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Paradise Valley Storm Water Master Plan Adoption

Town Council Session
November 13, 2025



Kimley»Horn

Project Timeline

Project Kick Off
March 26, 2024



- Town Priorities
- Overview of Project Scope and Schedule

1st Council Session
June 13, 2024



- Data Collection
- Hydrology and Hydraulics Model

2nd Council Session
November 14, 2024



- Flood Hazard Analysis
- Identification of Priority Areas
- Project Ranking Criteria

Project Timeline

3rd Council Session
March 27, 2025

4th Council Session
October 9, 2025

Plan Implementation

- Model Finalization
- Flood Hazard Area Prioritization Results
- Proposed Project Alternative Analysis

- Draft Final Deliverables
- Adoption (November 13, 2025)

Summary of Comments Addressed from 10/09/25 Council Work Session & Staff

Comment	Page #	Response
Change row colors to match previous table	42	Updated
Conduct spelling and grammar check of entire document	n/a	Completed
Change “Medium” to “Moderate”	iii	Updated
Change Figure 4 colors to match Figures 5 & 6	33 & 34	Updated
Change “Medium” to “Moderate”	41	Updated
Rearrange order of legend	136	Updated
Add ‘PV Border’ to legend	161	Added
Table title is cutoff	362	Fixed

Table 7 (Page 42) Updates



PARADISE VALLEY STORM WATER MASTER PLAN

Table 7: Flood Hazard Area Ranking and Characteristics

Flood Hazard Area	Matrix Score	Severity of Flooding	Structures with Adjacent Depths of at Least 0.5 ft	Streets Impacted by at Least 0.5 ft Depths	Potential Impact to Emergency Access
N	49	Severe	123	2 Collector; 8 Local	Yes
A	45	Severe	43	2 Collector; 6 Local	Yes
O	45	Severe	22	2 Collector; 4 Local	Yes
K	43	Severe	141	2 Collector; 13 Local	No
L	41	Severe	35	0 Collector; 5 Local	Yes
H	40	Severe	9	2 Collector; 2 Local	Yes
P	39	Severe	17	1 Collector; 2 Local	Yes
C	39	Moderate	70	1 Collector; 2 Local	No
E	38	Moderate	52	2 Collector; 5 Local	No
S	36	Severe	14	1 Collector; 1 Local	Yes
R	36	Severe	27	1 Collector; 5 Local	Yes
D	33	Severe	20	2 Collector; 1 Local	No
G	32	Severe	2	0 Collector; 2 Local	Yes
M	25	Moderate	19	1 Collector; 6 Local	No
B	25	Moderate	4	1 Collector; 2 Local	No
J	21	Moderate	8	0 Collector; 3 Local	No

Flood Mitigation Alternatives Developed

...cont. Table 7 (Page. 42) Updates - Matching to Table 6(Pg. 41) and Figure 7 (Pg. ii)



PARADISE VALLEY STORM WATER MASTER PLAN

Flood hazard areas with moderate and severe classifications were ranked in a decision matrix based on five criteria, as outlined in **Table 6**. Classification of the severity of flooding and the potential number of structures that could be benefited in the area were the criteria that were given the greatest weight within the matrix with a weighted score of 5. Structures that could be benefited were defined as any structure with adjacent flood depths of 0.5 feet. The number of streets inundated with at least 0.5 feet of depth was another variable considered in the matrix and was given a weighted score of 4. Impacts to emergency access and the potential for multi-use opportunities were considered in the matrix as well with priority scores of 3 and 1, respectively. The results of the area decision matrix and area data sheets are provided in **Appendix D**.

Table 7 includes the location, the severity designation, the number of buildings impacted, and potential impacts to emergency access for each flood hazard area. Of the 16 areas classified as having severe or moderate flood potential, the top 9 were selected to develop flood mitigation alternatives. The three areas classified as having nuisance flooding potential were not included in the ranking, but can be evaluated further by Town maintenance or engineering staff as annual maintenance budgets allow.

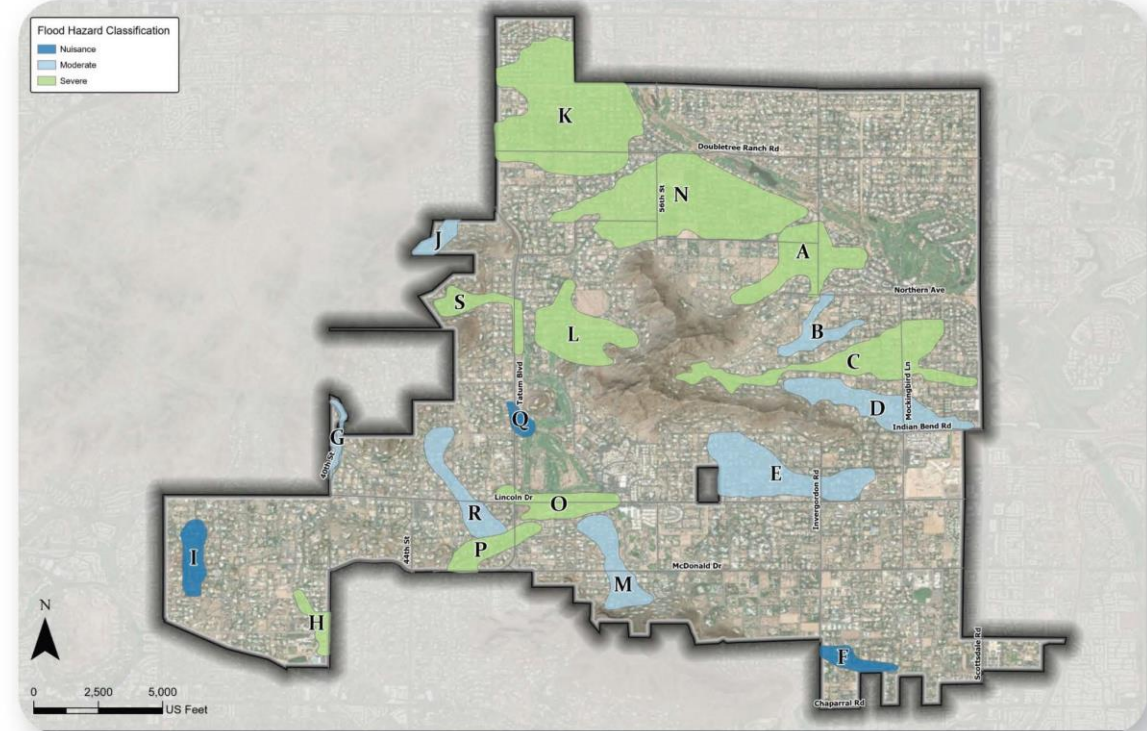
Table 6: Flood Hazard Area Prioritization Criteria

Criteria	Scoring Criteria	Weighted Score	Highest Possible Score	Lowest Possible Score
Severity of Flooding	1- Nuisance	5	15	5
	2- Moderate			
	3- Severe			
Potential Structures Protected	1- 1 to 30 Structures	5	15	5
	2- 31-50 Structures			
	3- >51 Structures			
Potential Streets Protected	1- Local Street Benefits Only	4	12	4
	2- Arterial/Collector Street or Multiple Local Streets Benefits			
	3- Multiple arterial/collector & Local Street Benefits			
Restriction to Emergency Access	0- No Impact to Emergency Access	3	6	0
	2- Impacts to Emergency Access			
Multi-Use Opportunities	1- No Opportunities	1	2	1
	2- Possible Opportunities			



PARADISE VALLEY STORM WATER MASTER PLAN

Figure 7: Classifications of Flood Hazard Areas





PARADISE VALLEY STORM WATER MASTER PLAN

and well-being of residents and the community. The degree of flooding, whether nuisance, moderate, or severe, influences the urgency and scale of necessary interventions.

2. Potential Structures Protected (Weight: 5)

- The number of structures that could be protected by mitigation measures was also heavily weighted. This criterion reflects the plan's focus on minimizing property damage and protecting as many residential and commercial buildings as possible.

3. Potential Streets Protected (Weight: 4)

- The number of roads (local, collector, arterial) affected by flooding and their role in community connectivity and accessibility were considered significant, but slightly less critical than the direct impact of flooding on structures and severity.

4. Impacts to Emergency Access (Weight: 3)

- Evaluating how flooding affects emergency vehicle access and response times was important, as maintaining reliable emergency services is crucial during and after flood events. This criterion was given a moderate weight.

5. Multi-Use Opportunities (Weight: 1)

- This criterion considered the potential for projects to incorporate additional community benefits beyond flood mitigation, such as recreational spaces or aesthetic enhancements. It had the lowest weight, reflecting its lower priority relative to immediate flood risk reduction.

For a detailed review of how each criterion was scored and its weight, please refer to the decision matrices included within the full text of the Master Plan and **Appendix D** where the area decision matrix and area data sheets are provided.

Snapshot of Decision Matrix (Table 6 from the Master Plan)

Criteria	Scoring Criteria	Score Range	Weighted Score
Severity of Flooding	Nuisance, Moderate, Severe	1, 3, 5	5
Potential Structures Protected	1 to 30 Structures, 31-50 Structures, >51	1, 3, 5	5

Criteria	Scoring Criteria	Score Range	Weighted Score
Potential Streets Protected	Local Street Benefits Only, Arterial/Collector Street or Multiple Local Streets Benefits, Multiple arterial/collector & Local Street Benefits	1, 2, 4	4
Impacts to Emergency Access	No Impact to Emergency Access, Impacts to Emergency Access	1, 3	3
Multi-Use Opportunities	No Opportunities, Possible Opportunities	1, 2	1

The nine-highest ranking flood hazard areas are furthered for project alternative development. Nine areas were chosen to advance based on the scoring results and a logical breakpoint. The nine highest-ranking flood hazard areas identified are:

- Flood Hazard Area A:** Invergordon Road and Mockingbird Lane
- Flood Hazard Area C:** Cheney Wash
- Flood Hazard Area E:** Lincoln Wash
- Flood Hazard Area H:** 40th Street and Stanford Drive
- Flood Hazard Area K:** Mountain View Road
- Flood Hazard Area L:** Upstream Cherokee Wash
- Flood Hazard Area N:** Downstream Cherokee Wash
- Flood Hazard Area O:** Lincoln Drive
- Flood Hazard Area P:** Tatum Boulevard and McDonald Drive

Proposed Project Alternatives

For the nine highest-ranking flood hazard areas, flood mitigation projects are identified and/or developed. Identified projects are those from previous studies. These projects and new projects are further developed. Projects are categorized into maintenance projects, medium-sized projects, and large projects based on their estimated construction costs:

- Maintenance Projects:** Costs less than \$250,000.
- Medium Projects:** Costs between \$250,000 and \$1.3 million. These are eligible for the Flood Control District of Maricopa County's Small Project Assistance Program (SPAP).
- Large Projects:** Costs exceed \$1.3 million. These projects qualify for other grant programs like the Flood Control District of Maricopa County's Capital Improvement Project Partnership Program (CIPPP) or other grant opportunities through FEMA.

