ARIZONA DEPARTMENT OF TRANSPORTATION

ROADWAY GROUP

INITIAL DRAINAGE REPORT

April 2023

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Federal ID: 101-A(218)T

I-10/SR-101L DHOV Design Concept Report

I-10 Pearl Harbor Memorial Hwy

Interstate 10 Milepost 131.0 – 136.0

Prepared By: AECOM Imagine it. Delivered.

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

Project 101-A(218)T is a Initial Design Concept Report (IDCR) that develops a recommended roadway improvements at the existing Interstate 10 and State Route 101L, Agua Fria Freeway (I-10 / SR-101L) system interchange. The study develops alternative alignments for the new direct high occupancy vehicle (DHOV) ramps that will directly connect the HOV lanes on SR-101L with the HOV lanes on I-10. The Federal Aid Project number is F0475 01L.

The study will also develop a recommended alternative for a direct connection ramp from SB SR-101L to 91st Avenue and evaluate future improvements at the cross streets north of the system interchange, which includes McDowell Road and Thomas Road. The intersections of adjacent arterial streets that cross I-10 may be improved to handle the anticipated traffic with the new DHOV and 91st Avenue connector ramps in place.

This Initial Drainage Report describes the existing drainage conditions along I-10 and SR-101L, the system interchange, and the affected side streets. The drainage concepts for the following are developed herein, for the purpose of developing a drainage cost estimate for each alternative: Alternative B and Alternative F for the two main DHOV ramp alternatives, and Alternative 3, which is the recommended 91st Avenue connection.

1.2 PROJECT LIMITS

The SR-101L at I-10 system interchange is located within the city limits of Phoenix, Avondale, and Tolleson in Maricopa County, Arizona. The study area on SR-101L extends north from Milepost (MP) 0 to north of Indian School Road at MP 4.5, and on I-10 from west of Avondale Boulevard at MP 131 and ends east of MP 136, at 79th Avenue, and includes the two SR-101L interchanges at McDowell Road and Thomas Road, and the next adjacent signalized I-10 interchanges on each side of the TI. **Figures 1-1** and **Figure 1-2** present the Project Location and Project Vicinity, respectively.

The system interchange provides directional ramps serving all major system movements between I-10 and SR 101L. Immediately adjacent to the system interchange area are the I-10 service TIs with 99th Avenue and 91st Avenue. Within the study area, SR 101L has a partial diamond TI at McDowell Road and a full diamond TI at Thomas Road.

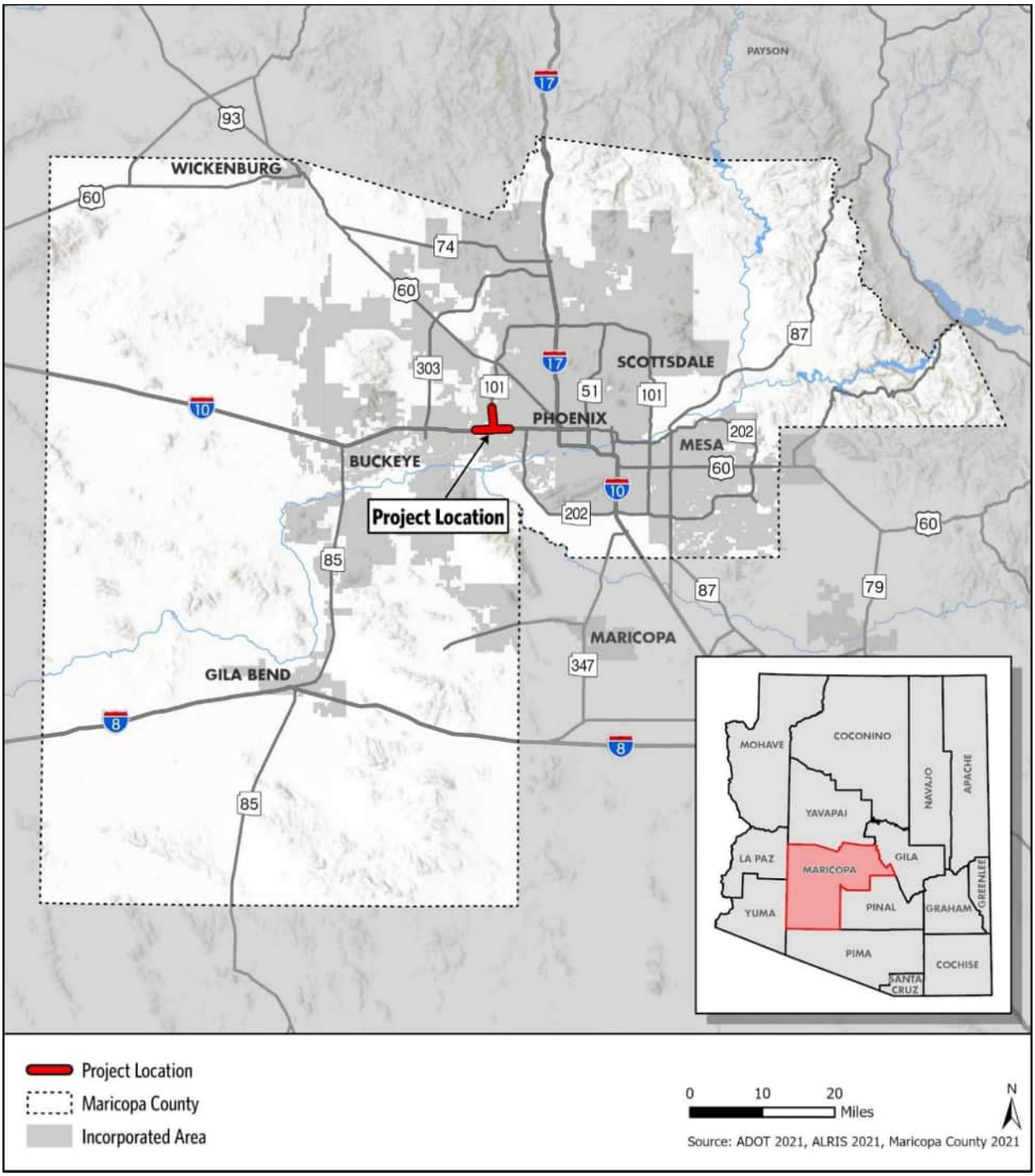

Figure 1-1 Project Location Map

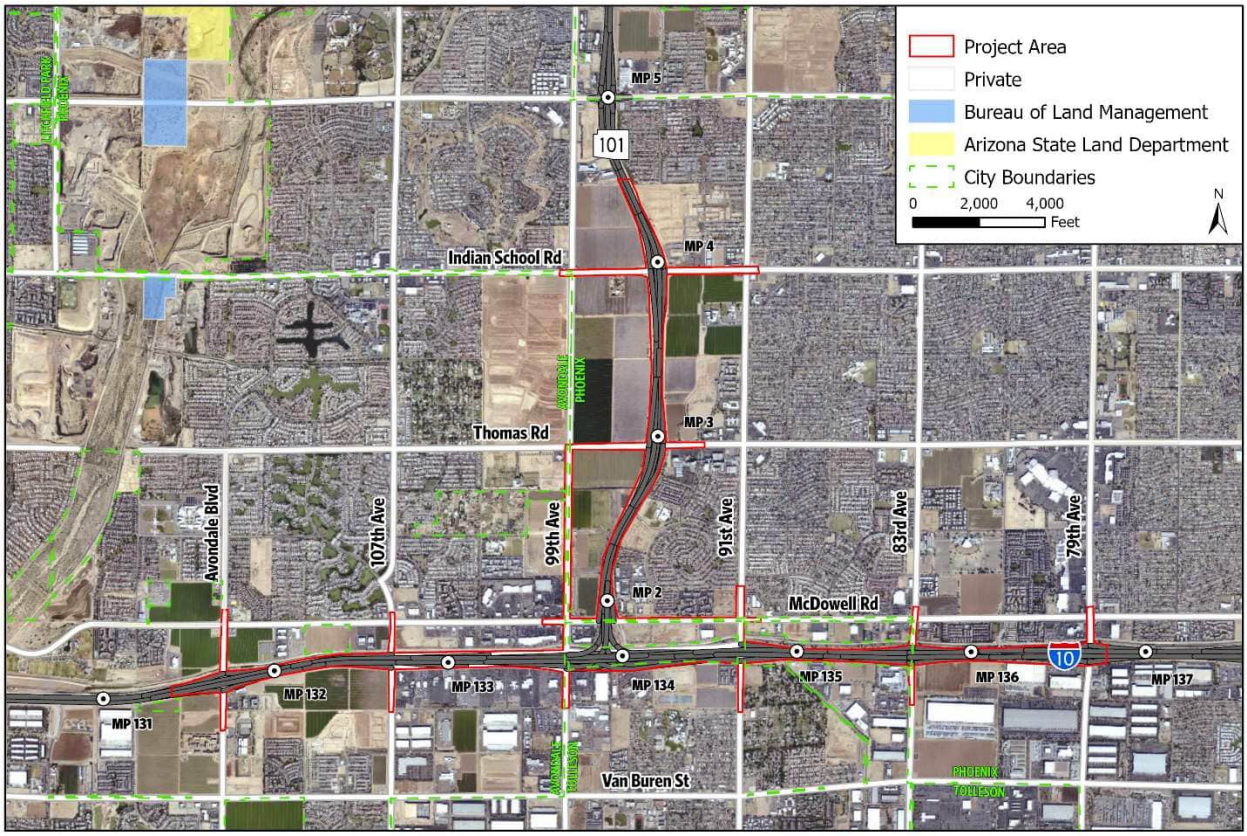

Figure 1-2 Project Vicinity Map

1.3 SITE DESCRIPTION

The existing I-10 corridor is oriented east-west and is a Class I interstate freeway located approximately one quarter mile south of McDowell Road in the west part of the City of Phoenix (see **Figure 1-2**). The SR-101L Class I freeway was built to interstate standards.

The project is bounded by 99th Avenue on the west, 91st Avenue on the East, and on the north by Indian School Road. The I-10 / SR-101L system traffic interchange (herein referred to as "system TI") provides directional ramps serving all major system movements between I-10 and SR-101L. Nested within the system TI are the I-10 service TIs with 99th Avenue and 91st Avenue. Within the study area, SR-101L has a partial diamond TI at McDowell Road and a full diamond TI at Thomas Road.

1.3.1 Stakeholders

The project site is located entirely within Maricopa County and lies within Town of Tolleson and the northern portion lies within City of Phoenix, both of which are stakeholders. The City of

Glendale, and the City of Goodyear are located just outside of the project site but are also considered stakeholders.

1.3.2 Overall Site Topography

Overall runoff for the developed offsite area generally drains from north to south and east to west, ultimately draining into the Agua Fria River, which is designated as a "Waters of the US".

1.3.3 I-10 / SR-101L System TI Drainage Overview

The existing system of offsite channels and detention basins are designed to capture and convey the 100-year peak offsite runoff from the north and east (see **Figure 1-1**). The existing ground to the west of SR-101L drains westward (away from that freeway).

The existing I-10 roadway has a regional drainage channel along the north side of the freeway, and SR-101L has a regional drainage channel along the east side of the freeway. The SR-101L channel has a confluence with the I-10 channel in the existing system interchange. There are also a pair of existing regional offline detention basins located side-by-side on the northeast quadrant of the confluence of the two channels. The east basin (I-10 basin) is connected to the I-10 drainage channel and the west basin (SR-101L basin) connects to the SR-101L drainage channel.

The 100-year stored volume capacities are:

I-10 basin: 189 ac-ft

SR-101L basin: 136 ac-ft

Runoff from the local streets drain into storm drains that also discharge into the ADOT channel system.

1.3.4 I-10 and SR-101L Onsite Drainage Overview

Within the project limits, all the 10-year peak onsite runoff from the two freeways ultimately drains into the ADOT offsite channel system. Systems of storm drains are used to collect the system TI runoff, and discharge into the two offsite drainage channels.

The south half of the system interchange drains into an interconnected series of three (3) onsite infield detention basins. The total storage capacity of the three basins is 5.9 acre-feet. The basins drain from east to west, with the downstream basin drained by a 24-inch diameter storm drain that extends west along the 99th Avenue on-ramp and north along 99th Avenue with outfall into the I-10 drainage channel.

1.3.5 Existing and Proposed Land Use

The contributing watershed north and east of the TI is generally developed with single family residential and some commercial land use. The watershed to the west of SR-101L is characterized

by existing agricultural land use. Future land use in this area is expected to be commercial or light industrial in nature.

1.3.6 Other Drainage Studies

The future development of the land west of SR-101L will have to meet the Flood Control District of Maricopa County's 2011 Glendale Area Stormwater Management Plan, which serves as an update to the preceding Maryvale Area Drainage Master Study (ADMS). Since the offsite runoff from west of SR-101L will not reach the ADOT drainage facilities, that offsite runoff need not be studied for this DCR.

A Maricopa Association of Governments (MAG) feasibility study for the I-10 / SR-101L DHOV was completed in November 2018. Additional alternatives for this IDCR were developed based all or in part on the alternatives developed in the MAG study.

1.4 EXISTING DRAINAGE PROBLEMS

No major existing drainage problems were reported within the project limits.

1.5 FEDERAL EMERGENCY MANAGEMENT AGENCY MAPPING

The pertinent Flood Insurance Rate Maps (FIRM) available within the project area is:

- 04013C-2160M

Excerpts from that FIRM panel are shown on **Figure 1-3**.

The only flood zones that are mapped within the project limits are within the SR-101L channel and along the raised banks of the Roosevelt Water Conservation District (RWCD) canal, to the east of the SR-101L channel.

A triangular shaped Zone A area is located west of 99th Avenue and does not affect the project.

There are mapped floodplains (Zone A and Zone AH, Elevation 1026) near 91st Avenue located just north of I-10 and along McDowell Road.

There are no mapped floodplains along the project limits north of Osborn Road (1/2 mile north of Thomas Road).

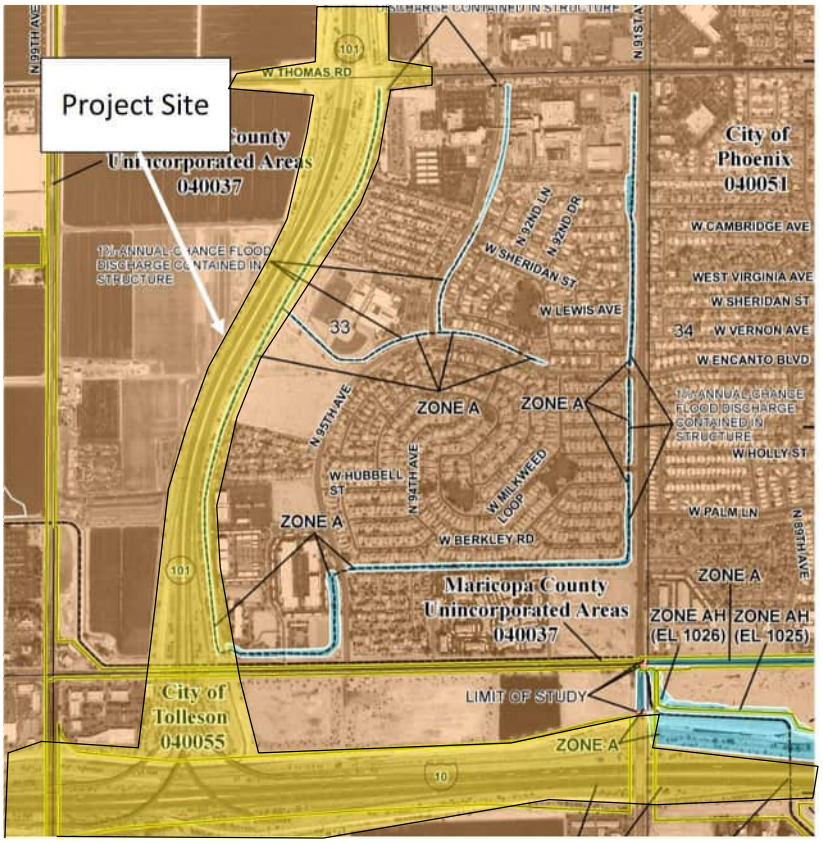

Figure 1-3 FIRM 04013C-2160M

1.6 DRAINAGE DESIGN STANDARDS

This Initial Drainage Report will follow the ADOT drainage design standards as shown in the Highway Drainage Design Manual — Hydrology (Reference 1, HDDM Hydrology), and Highway Drainage Design Manual — Hydraulics (Reference 2, HDDM Hydraulics). The following drainage design frequencies will be used for this project:

Table 1-1 Drainage Design Frequencies

Description	Design Flow Frequency	Check Flow Frequency
Onsite Pavement Runoff, Bridge Runoff, Scuppers, Catch Basins	10-year onsite runoff must meet top width spread requirements (shoulder plus half outside lane and depth not to exceed curb height)	100-year flow must remain within proposed right of way
Cross-Culverts	50-year* offsite runoff culvert head water (HW) does not exceed 3-inches below edge of pavement and HW to culvert height ratio less than 1.5	100-year HW contained within right of way
Roadside Channels	25-year* offsite runoff with 1-foot freeboard	100-year HW contained within right of way
Clogging Factor for Curb Opening Inlets	20-percent (all cases)	n/a
Flanking Inlets	10-year onsite runoff	Overflow can overtop curb*
Storm Drain Pipe	10-year onsite runoff	No depressed sections that are being affected

2.0 EXISTING DRAINAGE FACILITIES

2.1 OVERVIEW

The existing system traffic interchange (System TI) is located 3.6 miles east of the Agua Fria River Crossing at Interstate 10, which is the ultimate outfall for the offsite and onsite drainage facilities. The existing system interchange is guarded against drainage impacts by significant integrated drainage infrastructure implemented as part of the adjoining transportation corridors.

Drainage patterns in the area generally occur from east to west, and from north to south. The contributing watershed north and east of the System TI is generally residential land use. Watershed area on the west side of SR101L is characterized with existing agricultural land use, but it is limited to three quarters of a section on the east side. Future land use in this area is expected to be commercial in nature. Future land development on the west side of SR101L should result in a long-term reduction in peak flows, per FCDMC master plans. The areas adjacent to and north of I-10 are almost completely developed with residential, commercial, and office complex land use. The area south of I-10 is a mixture of light industrial and commercial land use.

The System TI is located within the boundary of the Flood Control District of Maricopa County's 2011 Glendale Area Stormwater Management Plan which serves as an update to the preceding Maryvale Area Drainage Master Study (ADMS). Existing and future land use conditions are considered in the hydrologic analysis included as part of the stormwater management plan. Both conditions will be reviewed with this project to determine pertinent existing and future peak discharges into the freeway channels and evaluate whether conveyance capacity is available to accommodate new roadway improvements.

2.2 EXISTING FREEWAY DRAINAGE

2.2.1 I-10 Offsite Drainage

The I-10 Corridor is protected by a continuous concrete lined channel that extends along its north side. The channel originates at 35th Avenue and drains west with outfall into the Agua Fria River. The channel is sized for the regional 100-year flow, with a 25-foot wide channel bottom and channel banks with 2:1 sideslopes.

The I-10 drainage channel is the outfall for onsite drainage areas and storm drain systems as well as the SR101L drainage channel which is discussed in the following section.

2.2.2 SR-101L Offsite Drainage

Offsite drainage from the east of the SR101L corridor is intercepted by a concrete lined channel extending along the east side of the freeway. The channel originates a half-mile north of Camelback Road and drains south with outfall into the I-10 drainage channel. The channel is sized for the regional 100-year flow, with a 15-foot wide channel bottom and channel banks with 2:1 sideslopes.

2.2.3 I-10 Onsite Drainage

The various ramps have either roadway half barrier or freeway curb and gutter. The existing catch basins are either ADOT Std Dwg C-15.91 (for curb & gutter) or Std Dwg C-15.92 (for half barrier), both types being grate inlets. Area drain inlets (ADOT Std Dwg C-15.80) are used in certain infield areas.

I-10 at 83rd Ave — Along the north side of I-10, a 42-inch storm drain from the west and a 48-inch diameter storm drain from the east, both discharge into the 83rd Avenue pump station. We do not anticipate needing to connect to the 83rd Avenue system.

I-10 at 91st Ave — Along the north side of I-10, a 36-inch storm drain from the west and a 42-inch diameter storm drain from the east, both discharge into the 91st Avenue pump station. We do not anticipate needing to connect directly to the 91st Avenue system however, with the roadway widening between the System TI and 91st Avenue, we will be connecting to the cross drainage on the EB I-10 (south side of I-10). Those cross drains connect to the 91st Avenue pump station.

I-10 at 99th Avenue — There is a 42-inch diameter storm drain along 99th Avenue that passes under the freeway flyover ramps and then discharges into the I-10 drainage channel (on the west side of 99th Ave). We do not anticipate needing to connect to the 99th Avenue system.

2.2.4 I-10/SR101L System Interchange Onsite Drainage

There is a 24-inch diameter storm drain along the I-10 median, starting under Ramp SE and then turns north to cross under Ramp W-N and discharge into the I-10 drainage channel. The lower ramps are drained by individual laterals that discharge into the three southern detention basins.

The deck drains on individual flyover ramps drain to infield areas. Any new ramps will require separate deck drains and down-drains that will discharge to infield areas where possible.

EB I-10 to 91st Avenue Off Ramp — Curb-and-gutter along the ramp collects onsite runoff. Catch basins or spillways outfall to the I-10 infield ditches and basins that are part of the drainage system that ultimately reaches the ADOT I-10 channel that flows west along the north side of the Interstate.

2.2.5 SR-101L at McDowell Road Onsite Drainage

There is a 24-inch diameter storm drain that drains from west to east, that crosses SR101L just north of McDowell Road (and north of the RID RCBC). The storm drain discharges into the SR101L drainage channel RCBC under McDowell Rd. Minor laterals drain into the V-ditches in the infield areas next to Ramps C and D. The V-ditches drain to area inlets that collect flows into the 24-inch storm drain.

2.2.6 SR-101L at Thomas Road Onsite Drainage

North of the TI, there is a 30-inch storm drain parallel to the west side of the SR101L SB lanes. The storm drain turns eastward at the Ramp TC gore. The storm drain crosses under SR101L and discharges into the SR101L drainage channel.

South of the TI, there is a 24- to 30-inch diameter storm drain parallel to the west side of the SR101L SB lanes. The storm drain turns eastward at the Ramp TA gore. The storm drain crosses under SR101L and discharges into the SR101L drainage channel. South of that storm drain, there are 10 individual laterals that drain the median and then discharge directly into the SR101L drainage channel.

2.3 EXISTING DETENTION BASINS

2.3.1 Offline Detention Basins

Two adjacent offline regional detention basins located at the confluence of the SR101L / I-10 drainage channels are designed to reduce peak flows from the respective adjacent drainage channels. One basin is connected to the I-10 drainage channel, and the other is connected to the SR101L drainage channel. The basins are designed for the 100-year storm and connect through a 7'x6' CBC. The I-10 basin is approximately 18-feet deep and the SR101L basin is approximately 15-feet deep. The 100-year stored volume capacities are:

I-10 basin: 189 ac-ft

SR101L basin: 136 ac-ft.

2.3.2 I-10/SR-101L System TI Detention Basins

The south half of the I-10/SR101L Traffic Interchange drains into an interconnected series of three (3) onsite detention basins. The total storage capacity of the three basins is 5.9 acre-feet. The basins drain from east to west, with the downstream basin drained by a 24-inch diameter storm drain that extends west along the 99th Avenue on-ramp and north along 99th Avenue with outfall into the I-10 drainage channel.

2.4 EXISTING LOCAL STREET DRAINAGE

2.4.1 Indian School Road

SR101L crosses under Indian School Road with a depressed profile. Indian School Road is a four-lane undivided arterial street without curb-and-gutter outside of the SR 101 TI footprint, allowing pavement runoff to sheet flow onto the adjacent parcels. Curb-and-gutter and catch basins within the TI footprint collect onsite flows that are conveyed through a 24" trunk line into the freeway's 72" trunk line that flows north toward the mainline sag low point at the north side of the Indian School Road underpass, where four 96-inch pipes connect to the pump station located on the northeast corner of the TI east of the SR101L drainage channel. The 96-inch pipes are the primary inflow pipes that also function as an underground storage chamber upstream of the pump station.

No design modifications are anticipated for any storm drains or flows that would enter the Indian School Road pump station. The pump station plans are shown on the 101-MA-3 as-built record drawings.

The pump station discharges into the ADOT offsite channel that flows south along the east side of the SR-101L mainline. A short 24" trunk line along Indian School Road east of the TI connects two catch basins located on both sides of the street to the ADOT channel at the east outlet wing of the (4) 8'x8' CBC that crosses Indian School Road, adjacent to the 54" pipe/8'x2' CBC that serves as the outfall for the pump station.

2.4.2 Thomas Road

Thomas Road is a four-lane undivided arterial street without curb-and-gutter west of the SR 101 TI, where pavement runoff is allowed to sheet flow onto the adjacent parcels. Within the TI and to the east, the street is a six-lane divided arterial with curb-and-gutter, catch basins and storm drain systems that collect onsite flows that are conveyed to the ADOT channel. A 24"/30" trunk line conveys flows from the TI footprint to the ADOT channel at the west outlet wing of the (4) 10'x6' CBC crossing Thomas Road, and a 24" trunk line conveys flows from east of the TI to a point west of 91st Avenue along the street center line to the outfall at the east outlet wing of the ADOT channel CBC.

2.4.3 McDowell Road

McDowell Road is a four-lane divided arterial street with curb-and-gutter, catch basins and storm drain systems that collect onsite flows that are conveyed to the ADOT channel. Trunk lines along the street center line exist on both sides of the freeway. The west trunk line conveys onsite flows from within the TI footprint. The east trunk line collects pavement runoff from east of the TI to about 95th Avenue. The two trunk lines meet at a manhole east of the TI and discharge into the ADOT channel at the east outlet wing of the 3-10'x8' CBC crossing the street.

A concrete-lined irrigation channel owned and operated by the Roosevelt Water Conservation District (RWCD) flows west along the north side of McDowell Road that transitions to a 2-10'x8' CBC for 604' within the McDowell Road TI footprint. The ADOT channel's (3) 10'x8' CBC crosses under the RWCD CBC.

The SR-101L southbound off ramp at McDowell Road does not have curb-and-gutter. Pavement runoff sheet flows to the outside roadside and is not collected back into the freeway drainage system.

2.4.4 91st Avenue

I-10 crosses under 91st Avenue with a depressed profile. The pump station that drains that TI is located at the NW corner of the TI, located between the I-10 drainage channel and Ramp A. The pump station plans are shown on the 010-2(40) VOL 1 as-built record drawings. During final design, the impacts to the 91st Avenue pump station will be evaluated (and mitigated) that result from additional pavement runoff from new or widened I-10 roadway and/or the new 91st Avenue connector ramp.

2.4.5 I-10 Service Traffic Interchanges

The I-10 traffic interchanges from 83rd Avenue to Avondale Boulevard may be impacted by the proposed improvements in the system traffic interchange project. All of these traffic interchanges have closed storm drain systems that connect to the Interstate mainline drainage systems that outfall to the I-10 channel.

2.5 MAJOR IRRIGATION CROSSINGS

The Roosevelt Water Conservation District (RWCD) canal crosses the study corridor at two locations: I-10 crossing east of 91st Avenue, and SR101L along the north side of McDowell Road.

2.5.1 I-10 RWCD Crossings

There are two irrigation crossings within the project area. A lateral crosses under I-10 just east of 91st Avenue, through a 48-inch diameter RGRCP, and a 36-inch diameter irrigation pipe crosses under I-10 on the west side of 99th Avenue. Neither crossing is expected to be impacted by the proposed roadway improvements.

2.5.2 SR-101L Irrigation Crossings

The RWCD canal flows enter a 2-barrel 10’x8’ RCBC where it passes under SR101L along the north side of McDowell Road. The SR101L drainage channel crosses under the RWCD canal with a 3-barrel 10’x8’ reinforced concrete box culvert (RCBC).

An irrigation lateral (diameter 36-in) crosses from east to west under SR101L at approximately the Palm Lane alignment, one quarter mile north of McDowell Road.

The RWCD canal system undergoes a dry-up period during November each year (actual dates vary year to year). Any modifications to the RWCD canal system must be coordinated closely with RWCD and all irrigation plans for modifications must be approved by them.

3.0 PROPOSED BRIDGE AND ROADWAY IMPROVEMENTS

3.1.1 I-10 / SR-101L DHOV Ramps

The IDCR scope calls for a variety of roadway and ramp alternative alignments to be conceived and then screened for traffic functionality, new bridge constructability, and maintenance of traffic issues. The two DHOV ramp alternatives carried forward are Alternative B and Alternative F.

Alternative B — This alternative provides room within the SR-101L median to land the DHOV ramp. Ramp EN is relocated to the east side of the system interchange and continues to be the highest-level bridge. The new DHOV ramp is added within the medians of SR-101L and I-10, and will be at the same level as the existing Ramp SE.

Alternative F — DHOV Alternative F, as show in Figure 3.10, would avoid the existing SR-101L / I-10 system interchange all together as it would construct the new DHOV to the east of the system interchange and merge with SR-101L further to the north. **Alternative F is the recommended DHOV alternative.**

3.1.2 91st Avenue Connector

Alternative 1 — One lane SB SR-101L to 91st Avenue exit ramp, braid over the Thomas Road southbound entrance ramp, braid over the McDowell Road southbound exit ramp, one lane flyover bridge to 91st Avenue. McDowell Road southbound exit ramp remains in its current location. This configuration is shown on the Alternative B design roll plot in **Appendix C**. This alternative includes:

- One lane exit just north of the Thomas Road bridge
- Braid over the Thomas Road southbound entrance Ramp
- Bridge/braid over the McDowell Road southbound exit ramp. McDowell exit stays in its current location
- One lane flyover ramp to 91st Avenue

Alternative 2 — Two lane combined exit ramp from SR-101L to McDowell Road and 91st Avenue, braid over the Thomas Road southbound entrance ramp, one lane drops to McDowell Road exit, and one lane flyover bridge to 91st Avenue. This configuration is show on the Alternative F exhibits in **Appendix C**. This alternative includes:

- Two lane exit just south of the Thomas Road bridge that combines the McDowell Road and 91st Avenue exits
- Braid over the Thomas Road southbound entrance Ramp
- One lane drops at McDowell Road Exit
- One lane flyover ramp to 91st Avenue

Alternative 3 — This alternative will relocate the southbound McDowell Road exit north of Thomas Road to braid over the Thomas Road southbound entrance ramp and extend south to

McDowell Road. Add a slip ramp from the end of Ramp S-E bridge to connect to the I-10 eastbound to 91st Avenue exit ramp. **This alternative is the recommended 91st Avenue connector**, which includes:

- One lane exit ramp to McDowell Road just north of Thomas Road that braids over the Thomas Road southbound entrance Ramp
- No flyover ramp
- Slip ramp from Ramp SE that exits to 91st Avenue

3.1.3 I-10 Eastbound Modifications

I-10 Eastbound Lanes — Ramp SE entrance then two auxiliary lanes between the 83rd Avenue eastbound exit ramp and the 91st Avenue eastbound entrance ramp. The Alternative B roll plot in Appendix B illustrates this design concept.

- Higher cost relative to the I-10 Eastbound Extended Auxiliary Lanes configuration
- Increased construction complexity with the implementation of a braided ramp bridge
- Increased traffic control requirements
- Minimal traffic operational benefit relative to the I-10 Eastbound Extended Auxiliary Lanes configuration

I-10 Eastbound Extended Auxiliary Lanes — Extended auxiliary lane from Ramp S-E entrance to 75th Avenue. The Alternative F roll plot in Appendix B illustrates this design concept.

