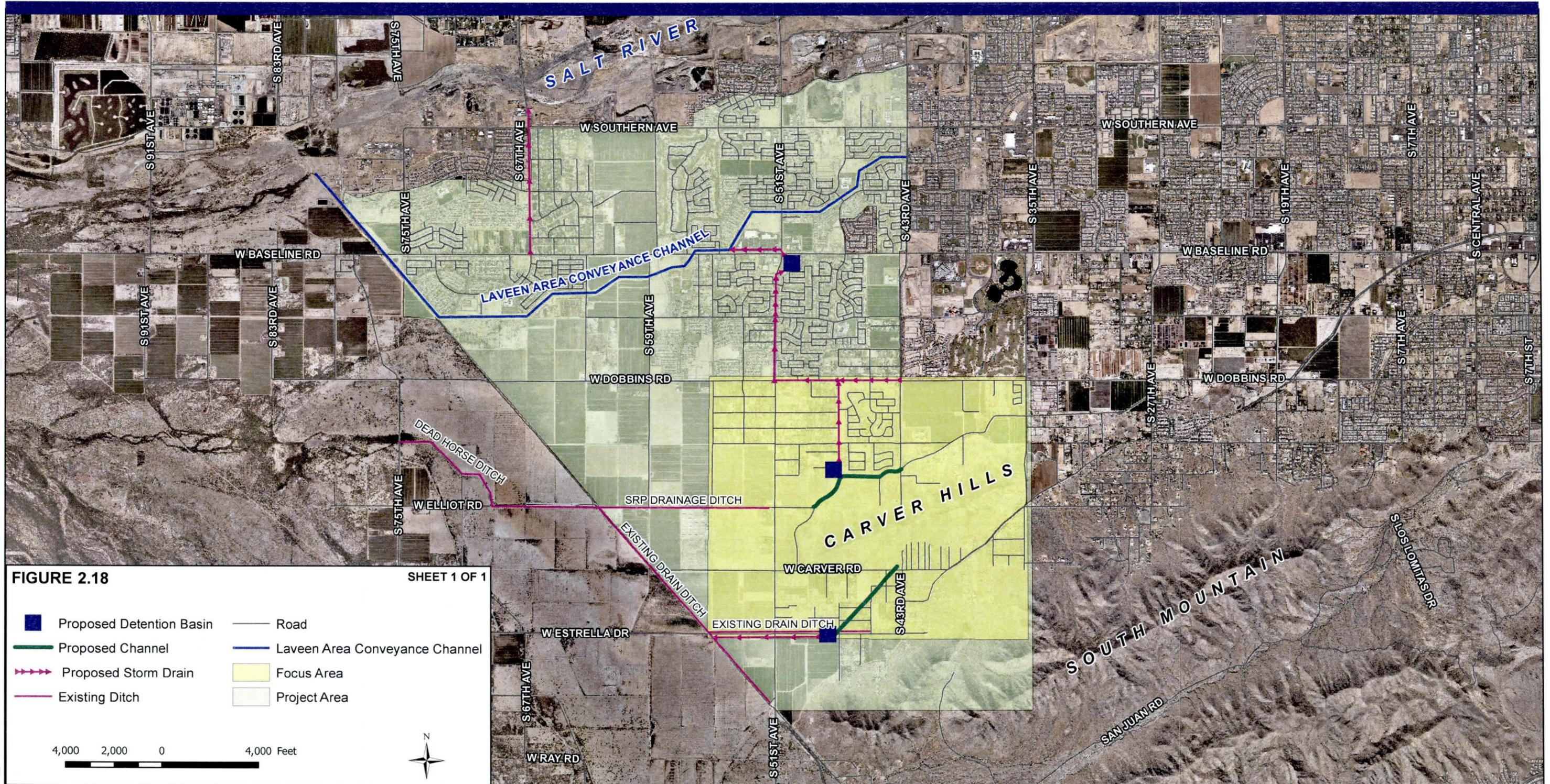
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Laveen Area Drainage Master Plan Update

Laveen ADMP Alternative 6



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Flood Control District of Maricopa County, GIS Division, 6/22/2015



Laveen Area Drainage Master Plan Update

Laveen ADMP Recommended Drainage Facilities

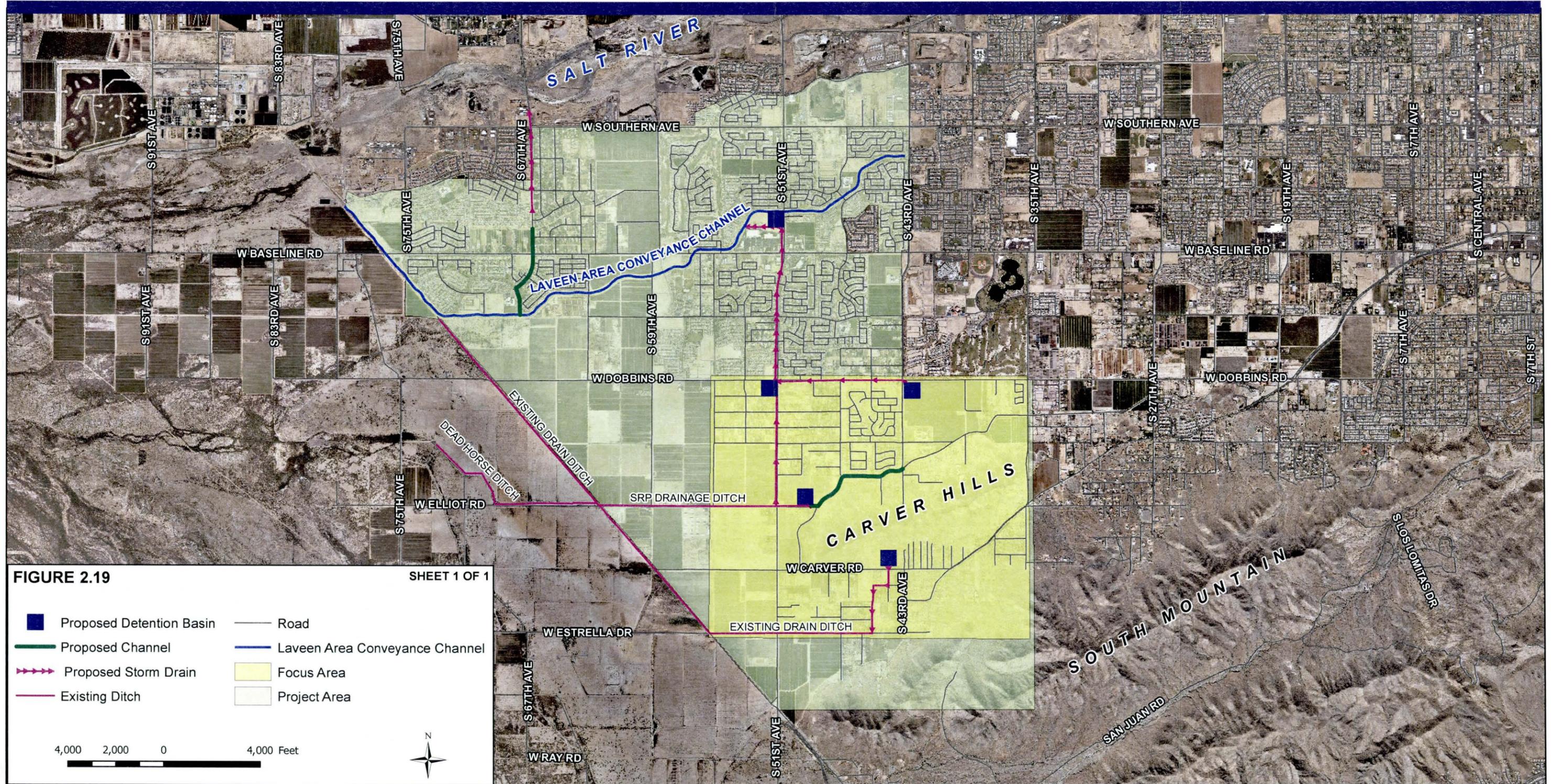


FIGURE 2.19 SHEET 1 OF 1

- Proposed Detention Basin
- Proposed Channel
- - - Proposed Storm Drain
- Existing Ditch
- Road
- Laveen Area Conveyance Channel
- Focus Area
- Project Area

4,000 2,000 0 4,000 Feet

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Flood Control District of Maricopa County, GIS Division, 6/22/2015



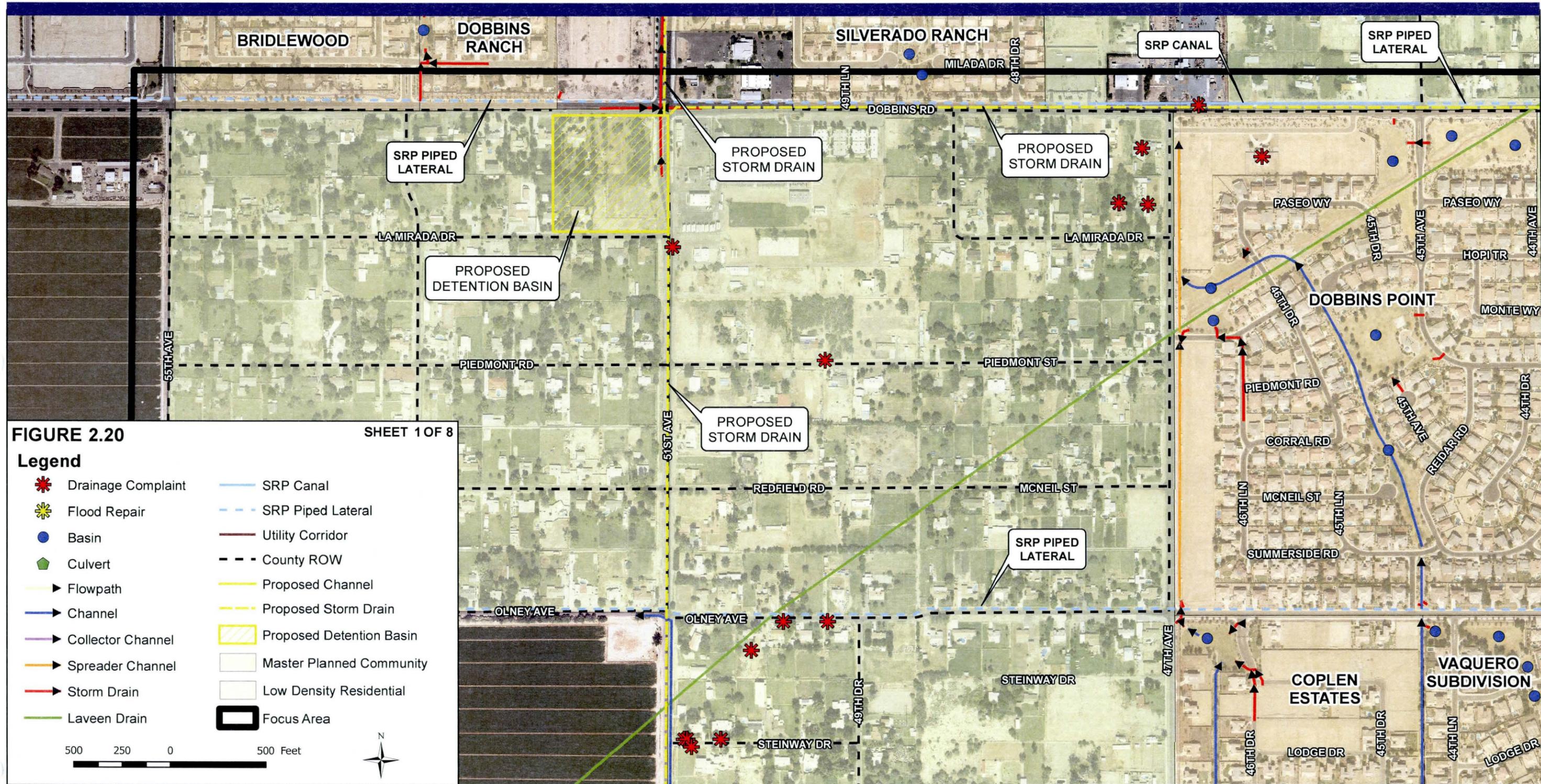
Laveen Area Drainage Master Plan Update

Detail Recommended Drainage Improvements from 2001 Laveen ADMP

SHEET LAYOUT

1	2
3	4
5	6
7	8

FOCUS AREA



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Flood Control District of Maricopa County, GIS Division, 6/22/2015