Page 33 and 34 Updates



PARADISE VALLEY STORM WATER MASTER PLAN

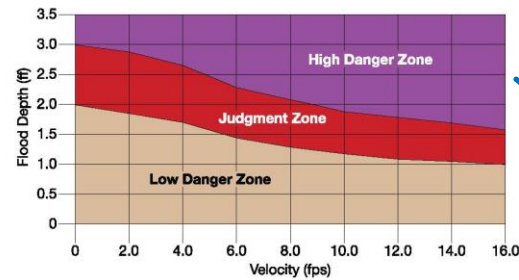
C. Potential Risk to Passenger Vehicles

During large storm events in Town of Paradise Valley, roads such as Doubletree Ranch Road and 40th Street have been closed for passenger vehicle safety. Data obtained from the Town revealed an incident in which a car had been swept off the road at the CCW low water crossing on 40th St. Given the issues identified, risk to passenger safety was an important hazard to evaluate in the Paradise Valley Master Plan.

The methodology used to identify potential risk to passenger vehicles is based on the depth-velocity flood danger level relationship for passenger vehicles developed in ACER Technical Memorandum No. 11: Downstream Hazard Classification Guidelines, (U.S. Department of the Interior Bureau of Reclamation, 1988). The memorandum presents the relationship, created between both the depth and velocity of flood water on a roadway, that is used to classify road conditions as a low danger zone, judgment zone, and high danger zone. **Figure 4** shows the graphical representation of this relationship. Each zone provides predictions of the severity of risk to passenger vehicles.

- **Low Danger Zone** – In this zone, almost all passenger vehicles can safely navigate on the road. The risk categorization is based on the ranges of the depth and velocity relationship shown in **Figure 4**. It should be noted that depths lower than 0.5 feet were removed from this zone due to the negligible effect on passenger vehicles. The depth of 0.5 feet was chosen as the minimum, because at this height, water will begin to reach the bottom of many passenger vehicles.
- **Judgement Zone** – In this zone, roadway flooding with a combination of depths and velocities shown in **Figure 4** present a highly significant hazard to most passenger vehicles. The ranges of depth outlined in this category are 2 to 3 feet of water. At these depths, emergency vehicles should proceed with caution, and passenger vehicles should be blocked from proceeding.
- **High Danger Zone** – In this zone, flood hazards are extreme for all passenger vehicles. The associated depths and velocities of this zone, shown in **Figure 4**, will block access to emergency vehicles.

Figure 4: Depth Times Velocity Graph for Passenger Vehicles (USBR 1988)



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Analyses of passenger vehicular risk were conducted for the 10-year and 100-year storm events. Using modeling results, areas of the Town were categorized into each flood zone type. The resulting passenger vehicle flood hazard layer was intersected with the centerline of all roads within Paradise Valley. Two methodologies were utilized to display and quantify the results of the intersection. The polyline method serves to quantify what percentage of roads in the Town are located within the high danger zone risk category, while the point method quantifies the total number of roadway wash crossings subject to the same risk category.

Figure 5: Example of Polyline Shapefile for Passenger Vehicles Risks

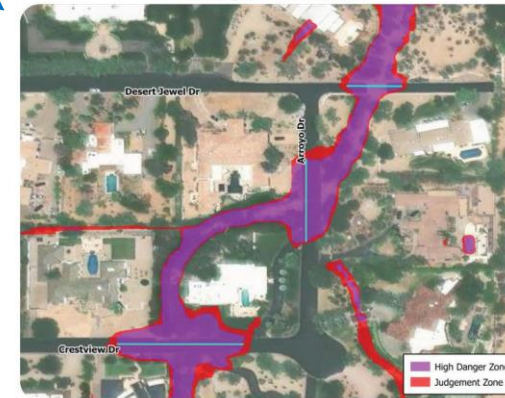
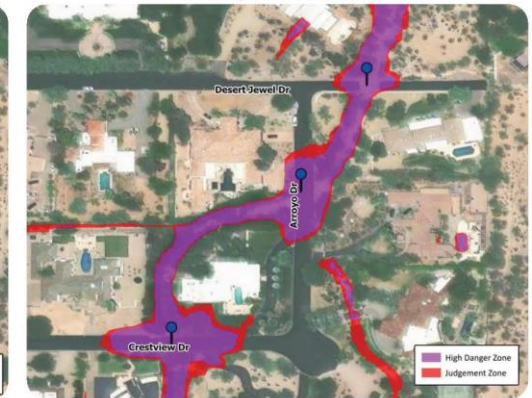


Figure 6: Example of Point Shapefile for Passenger Vehicles Risks



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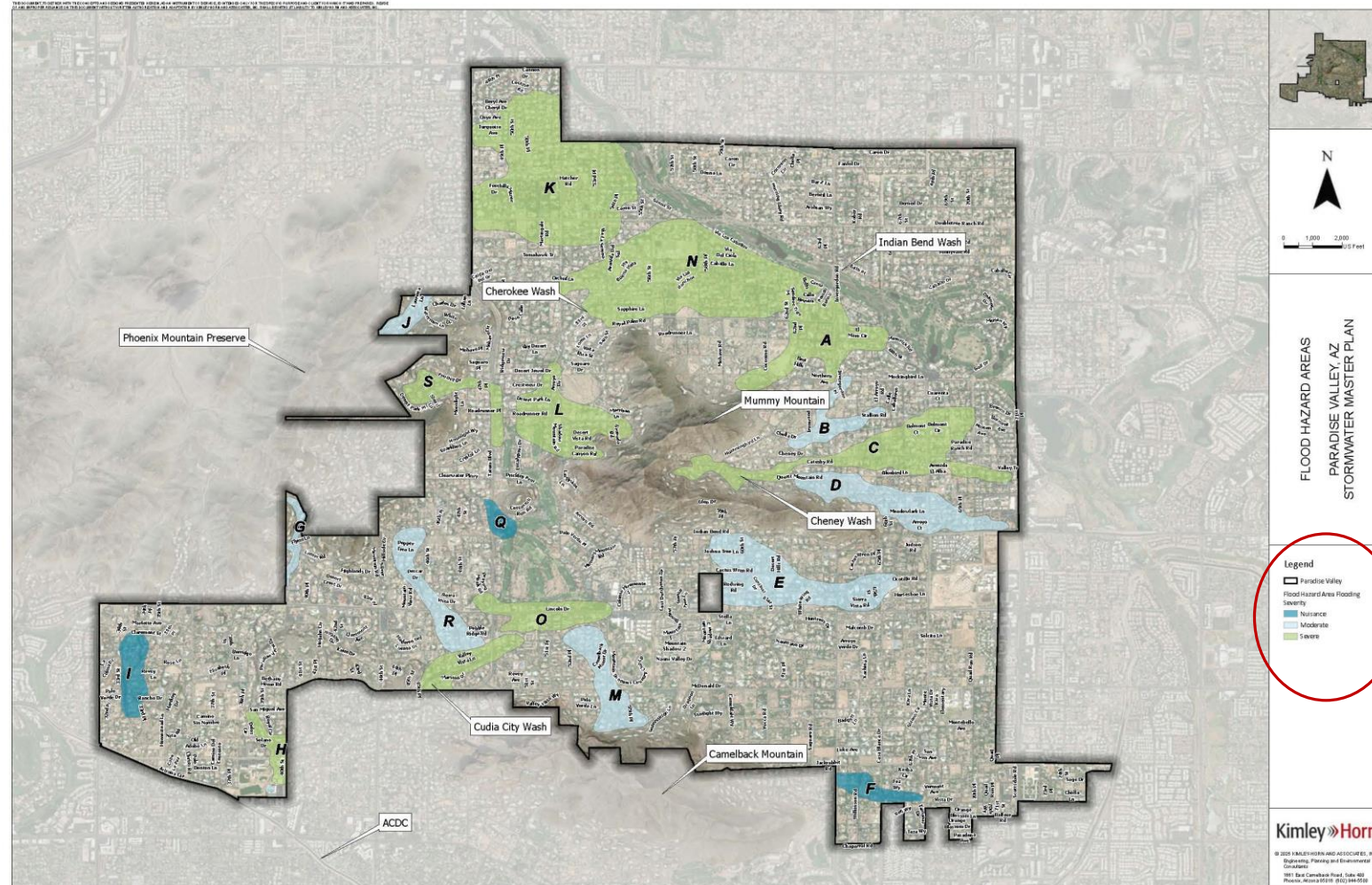
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	2- 31-50 Structures			
	3- >51 Structures			
Potential Streets Protected	1- Local Street Benefits Only	4	12	4
	2- Arterial/Collector Street or Multiple Local Streets Benefits			
	3- Multiple arterial/collector & Local Street Benefits			
Restriction to Emergency Access	0- No Impact to Emergency Access	3	6	0
	2- Impacts to Emergency Access			
Multi-Use Opportunities	1- No Opportunities	1	2	1
	2- Possible Opportunities			

