Appendix H – HEC-HMS Input Data Supporting Documentation

Exhibit H.1 **Drainage Criteria Manual Table 2-3: 24-hour Rainfall Depths**

Exhibit H.2 **Zoning**

Exhibit H.3 **Land Use and Percent Impervious Cover**

Exhibit H.4 **Drainage Criteria Manual Section 2.4.2: Time of Concentration Equations**

Exhibit H.5 **Soil Survey Geographic Database (SSURGO) Soil Map and Soil Descriptions**

Exhibit H.6 **Effective HEC-HMS Model Soil Map**

Exhibit H.7 **Technical Release-55 Table 2-2a: Runoff Curve Numbers for Urban Areas**

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Exhibit H.9 **HEC-HMS Technical Reference Manual**

Exhibit H.10 **Correspondence with WPD**

Exhibit H.1

Drainage Criteria Manual Table 2-3:

24-hour Rainfall Depths

Table 2-3. Depth-Duration-Frequency Table for Austin and Travis County>

Depth of Precipitation (in inches)

Recurrence Interval (year)	5 min*	15 min	30 min	1-hr	2-hr	3-hr	6-hr	12-hr	24-hr
2	0.48	0.98	1.32	1.72	2.16	2.32	2.67	3.06	3.44
5	0.62	1.26	1.71	2.28	2.89	3.13	3.56	4.07	4.99
10	0.71	1.47	1.98	2.68	3.42	3.71	4.21	4.81	6.1
25	0.84	1.76	2.36	3.28	4.2	4.55	5.14	5.9	7.64
50	0.94	2.01	2.68	3.79	4.88	5.28	5.94	6.86	8.87
100	1.05	2.29	3.04	4.37	5.66	6.11	6.85	7.96	10.2
250	1.21	2.73	3.57	5.26	6.86	7.38	8.24	9.67	12
500	1.33	3.11	4.02	6.06	7.94	8.51	9.47	11.2	13.5

* The 5-min rainfall depths were calculated using the 5-min rainfall intensity values from Table 2-4.

Exhibit H.2

Zoning

City of Austin

Neighborhood Planning

Guide To Zoning

City of Austin

Planning & Development Review Department
505 Barton Springs Road
One Texas Center
Austin, TX 78704

June 2014

DISCLAIMER: This Guide is for informational purposes only. It does not constitute legal regulations. Consult the Land Development Code for specific regulations.

Standard Land Uses
and Map Designations

	Land Use	Definition	Typical Zoning*	Color
Residential	Rural Residential	The designation for low-density residential areas that are not suitable or desirable for urban development, generally at densities of one unit per acre or less.	RR, LA	**Pale Yellow**
	Single Family	Single family detached, or two family residential uses at typical urban and/or suburban densities.	SF-1, SF-2, SF-3	**Yellow**
	Urban Single Family	Single family detached, small-lot single family, or two family residential uses at urban densities.	SF-4A and SF-4B	**Yellow with Black Stipple**
	Higher-Density Single Family	Single-family housing, generally up to 15 units per acre, which includes townhouses and condominiums as well as traditional small-lot single family.	SF-5, SF-6 and MH	**Goldenrod**
	Mixed Residential	An area with a variety of different housing types, including single-family residential, townhouses, duplexes, apartments, and limited neighborhood-serving retail. Single-family residential should comprise at least half of a mixed residential area.	SF-3, SF-4, SF-5, SF-6, MF-1, MF-2, MF-3, MF-4, MF-5, MF-6	**Salmon**
	Multifamily	Higher-density housing with 3 or more units on one lot.	MF-1, MF-2, MF-3, MF-4, MF-5, MF-6 and MH	**Orange**
Mixed Use	Neighborhood Mixed Use	An area that is appropriate for a mix of neighborhood commercial (small-scale retail or offices, professional services, convenience retail, and shopfront retail that serve a market at a neighborhood scale) and small to medium-density residential uses.	NO-MU, LO-MU, LR-MU (see note for vertical mixed use building "V" designation)	**Brown w/ White Stipple**
	Mixed Use/Office	An area that is appropriate for a mix of residential and office uses.	NO-MU, LO-MU and GO-MU (see note for vertical mixed use building "V" designation)	**Reddish Brown**
	Mixed Use	An area that is appropriate for a mix of residential and non-residential uses.	NO-MU, LO-MU, GO-MU, LR-MU, GR-MU, CS-MU, CS-1-MU (see note for vertical mixed use "V" designation)	**Brown**
	High Density Mixed Use	An area that is appropriate for a mix of residential and non-residential uses with floor-to-area ratios of 3.0 or higher.	CH, DMU, CBD (see note for vertical mixed use "V" designation)	**Dark Brown**
Commercial/Industrial	Office	An area that provides for office uses as a transition from residential to commercial uses, or for large planned office areas. Permitted uses included business, professional, and financial offices as well as offices for individuals and non-profit organizations.	NO, LO, GO	**Pink**
	Neighborhood Commercial	Lots or parcels containing small-scale retail or offices, professional services, convenience retail, and shopfront retail that serve a market at a neighborhood scale.	NO, LO, LR	**Red w/ White Stipple**
	Commercial	Lots or parcels containing retail sales, services, hotel/motels and all recreational services that are predominantly privately owned and operated for profit (for example, theaters and bowling alleys). Included are private institutional uses (convalescent homes and rest homes in which medical or surgical services are not a main function of the institution), but not hospitals.	LR, GR, CS, CS-1, CH, W/LO	**Red**
	Industry	Areas reserved for manufacturing and related uses that provide employment but are generally not compatible with other areas with lower intensity use. Industry includes general warehousing, research and development, and storage of hazardous materials.	IP, MI, LI, R&D, W/LO	**Purple**