Laveen Area Drainage Master Plan Update

Detail Recommended Drainage Improvements from 2001 Laveen ADMP

SHEET LAYOUT

1	2
3	4
5	6
7	8

FOCUS AREA

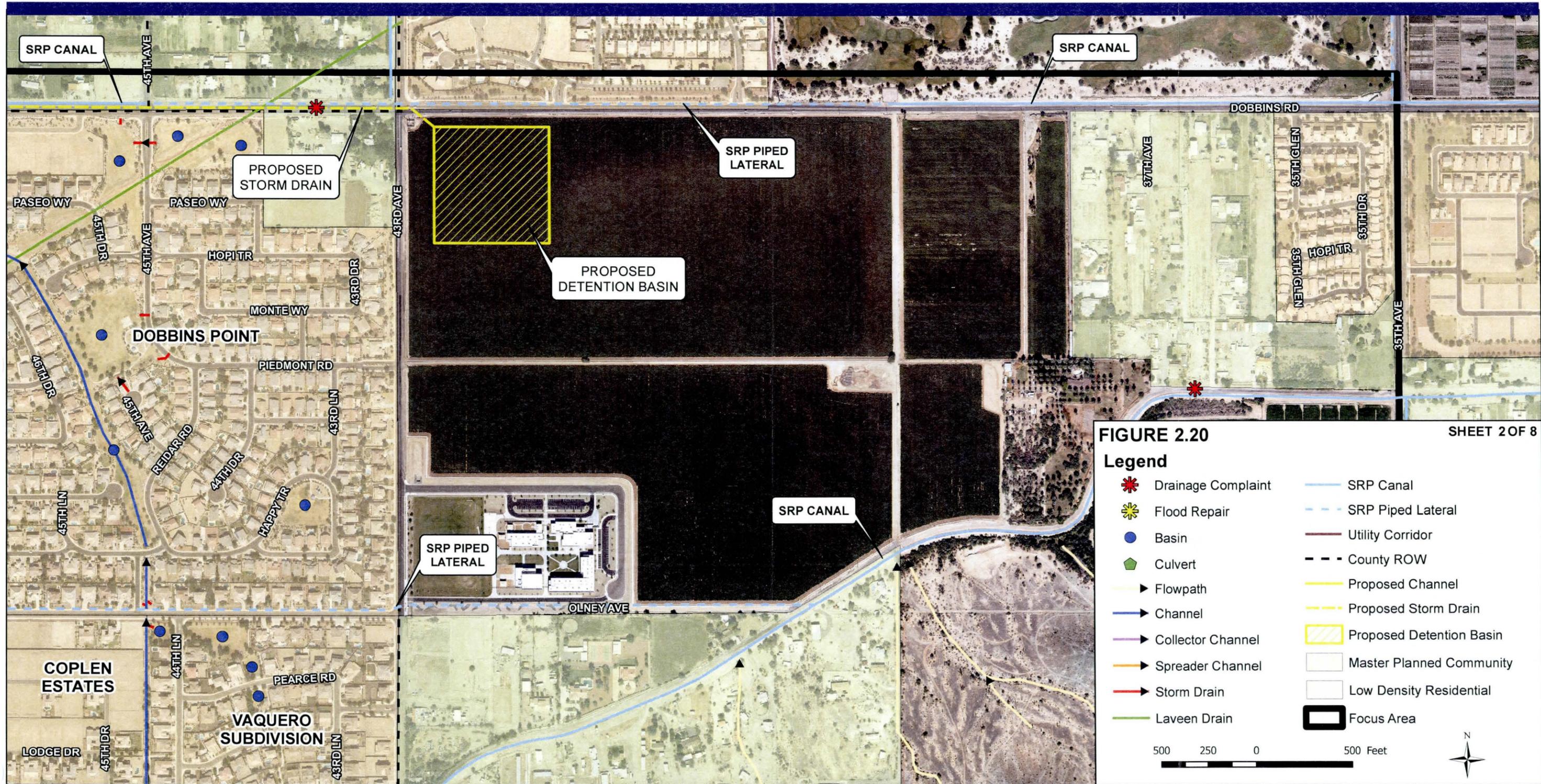


FIGURE 2.20

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Laveen Area Drainage Master Plan Update

Detail Recommended Drainage Improvements from 2001 Laveen ADMP

SHEET LAYOUT

1	2
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7	8

FOCUS AREA

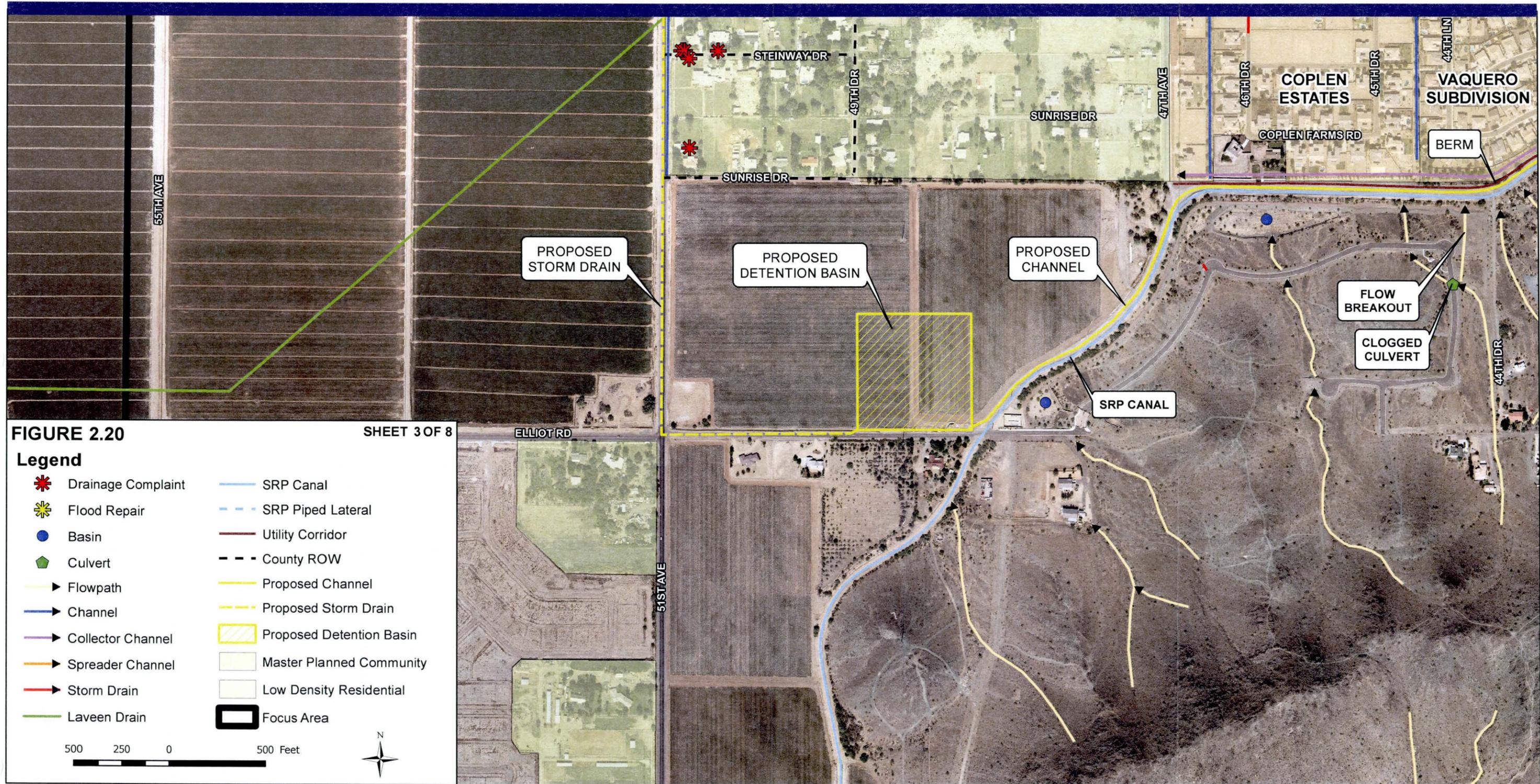


FIGURE 2.20

SHEET 3 OF 8

- Legend**
- Drainage Complaint
 - Flood Repair
 - Basin
 - Culvert
 - Flowpath
 - Channel
 - Collector Channel
 - Spreader Channel
 - Storm Drain
 - Laveen Drain
 - SRP Canal
 - SRP Piped Lateral
 - Utility Corridor
 - County ROW
 - Proposed Channel
 - Proposed Storm Drain
 - Proposed Detention Basin
 - Master Planned Community
 - Low Density Residential
 - Focus Area

Document Path: V:\52813\active\181300440\gis\worktemp\dave\mxd\Figure 2.20 Detail Recommended Drainage Improvements.mxd