- Significantly lower cost relative to the braided ramp configuration
- Provides more room for all weaving movements
- Simple construction with outside widening only
- Similar traffic operational performance as the braided ramp configuration

Two lane configurations were considered to evaluate the weaving movements and traffic operational performance between traffic entering I-10 from the Ramp S-E, and traffic on I-10 destined to 83rd and 75th Avenues. The following is a comparative summary of the I-10 eastbound lane configurations. **This is the recommended alternative for the I-10 Eastbound lanes**.

I-10 Westbound Braided Ramps — This alternative has a ramp between the 83rd Avenue westbound entrance ramp and 91st Avenue westbound exit ramp and extended auxiliary lane to 99th Avenue westbound exit ramp. The Alternative B roll plot in Appendix B illustrates this design concept..

- Higher cost with the implementation of the braided ramps
- Increased construction complexity with the implementation of a braided ramp bridge
- Increased traffic control requirements

I-10 Westbound Extended Auxiliary Lane to 91st Avenue Exit Ramp Only — Extend an auxiliary lane to the 91st Avenue westbound exit ramp. The Alternative F roll plot in Appendix B illustrates this design concept.

- Significantly lower cost relative to the braided ramp configuration
- Keeps the weaving movements on I-10 between 83rd Avenue Entrance and 91st Avenue exit ramps
- Does not operate at as high of level of service as the I-10 Westbound Braided Ramps configuration.

4.0 HYDROLOGY

The offsite runoff condition is expected to remain constant for I-10 and SR-101L because the channels are designed for the 100-year storm. Any new development to the west of SR-101L drains away from the freeway. Any offsite development must comply with the Maricopa County stormwater retention policy (retain the 100-yr, 2-hr storm volume), so the offsite runoff is expected to decrease over time. Therefore, the offsite runoff reaching the two freeways is expected to remain constant and does not need to be analyzed. Only the onsite runoff is analyzed for this IDCR.

4.1 PRECIPITATION

The National Oceanographic and Atmospheric Administration (NOAA) Atlas 14 rainfall precipitation depths and rainfall intensities were downloaded from the NOAA website. The summary tables are shown in **Appendix A**. Since none of the observed onsite or offsite flow paths exceed 600 feet, the minimum time of concentration will be 10-minutes. The following rainfall intensities are used for the drainage design of this project:

$i_{10yr,10min}$ 3.80 in/hr

$i_{50yr,10min}$ 5.22 in/hr

$i_{100yr,10min}$ 5.99 in/hr

4.2 SOILS

The existing soils for this project are available through the Natural Resources Conservation Service (NRCS) Soil Survey Website. The soils map and soil description are shown in Appendix A. The majority of soils are a mix of loam and clay loam, which can be classified as hydrographic soil group (HSG) "C".

4.3 WATERSHED DELINEATION

The onsite watershed boundaries are drawn on **Figure A1 in Appendix A**. The recommended alternative roadway and ramp configurations are used to establish the paved sections. The watershed sub-basin areas are measured in CADD and tallied on the Rational calculations in **Appendix B**.

4.3.1 Rational Method

All of the delineated sub-basins for this project have areas less than 160 acres. Therefore, the Rational method can be used. The Rational formula is:

$$Q = C \bullet i \bullet A$$

Where: Q = Peak Runoff (cubic feet/second; for 10-yr)
C = Runoff Coefficient
i = Rainfall Intensity (inches/hour; for 10-yr)

A = measured area (acres)

4.3.2 Runoff Coefficient

The runoff coefficients for paved and bare ground are standard values used by ADOT. The wooded vacant lot next to 4th Street has a C-value derived from the HDDM **Figure B1 in Appendix B**. The C-values used on this project are as follows:

C_{paved} = 0.94 for 10-year and 0.95 for the 100-year
$C_{bare\ (or\ median)}$ = 0.70

Where more than one C-value applies to portions of a given sub-basin, a weighted mean C-value is computed:

$$C_{weighted} = \sum (C_i A_i) / A_{total} \quad \text{(where i= 1 to n)}$$

And $Q = C_{weighted} \times A_{total} \times i$

4.4 HYDROLOGIC MODEL RESULTS

The Rational method calculations are shown in **Appendix B** and the summary of onsite runoff flows are shown on **Table 3-1**.

Table 4-1 Summary of Offsite and Onsite Rational Runoff

Onsite Sub-Basin	$Q_{10yr,10min}$ (cfs)		
I-10 EB		**WB I-10 to NB SR-101L**	
A1592-211	**1.144**	XA1591-219	**1.950**
A1592-210	**1.528**	XA1591-218	**1.944**
A1591-209	**2.616**	XA1591-217	**0.450**
A1591-208	**3.130**	A1592-216	**0.693**
A1591-207	**3.157**	A1592-215	**2.660**
A1592-206	**3.957**	A1592-214	**2.229**
A1592-205	**4.513**	A1592-213	**2.012**
A1592-204	**4.389**		
A1592-203	**6.046**	A1591-300	**0.190**
A1592-202	**4.777**		
A1592-201	**6.862**		
A1592-200A	**0.538**		
A1592-200	**7.524**		

5.0 HYDRAULICS

5.1 CULVERTS

The existing culverts that cross I-10 or SR-101L are not expected to change, so they are not analyzed for this IDCR.

5.2 OFFSITE CHANNELS

The existing I-10 north drainage channel and the SR-101L east drainage channel are designed for the 100-year peak offsite runoff for the area. The onsite runoff that discharges into the channels has a significantly shorter time of concentration than the offsite flow. Therefore, the onsite peak runoff will pass through the system before the peak of the offsite flow occurs in the channels.

For this reason, we do not anticipate the need to evaluate the hydraulic capacity of the offsite drainage channels and/or the regional offline detention basins.

5.3 PAVEMENT DRAINAGE

The pavement drainage gutter flow is modeled using the results of Table 3-1 at each catch basin. The pavement drainage along the new/modified roadways is modeled using FlowMaster ® - Gutter routine. See **Appendix C** for the pavement spread calculations. The allowable spread requirements stated in Table 1-1 are met. The Manning's roughness factor used for these analyses is:

n_{pvmt} = 0.016 (AC pavement, PCCP pavement, and bridge deck)

The spread for the catch basins that are located at sag curves are modeled directly in FlowMaster using the Inlet at Sag Curve routine.

5.4 ONSITE DETENTION BASINS

There are three onsite detention basins in the south half of the system interchange. None of the alternatives encroach into any of the three basins. The increases in onsite runoff due to additional pavement will not reach these basins. Therefore, the capacities of the basins are not modified for this IDCR.

6.0 RECOMMENDED DRAINAGE DESIGN

6.1 CULVERTS

No new freeway cross culverts are anticipated for any of the alternatives analyzed.

6.2 CATCH BASINS

The roadway/ramp segments that have curb will generally use the Type E freeway curb. The standard C-15.91 grate inlet is used for such locations. Slotted drain will be used wherever necessary to achieve the desired 80-percent or greater capture efficiency at each inlet.

At sag curves with freeway curb, the Type B curb is required (6-inch depth). Catch basins at such locations will also be C-15.91 grate inlets. Flanking inlets are required at any sag curve. Flanking inlets are also C-15.91 grate inlets with slotted drain as needed to achieve the desired 80-percent capture efficiency.

Where roadway half barrier is used, the catch basins used are the C-15.92 type grate inlet. Slotted drains are anticipated on these catch basins as well.

Infield areas are typically drained by C-15.80 grate inlets.

The recommended Alt F and Alt3 combination has 111 new catch basins and 18 new deck drains. Where possible, new catch basins will be built on existing cross culverts, or existing storm drains that cross SR-101L or I-10. Where possible, the deck drains will connect to downdrains mounted to the outside of the flyover structures and will discharge onto dumped riprap aprons or into a dedicated storm drain.

6.3 STORM DRAINS

At locations where there is an existing storm drain network, we anticipate using the existing collector pipes/trunk line as much as possible. Where the roadway edges are being shifted, the existing catch basins will be removed and replaced using one of the catch basins described above. The lateral pipe at each inlet will be extended (or shortened) as needed to connect the new catch basin to the storm drain.

Some locations will require a new storm drain that will connect to either an existing storm drain, an existing channel (rare), or discharge into a detention basin.

The storm drains are not modeled hydraulically but preliminary sizing is based on the known inflows into the storm drain.

See **Table 5-1** for the summary of new storm drain collectors and trunk lines. In the interest of brevity, the lateral extensions less than 10-feet are not included on Table 5-1.

Table 6-1 New Storm Drains (Recommended Alts Combined)

Roadway/Ramp ID	Pipe Designation	Location	Storm Drain Diameter (in)	Length (ft)
SR-101L	24P78	SB	24	34
SR-101L	24P77	SB	24	34
SR-101L	24P76	SB	24	36
SR-101L	24P72-24P75	SB	24	398
DHOV Ramp	24P69-24P70	SB	24	102
DHOV Ramp	24P71	SB to NB	24	44
DHOV Ramp	24P68	SB to NB	24	30
DHOV Ramp	24P65-24P67	NB	24	102
DHOV Ramp	24P63-24P64	SB to NB	24	52
DHOV Ramp	24P61-24P62	SB to NB	24	62
DHOV Ramp	24P59-24P60	SB to NB	24	42
DHOV Ramp	24P58	SB to NB	24	30
DHOV Ramp	18P56-18P55	SB	18	100
DHOV Ramp	18P53-18P52	SB	18	94
Det Basin 5 Outflow	24P51	n/a	24	44
Det Basin 4 Outflow	24P50	n/a	24	44
Deck Drain outlet	24P49	n/a	24	32
DHOV Ramp	18P43	EB	18	50
DHOV Ramp	18P45	EB	18	46
DHOV Ramp	24P46	n/a	24	116

DHOV Ramp	24P37-24P36	WB	24	102
DHOV Ramp	24P40-24P39	EB	24	102
DHOV Ramp/ EB I-10	24P38-24P41	WB to EB	24	160
I-10	36P42	EB	36	150
I-10	24P34	EB	36	150
Ramp SE	24P34	EB	24	54
I-10	36P29	EB	36	32
I-10	36P29	EB	36	32
91st Ave Conn	36P30	EB	36	40
91st Ave Conn	36P31	EB	36	270
I-10	36P27	EB	36	27
I-10	18P25-18P23	EB	18	264
I-10	18P22	EB	18	52
I-10	24P18	EB	24	200
I-10	24P17	EB	24	200
I-10	24P16	EB	24	24
I-10	24P13	EB	24	152
I-10	24P12	EB	24	38
I-10	24P11-24P27	EB	24	452
I-10 83rd Ave Off	36P9	EB	36	28

6.4 PROPOSED LOCAL STREET DRAINAGE

Roadway improvements along Thomas Road and McDowell Road were evaluated in the context of the area's need for updated street network performance. Proposed improvements include the upgrade of the segment of Thomas Road west of SR-101L and the segment of McDowell Road from 91st Avenue to 99th Avenue to a full 6-lane dived section. These improvements are not expected to be included in the scope of the system traffic interchange project and would be developed separately in the future.

Improvements along Thomas Road would require the development of a local drainage system that may include temporary linear retention basins. Future development of the currently farmed land on both sides of the street would include facilities to retain or dispose of the adjacent half-street pavement runoff.

Widening of McDowell Road would require the modification, expansion and enhancement of the trunk lines that currently discharge into the SR-101L channel. The RWCD channel's 2-10'x8' CBC at the TI would require upstream and downstream extensions to accommodate expanded curb returns at the SR 101 NB on ramp, and the relocation of curb-and-gutter and sidewalk further to the north. As stated previously, the RWCD CBC extension will not occur as part of this I-10/SR-101L DHOV project and would be completed under another contract in the future.

6.5 PROPOSED I-10 SERVICE TI DRAINAGE

Spot widening is proposed to add turn lanes at the I-10 interchanges with 91st Avenue, 99th Avenue, 107th Avenue and Avondale Boulevard. New catch basins and extended lateral storm drain connections to the existing drainage systems would be needed at locations where existing catch basins would be relocated or as required by design criteria.

6.6 91ST AVENUE CONNECTOR ALTERNATIVES 1 AND 2

The 91st Avenue Connector Alts 1 and 2 onsite drainage concept is the same for both Alt B and Alt F alternatives. DCR alternatives B and F include the construction of a roadway parallel to the southbound SR-101L roadway that peels off the mainline from north of Thomas Road, crosses over the Thomas on ramp, over McDowell Road, over I-10 in a fly-over ramp that connects to the existing eastbound I-10/91st Avenue off ramp.

New storm drain will be installed from catch basins along the connector to the existing laterals and trunk line that service the southbound SR-101L mainline and comprise the freeway drainage system for the SR-101L segment north of Encanto Boulevard (half-way between Thomas Road and McDowell Road) that is normally crowned or superelevated to drain to the outside.

South of Encanto Boulevard the SR-101L southbound lanes are superelevated to drain to the inside concrete barrier and therefore any storm drain connections from the west would require the installation of new pipe across all existing lanes of traffic. To avoid impacts to the existing mainline, a new trunk line flowing south along the connector roadway would convey onsite flows to the SR-101L channel south of McDowell Road. The trunk line would cross under the RWCD 2-10'x8' CBC, turn east along McDowell Road parallel to the existing sewer line and street storm

drain trunk line to a manhole on the east side of the TI, and then turn south to outfall at the west bank of the SR-101L channel downstream of the McDowell CBC and the channel maintenance access ramp. The trunkline would discharge into a new detention basin on the west side of the existing SR-101L channel to attenuate impacts and provide first flush treatment prior to the connection to the channel.

The new southbound McDowell off ramp would be reconstructed in both alternatives, adding curb-and-gutter or barrier along the outside edge, requiring new catch basins that would connect to the proposed trunk line described above.

Deck drains and catch basins along the approaches of the I-10 fly-over structure would outfall to the I-10 drainage system through new storm drain connections.

6.7 RECOMMENDED 91ST AVENUE CONNECTOR ALTERNATIVE 3

The preferred alternative for the 91st Avenue Connector includes a slip ramp from the existing system TI ramp S-E that merges with the existing eastbound I-10 off ramp, eliminating the need for the fly-over structure proposed in Alternatives 1 and 2. Catch basins along the new slip ramp prior to the merge with the existing 91st Avenue off ramp intercept that pavement runoff. The new catch basins will connect to the modified existing I-10 drainage system.

6.8 CHANNELS/V-DITCHES

The only new or relocated V-ditches that are anticipated are primarily along the edges of SR-101L roadway or ramps. Those V-ditch slopes are typically set to match the roadway longitudinal slope, unless the roadway has a variable slope or any local crests or sag curves. In such cases, the ditch slope will be set independently.

The side slopes of any new unlined V-ditches or channels are set at 3:1 maximum side slope.

6.9 EROSION CONTROL

Wherever there will be new storm drain outlets that must discharge into an infield area or detention basin, a new dumped riprap outlet apron is recommended. V-ditches are typically only lined with dumped riprap if the flow velocity exceeds the allowable maximum. For the types of soil in the project limits (**loam and clay loam**), the maximum allowable flow velocity is: **2.5 feet per second**.

During final design, if a new V-ditch or channel must have a flow velocity that exceeds the maximum allowable velocity, then dumped riprap bank lining is typically warranted. The procedures and formulas outlined in HEC-15 – Design of Roadside Channels with Flexible Linings will be used to size the riprap lining and determine the flow depth.

New trapezoidal channels are assumed to require dumped riprap bank lining with a natural (unlined) channel bottom. Full channel lining with riprap is undesirable due to the vegetation that occurs in channels. A riprap bottom would make access within the channel very difficult, if not impossible for maintenance crews to access the channel. Therefore, concrete lining of the channel is recommended if flow velocity exceeds 9 feet per second.

6.10 EROSION PROTECTION

For this project, the new flyover bridges that cross over the existing channels will not require any scour protection. The only slope protection needed will be the standard concrete or shotcrete abutment slope protection, which is accounted for in the new bridge designs.

7.0 REFERENCES

1. Arizona Department of Transportation. *Highway Drainage Design Manual: Hydrology. Volume 2. Second Edition.* 2014.
2. Arizona Department of Transportation. *Highway Drainage Design Manual: Hydraulics. Volume 3. Second Edition.* 2015.
3. U.S. Department of Transportation, Federal Highway Administration. *HY-8 Culvert Hydraulic Analysis Program. Version 7.5.* July 2016.
4. U.S. Department of Homeland Security. Federal Emergency Management Agency. Flood Insurance Rate Map (FIRM), Panel 6828G; Community 04005C. Effective September 3, 2010.
5. Bentley Systems Inc. *FlowMaster Version 08.11.01.03.* 2018

APPENDIX A

PRELIMINARY HYDROLOGY & WATERSHED MAPS

Table A1 and A2 — Rainfall Depths and Intensities

Rational Method C-Values

NOAA Atlas 14, Volume 1, Version 5
Location name: Tolleson, Arizona, USA*
Latitude: 33.4616°, Longitude: -112.2686°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.196 (0.161-0.243)	0.255 (0.211-0.317)	0.347 (0.284-0.429)	0.416 (0.339-0.513)	0.510 (0.410-0.626)	0.583 (0.462-0.710)	0.656 (0.511-0.799)	0.732 (0.561-0.889)	0.832 (0.622-1.01)	0.909 (0.665-1.11)
10-min	0.298 (0.245-0.370)	0.389 (0.321-0.483)	0.528 (0.433-0.652)	0.634 (0.516-0.780)	0.776 (0.624-0.952)	0.887 (0.703-1.08)	0.999 (0.778-1.22)	1.11 (0.854-1.35)	1.27 (0.946-1.54)	1.38 (1.01-1.68)
15-min	0.370 (0.304-0.458)	0.482 (0.398-0.599)	0.654 (0.536-0.809)	0.785 (0.640-0.967)	0.962 (0.773-1.18)	1.10 (0.871-1.34)	1.24 (0.964-1.51)	1.38 (1.06-1.68)	1.57 (1.17-1.91)	1.71 (1.25-2.09)
30-min	0.498 (0.409-0.617)	0.649 (0.536-0.806)	0.881 (0.722-1.09)	1.06 (0.862-1.30)	1.30 (1.04-1.59)	1.48 (1.17-1.81)	1.67 (1.30-2.03)	1.86 (1.43-2.26)	2.11 (1.58-2.57)	2.31 (1.69-2.81)
60-min	0.616 (0.506-0.764)	0.803 (0.663-0.998)	1.09 (0.894-1.35)	1.31 (1.07-1.61)	1.60 (1.29-1.97)	1.83 (1.45-2.23)	2.06 (1.61-2.51)	2.30 (1.76-2.80)	2.62 (1.96-3.18)	2.86 (2.09-3.48)
2-hr	0.698 (0.585-0.845)	0.901 (0.756-1.10)	1.20 (1.01-1.46)	1.44 (1.19-1.73)	1.75 (1.43-2.10)	2.00 (1.61-2.39)	2.25 (1.78-2.68)	2.50 (1.95-2.98)	2.84 (2.17-3.39)	3.11 (2.32-3.72)
3-hr	0.742 (0.621-0.904)	0.950 (0.800-1.16)	1.25 (1.05-1.52)	1.49 (1.23-1.80)	1.82 (1.49-2.18)	2.08 (1.67-2.49)	2.35 (1.86-2.82)	2.64 (2.05-3.15)	3.04 (2.30-3.63)	3.37 (2.48-4.03)
6-hr	0.879 (0.754-1.05)	1.11 (0.958-1.33)	1.43 (1.22-1.69)	1.68 (1.42-1.98)	2.02 (1.69-2.37)	2.29 (1.88-2.68)	2.57 (2.08-3.00)	2.85 (2.27-3.34)	3.25 (2.52-3.81)	3.56 (2.70-4.18)
12-hr	0.972 (0.846-1.14)	1.23 (1.07-1.43)	1.55 (1.35-1.81)	1.81 (1.56-2.10)	2.15 (1.83-2.50)	2.42 (2.04-2.80)	2.69 (2.23-3.12)	2.97 (2.43-3.44)	3.34 (2.67-3.89)	3.64 (2.85-4.26)
24-hr	1.13 (1.01-1.26)	1.43 (1.29-1.60)	1.86 (1.66-2.08)	2.19 (1.96-2.45)	2.66 (2.36-2.95)	3.03 (2.67-3.35)	3.41 (2.99-3.77)	3.80 (3.32-4.21)	4.35 (3.76-4.81)	4.78 (4.10-5.30)
2-day	1.21 (1.08-1.35)	1.54 (1.38-1.73)	2.02 (1.82-2.26)	2.41 (2.15-2.69)	2.94 (2.61-3.28)	3.37 (2.98-3.76)	3.81 (3.35-4.26)	4.29 (3.74-4.80)	4.94 (4.26-5.54)	5.46 (4.67-6.14)
3-day	1.27 (1.14-1.43)	1.62 (1.45-1.82)	2.13 (1.91-2.39)	2.55 (2.27-2.85)	3.12 (2.77-3.48)	3.58 (3.16-4.00)	4.07 (3.57-4.55)	4.59 (3.99-5.13)	5.31 (4.57-5.94)	5.89 (5.02-6.62)
4-day	1.34 (1.19-1.50)	1.70 (1.52-1.92)	2.25 (2.01-2.52)	2.68 (2.39-3.00)	3.30 (2.92-3.69)	3.80 (3.34-4.23)	4.33 (3.79-4.83)	4.89 (4.24-5.46)	5.69 (4.87-6.35)	6.33 (5.37-7.09)
7-day	1.48 (1.32-1.67)	1.89 (1.69-2.13)	2.50 (2.23-2.80)	2.98 (2.65-3.33)	3.66 (3.24-4.09)	4.21 (3.71-4.71)	4.80 (4.19-5.36)	5.42 (4.69-6.05)	6.29 (5.39-7.03)	6.99 (5.94-7.84)
10-day	1.62 (1.45-1.83)	2.08 (1.85-2.33)	2.73 (2.44-3.07)	3.26 (2.90-3.66)	4.00 (3.53-4.48)	4.60 (4.04-5.14)	5.22 (4.56-5.85)	5.88 (5.09-6.58)	6.80 (5.83-7.62)	7.54 (6.40-8.47)
20-day	1.98 (1.78-2.22)	2.55 (2.28-2.85)	3.36 (3.01-3.74)	3.97 (3.54-4.42)	4.80 (4.26-5.33)	5.43 (4.81-6.03)	6.07 (5.35-6.76)	6.73 (5.89-7.49)	7.60 (6.62-8.47)	8.28 (7.15-9.24)
30-day	2.33 (2.08-2.61)	3.00 (2.67-3.35)	3.94 (3.51-4.39)	4.66 (4.14-5.19)	5.63 (4.97-6.26)	6.37 (5.60-7.08)	7.13 (6.24-7.92)	7.90 (6.87-8.79)	8.93 (7.70-9.96)	9.72 (8.32-10.9)
45-day	2.73 (2.44-3.04)	3.52 (3.14-3.91)	4.62 (4.13-5.14)	5.44 (4.86-6.04)	6.53 (5.80-7.23)	7.34 (6.50-8.14)	8.15 (7.18-9.05)	8.97 (7.86-9.96)	10.0 (8.74-11.2)	10.8 (9.38-12.1)
60-day	3.02 (2.71-3.37)	3.90 (3.50-4.34)	5.13 (4.59-5.69)	6.02 (5.38-6.66)	7.18 (6.39-7.95)	8.04 (7.13-8.90)	8.89 (7.86-9.86)	9.73 (8.56-10.8)	10.8 (9.46-12.0)	11.6 (10.1-13.0)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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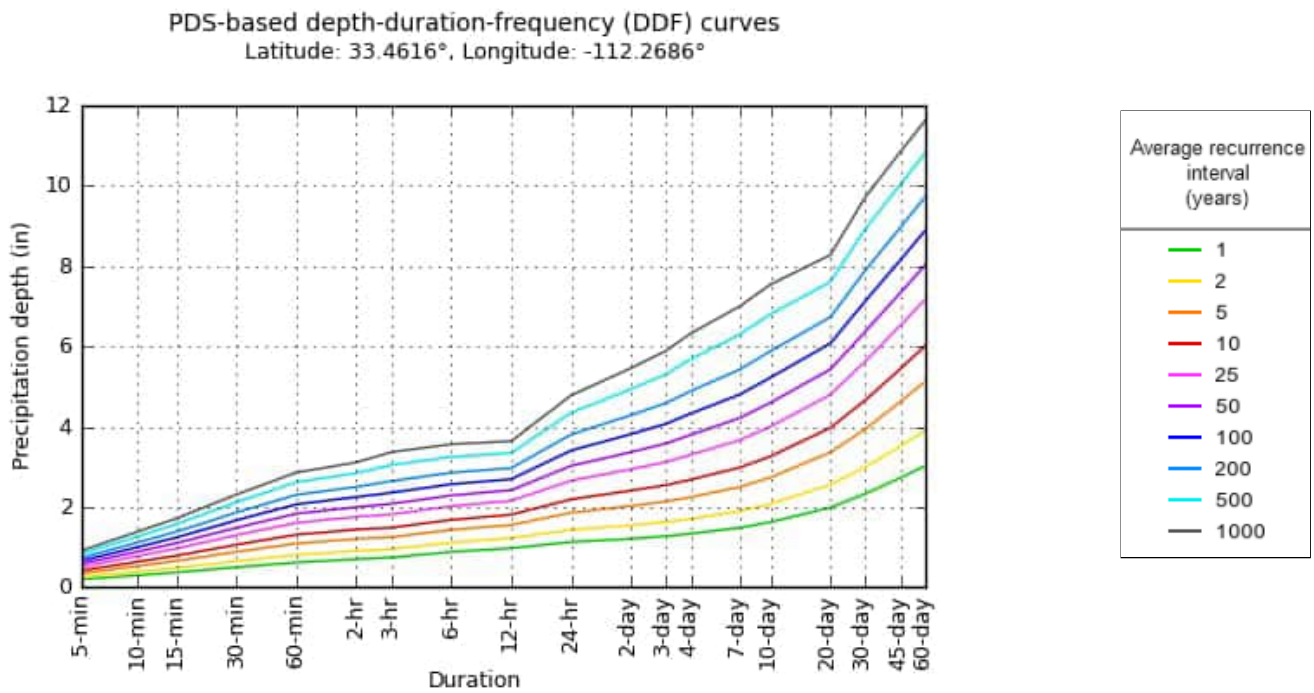
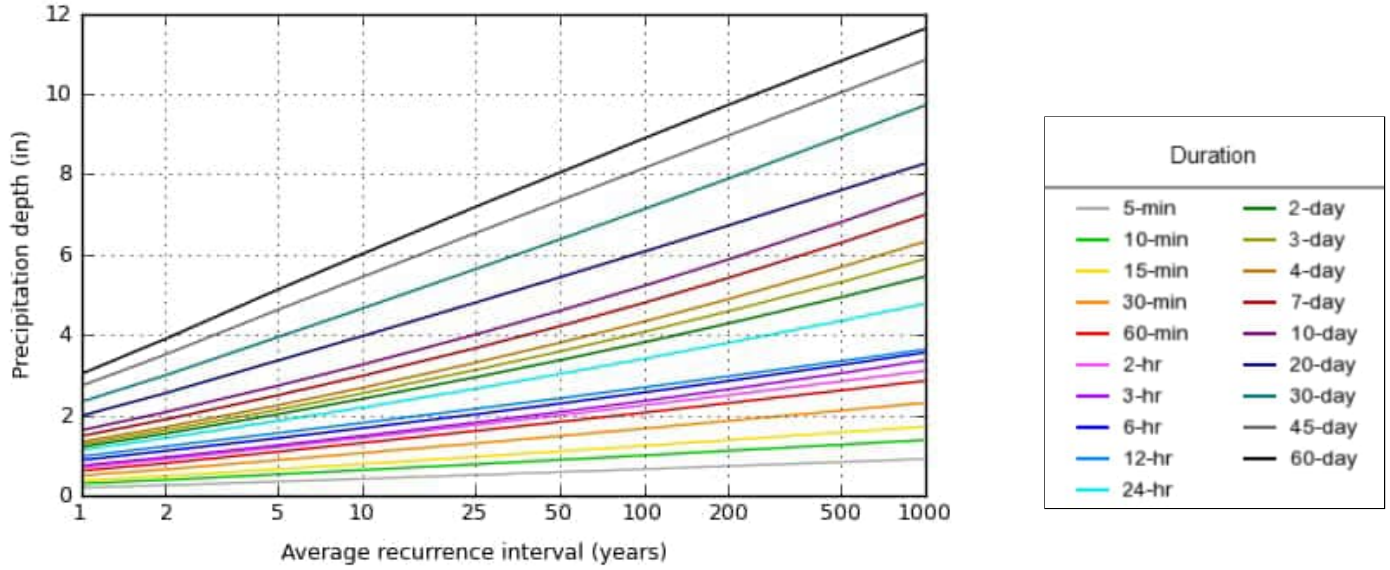
PF graphical





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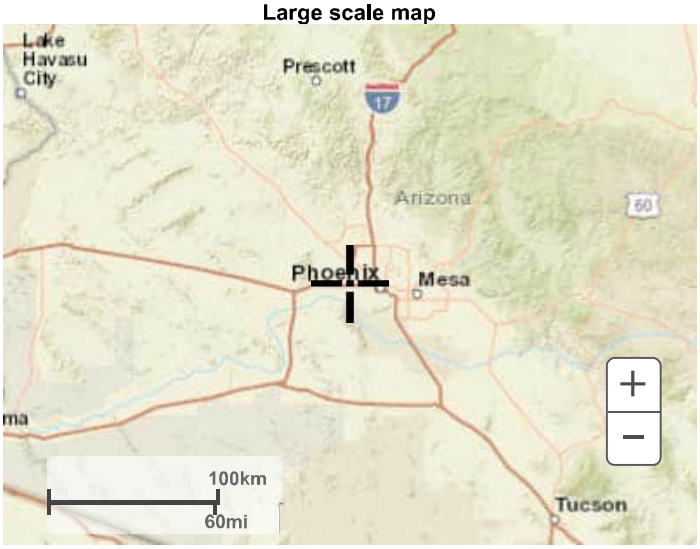
Maps & aerials

Small scale terrain

Large scale terrain

Large scale map



Large scale aerial

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Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