Updated July 5, 2011

Standard Land Uses and Map Designations

	Land Use	Definition	Typical Zoning*	Color
Civic/Open Space	Environmental Conservation	Areas intended to be protected from development, including areas in the Drinking Water Protection zone, locations of critical environmental features, and areas where public services or facilities are not available.	P, DR, RR	**Blue-Green**
	Recreation & Open Space	This category allows large public parks and recreation areas such as public and private golf courses, trails and easements, drainage-ways and detention basins, and any other public usage of large areas on permanent open land.	Varies	**Green**
	Civic	Any site for public or semi-public facilities, including governmental offices, police and fire facilities, hospitals, and public and private schools. Includes major religious facilities and other religious activities that are of a different type and scale than surrounding uses.	Varies (Typically P for gov't facilities)	**Blue**
	Utilities	Land used or dedicated for public and private utilities, including pipelines, utility lines, water and wastewater facilities, substations, and telephone.	P	**Dark Grey**
Special Purpose	Agriculture	Rural areas used for agricultural purposes, including productive agricultural lands to be preserved for future farming or ranching activities.	AG	**Pale Green**
	Major Impact Facilities	Facilities that serve community and regional need but have significant impacts on the surrounding area that require special location and compatibility considerations. Major Impact Facilities include airports, stadiums, landfills, resource extraction, and correctional facilities.	P, AV	**Dark Purple**
	Major Planned Developments	Master-planned developments for large multi-acre tracts that incorporate a wide variety of land uses that may include, but are not limited to, single family and multifamily residential, commercial, and clean industrial.	PUD, PDA	**Lavender**
	Transportation	Areas dedicated to vehicle, air, or rail transportation. These include existing and platted streets, planned and dedicated rights-of-way, and rail and rail facilities.	ROW	**Grey**
	Water	Any public waters, including lakes, rivers, and creeks.	--	**Light Blue**

*Indicates zoning categories usually found in these land use designations. Not an exhaustive list of all zoning categories allowed in each land use. Refer to "Land Use and Zoning Matrix" for a complete list of zoning districts permitted in each land use category.

Note 1: The vertical mixed use building (V) designation is permitted in Mixed Use Future Land Use categories in combination with commercially zoned properties (1) along a Core Transit Corridor; or (2) in conjunction with the (MU) combining district.

Note 2: Refer to the Appendix of the Oak Hill Combined Neighborhood Plan for the Council amended Standard Land Use table.

	Map Designation	Definition	Regulating Plans	Color
Other	Specific Regulating District	This map designation is intended for areas that have an adopted regulating plan. This district will be identified on the Future Land Use Map, but is not considered a typical land use category. The purpose of this designation is to make the user aware of the Regulating Plan and that it should be reviewed for development regulations.	1. Plaza Saltillo TOD Station Area Plan 2. Martin Luther King (MLK) Boulevard TOD Station Area Plan 3. Lamar/Justin TOD Station Area Plan	**Dark Olive w/ White Stipple**

Updated July 5, 2011

LAND USE AND ZONING MATRIX

MAP COLOR	LAND USE	LA	RR	SF-1	SF-2	SF-3	SF-4A	SF-4B	SF-5	SF-6	MF-1	MF-2	MF-3	MF-4	MF-5	MF-6	NO	LO	GO	LR	GR	CS	CS-1	CH	L	DMU	CBD	W/LO	IP	MI	LI	R&D	DR	AG	MH	CR	P	AV	PUD	TOD	MU & V
Pale Yellow	Rural Residential	▨	▨	1	1	1	1	1	1	1																													5		
Yellow	Single Family	░	░	▨	▨	▨	4	4	2	2																													5		
Yellow with Black Stipple	Urban Single Family	░	░	░	░	░	▨	▨																															5		
Goldenrod	Higher Density Single Family	░	░	░	░	░	░	░	▨	▨																								▨				5		
Salmon	Mixed Residential	░	░	░	░	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨																						5		
Orange	Multifamily	░	░	░	░	░	░	░	░	░	▨	▨	▨	▨	▨	▨																		▨				5		
Brown with white stipple	Neighborhood Mixed Use	░	░	░	░	░	░	░	░	░	░	░					▨	▨		▨																			5		▨
Reddish Brown	Mixed Use/Office	░	░	░	░	░	░	░	░	░	░	░	░	░	░		▨	▨	▨																				5		▨
Brown	Mixed Use	░	░	░	░	░	░	░	░	░	░	░	░	░	░	░	▨	▨	▨	▨	▨	▨	▨								3								5		▨
Dark Brown	High Density Mixed Use	░	░	░	░	░	░	░	░	░	░	░	░	░	░	░	░	░	░	░	░	░	░	▨	░	▨	▨				3								5		▨
Pink	Office																▨	▨	▨																				5		
Red with white stipple	Neighborhood Commercial																▨	▨		▨																			5		
Red	Commercial																░	░	░	▨	▨	▨	▨	▨				▨											5		
Purple	Industry																											▨	▨	▨	▨	▨							5		
Pale Green	Agriculture																																░	▨					5		
Dark Purple	Major Impact Facilities																													░	░						▨	▨	5		
Lavender	Major Planned Development																							7					7	7	7	7							▨		
Blue-Green	Environmental Conservation	These land use categories are specialized categories that apply to the specified land use only, regardless of the underlying zoning categories. Any zoning change that involves a change in the specified land use to another land use (i.e. redeveloping church property - CIVIC land use - into apartments - MULTIFAMILY land use) requires a plan amendment.																																							
Green	Recreation & Open Space																																								
Blue	Civic																																								
Dark Grey	Utilities																																								
Magenta	Warehouse/ Limited Office	**Discontinued July 2008 (See Note #6)**																																							
Beige	Mobile Homes	**Discontinued November 2010 (See Note #9)**																																							
Dark Olive w/ White Stipple	Specific Regulating District	This map designation is intended for areas that have an adopted regulating plan. This district will be identified on the Future Land Use Map, but is not considered a typical land use category. The purpose of this designation is to make the user aware of the Regulating Plan and that it should be reviewed for development regulations. (Note #10)																																							

░ Permitted Zoning

▨ Typical Zoning

NOTES:

1. Other Single Family zoning districts may be allowed if overall density and impervious cover is consistent with the Rural Residential land use category.

2. For all plans adopted prior to January 2002, with the exception of the Central East Austin Neighborhood Plan, SF-5 and SF-6 can be used in the Single Family land use designation without a plan amendment.

3. In certain cases, LI zoning may be used in Mixed Use or High Density Mixed Use land use categories provided the most intense industrial uses are limited through a Conditional Overlay or Planned Development Area.