Flood Control District of Maricopa County, GIS Division, 6/22/2015



Laveen Area Drainage Master Plan Update

Detail Recommended Drainage Improvements from 2001 Laveen ADMP

SHEET LAYOUT

1	2
3	4
5	6
7	8

FOCUS AREA

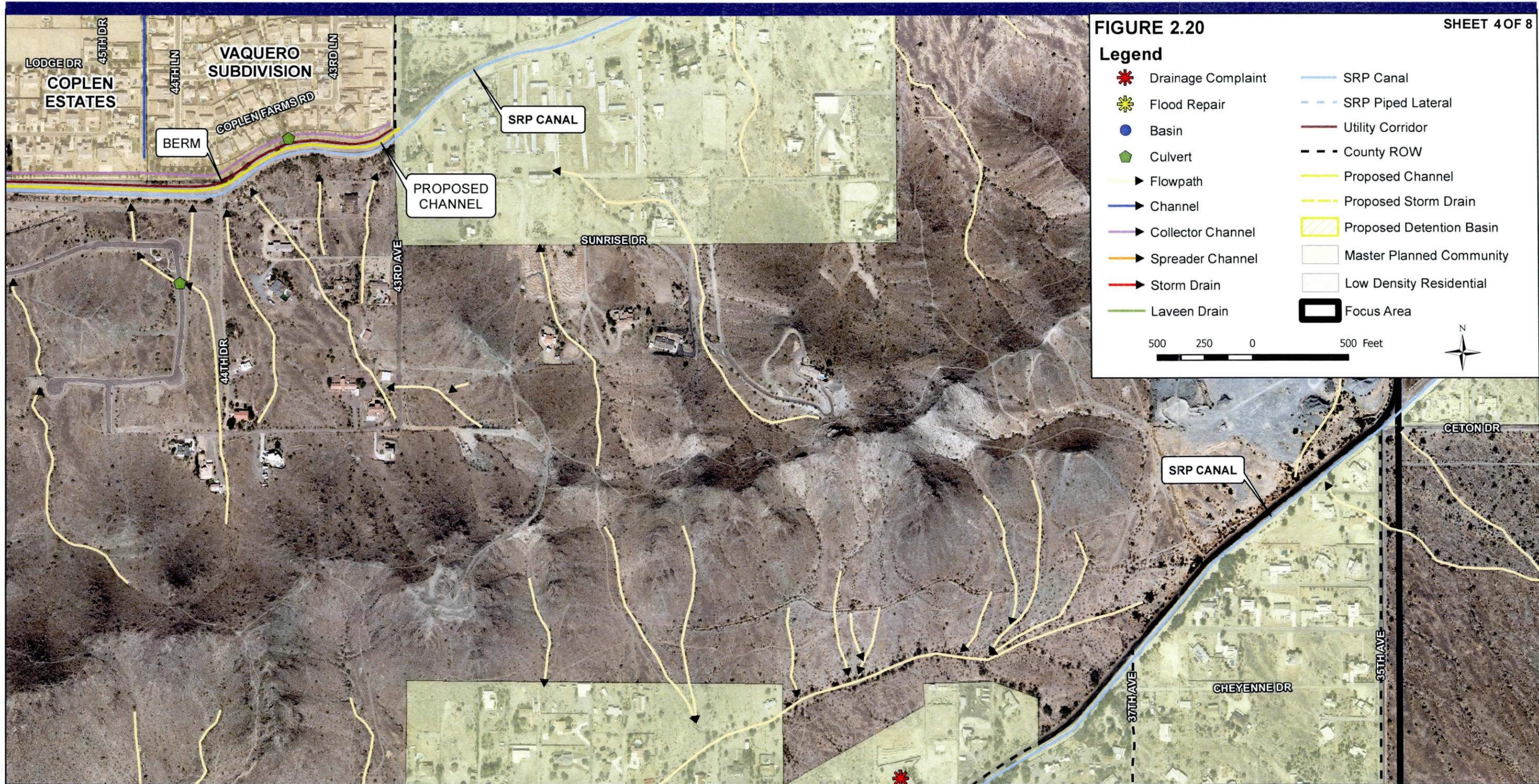


FIGURE 2.20

SHEET 4 OF 8

Legend

- Drainage Complaint
- Flood Repair
- Basin
- Culvert
- Flowpath
- Channel
- Collector Channel
- Spreader Channel
- Storm Drain
- Laveen Drain
- SRP Canal
- SRP Piped Lateral
- Utility Corridor
- County ROW
- Proposed Channel
- Proposed Storm Drain
- Proposed Detention Basin
- Master Planned Community
- Low Density Residential
- Focus Area

500 250 0 500 Feet





Laveen Area Drainage Master Plan Update

Detail Recommended Drainage Improvements from 2001 Laveen ADMP

SHEET LAYOUT

1	2
3	4
5	6
7	8

FOCUS AREA





Laveen Area Drainage Master Plan Update

Detail Recommended Drainage Improvements from 2001 Laveen ADMP

SHEET LAYOUT

1	2
3	4
5	6
7	8

W. Estrella

FOCUS AREA

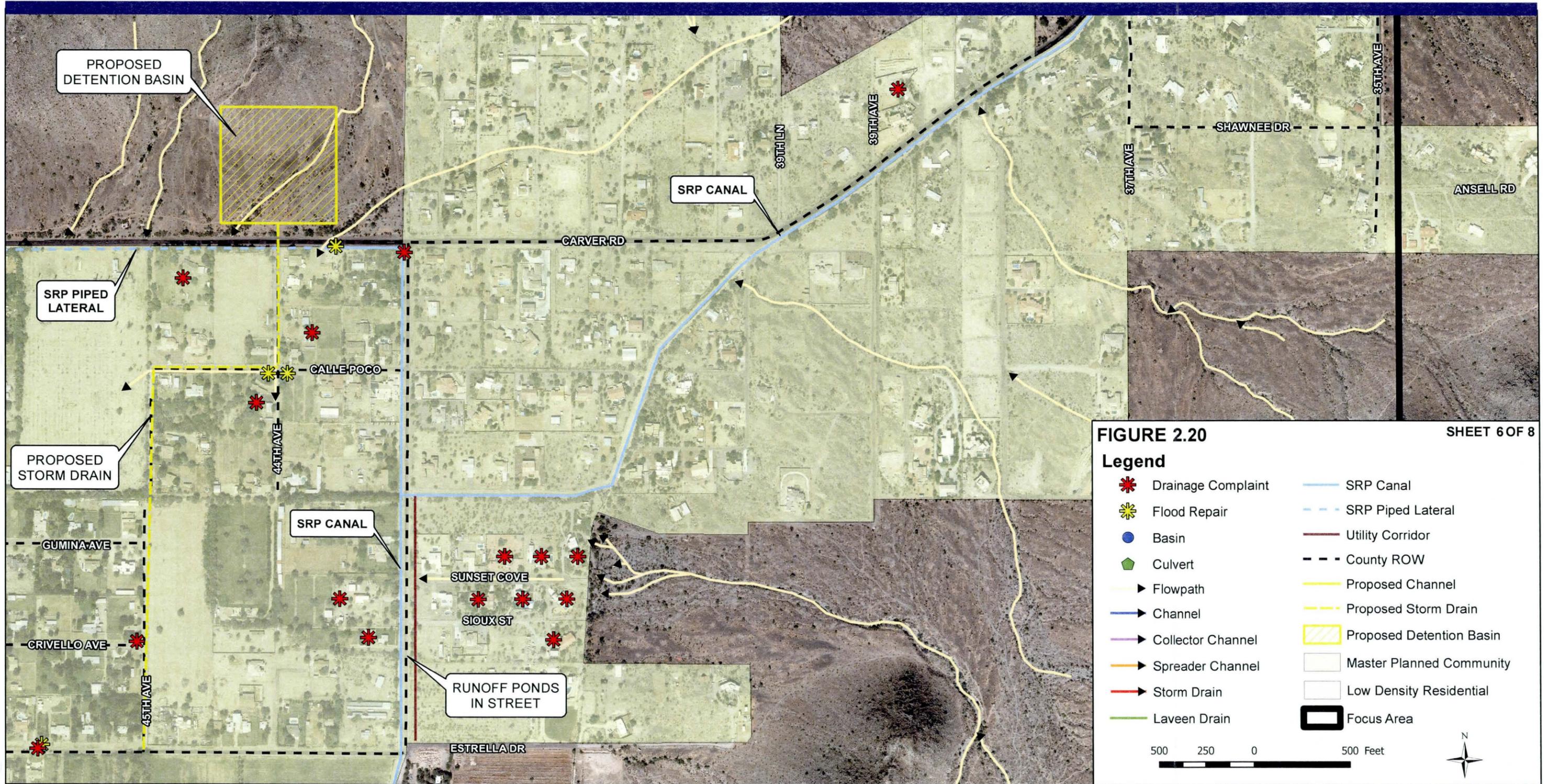


FIGURE 2.20

SHEET 6 OF 8

Legend

- Drainage Complaint
- Flood Repair
- Basin
- Culvert
- Flowpath
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- Collector Channel
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- Focus Area

500 250 0 500 Feet





Laveen Area Drainage Master Plan Update

Detail Recommended Drainage Improvements from 2001 Laveen ADMP

SHEET LAYOUT

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5	6
7	8

FOCUS AREA

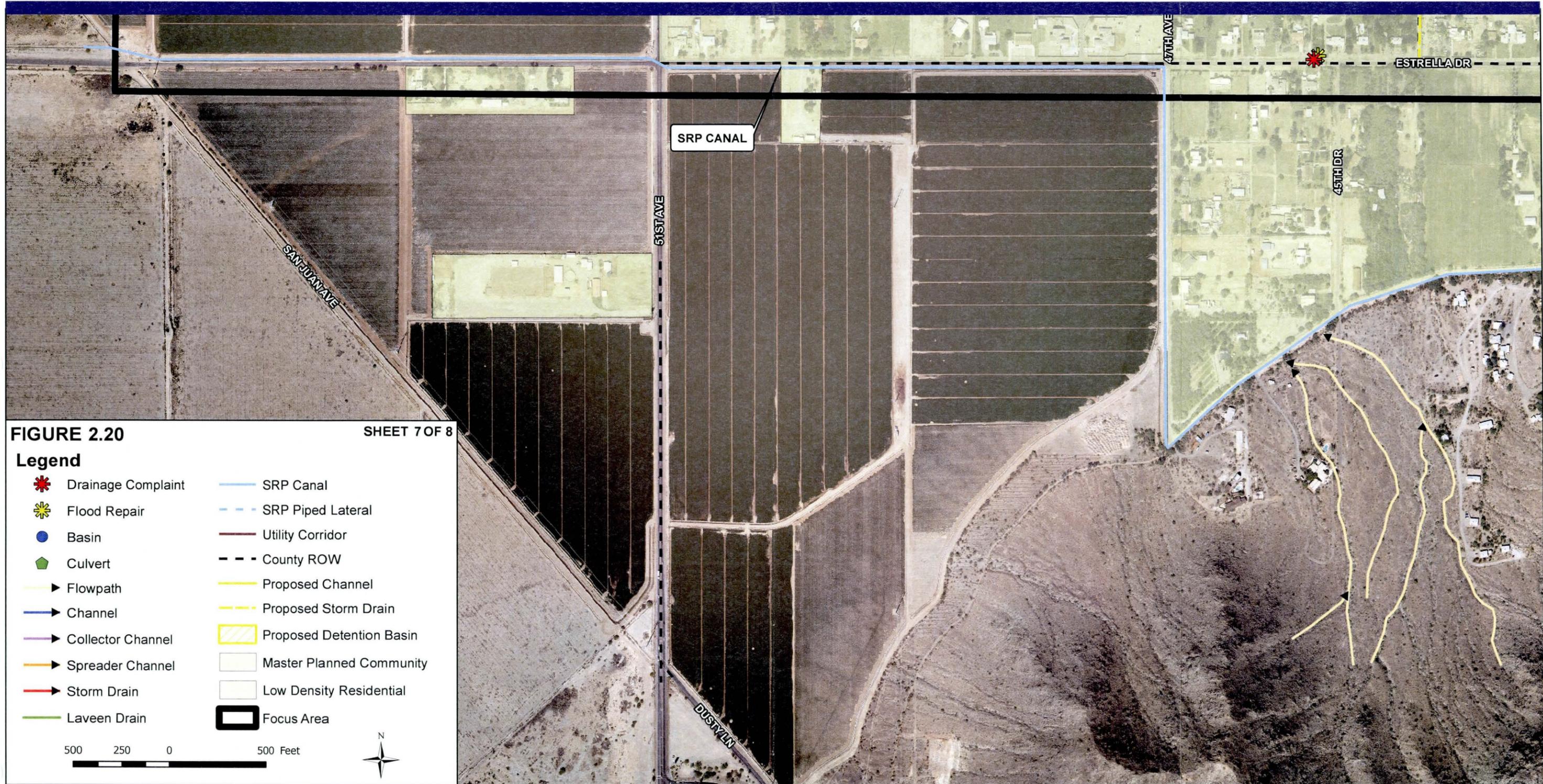


FIGURE 2.20

SHEET 7 OF 8

Legend

- Drainage Complaint
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- County ROW
- Proposed Channel
- Proposed Storm Drain
- Proposed Detention Basin
- Master Planned Community
- Low Density Residential
- Focus Area