NOAA Atlas 14, Volume 1, Version 5
Location name: Tolleson, Arizona, USA*
Latitude: 33.4616°, Longitude: -112.2686°
Elevation: m/ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.35 (1.93-2.92)	3.06 (2.53-3.80)	4.16 (3.41-5.15)	4.99 (4.07-6.16)	6.12 (4.92-7.51)	7.00 (5.54-8.52)	7.87 (6.13-9.59)	8.78 (6.73-10.7)	9.98 (7.46-12.1)	10.9 (7.98-13.3)
10-min	1.79 (1.47-2.22)	2.33 (1.93-2.90)	3.17 (2.60-3.91)	3.80 (3.10-4.68)	4.66 (3.74-5.71)	5.32 (4.22-6.49)	5.99 (4.67-7.30)	6.68 (5.12-8.12)	7.60 (5.68-9.24)	8.30 (6.07-10.1)
15-min	1.48 (1.22-1.83)	1.93 (1.59-2.40)	2.62 (2.14-3.24)	3.14 (2.56-3.87)	3.85 (3.09-4.72)	4.40 (3.48-5.36)	4.95 (3.86-6.03)	5.52 (4.23-6.71)	6.28 (4.69-7.64)	6.86 (5.02-8.34)
30-min	0.996 (0.818-1.23)	1.30 (1.07-1.61)	1.76 (1.44-2.18)	2.12 (1.72-2.60)	2.59 (2.08-3.18)	2.96 (2.35-3.61)	3.34 (2.60-4.06)	3.72 (2.85-4.52)	4.23 (3.16-5.14)	4.62 (3.38-5.62)
60-min	0.616 (0.506-0.764)	0.803 (0.663-0.998)	1.09 (0.894-1.35)	1.31 (1.07-1.61)	1.60 (1.29-1.97)	1.83 (1.45-2.23)	2.06 (1.61-2.51)	2.30 (1.76-2.80)	2.62 (1.96-3.18)	2.86 (2.09-3.48)
2-hr	0.349 (0.292-0.422)	0.450 (0.378-0.548)	0.602 (0.504-0.730)	0.718 (0.594-0.866)	0.877 (0.716-1.05)	0.998 (0.804-1.19)	1.12 (0.892-1.34)	1.25 (0.974-1.49)	1.42 (1.08-1.69)	1.55 (1.16-1.86)
3-hr	0.247 (0.207-0.301)	0.316 (0.266-0.387)	0.416 (0.348-0.506)	0.495 (0.411-0.599)	0.604 (0.495-0.725)	0.692 (0.557-0.828)	0.784 (0.620-0.937)	0.880 (0.684-1.05)	1.01 (0.764-1.21)	1.12 (0.824-1.34)
6-hr	0.147 (0.126-0.175)	0.186 (0.160-0.221)	0.238 (0.204-0.283)	0.280 (0.237-0.331)	0.337 (0.282-0.396)	0.382 (0.314-0.447)	0.429 (0.348-0.502)	0.476 (0.379-0.558)	0.542 (0.421-0.635)	0.595 (0.451-0.698)
12-hr	0.081 (0.070-0.094)	0.102 (0.088-0.119)	0.129 (0.112-0.150)	0.150 (0.129-0.174)	0.179 (0.152-0.207)	0.201 (0.169-0.232)	0.223 (0.185-0.259)	0.246 (0.202-0.286)	0.278 (0.221-0.323)	0.302 (0.236-0.354)
24-hr	0.047 (0.042-0.053)	0.060 (0.054-0.067)	0.077 (0.069-0.087)	0.091 (0.082-0.102)	0.111 (0.098-0.123)	0.126 (0.111-0.140)	0.142 (0.125-0.157)	0.159 (0.138-0.175)	0.181 (0.157-0.201)	0.199 (0.171-0.221)
2-day	0.025 (0.023-0.028)	0.032 (0.029-0.036)	0.042 (0.038-0.047)	0.050 (0.045-0.056)	0.061 (0.054-0.068)	0.070 (0.062-0.078)	0.079 (0.070-0.089)	0.089 (0.078-0.100)	0.103 (0.089-0.115)	0.114 (0.097-0.128)
3-day	0.018 (0.016-0.020)	0.023 (0.020-0.025)	0.030 (0.027-0.033)	0.035 (0.032-0.040)	0.043 (0.038-0.048)	0.050 (0.044-0.056)	0.057 (0.050-0.063)	0.064 (0.055-0.071)	0.074 (0.063-0.083)	0.082 (0.070-0.092)
4-day	0.014 (0.012-0.016)	0.018 (0.016-0.020)	0.023 (0.021-0.026)	0.028 (0.025-0.031)	0.034 (0.030-0.038)	0.040 (0.035-0.044)	0.045 (0.039-0.050)	0.051 (0.044-0.057)	0.059 (0.051-0.066)	0.066 (0.056-0.074)
7-day	0.009 (0.008-0.010)	0.011 (0.010-0.013)	0.015 (0.013-0.017)	0.018 (0.016-0.020)	0.022 (0.019-0.024)	0.025 (0.022-0.028)	0.029 (0.025-0.032)	0.032 (0.028-0.036)	0.037 (0.032-0.042)	0.042 (0.035-0.047)
10-day	0.007 (0.006-0.008)	0.009 (0.008-0.010)	0.011 (0.010-0.013)	0.014 (0.012-0.015)	0.017 (0.015-0.019)	0.019 (0.017-0.021)	0.022 (0.019-0.024)	0.025 (0.021-0.027)	0.028 (0.024-0.032)	0.031 (0.027-0.035)
20-day	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.010 (0.009-0.011)	0.011 (0.010-0.013)	0.013 (0.011-0.014)	0.014 (0.012-0.016)	0.016 (0.014-0.018)	0.017 (0.015-0.019)
30-day	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.007)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.011)	0.011 (0.010-0.012)	0.012 (0.011-0.014)	0.013 (0.012-0.015)
45-day	0.003 (0.002-0.003)	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.004-0.006)	0.006 (0.005-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.011)
60-day	0.002 (0.002-0.002)	0.003 (0.002-0.003)	0.004 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.004-0.006)	0.006 (0.005-0.006)	0.006 (0.005-0.007)	0.007 (0.006-0.007)	0.008 (0.007-0.008)	0.008 (0.007-0.009)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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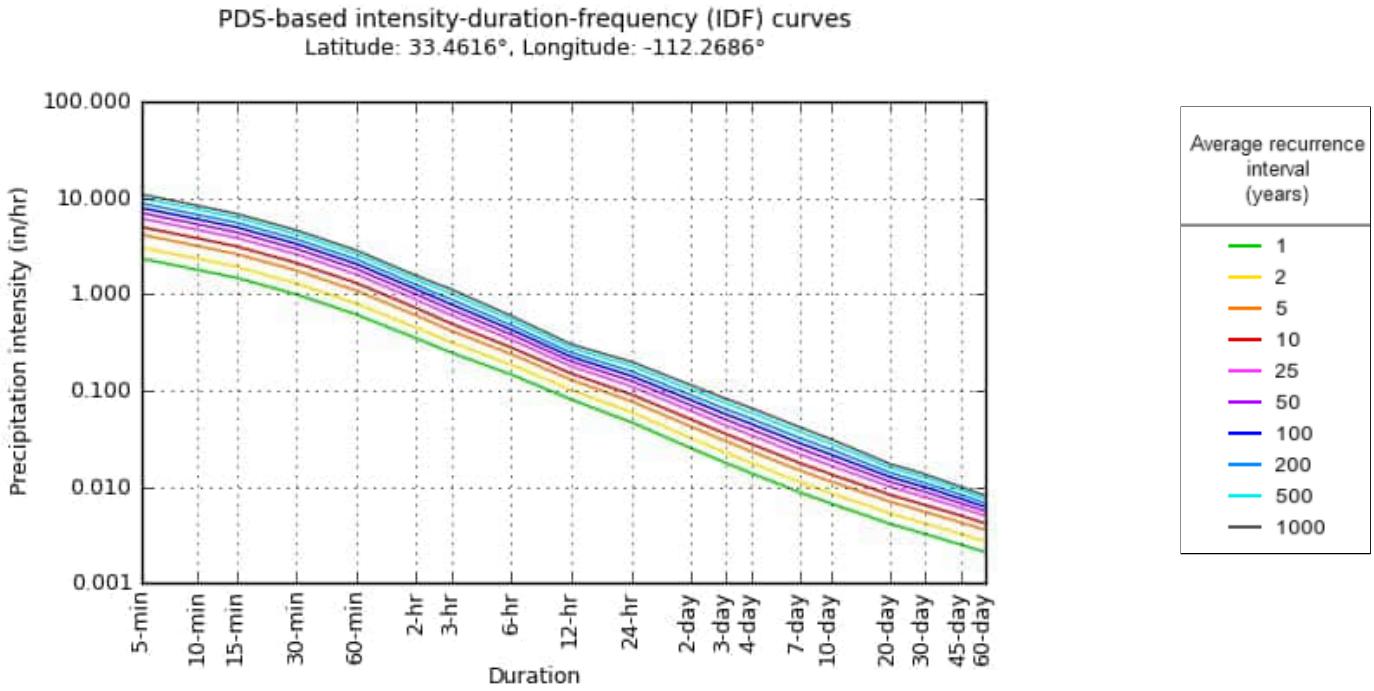
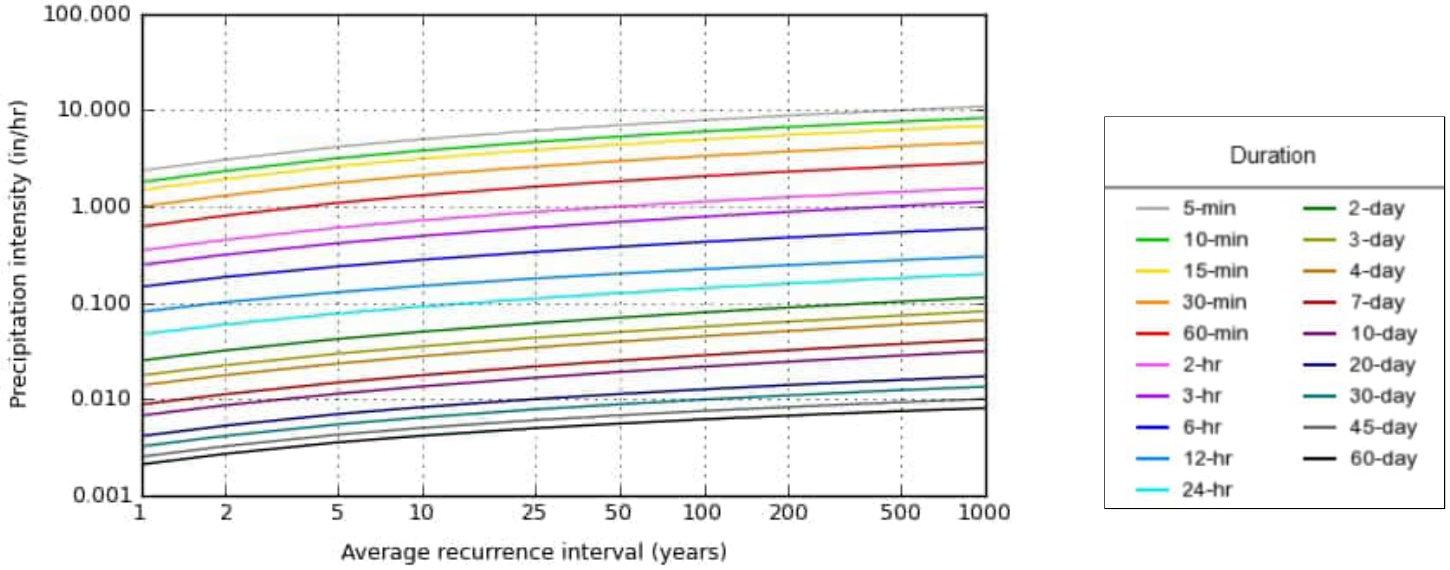
PF graphical





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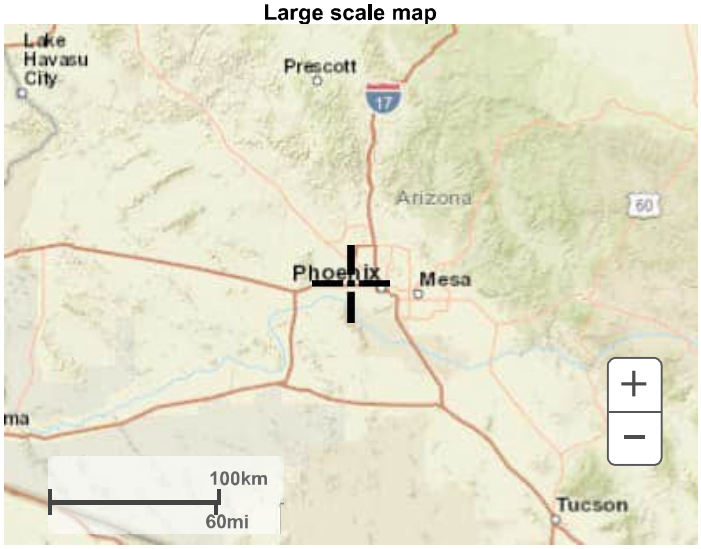
Maps & aerials

Small scale terrain

Large scale terrain

Large scale map



Large scale aerial

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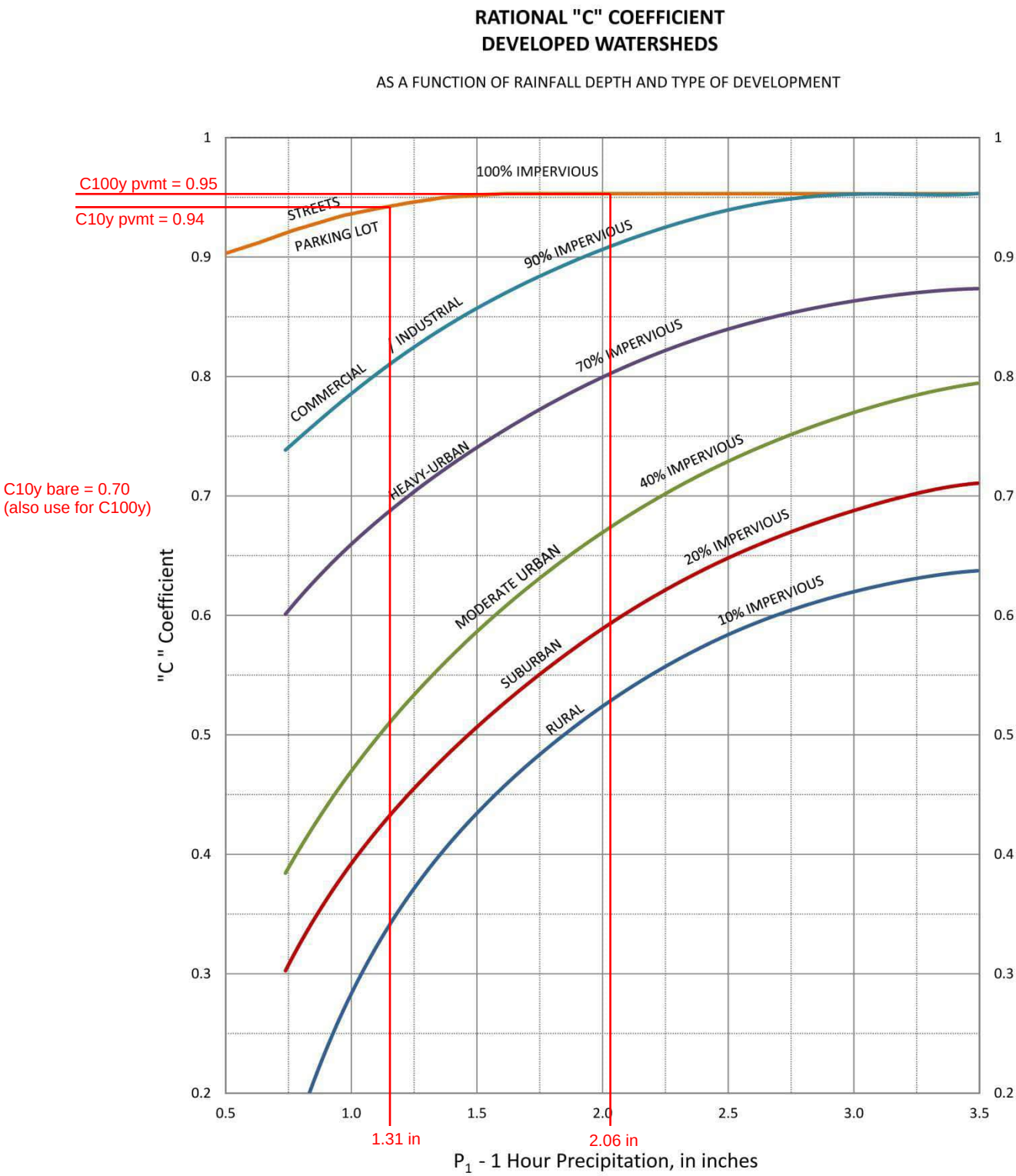


Figure 2–1 Rational "C" Coefficient – Developed Watersheds

APPENDIX B

RATIONAL METHOD AND GUTTER SPREAD CALCULATIONS

Rational method C-values

Table B1— Rational Method — Onsite Sub-Basins (Recommended Alts)

I-10/SR 101L DHOV INITIAL DESIGN CONCEPT REPORT

SUB-BASIN 10-YEAR, 50-YEAR, 100-YEAR RATIONAL METHOD CALCULATIONS

I_{10} = 3.80 in/hr C =0.94

I_{50} = 5.22 in/hr C = 0.94

I_{100} = 5.99 in/hr C=0.95

SR101L NB and SB Areas				
Sub-basin	Area	Q_{10}	Q_{50}	Q_{100}
ID	(sf)	(cfs)	(cfs)	(cfs)
A1591-207	27,502	2.26	3.10	3.59
A1591-208	29,490	2.42	3.32	3.85
A1591-209	26,609	2.18	3.00	3.48
A1591-300	2,279	0.19	0.26	0.30
A1592-01	1,446	0.12	0.16	0.19
A1592-02	5,668	0.46	0.64	0.74
A1592-03	1,422	0.12	0.16	0.19
A1592-04	1,500	0.12	0.17	0.20
A1592-05	18,430	1.51	2.08	2.41
A1592-06	7,731	0.63	0.87	1.01
A1592-12	3,509	0.29	0.40	0.46
A1592-13	3,198	0.26	0.36	0.42
A1592-14	8,580	0.70	0.97	1.12
A1592-200	90,591	7.43	10.20	11.83
A1592-200A	6,412	0.53	0.72	0.84
A1592-201	53,682	4.40	6.05	7.01
A1592-202	18,801	1.54	2.12	2.46
A1592-203	48,416	3.97	5.45	6.32
A1592-204	27,053	2.22	3.05	3.53
A1592-205	33,701	2.76	3.80	4.40
A1592-206	36,880	3.02	4.15	4.82
A1592-210	14,869	1.22	1.67	1.94
A1592-211	13,836	1.13	1.56	1.81
A1592-212	26,679	2.19	3.01	3.49
A1592-213	14,137	1.16	1.59	1.85
A1592-214	14,011	1.15	1.58	1.83
A1592-215	30,563	2.51	3.44	3.99
A1592-216	7,536	0.62	0.85	0.98
A1592-22	6,352	0.52	0.72	0.83
A1592-23	9,467	0.78	1.07	1.24
A1592-24	9,467	0.78	1.07	1.24
A1592-25	3,746	0.31	0.42	0.49
A1592-26	5,280	0.43	0.59	0.69
A1592-27	5,379	0.44	0.61	0.70
A1592-28	5,284	0.43	0.60	0.69
A1592-29	5,315	0.44	0.60	0.69
A1592-30	5,407	0.44	0.61	0.71
A1592-31	5,366	0.44	0.60	0.70
A1592-32	5,400	0.44	0.61	0.71
A1592-33	1,445	0.12	0.16	0.19
A1592-34	6,370	0.52	0.72	0.83
A1592-35	1,413	0.12	0.16	0.18
A1592-36	1,507	0.12	0.17	0.20
A1592-37	16,873	1.38	1.90	2.20
A1592-38	925	0.08	0.10	0.12
A1592-39	579	0.05	0.07	0.08
A1592-40	1,453	0.12	0.16	0.19
A1592-41	6,350	0.52	0.72	0.83
A1592-47	3,620	0.30	0.41	0.47
A1592-48	3,237	0.27	0.36	0.42
A1592-49	8,942	0.73	1.01	1.17
A1592-59	6,383	0.52	0.72	0.83
A1592-60	9,584	0.79	1.08	1.25
A1592-61	8,753	0.72	0.99	1.14
A1592-62	3,425	0.28	0.39	0.45
A1592-63	5,101	0.42	0.57	0.67
A1592-64	7,910	0.65	0.89	1.03
A1592-65	1,217	0.10	0.14	0.16
A1592-66	564	0.05	0.06	0.07
A1592-67	564	0.05	0.06	0.07
A1592-68	6,347	0.52	0.71	0.83
A1592-69	564	0.05	0.06	0.07
A1592-70	3,853	0.32	0.43	0.50

I_10 EB and Associated Ramps Areas				
Sub-basin	Area	Q_{10}	Q_{50}	Q_{100}
ID	(sf)	(cfs)	(cfs)	(cfs)
AC1580-100	22,961	1.79	2.46	2.82
AC1580-101	192,566	13.82	18.98	21.78
AC1580-102	4,338	0.26	0.36	0.42
AC1580-103	16,958	1.36	1.87	2.14
AC1591-100	1,953	0.16	0.22	0.26
AC1591-102	1,896	0.16	0.21	0.25
AC1591-103	33,241	2.73	3.74	4.34
AC1591-104	13,532	1.11	1.52	1.77
AC1591-105	25,834	2.12	2.91	3.37
AC1591-106	8,564	0.70	0.96	1.12
AC1591-107	5,653	0.46	0.64	0.74
AC1591-108	20,284	1.66	2.28	2.65
AC1591-109	26,470	2.17	2.98	3.46
AC1592-100	12,760	1.05	1.44	1.67
AC1592-101	6,520	0.53	0.73	0.85
AC1592-102	4,660	0.38	0.52	0.61
AC1592-103	25,743	1.70	2.33	2.67
AC1592-104	18,828	1.33	1.82	2.09
AC1592-105	91,220	7.27	9.99	11.46
AC1592-106	118,699	9.15	12.57	14.42
AC1592-107	121,739	9.20	12.64	14.50
AC1592-108	24,086	1.89	2.60	2.98
AC1592-109	17,522	1.44	1.97	2.29
AC1592-110	17,480	1.43	1.97	2.28
AC1592-111	9,987	0.82	1.12	1.30
AC1592-112	32,721	2.68	3.69	4.27
AC1592-113	23,580	1.93	2.66	3.08
AC1592-114	47,725	3.91	5.38	6.23
AC1592-115	44,940	3.69	5.06	5.87
AC1592-116	25,532	2.09	2.88	3.34
AC1592-117	17,064	1.40	1.92	2.23
AC1592-118	20,604	1.69	2.32	2.69
AC1592-119	21,672	1.78	2.44	2.83
AC1592-120	18,302	1.50	2.06	2.39
AC1592-121	18,074	1.48	2.04	2.36
AC1592-122	9,468	0.78	1.07	1.24
AC1592-123	22,328	1.83	2.52	2.92
AC1592-124	22,930	1.88	2.58	3.00
AC1592-125	38,182	2.88	3.95	4.54
AC1592-126	34,437	2.82	3.88	4.50
AC1592-127	63,959	4.78	6.57	7.54
AC1592-128	65,889	4.83	6.64	7.62
AC1592-129	58,116	4.49	6.17	7.08
AC1592-130	31,229	2.56	3.52	4.08
AC1592-131	80,892	6.63	9.11	10.57
AC1592-161	27,128	2.22	3.06	3.54
AC1592-162	64,159	5.26	7.23	8.38
AC1592-163	23,735	1.95	2.67	3.10
AC1592-164	35,361	2.90	3.98	4.62

DHOV Areas				
Sub-basin	Area	Q_{10}	Q_{50}	Q_{100}
ID	(sf)	(cfs)	(cfs)	(cfs)
AR4003-07	8,046	0.66	0.91	1.05
AR4003-08	9,380	0.77	1.06	1.23
AR4003-09	1,623	0.13	0.18	0.21
AR4003-10	8,229	0.67	0.93	1.07
AR4003-11	9,161	0.75	1.03	1.20
AR4003-15	9,337	0.77	1.05	1.22
AR4003-16	4,206	0.34	0.47	0.55
AR4003-17	8,131	0.67	0.92	1.06
AR4003-18	4,099	0.34	0.46	0.54
AR4003-19	4,260	0.35	0.48	0.56
AR4003-20	3,618	0.30	0.41	0.47
AR4003-21	12,339	1.01	1.39	1.61
AR4003-42	8,231	0.67	0.93	1.08
AR4003-43	9,547	0.78	1.08	1.25
AR4003-44	1,720	0.14	0.19	0.22
AR4003-45	8,375	0.69	0.94	1.09
AR4003-46	9,341	0.77	1.05	1.22
AR4003-50	8,811	0.72	0.99	1.15
AR4003-51	648	0.05	0.07	0.08
AR4003-52	2,258	0.19	0.25	0.29
AR4003-53	1,877	0.15	0.21	0.25
AR4003-54	8,141	0.67	0.92	1.06
AR4003-55	4,136	0.34	0.47	0.54
AR4003-56	4,188	0.34	0.47	0.55
AR4003-57	3,682	0.30	0.41	0.48
AR4003-58	12,473	1.02	1.40	1.63

Gutter Flow for I-10/SR-101L DHOV DCR

RUNOFF ZONE: **WB10 NB101N**

Control 0 Use keyboard Delete button to initialize, then enter any character or number to start calculations

spur dike	begin	0	Spacing	-5		
Pier Cap	end	1000	$i_{10,10}$ =	3.8	$i_{50,10}$ =	5.22
Abutment	iteration	1000	$i_{50,10}$ =	5.22	$i_{100,10}$ =	5.99
		0.001				

Sub-Basin	Rational Method Hydrology: Station	Length (ft)	Width (ft)	Area (acre)	C	10-year Rainfall Intensity I (in/hr)	Local Runoff Qrat (cfs)	Carryover Qco (cfs)	Total Q at CP (cfs)
					0.94	3.8			
AR4003-8	18+86.01			0.215	0.940	3.800	0.769	0.000	0.769
AR4003-7	16+04.35			0.185	0.940	3.800	0.660	0.086	0.746
A1592-6	13+37.48			0.177	0.940	3.800	0.634	0.074	0.708
A1592-5	7+01.04			0.423	0.940	3.800	1.511	0.144	1.656
A1592-4	6+49.32			0.034	0.940	3.800	0.123	0.646	0.769
A1592-3	6+00.10			0.033	0.940	3.800	0.117	0.203	0.320
A1592-2	4+04.71			0.130	0.940	3.800	0.465	0.042	0.507
A1592-1	3+54.71			0.033	0.940	3.800	0.119	0.102	0.220
AR4003-9	22+79.76			0.037	0.940	3.800	0.133	0.000	0.133
AR4003-10	25+68.22			0.189	0.940	3.800	0.675	0.005	0.680
AR4003-11	28+87.19			0.210	0.940	3.800	0.751	0.064	0.816
A1592-12	30+13.30			0.081	0.940	3.800	0.288	0.088	0.376
A1592-13	30+64.28			0.073	0.940	3.800	0.262	0.145	0.407
AR4003-19	43+01.78			0.098	0.940	3.800	0.349	0.000	0.349
AR4003-18	41+60.21			0.094	0.940	3.800	0.336	0.085	0.422
AR4003-17	38+77.48			0.187	0.940	3.800	0.667	0.080	0.747
AR4003-16	37+34.96			0.097	0.940	3.800	0.345	0.165	0.510
AR4003-15	34+14.76			0.214	0.940	3.800	0.766	0.081	0.847
A1592-14	31+08.63			0.197	0.940	3.800	0.704	0.115	0.819
AR4003-20	45+84.67			0.083	0.940	3.800	0.297	0.000	0.297
AR4003-21	50+09.37			0.283	0.940	3.800	1.012	0.024	1.036
A1592-22	52+27.71			0.146	0.940	3.800	0.521	0.163	0.684
A1592-23	55+58.26			0.217	0.940	3.800	0.776	0.097	0.873
A1592-24	58+37.43			0.217	0.940	3.800	0.776	0.133	0.909
A1592-25	59+11.58			0.086	0.940	3.800	0.307	0.314	0.621
A1592-32	70+72.00			0.124	0.940	3.800	0.443	0.000	0.443
A1592-31	68+87.00			0.123	0.940	3.800	0.440	0.114	0.554
A1592-30	67+02.00			0.124	0.940	3.800	0.443	0.164	0.607
A1592-29	65+17.00			0.122	0.940	3.800	0.436	0.190	0.626
A1592-28	63+32.00			0.121	0.940	3.800	0.433	0.196	0.629
A1592-27	61+47.00			0.123	0.940	3.800	0.441	0.148	0.589
A1592-26	59+62.00			0.121	0.940	3.800	0.433	0.110	0.543

Sub-Basin	Gutter and Shoulder Data: TYPE	Curb Height (ft)	Curb Face x-slope S_{x1} (ft/ft)	Normal Gutter x-slope S_{x2} (ft/ft)	Gutter Depress d_2 (ft)	A/C Overlay d_3 (ft)	d_1 (ft)	Roadway x-slope S_{x3} (ft/ft)	Gutter Longitdl Slope S_L (ft/ft)	Within Curb Capacity?	Shoulder Width (ft)
AR4003-8	SD101	0.600	1000.000	0.020	0.040	0.000	0.113	0.058	0.025	OK	8.00
AR4003-7	SD101	0.600	1000.000	0.020	0.040	0.000	0.101	0.052	0.038	OK	8.00
A1592-6	SD101	0.600	1000.000	0.020	0.040	0.000	0.090	0.020	0.046	OK	8.00
A1592-5	SD101	0.600	1000.000	0.020	0.040	0.000	0.155	0.020	0.015	OK	8.00
A1592-4	SD101	0.600	1000.000	0.020	0.040	0.000	0.115	0.020	0.015	OK	8.00
A1592-3	SD101	0.600	1000.000	0.020	0.040	0.000	0.082	0.020	0.015	OK	8.00
A1592-2	SD101	0.600	1000.000	0.020	0.040	0.000	0.098	0.020	0.015	OK	8.00
A1592-1	SD101	0.600	1000.000	0.020	0.040	0.000	0.071	0.020	0.015	OK	8.00
AR4003-9	SD101	0.600	1000.000	0.020	0.040	0.000	0.077	0.058	0.004	OK	8.00
AR4003-10	SD101	0.600	1000.000	0.020	0.040	0.000	0.105	0.058	0.026	OK	8.00
AR4003-11	SD101	0.600	1000.000	0.020	0.040	0.000	0.112	0.058	0.028	OK	8.00
A1592-12	SD101	0.600	1000.000	0.020	0.040	0.000	0.089	0.058	0.017	OK	8.00
A1592-13	SD101	0.600	1000.000	0.020	0.040	0.000	0.098	0.058	0.013	OK	8.00
AR4003-19	SD101	0.600	1000.000	0.020	0.040	0.000	0.109	0.020	0.004	OK	8.00
AR4003-18	SD101	0.600	1000.000	0.020	0.040	0.000	0.094	0.020	0.013	OK	8.00
AR4003-17	SD101	0.600	1000.000	0.020	0.040	0.000	0.100	0.020	0.030	OK	8.00
AR4003-16	SD101	0.600	1000.000	0.020	0.040	0.000	0.086	0.020	0.030	OK	8.00
AR4003-15	SD101	0.600	1000.000	0.020	0.040	0.000	0.127	0.058	0.018	OK	8.00
A1592-14	SD101	0.600	1000.000	0.020	0.040	0.000	0.146	0.058	0.009	OK	8.00
AR4003-20	SD101	0.600	1000.000	0.020	0.040	0.000	0.085	0.040	0.013	OK	8.00
AR4003-21	SD101	0.600	1000.000	0.020	0.040	0.000	0.114	0.040	0.039	OK	8.00
A1592-22	SD101	0.600	1000.000	0.020	0.040	0.000	0.091	0.040	0.049	OK	8.00
A1592-23	SD101	0.600	1000.000	0.020	0.040	0.000	0.115	0.040	0.026	OK	8.00
A1592-24	SD101	0.600	1000.000	0.020	0.040	0.000	0.169	0.040	0.005	OK	8.00
A1592-25	SD101	0.600	1000.000	0.020	0.040	0.000	0.200	0.040	0.001	OK	8.00
A1592-32	SD101	0.600	1000.000	0.020	0.040	0.000	0.120	0.020	0.004	OK	8.00
A1592-31	SD101	0.600	1000.000	0.020	0.040	0.000	0.131	0.020	0.004	OK	8.00
A1592-30	SD101	0.600	1000.000	0.020	0.040	0.000	0.136	0.020	0.004	OK	8.00
A1592-29	SD101	0.600	1000.000	0.020	0.040	0.000	0.137	0.020	0.004	OK	8.00
A1592-28	SD101	0.600	1000.000	0.020	0.040	0.000	0.119	0.024	0.009	OK	8.00
A1592-27	SD101	0.600	1000.000	0.020	0.040	0.000	0.145	0.040	0.004	OK	8.00
A1592-26	SD101	0.600	1000.000	0.020	0.040	0.000	0.140	0.040	0.004	OK	8.00