4. SF-4A and SF-4B zoning may be compatible with Single Family land use category only in plans adopted prior to January 2009; otherwise, these zoning categories are considered incompatible with a Single Family future land use designation.

5. If the uses included in a PUD development conflict with the future land use designation on the FLUM for the site, then a plan amendment will be required.

6. Warehouse/Limited Office is used only in the Dawson, Govalle/Johnston Terrace, and Southeast Combined plans - the permitted zoning categories are NO, LO, and W/LO.

7. Major Planned Development may be permitted in LI, IP, CH, MI, and R&D zoning districts with the combination of the PDA combining district.

8. Refer to Appendix C of the Oak Hill Combined Neighborhood Plan for the Council-amended matrix.

9. Mobile Home land use category is used only in the Govalle/Johnston Terrace Combined, North Austin Civic Association, South Congress Combined, and Southeast Combined Neighborhood Plans.

10. Transit-Oriented Development (TOD) land use was incorporated into the Specific Regulating District map designation (July 2011). A plan amendment is required when there is a rezoning request to change the regulating district boundaries.

Planning and Development Review Department

Updated July 2011

Land Uses--Colors and Codes

emailed from Maureen Meredith on 9/8/2014

	Land Use	Generic Color	R - G - B Code	ArcGIS Color Name	GIS Code
Residential	Rural Residential	Pale Yellow	255 - 255 - 190	Yucca Yellow	50
	Single Family	Yellow	255 - 255 - 0	Solar Yellow	100
	Urban Single Family	Yellow with Black Stipple	255 - 255 - 0	Solar Yellow w/ Black Stipple	108
	Higher-Density Single Family	Goldenrod	205 - 205 - 102	Light Olivenite	111
	Mixed Residential	Salmon	255 - 190 - 190	Rose Quartz	130
	Multifamily	Orange	255 - 170 - 0	Electron Gold	200
Mixed Use	Neighborhood Mixed Use	Brown w/ White Stipple	137 - 112 - 68	Leather Brown w/ White Stipple	325
	Mixed Use/Office	Reddish Brown	115 - 0 - 0	Dark Umber	430
	Mixed Use	Brown	137 - 112 - 68	Leather Brown	330
	High Density Mixed Use	Dark Brown	115 - 76 - 0	Burnt Umber	335
Commercial/Industrial	Office	Pink	255 - 115 - 223	Fushia Pink	400
	Warehouse/Limited Office (discontinued 1)	Magenta	169 - 0 - 230	Anemone Violet	350
	Neighborhood Commercial	Red w/ White Stipple	255 - 0 - 0	Mars Red w/ White Stipple	315
	Commercial	Red	230 - 0 - 0	Poinsettia Red	330
	Industry	Purple	132 - 0 - 168	Dark Amethyst	500
Civic/Open Space	Environmental Conservation	Blue-Green	0 - 230 - 169	Chrysophase	750
	Recreation & Open Space	Green	56 - 168 - 0	Leaf Green	750
	Civic	Blue	190 - 210 - 255	Sugilite Sky	600
	Utilities	Dark Grey	104 - 104 - 104	Gray 60%	870
Special Purpose	Agriculture	Pale Green	211 - 255 - 190	Tzavorite Green	10
	Major Impact Facilities	Dark Purple	76 - 0 - 115	Ultramarine	560
	Major Planned Developments	Lavender	223 - 115 - 255	Heliotrope	490
	Mobile Homes (discontinued-2)	Beige	255 - 234 - 190	Beige	113
	Transportation	Grey	204 - 204 - 204	Gray 20%	800
	Water	Light Blue	115 - 223 - 255	Apatite Blue	940
Other	Specific Regulating District (see note #3)	Dark Olive w/ White Stipple	115 - 115 - 0	Dark Olivenite w/ White Stipple	340

Note 1: Warehouse/Limited Office (W/LO) was discontinued July 2008; however, the W/LO LU Color and Code is maintained in this chart since this Land Use appears in the Dawson, Govalle/Johnston Terrace and Southeast FLUMs.

Note 2: Mobile Homes was discontinued November 2010; however the Mobile Homes Color and Code is maintained in this chart since this Land Use appears in Govalle/Johnston Terrace, NACA, Southeast Combined and South Congress Combined FLUMs.

Note 3: TOD land use was discontinued July 2011 and was incorporated into the Specific Regulating District map designation.

