FINAL DRAINAGE MEMORANDUM

CITY OF TEMPE

Scottsdale Road, Curry Road to Continental Drive – Bike Lanes

City of Tempe Project #T0260 03D

Prepared For:

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April 2023

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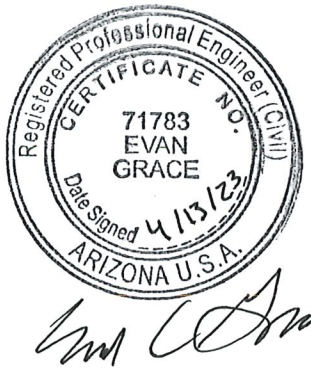


1.0 INTRODUCTION

Purpose and Background

The purpose of this project is to add new bike lanes in both directions along a portion of Scottsdale Road within the City of Tempe, Arizona. J2 was retained by NFra Inc. (NFra) to evaluate the existing drainage facilities and identify the need for additional facilities as part of the proposed improvements.

Location of Study

The extents of the project extend between Curry Road at the south limit and Continental Drive at the north limit along Scottsdale Road. Figure 1 and Figure 2 show the project location and the project vicinity. Figure 3 is a schematic of the existing storm drain system.

Previous Studies

For reference, this area was recently studied as part of the Flood Control District of Maricopa County (FCD) Lower Indian Bend Wash Area Drainage Master Study (LIBW ADMS) completed in 2017. This study consisted of a comprehensive hydrologic and hydraulic model of the area using FLO-2D software and incorporated the catch basins and stormdrain within the project extents.

Drainage Criteria

The proposed improvements impact existing stormdrain inlets within the project area. The impact of the proposed improvements to the stormdrain system (pipe flow/capacity) was not within the scope of this project, however it is anticipated that the impact to the performance of the stormdrain system is minimal. Therefore, the drainage criteria for the project are defined in the *City of Tempe Public Works Department Engineering Design Criteria (May 2015).* Applicable City of Tempe design criteria include:

- Streets, catch basins, and storm sewers shall be designed for a 10-year storm.
- Peak flows from a 100-year storm must be carried within the cross section between buildings (front yards and streets).
- Only curb-opening inlets will be allowed on City of Tempe streets.
    - Length of curb opening shall be 5.5' minimum.
    - Slotted drain with angled slots (minimum length of 10') may be used in combination with catch basins.
- Catch basins shall be designed to intercept a minimum of 80% of the total runoff delivered to the point in the street where depth of street flow reaches curb height or a storm water spread limitation restricted to one 12-foot lane of traffic in each direction.
- 20% clogging factor applied to curb-opening inlets.
- The minimum time of concentration utilized was 5-minutes. The maximum overland flow time was 10 minutes.
- Valley gutters will not be permitted across midsection collector streets or arterial streets.