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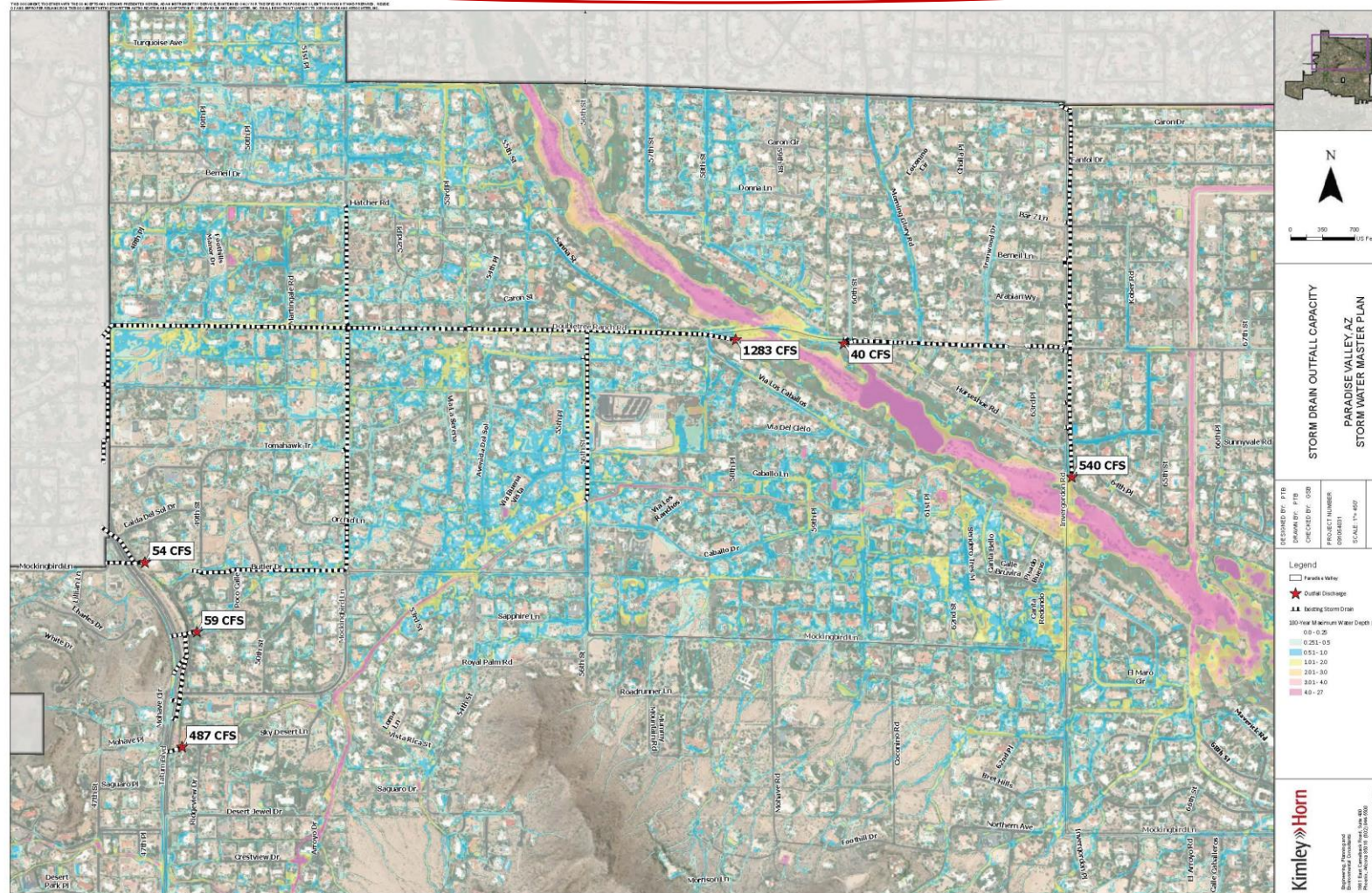
PARADISE VALLEY STORM WATER MASTER PLAN



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PARADISE VALLEY STORM WATER MASTER PLAN



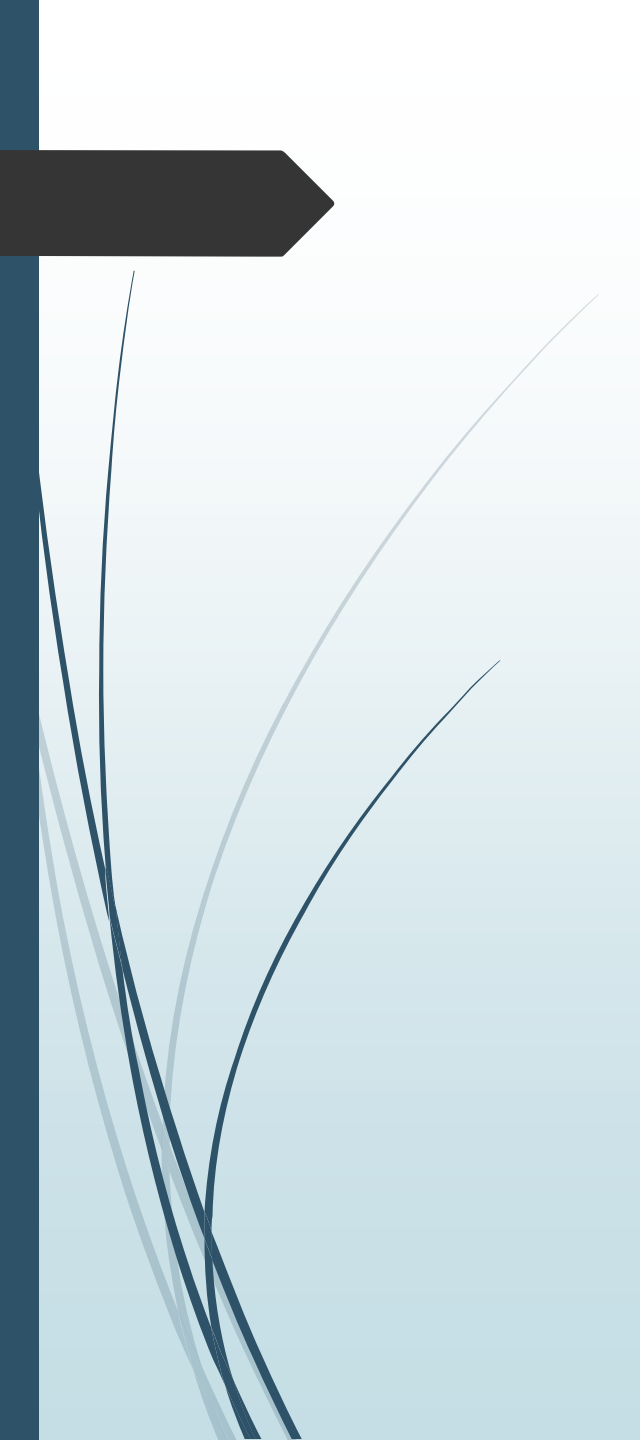
Page 362 Updates



PARADISE VALLEY STORM WATER MASTER PLAN

Area H - Engineer's Opinion of Probable Cost

Item	Description	Unit	Quantity	Unit Price	Cost
Construction Estimate					
1	Storm Drain Outlet	EA	1	\$2,500	\$2,500
2	Storm Drain Pipe 24"	LF	110	\$410	\$45,100
3	Manhole	EA	1	\$10,000	\$10,000
4	Staff Gage	EA	1	\$210	\$210
5	Flood Warning Sign	EA	1	\$275	\$275
6	Protective Railing	LF	75	\$180	\$13,500
7	Removal of Curb and Gutter	LF	3	\$250	\$750
8	Curb & Gutter	LF	3	\$100	\$300
9	Concrete Sidewalk	SF	10	\$35	\$350
10	Storm Drain Pipe 36"	SF	15	\$375	\$5,625
11	Remove Bollards	EA	6	\$260	\$1,560
12	Removal of Pipe	LF	15	\$75	\$1,125
13	Riprap	CY	15	\$120	\$1,800
14	Channel Excavation	CY	1,200	\$28	\$33,600
15	Diversion Structure	LS	1	\$55,000	\$55,000
16	Basin Excavation	CY	2,600	\$25	\$65,000
17	Landscaping	LS	1	\$15,000	\$15,000
Sub Total					\$251,695
General Costs					
18	SWPPP (10%)	LS	1	\$25,170	\$25,170
19	Mobilization/Demobilization (50%)	LS	1	\$125,848	\$125,848
20	Design (50%)	LS	1	\$125,848	\$125,848
21	Construction Management (45%)	LS	1	\$113,263	\$113,263
22	Utilities (20%)	LS	1	\$50,339	\$50,339
23	Traffic Control (20%)	LS	1	\$50,339	\$50,339
Subtotal					\$742,500
Contingency (40%)					\$297,000
Total					\$1,039,500



QUESTIONS?