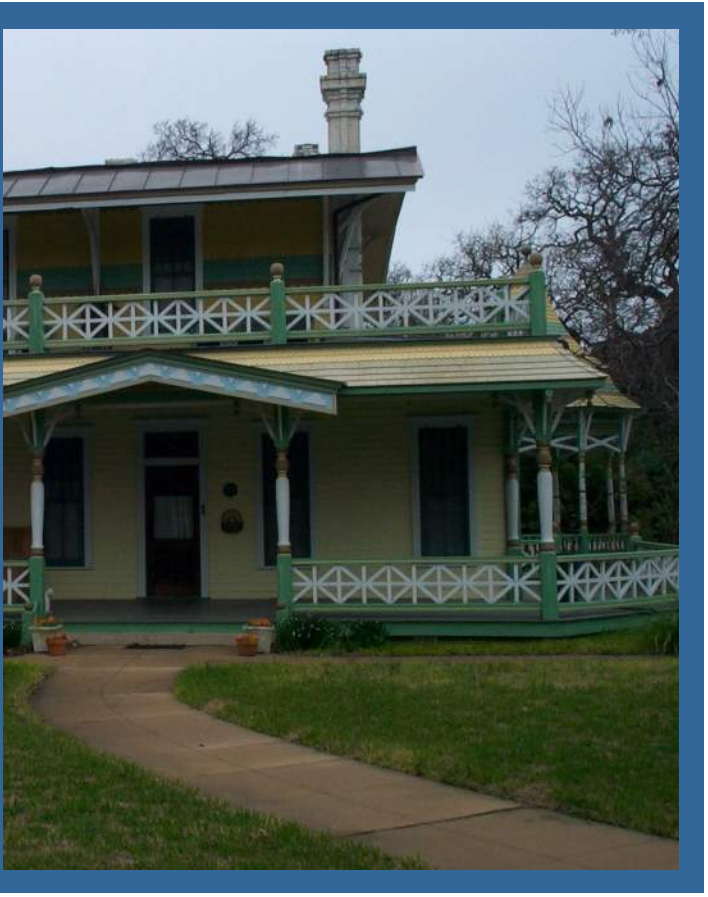
Greater South River City Combined

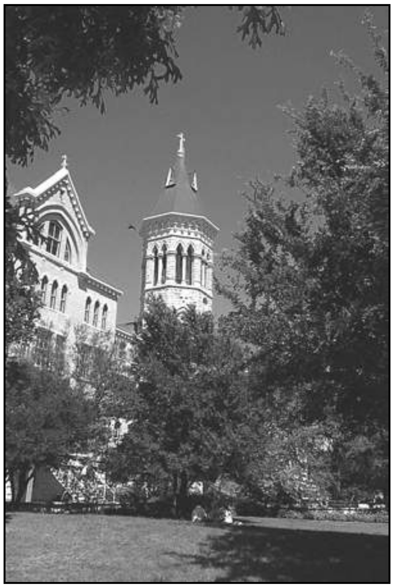
Neighborhood Plan

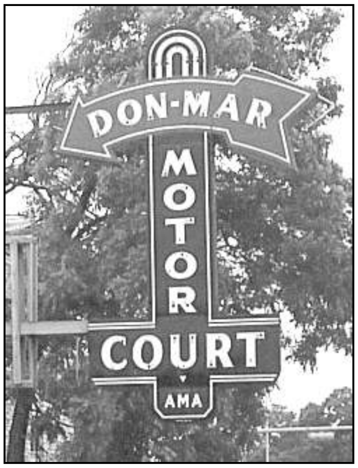
PLAN ADOPTED: September 29, 2005

This Neighborhood Plan has been amended by City Council. These amendments may include text changes or Future Land Use Map (FLUM) changes. Please refer to the Ordinance Chart on the planning area webpage for more information on amendments. Planning and Development Review staff updates the Ordinance Chart on a regular basis; however, newly adopted amendments may not be reflected on the chart.