500 250 0 500 Feet



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Laveen Area Drainage Master Plan Update

Detail Recommended Drainage Improvements from 2001 Laveen ADMP

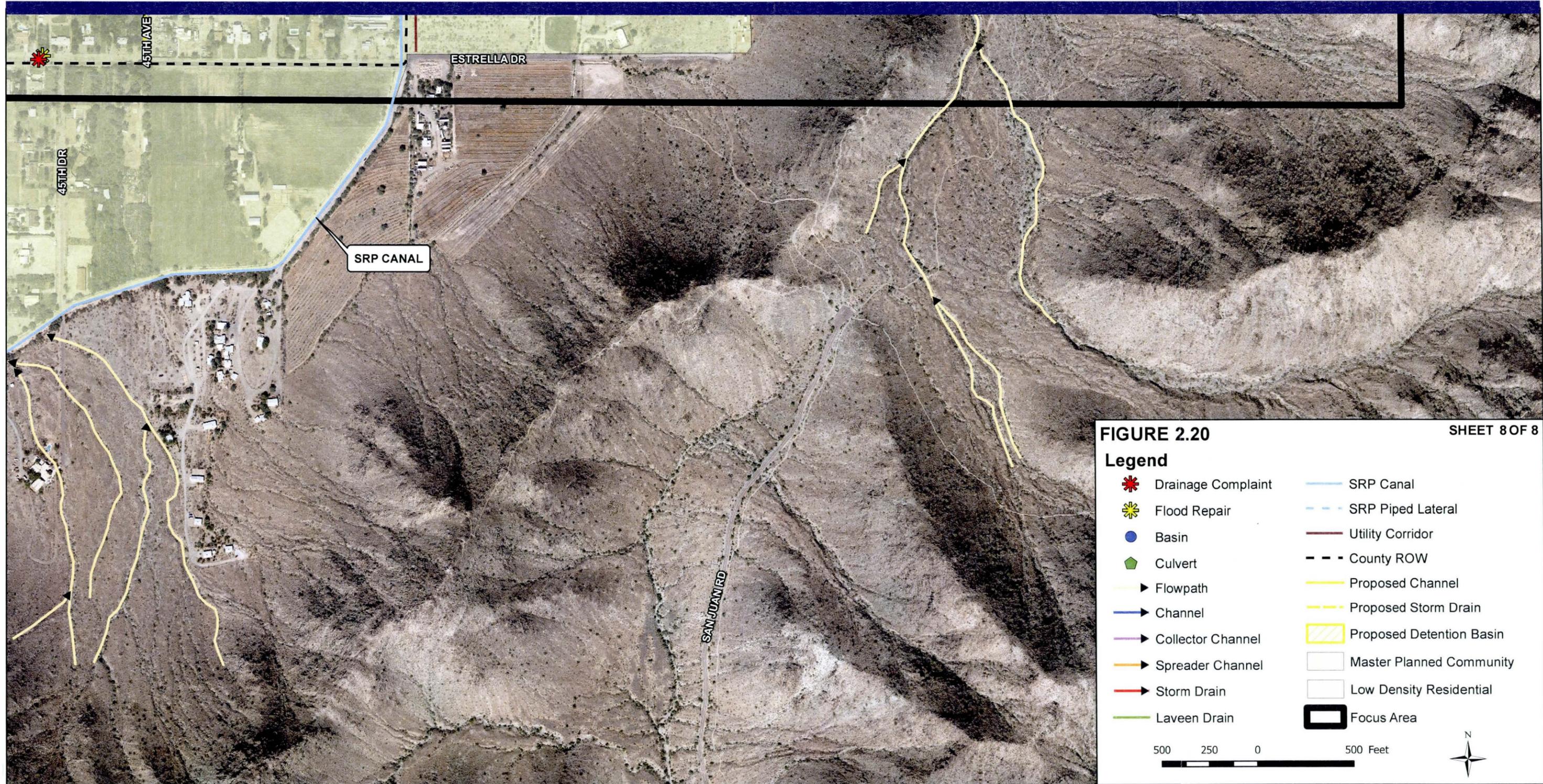
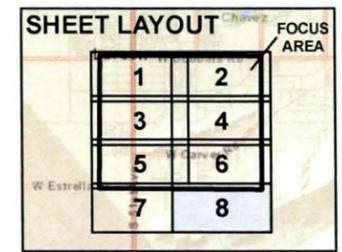


FIGURE 2.20

SHEET 8 OF 8

Legend

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- Proposed Detention Basin
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- Low Density Residential
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Table 2.1 – Near Term Improvements for the Laveen ADMP Update Study Area

Idea #	Location of Flooding Area	Brainstorm Ideas	Opportunities	Constraints	Comments
1	47th Avenue and Elliot along SRP Canal	Construct a berm between Carver Mountain Estate property line and the canal on SRP's easement.	Fill material may be available from excavation of the proposed 27 th Avenue Basin.	Need right of way approval from SRP/USA. A dam like situation may be created at locations where upstream washes out fall to the canal.	Hydrologic and hydraulic analysis will be required for this idea to move forward. Evaluations will extend past the 2015 monsoon season.
2	43rd Avenue (Carver to Estrella)	Message warning sign on 43rd Ave to be activated remotely that warn drivers of potential road flooding.			District to coordinate with MCDOT to implement. Coordination time will extend in to the fall of 2015.
3	43rd Avenue (Carver to Estrella)	Provide sand bags and sand to homes owners along Sioux and Sunset Cove streets.	Sand bags can be used to minimize the amount of flow that may enter a house.	May be considered an attractive nuisance, potential liability if flow is directed to neighbor's house. Location needed to store sand. Elderly may not be able to use.	Implemented by District based on input from residents as location of storing of sand and sand bags.
4	43rd Avenue (Carver to Estrella)	Develop Flood Warning Plan	Can be done quickly	Will need to hire a consultant. Possible budget constraints.	Implemented by District through hire of consultant to draft the plan. Due to consultant selection process the development of the Flood Warning Plan will extend past the 2015 monsoon season. Final implementation of the flood warning plan by MCDEM.

Table 2.1 – Near Term Improvements for the Laveen ADMP Update Study Area Continued

Idea #	Location of Flooding Area	Brainstorm Ideas	Opportunities	Constraints	Comments
5	43rd Avenue (Carver to Estrella)	Flood proofing of homes affected by 2014 floods	Large lots may facilitate flood proofing through construction of onsite retention basins.	Improvements may be too expensive for land owner to implement. Long term maintenance would be required.	Implemented through outreach by District. Assist in providing information on flood proofing ideas. District to develop plan where the residents within the Laveen ADMP area where the District will work with P&D to reduce or eliminate any potential permit fees for flood proofing by residents.

Table 2.2 – Mid Term Improvements for the Laveen ADMP Update Study Area

Idea #	Location of Flooding Area	Brainstorm Ideas	Opportunities	Constraints	Comments
1	43rd Avenue (Carver to Estrella)	Inverted crown road on Sunset Cove. Outfalls identified below		Suitable outfall needs to be determined. Would require obtaining Right of Way. High flow velocities would need to be mitigated. May increase flooding downstream.	Construction plans would need to be developed. Requires engineering consultant.

Table 2.2 – Mid Term Improvements for the Laveen ADMP Update Study Area Continued

Idea #	Location of Flooding Area	Brainstorm Ideas	Opportunities	Constraints	Comments
2	43 Avenue (Carver to Estrella)	On 43rd Avenue near Sioux Street, provide dry wells in road ROW to help alleviate ponding in roadway.	Available MCDOT ROW on 43rd Ave	Percolation rates may be too low due to caliche and rock at the near surface, requires ADEQ permit for dry wells	Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Need to determine suitable locations for dry wells. Need construction plans. Requires engineering consultant.
3	43rd Avenue (Carver to Estrella)	Flood proofing of homes affected by 2014 floods	Large lots may facilitate flood proofing.	Improvements may be too expensive for land owner to implement. Long term maintenance would be required.	Implemented through outreach by District. Assist in providing information on flood proofing ideas. Work with P&D to eliminate any potential permit fees for flood proofing by residents.
4	47th Avenue and Elliot along SRP Canal	Construct a berm between Carver Mountain Estates property line and the canal on SRP's easement.	Fill material may be available from excavation of swales at the proposed 27th Avenue Basin or from deepening the Carver Mountain Estates retention basin.	Need right of way approval from SRP/USA and Carver Mountain Estates. A dam like situation may be created at locations where upstream washes out fall to the canal.	Hydraulic analysis required to evaluate impacts due to construction of the berm. In the event of a berm failure, downstream impacts need to be determined. Implemented by FCD based on input from SRP.
5	Neighborhood west of 47th Avenue, between Dobbins and Elliot	Channel or series of retention basins within roadway ROW	Available MCDOT ROW	May require the relocation of utilities, mail boxes, driveways, etc.	Depending on utility relocation, could be an intermediate or long term fix, need construction plans. Requires engineering consultant.

Table 2.2 – Mid Term Improvements for the Laveen ADMP Update Study Area Continued

Idea #	Location of Flooding Area	Brainstorm Ideas	Opportunities	Constraints	Comments
6	Neighborhood west of 47th Avenue, between Dobbins and Elliot	Flood proofing of homes affected by 2014 floods	Large lots may facilitate flood proofing through construction of onsite retention basins.	Improvements may be too expensive for land owner to implement. Long term maintenance would be required.	Implemented through outreach by District. Assist in providing information on flood proofing ideas. Work with P&D to eliminate any potential permit fees for flood proofing by residents.
7	Neighborhood west of 47th Avenue, between Dobbins and Elliot	Construct inverted crown roads where flow would be conveyed to dry wells at end of the roads.	Available MCDOT ROW	Flow rates and volume may exceed dry well volume and percolation rates. Potential utilities conflicts. ADEQ dry well permit required.	Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Need to determine suitable locations for dry wells. Need construction plans. Requires engineering consultant.
8	General	Use underground storage pipes with roadway inlets so overall drainage patterns are not disturbed/diverted. This could be applied anywhere there are no utility conflicts.	Avoids Utilities		Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Need construction drawings. Requires engineering consultant.

Table 2.3 – Long Term Solutions for the Laveen ADMP Update Study Area

Idea #	Location of Flooding Area	Brainstorm Ideas	Opportunities	Constraints	Comments
1	43rd Avenue (Carver to Estrella)	Design/Construct Storm drain within 43rd Ave., Carver Road south to Estrella Road. Design/construct channel on north side of Estrella to a basin at NW corner of 51st Avenue and Estrella. Storm drain will outfall to channel.	Available MCDOT ROW.	Potential utilities conflicts (Kinder Morgan Line on 51st Ave.).	Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Need construction plans. Requires engineering consultant.
2	43rd Avenue (Carver to Estrella)	Detention Basin in the South Mountain park, upstream of properties north of Sioux Street	Potential partnering with City of Phoenix Parks Department.	Permit from Parks for building structures in preserve will take a long time.	Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Need construction plans. Requires engineering consultant.
3	43rd Avenue (Carver to Estrella)	Use SRP laterals to collect water and drain storm water to a retention basin outfall located south of Estrella (i.e. provide discharge location for the SRP water in the lateral so it can collect storm water during floods).	Utilize existing facilities.	May not be an acceptable use of the SRP canal. Canal historic designation, requires State Historic Preservation Office (SHPO) review and approval. Retention basin site would require right of way.	Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Need construction plans. Requires engineering consultant. SHPO process will be long. SRP has to approve use of their facility.