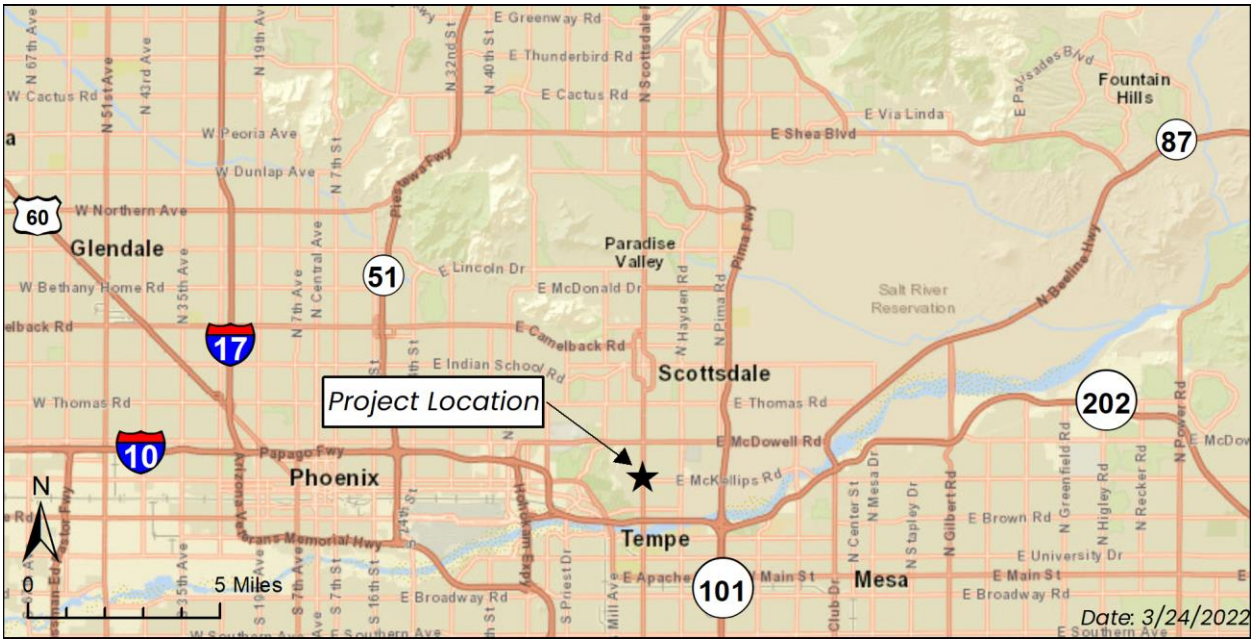


Figure 1 - Project Location

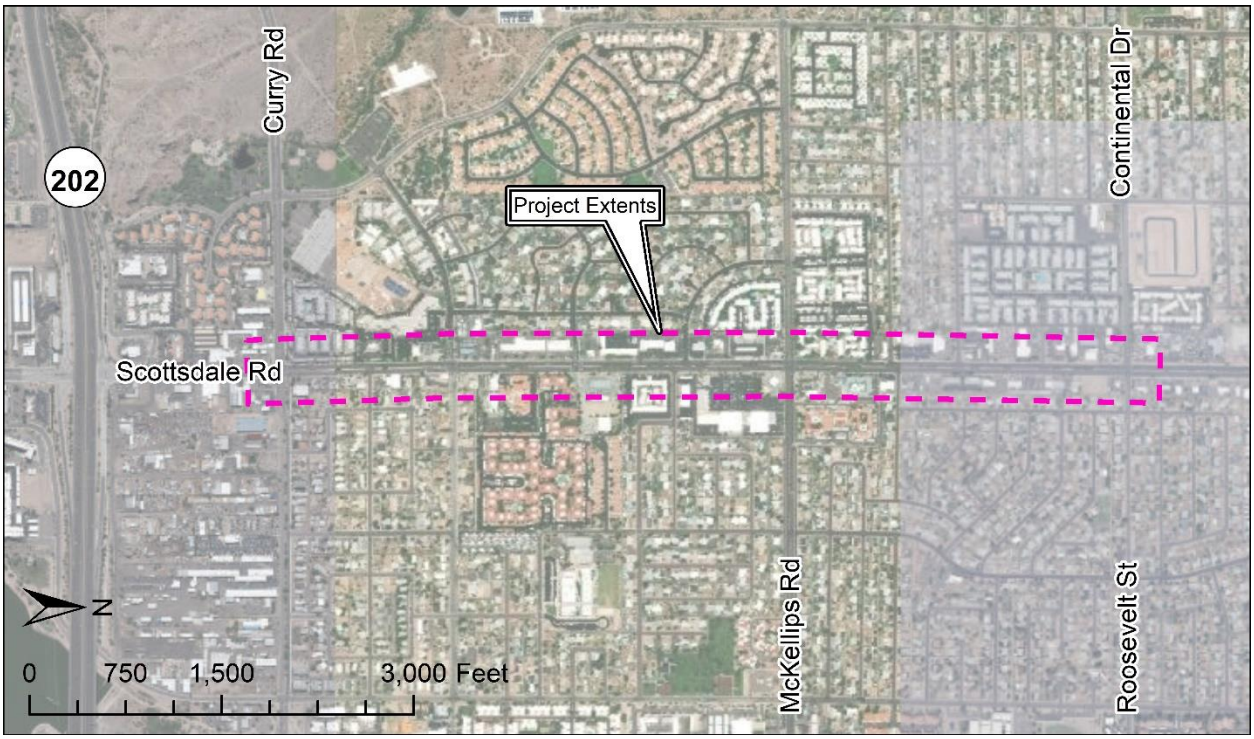


Figure 2 - Project Vicinity

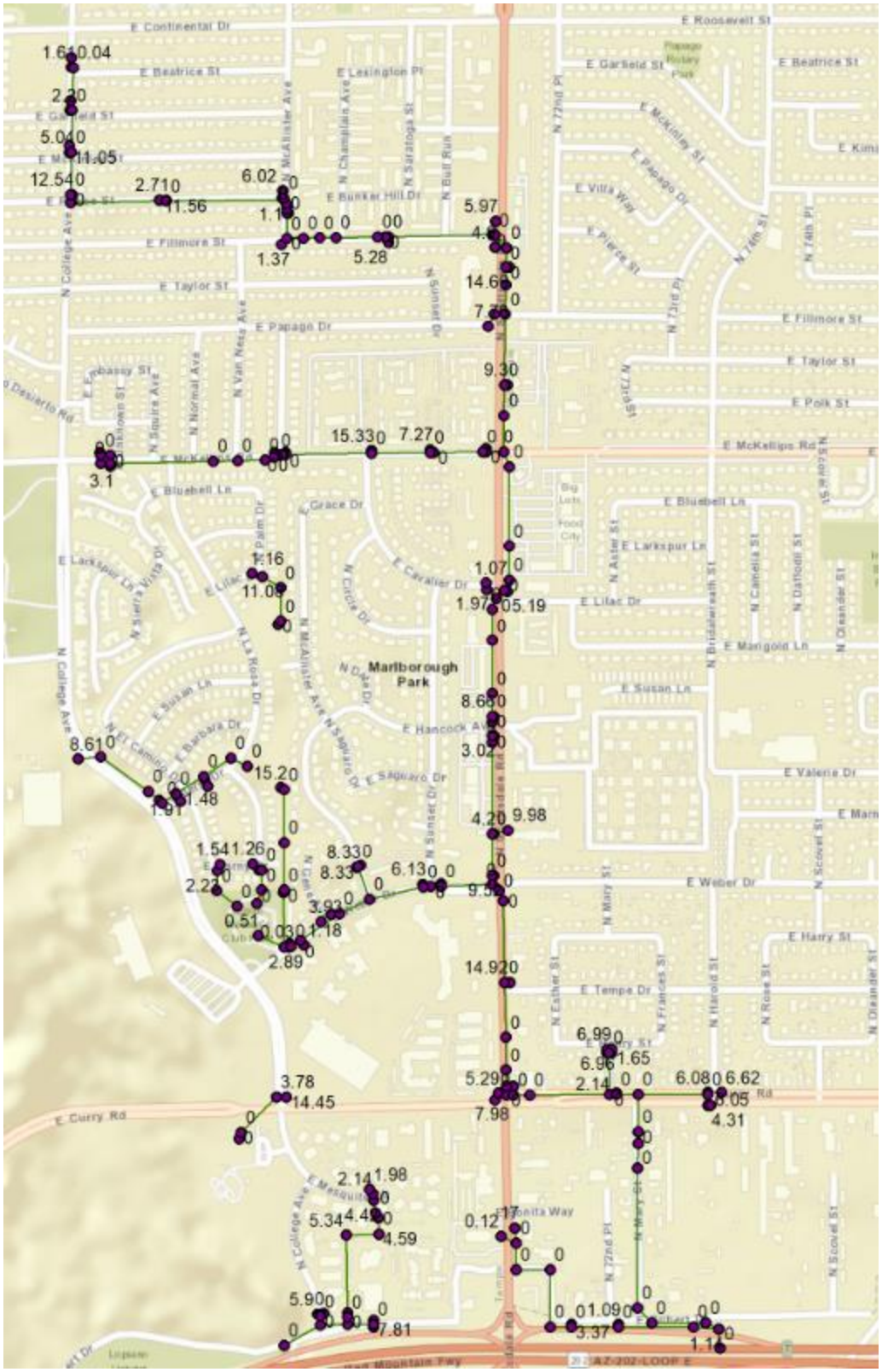


Figure 3 - Storm Drain Schematic

2.0 EXISTING DRAINAGE

The existing segment of Scottsdale Road between Continental Drive and Curry Road is approximately 84' from lip of gutter to lip of gutter (three northbound lanes, three southbound lanes, and a median). The median transitions into a turn lane at the intersections with Continental Drive, McKellips Road, Hancock Avenue, Weber Drive, and Curry Road.

The existing drainage conditions along Scottsdale Road consist of pavement drainage captured by catch basins of either curb-opening, grate, and slotted drain types. The catch basins connect to a single stormdrain system that routes flows to the south towards the Arizona Department of Transportation (ADOT) State Route 202 highway drainage system which the outlets into Tempe Town Lake. The catch basins generally consist of Maricopa Association of Governments (MAG) standard details or modified forms thereof.

A FlowMaster model was created to check the existing drainage system for spread and flow. The rational equation (**Equation 1**) was used to calculate flows for the model.

Equation 1 – Rational Equation

Q=CiA where:

- Q = Flow (cfs)
- C = runoff discharge coefficient (unitless)
  - C = 0.95 per City of Tempe criteria
- i = rainfall intensity (in/hr)
  - i = 4.63 per 10-year, 5-minute NOAA Atlas 14 Point Precipitation Frequency
- A = Drainage Area (sf) determined using available topographic data
  - Areas are in **Table 2-1** and **Table 3-1** below

Additional assumptions used in the FlowMaster model include:

- City of Tempe standard street cross slope of 0.025 ft/ft
- Slope of 0.004 ft/ft from Roosevelt St. to McKellips Rd.
- Slope of 0.008 ft/ft from McKellips Rd. to Curry Rd.
- City of Tempe standard 20% clogging factor for curb-opening catch basins
- Maximum allowable spread of 22', allowing at least (1) 12' lane of traffic each way
- Standard vertical curb and gutter per MAG Standard Detail 220-1

The drainage areas are defined in **Appendix A** and the areas are summarized in **Table 2-1** below. The FlowMaster results for the existing condition are attached in **Appendix B.** Spread and depth criteria are met for all existing catch basins.

Table 2-1 – Existing Drainage Areas