Sub-Basin	Governing Gutter Spread Calculations: Qw (cfs)	Q (cfs)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta	Aw (sq ft)	A (sq ft)	Vw (fps)	V (fps)
				0					
AR4003-8	0.694	0.782	3.259	8.000	OK	0.186	0.232	3.733	3.373
AR4003-7	0.682	0.757	3.177	8.000	OK	0.162	0.198	4.210	3.827
A1592-6	0.593	0.720	4.500	8.000	OK	0.140	0.203	4.237	3.557
A1592-5	0.999	1.666	7.750	8.000	OK	0.270	0.601	3.699	2.774
A1592-4	0.558	0.772	5.750	8.000	OK	0.190	0.331	2.939	2.334
A1592-3	0.277	0.323	4.100	8.000	OK	0.124	0.168	2.236	1.920
A1592-2	0.405	0.512	4.900	8.000	OK	0.156	0.240	2.593	2.133
A1592-1	0.202	0.222	3.550	8.000	OK	0.102	0.126	1.977	1.761
AR4003-9	0.131	0.137	2.638	8.000	OK	0.114	0.126	1.146	1.086
AR4003-10	0.614	0.680	3.121	8.000	OK	0.170	0.206	3.609	3.293
AR4003-11	0.726	0.816	3.241	8.000	OK	0.184	0.229	3.946	3.570
A1592-12	0.354	0.379	2.845	8.000	OK	0.138	0.159	2.565	2.390
A1592-13	0.374	0.408	3.000	8.000	OK	0.156	0.185	2.397	2.207
AR4003-19	0.263	0.353	5.450	8.000	OK	0.178	0.297	1.480	1.189
AR4003-18	0.340	0.422	4.700	8.000	OK	0.148	0.221	2.298	1.909
AR4003-17	0.594	0.760	5.000	8.000	OK	0.160	0.250	3.714	3.042
AR4003-16	0.434	0.516	4.300	8.000	OK	0.132	0.185	3.289	2.791
AR4003-15	0.739	0.858	3.500	8.000	OK	0.214	0.279	3.455	3.073
A1592-14	0.688	0.831	3.828	8.000	OK	0.252	0.349	2.729	2.381
AR4003-20	0.278	0.303	3.125	8.000	OK	0.130	0.155	2.136	1.951
AR4003-21	0.882	1.048	3.850	8.000	OK	0.188	0.256	4.692	4.085
A1592-22	0.626	0.695	3.275	8.000	OK	0.142	0.175	4.407	3.982
A1592-23	0.734	0.875	3.875	8.000	OK	0.190	0.260	3.865	3.360
A1592-24	0.658	0.911	5.225	8.000	OK	0.298	0.506	2.207	1.801
A1592-25	0.417	0.625	6.000	8.000	OK	0.360	0.680	1.158	0.919
A1592-32	0.315	0.447	6.000	8.000	OK	0.200	0.360	1.577	1.242
A1592-31	0.375	0.560	6.550	8.000	OK	0.222	0.429	1.689	1.306
A1592-30	0.403	0.617	6.800	8.000	OK	0.232	0.462	1.738	1.335
A1592-29	0.409	0.629	6.850	8.000	OK	0.234	0.469	1.748	1.340
A1592-28	0.469	0.630	5.292	8.000	OK	0.198	0.328	2.370	1.919
A1592-27	0.456	0.592	4.625	8.000	OK	0.250	0.388	1.826	1.527
A1592-26	0.427	0.546	4.500	8.000	OK	0.240	0.365	1.777	1.495

Sub-Basin	On-Grade Slotted Drain/Curb Inlet Calculations: Catch Basin	Total Q at CP (cfs)	Curb Opening - Slotted Drain Length (ft)	Capture Ratio	Lf (ft)	Lt	E	Qi
AR4003-8	25	0.769	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-7	25	0.746	0.000	0.000	0.000	0.000	0.000	0.000
A1592-6	17	0.708	0.000	0.000	0.000	0.000	0.000	0.000
A1592-5	17	1.656	0.000	0.000	0.000	0.000	0.000	0.000
A1592-4	17	0.769	0.000	0.000	0.000	0.000	0.000	0.000
A1592-3	17	0.320	0.000	0.000	0.000	0.000	0.000	0.000
A1592-2	17	0.507	0.000	0.000	0.000	0.000	0.000	0.000
A1592-1	17	0.220	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-9	25	0.133	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-10	25	0.680	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-11	25	0.816	0.000	0.000	0.000	0.000	0.000	0.000
A1592-12	17	0.376	0.000	0.000	0.000	0.000	0.000	0.000
A1592-13	17	0.407	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-19	25	0.349	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-18	25	0.422	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-17	25	0.747	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-16	25	0.510	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-15	25	0.847	0.000	0.000	0.000	0.000	0.000	0.000
A1592-14	17	0.819	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-20	25	0.297	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-21	25	1.036	0.000	0.000	0.000	0.000	0.000	0.000
A1592-22	17	0.684	0.000	0.000	0.000	0.000	0.000	0.000
A1592-23	17	0.873	0.000	0.000	0.000	0.000	0.000	0.000
A1592-24	17	0.909	0.000	0.000	0.000	0.000	0.000	0.000
A1592-25	17	0.621	0.000	0.000	0.000	0.000	0.000	0.000
A1592-32	17	0.443	0.000	0.000	0.000	0.000	0.000	0.000
A1592-31	17	0.554	0.000	0.000	0.000	0.000	0.000	0.000
A1592-30	17	0.607	0.000	0.000	0.000	0.000	0.000	0.000
A1592-29	17	0.626	0.000	0.000	0.000	0.000	0.000	0.000
A1592-28	17	0.629	0.000	0.000	0.000	0.000	0.000	0.000
A1592-27	17	0.589	0.000	0.000	0.000	0.000	0.000	0.000
A1592-26	17	0.543	0.000	0.000	0.000	0.000	0.000	0.000

Sub-Basin	On-Grade Grate Inlet Calculations: Lf (ft)	Gutter Backslope Grate Width W (ft)	Gutter Pan Grate Width W (ft)	Splash Over Velocity Vo (fps)	On-Grade Eo	Rf	Rs	E	Qi (cfs)	Bypass Flow Qbf (cfs)
										0
AR4003-8	0.896	0.000	0.000	6.990	0.887	1.000	0.027	0.890	0.697	0.086
AR4003-7	0.896	0.000	0.000	6.990	0.900	1.000	0.020	0.902	0.683	0.074
A1592-6	1.500	0.000	1.969	3.855	0.824	0.966	0.025	0.800	0.576	0.144
A1592-5	1.500	0.000	1.969	3.855	0.600	1.000	0.031	0.612	1.020	0.646
A1592-4	1.500	0.000	1.969	3.855	0.724	1.000	0.046	0.736	0.568	0.203
A1592-3	1.500	0.000	1.969	3.855	0.859	1.000	0.074	0.870	0.281	0.042
A1592-2	1.500	0.000	1.969	3.855	0.790	1.000	0.057	0.802	0.411	0.102
A1592-1	1.500	0.000	1.969	3.855	0.909	1.000	0.090	0.917	0.204	0.018
AR4003-9	0.896	0.000	0.000	6.990	0.956	1.000	0.190	0.964	0.132	0.005
AR4003-10	0.896	0.000	0.000	6.990	0.902	1.000	0.029	0.905	0.615	0.064
AR4003-11	0.896	0.000	0.000	6.990	0.889	1.000	0.025	0.892	0.728	0.088
A1592-12	1.500	0.000	1.969	3.855	0.933	1.000	0.153	0.943	0.358	0.021
A1592-13	1.500	0.000	1.969	3.855	0.916	1.000	0.169	0.930	0.380	0.029
AR4003-19	0.896	0.000	0.000	6.990	0.746	1.000	0.049	0.758	0.268	0.085
AR4003-18	0.896	0.000	0.000	6.990	0.806	1.000	0.023	0.811	0.342	0.080
AR4003-17	0.896	0.000	0.000	6.990	0.781	1.000	0.010	0.784	0.596	0.165
AR4003-16	0.896	0.000	0.000	6.990	0.841	1.000	0.012	0.843	0.435	0.081
AR4003-15	0.896	0.000	0.000	6.990	0.861	1.000	0.031	0.866	0.743	0.115
A1592-14	1.500	0.000	1.969	3.855	0.828	1.000	0.139	0.852	0.708	0.123
AR4003-20	0.896	0.000	0.000	6.990	0.916	1.000	0.050	0.921	0.279	0.024
AR4003-21	0.896	0.000	0.000	6.990	0.842	1.000	0.013	0.844	0.884	0.163
A1592-22	1.500	0.000	1.969	3.855	0.901	0.950	0.045	0.860	0.598	0.097
A1592-23	1.500	0.000	1.969	3.855	0.840	0.999	0.056	0.848	0.742	0.133
A1592-24	1.500	0.000	1.969	3.855	0.722	1.000	0.140	0.761	0.693	0.218
A1592-25	1.500	0.000	1.969	3.855	0.667	1.000	0.342	0.781	0.488	0.137
A1592-32	1.500	0.000	1.969	3.855	0.706	1.000	0.130	0.744	0.333	0.114
A1592-31	1.500	0.000	1.969	3.855	0.669	1.000	0.117	0.708	0.397	0.164
A1592-30	1.500	0.000	1.969	3.855	0.653	1.000	0.111	0.692	0.427	0.190
A1592-29	1.500	0.000	1.969	3.855	0.650	1.000	0.110	0.689	0.433	0.196
A1592-28	1.500	0.000	1.969	3.855	0.745	1.000	0.079	0.766	0.482	0.148
A1592-27	1.500	0.000	1.969	3.855	0.771	1.000	0.187	0.813	0.482	0.110
A1592-26	1.500	0.000	1.969	3.855	0.781	1.000	0.194	0.824	0.450	0.096

Sub-Basin	Sag Inlet Calculations: Effective Grate Perimeter (ft)	Sag Point Capture Ratio	Factored Grate Perimeter (ft)	Depth of Weir Flow into Grate (ft)	Local Depression at Inlet (ft)	T2 (ft)	T3 (ft)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta
					1					
AR4003-8	1.791666667	0.5	0.895833333	0.434305	0.083333333	2	5.361586396	7.361586396	14.00	OK
AR4003-7	1.791666667	0.5	0.895833333	0.425368	0.083333333	2	5.829600468	7.829600468	14.00	OK
A1592-6	6.938	0.5	3.469	0.166625	0.083333333	2	2.164601226	4.164601226	14.00	OK
A1592-5	6.938	0.5	3.469	0.293602	0.083333333	2	8.513414778	10.51341478	14.00	OK
A1592-4	6.938	0.5	3.469	0.176137	0.083333333	2	2.640190785	4.640190785	14.00	OK
A1592-3	6.938	0.5	3.469	0.098169	0.083333333	2	0	2	14.00	OK
A1592-2	6.938	0.5	3.469	0.133375	0.083333333	2	0.502108302	2.502108302	14.00	OK
A1592-1	6.938	0.5	3.469	0.076486	0.083333333	2	0	2	14.00	OK
AR4003-9	1.791666667	0.5	0.895833333	0.13483	0.083333333	2	0.198223469	2.198223469	14.00	OK
AR4003-10	1.791666667	0.5	0.895833333	0.399906	0.083333333	2	4.768498752	6.768498752	14.00	OK
AR4003-11	1.791666667	0.5	0.895833333	0.451608	0.083333333	2	5.65990991	7.65990991	14.00	OK
A1592-12	6.938	0.5	3.469	0.109274	0.083333333	2	0	2	14.00	OK
A1592-13	6.938	0.5	3.469	0.115178	0.083333333	2	0	2	14.00	OK
AR4003-19	1.791666667	0.5	0.895833333	0.256592	0.083333333	2	6.662946472	8.662946472	14.00	OK
AR4003-18	1.791666667	0.5	0.895833333	0.290849	0.083333333	2	8.375786457	10.37578646	14.00	OK
AR4003-17	1.791666667	0.5	0.895833333	0.425743	0.083333333	2	15.12048252	17.12048252	14.00	EXCEEDED
AR4003-16	1.791666667	0.5	0.895833333	0.330028	0.083333333	2	10.33472992	12.33472992	14.00	OK
AR4003-15	1.791666667	0.5	0.895833333	0.462975	0.083333333	2	5.855884586	7.855884586	14.00	OK
A1592-14	6.938	0.5	3.469	0.183602	0.083333333	2	1.039119941	3.039119941	14.00	OK
AR4003-20	1.791666667	0.5	0.895833333	0.230107	0.083333333	2	2.669339063	4.669339063	14.00	OK
AR4003-21	1.791666667	0.5	0.895833333	0.529629	0.083333333	2	10.15740334	12.15740334	14.00	OK
A1592-22	6.938	0.5	3.469	0.162905	0.083333333	2	0.989296273	2.989296273	14.00	OK
A1592-23	6.938	0.5	3.469	0.191673	0.083333333	2	1.708489025	3.708489025	14.00	OK
A1592-24	6.938	0.5	3.469	0.196917	0.083333333	2	1.839592184	3.839592184	14.00	OK
A1592-25	6.938	0.5	3.469	0.152727	0.083333333	2	0.734846481	2.734846481	14.00	OK
A1592-32	6.938	0.5	3.469	0.121878	0.083333333	2	0	2	14.00	OK
A1592-31	6.938	0.5	3.469	0.141594	0.083333333	2	0.913028169	2.913028169	14.00	OK
A1592-30	6.938	0.5	3.469	0.150444	0.083333333	2	1.355531864	3.355531864	14.00	OK
A1592-29	6.938	0.5	3.469	0.153508	0.083333333	2	1.5087535	3.5087535	14.00	OK
A1592-28	6.938	0.5	3.469	0.154004	0.083333333	2	1.277930655	3.277930655	14.00	OK
A1592-27	6.938	0.5	3.469	0.147366	0.083333333	2	0.600817707	2.600817707	14.00	OK
A1592-26	6.938	0.5	3.469	0.139708	0.083333333	2	0.409356037	2.409356037	14.00	OK

NOTES:

n-values used: 0.013 for concrete curb, 0.016 for asphalt overlay (which only applies to flow depth d1 that exceeds d2 + d3)

On Ramp curb returns, use C-15.10, C-15.20, C-15.30, or C-15.40 catch basins for Type D, D1, or D2 curb is used.

On freeway mainline, use ADOT C-15.91 catch basin when Type B, C, or E mountable curb is used.

Use ADOT C-15.92 inlet when next to roadway half barrier (HB25 or HB45) or structural barrier (SD101 or SD102).

Splash-over velocity is for parallel bar, 2-inch spacing (grate inlets).

$E_o = Qw / Q$

$Rs = 1/(1+(0.15*V_w^{1.8})/(S_x*L^{2.3}))$

Gutter Flow for I-10/SR-101L DHOV DCR

RUNOFF ZONE: **SB101 EB10**

<<Use keyboard Delete button to Initialize, then enter any character or number to start calculations

spur dike	begin	0	Spacing	-5			
Pier Cap	end	1000	$i_{10,10}$ =	3.8	$i_{50,10}$ =	5.22	
Abutment	iteration	1000	$i_{50,10}$ =	5.22	$i_{100,10}$ =	5.99	
		0.001					

Rational Method Hydrology / Gutter and Shoulder Data

Sub-Basin	Station	Length (ft)	Width (ft)	Area (acre)	C	10-year Rainfall Intensity I (in/hr)	Local Runoff Qrat (cfs)	Carryover Qco (cfs)	Total Q at CP (cfs)	TYPE	Curb Height (ft)	Curb Face X-slope S_{x1} (ft/ft)	Normal Gutter X-slope S_{x2} (ft/ft)	Gutter Depress d_2 (ft)	A/C Overlay d_3 (ft)	d_1 (ft)	Roadway X-slope S_{x3} (ft/ft)	Gutter Longtdl Slope S_L (ft/ft)	Within Curb Capacity?	Shoulder Width (ft)
					0.94	3.8														
AR4003-43	18+85.82	1885.8	28.167	0.219	0.940	3.800	0.783	0.000	0.783	SD101	0.600	1000.000	0.020	0.040	0.000	0.114	0.058	0.025	OK	8.00
AR4003-42	16+04.24	281.6	28.167	0.189	0.940	3.800	0.675	0.089	0.764	SD101	0.600	1000.000	0.020	0.040	0.000	0.097	0.052	0.047	OK	8.00
A1592-41	13+87.53	216.7	28.167	0.146	0.940	3.800	0.521	0.069	0.589	SD101	0.600	1000.000	0.020	0.040	0.000	0.079	0.010	0.049	OK	8.00
A1592-40	13+37.33	50.2	28.167	0.033	0.940	3.800	0.119	0.133	0.252	SD101	0.600	1000.000	0.020	0.040	0.000	0.061	0.020	0.046	OK	8.00
A1592-39	13+37.30	0.0	28.167	0.013	0.940	3.800	0.047	0.012	0.060	SD101	0.600	1000.000	0.020	0.040	0.000	0.035	0.020	0.046	OK	8.00
A1592-38	12+87.53	49.8	28.167	0.021	0.940	3.800	0.076	0.000	0.076	SD101	0.600	1000.000	0.020	0.040	0.000	0.039	0.020	0.043	OK	8.00
A1592-37	7+01.04	586.5	28.167	0.387	0.940	3.800	1.384	0.000	1.384	SD101	0.600	1000.000	0.020	0.040	0.000	0.145	0.020	0.015	OK	8.00
A1592-36	6+49.32	51.7	28.167	0.035	0.940	3.800	0.124	0.506	0.629	SD101	0.600	1000.000	0.020	0.040	0.000	0.107	0.020	0.015	OK	8.00
A1592-35	6+00.27	49.1	28.167	0.032	0.940	3.800	0.116	0.150	0.266	SD101	0.600	1000.000	0.020	0.040	0.000	0.077	0.020	0.015	OK	8.00
A1592-34	3+83.64	216.6	28.167	0.146	0.940	3.800	0.522	0.030	0.552	SD101	0.600	1000.000	0.020	0.040	0.000	0.101	0.020	0.015	OK	8.00
A1592-33	3+33.65	50.0	28.167	0.033	0.940	3.800	0.118	0.116	0.235	SD101	0.600	1000.000	0.020	0.040	0.000	0.073	0.020	0.015	OK	8.00
AR4003-44	22+79.90	2279.9	28.167	0.039	0.940	3.800	0.141	0.000	0.141	SD101	0.600	1000.000	0.020	0.040	0.000	0.079	0.058	0.004	OK	8.00
AR4003-45	28+68.42	588.5	28.167	0.192	0.940	3.800	0.687	0.006	0.692	SD101	0.600	1000.000	0.020	0.040	0.000	0.103	0.058	0.030	OK	8.00
AR4003-46	28+37.49	30.9	28.167	0.214	0.940	3.800	0.766	0.064	0.830	SD101	0.600	1000.000	0.020	0.040	0.000	0.110	0.058	0.033	OK	8.00
A1592-47	30+13.29	175.8	28.167	0.083	0.940	3.800	0.297	0.088	0.385	SD101	0.600	1000.000	0.020	0.040	0.000	0.090	0.058	0.017	OK	8.00
A1592-48	30+64.27	51.0	28.167	0.074	0.940	3.800	0.265	0.146	0.411	SD101	0.600	1000.000	0.020	0.040	0.000	0.099	0.058	0.013	OK	8.00
AR4003-56	43+01.76	4301.8	28.167	0.096	0.940	3.800	0.343	0.000	0.343	SD101	0.600	1000.000	0.020	0.040	0.000	0.108	0.020	0.004	OK	8.00
AR4003-55	41+60.25	141.5	28.167	0.095	0.940	3.800	0.339	0.082	0.422	SD101	0.600	1000.000	0.020	0.040	0.000	0.094	0.020	0.013	OK	8.00
AR4003-54	38+77.49	282.8	28.167	0.187	0.940	3.800	0.668	0.080	0.747	SD101	0.600	1000.000	0.020	0.040	0.000	0.100	0.020	0.030	OK	8.00
AR4003-53	38+16.27	61.2	28.167	0.043	0.940	3.800	0.154	0.165	0.319	SD101	0.600	1000.000	0.020	0.040	0.000	0.072	0.020	0.030	OK	8.00
AR4003-52	37+35.02	81.3	28.167	0.052	0.940	3.800	0.185	0.031	0.216	SD101	0.600	1000.000	0.020	0.040	0.000	0.058	0.004	0.030	OK	8.00
AR4003-51	37+35.00	0.0	28.167	0.015	0.940	3.800	0.053	0.038	0.091	SD101	0.600	1000.000	0.020	0.040	0.000	0.045	0.004	0.030	OK	8.00
AR4003-50	34+14.85	320.2	28.167	0.202	0.940	3.800	0.723	0.001	0.724	SD101	0.600	1000.000	0.020	0.040	0.000	0.118	0.058	0.018	OK	8.00
A1592-49	31+08.78	306.1	28.167	0.205	0.940	3.800	0.733	0.086	0.819	SD101	0.600	1000.000	0.020	0.040	0.000	0.146	0.058	0.009	OK	8.00
AR4003-57	45+84.70	4584.7	28.167	0.085	0.940	3.800	0.302	0.000	0.302	SD101	0.600	1000.000	0.020	0.040	0.000	0.085	0.040	0.013	OK	8.00
AR4003-58	50+09.50	424.8	28.167	0.286	0.940	3.800	1.023	0.024	1.047	SD101	0.600	1000.000	0.020	0.040	0.000	0.114	0.040	0.039	OK	8.00
A1592-59	52+27.01	217.5	28.167	0.147	0.940	3.800	0.523	0.163	0.687	SD101	0.600	1000.000	0.020	0.040	0.000	0.091	0.040	0.049	OK	8.00
A1592-60	55+58.53	331.5	28.167	0.220	0.940	3.800	0.786	0.097	0.883	SD101	0.600	1000.000	0.020	0.040	0.000	0.116	0.040	0.026	OK	8.00
A1592-61	58+58.61	300.1	28.167	0.201	0.940	3.800	0.718	0.200	0.917	SD101	0.600	1000.000	0.020	0.040	0.000	0.185	0.040	0.003	OK	8.00
A1592-70	70+72.40	1213.8	28.167	0.088	0.940	3.800	0.316	0.000	0.316	SD101	0.600	1000.000	0.020	0.040	0.000	0.105	0.020	0.004	OK	8.00
A1360-69A	68+11.86	6811.9	28.167	0.206	0.940	3.800	0.735	0.064	0.799	SD101	0.600	1000.000	0.020	0.040	0.000	0.151	0.020	0.004	OK	8.00
A1592-69	67+91.86	280.5	28.167	0.013	0.940	3.800	0.046	0.000	0.046	SD101	0.600	1000.000	0.020	0.040	0.000	0.051	0.020	0.004	OK	8.00
A1592-68	65+74.50	217.4	28.167	0.146	0.940	3.800	0.520	0.000	0.521	SD101	0.600	1000.000	0.020	0.040	0.000	0.128	0.019	0.004	OK	8.00
A1360-67A	65+27.26	264.6	28.167	0.032	0.940	3.800	0.114	0.157	0.271	SD101	0.600	1000.000	0.020	0.040	0.000	0.094	0.011	0.004	OK	8.00
A1592-67	65+07.26	20.0	28.167	0.013	0.940	3.800	0.046	0.000	0.046	SD101	0.600	1000.000	0.020	0.040	0.000	0.051	0.007	0.004	OK	8.00
A1360-66A	64+82.96	24.3	28.167	0.019	0.940	3.800	0.068	0.002	0.069	SD101	0.600	1000.000	0.020	0.040	0.000	0.057	0.004	0.004	OK	8.00
A1592-66	64+62.96	20.0	28.167	0.013	0.940	3.800	0.046	0.000	0.046	SD101	0.600	1000.000	0.020	0.040	0.000	0.048	0.001	0.004	OK	8.00
A1592-65	64+19.75	43.2	28.167	0.028	0.940	3.800	0.100	0.006	0.106	SD101	0.600	1000.000	0.020	0.040	0.000	0.067	0.009	0.004	OK	8.00
A1592-64	61+40.05	279.7	28.167	0.182	0.940	3.800	0.649	0.014	0.662	SD101	0.600	1000.000	0.020	0.040	0.000	0.153	0.040	0.004	OK	8.00
A1592-63	59+66.42	173.6	28.167	0.117	0.940	3.800	0.418	0.136	0.555	SD101	0.600	1000.000	0.020	0.040	0.000	0.141	0.040	0.004	OK	8.00
A1592-62	59+11.58	54.8	28.167	0.079	0.940	3.800	0.281	0.099	0.380	SD101	0.600	1000.000	0.020	0.040	0.000	0.162	0.040	0.001	OK	8.00

Governing Gutter Spread Calculations / On-Grade Slotted Drain/Curb Inlet Calculations

Sub-Basin	Qw (cfs)	Q (cfs)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta	Aw (sq ft)	A (sq ft)	Vw (fps)	V (fps)	Catch Basin	Total Q at CP (cfs)	Curb Opening - Slotted Drain Length (ft)	Capture Ratio	Lf (ft)	Lt	E	Qi
				0													
AR4003-43	0.707	0.798	3.276	8.000	OK	0.188	0.235	3.759	3.393	25	0.783	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-42	0.696	0.766	3.101	8.000	OK	0.154	0.185	4.520	4.132	25	0.764	0.000	0.000	0.000	0.000	0.000	0.000
A1592-41	0.464	0.595	5.778	8.000	OK	0.118	0.192	3.934	3.106	17	0.589	0.000	0.000	0.000	0.000	0.000	0.000
A1592-40	0.250	0.263	3.050	8.000	OK	0.082	0.093	3.051	2.825	17	0.252	0.000	0.000	0.000	0.000	0.000	0.000
A1592-39	0.060	0.060	1.750	8.000	OK	0.031	0.031	1.972	1.972	17	0.060	0.000	0.000	0.000	0.000	0.000	0.000
A1592-38	0.078	0.078	1.950	8.000	OK	0.038	0.038	2.052	2.052	17	0.076	0.000	0.000	0.000	0.000	0.000	0.000
A1592-37	0.879	1.403	7.250	8.000	OK	0.250	0.526	3.517	2.668	17	1.384	0.000	0.000	0.000	0.000	0.000	0.000
A1592-36	0.483	0.641	5.350	8.000	OK	0.174	0.286	2.776	2.239	17	0.629	0.000	0.000	0.000	0.000	0.000	0.000
A1592-35	0.242	0.274	3.850	8.000	OK	0.114	0.148	2.121	1.850	17	0.266	0.000	0.000	0.000	0.000	0.000	0.000
A1592-34	0.430	0.554	5.050	8.000	OK	0.162	0.255	2.657	2.171	17	0.552	0.000	0.000	0.000	0.000	0.000	0.000
A1592-33	0.214	0.238	3.650	8.000	OK	0.106	0.133	2.016	1.783	17	0.235	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-44	0.138	0.145	2.672	8.000	OK	0.118	0.131	1.170	1.106	25	0.141	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-45	0.632	0.697	3.086	8.000	OK	0.166	0.200	3.804	3.480	25	0.692	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-46	0.753	0.843	3.207	8.000	OK	0.180	0.222	4.181	3.792	25	0.830	0.000	0.000	0.000	0.000	0.000	0.000
A1592-47	0.362	0.389	2.862	8.000	OK	0.140	0.162	2.589	2.409	17	0.385	0.000	0.000	0.000	0.000	0.000	0.000
A1592-48	0.382	0.418	3.017	8.000	OK	0.158	0.188	2.417	2.222	17	0.411	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-56	0.259	0.346	5.400	8.000	OK	0.176	0.292	1.474	1.187	25	0.343	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-55	0.340	0.422	4.700	8.000	OK	0.148	0.221	2.298	1.909	25	0.422	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-54	0.594	0.760	5.000	8.000	OK	0.160	0.250	3.714	3.042	25	0.747	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-53	0.295	0.326	3.600	8.000	OK	0.104	0.130	2.834	2.515	25	0.319	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-52	0.178	0.216	7.123	8.000	OK	0.076	0.122	2.344	1.770	25	0.216	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-51	0.094	0.096	3.423	8.000	OK	0.050	0.054	1.889	1.787	25	0.091	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-50	0.639	0.728	3.345	8.000	OK	0.196	0.248	3.262	2.931	25	0.724	0.000	0.000	0.000	0.000	0.000	0.000
A1592-49	0.688	0.831	3.828	8.000	OK	0.252	0.349	2.729	2.381	17	0.819	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-57	0.278	0.303	3.125	8.000	OK	0.130	0.155	2.136	1.951	25	0.302	0.000	0.000	0.000	0.000	0.000	0.000
AR4003-58	0.882	1.048	3.850	8.000	OK	0.188	0.256	4.692	4.085	25	1.047	0.000	0.000	0.000	0.000	0.000	0.000
A1592-59	0.626	0.695	3.275	8.000	OK	0.142	0.175	4.407	3.982	17	0.687	0.000	0.000	0.000	0.000	0.000	0.000
A1592-60	0.747	0.893	3.900	8.000	OK	0.192	0.264	3.892	3.378	17	0.883	0.000	0.000	0.000	0.000	0.000	0.000
A1592-61	0.641	0.925	5.625	8.000	OK	0.330	0.593	1.942	1.561	17	0.917	0.000	0.000	0.000	0.000	0.000	0.000
A1592-70	0.241	0.317	5.250	8.000	OK	0.170	0.276	1.419	1.150	17	0.316	0.000	0.000	0.000	0.000	0.000	0.000
A1360-69A	0.493	0.808	7.550	8.000	OK	0.262	0.570	1.883	1.418	22	0.799	20.000	0.670	13.400	13.129	1.000	0.808
A1592-69	0.048	0.049	2.550	8.000	OK	0.062	0.065	0.773	0.747	17	0.046	0.000	0.000	0.000	0.000	0.000	0.000
A1592-68	0.350	0.528	6.714	8.000	OK	0.216	0.423	1.621	1.246	17	0.521	0.000	0.000	0.000	0.000	0.000	0.000
A1360-67A	0.188	0.272	7.063	8.000	OK	0.148	0.285	1.269	0.957	22	0.271	20.000	0.670	13.400	8.199	1.000	0.272
A1592-67	0.047	0.049	3.547	8.000	OK	0.062	0.071	0.755	0.690	17	0.046	0.000	0.000	0.000	0.000	0.000	0.000
A1360-66A	0.062	0.073	6.781	8.000	OK	0.074	0.115	0.832	0.638	22	0.069	20.000	0.670	13.400	4.721	1.000	0.073
A1592-66	0.040	0.046	11.000	8.000	EXCEEDED	0.056	0.092	0.718	0.505	17	0.046	0.000	0.000	0.000	0.000	0.000	0.000
A1592-65	0.090	0.106	5.038	8.000	OK	0.094	0.135	0.956	0.784	17	0.106	0.000	0.000	0.000	0.000	0.000	0.000
A1592-64	0.506	0.671	4.825	8.000	OK	0.266	0.426	1.902	1.577	17	0.662	0.000	0.000	0.000	0.000	0.000	0.000
A1592-63	0.432	0.555	4.525	8.000	OK	0.242	0.370	1.787	1.502	17	0.555	0.000	0.000	0.000	0.000	0.000	0.000
A1592-62	0.281	0.382	5.050	8.000	OK	0.284	0.470	0.990	0.813	17	0.380	0.000	0.000	0.000	0.000	0.000	0.000