CITY OF AUSTIN
FOUNDED 1839

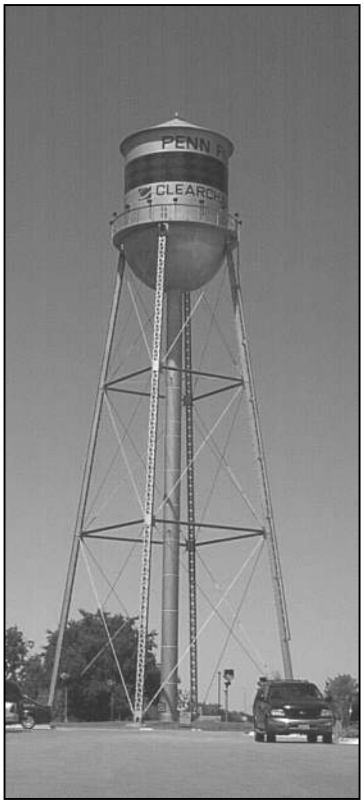






The Greater South River City Combined Neighborhood Plan

South River City
&
St. Edward's Neighborhoods



September 2005

Bouldin Creek

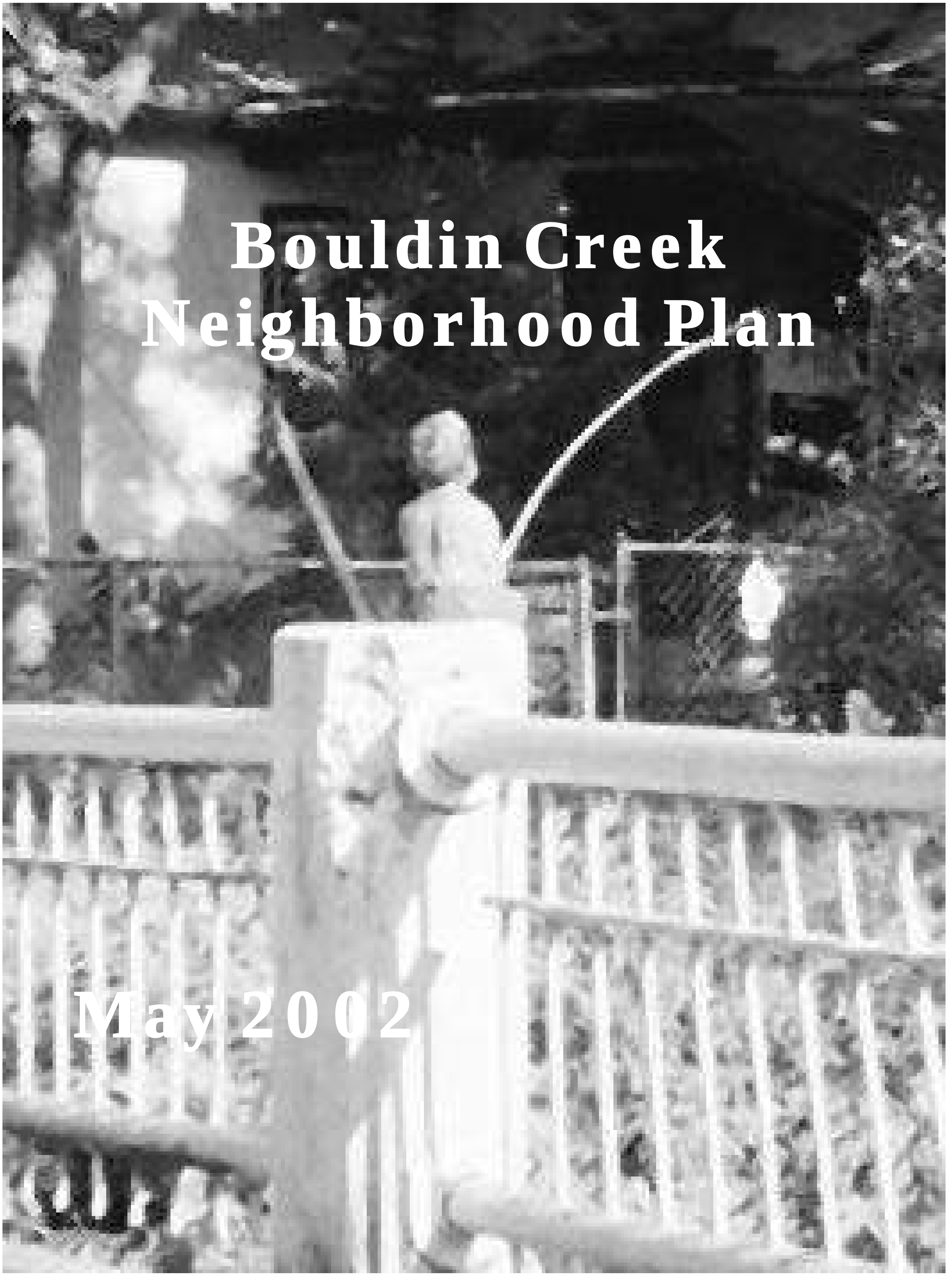
Neighborhood Plan

PLAN ADOPTED: May 23, 2002

This Neighborhood Plan has been amended by City Council. These amendments may include text changes or Future Land Use Map (FLUM) changes. Please refer to the Ordinance Chart on the planning area webpage for more information on amendments. Planning and Development Review staff updates the Ordinance Chart on a regular basis; however, newly adopted amendments may not be reflected on the chart.

CITY OF AUSTIN
FOUNDED 1839

Bouldin Creek Neighborhood Plan

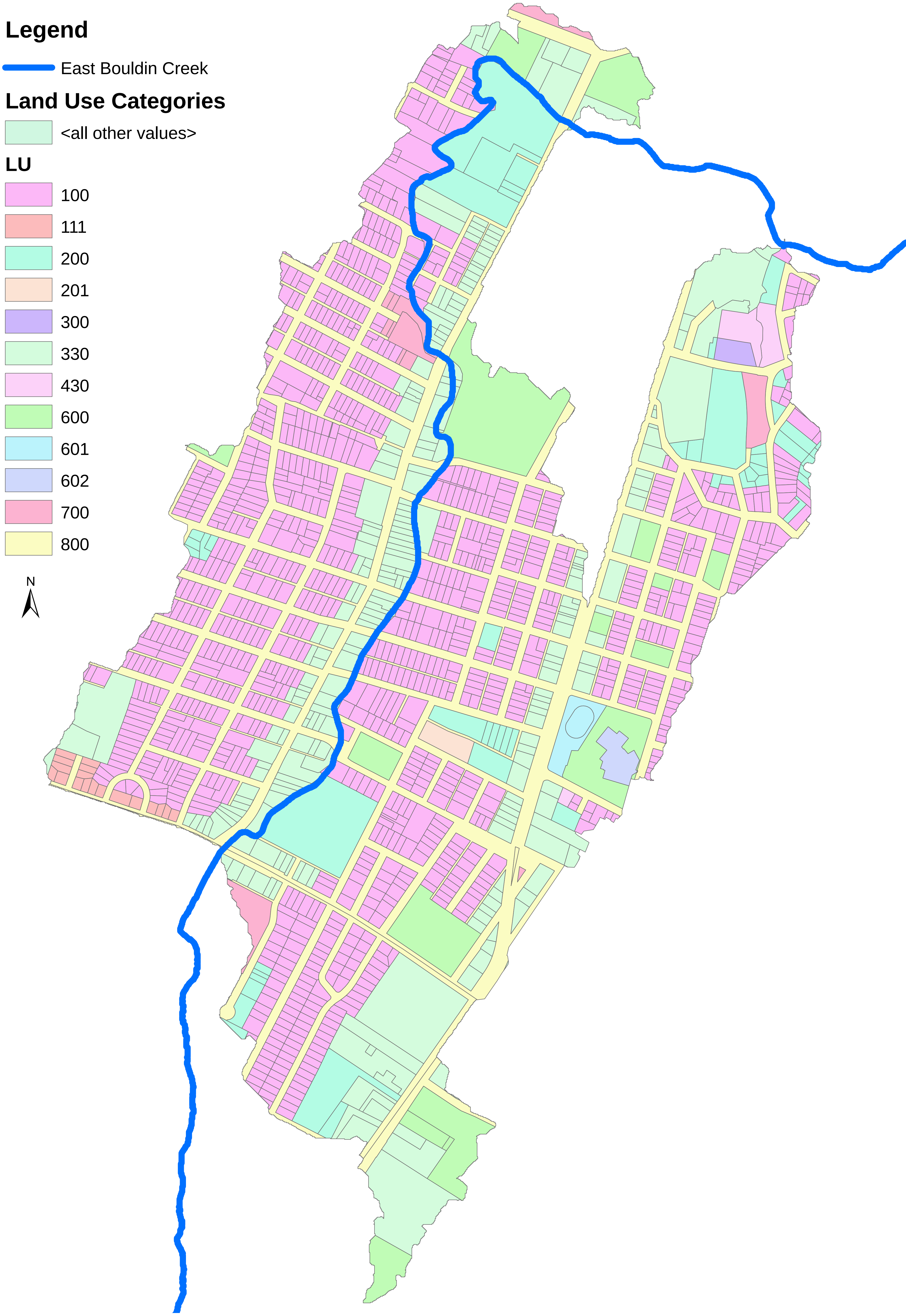


May 2002

Exhibit H.3

Land Use and Percent Impervious Cover

Future Land Use Map for Project Area



Zoning Allowed for Land Use Categories

▨ = Zone Allowed

FLUM GIS Code	Land Use	Max % Impervious Cover	Zoning and % Impervious Cover Limits																												
			LA	RR	SF-1	SF-2	SF-3	SF-4A	SF-4B	SF-5	SF-6	MF-1	MF-2	MF-3	MF-4	MF-5	MF-6	NO	LO	GO	LR	GR	CS	CS-1	CH	W/LO	LI	MH	P	PUD	MU&V
			none	25%	40%	45%	45%	65%	60%	55%	55%	55%	60%	65%	70%	70%	80%	60%	70%	80%	80%	90%	95%	95%	85%	70%	80%	none	none	none	none
100	Single Family	65%	▨	▨	▨	▨	▨	▨	▨																						
111	Higher density Single Family	65%	▨	▨	▨	▨	▨	▨	▨	▨	▨																				
200	Multi-family	80%	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨											▨		▨	
300	Commercial	95%																▨	▨	▨	▨	▨	▨	▨	▨	▨				▨	
330	Mixed Use	95%	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨			▨			▨	▨
430	Mixed Use/Office	not given	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨		▨	▨	▨											▨
600	Civic	not given																											▨		
700	Recreation and Open Space	not given																													
800	Transportation	not given																													
870	Utilities	not given																													