DA #	Inlet Location	Inlet Type	Area (sf)	Area (ac)	C	10-yr 5-min Intensity (in/hr)	Q (cfs)	Longitudinal Slope
1	NWC Fillmore St	14' Curb Opening + 10' Slotted Drain	70,679	1.623	0.95	4.63	7.14	0.004
2	SWC Fillmore St	14' Curb Opening	16,140	0.371	0.95	4.63	1.63	0.004
3	NWC Papago Dr	14' Curb Opening	39,988	0.918	0.95	4.63	4.04	0.004
3B	SWC Papago Dr	9' Curb Opening	24,625	0.565	0.95	4.63	2.49	0.004
4	NWC McKellips Rd	9' Curb Opening	52,326	1.201	0.95	4.63	5.28	0.004
5	NWC Cavalier Dr	14' Curb Opening	61,609	1.414	0.95	4.63	6.22	0.008
5B	SWC Cavalier Dr	14' Curb Opening	12,868	0.295	0.95	4.63	1.30	0.008
6	NWC Hancock Ave	14' Curb Opening	56,604	1.299	0.95	4.63	5.72	0.008
7	SWC Hancock Ave	9' Curb Opening	19,530	0.448	0.95	4.63	1.97	0.008
8	300' N of Weber Dr	9' Curb Opening	25,038	0.575	0.95	4.63	2.53	0.008
9	NWC Weber Dr	14' Curb Opening	18,282	0.420	0.95	4.63	1.85	0.008
10	NWC Curry Rd	20' Slotted Drain	56,642	1.300	0.95	4.63	5.72	0.008
11	NWC Curry Rd	4'-4" x 2'-6" Grate	27,145	0.623	0.95	4.63	2.74	0.008
12	300' N of Papago Dr	9' Curb Opening	67,442	1.548	0.95	4.63	6.81	0.004
13	380' N of McKellips	4' Curb Opening	30,753	0.706	0.95	4.63	3.11	0.004
14	NEC Lilac Dr	9' Curb Opening	50,433	1.158	0.95	4.63	5.09	0.008
15	300' N of Weber Dr	9' Curb Opening	63,407	1.456	0.95	4.63	6.40	0.008
16	NEC Tempe Dr	7' Curb Opening	40,984	0.941	0.95	4.63	4.14	0.008
17	NEC Curry Rd	7' Curb Opening	26,679	0.612	0.95	4.63	2.69	0.008

3.0 PROPOSED DRAINAGE IMPROVEMENTS

The proposed street improvements include ramps, medians, and street widening. Scottsdale Road was widened in the following two locations: 1) Papago Drive to Lilac Drive (east side) and 2) Weber Road to Curry Road (west side). The widening will result in an increased roadway pavement area of less than 0.4 acres. The increased impervious area will have a minimal impact on the hydraulic operation of the existing storm drain facilities. Both the east and west side of Scottsdale Road will meet the required spread criteria (22' maximum). The storm drain system for the west side of the road may be improved at Curry Road. The existing section of slotted drain and grate opening catch basin will be replaced with curb opening inlets. The existing curb opening inlet on the east side of Scottsdale Road, approximately 380' north of McKellips Rd, will be replaced with a proposed curb opening of equal or greater length.