October 9, 2025 Study Session's Topics



PRESENTATION OF DRAFT FINAL
STORM WATER MASTER PLAN



POSSIBLE COUNCIL
ADOPTION

Project Purpose



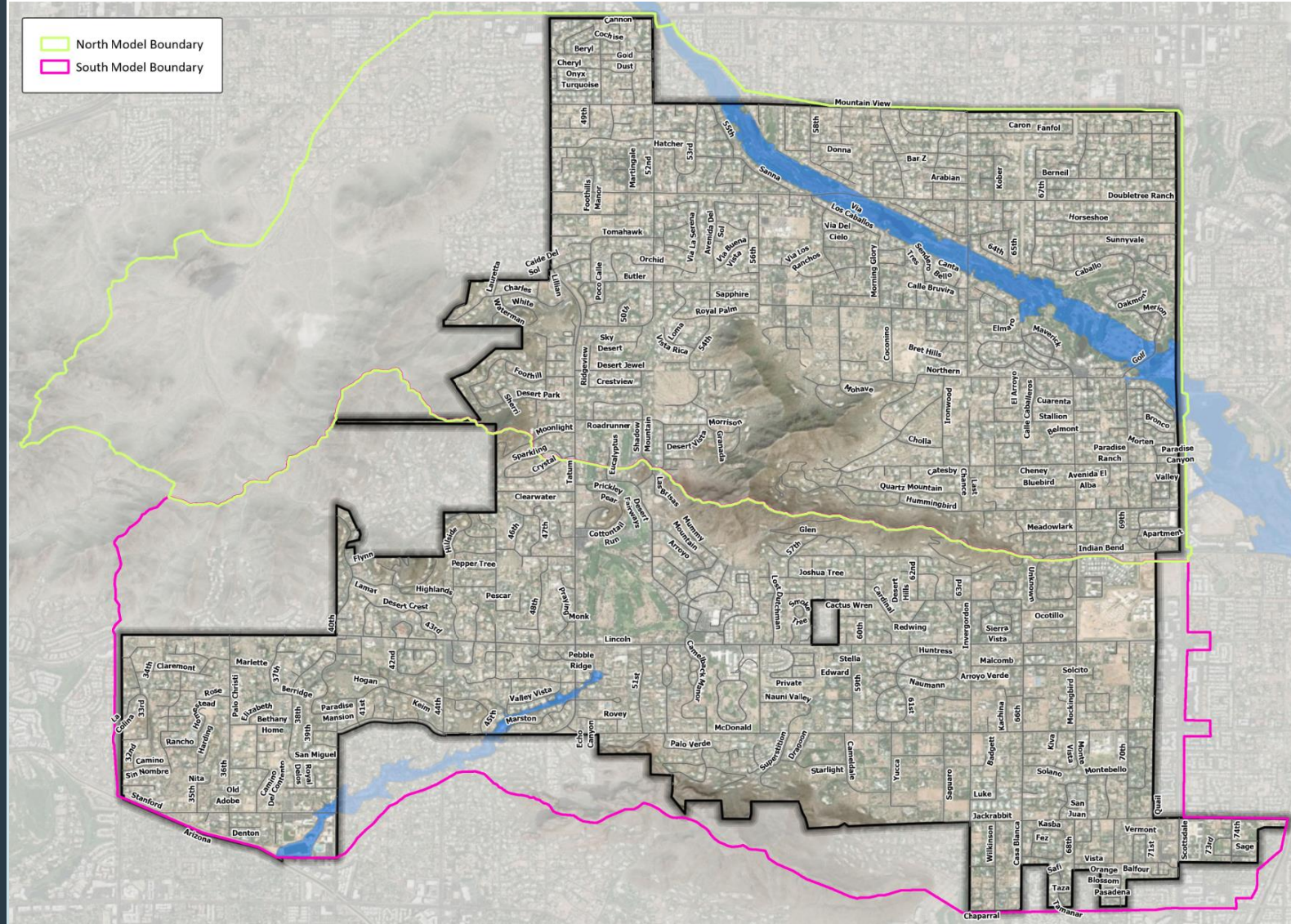
- Identify flood prone areas
- Develop conceptual solutions
- Inform CIP
- Identify funding opportunities for infrastructure improvements



Methodology for Identifying Flood Hazard Areas

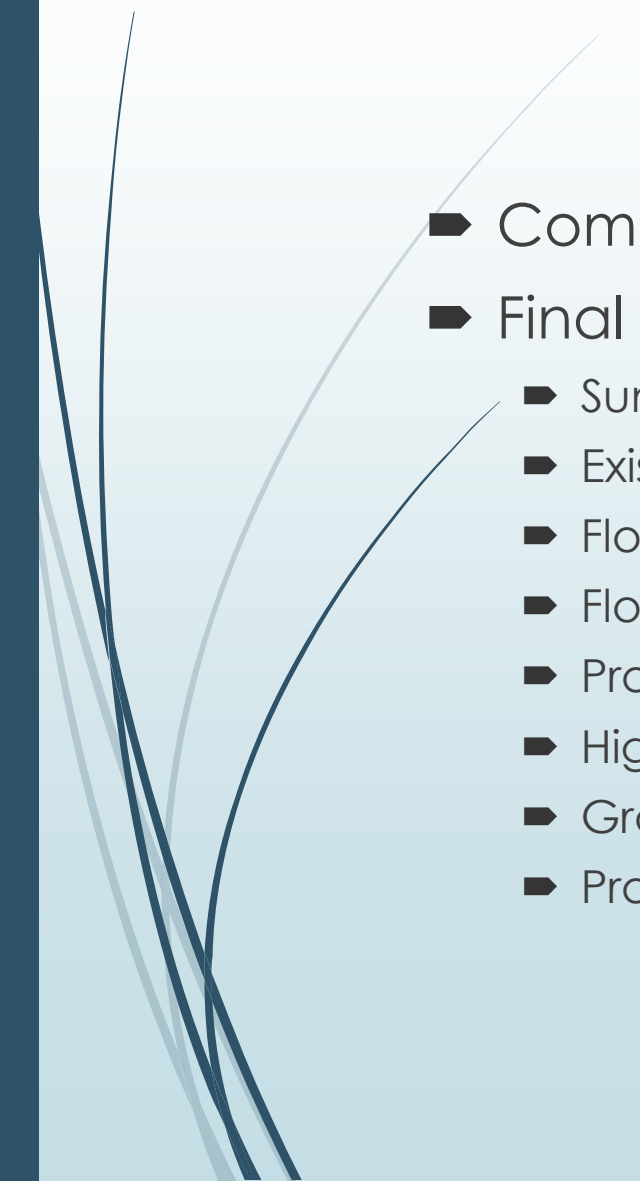
- Data from Town staff and residents
- Previous conceptual engineering studies
- Comprehensive Town-wide 2D hydrology and hydraulics models

Study Location





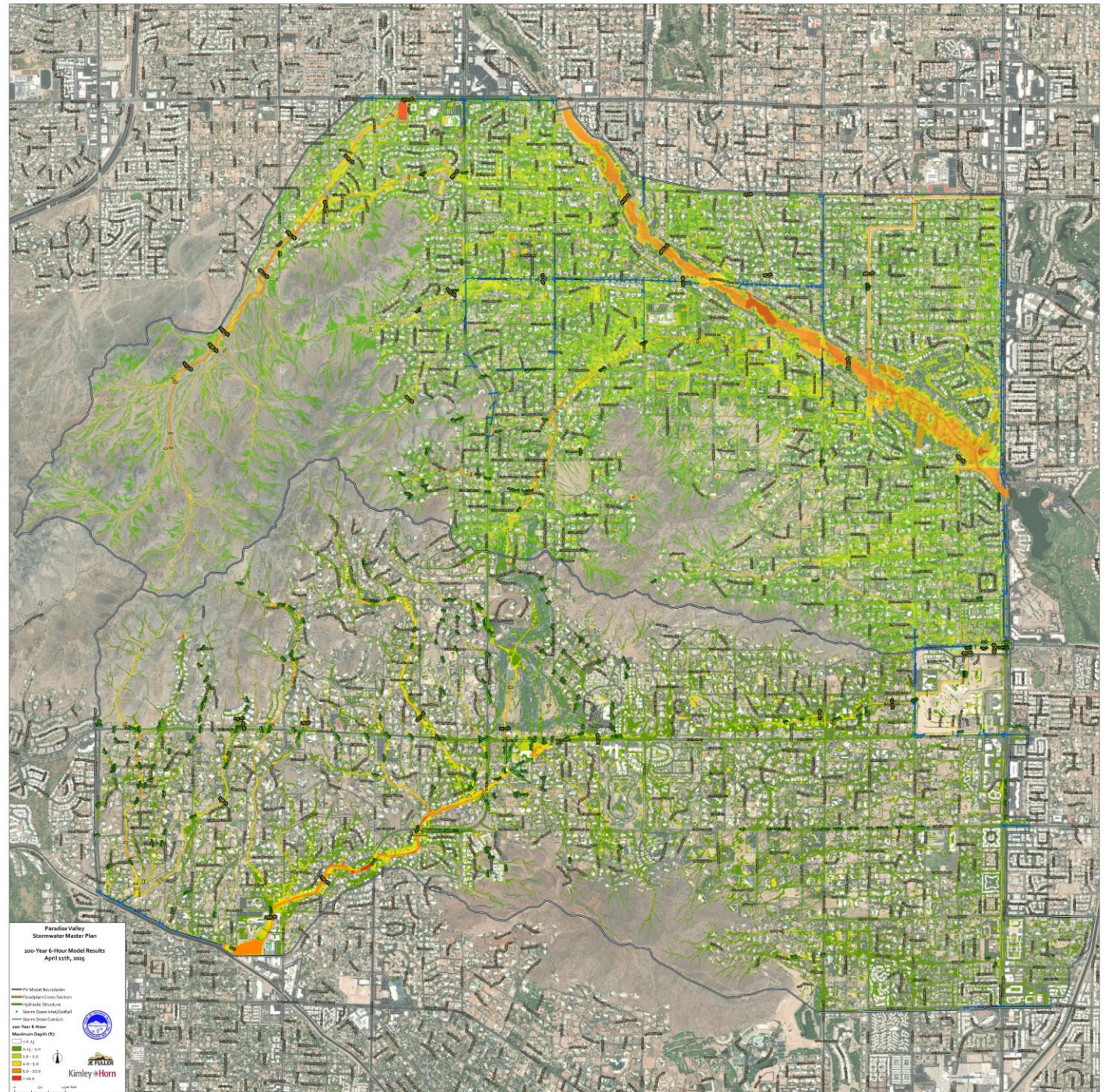
Final Deliverables



- Comprehensive Town-wide 2D Hydrology and Hydraulics Model
- Final SWMP Report
 - Summary of Data Collection
 - Existing Infrastructure Capacity
 - Flood Hazard Analysis
 - Flood Hazard Area Classification/Prioritization
 - Proposed Project Alternatives
 - Highest Priority Alternatives with Cost Analysis
 - Grant Funding Opportunities
 - Project Prioritization

Model Completion

- Reliable and accurate model
 - 2-, 10-, and 100-year results
- FCDMC reviewed and approved *