Percent Impervious Cover for Land Use Codes

LU Code for Calcs	Ultimate % IC	Land Use	Location	Basis for Ultimate %IC
100	65%	Single Family		max allowed by zoning
111	65%	Higher Density Single Family	EBLDN revised watersheds	max allowed by zoning
200	80%	Multi-Family		max allowed by zoning
201	88%	Multi-Family	apartment complex at 300 Crockett (and Newton)	use existing % IC since it is higher than zoning limit
300	95%	Commercial	one lot in EBLDN-E	max allowed by zoning
330	95%	Mixed Use	South Congress and South 1st	max allowed by zoning; existing % IC on SOCO is approx 92%; see 330 tab
430	95%	Mixed Use/Office	Leland Street	Use 95%, which is max for commercial since MU can include commercial
600	80%	Civic	Fulmore MS - area available for development	use 80%, which is max allowed for office zoning categories (GO) since Civic could be government offices
601	80%	Civic	Fulmore MS - area NOT available for development (track area)	use 80%, which is max allowed for office zoning categories (GO) since Civic could be government offices
602	88%	Civic	Fulmore MS - buildings (DA-A25)	use existing % IC since it is higher than zoning limit
700	existing	Recreationand Open Space	Park at Congress/College/Live Oak	use existing %IC
800	existing	Transportation	transportation	use existing %IC
870	existing	Utilities		use existing %IC

N:\Team3\WPD_EBC_Annie\Eng_Analysis\Prelim Eng Phase\Ultimate IC and Land Use
Tab: Ult % IC by FLUM category

Exhibit H.4

Drainage Criteria Manual Section 2.4.2:

Time of Concentration Equations

2.4.2 - Time of Concentration

The time of concentration is the time for surface runoff to flow from the most remote point in the watershed to the point of interest. This applies to the most remote point in time, not necessarily the most remote point in distance. Runoff from a drainage area usually reaches a peak at the time when the entire area is contributing. However, runoff may reach a peak prior to the time the entire drainage area is contributing if the area is irregularly shaped or if land use characteristics differ significantly within the area. Sound engineering judgment should be used to determine a flow path representative of the drainage area and in the subsequent calculation of the time of concentration. The time of concentration to any point in a storm drainage system is a combination of the sheet flow (overland), the shallow concentrated flow and the channel flow, which may include storm drains. The minimum time of concentration for any drainage area shall be 5 minutes. Additionally, the minimum slope used for calculation of sheet and shallow flow travel time components should be 0.005 feet per foot (0.5%). The preferred procedure for estimating time of concentration is the NRCS method as described in NRCS's Technical Release 55 (TR-55). This method is outlined below. The overall time of concentration is calculated as the sum of the sheet, shallow concentrated and channel flow travel times. Note that there may be multiple shallow concentrated and channel segments depending on the nature of the flow path.

$$T_C = T_{t(\text{sheet})} + T_{t(\text{shallow concentrated})} + T_{t(\text{channel})} \qquad \text{(Eq. 2-2)}$$

A. Sheet Flow. Sheet flow is shallow flow over land surfaces, which usually occurs in the headwaters of streams. The engineer should realize that sheet flow occurs for only very short distances, especially in urbanized conditions. Sheet flow for both natural (undeveloped) and developed conditions should be limited to a maximum of 100 feet. Sheet flow for developed conditions should be based on the actual pavement or grass conditions for areas that are already developed and should be representative of the anticipated land use within the headwater area in the case of currently undeveloped areas. In a typical residential subdivision, sheet flow may be the distance from one end of the lot to the other or from the house to the edge of the lot. In some heavily urbanized drainage areas, sheet flow may not exist in the headwater area. The NRCS method employs equation 2-3, which is a modified form kinematic wave equation, for the calculation of the sheet flow travel time.

$$T_t = 0.42(nL)^{0.8}/((P_2)^{0.5}s^{0.4}) \qquad \text{(Eq. 2-3)}$$

Where,

T_t = Sheet flow travel time in minutes

L = Length of the reach in ft.

n = Manning's n (see Table 2-2)

P_2 = 2-year, 24-hour rainfall in inches (see Table 2-3)

s = Slope of the ground in ft/ft

B. Shallow Concentrated Flow. After a maximum of approximately 100 feet, sheet flow usually becomes shallow concentrated flow collecting in swales, small rills, and gullies. Shallow concentrated flow is assumed not to have a well-defined channel and has flow depths of 0.1 to 0.5 feet. The travel time for shallow concentrated flows can be computed by equations 2-4 and 2-5. These two equations are based on the solution of Manning's equation with different assumptions for n (Manning's roughness coefficient) and r (hydraulic radius, ft). For unpaved areas, n is 0.05 and r is 0.4; for paved areas, n is 0.025 and r is 0.2.

$$\text{Unpaved } T_t = L/(60(16.1345)(s)^{0.5}) \text{ (Eq. 2-4)}$$

Paved $T_t = L/(60(20.3282)(s)^{0.5})$ (Eq. 2-5)

Where,

T_t = Travel time for shallow concentrated flows in minutes

L = Length of the reach in ft.

s = Slope of the ground in ft/ft

C. Channel or Storm Drain Flow. The velocity in an open channel or a storm drain not flowing full can be determined by using Manning's Equation. Channel velocities can also be determined by using backwater profiles. For open channel flow, average flow velocity is usually determined by assuming a bank-full condition. Note that the channel flow component of the time of concentration may need to be divided into multiple segments in order to represent significant changes in channel characteristics. The details of using Manning's equation and selecting Manning's "n" values for channels can be obtained from Section 6