It should be noted that significant storm water may contribute to Scottsdale Road from the several side streets throughout the project extents. However, independent capital improvement projects would need to be implemented to address this storm water runoff.

The widening of Scottsdale Road will require the replacement of 2 catch basins and one segment of slotted drain.. Both existing catch basins at the northwest corner of Curry Road will need to be replaced with a MAG 532 (8' – 0" Curb Opening Catch Basin - Type "C"). As a result of the roadway widening, existing pipes will need to be extended in-order to connect to the proposed catch basins within the widened section.

The proposed condition FlowMaster model was created using the drainage areas in **Table 3-1.** The proposed condition FlowMaster results are attached in **Appendix C**. The proposed drainage areas are defined in **Appendix A.** The differences between existing and proposed drdainage areas are minimal. Existing and proposed drainage areas are illustrated on the same exhibit. The proposed catch basins satisfy spread and depth criteria.

Table 3-1 – Proposed Drainage Areas

DA #	Inlet Location	Inlet Type	Area (sf)	Area (ac)	C	10-yr 5-min Intensity (in/hr)	Q (cfs)	Longitudinal Slope
1	NWC Fillmore St	14' Curb Opening + 10' Slotted Drain	70,679	1.623	0.95	4.63	7.14	0.004
2	SWC Fillmore St	14' Curb Opening	16,140	0.371	0.95	4.63	1.63	0.004
3	NWC Papago Dr	14' Curb Opening	39,988	0.918	0.95	4.63	4.04	0.004
3B	SWC Papago Dr	9' Curb Opening	24,625	0.565	0.95	4.63	2.49	0.004
4	NWC McKellips Rd	9' Curb Opening	52,326	1.201	0.95	4.63	5.28	0.004
5	NWC Cavalier Dr	14' Curb Opening	61,609	1.414	0.95	4.63	6.22	0.008
5B	SWC Cavalier Dr	14' Curb Opening	12,868	0.295	0.95	4.63	1.30	0.008
6	NWC Hancock Ave	14' Curb Opening	56,604	1.299	0.95	4.63	5.72	0.008
7	SWC Hancock Ave	9' Curb Opening	19,530	0.448	0.95	4.63	1.97	0.008
8	300' N of Weber Dr	9' Curb Opening	25,038	0.575	0.95	4.63	2.53	0.008
9	NWC Weber Dr	14' Curb Opening	18,282	0.420	0.95	4.63	1.85	0.008
10	NWC Curry Rd	8' Curb Opening	63,741	1.463	0.95	4.63	6.44	0.008
11	NWC Curry Rd	8' Curb Opening	27,180	0.624	0.95	4.63	2.74	0.008
12	300' N of Papago Dr	9' Curb Opening	67,442	1.548	0.95	4.63	6.81	0.004
13	380' N of McKellips	5'-6" Curb Opening	31,732	0.728	0.95	4.63	3.20	0.004
14	NEC Lilac Dr	9' Curb Opening	57,753	1.326	0.95	4.63	5.83	0.008
15	300' N of Weber Dr	9' Curb Opening	63,407	1.456	0.95	4.63	6.40	0.008
16	NEC Tempe Dr	7' Curb Opening	40,984	0.941	0.95	4.63	4.14	0.008
17	NEC Curry Rd	7' Curb Opening	26,679	0.612	0.95	4.63	2.69	0.008

4.0 REFERENCES

1. ESRI, ArcGIS Version 10.7, 2018.

2. City of Tempe Public Works Department, *Engineering Design Criteria,* August 2020.

3. Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Hydrology*, August 15, 2013.

4. Flood Control District of Maricopa County, *Drainage Design Manual for Maricopa County, Hydraulics*, December 14, 2018.

5. Flood Control District of Maricopa County, *Lower Indian Bend Wash Area Drainage Master Study,* December 2017.

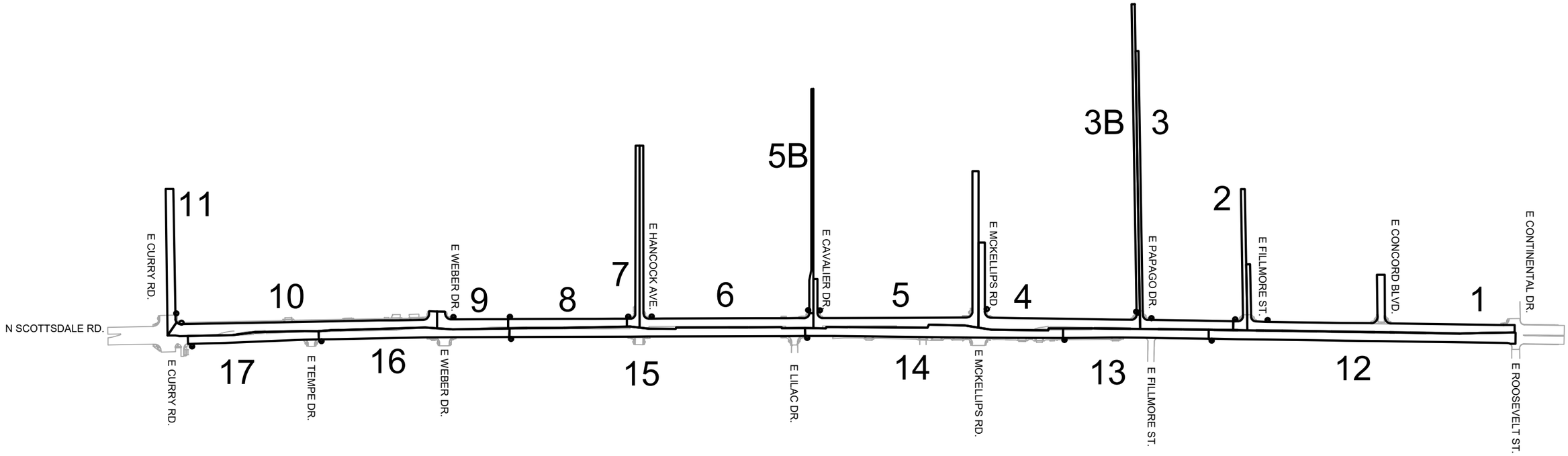
6. NOAA Atlas 14 Point Precipitation Frequency Estimates