On-Grade Grate Inlet Calculations / Sag Inlet Calculations

Sub-Basin	Lf (ft)	Gutter Backslope Grate Width W (ft)	Gutter Pan Grate Width W (ft)	Splash Over Velocity Vo (fps)	On-Grade Eo	Rf	Rs	E	Qi (cfs)	Bypass Flow (cfs)	Qbf	Effective Grate Perimeter (ft)	Sag Point Capture Ratio	Factored Grate Perimeter (ft)	Depth of Weir Flow into Grate (ft)	Local Depression at Inlet (ft)	T2 (ft)	T3 (ft)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta
										0						1					
AR4003-43	0.896	0.000	0.000	6.990	0.885	1.000	0.027	0.889	0.709	0.089		1.791666667	0.5	0.895833333	0.439443	0.083333333	2	5.450172303	7.450172303	14.00	OK
AR4003-42	0.896	0.000	0.000	6.990	0.909	1.000	0.017	0.910	0.697	0.069		1.791666667	0.5	0.895833333	0.432322	0.083333333	2	5.966306581	7.966306581	14.00	OK
A1592-41	1.500	0.000	1.969	3.855	0.780	0.993	0.015	0.777	0.463	0.133		6.938	0.5	3.469	0.147463	0.083333333	2	2.337628708	4.337628708	14.00	OK
A1592-40	1.500	0.000	1.969	3.855	0.952	1.000	0.044	0.954	0.251	0.012		6.938	0.5	3.469	0.083645	0.083333333	2	0	2	14.00	OK
A1592-39	1.500	0.000	1.969	3.855	1.000	1.000	0.091	1.000	0.060	0.000		6.938	0.5	3.469	0.031979	0.083333333	2	0	2	14.00	OK
A1592-38	1.500	0.000	1.969	3.855	1.000	1.000	0.085	1.000	0.078	0.000		6.938	0.5	3.469	0.037586	0.083333333	2	0	2	14.00	OK
A1592-37	1.500	0.000	1.969	3.855	0.627	1.000	0.034	0.640	0.897	0.506		6.938	0.5	3.469	0.26049	0.083333333	2	6.857846505	8.857846505	14.00	OK
A1592-36	1.500	0.000	1.969	3.855	0.754	1.000	0.051	0.766	0.491	0.150		6.938	0.5	3.469	0.154036	0.083333333	2	1.53514147	3.53514147	14.00	OK
A1592-35	1.500	0.000	1.969	3.855	0.882	1.000	0.080	0.891	0.244	0.030		6.938	0.5	3.469	0.086707	0.083333333	2	0	2	14.00	OK
A1592-34	1.500	0.000	1.969	3.855	0.777	1.000	0.055	0.790	0.437	0.116		6.938	0.5	3.469	0.141199	0.083333333	2	0.893284161	2.893284161	14.00	OK
A1592-33	1.500	0.000	1.969	3.855	0.900	1.000	0.087	0.909	0.216	0.022		6.938	0.5	3.469	0.079881	0.083333333	2	0	2	14.00	OK
AR4003-44	0.896	0.000	0.000	6.990	0.952	1.000	0.184	0.961	0.139	0.006		1.791666667	0.5	0.895833333	0.140199	0.083333333	2	0.290795936	2.290795936	14.00	OK
AR4003-45	0.896	0.000	0.000	6.990	0.906	1.000	0.026	0.909	0.633	0.064		1.791666667	0.5	0.895833333	0.4049	0.083333333	2	4.854589216	6.854589216	14.00	OK
AR4003-46	0.896	0.000	0.000	6.990	0.893	1.000	0.022	0.895	0.755	0.088		1.791666667	0.5	0.895833333	0.456748	0.083333333	2	5.748527223	7.748527223	14.00	OK
A1592-47	1.500	0.000	1.969	3.855	0.931	1.000	0.151	0.942	0.366	0.023		6.938	0.5	3.469	0.111037	0.083333333	2	0	2	14.00	OK
A1592-48	1.500	0.000	1.969	3.855	0.914	1.000	0.167	0.928	0.388	0.030		6.938	0.5	3.469	0.116009	0.083333333	2	0	2	14.00	OK
AR4003-56	0.896	0.000	0.000	6.990	0.750	1.000	0.049	0.762	0.264	0.082		1.791666667	0.5	0.895833333	0.253698	0.083333333	2	6.518253368	8.518253368	14.00	OK
AR4003-55	0.896	0.000	0.000	6.990	0.806	1.000	0.023	0.811	0.342	0.080		1.791666667	0.5	0.895833333	0.29085	0.083333333	2	8.375824956	10.37582496	14.00	OK
AR4003-54	0.896	0.000	0.000	6.990	0.781	1.000	0.010	0.784	0.596	0.165		1.791666667	0.5	0.895833333	0.426052	0.083333333	2	15.13595823	17.13595823	14.00	EXCEEDED
AR4003-53	0.896	0.000	0.000	6.990	0.904	1.000	0.016	0.906	0.295	0.031		1.791666667	0.5	0.895833333	0.241295	0.083333333	2	5.898082998	7.898082998	14.00	OK
AR4003-52	0.896	0.000	0.000	6.990	0.824	1.000	0.004	0.825	0.178	0.038		1.791666667	0.5	0.895833333	0.186118	0.083333333	2	17.86860113	19.86860113	14.00	EXCEEDED
AR4003-51	0.896	0.000	0.000	6.990	0.987	1.000	0.006	0.987	0.094	0.001		1.791666667	0.5	0.895833333	0.104682	0.083333333	2	0	2	14.00	OK
AR4003-50	0.896	0.000	0.000	6.990	0.878	1.000	0.035	0.882	0.643	0.086		1.791666667	0.5	0.895833333	0.417037	0.083333333	2	5.063861601	7.063861601	14.00	OK
A1592-49	1.500	0.000	1.969	3.855	0.828	1.000	0.139	0.852	0.708	0.123		6.938	0.5	3.469	0.18365	0.083333333	2	1.039950392	3.039950392	14.00	OK
AR4003-57	0.896	0.000	0.000	6.990	0.916	1.000	0.050	0.921	0.279	0.024		1.791666667	0.5	0.895833333	0.232831	0.083333333	2	2.737452601	4.737452601	14.00	OK
AR4003-58	0.896	0.000	0.000	6.990	0.842	1.000	0.013	0.844	0.884	0.163		1.791666667	0.5	0.895833333	0.533359	0.083333333	2	10.25063776	12.25063776	14.00	OK
A1592-59	1.500	0.000	1.969	3.855	0.901	0.950	0.045	0.860	0.598	0.097		6.938	0.5	3.469	0.163299	0.083333333	2	0.999142569	2.999142569	14.00	OK
A1592-60	1.500	0.000	1.969	3.855	0.837	0.997	0.055	0.843	0.753	0.140		6.938	0.5	3.469	0.193081	0.083333333	2	1.743702955	3.743702955	14.00	OK
A1592-61	1.500	0.000	1.969	3.855	0.693	1.000	0.170	0.745	0.689	0.236		6.938	0.5	3.469	0.198063	0.083333333	2	1.868249958	3.868249958	14.00	OK
A1592-70	1.500	0.000	1.969	3.855	0.761	1.000	0.153	0.798	0.253	0.064		6.938	0.5	3.469	0.097321	0.083333333	2	0	2	14.00	OK
A1360-69A	0.000	0.000	0.146	0.000	0.000	0.831	0.000	0.000	0.000	0.000		0.292	0	0	#DIV/0!	0.083333333	2	#DIV/0!	#DIV/0!	14.00	#DIV/0!
A1592-69	1.500	0.000	1.969	3.855	0.986	1.000	0.350	0.991	0.048	0.000		6.938	0.5	3.469	0.02703	0.083333333	2	0	2	14.00	OK
A1592-68	1.500	0.000	1.969	3.855	0.663	1.000	0.117	0.703	0.371	0.157		6.938	0.5	3.469	0.13582	0.083333333	2	0.668936151	2.668936151	14.00	OK
A1360-67A	0.000	0.000	0.146	0.000	0.000	0.886	0.000	0.000	0.000	0.000		0.292	0	0	#DIV/0!	0.083333333	2	#DIV/0!	#DIV/0!	14.00	#DIV/0!
A1592-67	1.500	0.000	1.969	3.855	0.963	1.000	0.166	0.969	0.047	0.002		6.938	0.5	3.469	0.02703	0.083333333	2	0	2	14.00	OK
A1360-66A	0.000	0.000	0.146	0.000	0.000	0.925	0.000	0.000	0.000	0.000		0.292	0	0	#DIV/0!	0.083333333	2	#DIV/0!	#DIV/0!	14.00	#DIV/0!
A1592-66	1.500	0.000	1.969	3.855	0.866	1.000	0.027	0.869	0.040	0.006		6.938	0.5	3.469	0.02703	0.083333333	2	0	2	14.00	OK
A1592-65	1.500	0.000	1.969	3.855	0.849	1.000	0.140	0.870	0.092	0.014		6.938	0.5	3.469	0.046938	0.083333333	2	0	2	14.00	OK
A1592-64	1.500	0.000	1.969	3.855	0.754	1.000	0.176	0.797	0.535	0.136		6.938	0.5	3.469	0.159413	0.083333333	2	0.901995112	2.901995112	14.00	OK
A1592-63	1.500	0.000	1.969	3.855	0.779	1.000	0.192	0.822	0.456	0.099		6.938	0.5	3.469	0.141597	0.083333333	2	0.456582069	2.456582069	14.00	OK
A1592-62	1.500	0.000	1.969	3.855	0.736	1.000	0.408	0.844	0.322	0.060		6.938	0.5	3.469	0.110017	0.083333333	2	0	2	14.00	OK

NOTES:

n-values used: 0.013 for concrete curb, 0.016 for asphalt overlay (which only applies to flow depth d1 that exceeds d2 + d3)

On Ramp curb returns, use C-15.10, C-15.20, C-15.30, or C-15.40 catch basins for Type D, D1, or D2 curb is used.

On freeway mainline, use ADOT C-15.91 catch basin when Type B, C, or E mountable curb is used.

Use ADOT C-15.92 inlet when next to roadway half barrier (HB25 or HB45) or structural barrier (SD101 or SD102).

Splash-over velocity is for parallel bar, 2-inch spacing (grate inlets).

$E_o = Qw / Q$

$Rs = 1/(1+(0.15*V_w^{1.8})/(S_x*L^{2.3}))$

GUTTER FLOW FOR I-10/SR101L DHOV DCR

RUNOFF ZONE: **EB10**

			Control		
			5	<<Use keyboard Delete button to Initialize, then enter any character or number to start calculations	
spur dike	begin		0	Spacing	-5
Pier Cap	end		1000	$i_{10,10}$=	3.8
Abutment	iteration		1000	$i_{50,10}$ =	5.22
			0.001		

Sub-Basin	Station	Length (ft)	Width (ft)	Area (acre)	C	10-year Rainfall Intensity I (in/hr)	Local Runoff Qrat (cfs)	Carryover Qco (cfs)	Total Q at CP (cfs)	TYPE	Curb Height (ft)	Curb Face X-slope S_{x1} (ft/ft)	Normal Gutter X-slope S_{x2} (ft/ft)	Gutter Depress d_2 (ft)	A/C Overlay d_3 (ft)	d_1 (ft)	Roadway X-slope S_{x3} (ft/ft)	Gutter Longtdl Slope S_L (ft/ft)	Within Curb Capacity?	Shoulder Width (ft)	Qw (cfs)	Q (cfs)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta	Aw (sq ft)	A (sq ft)	Vw (fps)	V (fps)
Rational Method Hydrology										Gutter and Shoulder Data											Governing Gutter Spread Calculations								
					0.94	3.8																		6					
	7069+80.00																												
C1591-100	7066+92.00	208.310	45.000	0.045	0.940	3.800	0.160	0.000	0.160	C	0.250	0.167	0.021	0.041	0.000	0.096	0.020	0.001	OK	12.00	0.132	0.161	4.703	18.000	OK	0.175	0.251	0.756	0.641
bypass goes to infield area																													
C1592-102	7069+63.00	180.000	43.500	0.107	0.940	3.800	0.382	0.000	0.382	HB45	0.600	1000.000	0.020	0.040	0.000	0.139	0.020	0.001	OK	12.00	0.247	0.383	6.950	18.000	OK	0.238	0.483	1.037	0.793
C1592-101	7069+76.00	192.000	43.500	0.150	0.940	3.800	0.535	0.103	0.638	HB45	0.600	1000.000	0.020	0.040	0.000	0.170	0.020	0.001	OK	12.00	0.362	0.644	8.500	18.000	OK	0.300	0.723	1.208	0.891
C1592-100	7071+65.00	304.000	55.000	0.293	0.940	3.800	1.046	0.227	1.273	HB45	0.600	1000.000	0.020	0.040	0.000	0.222	0.020	0.001	OK	12.00	0.594	1.285	11.100	18.000	OK	0.404	1.232	1.470	1.043
bypass to existing system west of project area																													
HP																													
C1592-161	7093+46.00	0.000	0.000	0.623	0.940	3.800	2.225	0.000	2.225	HB45	0.600	1000.000	0.020	0.040	0.000	0.182	0.020	0.012	OK	10.00	1.208	2.254	9.100	16.000	OK	0.324	0.828	3.728	2.722
C1592-162	7094+00.00	0.000	0.000	1.473	0.940	3.800	5.261	1.014	6.275	HB45	0.600	1000.000	0.020	0.040	0.000	0.271	0.020	0.012	OK	10.00	2.502	6.331	13.550	16.000	OK	0.502	1.836	4.984	3.448
C1592-163	7099+60.00	0.000	0.000	0.545	0.940	3.800	1.946	4.012	5.959	HB45	0.600	1000.000	0.020	0.040	0.000	0.265	0.020	0.012	OK	10.00	2.403	5.973	13.250	16.000	OK	0.490	1.756	4.904	3.402
Bypass to Infield Area																													
C1592-164	7092+96.00	0.000	0.000	0.812	0.940	3.800	2.900	0.000	2.900	HB45	0.600	1000.000	0.020	0.040	0.000	0.198	0.020	0.013	OK	4.00	1.472	2.921	9.900	10.000	OK	0.356	0.980	4.134	2.980
C1592-103A	7093+26.00	0.000	0.000	0.071	0.940	3.800	0.252	1.449	1.701	HB45	0.600	1000.000	0.020	0.040	0.000	0.161	0.020	0.013	OK	4.00	0.999	1.711	8.050	10.000	OK	0.282	0.648	3.544	2.640
C1592-103	7093+46.00	1492.000	131.500	0.065	0.940	3.800	0.231	0.448	0.679	HB45	0.600	1000.000	0.020	0.040	0.000	0.115	0.020	0.012	OK	4.00	0.499	0.690	5.750	10.000	OK	0.190	0.331	2.626	2.086
C1592-104	7094+00.00	54.000	124.000	0.194	0.940	3.800	0.693	0.180	0.873	HB45	0.600	1000.000	0.020	0.040	0.000	0.127	0.020	0.012	OK	4.00	0.607	0.891	6.350	10.000	OK	0.214	0.403	2.838	2.209
C1592-105A	7099+50.00			1.819	0.940	3.800	6.499	0.269	6.768	HB45	0.600	1000.000	0.020	0.040	0.000	0.279	0.020	0.012	OK	10.32	2.636	6.829	13.950	16.320	OK	0.518	1.946	5.089	3.509
C1592-105	7099+60.00	560.000	129.500	0.046	0.940	3.800	0.165	5.093	5.258	HB45	0.600	1000.000	0.020	0.040	0.000	0.253	0.020	0.012	OK	10.56	2.211	5.295	12.650	16.560	OK	0.466	1.600	4.743	3.309
C1592-106	7102+35.00	708.000	131.333	2.083	0.940	3.800	7.442	3.199	10.640	HB45	0.600	1000.000	0.020	0.040	0.000	0.328	0.020	0.013	OK	12.00	3.596	10.642	16.400	18.000	OK	0.616	2.690	5.836	3.957
LP																													
C1592-108	7103+14.00	191.000	123.000	0.463	0.940	3.800	1.654	0.000	1.654	HB45	0.600	1000.000	0.020	0.040	0.000	0.161	0.020	0.013	OK	12.00	0.981	1.678	8.050	18.000	OK	0.282	0.648	3.477	2.590
C1592-107	7106+68.00	741.000	114.500	1.936	0.940	3.800	6.916	0.674	7.590	HB45	0.600	1000.000	0.020	0.040	0.000	0.289	0.020	0.013	OK	12.00	2.870	7.650	14.450	18.000	OK	0.538	2.088	5.334	3.664
C1592-111	7121+26.00	87.000	119.000	0.229	0.940	3.800	0.819	0.000	0.819	HB45	0.600	1000.000	0.020	0.040	0.000	0.122	0.020	0.013	OK	10.00	0.574	0.821	6.100	16.000	OK	0.204	0.372	2.811	2.206
C1592-110	7119+72.00	154.000	118.000	0.401	0.940	3.800	1.433	0.235	1.668	HB45	0.600	1000.000	0.020	0.040	0.000	0.161	0.020	0.013	OK	10.00	0.981	1.678	8.050	16.000	OK	0.282	0.648	3.477	2.590
C1592-109	7118+22.00	150.000	120.000	0.402	0.940	3.800	1.437	0.674	2.110	HB45	0.600	1000.000	0.020	0.040	0.000	0.176	0.020	0.013	OK	9.00	1.160	2.113	8.800	15.000	OK	0.312	0.774	3.717	2.728
C1591-103	15+12.00	351.500	95.053	0.763	0.940	3.800	2.726	0.923	3.649	C	0.250	0.167	0.021	0.041	0.000	0.212	0.020	0.012	OK	12.00	1.981	3.680	10.503	18.000	OK	0.508	1.239	3.900	2.969
C1591-102	14+42.00	69.000	28.200	0.044	0.940	3.800	0.155	1.650	1.806	C	0.250	0.167	0.021	0.041	0.000	0.156	0.020	0.014	OK	12.00	1.161	1.807	7.703	18.000	OK	0.337	0.668	3.445	2.704
C1591-107	13+22.00	203.000	28.000	0.130	0.940	3.800	0.464	0.848	1.312	C	0.250	0.167	0.021	0.041	0.000	0.169	0.020	0.005	OK	12.00	0.817	1.330	8.353	18.000	OK	0.375	0.785	2.179	1.695
Sag - 91st Ave Ramp D																													
xC1591-107	1+55.00	0.000	0.000	0.099	0.940	3.800	0.354	0.000	0.354	C	0.250	0.167	0.021	0.041	0.000	0.085	0.020	0.013	OK	12.00	0.310	0.358	4.153	18.000	OK	0.147	0.196	2.100	1.825
xC1591-106	4+89.00	0.000	0.000	0.239	0.940	3.800	0.852	0.044	0.896	C	0.250	0.167	0.021	0.041	0.000	0.120	0.020	0.014	OK	12.00	0.675	0.912	5.903	18.000	OK	0.237	0.393	2.844	2.318
C1591-106	7+86.00	292.000	28.000	0.197	0.940	3.800	0.702	0.226	0.928	C	0.250	0.167	0.021	0.041	0.000	0.129	0.020	0.010	OK	12.00	0.670	0.940	6.353	18.000	OK	0.261	0.455	2.562	2.064
C1592-112	7125+00.00	289.000	119.000	0.751	0.940	3.800	2.683	0.000	2.683	HB45	0.600	1000.000	0.020	0.040	0.000	0.264	0.020	0.003	OK	10.00	1.091	2.702	13.200	16.000	OK	0.488	1.742	2.235	1.551
C1592-113	7127+00.00	198.000	119.000	0.541	0.940	3.800	1.934	1.493	3.426	HB45	0.600	1000.000	0.020	0.040	0.000	0.256	0.020	0.005	OK	10.00	1.422	3.439	12.800	16.000	OK	0.472	1.638	3.014	2.099
C1592-114A	7131+10.00			1.068	0.940	3.800	3.817	1.927	5.743	HB45	0.600	1000.000	0.020	0.040	0.000	1.001	0.020	0.005	overtopped	10.00	0.000	0.000	0.000	16.000	OK	0.000	0.000	#DIV/0!	#DIV/0!
C1592-114	7131+00.00	400.000	119.000	0.027	0.940	3.800	0.097	0.000	0.097	HB45	0.600	1000.000	0.020	0.040	0.000	0.065	0.020	0.005	OK	10.00	0.093	0.099	3.250	16.000	OK	0.090	0.106	1.034	0.941
C1592-115A	7134+56.00			0.977	0.940	3.800	3.490	0.005	3.495	HB45	0.600	1000.000	0.020	0.040	0.000	0.258	0.020	0.005	OK	10.00	1.443	3.509	12.900	16.000	OK	0.476	1.664	3.030	2.109
C1592-115	7134+76.00	376.000	119.000	0.054	0.940	3.800	0.195	0.920	1.114	HB45	0.600	1000.000	0.020	0.040	0.000	0.166	0.020	0.005	OK	10.00	0.640	1.119	8.300	16.000	OK	0.292	0.689	2.193	1.625
C1592-116	7137+00.00	224.000	119.000	0.586	0.940	3.800	2.094	0.443	2.536	HB45	0.600	1000.000	0.020	0.040	0.000	0.228	0.020	0.005	OK	10.00	1.153	2.545	11.400	16.000	OK	0.416	1.300	2.771	1.959
C1592-117	7138+48.00	148.000	122.000	0.392	0.940	3.800	1.399	1.321	2.720	HB45	0.600	1000.000	0.020	0.040	0.000	0.234	0.020	0.005	OK	10.00	1.209	2.723	11.700	16.000	OK	0.428	1.369	2.824	1.989
C1592-118	7140+00.00	152.000	138.000	0.473	0.940	3.800	1.690	1.439	3.129	HB45	0.600	1000.000	0.020	0.040	0.000	0.247	0.020	0.005	OK	10.00	1.333	3.134	12.350	16.000	OK	0.454	1.525	2.937	2.054
C1592-119	7141+49.00	149.000	138.000	0.498	0.940	3.800	1.777	1.717	3.494	HB45	0.600	1000.000	0.020	0.040	0.000	0.263	0.020	0.004	OK	10.00	1.420	3.507	13.150	16.000	OK	0.486	1.729	2.921	2.028
C1592-120	7142+85.00	136.000	145.000	0.420	0.940	3.800	1.501	1.989	3.490	HB45	0.600	1000.000	0.020	0.040	0.000	0.263	0.020	0.004	OK	10.00	1.420	3.507	13.150	16.000	OK	0.486	1.729	2.921	2.028
C1592-121	7144+14.00	130.000	151.000	0.415	0.940	3.800	1.482	1.989	3.471	HB45	0.600	1000.000	0.020	0.040	0.000	0.262	0.020	0.004	OK	10.00	1.410	3.472	13.100	16.000	OK	0.484	1.716	2.913	2.023
C1592-122	7144+68.00	54.000	111.000	0.217	0.940	3.800	0.776	1.965	2.742	HB45	0.600	1000.000	0.020	0.040	0.000	0.240	0.020	0.004	OK	10.00	1.203	2.765	12.000	16.000	OK	0.440	1.440	2.734	1.920
C1592-123	7+14.00	134.000	160.000	0.513	0.940	3.800	1.831	1.479	3.310	HB45	0.600	1000.000	0.020	0.040	0.000	0.068	4.000	5.000	OK	10.00	3.346	3.347	2.007	16.000	OK	0.096	0.096	34.852	34.831
C1592-124	10+30.00	313.000	71.457	0.526	0.940	3.800	1.880	9.335	11.215	HB45	0.600	1000.000	0.020	0.040	0.000	0.121	4.000	5.000	OK	10.00	11.280	11.304	2.020	16.000	OK	0.202	0.203	55.841	55.733
83-Ramp B																													
C1592-125	7149+23.00	244.000	106.000	0.600	0.940	3.800	2.144	0.000	2.144	HB45	0.600	1000.000	0.020	0.040	0.000	0.218	0.020	0.004	OK	10.00	1.010	2.154	10.900	16.000	OK	0.396	1.188	2.550	1.813
C1592-126A	7152+28.00			0.742	0.940	3.800	2.649	1.077	3.725	HB45	0.600	1000.000	0.020	0.040	0.000	0.270	0.020	0.004	OK	10.00	1.488	3.755	13.500	16.000	OK	0.500	1.823	2.977	2.060

Sub-Basin	Catch Basin	Total Q at CP (cfs)	Curb Opening - Slotted Drain Length (ft)	Capture Ratio	Lf (ft)	Lt	E	Qi	Lf (ft)	Gutter Backslope Grate Width W (ft)	Gutter Pan Grate Width W (ft)	Splash Over Velocity Vo (fps)	On-Grade Eo	Rf	Rs	E	Qi (cfs)	Bypass Flow Qbf (cfs)	Effective Grate Perimeter (ft)	Sag Point Capture Ratio	Factored Grate Perimeter (ft)	Depth of Weir Flow into Grate (ft)	Local Depression at Inlet (ft)	T2 (ft)	T3 (ft)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta
		On-Grade Slotted Drain/Curb Inlet Calculations							On-Grade Grate Inlet Calculations										Sag Inlet Calculations									
																							1					
																		0										
C1591-100	15	0.160	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.823	1.000	0.359	0.886	0.142	0.018	7	0.5	3.5	0.061501	0.083333333	1.95	0	1.95	18.00	OK
C1592-102	17	0.382	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.644	1.000	0.241	0.730	0.280	0.103	6.938	0.5	3.469	0.110474	0.083333333	2	0	2	18.00	OK
C1592-101	17	0.638	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.563	1.000	0.194	0.648	0.417	0.227	6.938	0.5	3.469	0.15549	0.083333333	2	1.607836989	3.607836989	18.00	OK
C1592-100	17	1.273	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.462	1.000	0.145	0.540	0.694	0.591	6.938	0.5	3.469	0.246455	0.083333333	2	6.156087435	8.156087435	18.00	OK
C1592-161	17	2.225	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.536	1.000	0.031	0.550	1.240	1.014	6.938	0.5	3.469	0.357502	0.083333333	2	11.70841073	13.70841073	16.00	OK
C1592-162	17	6.275	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.395	0.898	0.018	0.366	2.319	4.012	6.938	0.5	3.469	0.713717	0.083333333	2	29.51918558	31.51918558	16.00	EXCEEDED
C1592-163	17	5.959	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.402	0.906	0.019	0.376	2.244	3.728	6.938	0.5	3.469	0.689515	0.083333333	2	28.30908955	30.30908955	16.00	EXCEEDED
C1592-164	17	2.900	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.504	0.975	0.026	0.504	1.472	1.449	6.938	0.5	3.469	0.426597	0.083333333	2	15.16320003	17.16320003	10.00	EXCEEDED
C1592-103A	22	1.701	20.000	0.670	13.400	25.538	0.738	1.262	0.000	0.000	0.146	0.000	0.000	0.681	0.000	0.000	0.000	0.448	0.292	0	0	#DIV/0!	0.083333333	2	#DIV/0!	#DIV/0!	10.00	#DIV/0!
C1592-103	17	0.679	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.724	1.000	0.056	0.739	0.510	0.180	6.938	0.5	3.469	0.162089	0.083333333	2	1.937762465	3.937762465	10.00	OK
C1592-104	17	0.873	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.682	1.000	0.049	0.698	0.621	0.269	6.938	0.5	3.469	0.191617	0.083333333	2	3.414200619	5.414200619	10.00	OK
C1592-105A	20	6.768	10.000	0.670	6.700	44.564	0.254	1.736	0.000	0.000	0.146	0.000	0.000	0.542	0.000	0.000	0.000	5.093	0.292	0	0	#DIV/0!	0.083333333	2	#DIV/0!	#DIV/0!	16.32	#DIV/0!
C1592-105	17	5.258	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.418	0.920	0.020	0.396	2.096	3.199	6.938	0.5	3.469	0.634322	0.083333333	2	25.54944236	27.54944236	16.56	EXCEEDED
C1592-106	17	10.640	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.338	0.822	0.014	0.287	3.053	7.590	6.938	0.5	3.469	1.014899	0.083333333	2	44.57826196	46.57826196	18.00	EXCEEDED
C1592-108	17	1.654	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.584	1.000	0.035	0.599	1.005	0.674	6.938	0.5	3.469	0.293451	0.083333333	2	8.505880603	10.5058806	18.00	OK
C1592-107	17	7.590	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.375	0.867	0.016	0.335	2.566	5.084	6.938	0.5	3.469	0.810231	0.083333333	2	34.34490651	36.34490651	18.00	EXCEEDED
C1592-111	17	0.819	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.699	1.000	0.050	0.714	0.586	0.235	6.938	0.5	3.469	0.183635	0.083333333	2	3.015063332	5.015063332	16.00	OK
C1592-110	17	1.668	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.584	1.000	0.035	0.599	1.005	0.674	6.938	0.5	3.469	0.295095	0.083333333	2	8.588093194	10.58809319	16.00	OK
C1592-109	17	2.110	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.549	1.000	0.031	0.563	1.189	0.923	6.938	0.5	3.469	0.345159	0.083333333	2	11.09126155	13.09126155	15.00	OK
C1591-103	15	3.649	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.538	1.000	0.028	0.552	2.030	1.650	7	0.5	3.5	0.494328	0.083333333	1.95	18.50222633	20.45222633	18.00	EXCEEDED
C1591-102	15	1.806	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.643	1.000	0.035	0.655	1.184	0.622	7	0.5	3.5	0.309231	0.083333333	1.95	9.247375105	11.1973751	18.00	OK
C1591-107	15	1.312	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.614	1.000	0.077	0.644	0.857	0.473	7	0.5	3.5	0.249882	0.083333333	1.95	6.279949173	8.229949173	18.00	OK
xC1591-107	15	0.354	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.866	1.000	0.082	0.877	0.314	0.044	7	0.5	3.5	0.104334	0.083333333	1.95	0	1.95	18.00	OK
xC1591-106	15	0.896	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.740	1.000	0.049	0.753	0.686	0.226	7	0.5	3.5	0.193851	0.083333333	1.95	3.478372738	5.428372738	18.00	OK
C1591-106	15	0.928	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.713	1.000	0.059	0.730	0.686	0.254	7	0.5	3.5	0.198382	0.083333333	1.95	3.704921477	5.654921477	18.00	OK
C1592-112	17	2.683	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.404	1.000	0.074	0.448	1.210	1.493	6.938	0.5	3.469	0.40509	0.083333333	2	14.08783013	16.08783013	16.00	EXCEEDED
C1592-113	17	3.426	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.414	1.000	0.044	0.440	1.512	1.927	6.938	0.5	3.469	0.476784	0.083333333	2	17.67252935	19.67252935	16.00	EXCEEDED
C1592-114A	20	5.743	10.000	0.670	6.700	0.000	0.000	0.000	0.000	0.000	0.146	0.000	0.000	#DIV/0!	0.000	#DIV/0!	0.000	0.000	0.292	0	0	#DIV/0!	0.083333333	2	#DIV/0!	#DIV/0!	16.00	#DIV/0!
C1592-114	17	0.097	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.935	1.000	0.242	0.951	0.095	0.005	6.938	0.5	3.469	0.044275	0.083333333	2	0	2	16.00	OK
C1592-115A	22	3.495	20.000	0.670	13.400	25.534	0.738	2.590	0.000	0.000	0.146	0.000	0.000	0.727	0.000	0.000	0.000	0.920	0.292	0	0	#DIV/0!	0.083333333	2	#DIV/0!	#DIV/0!	16.00	#DIV/0!
C1592-115	17	1.114	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.572	1.000	0.076	0.605	0.677	0.443	6.938	0.5	3.469	0.225481	0.083333333	2	5.107398816	7.107398816	16.00	OK
C1592-116	17	2.536	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.453	1.000	0.051	0.481	1.224	1.321	6.938	0.5	3.469	0.390158	0.083333333	2	13.3412304	15.3412304	16.00	OK
C1592-117	17	2.720	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.444	1.000	0.050	0.472	1.284	1.439	6.938	0.5	3.469	0.408819	0.083333333	2	14.27427797	16.27427797	16.00	EXCEEDED
C1592-118	17	3.129	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.426	1.000	0.046	0.452	1.417	1.717	6.938	0.5	3.469	0.44876	0.083333333	2	16.27135348	18.27135348	16.00	EXCEEDED
C1592-119	17	3.494	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.405	1.000	0.047	0.433	1.518	1.989	6.938	0.5	3.469	0.483022	0.083333333	2	17.98443357	19.98443357	16.00	EXCEEDED
C1592-120	17	3.490	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.405	1.000	0.047	0.433	1.518	1.989	6.938	0.5	3.469	0.482695	0.083333333	2	17.96810715	19.96810715	16.00	EXCEEDED
C1592-121	17	3.471	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.406	1.000	0.047	0.434	1.507	1.965	6.938	0.5	3.469	0.480975	0.083333333	2	17.88206024	19.88206024	16.00	EXCEEDED
C1592-122	17	2.742	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.435	1.000	0.053	0.465	1.285	1.479	6.938	0.5	3.469	0.41094	0.083333333	2	14.38032385	16.38032385	16.00	EXCEEDED
C1592-123	17	3.310	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	1.000	-1.790	0.102	-1.789	-5.988	9.335	6.938	0.5	3.469	0.465977	0.083333333	2	0.085660961	2.085660961	16.00	OK
C1592-124	17	11.215	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.998	-3.679	0.046	-3.671	-41.497	52.801	6.938	0.5	3.469	1.051139	0.083333333	2	0.231951293	2.231951293	16.00	OK
C1592-125	17	2.144	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.469	1.000	0.059	0.500	1.077	1.077	6.938	0.5	3.469	0.348789	0.083333333	2	11.27278221	13.27278221	16.00	OK
C1592-126A	20	3.725	10.000	0.670	6.700	25.485	0.423	1.586	0.000	0.000	0.146	0.000	0.000	0.732	0.000	0.000	0.000	2.168	0.292	0	0	#DIV/0!	0.083333333	2	#DIV/0!	#DIV/0!	16.00	#DIV/0!