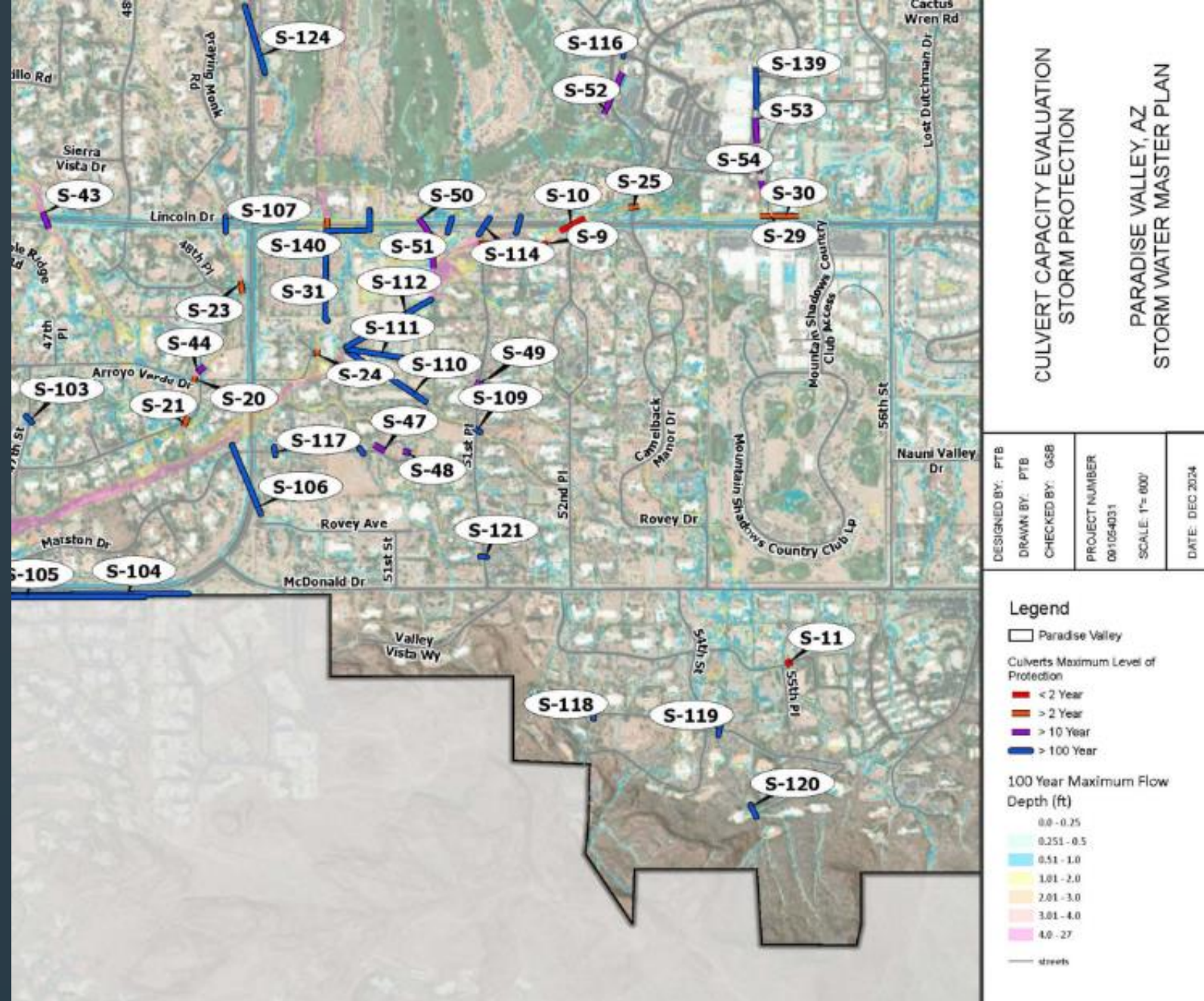


Data Collection

- 275 stormwater problem locations were identified
 - Identified by both staff and residents
 - Consists of structure (25), property(39), and road(211)flooding
- Flood hazard data and projects from regional and Town studies
 - Cheney Watershed Study - Town
 - Cudia City Wash ADMS and DCR - FCDMC
 - Lower Indian Bend Wash ADMP - FCDMC
 - Middle Indian Bend Wash ADMS – FCDMC
 - East Shea ADMS - FCDMC

Existing Infrastructure Evaluation

- Focused on street inlets and storm drain
- Used 2-, 10-, and 100-year model results to evaluate performance



Flood Hazard Analysis

Includes:

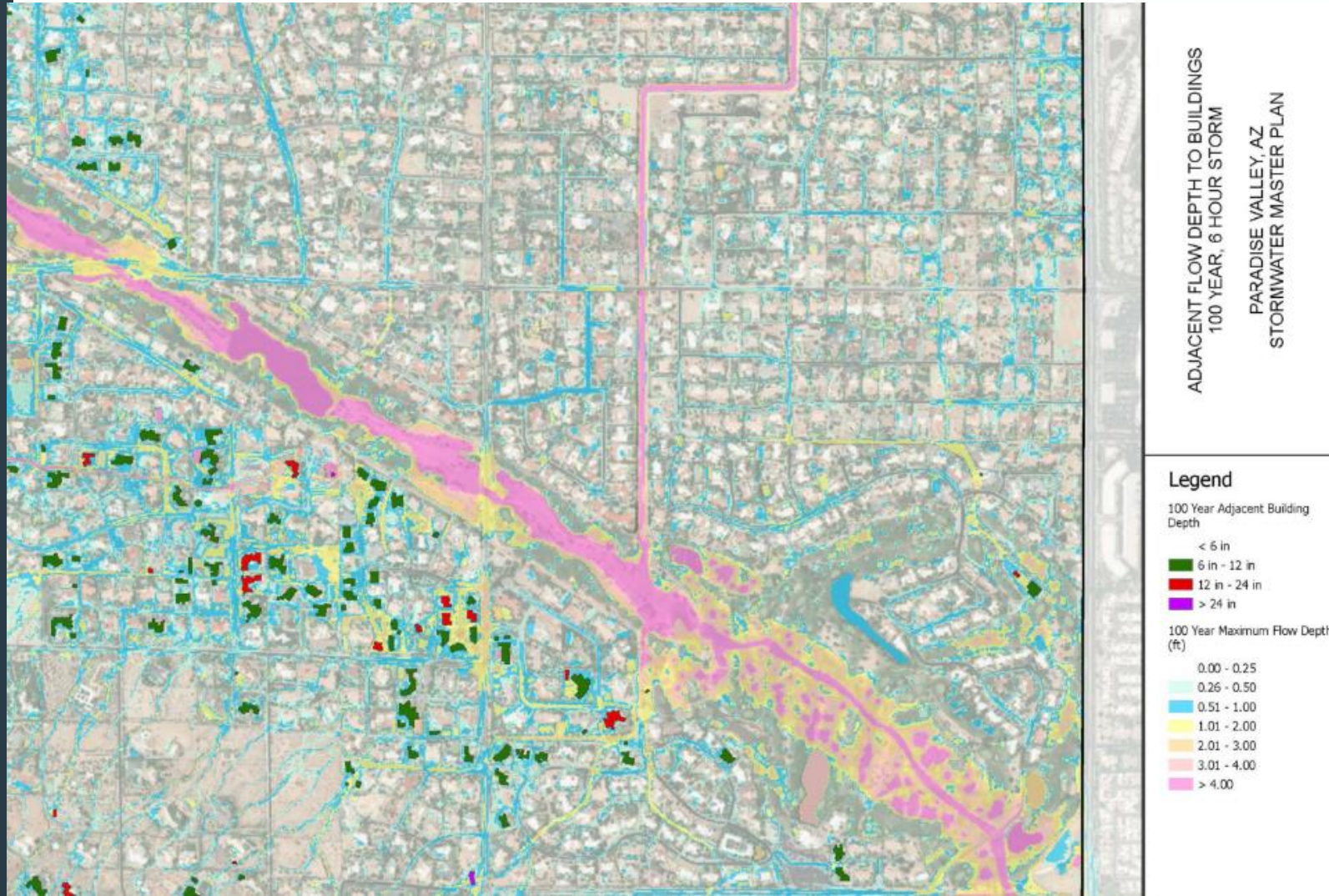
- Building inundation analysis
- Erosion potential
- Sedimentation potential
- Risk to passenger vehicles

Methodology	Per Storm Event		
	2-Year	10-Year	100-Year
>0.5 feet of flow depth for at least 20% of the building	43	304	857
>1 foot of flow depth for at least 15% of the building	11	43	283
>2 feet of flow depth for at least 10% of the building	6	9	52
Total Structures Impacted	60	356	1,192

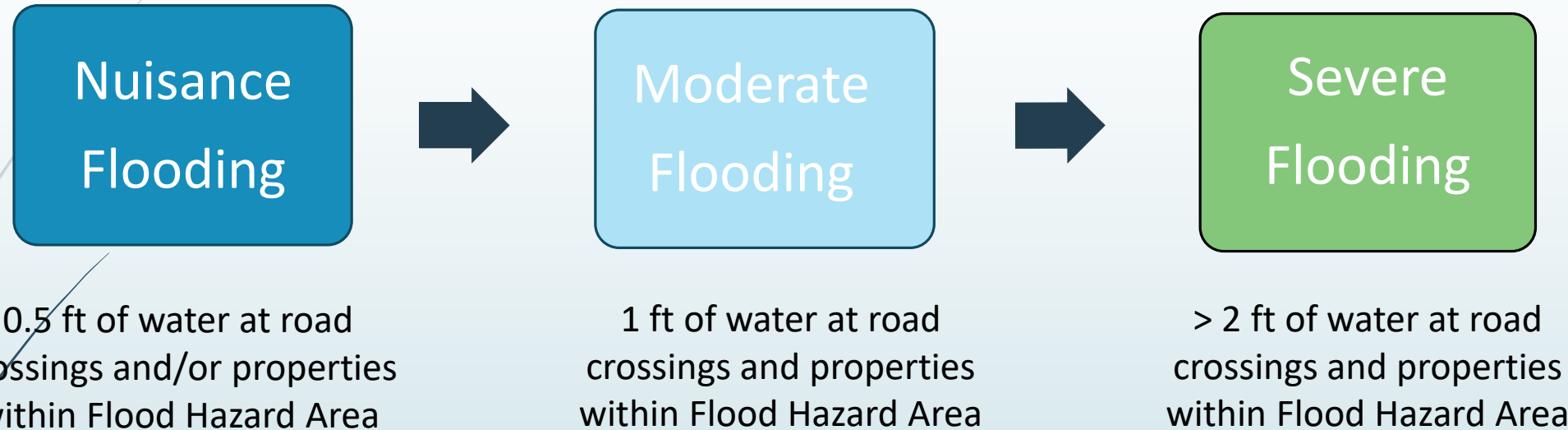
Storm Event	Street Type	Extreme Erosion Risk Locations	Extreme Sediment Risk Locations
100-Year	Arterial	6	28
	Collector	29	144
	Residential	245	989
10-Year	Arterial	2	14
	Collector	12	65
	Residential	92	352