7. 2015 City of Phoenix Supplemental Details

8. Maricopa Association of Governments Uniform Standard Details 2022

Appendix A

APPENDIX A - EXISTING & PROPOSED DRAINAGE AREAS



0 500' 1000'

SCALE: 1"=500'

Appendix B

Existing Condition

DA #	Inlet Location	Inlet Type	Area (sf)	Area (ac)	C	i (in/hr)	Q (cfs)	Long. Slope	Total Q (cfs)	Bypass (cfs)	Spread (ft)	Depth (in)	Effficiency (%)
1	NWC Fillmore St	14- Curb Opening + 10' Slotted Drain	70,679	1.623	0.95	4.63	7.14	0.004	7.14	0.00	15.10	5.1	100.00
2	SWC Fillmore St	14' Curb Opening	16,140	0.371	0.95	4.63	1.63	0.004	1.63	0.00	8.50	3.1	100.00
3	NWC Papago Dr	14' Curb Opening	39,988	0.918	0.95	4.63	4.04	0.004	4.04	0.06	12.10	4.2	98.51
3B	SWC Papago Dr	9' Curb Opening	24,625	0.565	0.95	4.63	2.49	0.004	2.55	0.20	10.10	3.6	92.16
4	NWC McKellips Rd	9' Curb Opening	52,326	1.201	0.95	4.63	5.28	0.004	5.48	1.63	13.60	4.7	70.26
5	NWC Cavalier Dr	14' Curb Opening	61,609	1.414	0.95	4.63	6.22	0.008	7.85	2.01	13.70	4.7	74.39
5B	SWC Cavalier Dr	14' Curb Opening	12,868	0.295	0.95	4.63	1.30	0.008	3.31	0.09	9.80	3.5	97.28
6	NWC Hancock Ave	14' Curb Opening	56,604	1.299	0.95	4.63	5.72	0.008	5.81	0.97	12.20	4.2	83.30
7	SWC Hancock Ave	9' Curb Opening	19,530	0.448	0.95	4.63	1.97	0.008	2.94	0.57	9.30	3.4	80.61
8	300' N of Weber (west)	9' Curb Opening	25,038	0.575	0.95	4.63	2.53	0.008	3.10	0.65	9.50	3.4	79.03
9	NWC Weber Dr	14' Curb Opening	18,282	0.420	0.95	4.63	1.85	0.008	2.50	0.00	8.80	3.2	100.00
10	NWC Curry Rd	20' Slotted Drain	56,642	1.300	0.95	4.63	5.72	0.008	5.72	0.08	12.10	4.2	98.60
11	NWC Curry Rd	4'-4" x 2'-6" Grate	27,145	0.623	0.95	4.63	2.74	0.008	2.82	0.77	8.70	3.6	72.70
12	300' N of Fillmore St (east)	9' Curb Opening	67,442	1.548	0.95	4.63	6.81	0.004	6.81	2.44	17.00	4.7	64.17
13	380' N of McKellips	4' Curb Opening	30,753	0.706	0.95	4.63	3.11	0.004	5.55	3.58	13.70	4.5	35.50
14	NEC Lilac Dr	9' Curb Opening	50,433	1.158	0.95	4.63	5.09	0.008	8.67	4.29	14.20	4.8	50.52
15	300' north Weber Dr (east)	9' Curb Opening	63,407	1.456	0.95	4.63	6.40	0.008	10.69	5.81	15.40	5.2	45.65
16	NEC Temple Dr	7' Curb Opening	40,984	0.941	0.95	4.63	4.14	0.008	9.95	6.18	15.00	5.1	37.89
17	NEC Curry Rd	7' Curb Opening	26,679	0.612	0.95	4.63	2.69	0.008	8.87	5.31	14.30	4.9	40.14

Worksheet for DA01A - Slotted Drain on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	7.14 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Slot Length	8.0 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	68.08 %
Intercepted Flow	4.86 cfs
Bypass Flow	2.28 cfs
Spread	15.1 ft
Depth	5.1 in
Flow Area	2.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.49 ft/s
Equivalent Cross Slope	0.063 ft/ft
Length Factor	0.470
Total Interception Length	17.0 ft

Worksheet for DA01B - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.28 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	2.28 cfs
Bypass Flow	0.00 cfs
Spread	9.7 ft
Depth	3.5 in
Flow Area	1.2 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	1.89 ft/s
Equivalent Cross Slope	0.083 ft/ft
Length Factor	1.254
Total Interception Length	8.9 ft

Worksheet for DA02 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	1.63 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	1.63 cfs
Bypass Flow	0.00 cfs
Spread	8.5 ft
Depth	3.1 in
Flow Area	0.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	1.75 ft/s
Equivalent Cross Slope	0.091 ft/ft
Length Factor	1.521
Total Interception Length	7.4 ft

Worksheet for DA03 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	4.04 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	98.56 %
Intercepted Flow	3.98 cfs
Bypass Flow	0.06 cfs
Spread	12.1 ft
Depth	4.2 in
Flow Area	1.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.17 ft/s
Equivalent Cross Slope	0.072 ft/ft
Length Factor	0.905
Total Interception Length	12.4 ft