	Rational Method Hydrology								
Sub-Basin	Station	Length (ft)	Width (ft)	Area (acre)	C	10-year Rainfall Intensity I (in/hr)	Local Runoff Qrat (cfs)	Carryover Qco (cfs)	Total Q at CP (cfs)
					0.94	3.8			
C1592-126	7152+48.00	322.500	107.000	0.049	0.940	3.800	0.175	1.077	1.252
C1592-127	7155+28.00	527.000	99.000	0.961	0.940	3.800	3.434	1.737	5.172
Sag									
C1592-129	7161+31.00	478.500	94.000	1.032	0.940	3.800	3.686	0.000	3.686
C1592-128A	7157+73.00			0.841	0.940	3.800	3.002	2.158	5.160
C1592-128	7157+53.00	389.500	99.000	0.047	0.940	3.800	0.169	2.158	2.327

	Gutter and Shoulder Data											
Sub-Basin	TYPE	Curb Height (ft)	Curb Face X-slope S_{xb} (ft/ft)	Normal Gutter X-slope S_{xd} (ft/ft)	Gutter Depress d_2 (ft)	A/C Overlay d_3 (ft)	d_1 (ft)	Roadway X-slope S_{xa} (ft/ft)	Gutter Longtdl Slope S_L (ft/ft)	Within Curb Capacity?	Shoulder Width (ft)
C1592-126	HB45	0.600	1000.000	0.020	0.040	0.000	0.177	0.020	0.004	OK	10.00
C1592-127	HB45	0.600	1000.000	0.020	0.040	0.000	0.314	0.020	0.004	OK	10.00
Sag											
C1592-129	HB45	0.600	1000.000	0.020	0.040	0.000	0.276	0.020	0.004	OK	10.00
C1592-128A	HB45	0.600	1000.000	0.020	0.040	0.000	0.313	0.020	0.004	OK	10.00
C1592-128	HB45	0.600	1000.000	0.020	0.040	0.000	0.231	0.020	0.004	OK	10.00

	Governing Gutter Spread Calculations									
Sub-Basin	Qw (cfs)	Q (cfs)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta	Aw (sq ft)	A (sq ft)	Vw (fps)	V (fps)
				6					
C1592-126	0.687	1.256	8.850	16.000	OK	0.314	0.783	2.187	1.604
C1592-127	1.823	5.203	15.700	16.000	OK	0.588	2.465	3.100	2.111
Sag									
C1592-129	1.448	3.718	13.800	16.000	OK	0.512	1.904	2.828	1.952
C1592-128A	1.813	5.160	15.650	16.000	OK	0.586	2.449	3.093	2.107
C1592-128	1.050	2.341	11.550	16.000	OK	0.422	1.334	2.487	1.755

	On-Grade Slotted Drain/Curb Inlet Calculations								
Sub-Basin	Catch Basin	Total Q at CP (cfs)	Curb Opening - Slotted Drain Length (ft)	Capture Ratio	Lf (ft)	Lt	E	Qi
C1592-126	17	1.252	0.000	0.000	0.000	0.000	0.000	0.000
C1592-127	17	5.172	0.000	0.000	0.000	0.000	0.000	0.000
Sag								
C1592-129	17	3.686	0.000	0.000	0.000	0.000	0.000	0.000
C1592-128A	20	5.160	10.000	0.670	6.700	27.977	0.389	2.008
C1592-128	17	2.327	0.000	0.000	0.000	0.000	0.000	0.000

	On-Grade Grate Inlet Calculations										
Sub-Basin	Lf (ft)	Gutter Backslope Grate Width W (ft)	Gutter Pan Grate Width W (ft)	Splash Over Velocity Vo (fps)	On-Grade Eo	Rf	Rs	E	Qi (cfs)	Bypass Flow Qbf (cfs)
C1592-126	1.500	0.000	1.969	3.855	0.547	1.000	0.077	0.581	0.730	0.526
C1592-127	1.500	0.000	1.969	3.855	0.350	1.000	0.042	0.378	1.966	3.237
Sag										
C1592-129	1.500	0.000	1.969	3.855	0.389	1.000	0.050	0.420	1.560	2.158
C1592-128A	0.000	0.000	0.146	0.000	0.000	0.722	0.000	0.000	0.000	3.153
C1592-128	1.500	0.000	1.969	3.855	0.448	1.000	0.062	0.482	1.129	1.212

	Sag Inlet Calculations										
Sub-Basin	Effective Grate Perimeter (ft)	Sag Point Capture Ratio	Factored Grate Perimeter (ft)	Depth of Weir Flow into Grate (ft)	Local Depression at Inlet (ft)	T2 (ft)	T3 (ft)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta
					1					
C1592-126	6.938	0.5	3.469	0.243678	0.083333333	2	6.017256075	8.017256075	16.00	OK
C1592-127	6.938	0.5	3.469	0.627401	0.083333333	2	25.20338626	27.20338626	16.00	EXCEEDED
Sag										
C1592-129	6.938	0.5	3.469	0.50058	0.083333333	2	18.86233709	20.86233709	16.00	EXCEEDED
C1592-128A	0.292	0	0	#DIV/0!	0.083333333	2	#DIV/0!	#DIV/0!	16.00	#DIV/0!
C1592-128	6.938	0.5	3.469	0.368372	0.083333333	2	12.25192302	14.25192302	16.00	OK

NOTES:

n-values used: 0.013 for concrete curb, 0.016 for asphalt overlay (which only applies to flow depth d1 that exceeds d2 + d3)

On Ramp curb returns, use C-15.10, C-15.20, C-15.30, or C-15.40 catch basins for Type D, D1, or D2 curb is used.

On freeway mainline, use ADOT C-15.91 catch basin when Type B, C, or E mountable curb is used.

Use ADOT C-15.92 inlet when next to roadway half barrier (HB25 or HB45) or structural barrier (SD101 or SD102).

Splash-over velocity is for parallel bar, 2-inch spacing (grate inlets).

$E_o = Qw / Q$

$Rs = 1/(1+(0.15*V_o^{1.8})/(S_x*L^{2.3}))$

Gutter Flow for I-10/SR-101L DHOV DCR

RUNOFF ZONE: **SB101 EB10**

1 =Use keyboard Delete button to isolate, then enter any character or number to start calculations

spur dike	begin	0	Spacing	-5		
Pier Cap	end	1000	$I_{10,10}$ =	3.8	$I_{50,10}$ =	5.22
Abutment	iteration	1000	$I_{50,10}$ =	5.22	$I_{100,10}$ =	5.99
		0.001				

Sub-Basin	Rational Method Hydrology									Gutter and Shoulder Data											Governing Gutter Spread Calculations										On-Grade Slotted Drain/Curb Inlet Calculations								On-Grade Grate Inlet Calculations										Sag Inlet Calculations									
	Station	Length (ft)	Width (ft)	Area (acre)	C 0.94	10-year Rainfall Intensity I (in/hr) 3.8	Local Runoff Qrat (cfs)	Carryover Qco (cfs)	Total Q at CP (cfs)	TYPE	Curb Height (ft)	Curb Face X-slope S_{x1} (ft/ft)	Normal Gutter X-slope S_{x2} (ft/ft)	Gutter Depress d_2 (ft)	A/C Overlay d_3 (ft)	d_1 (ft)	Roadway X-slope S_{x3} (ft/ft)	Gutter Longtdl Slope S_L (ft/ft)	Within Curb Capacity?	Shoulder Width (ft)	Qw (cfs)	Q (cfs)	Spread Width T (ft)	Allowable Spread, Ta (ft) 0	T < Ta	Aw (sq ft)	A (sq ft)	Vw (fps)	V (fps)	Catch Basin	Total Q at CP (cfs)	Curb Opening - Slotted Drain Length (ft)	Capture Ratio	Lf (ft)	Lt (ft)	E	Qi	Lf (ft)	Gutter Backslope Grate Width W (ft)	Gutter Pan Grate Width W (ft)	Splash Over Velocity Vo (fps)	On-Grade Eo	Rf	Rs	E	Qi (cfs)	Bypass Flow Qbf (cfs) 0	Effective Grate Perimeter (ft)	Sag Point Capture Ratio	Factored Grate Perimeter (ft)	Depth of Weir Flow into Grate (ft)	Local Depression at Inlet (ft) 1	T2 (ft)	T3 (ft)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta
A1592-211	192+53.77	19253.8	85.000	0.318	0.940	3.800	1.135	0.000	1.135	SD101	0.600	1000.000	0.020	0.040	0.000	0.177	0.040	0.006	OK	10.00	0.809	1.144	5.425	16.000	OK	0.314	0.549	2.576	2.086	17	1.135	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.707	1.000	0.110	0.739	0.846	0.299	6.938	0.5	3.469	0.228215	0.083333333	2	2.622045693	4.622045693	16.00	OK
A1592-210	190+70.51	183.3	85.000	0.341	0.940	3.800	1.219	0.299	1.518	SD101	0.600	1000.000	0.020	0.040	0.000	0.181	0.040	0.010	OK	10.00	1.069	1.528	5.525	16.000	OK	0.322	0.571	3.320	2.678	17	1.518	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.700	1.000	0.072	0.721	1.102	0.426	6.938	0.5	3.469	0.277074	0.083333333	2	3.843515181	5.843515181	16.00	OK
A1591-209	187+48.21	322.3	85.000	0.611	0.940	3.800	2.182	0.426	2.608	C	0.250	0.167	0.021	0.041	0.000	0.192	0.040	0.016	OK	10.00	1.901	2.616	5.726	16.000	OK	0.445	0.730	4.274	3.583	15	2.608	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.727	1.000	0.047	0.740	1.935	0.681	7	0.5	3.5	0.395096	0.083333333	1.95	6.770316976	8.720316976	16.00	OK
A1591-208	184+00.14	348.1	85.000	0.677	0.940	3.800	2.418	0.681	3.099	C	0.250	0.167	0.021	0.041	0.000	0.206	0.040	0.016	OK	10.00	2.215	3.130	6.076	16.000	OK	0.489	0.829	4.531	3.774	15	3.099	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.708	1.000	0.043	0.720	2.254	0.876	7	0.5	3.5	0.443222	0.083333333	1.95	7.975965792	9.925965792	16.00	OK
A1591-207	180+87.96	312.2	85.000	0.631	0.940	3.800	2.255	0.876	3.131	C	0.250	0.167	0.021	0.041	0.000	0.221	0.040	0.012	OK	10.00	2.175	3.157	6.451	16.000	OK	0.537	0.942	4.048	3.350	15	3.131	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.689	1.000	0.052	0.705	2.226	0.931	7	0.5	3.5	0.446317	0.083333333	1.95	8.050833482	10.00083348	16.00	OK
A1592-206	177+44.05	343.9	115.000	0.847	0.940	3.800	3.024	0.931	3.956	SD101	0.600	1000.000	0.020	0.040	0.000	0.290	0.040	0.007	OK	10.00	2.155	3.957	8.250	16.000	OK	0.540	1.321	3.990	2.995	17	3.956	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.544	0.988	0.053	0.562	2.224	1.733	6.938	0.5	3.469	0.524713	0.083333333	2	10.03449448	12.03449448	16.00	OK
A1592-205	174+15.66	328.4	115.000	0.774	0.940	3.800	2.764	1.733	4.496	SD101	0.600	1000.000	0.020	0.040	0.000	0.348	0.040	0.004	OK	10.00	2.195	4.513	9.700	16.000	OK	0.656	1.842	3.346	2.450	17	4.496	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.487	1.000	0.072	0.523	2.361	2.152	6.938	0.5	3.469	0.57151	0.083333333	2	11.20441693	13.20441693	16.00	OK
A1592-204	170+85.74	329.9	82.000	0.621	0.940	3.800	2.218	2.152	4.370	SD101	0.600	1000.000	0.020	0.040	0.000	0.344	0.040	0.004	OK	10.00	2.151	4.389	9.600	16.000	OK	0.648	1.803	3.319	2.434	17	4.370	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.490	1.000	0.073	0.527	2.313	2.076	6.938	0.5	3.469	0.560744	0.083333333	2	10.93526097	12.93526097	16.00	OK
A1592-203	164+73.12	612.6	82.000	1.111	0.940	3.800	3.970	2.076	6.046	SD101	0.600	1000.000	0.020	0.040	0.000	0.433	0.040	0.002	OK	10.00	2.543	6.046	11.825	16.000	OK	0.826	2.757	3.079	2.193	17	6.046	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.421	1.000	0.082	0.468	2.831	3.215	6.938	0.5	3.469	0.696231	0.083333333	2	14.32245322	16.32245322	16.00	EXCEEDED
A1592-202	162+08.37	264.7	82.000	0.432	0.940	3.800	1.542	3.215	4.756	SD101	0.600	1000.000	0.020	0.040	0.000	0.435	0.040	0.001	OK	10.00	2.003	4.777	11.875	16.000	OK	0.830	2.780	2.413	1.718	17	4.756	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.419	1.000	0.122	0.490	2.341	2.436	6.938	0.5	3.469	0.593346	0.083333333	2	11.75030875	13.75030875	16.00	OK
A1592-201	158+56.48	351.9	82.000	1.232	0.940	3.800	4.402	2.436	6.838	SD101	0.600	1000.000	0.020	0.040	0.000	0.543	0.040	0.001	OK	10.00	2.456	6.862	14.575	16.000	OK	1.046	4.209	2.347	1.630	17	6.838	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.358	1.000	0.127	0.440	3.016	3.845	6.938	0.5	3.469	0.755782	0.083333333	2	15.81122229	17.81122229	16.00	EXCEEDED
A1592-200A	142+06.35	14206.4	82.000	0.147	0.940	3.800	0.526	0.000	0.526	SD101	0.600	1000.000	0.020	0.040	0.000	0.092	0.021	0.023	OK	10.00	0.443	0.538	4.469	16.000	OK	0.144	0.208	3.075	2.585	17	0.526	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.823	1.000	0.045	0.831	0.447	0.091	6.938	0.5	3.469	0.136668	0.083333333	2	0.633212379	2.633212379	16.00	OK
A1592-200	155+24.50	1318.2	82.000	2.080	0.940	3.800	7.429	0.091	7.520	SD101	0.600	1000.000	0.020	0.040	0.000	0.573	0.040	0.001	OK	10.00	2.587	7.524	15.325	16.000	OK	1.106	4.657	2.339	1.615	17	7.520	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.344	1.000	0.128	0.428	3.219	4.305	6.938	0.5	3.469	0.80523	0.083333333	2	17.04742254	19.04742254	16.00	EXCEEDED

NOTES:

n-values used: 0.013 for concrete curb, 0.016 for asphalt overlay (which only applies to flow depth d1 that exceeds d2 + d3)

On Ramp curb returns, use C-15.10, C-15.20, C-15.30, or C-15.40 catch basins for Type D, D1, or D2 curb is used.

On freeway mainline, use ADOT C-15.91 catch basin when Type B, C, or E mountable curb is used.

Use ADOT C-15.92 inlet when next to roadway half barrier (HB25 or HB45) or structural barrier (SD101 or SD102).

Splash-over velocity is for parallel bar, 2-inch spacing (grate inlets).

$E_o = Qw / Q$

$Rs = 1/(1+(0.15*V_w^{1.8})/(S_x*L^{2.3}))$

1.Stationing is from existing SR101L Alignment

2.Roadway X-slope & Gutter Longitudinal slope based on existing contours

Gutter Flow for I-10/SR-101L DHOV DCR

RUNOFF ZONE: **NB101WB10**

Control

0 Use keyboard Delete button to initialize, then enter any character or number to start calculations

spur dike	begin	0	Spacing	-5			
Pier Cap	end	1000	$I_{10,10}$=	3.8	$I_{50,10}$ =	5.22	
Abutment	iteration	1000	$I_{50,10}$ =	5.22	$I_{100,10}$ =	5.99	

0.001

Sub-Basin	Rational Method Hydrology									Gutter and Shoulder Data												Governing Gutter Spread Calculations										On-Grade Slotted Drain/Curb Inlet Calculations								On-Grade Grate Inlet Calculations										Sag Inlet Calculations									
	Station	Length (ft)	Width (ft)	Area (acre)	C	10-year Rainfall Intensity I (in/hr)	Local Runoff Qrat (cfs)	Carryover Qco (cfs)	Total Q at CP (cfs)	TYPE	Curb Height (ft)	Curb Face X-slope S_{x1} (ft/ft)	Normal Gutter X-slope S_{x2} (ft/ft)	Gutter Depress d_2 (ft)	A/C Overlay d_3 (ft)	d_1 (ft)	Roadway X-slope S_{x3} (ft/ft)	Gutter Longtdl Slope S_L (ft/ft)	Within Curb Capacity?	Shoulder Width (ft)	Qw (cfs)	Q (cfs)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta	Aw (sq ft)	A (sq ft)	Vw (fps)	V (fps)	Catch Basin	Total Q at CP (cfs)	Curb Opening - Slotted Drain Length (ft)	Capture Ratio	Lf (ft)	Lt	E	Qi	Lf (ft)	Gutter Backslope Grate Width W (ft)	Gutter Pan Grate Width W (ft)	Splash Over Velocity Vo (fps)	On-Grade Eo	Rf	Rs	E	Qi (cfs)	Bypass Flow Qbf (cfs)	Effective Grate Perimeter (ft)	Sag Point Capture Ratio	Factored Grate Perimeter (ft)	Depth of Weir Flow into Grate (ft)	Local Depression at Inlet (ft)	T2 (ft)	T3 (ft)	Spread Width T (ft)	Allowable Spread, Ta (ft)	T < Ta
					0.94	3.8																		0																					0				1					
XA1591-219	180+33.95	18080.8	0.000	0.541	0.940	3.800	1.932	0.000	1.932	SD101	0.600	1000.000	0.020	0.040	0.000	0.192	0.040	0.012	OK	10.00	1.327	1.950	5.800	16.000	OK	0.344	0.633	3.856	3.082	17	1.932	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.680	1.000	0.056	0.698	1.362	0.588	6.938	0.5	3.469	0.325377	0.083333333	2	5.051083953	7.051083953	16.00	OK
XA1591-218	177+71.36	17771.4	0.000	0.541	0.940	3.800	1.932	0.000	1.932	SD101	0.600	1000.000	0.020	0.040	0.000	0.212	0.040	0.007	OK	10.00	1.259	1.944	6.300	16.000	OK	0.384	0.754	3.278	2.579	17	1.932	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.648	1.000	0.074	0.674	1.310	0.634	6.938	0.5	3.469	0.325377	0.083333333	2	5.051083953	7.051083953	16.00	OK
XA1591-217	177+15.32	17715.3	0.000	0.124	0.940	3.800	0.443	0.000	0.443	SD101	0.600	1000.000	0.020	0.040	0.000	0.116	0.040	0.007	OK	10.00	0.377	0.450	3.900	16.000	OK	0.192	0.264	1.964	1.705	17	0.443	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.837	1.000	0.167	0.864	0.389	0.061	6.938	0.5	3.469	0.122004	0.083333333	2	0	2	16.00	OK
A1592-216	176+44.47	70.8	87.000	0.173	0.940	3.800	0.618	0.070	0.688	SD101	0.600	1000.000	0.020	0.040	0.000	0.145	0.040	0.006	OK	10.00	0.534	0.693	4.625	16.000	OK	0.250	0.388	2.136	1.787	17	0.688	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.771	1.000	0.147	0.804	0.557	0.136	6.938	0.5	3.469	0.163565	0.083333333	2	1.005788356	3.005788356	16.00	OK
A1592-215	174+15.42	229.1	125.000	0.702	0.940	3.800	2.506	0.136	2.642	SD101	0.600	1000.000	0.020	0.040	0.000	0.279	0.040	0.004	OK	10.00	1.482	2.660	7.975	16.000	OK	0.518	1.232	2.860	2.159	17	2.642	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.557	1.000	0.093	0.598	1.591	1.069	6.938	0.5	3.469	0.400907	0.083333333	2	6.939351709	8.939351709	16.00	OK
A1592-214	172+55.94	159.5	85.000	0.322	0.940	3.800	1.149	1.069	2.218	SD101	0.600	1000.000	0.020	0.040	0.000	0.259	0.040	0.004	OK	10.00	1.296	2.229	7.475	16.000	OK	0.478	1.078	2.711	2.069	17	2.218	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.581	1.000	0.101	0.624	1.391	0.839	6.938	0.5	3.469	0.356787	0.083333333	2	5.83634499	7.83634499	16.00	OK
A1592-213	170+85.97	170.0	85.000	0.325	0.940	3.800	1.159	0.839	1.998	SD101	0.600	1000.000	0.020	0.040	0.000	0.248	0.040	0.004	OK	10.00	1.198	2.012	7.200	16.000	OK	0.456	0.997	2.628	2.018	17	1.998	0.000	0.000	0.000	0.000	0.000	0.000	1.500	0.000	1.969	3.855	0.596	1.000	0.106	0.639	1.285	0.727	6.938	0.5	3.469	0.332819	0.083333333	2	5.237132663	7.237132663	16.00	OK
A1591-300	177+87.62	17787.6	40.000	0.052	0.940	3.800	0.187	0.000	0.187	SD101	0.600	1000.000	0.020	0.040	0.000	0.078	0.040	0.008	OK	10.00	0.177	0.190	2.950	16.000	OK	0.116	0.134	1.527	1.414	15	0.187	0.000	0.000	0.000	0.000	0.000	0.000	1.500	1.000	2.000	6.993	0.935	1.000	0.240	0.950	0.180	0.009	7	0.5	3.5	0.068169	0.083333333	2	0	2	16.00	OK

NOTES:

n-values used: 0.013 for concrete curb, 0.016 for asphalt overlay (which only applies to flow depth d1 that exceeds d2 + d3)

On Ramp curb returns, use C-15.10, C-15.20, C-15.30, or C-15.40 catch basins for Type D, D1, or D2 curb is used.

On freeway mainline, use ADOT C-15.91 catch basin when Type B, C, or E mountable curb is used.

Use ADOT C-15.92 inlet when next to roadway half barrier (HB25 or HB45) or structural barrier (SD101 or SD102).

Splash-over velocity is for parallel bar, 2-inch spacing (grate inlets).

$E_o = Qw / Q$

$Rs = 1/(1+(0.15*v_w^{1.8})/(S_x*L^{2.7}))$

Project F0475 - SR 101L/I-10 System Traffic Interchange - DCR
Roadway SB SR 101L: Thomas Rd and McDowell Rd Exit Ramps; EB I-10: System TI Ramp SE Slip Ramp to 91st Ave Exit
Frequency 10-Year

Designed	AE	Date	Mar-2023
Reviewed	JG	Date	Apr-2023
Updated		Date	

Gutter & Inlet Hydraulic Computation Sheet

	SOUTHBOUND SR 101L							SB 101L: THOMAS EXIT		SB 101L: MCDOWELL RAMP C				
Inlet #	C113	C114	C115	C116	C117	C118	C119	T101	T100	M100	M101	M102	M103	M104
ID	A20000	A20184	A20487	A20791	A21241	A21851	A22401	B00753	B01062	C00745	C01006	C01326	C02171	C02442
Area #	20000	20184	20487	20791	21241	21851	22401	753	1062	745	1006	1326	2171	2442
Station	200+00	201+84	204+87	207+91	212+41	218+51	224+01	7+53	10+62	7+45	10+06	13+26	21+71	24+42
Offset from CL	83.00	103.30	95.00	95.00	102.73	95.00	86.50	10.00	10.00	10.00	10.00	10.00	10.00	16.00
Lt or Rt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Rt	Rt	Rt	Rt	Lt
Upstream Inlet	-	20000	20184	20487	20791	21241	21851	1062	-	1006	1326	-	-	-
Direction of Flow	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<	>>>>>	>>>>>
HYDROLOGY														
Tc (min)	10	10	10	10	10	10	10	10	10	10	10	10	10	10
i (in/hr)	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
Contributing Area														
Pavement (Sq.ft.)	18812	23345	29338	28535	52938	57913	50616	7255	7682	6772	8323	9893	12101	7062
Pavement (Acre)	0.4319	0.5359	0.6735	0.6551	1.2153	1.3295	1.1620	0.1666	0.1764	0.1555	0.1911	0.2271	0.2778	0.1621
Roadside (Sq.ft.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roadside (Acre)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Area	0.4319	0.5359	0.6735	0.6551	1.2153	1.3295	1.1620	0.1666	0.1764	0.1555	0.1911	0.2271	0.2778	0.1621
Runoff Coefficient C														
Pavement	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Roadside	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Composite C	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Flows														
Known (cfs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bypass (cfs)	0.00	0.03	0.11	0.02	0.19	0.02	0.13	0.01	0.00	0.01	0.01	0.00	0.00	0.00
CiA (cfs)	1.56	1.93	2.43	2.36	4.39	4.80	4.19	0.60	0.64	0.56	0.69	0.82	1.00	0.59
Total Q (cfs)	1.56	1.97	2.54	2.38	4.58	4.82	4.33	0.61	0.64	0.57	0.70	0.82	1.00	0.59
HYDRAULICS														
Roadway Slopes (ft/ft)														
Longitudinal (S)	0.009000	0.011000	0.018000	0.018000	0.015000	0.004400	0.004400	0.014500	0.014500	0.012000	0.019000	0.020000	0.030000	0.039000
Cross Slope (Sxp)	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
Gutter														
Standard and Type	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2
Pan Width (ft)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Back Slope Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depression (ft)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sx (ft/ft)	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
Sb (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gutter n	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
Gutter Capacity (cfs)	1.01	1.12	1.43	1.43	1.30	0.71	0.71	1.28	1.28	1.17	1.47	1.50	1.84	2.10
T in Gutter (ft)	-	-	-	-	-	-	-	1.90	1.93	1.92	1.90	1.99	1.99	1.55
Curb/Barrier Height (ft)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Depth of flow (ft)	0.30	0.31	0.31	0.31	0.38	0.46	0.45	0.21	0.22	0.22	0.21	0.22	0.22	0.19
Area in Gutter Ag (sq.ft)	0.44	0.47	0.47	0.46	0.64	0.83	0.80	0.22	0.23	0.23	0.22	0.24	0.24	0.16
Hyd Radius Gutter Rg (ft)	0.18	0.19	0.19	0.18	0.26	0.33	0.32	0.09	0.09	0.09	0.09	0.10	0.10	0.06
Qg (cfs)	1.50	1.85	2.39	2.26	3.63	3.05	2.84	0.60	0.64	0.57	0.70	0.82	1.00	0.59
Qo (cfs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T in Pavement (ft)	2.56	3.17	3.20	2.90	6.58	10.45	9.77	-	-	-	-	-	-	-
Pavement n	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160
Qp (cfs)	0.06	0.12	0.15	0.12	0.95	1.77	1.49	-	-	-	-	-	-	-
Q (cfs)	1.56	1.97	2.54	2.38	4.58	4.82	4.33	0.60	0.64	0.57	0.70	0.82	1.00	0.59
Spread (ft)	**5.06**	**5.67**	**5.70**	**5.40**	**9.08**	**12.95**	**12.27**	**2.50**	**2.50**	**2.50**	**2.50**	**2.50**	**2.50**	**2.50**
Shoulder Width (ft)	12.00	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Depth of Flow (in)	**3.61**	**3.76**	**3.77**	**3.70**	**4.58**	**5.51**	**5.35**	**2.56**	**2.60**	**2.59**	**2.57**	**2.66**	**2.65**	**2.28**
Flow Velocity (ft/s)	**3.41**	**3.94**	**5.05**	**4.94**	**5.65**	**3.65**	**3.55**	**2.73**	**2.80**	**2.52**	**3.14**	**3.40**	**4.16**	**3.64**
Allowable Spread	18.00	18.00	18.00	18.00	18.00	18.00	18.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
INLET														
Type	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Standard	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92
Location	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade
Inlet Depression (in)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Slotted Drain/Curb Opening?	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	no	yes	no
Capture Ratio	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Length (ft)	**5.0**	**5.0**	**10.0**	**5.0**	**15.0**	**10.0**	**15.0**	**5.0**	**0.0**	**0.0**	**0.0**	**0.0**	**5.0**	**0.0**
Se (ft/ft)	0.1321	0.1314	0.1313	0.1317	0.1264	0.1211	0.1219	0.1328	0.0000	0.0000	0.0000	0.0000	0.1333	0.0000
Effective Length (ft)	4	4	8	4	12	8	12	4	0	0	0	0	4	0
Lt (ft)	8	9	12	12	15	11	10	6	0	0	0	0	10	0
Efficiency	0.71	0.63	0.85	0.52	0.94	0.90	1.00	0.84	0.00	0.00	0.00	0.00	0.63	0.00
Sag Capacity (cfs)	101.58	101.58	149.39	101.58	197.19	149.39	197.19	101.58	0.00	0.00	0.00	0.00	101.58	0.00
Sag Depth (in)	2.22	2.60	2.38	2.95	2.93	3.65	2.82	1.19	0.00	0.00	0.00	0.00	1.66	0.00
SD Qi (cfs)	**1.11**	**1.24**	**2.17**	**1.25**	**4.32**	**4.37**	**4.33**	**0.51**	**0.00**	**0.00**	**0.00**	**0.00**	**0.63**	**0.00**
Bypass (cfs)	0.45	0.73	0.37	1.13	0.27	0.46	0.00	0.10	0.64	0.57	0.70	0.82	0.38	0.59
Spread at Inlet (ft)	3.28	4.00	2.91	4.17	3.35	5.68	12.27	1.31	2.50	2.50	2.50	2.50	1.77	2.50
Grate														
Capture Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Grate Length (in)	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38
Grate Width (in)	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63
# of Long Bars	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Width of Long Bars (in)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Width of Side Bars (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# of Transverse Bars	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Width of Trans. Bars (In)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Vo (ft/s)	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20
Perimeter (ft)	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30
Area (sq.ft)	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06
Clogged Perimeter (ft)	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Clogged Area (sq.ft.)	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53
INLET HYDRAULICS														
G Hydraulics - Grade														
Eo	0.9140	0.8360	0.9513	0.8189	0.9058	0.6790	0.3730	1.0000	0.9840	0.9840	0.9840	0.9840	1.0000	0.9840
Qs/Q	0.0860	0.1640	0.0487	0.1811	0.0942	0.3210	0.6270	0.0000	0.0160	0.0160	0.0160	0.0160	0.0000	0.0160
Rf	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Rs	0.10	0.08	0.05	0.05	0.04	0.09	0.09	0.13	0.13	0.15	0.11	0.10	0.07	0.09
Efficiency	0.92	0.85	0.95	0.83	0.91	0.71	0.43	1.00	0.99	0.99	0.99	0.99	1.00	0.99
Qi (cfs)	0.42	0.62	0.35	0.94	0.24	0.32	0.00	0.10	0.63	0.56	0.69	0.81	0.38	0.58
G Hydraulics - Sag														
Weir Depth (in)	1.43	1.97	1.26	2.64	1.01	1.45	0.00	0.51	1.80	1.68	1.92	2.13	1.27	1.70
Orifice Depth (in)	0.01	0.03	0.01	0.08	0.00	0.01	0.00	0.00	0.03	0.02	0.03	0.04	0.01	0.02
Controlling Depth (in)	1.43	1.97	1.26	2.64	1.01	1.45	0.00	0.51	1.80	1.68	1.92	2.13	1.27	1.70
Depth at Grate (in)	1.43	1.97	1.26	2.64	1.01	1.45	0.00	0.51	1.80	1.68	1.92	2.13	1.27	1.70
Flows														
Intercepted (cfs)	**1.52**	**1.86**	**2.52**	**2.19**	**4.56**	**4.69**	**4.33**	**0.61**	**0.63**	**0.56**	**0.69**	**0.81**	**1.00**	**0.58**
Bypass (cfs)	**0.03**	**0.11**	**0.02**	**0.19**	**0.02**	**0.13**	**0.00**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.00**	**0.01**