Table 2.3 – Long Term Solutions for the Laveen ADMP Update Study Area Continued

Idea #	Location of Flooding Area	Brainstorm Ideas	Opportunities	Constraints	Comments
4	43rd Avenue (Carver to Estrella)	Construct detention basin per the Laveen ADMP on the property located in the northwest corner of Carver Road and 43rd Avenue. Basin would drain to storm drain in 43rd Avenue (mentioned in Idea 1) or to storm drain along Carver, west to the future ADOT channel for the Loop 202 extension freeway.	Utilizes future ADOT channel for Loop 202 freeway extension	Would require Right of Way purchase for the basin. Due to shallow bedrock there may be depth limitations for the basin.	Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Need construction plans. Requires engineering consultant.
5	47th Avenue and Elliot along SRP Canal	Construct a berm between Carver Estate property line and the canal on SRP's easement.	Fill material may be available from excavation of swales at the proposed 27th Avenue Basin or from deepening the Carver Mountain Estates retention basin.	Need right of way approval from SRP/USA and Carver Mountain Estates. A dam like situation may be created at locations where upstream washes out fall to the canal.	Hydraulic analysis required to evaluate impacts due to construction of the berm. In the event of a berm failure, downstream impacts need to be determined. Implemented by FCD based on input from SRP.
6	Neighborhood west of 47th Avenue, between Dobbins and Elliot roads.	Channel or series of retention basins within roadway ROW	Available MCDOT Right of Way	May require the relocation of utilities, mail boxes, driveways, etc.	Depending on utility relocation, could be an intermediate or long term fix, need construction plans. Requires engineering consultant.

Table 2.3 – Long Term Solutions for the Laveen ADMP Update Study Area Continued

Idea #	Location of Flooding Area	Brainstorm Ideas	Opportunities	Constraints	Comments
7	Neighborhood west of 47th Avenue, between Dobbins and Elliot roads.	Utilize Laveen Drain	SRP owns and operates drain.	Drain conveys groundwater. The addition of storm water could overwhelm the drain, which might lead to failure of the clay drain pipe.	Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Requires engineering consultant.
8	Neighborhood west of 47th Avenue, between Dobbins and Elliot roads.	Utilize Laveen School District’s recreation fields located in the Southeast corner of 51st Ave. and Dobbins Road as a detention basin site	School fields are no longer in use and may be available.	Requires ROW Purchase.	Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Requires engineering consultant. School District approval could be a long process.
9	Neighborhood west of 47th Avenue, between Dobbins and Elliot Roads.	Extend the 51st Avenue Storm Drain to the south of Dobbins at a minimum to Sunrise Drive. Provide catch basins along 51st Ave. Provide catch basin and or channel along Sunrise Drive and a retention basin in the southeast corner of Sunrise Drive and 51st Ave.	Available City of Phoenix right of way for storm drain.	Right of way for drainage improvements along Sunrise Drive may be required. Right of way for detention basin would be required. Capacity of 51st Avenue Storm Drain north of Dobbins Road may be limited due to downstream storm drain capacities.	If storm drain capacity is an issue, utilize basin at Laveen School field site. See Idea 8. Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Requires engineering consultant.

Table 2.3 – Long Term Solutions for the Laveen ADMP Update Study Area Continued

Idea #	Location of Flooding Area	Brainstorm Ideas	Opportunities	Constraints	Comments
10	Neighborhood west of 47th Avenue, between Dobbins and Elliot Roads.	Construct storm drain in Dobbins Road between 51st Avenue and 35th Avenue. Storm drain would connect to existing 51st Avenue storm drain, or outfall into potential basin at Laveen School field site. See Idea 8.	Available City of Phoenix ROW for storm drain.	Capacity of 51st Avenue Storm Drain north of Dobbins Road may be limited due to downstream storm drain capacities.	If storm drain capacity is an issue, utilize basin at Laveen School field site. See Idea 8. Hydrologic and hydraulic analyses required to estimate flow rates and volumes. Requires engineering consultant.
11	SRP canal west of 35th Avenue, north of Elliot Road alignment.	Collection channel or storm drain along SRP's Elliot Road alignment with weir locations along the canal to allow water flows into this channel.		Requires right of way or easement from SRP/USA . Potential closing of access to some properties.	Getting a permit can be a long process. Hydrologic and hydraulic analyses required to estimate flow rates and volumes and locations for lateral weirs. Requires engineering consultant.

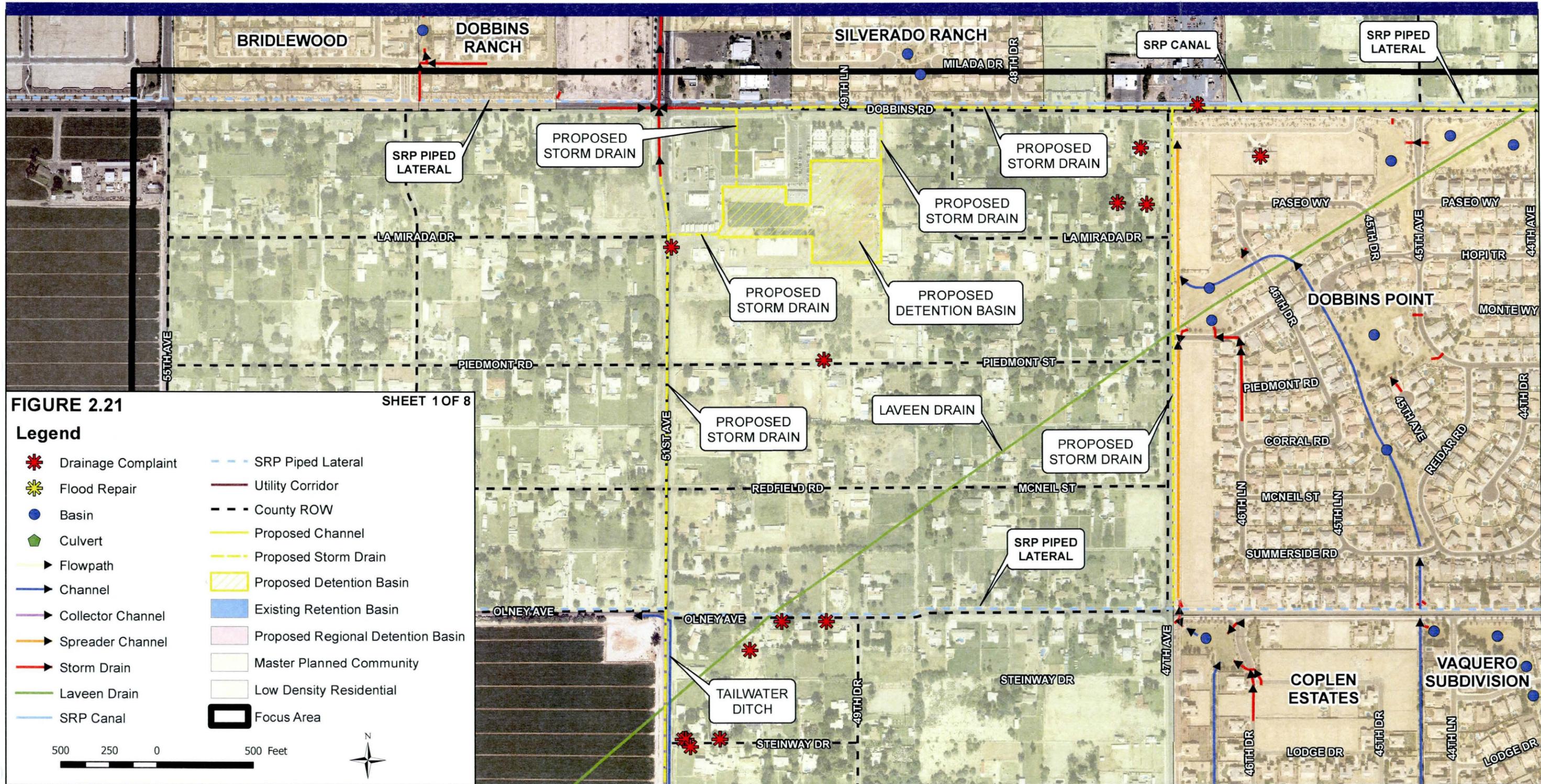


Laveen Area Drainage Master Plan Update

Brainstorm Flood Hazard Mitigation Solutions

SHEET LAYOUT

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Flood Control District of Maricopa County, GIS Division, 6/22/2015



Laveen Area Drainage Master Plan Update

Brainstorm Flood Hazard Mitigation Solutions

SHEET LAYOUT

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7	8

FOCUS AREA

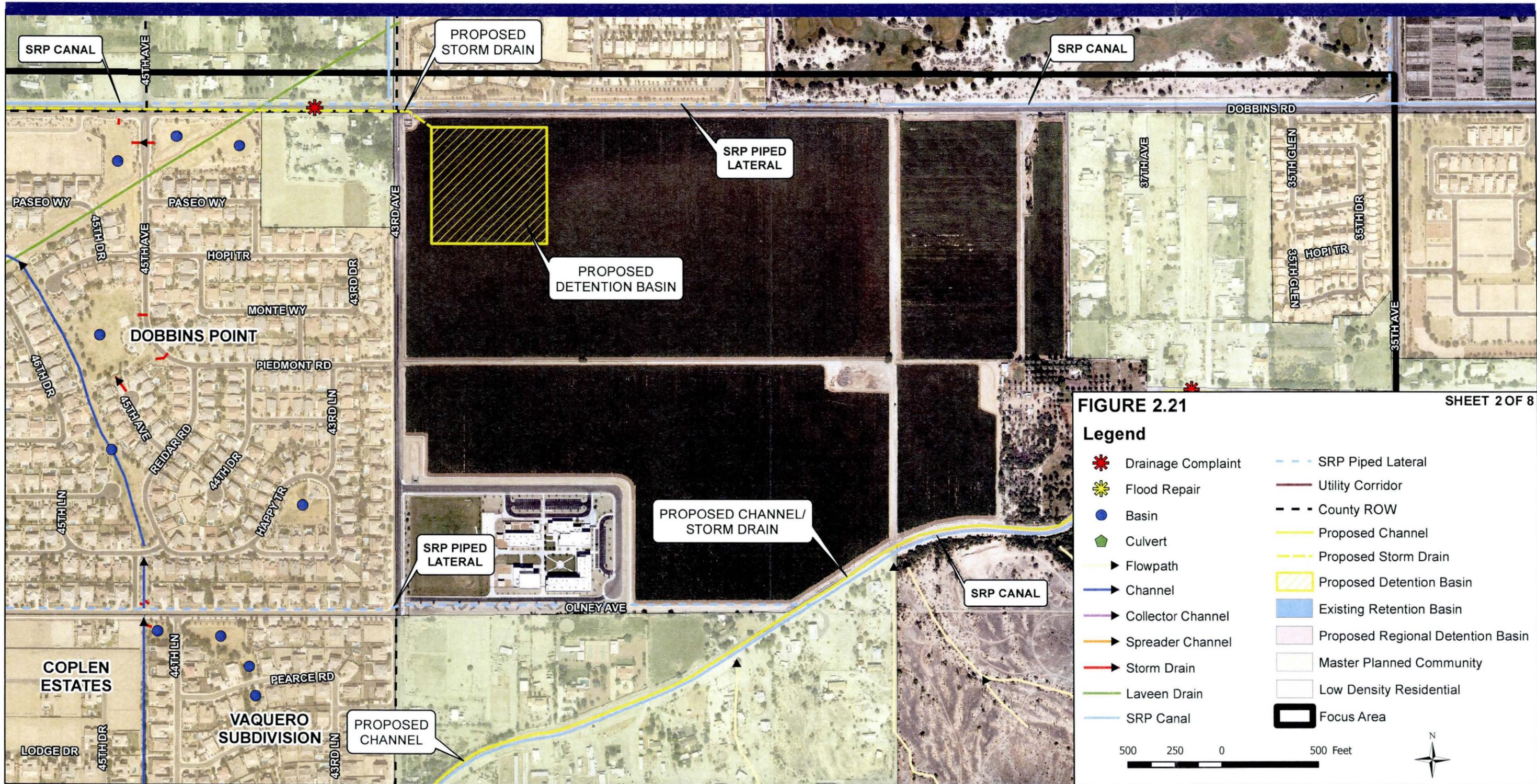


FIGURE 2.21

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Flood Control District of Maricopa County, GIS Division, 6/22/2015