Storm Event	Street Type	High Danger Zone for Passenger Vehicles
100-Year	Arterial	29 Crossings
		3.9% of Arterial Streets
	Collector	79 Crossings
		9.7% of Collector Streets
	Residential	931 Crossings
		7.0% of Residential Streets
10-Year	Arterial	12 Crossings
		1.2% of Arterial Streets
	Collector	29 Crossings
		3.4% of Collector Streets
	Residential	220 Crossings
		1.6% of Residential Streets

Building Inundation



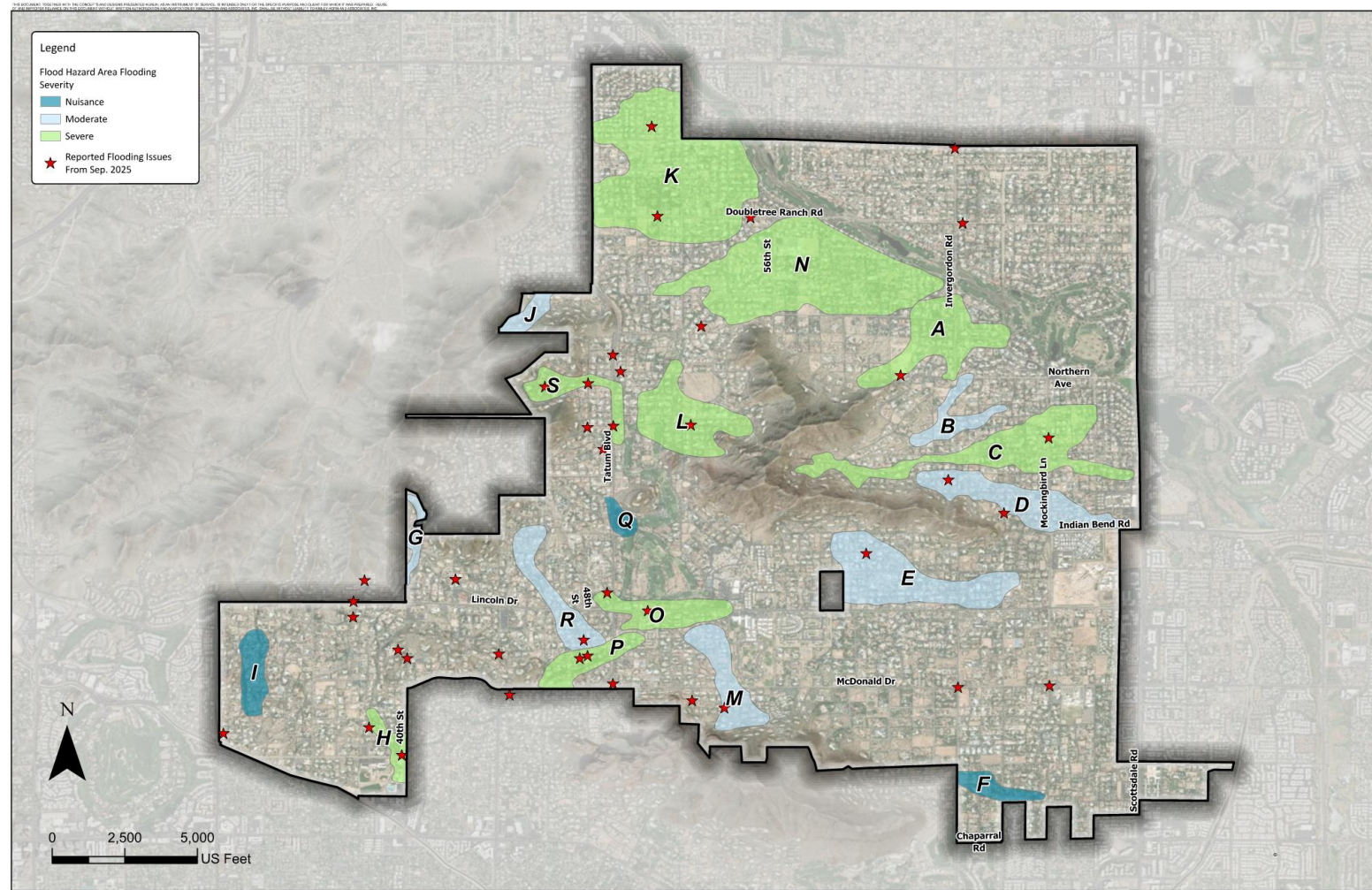
Flood Hazard Designations



- Delineation of areas based on max depth, depth x velocity, erosion & sedimentation potential, and impacted properties & structures

Flood Hazard Area Classification

- Nuisance – 3
- Moderate – 7
- Severe – 9



Flood Hazard Area Prioritization

Table 6: Flood Hazard Area Prioritization Criteria

Criteria	Scoring Criteria	Weighted Score	Highest Possible Score	Lowest Highest Score
Severity of Flooding	1- Nuisance	5	15	5
	2- Medium			
	3- Severe			
Potential Structures Protected	1- 1 to 30 Structures	5	15	5
	2- 31-50 Structures			
	3- >51 Structures			
Potential Streets Protected	1- Local Street Benefits Only	4	12	4
	2- Arterial/Collector Street or Multiple Local Streets Benefits			
	3- Multiple arterial/collector & Local Street Benefits			
Restriction to Emergency Access	0- No Impact to Emergency Access	3	6	0
	2- Impacts to Emergency Access			
Multi-Use Opportunities	1- No Opportunities	1	2	1

Flood Hazard Area Prioritization

Table 7: Flood Hazard Area Ranking and Characteristics

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C	39	Moderate	70	1 Collector; 2 Local	No
E	38	Moderate	52	2 Collector; 5 Local	No
S	36	Severe	14	1 Collector; 1 Local	Yes
R	36	Severe	27	1 Collector; 5 Local	Yes
D	33	Severe	20	2 Collector; 1 Local	No
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B	25	Moderate	4	1 Collector; 2 Local	No
J	21	Moderate	8	0 Collector; 3 Local	No

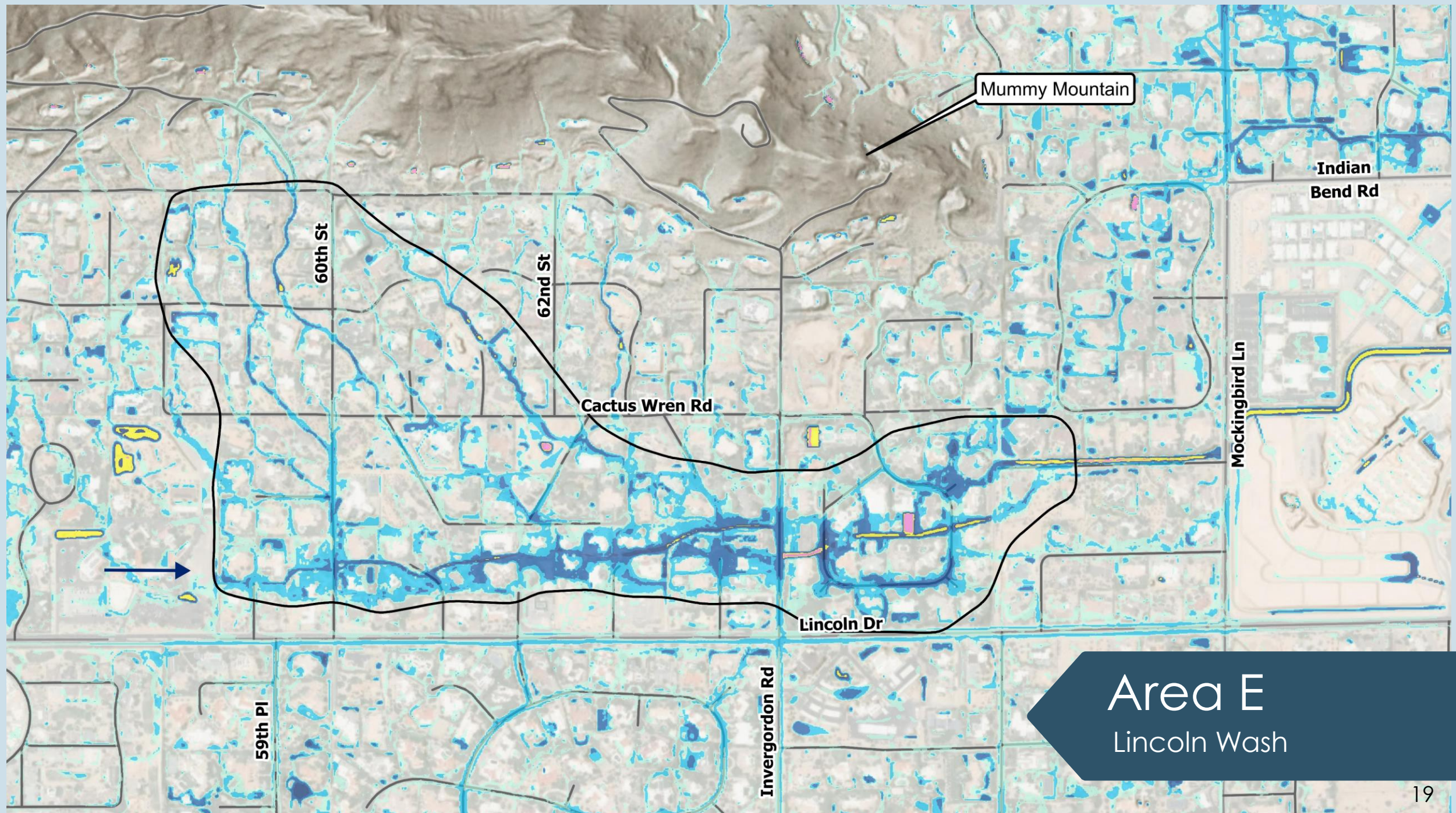
Flood Mitigation Alternatives Developed

Proposed Project Alternatives

- 2-3 projects per area
- Ranked based on Table 8 criteria
- Because of ROW constraints:
 - Cost was primary determining factor
- Most projects are storm drain or improved road crossings