Worksheet for DA03B - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.55 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	92.10 %
Intercepted Flow	2.35 cfs
Bypass Flow	0.20 cfs
Spread	10.1 ft
Depth	3.6 in
Flow Area	1.3 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	1.94 ft/s
Equivalent Cross Slope	0.081 ft/ft
Length Factor	0.756
Total Interception Length	9.5 ft

Worksheet for DA04 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.48 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	70.25 %
Intercepted Flow	3.85 cfs
Bypass Flow	1.63 cfs
Spread	13.6 ft
Depth	4.7 in
Flow Area	2.3 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.33 ft/s
Equivalent Cross Slope	0.067 ft/ft
Length Factor	0.490
Total Interception Length	14.7 ft

Worksheet for DA05 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	7.85 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	74.46 %
Intercepted Flow	5.84 cfs
Bypass Flow	2.01 cfs
Spread	13.7 ft
Depth	4.7 in
Flow Area	2.4 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.31 ft/s
Equivalent Cross Slope	0.067 ft/ft
Length Factor	0.532
Total Interception Length	21.1 ft

Worksheet for DA05B - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	3.31 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	97.36 %
Intercepted Flow	3.22 cfs
Bypass Flow	0.09 cfs
Spread	9.8 ft
Depth	3.5 in
Flow Area	1.2 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.69 ft/s
Equivalent Cross Slope	0.083 ft/ft
Length Factor	0.867
Total Interception Length	12.9 ft

Worksheet for DA06 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.81 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	83.27 %
Intercepted Flow	4.84 cfs
Bypass Flow	0.97 cfs
Spread	12.2 ft
Depth	4.2 in
Flow Area	1.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.08 ft/s
Equivalent Cross Slope	0.072 ft/ft
Length Factor	0.630
Total Interception Length	17.8 ft

Worksheet for DA07 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.94 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	80.50 %
Intercepted Flow	2.37 cfs
Bypass Flow	0.57 cfs
Spread	9.3 ft
Depth	3.4 in
Flow Area	1.1 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.62 ft/s
Equivalent Cross Slope	0.085 ft/ft
Length Factor	0.597
Total Interception Length	12.1 ft

Worksheet for DA08 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	3.10 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	78.92 %
Intercepted Flow	2.45 cfs
Bypass Flow	0.65 cfs
Spread	9.5 ft
Depth	3.4 in
Flow Area	1.2 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.65 ft/s
Equivalent Cross Slope	0.084 ft/ft
Length Factor	0.579
Total Interception Length	12.4 ft

Worksheet for DA09 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.50 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	2.50 cfs
Bypass Flow	0.00 cfs
Spread	8.8 ft
Depth	3.2 in
Flow Area	1.0 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.52 ft/s
Equivalent Cross Slope	0.089 ft/ft
Length Factor	1.019
Total Interception Length	11.0 ft

Worksheet for DA10 - Slotted Drain on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.72 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Slot Length	16.0 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	98.62 %
Intercepted Flow	5.64 cfs
Bypass Flow	0.08 cfs
Spread	12.1 ft
Depth	4.2 in
Flow Area	1.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.07 ft/s
Equivalent Cross Slope	0.072 ft/ft
Length Factor	0.907
Total Interception Length	17.6 ft

Worksheet for DA11 - Grate on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.82 cfs
Slope	0.008 ft/ft
Gutter Width	2.50 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Grate Width	2.50 ft
Grate Length	4.5 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	50.0 %

Options	
Grate Flow Option	Exclude None

Results	
Efficiency	72.84 %
Intercepted Flow	2.05 cfs
Bypass Flow	0.77 cfs
Spread	8.7 ft
Depth	3.6 in
Flow Area	1.0 ft²
Gutter Depression	1.0 in
Total Depression	1.0 in
Velocity	2.71 ft/s
Splash Over Velocity	8.64 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.152
Grate Flow Ratio	0.680
Active Grate Length	2.3 ft

Worksheet for DA12 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	6.81 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	64.11 %
Intercepted Flow	4.37 cfs
Bypass Flow	2.44 cfs
Spread	14.8 ft
Depth	5.0 in
Flow Area	2.8 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.46 ft/s
Equivalent Cross Slope	0.064 ft/ft
Length Factor	0.434
Total Interception Length	16.6 ft

Worksheet for DA13 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.55 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	3.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	35.51 %
Intercepted Flow	1.97 cfs
Bypass Flow	3.58 cfs
Spread	13.7 ft
Depth	4.7 in
Flow Area	2.4 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.34 ft/s
Equivalent Cross Slope	0.067 ft/ft
Length Factor	0.216
Total Interception Length	14.8 ft

Worksheet for DA14 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	8.67 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	50.48 %
Intercepted Flow	4.38 cfs
Bypass Flow	4.29 cfs
Spread	14.2 ft
Depth	4.8 in
Flow Area	2.6 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.39 ft/s
Equivalent Cross Slope	0.065 ft/ft
Length Factor	0.323
Total Interception Length	22.3 ft

Worksheet for DA15 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	10.69 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	45.69 %
Intercepted Flow	4.88 cfs
Bypass Flow	5.81 cfs
Spread	15.4 ft
Depth	5.2 in
Flow Area	3.0 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.57 ft/s
Equivalent Cross Slope	0.062 ft/ft
Length Factor	0.288
Total Interception Length	25.0 ft

Worksheet for DA16 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	9.95 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	5.6 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	37.94 %
Intercepted Flow	3.77 cfs
Bypass Flow	6.18 cfs
Spread	15.0 ft
Depth	5.1 in
Flow Area	2.8 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.51 ft/s
Equivalent Cross Slope	0.063 ft/ft
Length Factor	0.233
Total Interception Length	24.1 ft