Laveen Area Drainage Master Plan Update

Brainstorm Flood Hazard Mitigation Solutions

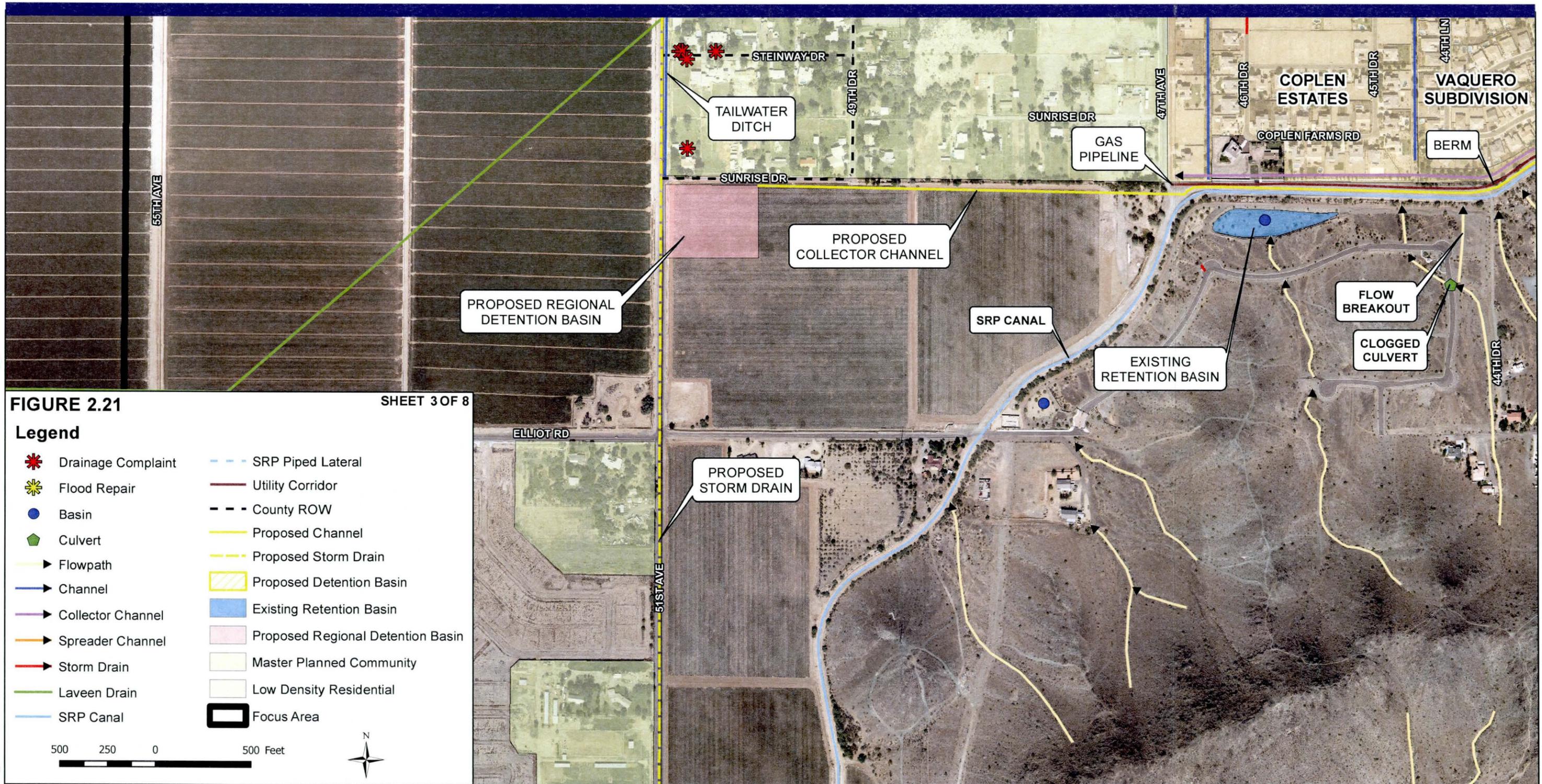
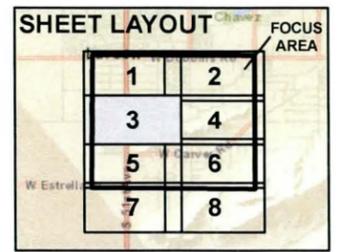


FIGURE 2.21 SHEET 3 OF 8

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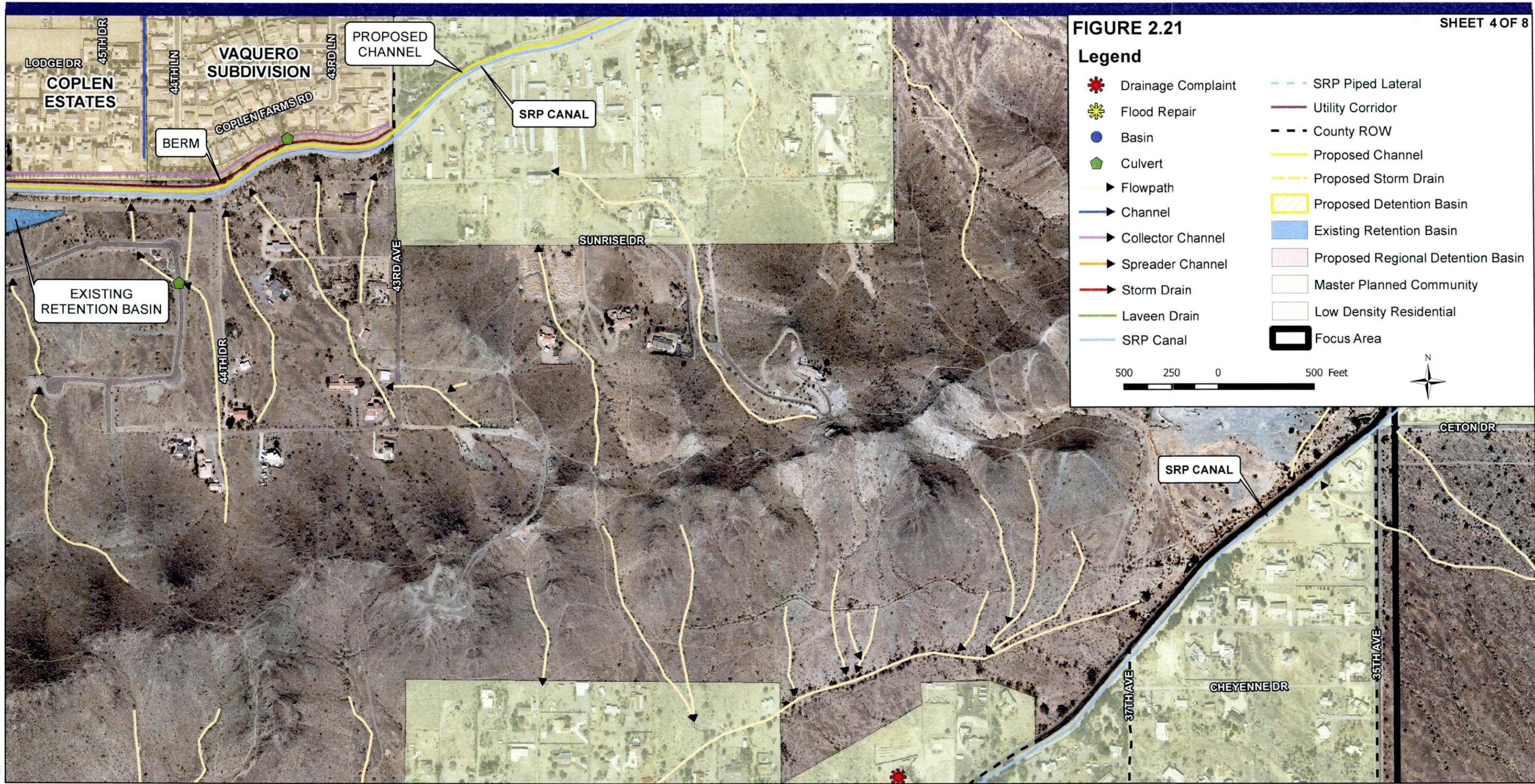
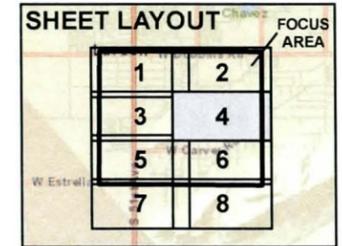
- Drainage Complaint
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- Proposed Regional Detention Basin
- Master Planned Community
- Low Density Residential
- Focus Area

500 250 0 500 Feet



Laveen Area Drainage Master Plan Update

Brainstorm Flood Hazard Mitigation Solutions



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Flood Control District of Maricopa County, GIS Division, 6/22/2015



Laveen Area Drainage Master Plan Update

Brainstorm Flood Hazard Mitigation Solutions

SHEET LAYOUT

1	2
3	4
5	6
7	8

FOCUS AREA

FIGURE 2.21

SHEET 5 OF 8

Legend

- Drainage Complaint
- Flood Repair
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Flood Control District of Maricopa County, GIS Division, 6/22/2015