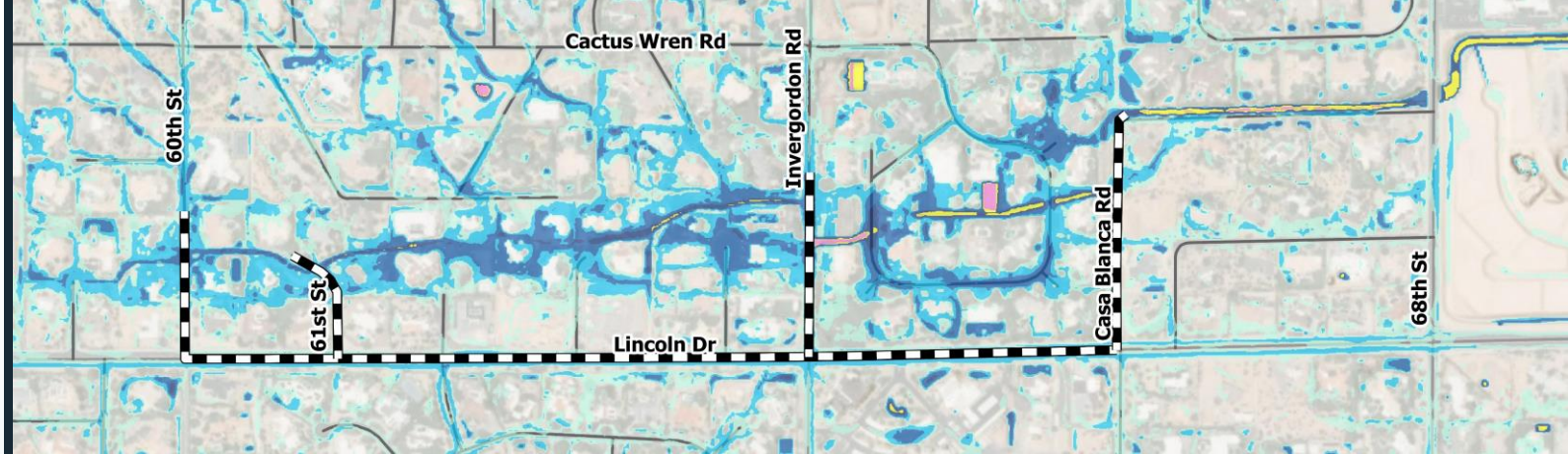
Table 8: Project Prioritization Criteria

Criteria	Scoring Criteria	Weighted Score	Highest Possible Score	Lowest Possible Score
Potential Structures Protected	1- 1 to 30 Structures	5	15	5
	2- 31 to 50 Structures			
	3- > 51 structures			
Design & Construction Cost/Benefit	1- Most Expensive	5	10	5
	2- Least Expensive			
Potential Streets Protected	1- Local Street Benefit Only	4	12	4
	2- Arterial/Collector Street or Local Streets Benefit			
	3- Multiple Arterial/Collector Streets and Local Streets Benefit			
Green Storm Water Infrastructure	1- No Opportunities	1	2	1
	2- Some Opportunities			
Project Partnership	1- Grant Funding or Partnerships Likely	4	12	4
	2- Local Partnership/Grant Eligible			
	3- Local and Federal Partnerships/Grant Eligible			
Multi-Use Opportunities	1- No Opportunities	2	4	2
	2- Some Opportunities			
Operation and Maintenance Costs	1- Maintenance After Every Storm Event	3	6	3
	2- Maintenance at Standard Intervals			
Utility Constraints	1- Major Constraints	3	6	3
	2- Minor Constraints			



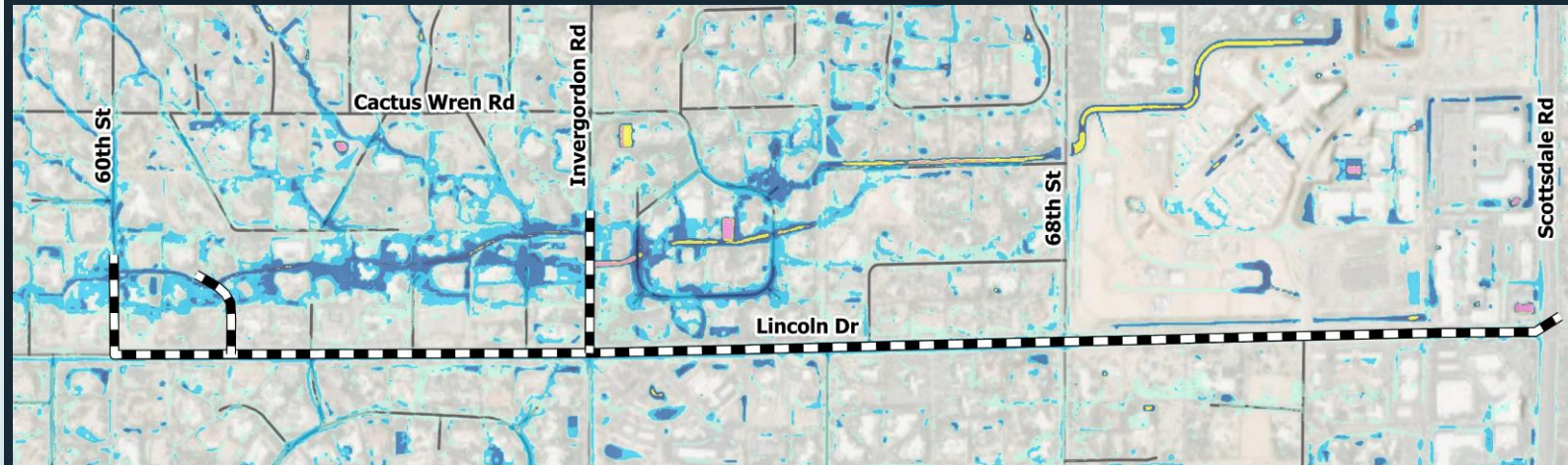
Alternative 1

- Outfall to Ritz-Carlton Channel
- ~\$14.9 M
- 4,500 LF of 36" SD
- 2,300 LF of 48" SD



Alternative 2

- Outfall to Existing Scottsdale Rd SD
- ~ \$9.5 M
- 4,500 LF of 36" SD
- 5,250 LF of 48" SD



Alternative 3

- 7,900 LF of Permeable Pavement
- ~\$1.4M



Highest Priority Alternatives

- 15% Plans
- Cost Estimates
- Benefit/Cost Analysis
- Proposed Conditions Modeling

Table 29: Prioritized Projects Summary



Area Identification	Selected Alternative	Ranking Score
N	Alternative 1	49
A	Alternative 1	45
O	Alternative 2	45
K	Alternative 2	43
L	Alternative 1 & 2	41
H	Alternative 2	40
P	Alternative 1	39
C	Alternative 2	39
E	Alternative 3	38

Area A Example

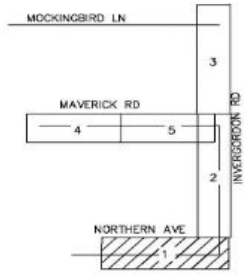
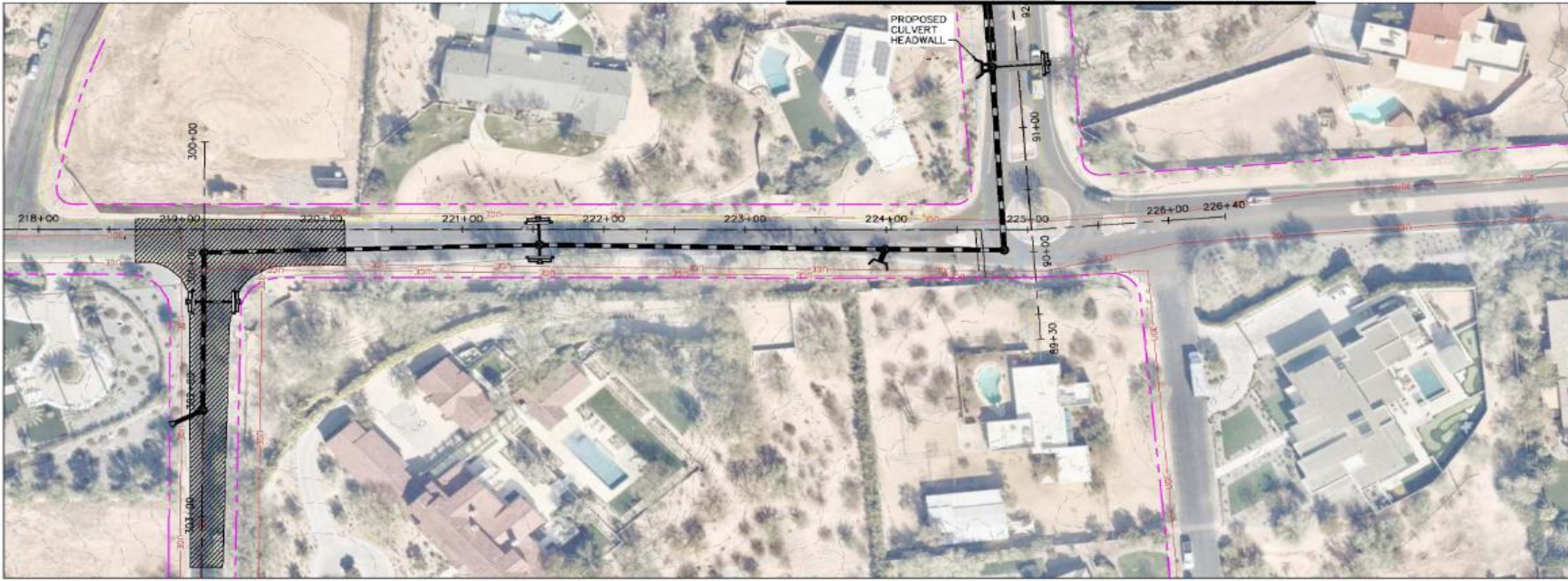
Table 30: Area A Benefit Cost Ratio Summary

Number of Properties Impacted		220
Approximate Population ¹		550
Benefit with Drainage Improvements in Place (\$)	Damage Reduction	21,394,816
	Social Benefits	1,978,900
	Total	23,293,796
Construction Cost		11,616,355
Benefit-Cost Ratio (BCR)		2.01