For storm drain flow under pressure conditions (hydraulic grade line is higher than the lowest crown of a storm drain) the following equation should be applied:

$V = Q/A$ (Eq. 2-6)

Where:

V = Average velocity, ft/s

Q = Design discharge, cfs

A = Cross-sectional area, ft2

Flow travel time through a channel can be calculated by equation (2-7):

$T_t = \Sigma(L_i/60\ V_i)$ (Eq. 2-7)

Where:

L_i = The i-th channel segment length, ft

V_i = The average flow velocity within the ith channel segment, ft/s

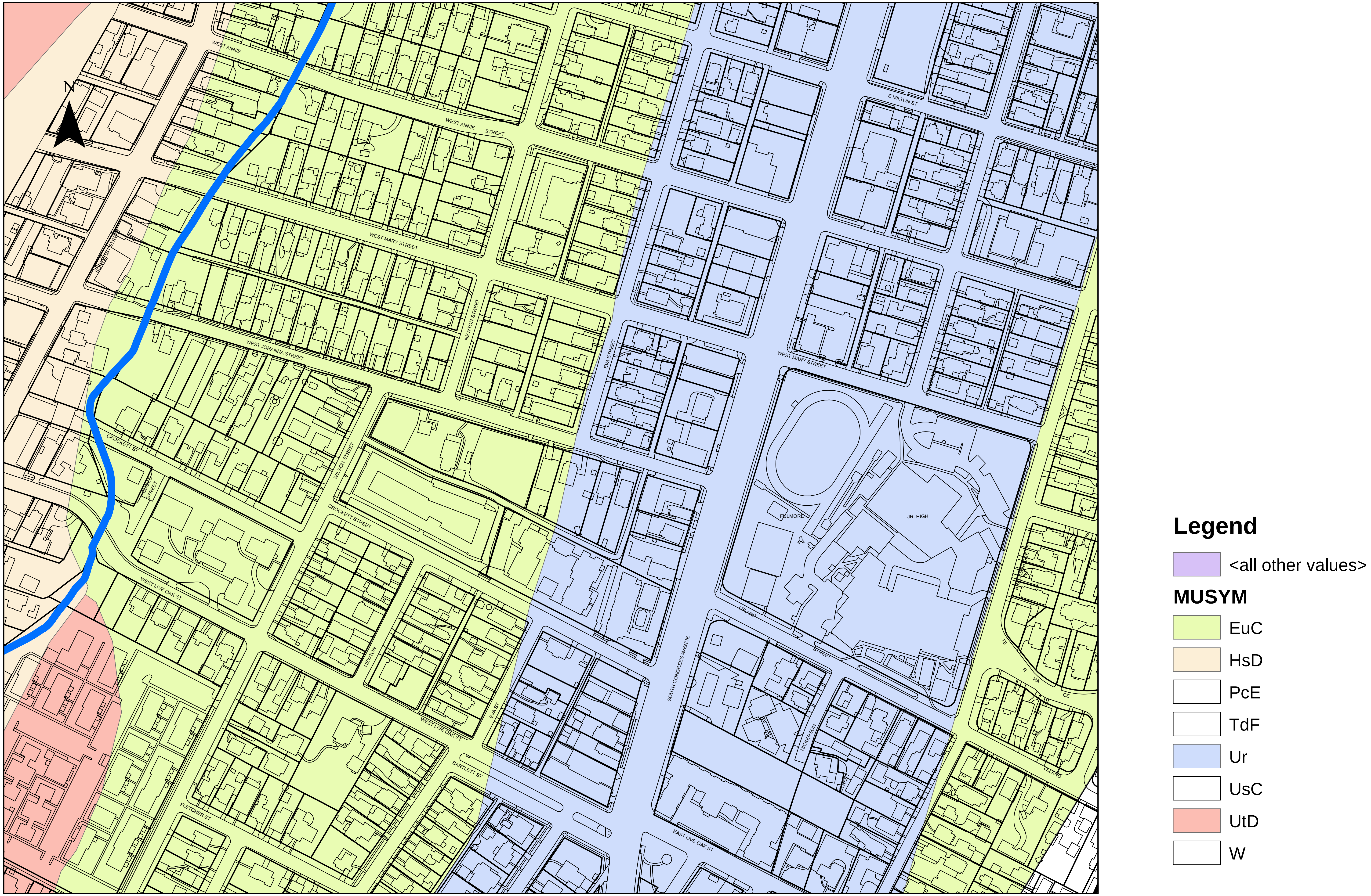
T_t = Total Flow travel time through the channel, min