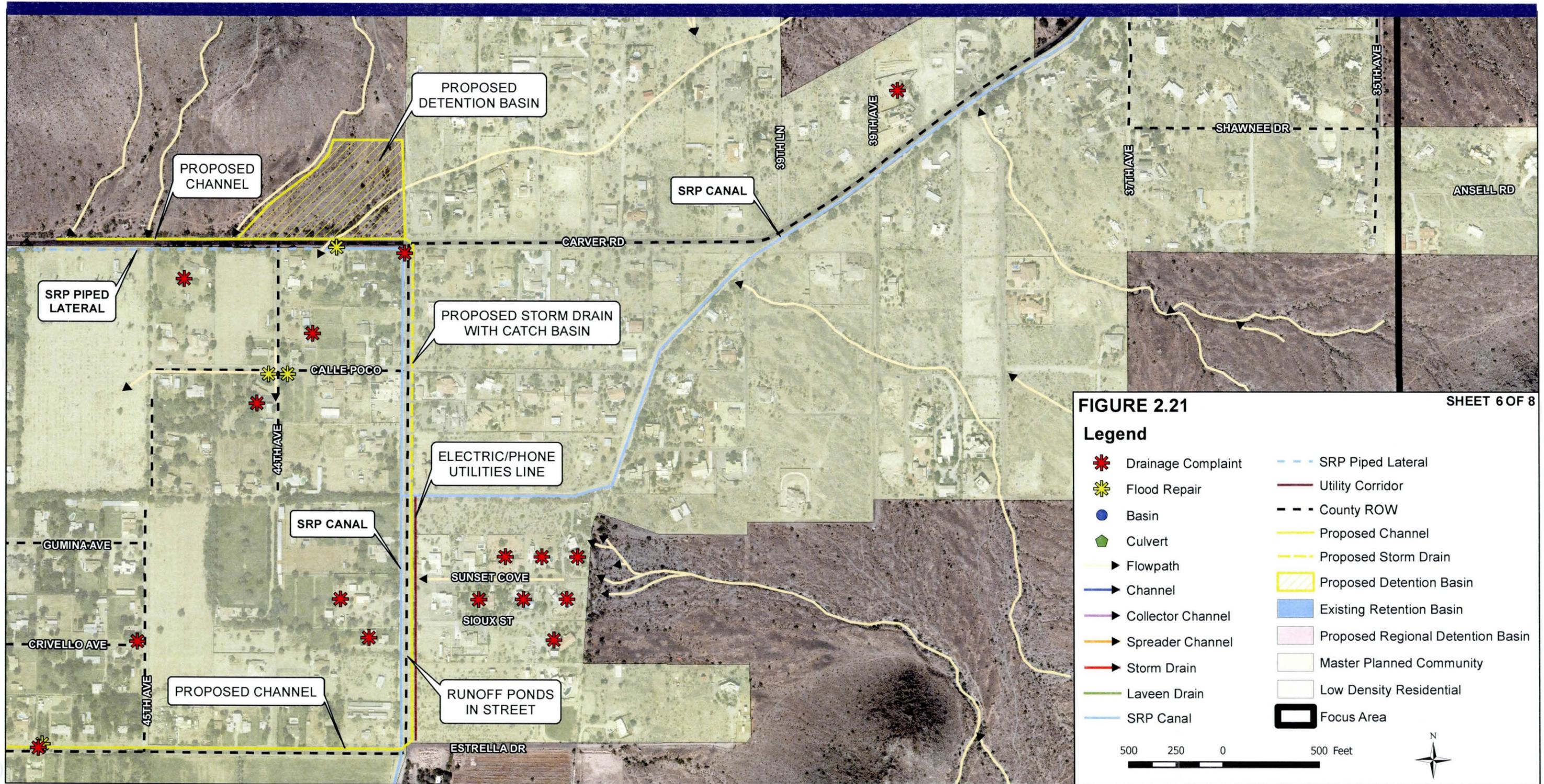
Laveen Area Drainage Master Plan Update

Brainstorm Flood Hazard Mitigation Solutions

SHEET LAYOUT

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FOCUS AREA



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Flood Control District of Maricopa County, GIS Division, 6/22/2015



Laveen Area Drainage Master Plan Update

Brainstorm Flood Hazard Mitigation Solutions

SHEET LAYOUT

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FOCUS AREA

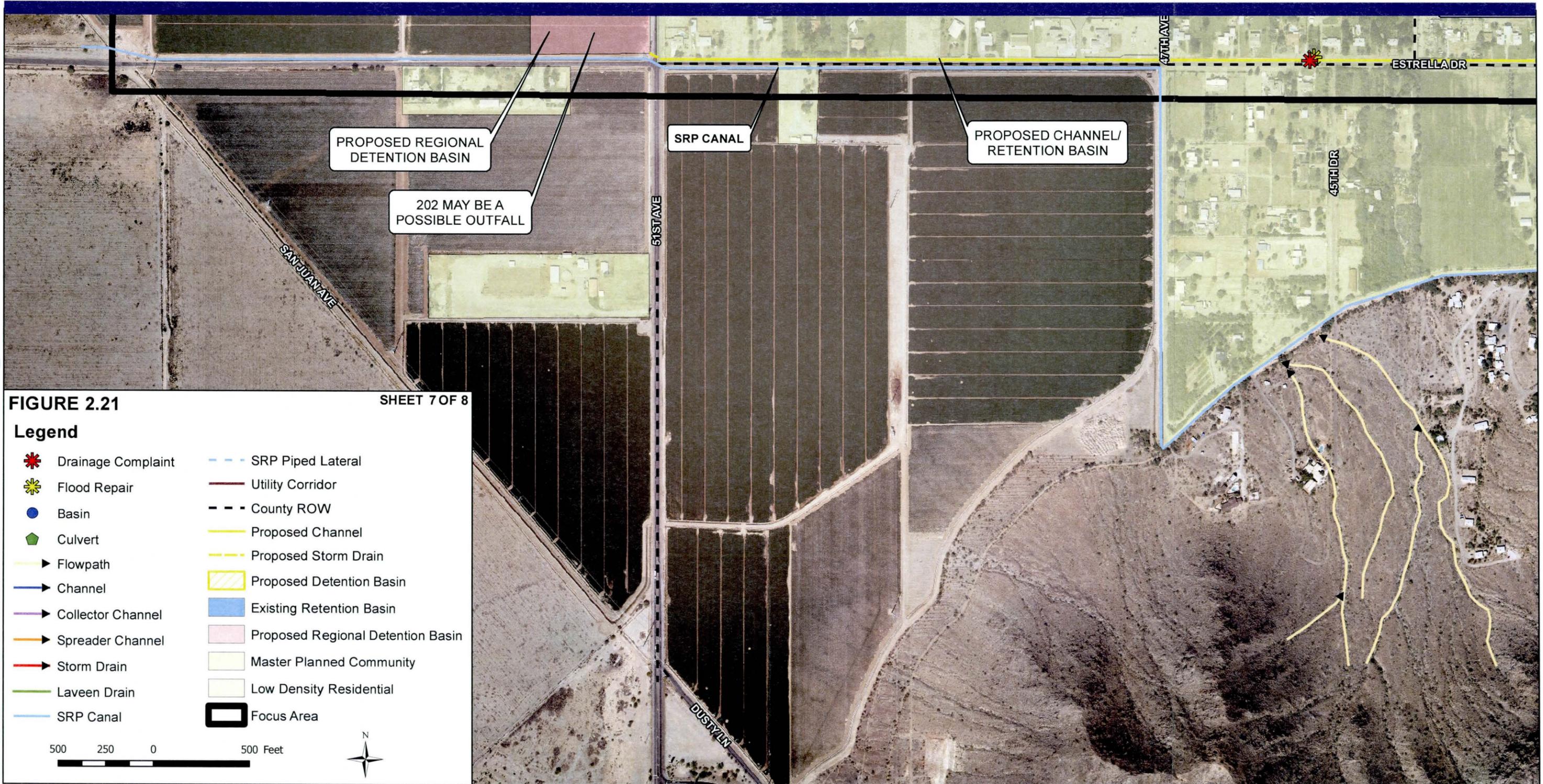


FIGURE 2.21

SHEET 7 OF 8

Legend

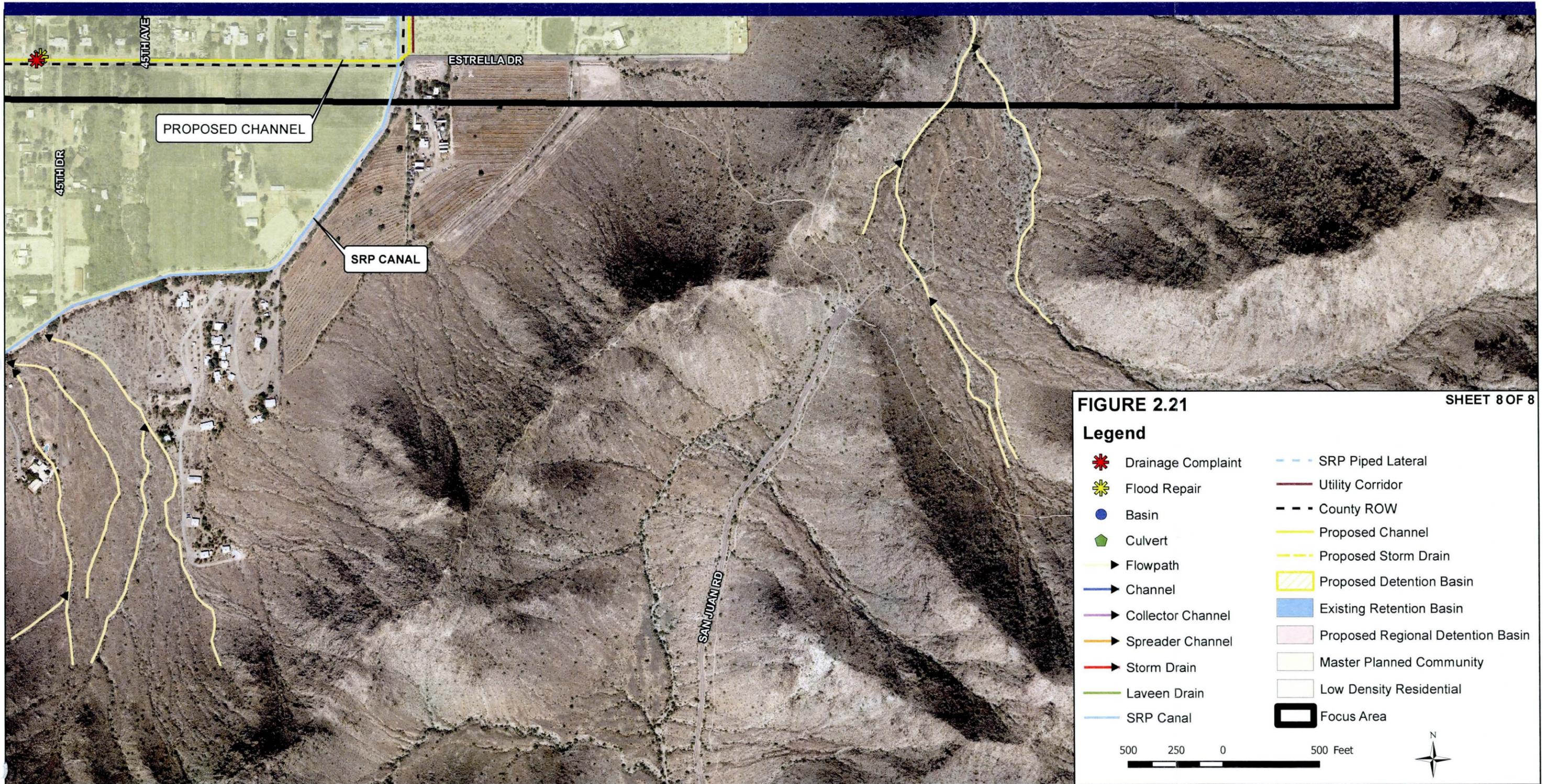
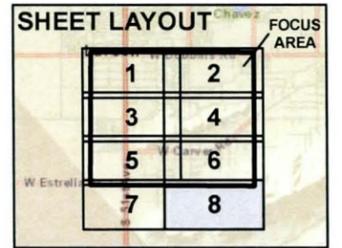
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Laveen Area Drainage Master Plan Update

Brainstorm Flood Hazard Mitigation Solutions



3 Recommendations for Next Steps

Potential flood mitigation projects were identified through brainstorming meetings. The feasibility and benefits of potential projects need to be evaluated through hydrologic, hydraulic and alternative evaluations. Given the drainage complexity due to multiple split flows, a two dimensional hydrologic/hydraulic modeling approach is recommended. The merits of two dimensional modeling over a one dimensional model (HEC-1) for the Laveen ADMP Update Focus Area are discussed in the following sections.