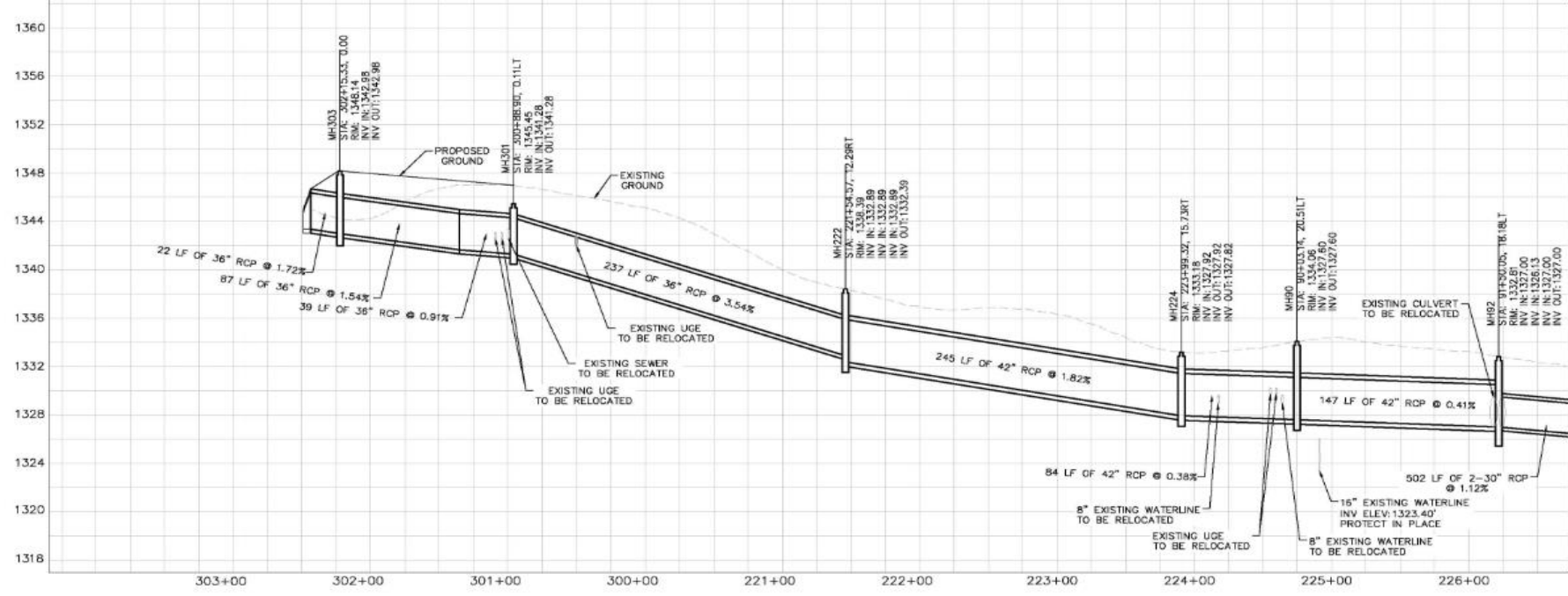
¹Assumed 2.5 people per household from U.S. Census for the Town of Paradise Valley.

²Social benefits are based on the number of residents impacted and are calculated using FEMA's Benefit Cost Analysis toolkit. This would account for traffic closures, interruptions to work, etc.

³Assumed at least seven 10-year storms and one 100- year storm occur during the 75-year life span of the improvements.



MATCHLINE STA. 92+00 SEE SHEET 02



MATCHLINE STA. 92+00 SEE SHEET 02

Kimley»Horn

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1661 E CAMPBELL RD # 100
PHOENIX, ARIZONA 85016 (602) 944-5500

NO.	REVISION	DATE

SCALE (H): 1"=40'
SCALE (V): 1"=5'

DESIGNED BY: PTB
DRAWN BY: PTB
CHECKED BY: CSH

DATE: 05/2025

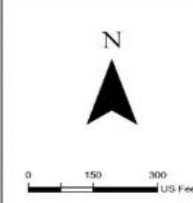
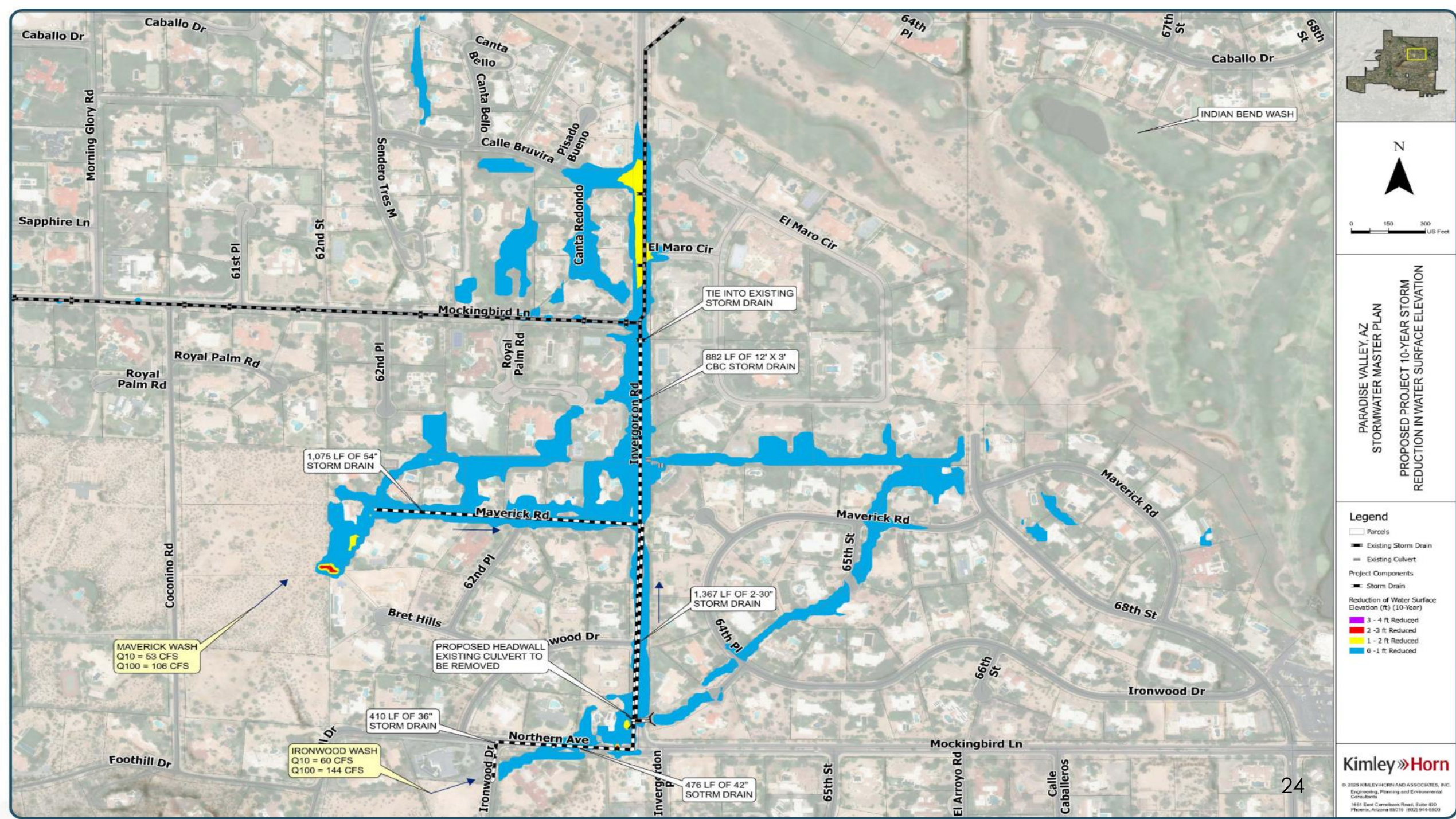
PARADISE VALLEY SWMP

AREA A SELECTED ALTERNATIVE 15% PLANS

PROJECT NO.
091054031

DRAWING NAME
AREA A

1 OF 6



PARADISE VALLEY, AZ
STORMWATER MASTER PLAN
PROPOSED PROJECT 10-YEAR STORM
REDUCTION IN WATER SURFACE ELEVATION

- Legend**
- Parcels
 - Existing Storm Drain
 - Existing Culvert
 - Project Components
 - Storm Drain
 - Reduction of Water Surface Elevation (ft) (10-Year)
 - 3 - 4 ft Reduced
 - 2 - 3 ft Reduced
 - 1 - 2 ft Reduced
 - 0 - 1 ft Reduced



Grant Funding Opportunities

- FCDMC Grants
 - Small Project Assistance Program (<\$1.3M)
 - Capital Improvement Program (>\$1.3M)
- Other Federal Grant Programs Identified
 - FEMA (x4)
 - US Department of Housing and Urban Development
 - EPA (x2)
 - US Army Corps of Engineers
 - US Economic Development Administration

Prioritization

Table 33: Project Prioritization

Flood Hazard Area Designation	Project Size (Medium or Large)	Primary Benefit	Cost	BCR	Project Considerations
K	Large	Residential Structures	~ \$6.1 M	3.08	The recommended project alternative for Area K has the highest BCR for the projects that primarily benefit residential structures. It is also potentially more cost effective than the Area A project. Because of this, it is ranked as the highest priority large project benefiting private property.
A	Large	Residential Structures	~ \$11.6M	2.01	recommended project alternative ties into the ongoing Mockingbird Lane drainage improvements, creating an overall flood mitigation project for the area.
H	Medium	Arterial Roadways	~ \$1M	n/a	Area H recommended project alternative may fall within the SPAP cost criteria, making it eligible for a 75% cost share with FCDMC. Because of this, Area H was ranked as the highest priority roadway-oriented project.
O	Large	Arterial and Residential Roadways	~ \$2M	n/a	Area O recommended project alternative benefits both an arterial roadway (Lincoln Drive) and residential streets. Because of this, it was ranked higher than Areas L and N.
N	Large	Residential Roadways	~ \$2M	n/a	Area N was ranked higher than Area L because of the lower cost for construction.
L	Large	Residential Roadways	~ \$6.1M	n/a	Area L benefits residential streets only.



Key Takeaways

- Comprehensive Town-wide flood hazard modeling
 - Regulate development
 - Design stormwater improvements
- Assessed building inundation, erosion, sedimentation, and vehicular hazards for 2-, 10-, & 100-year storms
- Identified 19 flood prone areas
- Developed project alternatives for 9 of these
- Further developed 15% plans, cost, benefit/cost for 6 of the 9
- Identified local and federal grant funding opportunities
- Cited prioritization considerations



QUESTIONS?