													EB I-10: 91ST AVE SLIP RAMP		
Inlet #	M105	M106	M107	M108	M109	M110	M111	M112	M113	M114	M115	M116	M117	S100	S101	S102
ID	C02618	C02801	C03127	C03457	C03784	C04050	C04250	C04300	C04350	C04650	C05000	C05236	C05500	D00000	D00475	D00536
Area #	2618	2801	3127	3457	3784	4050	4250	4300	4350	4650	5000	5236	5500	0	475	536
Station	26+18	28+01	31+27	34+57	37+84	40+50	42+50	43+00	43+50	46+50	50+00	52+36	55+00	00+00	4+75	5+36
Offset from CL	10.00	10.00	10.00	10.00	10.00	16.00	16.00	16.00	16.00	16.00	16.00	10.00	10.00	10.00	10.00	10.00
Lt or Rt	Rt	Rt	Rt	Rt	Rt	Lt	Lt	Lt	Lt	Lt	Lt	Rt	Rt	Rt	Rt	Rt
Upstream Inlet	-	2618	2801	3127	3457	-	4050	Sag	4650	5000	-	5500	-	-	0	475
Direction of Flow	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	v	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<	>>>>>	>>>>>	>>>>>
HYDROLOGY																
Tc (min)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
i (in/hr)	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
Contributing Area																
Pavement (Sq.ft.)	4585	4765	8483	8577	8487	6919	5198	2599	7791	9091	6129	6864	7763	14635	25842	4380
Pavement (Acre)	0.1053	0.1094	0.1947	0.1969	0.1948	0.1588	0.1193	0.0597	0.1789	0.2087	0.1407	0.1576	0.1782	0.3360	0.5933	0.1006
Roadside (Sq.ft.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roadside (Acre)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Area	0.1053	0.1094	0.1947	0.1969	0.1948	0.1588	0.1193	0.0597	0.1789	0.2087	0.1407	0.1576	0.1782	0.3360	0.5933	0.1006
Runoff Coefficient C																
Pavement	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Roadside	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Composite C	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Flows																
Known (cfs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bypass (cfs)	0.00	0.01	0.01	0.06	0.00	0.00	0.01	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.16
CiA (cfs)	0.38	0.39	0.70	0.71	0.70	0.57	0.43	0.22	0.65	0.75	0.51	0.57	0.64	1.21	2.14	0.36
Total Q (cfs)	0.38	0.40	0.71	0.77	0.70	0.57	0.44	0.24	0.66	0.76	0.51	0.58	0.64	1.21	2.14	0.52
HYDRAULICS																
Roadway Slopes (ft/ft)																
Longitudinal (S)	0.030000	0.010000	0.004000	0.004000	0.004000	0.004000	0.003000	0.000000	0.005000	0.040000	0.040000	0.040000	0.040000	0.007900	0.007900	0.001000
Cross Slope (Sxp)	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
Gutter																
Standard and Type	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2
Pan Width (ft)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Back Slope Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depression (ft)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sx (ft/ft)	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
Sb (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gutter n	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
Gutter Capacity (cfs)	1.84	1.06	0.67	0.67	0.67	0.67	0.58	-	0.75	2.13	2.13	2.13	2.13	0.95	0.95	0.34
T in Gutter (ft)	1.38	1.73	-	-	-	2.36	2.25	-	2.38	1.70	1.46	1.54	1.60	-	-	-
Curb/Barrier Height (ft)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Depth of flow (ft)	0.18	0.20	0.27	0.27	0.27	0.25	0.24	0.15	0.25	0.20	0.18	0.19	0.19	0.28	0.34	0.30
Area in Gutter Ag (sq.ft)	0.13	0.19	0.36	0.37	0.35	0.31	0.29	0.06	0.32	0.19	0.15	0.16	0.17	0.40	0.53	0.44
Hyd Radius Gutter Rg (ft)	0.05	0.08	0.14	0.15	0.14	0.13	0.12	0.03	0.13	0.07	0.06	0.06	0.07	0.16	0.21	0.18
Qg (cfs)	0.38	0.40	0.71	0.76	0.70	0.57	0.44	-	0.66	0.76	0.51	0.58	0.64	1.19	1.91	0.50
Qo (cfs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T in Pavement (ft)	-	-	0.90	1.24	0.85	0.03	-	-	0.17	-	-	-	-	1.72	4.34	2.56
Pavement n	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160
Qp (cfs)	-	-	0.00	0.01	0.00	-	-	-	-	-	-	-	-	0.02	0.23	0.02
Q (cfs)	0.38	0.40	0.71	0.77	0.70	0.57	0.44	0.24	0.66	0.76	0.51	0.58	0.64	1.21	2.14	0.52
Spread (ft)	**2.50**	**2.50**	**3.40**	**3.74**	**3.35**	**2.53**	**2.50**	**2.50**	**2.67**	**2.50**	**2.50**	**2.50**	**2.50**	**4.22**	**6.84**	**5.06**
Shoulder Width (ft)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Depth of Flow (in)	**2.15**	**2.43**	**3.22**	**3.30**	**3.20**	**3.01**	**2.91**	**0.93**	**3.04**	**2.40**	**2.21**	**2.26**	**2.31**	**3.41**	**4.04**	**3.61**
Flow Velocity (ft/s)	**2.82**	**2.07**	**1.98**	**2.04**	**1.97**	**1.81**	**1.50**	**0.00**	**2.06**	**4.06**	**3.46**	**3.64**	**3.79**	**2.99**	**3.61**	**1.14**
Allowable Spread	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
INLET																
Type	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Standard	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92
Location	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Sag	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade
Inlet Depression (in)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Slotted Drain/Curb Opening?	no	no	no	yes	yes	no	no	no	no	no	no	yes	no	yes	yes	yes
Capture Ratio	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Length (ft)	**0.0**	**0.0**	**0.0**	**5.0**	**5.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**5.0**	**0.0**	**5.0**	**5.0**	**5.0**
Se (ft/ft)	0.0000	0.0000	0.0000	0.1332	0.1331	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1334	0.0000	0.1327	0.1297	0.1320
Effective Length (ft)	0	0	0	4	4	0	0	0	0	0	0	4	0	4	4	4
Lt (ft)	0	0	0	5	4	0	0	0	0	0	0	8	0	7	9	3
Efficiency	0.00	0.00	0.00	0.97	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.79	0.66	1.00
Sag Capacity (cfs)	0.00	0.00	0.00	101.58	101.58	0.00	0.00	0.00	0.00	0.00	0.00	101.58	0.00	101.58	101.58	101.58
Sag Depth (in)	0.00	0.00	0.00	1.39	1.31	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	1.88	2.75	1.07
SD Qi (cfs)	**0.00**	**0.00**	**0.00**	**0.75**	**0.69**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.40**	**0.00**	**0.96**	**1.41**	**0.52**
Bypass (cfs)	0.38	0.40	0.71	0.02	0.01	0.57	0.44	0.24	0.66	0.76	0.51	0.17	0.64	0.26	0.74	0.00
Spread at Inlet (ft)	2.50	2.50	3.40	1.08	0.82	2.53	2.50	2.50	2.67	2.50	2.50	1.64	2.50	2.45	4.70	5.06
Grate																
Capture Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Grate Length (in)	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38
Grate Width (in)	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63
# of Long Bars	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Width of Long Bars (in)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Width of Side Bars (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# of Transverse Bars	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Width of Trans. Bars (In)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Vo (ft/s)	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20
Perimeter (ft)	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30
Area (sq.ft)	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06
Clogged Perimeter (ft)	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Clogged Area (sq.ft.)	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53
INLET HYDRAULICS																
G Hydraulics - Grade																
Eo	0.9840	0.9840	0.9006	1.0000	1.0000	0.9819	0.9840	0.9840	0.9718	0.9840	0.9840	1.0000	0.9840	0.9869	0.7650	0.7319
Qs/Q	0.0160	0.0160	0.0994	0.0000	0.0000	0.0181	0.0160	0.0160	0.0282	0.0160	0.0160	0.0000	0.0160	0.0131	0.2350	0.2681
Rf	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Rs	0.13	0.18	0.19	0.19	0.20	0.21	0.26	0.50	0.19	0.07	0.09	0.09	0.08	0.12	0.09	0.32
Efficiency	0.99	0.99	0.92	1.00	1.00	0.99	0.99	0.99	0.98	0.99	0.99	1.00	0.99	0.99	0.79	0.82
Qi (cfs)	0.37	0.39	0.65	0.02	0.01	0.57	0.43	0.23	0.64	0.75	0.50	0.17	0.63	0.25	0.58	0.00
G Hydraulics - Sag																
Weir Depth (in)	1.28	1.32	1.93	0.19	0.13	1.68	1.41	0.93	1.84	2.03	1.55	0.76	1.81	0.98	1.98	0.00
Orifice Depth (in)	0.01	0.01	0.03	0.00	0.00	0.02	0.01	0.00	0.03	0.04	0.02	0.00	0.03	0.00	0.04	0.00
Controlling Depth (in)	1.28	1.32	1.93	0.19	0.13	1.68	1.41	0.93	1.84	2.03	1.55	0.76	1.81	0.98	1.98	0.00
Depth at Grate (in)	1.28	1.32	1.93	0.19	0.13	1.68	1.41	0.93	1.84	2.03	1.55	0.76	1.81	0.98	1.98	0.00
Flows																
Intercepted (cfs)	**0.37**	**0.39**	**0.65**	**0.77**	**0.70**	**0.57**	**0.43**	**0.24**	**0.64**	**0.75**	**0.50**	**0.58**	**0.63**	**1.21**	**1.99**	**0.52**
Bypass (cfs)	**0.01**	**0.01**	**0.06**	**0.00**	**0.00**	**0.01**	**0.01**	**0.00**	**0.02**	**0.01**	**0.01**	**0.00**	**0.01**	**0.00**	**0.16**	**0.00**

I-10/SR101L DHOV DCR (DrgRptCalcs.fm8)

Label	Solve For	Discharge (cfs)	Spread (ft)	Left Side Slope (H:V)	Right Side Slope (H:V)	Bottom Width (ft)	Grate Width (ft)	Grate Length (ft)	Local Depression (in)	Local Depression Width (in)	Grate Type	Clogging (%)	Depth (in)	Wetted Perimeter (ft)
C1580-100 10-YR	Spread	1.79	4.0	4.000	4.000	3.00	2.50	2.0	1.0	1.0	P-50 mm (P-1-7/8")	50.0	1.4	4.0
C1580-100 100-YR	Spread	2.82	4.5	4.000	4.000	3.00	2.50	2.0	1.0	1.0	P-50 mm (P-1-7/8")	50.0	2.3	4.6
C1580-100 50-YR	Spread	2.46	4.3	4.000	4.000	3.00	2.50	2.0	1.0	1.0	P-50 mm (P-1-7/8")	50.0	2.0	4.4
C1580-101 (double)10-YR	Spread	13.82	7.0	4.000	4.000	3.00	2.50	4.0	1.0	1.0	P-50 mm (P-1-7/8")	50.0	5.9	7.1
C1580-101 (double)100-YR	Spread	21.78	8.8	4.000	4.000	3.00	2.50	4.0	1.0	1.0	P-50 mm (P-1-7/8")	50.0	8.7	9.0
C1580-101 (double)50-YR	Spread	18.98	8.0	4.000	4.000	3.00	2.50	4.0	1.0	1.0	P-50 mm (P-1-7/8")	50.0	7.6	8.2
C1580-102 10-YR	Spread	0.73	0.1	4.000	4.000	3.00	2.50	2.0	1.0	1.0	P-50 mm (P-1-7/8")	50.0	0.3	3.2
C1580-102 100-YR	Spread	1.24	0.1	4.000	4.000	3.00	2.50	2.0	1.0	1.0	P-50 mm (P-1-7/8")	50.0	0.9	3.6
C1580-102 50-YR	Spread	1.06	0.1	4.000	4.000	3.00	2.50	2.0	1.0	1.0	P-50 mm (P-1-7/8")	50.0	0.7	3.5

Top Width (ft)	Open Grate Area (ft²)	Active Grate Weir Length (ft)	Notes	Messages
3.96	2.3	6.5	EB I-10 Station 7069+30, Rt Q10	
4.54	2.3	6.5	EB I-10 Station 7069+30, Rt Q100	
4.35	2.3	6.5	EB I-10 Station 7069+30, Rt Q50	
6.95	4.5	10.5	Double C-15.80 EB I-10 Station 7071+57, Rt Q10 Total A=4.42 Acre	
8.82	4.5	10.5	Double C-15.80 EB I-10 Station 7071+57, Rt Q100 Total A=4.42 Acre	
8.04	4.5	10.5	Double C-15.80 EB I-10 Station 7071+57, Rt Q50 Total A=4.42 Acre	
3.23	2.3	6.5	EB I-10 Station 7088+53, Rt Q10 includes bypass flow 0.47 cfs from C1580-103	
3.61	2.3	6.5	EB I-10 Station 7088+53, Rt Q10 includes bypass flow 0.82 cfs from C1580-103	
3.48	2.3	6.5	EB I-10 Station 7088+53, Rt Q10 includes bypass flow 0.70 cfs from C1580-103	

I-10/SR101L DHOV DCR (DrgRptCalcs.fm8)

Label	Solve For	Manning Coefficient	Slope (ft/ft)	Left Side Slope (H:V)	Right Side Slope (H:V)	Bottom Width (ft)	Discharge (cfs)	Efficiency (%)	Grate Width (ft)	Grate Length (ft)	Grate Type	Clogging (%)	Intercepted Flow (cfs)	Bypass Flow (cfs)
C1580-103 On Grade-10 YR	Efficiency	0.016	0.003	4.000	4.000	3.00	1.36	65.48	2.50	2.0	P-50 mm (P-1-7/8")	50.0	0.89	0.47
C1580-103 On Grade-50 YR	Efficiency	0.016	0.003	4.000	4.000	3.00	1.87	62.69	2.50	2.0	P-50 mm (P-1-7/8")	50.0	1.17	0.70
C1580-103 On Grade-100 YR	Efficiency	0.016	0.003	4.000	4.000	3.00	2.14	61.45	2.50	2.0	P-50 mm (P-1-7/8")	50.0	1.32	0.82

Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	Velocity (ft/s)	Splash Over Velocity (ft/s)	Frontal Flow Factor	Side Flow Factor	Grate Flow Ratio	Active Grate Length (ft)	Critical Depth (in)	Critical Slope (ft/ft)	Froude Number	Flow Type	Specific Energy (ft)	Velocity Head (ft)	Depth (in)
0.8	4.8	4.75	1.60	5.66	1.000	0.028	0.645	1.0	2.1	0.007	0.668	Subcritical	0.26	0.04	2.6
1.1	5.2	5.09	1.77	5.66	1.000	0.023	0.618	1.0	2.5	0.007	0.684	Subcritical	0.31	0.05	3.1
1.2	5.3	5.25	1.84	5.66	1.000	0.022	0.606	1.0	2.7	0.007	0.691	Subcritical	0.33	0.05	3.4

Grate Flow Option	Notes	Messages
Exclude None		
Exclude None		
Exclude None		

Project F0475 - SR 101L/I-10 System Traffic Interchange - DCR
Roadway SB SR 101L: Thomas Rd and McDowell Rd Exit Ramps; EB I-10: System TI Ramp SE Slip Ramp to 91st Ave Exit
Frequency 10-Year

Designed	AE	Date	Mar-2023
Reviewed	JG	Date	Apr-2023
Updated		Date	

Gutter & Inlet Hydraulic Computation Sheet

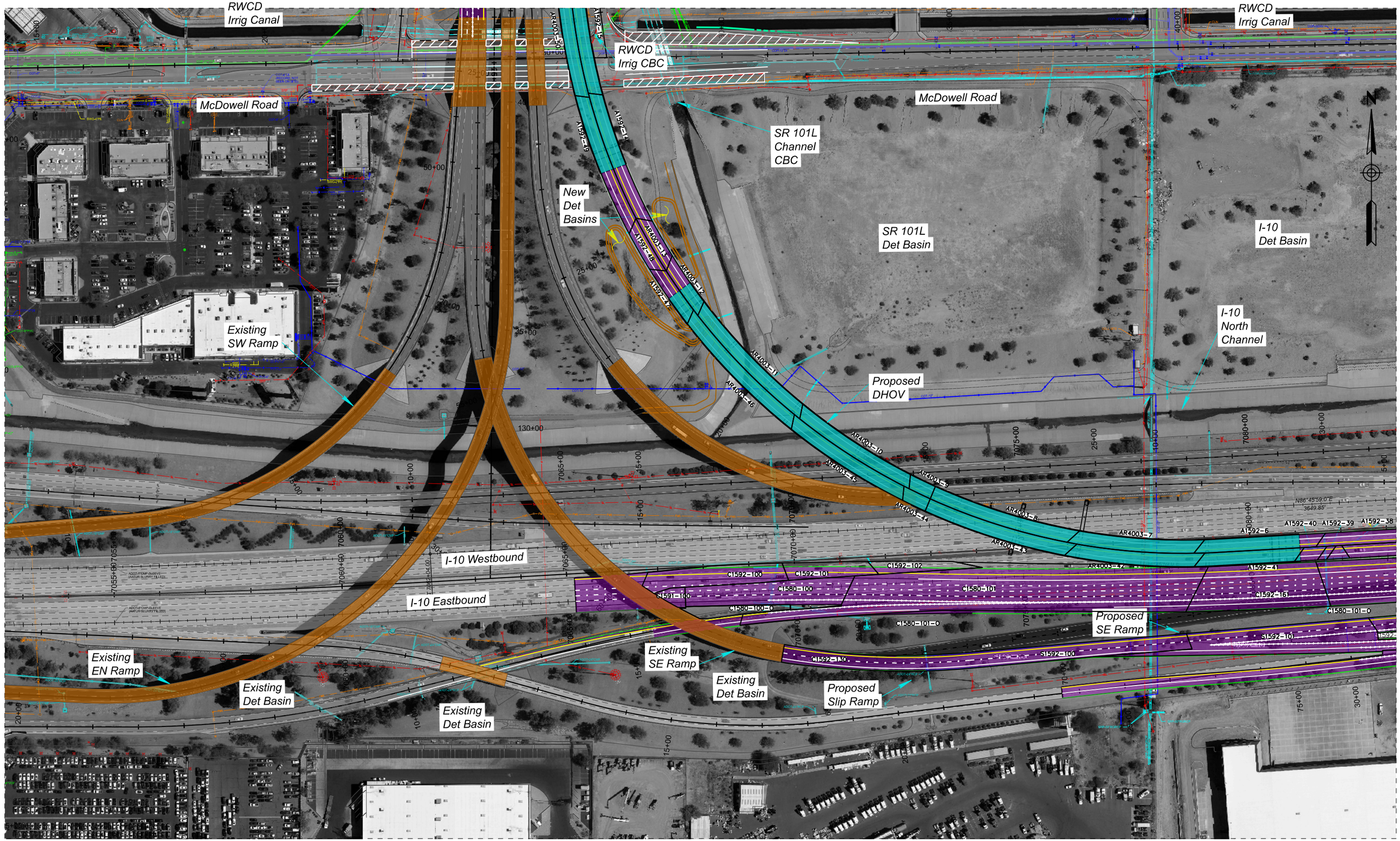
	SOUTHBOUND SR 101L							SB 101L: THOMAS EXIT		SB 101L: MCDOWELL RAMP C				
Inlet #	C113	C114	C115	C116	C117	C118	C119	T101	T100	M100	M101	M102	M103	M104
ID	A20000	A20184	A20487	A20791	A21241	A21851	A22401	B00753	B01062	C00745	C01006	C01326	C02171	C02442
Area #	20000	20184	20487	20791	21241	21851	22401	753	1062	745	1006	1326	2171	2442
Station	200+00	201+84	204+87	207+91	212+41	218+51	224+01	7+53	10+62	7+45	10+06	13+26	21+71	24+42
Offset from CL	83.00	103.30	95.00	95.00	102.73	95.00	86.50	10.00	10.00	10.00	10.00	10.00	10.00	16.00
Lt or Rt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Lt	Rt	Rt	Rt	Rt	Lt
Upstream Inlet	-	20000	20184	20487	20791	21241	21851	1062	-	1006	1326	-	-	-
Direction of Flow	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<	>>>>>	>>>>>
HYDROLOGY														
Tc (min)	10	10	10	10	10	10	10	10	10	10	10	10	10	10
i (in/hr)	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
Contributing Area														
Pavement (Sq.ft.)	18812	23345	29338	28535	52938	57913	50616	7255	7682	6772	8323	9893	12101	7062
Pavement (Acre)	0.4319	0.5359	0.6735	0.6551	1.2153	1.3295	1.1620	0.1666	0.1764	0.1555	0.1911	0.2271	0.2778	0.1621
Roadside (Sq.ft.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roadside (Acre)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Area	0.4319	0.5359	0.6735	0.6551	1.2153	1.3295	1.1620	0.1666	0.1764	0.1555	0.1911	0.2271	0.2778	0.1621
Runoff Coefficient C														
Pavement	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Roadside	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Composite C	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Flows														
Known (cfs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bypass (cfs)	0.00	0.03	0.11	0.02	0.19	0.02	0.13	0.01	0.00	0.01	0.01	0.00	0.00	0.00
CiA (cfs)	1.56	1.93	2.43	2.36	4.39	4.80	4.19	0.60	0.64	0.56	0.69	0.82	1.00	0.59
Total Q (cfs)	1.56	1.97	2.54	2.38	4.58	4.82	4.33	0.61	0.64	0.57	0.70	0.82	1.00	0.59
HYDRAULICS														
Roadway Slopes (ft/ft)														
Longitudinal (S)	0.009000	0.011000	0.018000	0.018000	0.015000	0.004400	0.004400	0.014500	0.014500	0.012000	0.019000	0.020000	0.030000	0.039000
Cross Slope (Sxp)	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
Gutter														
Standard and Type	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2
Pan Width (ft)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Back Slope Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depression (ft)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sx (ft/ft)	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
Sb (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gutter n	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
Gutter Capacity (cfs)	1.01	1.12	1.43	1.43	1.30	0.71	0.71	1.28	1.28	1.17	1.47	1.50	1.84	2.10
T in Gutter (ft)	-	-	-	-	-	-	-	1.90	1.93	1.92	1.90	1.99	1.99	1.55
Curb/Barrier Height (ft)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Depth of flow (ft)	0.30	0.31	0.31	0.31	0.38	0.46	0.45	0.21	0.22	0.22	0.21	0.22	0.22	0.19
Area in Gutter Ag (sq.ft)	0.44	0.47	0.47	0.46	0.64	0.83	0.80	0.22	0.23	0.23	0.22	0.24	0.24	0.16
Hyd Radius Gutter Rg (ft)	0.18	0.19	0.19	0.18	0.26	0.33	0.32	0.09	0.09	0.09	0.09	0.10	0.10	0.06
Qg (cfs)	1.50	1.85	2.39	2.26	3.63	3.05	2.84	0.60	0.64	0.57	0.70	0.82	1.00	0.59
Qo (cfs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T in Pavement (ft)	2.56	3.17	3.20	2.90	6.58	10.45	9.77	-	-	-	-	-	-	-
Pavement n	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160
Qp (cfs)	0.06	0.12	0.15	0.12	0.95	1.77	1.49	-	-	-	-	-	-	-
Q (cfs)	1.56	1.97	2.54	2.38	4.58	4.82	4.33	0.60	0.64	0.57	0.70	0.82	1.00	0.59
Spread (ft)	**5.06**	**5.67**	**5.70**	**5.40**	**9.08**	**12.95**	**12.27**	**2.50**	**2.50**	**2.50**	**2.50**	**2.50**	**2.50**	**2.50**
Shoulder Width (ft)	12.00	12.00	12.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Depth of Flow (in)	**3.61**	**3.76**	**3.77**	**3.70**	**4.58**	**5.51**	**5.35**	**2.56**	**2.60**	**2.59**	**2.57**	**2.66**	**2.65**	**2.28**
Flow Velocity (ft/s)	**3.41**	**3.94**	**5.05**	**4.94**	**5.65**	**3.65**	**3.55**	**2.73**	**2.80**	**2.52**	**3.14**	**3.40**	**4.16**	**3.64**
Allowable Spread	18.00	18.00	18.00	18.00	18.00	18.00	18.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
INLET														
Type	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Standard	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92
Location	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade
Inlet Depression (in)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Slotted Drain/Curb Opening?	yes	yes	yes	yes	yes	yes	yes	yes	no	no	no	no	yes	no
Capture Ratio	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Length (ft)	**5.0**	**5.0**	**10.0**	**5.0**	**15.0**	**10.0**	**15.0**	**5.0**	**0.0**	**0.0**	**0.0**	**0.0**	**5.0**	**0.0**
Se (ft/ft)	0.1321	0.1314	0.1313	0.1317	0.1264	0.1211	0.1219	0.1328	0.0000	0.0000	0.0000	0.0000	0.1333	0.0000
Effective Length (ft)	4	4	8	4	12	8	12	4	0	0	0	0	4	0
Lt (ft)	8	9	12	12	15	11	10	6	0	0	0	0	10	0
Efficiency	0.71	0.63	0.85	0.52	0.94	0.90	1.00	0.84	0.00	0.00	0.00	0.00	0.63	0.00
Sag Capacity (cfs)	101.58	101.58	149.39	101.58	197.19	149.39	197.19	101.58	0.00	0.00	0.00	0.00	101.58	0.00
Sag Depth (in)	2.22	2.60	2.38	2.95	2.93	3.65	2.82	1.19	0.00	0.00	0.00	0.00	1.66	0.00
SD Qi (cfs)	**1.11**	**1.24**	**2.17**	**1.25**	**4.32**	**4.37**	**4.33**	**0.51**	**0.00**	**0.00**	**0.00**	**0.00**	**0.63**	**0.00**
Bypass (cfs)	0.45	0.73	0.37	1.13	0.27	0.46	0.00	0.10	0.64	0.57	0.70	0.82	0.38	0.59
Spread at Inlet (ft)	3.28	4.00	2.91	4.17	3.35	5.68	12.27	1.31	2.50	2.50	2.50	2.50	1.77	2.50
Grate														
Capture Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Grate Length (in)	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38
Grate Width (in)	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63
# of Long Bars	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Width of Long Bars (in)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Width of Side Bars (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# of Transverse Bars	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Width of Trans. Bars (In)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Vo (ft/s)	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20
Perimeter (ft)	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30
Area (sq.ft)	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06
Clogged Perimeter (ft)	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Clogged Area (sq.ft.)	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53
INLET HYDRAULICS														
G Hydraulics - Grade														
Eo	0.9140	0.8360	0.9513	0.8189	0.9058	0.6790	0.3730	1.0000	0.9840	0.9840	0.9840	0.9840	1.0000	0.9840
Qs/Q	0.0860	0.1640	0.0487	0.1811	0.0942	0.3210	0.6270	0.0000	0.0160	0.0160	0.0160	0.0160	0.0000	0.0160
Rf	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Rs	0.10	0.08	0.05	0.05	0.04	0.09	0.09	0.13	0.13	0.15	0.11	0.10	0.07	0.09
Efficiency	0.92	0.85	0.95	0.83	0.91	0.71	0.43	1.00	0.99	0.99	0.99	0.99	1.00	0.99
Qi (cfs)	0.42	0.62	0.35	0.94	0.24	0.32	0.00	0.10	0.63	0.56	0.69	0.81	0.38	0.58
G Hydraulics - Sag														
Weir Depth (in)	1.43	1.97	1.26	2.64	1.01	1.45	0.00	0.51	1.80	1.68	1.92	2.13	1.27	1.70
Orifice Depth (in)	0.01	0.03	0.01	0.08	0.00	0.01	0.00	0.00	0.03	0.02	0.03	0.04	0.01	0.02
Controlling Depth (in)	1.43	1.97	1.26	2.64	1.01	1.45	0.00	0.51	1.80	1.68	1.92	2.13	1.27	1.70
Depth at Grate (in)	1.43	1.97	1.26	2.64	1.01	1.45	0.00	0.51	1.80	1.68	1.92	2.13	1.27	1.70
Flows														
Intercepted (cfs)	**1.52**	**1.86**	**2.52**	**2.19**	**4.56**	**4.69**	**4.33**	**0.61**	**0.63**	**0.56**	**0.69**	**0.81**	**1.00**	**0.58**
Bypass (cfs)	**0.03**	**0.11**	**0.02**	**0.19**	**0.02**	**0.13**	**0.00**	**0.00**	**0.01**	**0.01**	**0.01**	**0.01**	**0.00**	**0.01**