Worksheet for DA17 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	8.87 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	5.6 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	40.16 %
Intercepted Flow	3.56 cfs
Bypass Flow	5.31 cfs
Spread	14.3 ft
Depth	4.9 in
Flow Area	2.6 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.41 ft/s
Equivalent Cross Slope	0.065 ft/ft
Length Factor	0.248
Total Interception Length	22.6 ft

Appendix C

Proposed Condition

DA #	Inlet Location	Inlet Type	Area (sf)	Area (ac)	C	i (in/hr)	Q (cfs)	Long. Slope	Total Q (cfs)	Bypass (cfs)	Spread (ft)	Depth (in)	Effficiency (%)
1	NWC Fillmore St	14- Curb Opening + 10' Slotted Drain	70,679	1.623	0.95	4.63	7.14	0.004	7.14	0.00	15.10	5.1	100.00
2	SWC Fillmore St	14' Curb Opening	16,140	0.371	0.95	4.63	1.63	0.004	1.63	0.00	8.50	3.1	100.00
3	NWC Papago Dr	14' Curb Opening	39,988	0.918	0.95	4.63	4.04	0.004	4.04	0.06	12.10	4.2	98.51
3B	SWC Papago Dr	9' Curb Opening	24,625	0.565	0.95	4.63	2.49	0.004	2.55	0.20	10.10	3.6	92.16
4	NWC McKellips Rd	9' Curb Opening	52,536	1.206	0.95	4.63	5.30	0.004	5.48	1.63	13.60	4.7	70.26
5	NWC Cavalier Dr	14' Curb Opening	61,609	1.414	0.95	4.63	6.22	0.008	7.85	2.01	13.70	4.7	74.39
5B	SWC Cavalier Dr	14' Curb Opening	12,868	0.295	0.95	4.63	1.30	0.008	3.31	0.09	9.80	3.5	97.28
6	NWC Hancock Ave	14' Curb Opening	56,604	1.299	0.95	4.63	5.72	0.008	5.81	0.97	12.20	4.2	83.30
7	SWC Hancock Ave	9' Curb Opening	19,530	0.448	0.95	4.63	1.97	0.008	2.94	0.57	9.30	3.4	80.61
8	300' N of Weber (west)	9' Curb Opening	25,038	0.575	0.95	4.63	2.53	0.008	3.10	0.65	9.50	3.4	79.03
9	NWC Weber Dr	14' Curb Opening	18,282	0.420	0.95	4.63	1.85	0.008	2.50	0.00	8.80	3.2	100.00
10	**NWC Curry Rd**	**8' Curb Opening**	**63,741**	**1.463**	**0.95**	**4.63**	**6.44**	**0.008**	**6.44**	**3.05**	**12.70**	**4.4**	**52.64**
11	**NWC Curry Rd**	**8' Curb Opening**	**27,180**	**0.624**	**0.95**	**4.63**	**2.74**	**0.008**	**5.79**	**2.59**	**12.20**	**4.2**	**55.27**
12	300' N of Fillmore St (east)	9' Curb Opening	67,442	1.548	0.95	4.63	6.81	0.004	6.81	2.44	14.80	5.0	64.17
13	**380' N of McKellips**	**5'-6" Curb Opening**	**31,732**	**0.728**	**0.95**	**4.63**	**3.20**	**0.004**	**5.64**	**3.01**	**13.80**	**4.7**	**46.63**
14	NEC Lilac Dr	9' Curb Opening	57,753	1.326	0.95	4.63	5.83	0.008	8.84	4.42	14.30	4.9	50.00
15	300' north Weber Dr (east)	9' Curb Opening	63,407	1.456	0.95	4.63	6.40	0.008	10.82	5.90	15.50	5.2	45.47
16	NEC Temple Dr	7' Curb Opening	40,984	0.941	0.95	4.63	4.14	0.008	10.04	6.25	15.00	5.1	37.78
17	NEC Curry Rd	7' Curb Opening	26,679	0.612	0.95	4.63	2.69	0.008	8.94	5.36	17.10	4.8	40.04

Bold denotes a new or relocated inlet

Worksheet for DA01A - Slotted Drain on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	7.14 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Slot Length	8.0 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	68.08 %
Intercepted Flow	4.86 cfs
Bypass Flow	2.28 cfs
Spread	15.1 ft
Depth	5.1 in
Flow Area	2.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.49 ft/s
Equivalent Cross Slope	0.063 ft/ft
Length Factor	0.470
Total Interception Length	17.0 ft

Worksheet for DA01B - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.28 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	2.28 cfs
Bypass Flow	0.00 cfs
Spread	9.7 ft
Depth	3.5 in
Flow Area	1.2 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	1.89 ft/s
Equivalent Cross Slope	0.083 ft/ft
Length Factor	1.254
Total Interception Length	8.9 ft

Worksheet for DA02 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	1.63 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	1.63 cfs
Bypass Flow	0.00 cfs
Spread	8.5 ft
Depth	3.1 in
Flow Area	0.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	1.75 ft/s
Equivalent Cross Slope	0.091 ft/ft
Length Factor	1.521
Total Interception Length	7.4 ft

Worksheet for DA03 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	4.04 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	98.56 %
Intercepted Flow	3.98 cfs
Bypass Flow	0.06 cfs
Spread	12.1 ft
Depth	4.2 in
Flow Area	1.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.17 ft/s
Equivalent Cross Slope	0.072 ft/ft
Length Factor	0.905
Total Interception Length	12.4 ft

Worksheet for DA03B - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.55 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	92.10 %
Intercepted Flow	2.35 cfs
Bypass Flow	0.20 cfs
Spread	10.1 ft
Depth	3.6 in
Flow Area	1.3 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	1.94 ft/s
Equivalent Cross Slope	0.081 ft/ft
Length Factor	0.756
Total Interception Length	9.5 ft