3.1 Hydrology Modeling Approaches

The major hydrology modeling challenges characteristic of the Laveen ADMP Update watershed are challenges associated with split flow conditions that result from canals, tail water ditches, roadways, and various combinations of culverts, channels, and embankments. Table 3.1 list modeling challenges and approaches that would be taken with a HEC-1 and FLO-2D models.

Table 3.1 – Steps Required to Resolve Modeling Challenges

Hydrology Modeling Challenges	HEC-1	FLO-2D
Location of drainage complaints and proposed drainage improvements relative to existing watershed concentration points are inconsistent.	Would require sub-dividing watersheds (including upstream and adjacent) and conducting split flow and hydraulic analyses to determine and route split flow peak discharges to concentration points of concern. This would be an iterative approach. Another approach would be to determine a unit peak discharge from results of the existing HEC-1 model and apply it to the upstream area of concentration point of concern; however this type of evaluation would not include the split flows.	Solution inherent to model
Flood hazard risk assessment and flood hazard mitigation solutions	Would require watershed subdivisions, hydraulic analyses and evaluation of all upstream split flow conditions. This would be an iterative approach.	Solution inherent to model
Calculation of split flows	Manually calculated outside of HEC-1 and applied as a rating table in the model. If any of the splits are incorrect, the error can propagate downstream	Automatically calculated

3.2 Benefits of FLO-2D Analysis

There are major benefits of using a two dimensional analysis (e.g., FLO-2D) in this area. These include:

- 1) Split flows are automatically calculated within FLO-2D so the probability of errors propagating downstream is less as compared to HEC-1.
- 2) Depth and discharge results are provided at every grid location in a graphical format so the locations and sizes of public flood control structures (i.e., basins, storm drain, etc.) can be optimized, which can result in cost savings (e.g., Granite Reef Wash project).
- 3) Even without designed structures, the depth and discharge results provide tools to better locate/plan future private/public development similar to what is being done with the Pinnacle Peak West results.
- 4) FLO-2D would allow for modeling of localized basins in large lot developments to better identify the cumulative impacts to flooding hazards in the area (similar to Tempe ADMS).
- 5) Other FCD projects have realized a construction cost benefit due to FLO-2D modeling details and approach.

3.3 Other Benefits of Hydraulic Modeling

One major problem for all solutions in this area is the lack of a dedicated outfall. Since ADOT is bidding the Loop 202 project in late 2015, the next steps for the Laveen ADMP Update would allow for possible coordination with this freeway project for a dedicated outfall.

4 References

Cellar Barr Associates, Revised November, 1991, Laveen Area Master Drainage Study,

HDR, November, 2001 Laveen Area Drainage Master Plan

Flood Control District of Maricopa County, 1999, Report of the Flooding in Laveen Storm of July 28, 1999, by Afshin Ahouraiyan.

Laveen ADMP Update

Appendix A

City of Phoenix Drainage Studies
PDFs on CD



Laveen ADMP Update Report

PLATES



Laveen Area Drainage Master Plan Update

Existing Drainage Facilities/Drainage Complaints

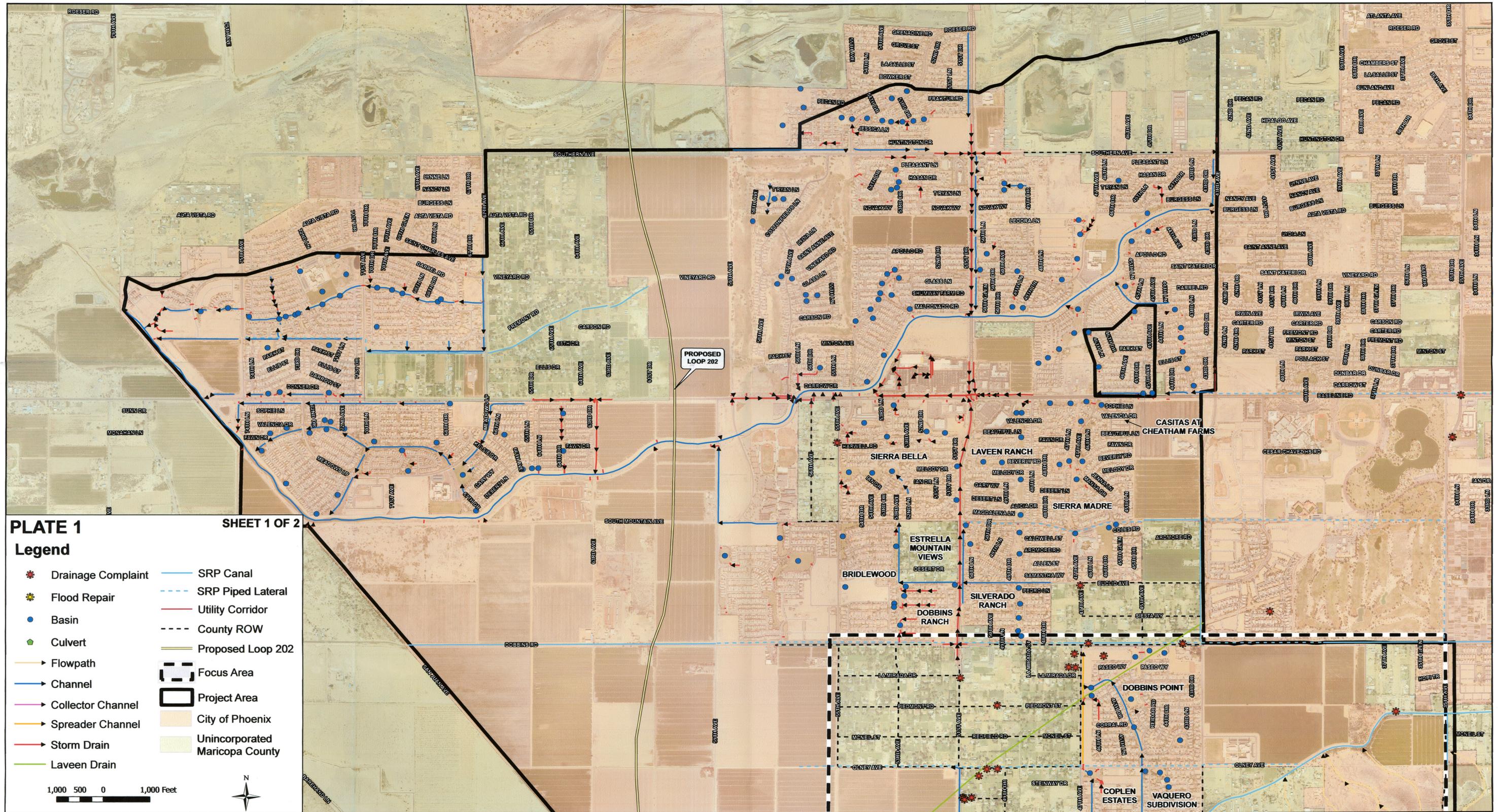
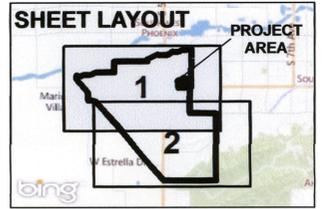


PLATE 1
SHEET 1 OF 2

Legend

- Drainage Complaint
- Flood Repair
- Basin
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- Channel
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- County ROW
- Proposed Loop 202
- Focus Area
- Project Area
- City of Phoenix
- Unincorporated Maricopa County

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Laveen Area Drainage Master Plan Update Existing Drainage Facilities/Drainage Complaints

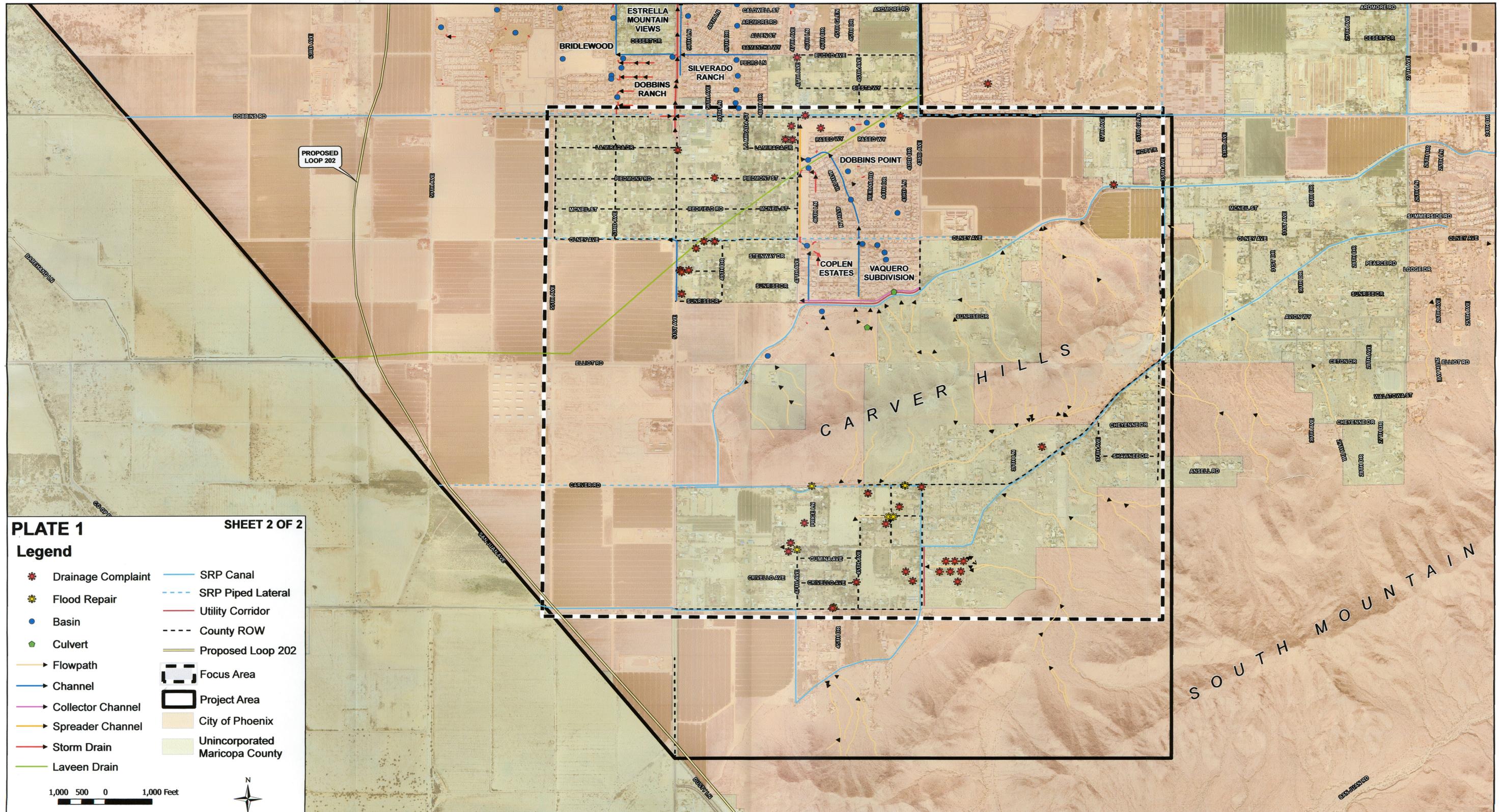
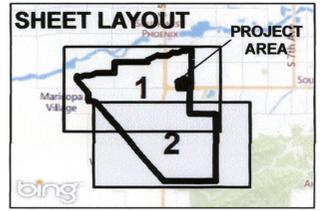


PLATE 1 SHEET 2 OF 2

Legend

- Drainage Complaint
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