	SB 101L: MCDOWELL RAMP C													EB I-10: 91ST AVE SLIP RAMP		
Inlet #	M105	M106	M107	M108	M109	M110	M111	M112	M113	M114	M115	M116	M117	S100	S101	S102
ID	C02618	C02801	C03127	C03457	C03784	C04050	C04250	C04300	C04350	C04650	C05000	C05236	C05500	D00000	D00475	D00536
Area #	2618	2801	3127	3457	3784	4050	4250	4300	4350	4650	5000	5236	5500	0	475	536
Station	26+18	28+01	31+27	34+57	37+84	40+50	42+50	43+00	43+50	46+50	50+00	52+36	55+00	00+00	4+75	5+36
Offset from CL	10.00	10.00	10.00	10.00	10.00	16.00	16.00	16.00	16.00	16.00	16.00	10.00	10.00	10.00	10.00	10.00
Lt or Rt	Rt	Rt	Rt	Rt	Rt	Lt	Lt	Lt	Lt	Lt	Lt	Rt	Rt	Rt	Rt	Rt
Upstream Inlet	-	2618	2801	3127	3457	-	4050	Sag	4650	5000	-	5500	-	-	0	475
Direction of Flow	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	>>>>>	v	<<<<<	<<<<<	<<<<<	<<<<<	<<<<<	>>>>>	>>>>>	>>>>>
HYDROLOGY																
Tc (min)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
i (in/hr)	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80	3.80
Contributing Area																
Pavement (Sq.ft.)	4585	4765	8483	8577	8487	6919	5198	2599	7791	9091	6129	6864	7763	14635	25842	4380
Pavement (Acre)	0.1053	0.1094	0.1947	0.1969	0.1948	0.1588	0.1193	0.0597	0.1789	0.2087	0.1407	0.1576	0.1782	0.3360	0.5933	0.1006
Roadside (Sq.ft.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roadside (Acre)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total Area	0.1053	0.1094	0.1947	0.1969	0.1948	0.1588	0.1193	0.0597	0.1789	0.2087	0.1407	0.1576	0.1782	0.3360	0.5933	0.1006
Runoff Coefficient C																
Pavement	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Roadside	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Composite C	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Flows																
Known (cfs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bypass (cfs)	0.00	0.01	0.01	0.06	0.00	0.00	0.01	0.02	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.16
CiA (cfs)	0.38	0.39	0.70	0.71	0.70	0.57	0.43	0.22	0.65	0.75	0.51	0.57	0.64	1.21	2.14	0.36
Total Q (cfs)	0.38	0.40	0.71	0.77	0.70	0.57	0.44	0.24	0.66	0.76	0.51	0.58	0.64	1.21	2.14	0.52
HYDRAULICS																
Roadway Slopes (ft/ft)																
Longitudinal (S)	0.030000	0.010000	0.004000	0.004000	0.004000	0.004000	0.003000	0.000000	0.005000	0.040000	0.040000	0.040000	0.040000	0.007900	0.007900	0.001000
Cross Slope (Sxp)	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200	0.0200
Gutter																
Standard and Type	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2	F2
Pan Width (ft)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
Back Slope Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Depression (ft)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sx (ft/ft)	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000
Sb (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gutter n	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013	0.013
Gutter Capacity (cfs)	1.84	1.06	0.67	0.67	0.67	0.67	0.58	-	0.75	2.13	2.13	2.13	2.13	0.95	0.95	0.34
T in Gutter (ft)	1.38	1.73	-	-	-	2.36	2.25	-	2.38	1.70	1.46	1.54	1.60	-	-	-
Curb/Barrier Height (ft)	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Depth of flow (ft)	0.18	0.20	0.27	0.27	0.27	0.25	0.24	0.15	0.25	0.20	0.18	0.19	0.19	0.28	0.34	0.30
Area in Gutter Ag (sq.ft)	0.13	0.19	0.36	0.37	0.35	0.31	0.29	0.06	0.32	0.19	0.15	0.16	0.17	0.40	0.53	0.44
Hyd Radius Gutter Rg (ft)	0.05	0.08	0.14	0.15	0.14	0.13	0.12	0.03	0.13	0.07	0.06	0.06	0.07	0.16	0.21	0.18
Qg (cfs)	0.38	0.40	0.71	0.76	0.70	0.57	0.44	-	0.66	0.76	0.51	0.58	0.64	1.19	1.91	0.50
Qo (cfs)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T in Pavement (ft)	-	-	0.90	1.24	0.85	0.03	-	-	0.17	-	-	-	-	1.72	4.34	2.56
Pavement n	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160	0.0160
Qp (cfs)	-	-	0.00	0.01	0.00	-	-	-	-	-	-	-	-	0.02	0.23	0.02
Q (cfs)	0.38	0.40	0.71	0.77	0.70	0.57	0.44	0.24	0.66	0.76	0.51	0.58	0.64	1.21	2.14	0.52
Spread (ft)	**2.50**	**2.50**	**3.40**	**3.74**	**3.35**	**2.53**	**2.50**	**2.50**	**2.67**	**2.50**	**2.50**	**2.50**	**2.50**	**4.22**	**6.84**	**5.06**
Shoulder Width (ft)	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Depth of Flow (in)	**2.15**	**2.43**	**3.22**	**3.30**	**3.20**	**3.01**	**2.91**	**0.93**	**3.04**	**2.40**	**2.21**	**2.26**	**2.31**	**3.41**	**4.04**	**3.61**
Flow Velocity (ft/s)	**2.82**	**2.07**	**1.98**	**2.04**	**1.97**	**1.81**	**1.50**	**0.00**	**2.06**	**4.06**	**3.46**	**3.64**	**3.79**	**2.99**	**3.61**	**1.14**
Allowable Spread	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00	14.00
INLET																
Type	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
Standard	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92	C-15.92
Location	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Sag	Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade
Inlet Depression (in)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Slotted Drain/Curb Opening?	no	no	no	yes	yes	no	no	no	no	no	no	yes	no	yes	yes	yes
Capture Ratio	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Length (ft)	**0.0**	**0.0**	**0.0**	**5.0**	**5.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**5.0**	**0.0**	**5.0**	**5.0**	**5.0**
Se (ft/ft)	0.0000	0.0000	0.0000	0.1332	0.1331	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1334	0.0000	0.1327	0.1297	0.1320
Effective Length (ft)	0	0	0	4	4	0	0	0	0	0	0	4	0	4	4	4
Lt (ft)	0	0	0	5	4	0	0	0	0	0	0	8	0	7	9	3
Efficiency	0.00	0.00	0.00	0.97	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.79	0.66	1.00
Sag Capacity (cfs)	0.00	0.00	0.00	101.58	101.58	0.00	0.00	0.00	0.00	0.00	0.00	101.58	0.00	101.58	101.58	101.58
Sag Depth (in)	0.00	0.00	0.00	1.39	1.31	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	1.88	2.75	1.07
SD Qi (cfs)	**0.00**	**0.00**	**0.00**	**0.75**	**0.69**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.40**	**0.00**	**0.96**	**1.41**	**0.52**
Bypass (cfs)	0.38	0.40	0.71	0.02	0.01	0.57	0.44	0.24	0.66	0.76	0.51	0.17	0.64	0.26	0.74	0.00
Spread at Inlet (ft)	2.50	2.50	3.40	1.08	0.82	2.53	2.50	2.50	2.67	2.50	2.50	1.64	2.50	2.45	4.70	5.06
Grate																
Capture Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Grate Length (in)	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38	40.38
Grate Width (in)	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63	23.63
# of Long Bars	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Width of Long Bars (in)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Width of Side Bars (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
# of Transverse Bars	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Width of Trans. Bars (In)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Vo (ft/s)	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20
Perimeter (ft)	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30
Area (sq.ft)	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06	5.06
Clogged Perimeter (ft)	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Clogged Area (sq.ft.)	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53
INLET HYDRAULICS																
G Hydraulics - Grade																
Eo	0.9840	0.9840	0.9006	1.0000	1.0000	0.9819	0.9840	0.9840	0.9718	0.9840	0.9840	1.0000	0.9840	0.9869	0.7650	0.7319
Qs/Q	0.0160	0.0160	0.0994	0.0000	0.0000	0.0181	0.0160	0.0160	0.0282	0.0160	0.0160	0.0000	0.0160	0.0131	0.2350	0.2681
Rf	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Rs	0.13	0.18	0.19	0.19	0.20	0.21	0.26	0.50	0.19	0.07	0.09	0.09	0.08	0.12	0.09	0.32
Efficiency	0.99	0.99	0.92	1.00	1.00	0.99	0.99	0.99	0.98	0.99	0.99	1.00	0.99	0.99	0.79	0.82
Qi (cfs)	0.37	0.39	0.65	0.02	0.01	0.57	0.43	0.23	0.64	0.75	0.50	0.17	0.63	0.25	0.58	0.00
G Hydraulics - Sag																
Weir Depth (in)	1.28	1.32	1.93	0.19	0.13	1.68	1.41	0.93	1.84	2.03	1.55	0.76	1.81	0.98	1.98	0.00
Orifice Depth (in)	0.01	0.01	0.03	0.00	0.00	0.02	0.01	0.00	0.03	0.04	0.02	0.00	0.03	0.00	0.04	0.00
Controlling Depth (in)	1.28	1.32	1.93	0.19	0.13	1.68	1.41	0.93	1.84	2.03	1.55	0.76	1.81	0.98	1.98	0.00
Depth at Grate (in)	1.28	1.32	1.93	0.19	0.13	1.68	1.41	0.93	1.84	2.03	1.55	0.76	1.81	0.98	1.98	0.00
Flows																
Intercepted (cfs)	**0.37**	**0.39**	**0.65**	**0.77**	**0.70**	**0.57**	**0.43**	**0.24**	**0.64**	**0.75**	**0.50**	**0.58**	**0.63**	**1.21**	**1.99**	**0.52**
Bypass (cfs)	**0.01**	**0.01**	**0.06**	**0.00**	**0.00**	**0.01**	**0.01**	**0.00**	**0.02**	**0.01**	**0.01**	**0.00**	**0.01**	**0.00**	**0.16**	**0.00**

APPENDIX C

RECOMMENDED DRAINAGE LAYOUT PLANS

Drainage Plan — Recommended Alt F and Alt 3 (with Onsite Sub-Basins)



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NOT FOR CONSTRUCTION OR RECORDING

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DRAWN	O RODRIGUEZ	3/23
CHECKED	D STOUGH	3/23
TEAM LEADER	R BRAGG	3/23

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I-10 & DHOV SUB-BASINS

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I-10		ARIZ.					
MILEPOST 131.0-136.0	LOCATION: I-10 / SR-101L DHOV RECOMMENDED ALTS ONSITE DRAINAGE					DWG NO:	
STRUCTURE NO.	TRACS NO.					1 OF 7	

DATE- LOCATION- REVISIONS- FINISHED PLANS- SURVEY NO.

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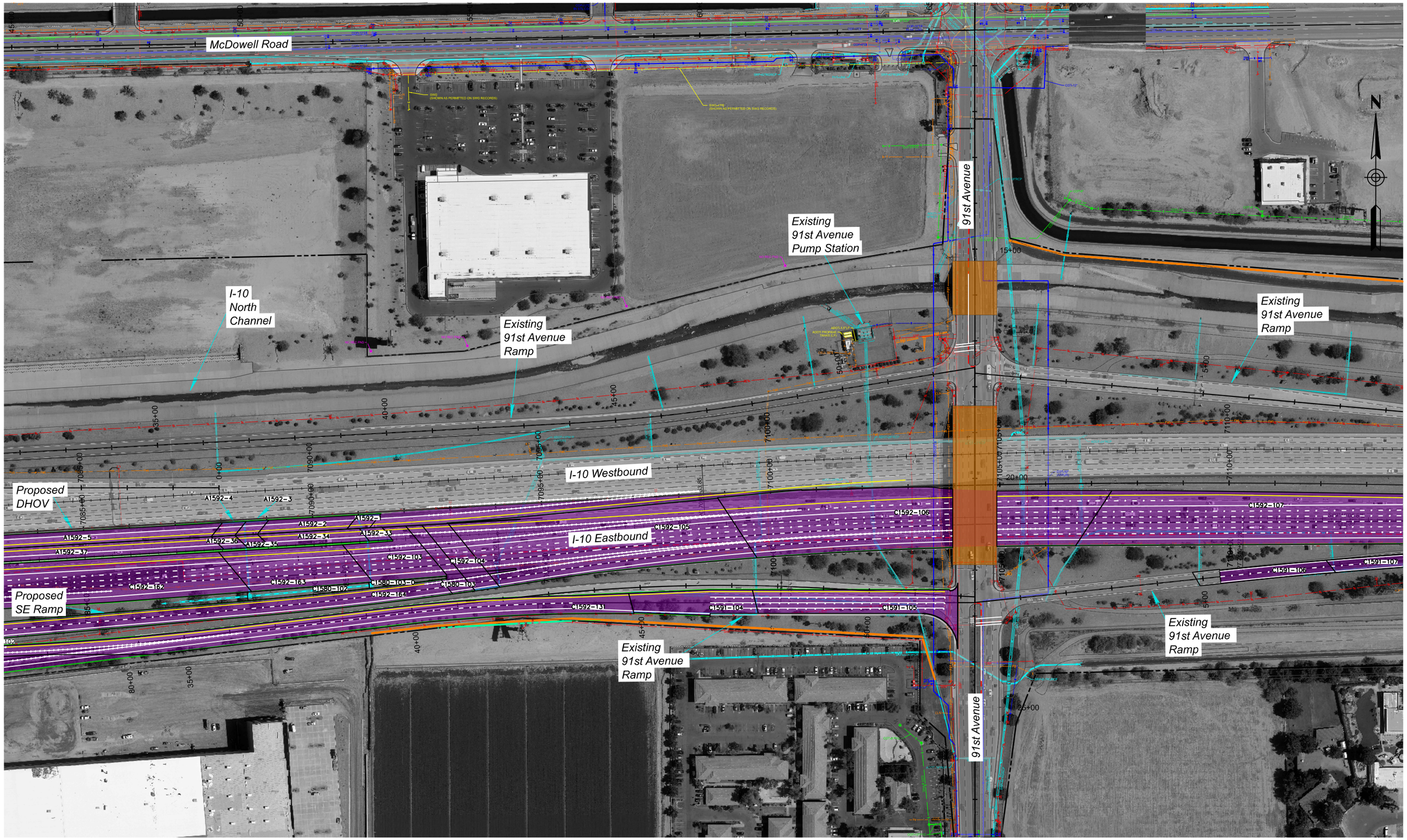

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STRUCTURE NO.	TRACS NO.					2 OF 7	

SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE-

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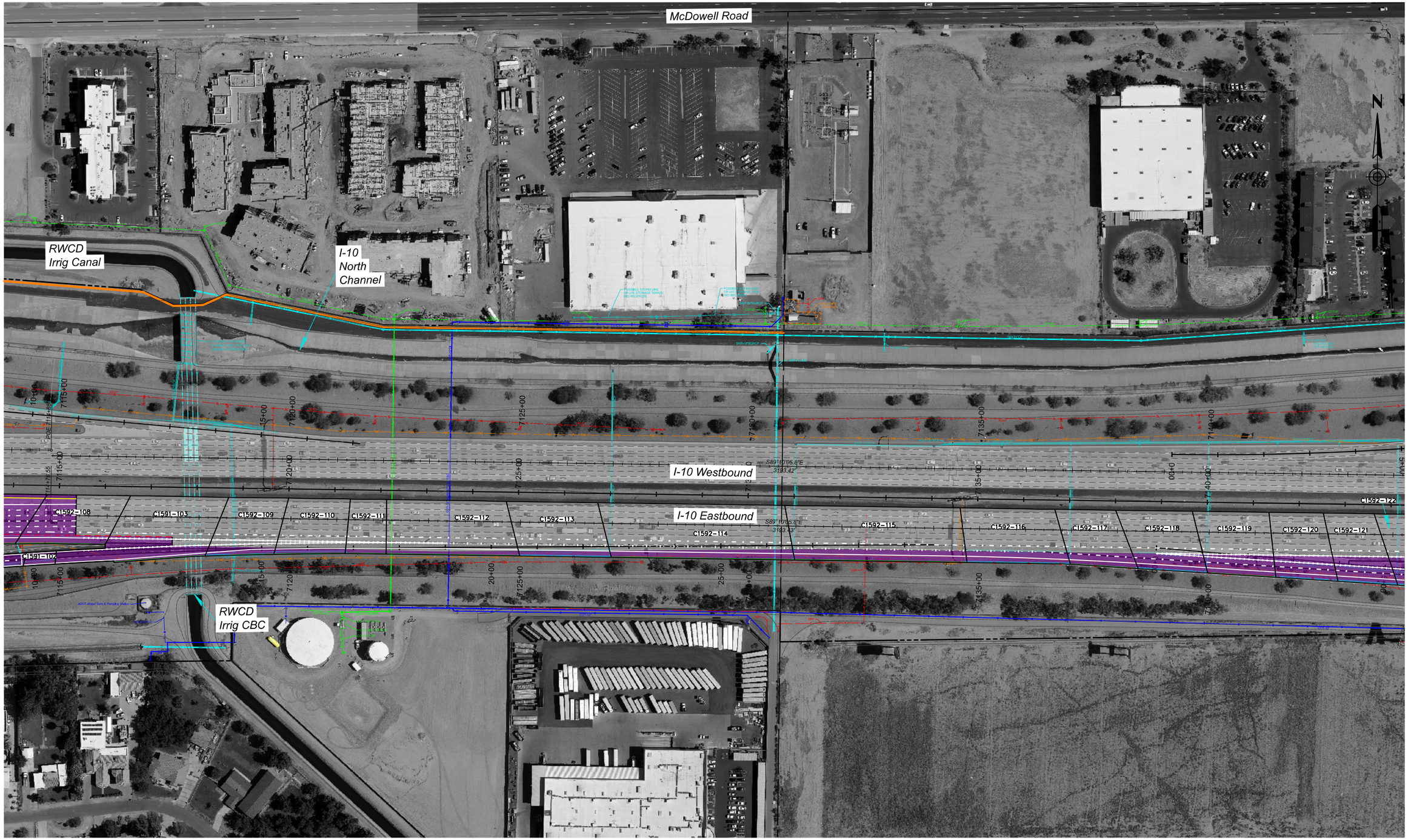

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SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE-

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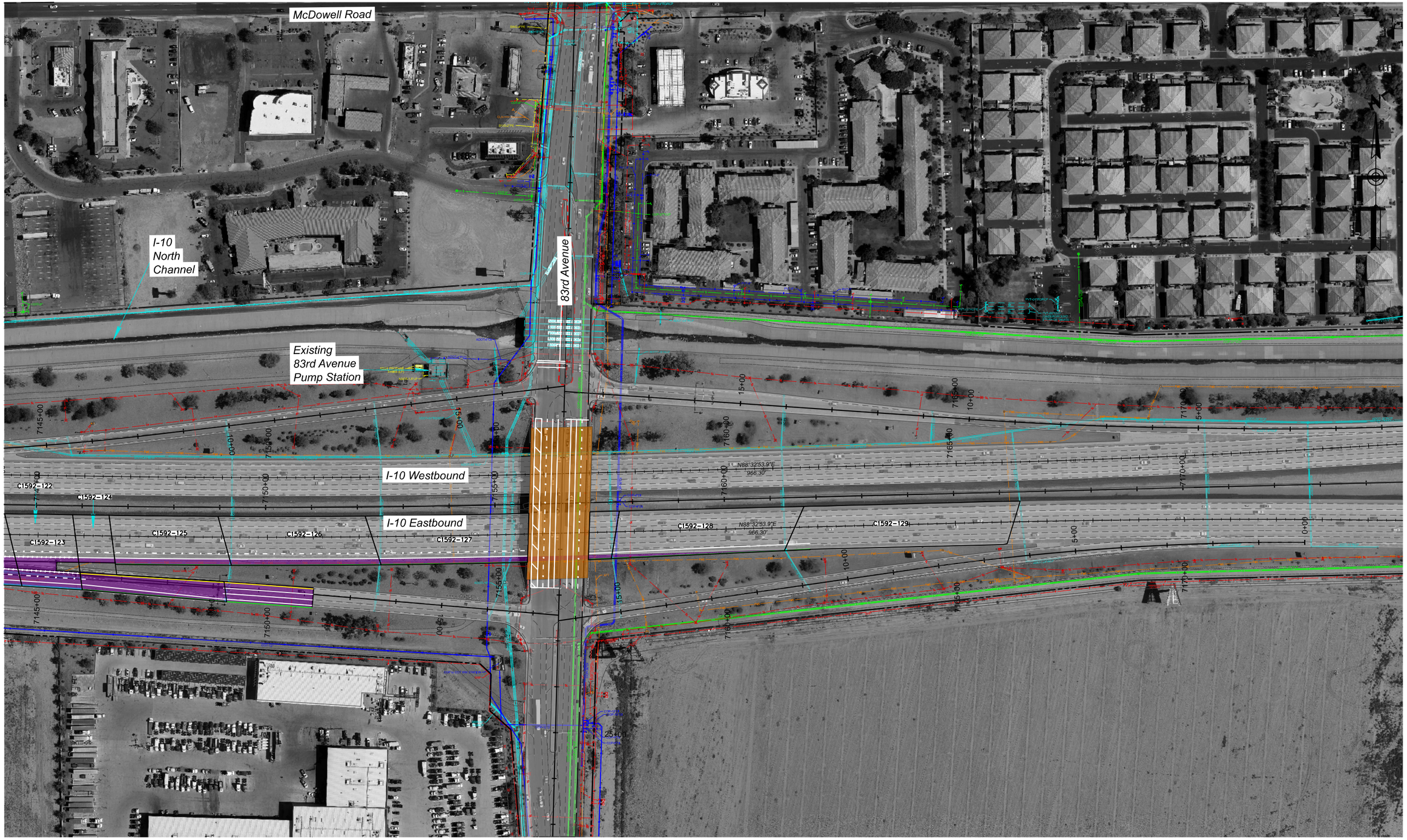

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SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE-

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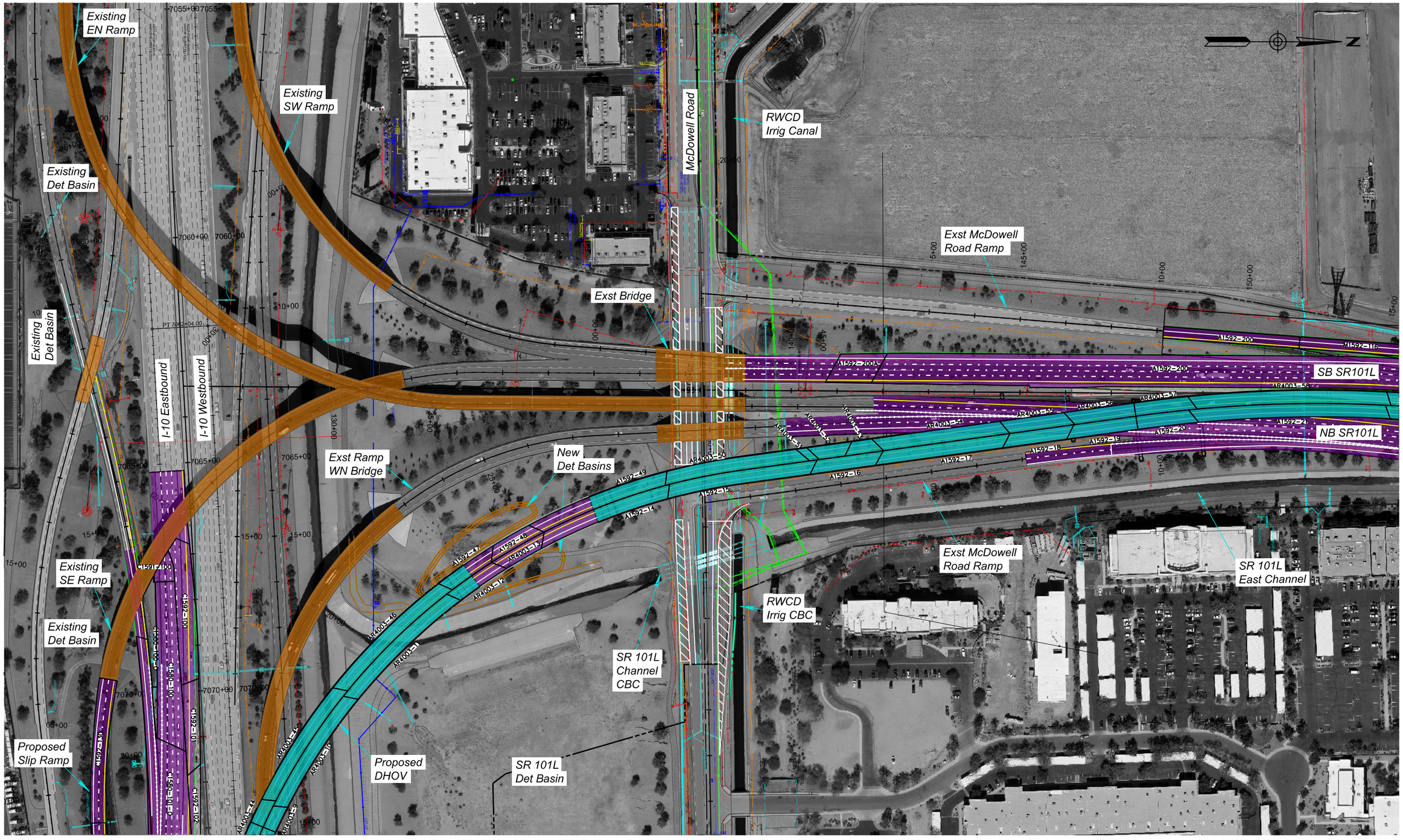

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SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE-

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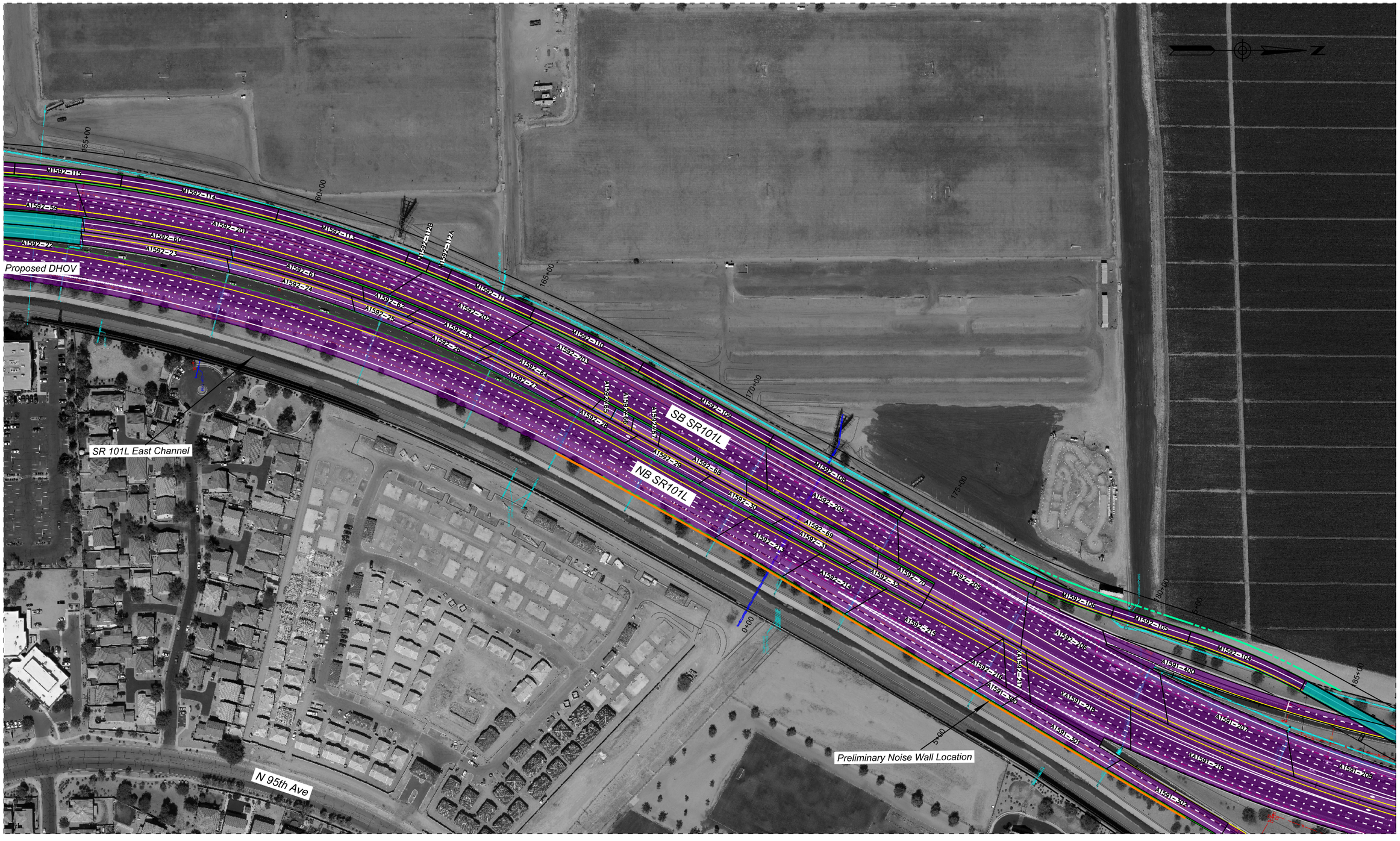

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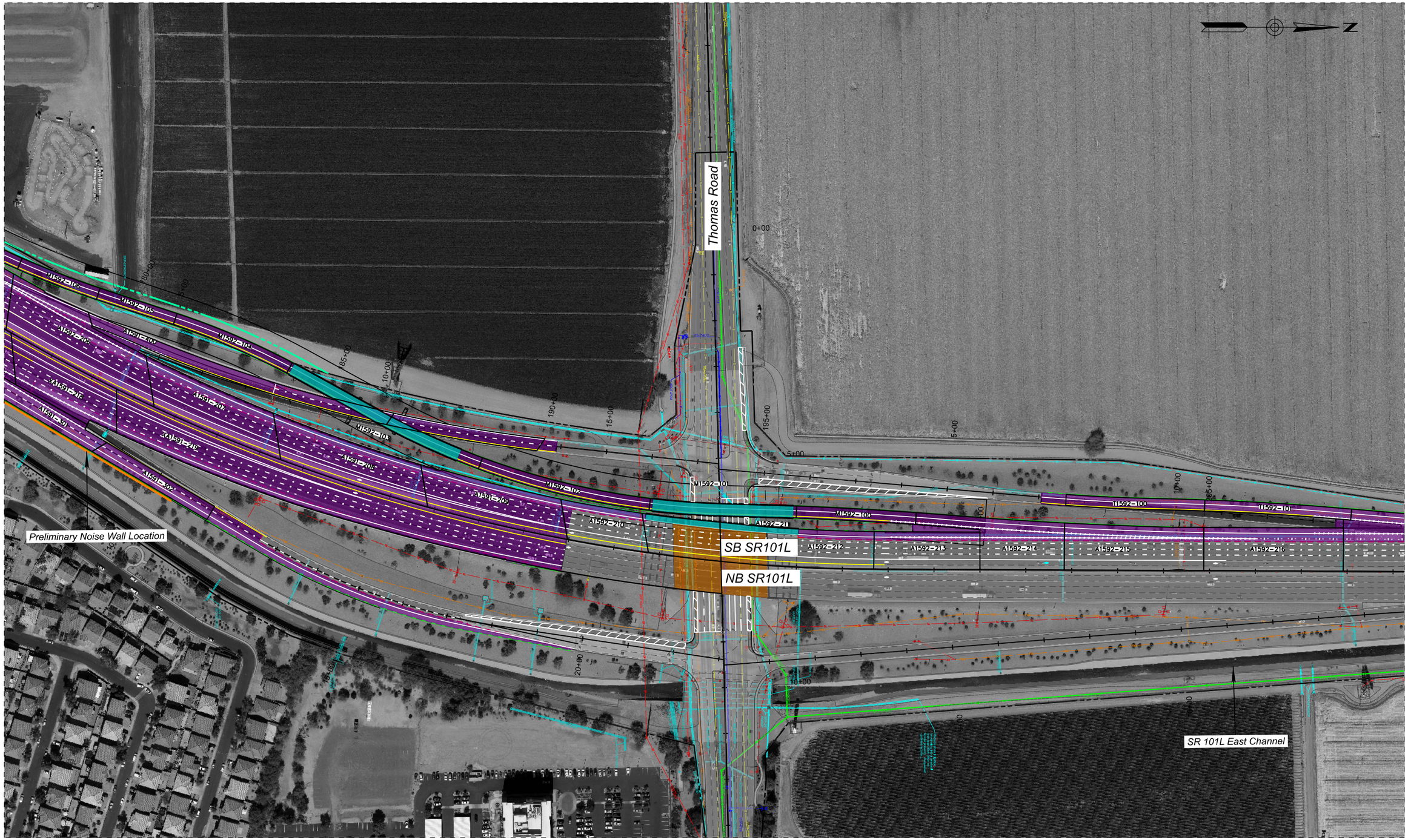
SURVEY NO. | FINISHED PLANS- | REVISIONS- | LOCATION- | DATE-



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