Worksheet for DA04 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.48 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	70.25 %
Intercepted Flow	3.85 cfs
Bypass Flow	1.63 cfs
Spread	13.6 ft
Depth	4.7 in
Flow Area	2.3 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.33 ft/s
Equivalent Cross Slope	0.067 ft/ft
Length Factor	0.490
Total Interception Length	14.7 ft

Worksheet for DA05 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	7.85 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	74.46 %
Intercepted Flow	5.84 cfs
Bypass Flow	2.01 cfs
Spread	13.7 ft
Depth	4.7 in
Flow Area	2.4 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.31 ft/s
Equivalent Cross Slope	0.067 ft/ft
Length Factor	0.532
Total Interception Length	21.1 ft

Worksheet for DA05B - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	3.31 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	97.36 %
Intercepted Flow	3.22 cfs
Bypass Flow	0.09 cfs
Spread	9.8 ft
Depth	3.5 in
Flow Area	1.2 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.69 ft/s
Equivalent Cross Slope	0.083 ft/ft
Length Factor	0.867
Total Interception Length	12.9 ft

Worksheet for DA06 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.81 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	83.27 %
Intercepted Flow	4.84 cfs
Bypass Flow	0.97 cfs
Spread	12.2 ft
Depth	4.2 in
Flow Area	1.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.08 ft/s
Equivalent Cross Slope	0.072 ft/ft
Length Factor	0.630
Total Interception Length	17.8 ft

Worksheet for DA07 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.94 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	80.50 %
Intercepted Flow	2.37 cfs
Bypass Flow	0.57 cfs
Spread	9.3 ft
Depth	3.4 in
Flow Area	1.1 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.62 ft/s
Equivalent Cross Slope	0.085 ft/ft
Length Factor	0.597
Total Interception Length	12.1 ft

Worksheet for DA08 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	3.10 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	78.92 %
Intercepted Flow	2.45 cfs
Bypass Flow	0.65 cfs
Spread	9.5 ft
Depth	3.4 in
Flow Area	1.2 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.65 ft/s
Equivalent Cross Slope	0.084 ft/ft
Length Factor	0.579
Total Interception Length	12.4 ft

Worksheet for DA09 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	2.50 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	11.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	2.50 cfs
Bypass Flow	0.00 cfs
Spread	8.8 ft
Depth	3.2 in
Flow Area	1.0 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.52 ft/s
Equivalent Cross Slope	0.089 ft/ft
Length Factor	1.019
Total Interception Length	11.0 ft

Worksheet for DA10 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	6.44 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	6.4 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	52.60 %
Intercepted Flow	3.39 cfs
Bypass Flow	3.05 cfs
Spread	12.7 ft
Depth	4.4 in
Flow Area	2.0 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.16 ft/s
Equivalent Cross Slope	0.070 ft/ft
Length Factor	0.339
Total Interception Length	18.9 ft

Worksheet for DA11 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.79 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	6.4 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	55.28 %
Intercepted Flow	3.20 cfs
Bypass Flow	2.59 cfs
Spread	12.2 ft
Depth	4.2 in
Flow Area	1.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.08 ft/s
Equivalent Cross Slope	0.072 ft/ft
Length Factor	0.360
Total Interception Length	17.8 ft

Worksheet for DA12 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	6.81 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	64.11 %
Intercepted Flow	4.37 cfs
Bypass Flow	2.44 cfs
Spread	14.8 ft
Depth	5.0 in
Flow Area	2.8 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.46 ft/s
Equivalent Cross Slope	0.064 ft/ft
Length Factor	0.434
Total Interception Length	16.6 ft

Worksheet for DA13 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	5.64 cfs
Slope	0.004 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	4.4 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	46.66 %
Intercepted Flow	2.63 cfs
Bypass Flow	3.01 cfs
Spread	13.8 ft
Depth	4.7 in
Flow Area	2.4 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	2.35 ft/s
Equivalent Cross Slope	0.067 ft/ft
Length Factor	0.295
Total Interception Length	14.9 ft

Worksheet for DA14 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	8.84 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	50.02 %
Intercepted Flow	4.42 cfs
Bypass Flow	4.42 cfs
Spread	14.3 ft
Depth	4.9 in
Flow Area	2.6 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.41 ft/s
Equivalent Cross Slope	0.065 ft/ft
Length Factor	0.320
Total Interception Length	22.5 ft

Worksheet for DA15 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	10.82 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	7.2 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	45.43 %
Intercepted Flow	4.92 cfs
Bypass Flow	5.90 cfs
Spread	15.5 ft
Depth	5.2 in
Flow Area	3.0 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.58 ft/s
Equivalent Cross Slope	0.062 ft/ft
Length Factor	0.286
Total Interception Length	25.2 ft

Worksheet for DA16 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	10.04 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	5.6 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	37.77 %
Intercepted Flow	3.79 cfs
Bypass Flow	6.25 cfs
Spread	15.0 ft
Depth	5.1 in
Flow Area	2.9 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.52 ft/s
Equivalent Cross Slope	0.063 ft/ft
Length Factor	0.232
Total Interception Length	24.2 ft

Worksheet for DA17 - Curb Opening on Grade

Project Description	
Solve For	Efficiency

Input Data	
Discharge	8.94 cfs
Slope	0.008 ft/ft
Gutter Width	1.42 ft
Gutter Cross Slope	0.059 ft/ft
Road Cross Slope	0.025 ft/ft
Roughness Coefficient	0.015
Curb Opening Length	5.6 ft
Local Depression	2.0 in
Local Depression Width	17.0 in

Results	
Efficiency	40.01 %
Intercepted Flow	3.58 cfs
Bypass Flow	5.36 cfs
Spread	14.4 ft
Depth	4.9 in
Flow Area	2.6 ft²
Gutter Depression	0.6 in
Total Depression	2.6 in
Velocity	3.42 ft/s
Equivalent Cross Slope	0.065 ft/ft
Length Factor	0.247
Total Interception Length	22.7 ft