Exhibit H.5

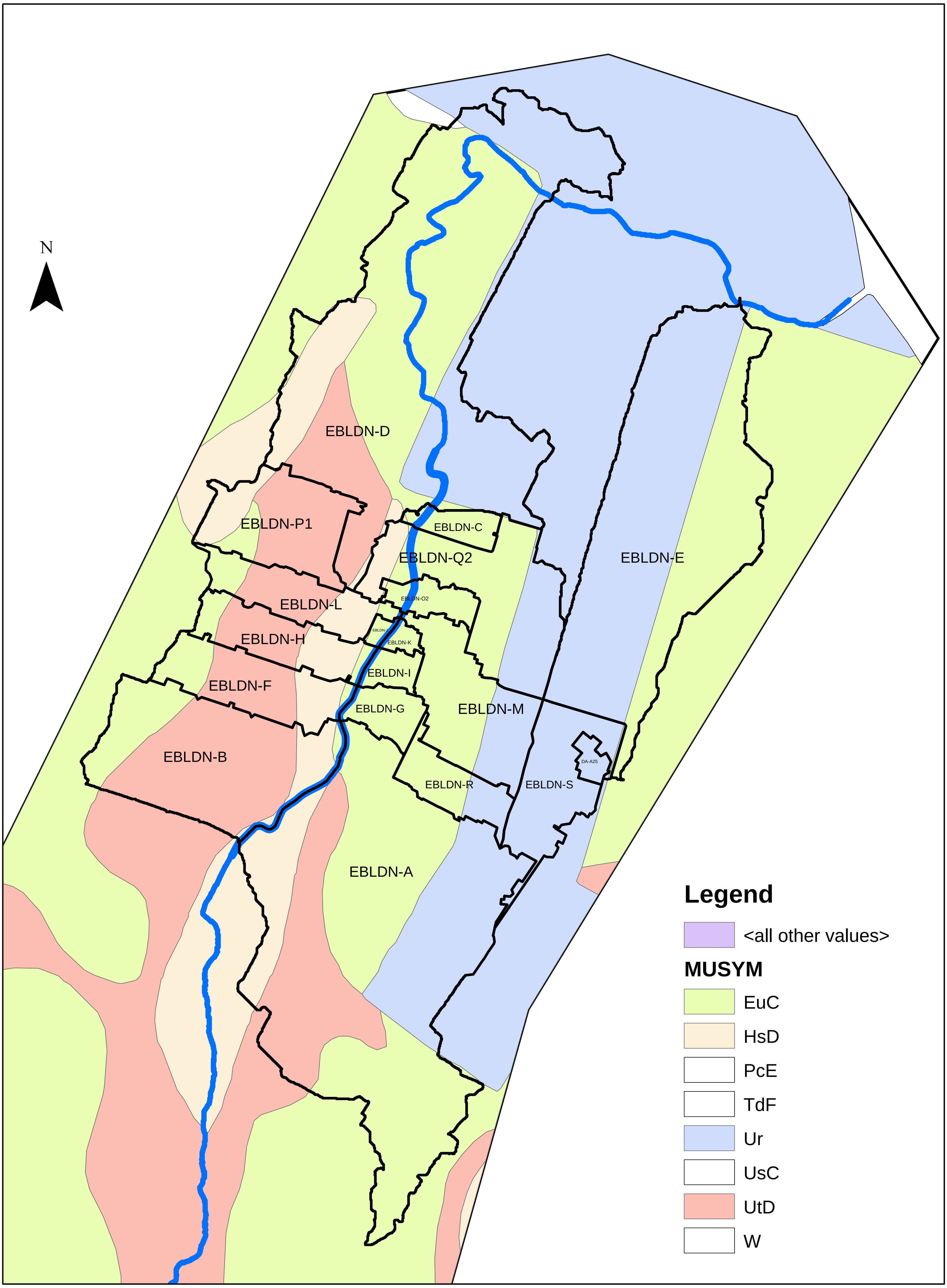
Soil Survey Geographic Database (SSURGO)

Soil Map and Soil Descriptions

SSURGO Soil Map - Project Area



SSURGO Soil Map - East Bouldin Creek Area



Travis County, Texas

UtD—Urban land, Austin, and Whitewright soils, 1 to 8 percent slopes

Map Unit Setting

National map unit symbol: f66n
Elevation: 0 to 4,000 feet
Mean annual precipitation: 8 to 60 inches
Mean annual air temperature: 54 to 73 degrees F
Frost-free period: 180 to 310 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 40 percent
Austin and similar soils: 30 percent
Whitewright and similar soils: 25 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H1 - 0 to 40 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

Description of Austin

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from chalk

Typical profile

H1 - 0 to 15 inches: silty clay
H2 - 15 to 36 inches: silty clay
H3 - 36 to 52 inches: bedrock

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.57 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 70 percent
Available water storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C

Description of Whitewright

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from austin chalk formation

Typical profile

H1 - 0 to 6 inches: clay loam
H2 - 6 to 14 inches: clay loam
H3 - 14 to 48 inches: bedrock

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 70 percent
Salinity, maximum in profile: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D

Minor Components

Unnamed

Percent of map unit: 5 percent

Data Source Information

Soil Survey Area: Travis County, Texas
Survey Area Data: Version 15, Sep 29, 2014

Travis County, Texas

Ur—Urban land, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: f66l
Elevation: 0 to 4,000 feet
Mean annual precipitation: 8 to 60 inches
Mean annual air temperature: 54 to 73 degrees F
Frost-free period: 180 to 310 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Typical profile

H1 - 0 to 40 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

Data Source Information

Soil Survey Area: Travis County, Texas
Survey Area Data: Version 15, Sep 29, 2014

Travis County, Texas

HsD—Houston Black soils and Urban land, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: f65f
Elevation: 0 to 4,000 feet
Mean annual precipitation: 8 to 60 inches
Mean annual air temperature: 54 to 73 degrees F
Frost-free period: 180 to 310 days
Farmland classification: Not prime farmland

Map Unit Composition

Houston black and similar soils: 56 percent
Urban land: 30 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Houston Black

Setting

Landform: Ridges
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve
Microfeatures of landform position: Linear gilgai
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from calcareous shale of taylor marl and eagleford shale

Typical profile

H1 - 0 to 8 inches: clay
H2 - 8 to 30 inches: clay
H3 - 30 to 80 inches: clay

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 2.0
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: D

Description of Urban Land

Typical profile

H1 - 0 to 40 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

Minor Components

Unnamed

Percent of map unit: 14 percent

Data Source Information

Soil Survey Area: Travis County, Texas
Survey Area Data: Version 15, Sep 29, 2014

Travis County, Texas

EuC—Eddy soils and Urban land, 0 to 6 percent slopes

Map Unit Setting

National map unit symbol: f550
Elevation: 0 to 4,000 feet
Mean annual precipitation: 8 to 60 inches
Mean annual air temperature: 54 to 73 degrees F
Frost-free period: 180 to 310 days
Farmland classification: Not prime farmland

Map Unit Composition

Eddy and similar soils: 55 percent
Urban land: 35 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eddy

Setting

Landform: Ridges
Landform position (two-dimensional): Shoulder, summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from austin chalk

Typical profile

H1 - 0 to 3 inches: gravelly loam
H2 - 3 to 14 inches: very gravelly loam
H3 - 14 to 20 inches: bedrock

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: 3 to 15 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 80 percent
Available water storage in profile: Very low (about 0.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D

Description of Urban Land

Typical profile

H1 - 0 to 40 inches: variable

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydrologic Soil Group: D

Minor Components

Unnamed

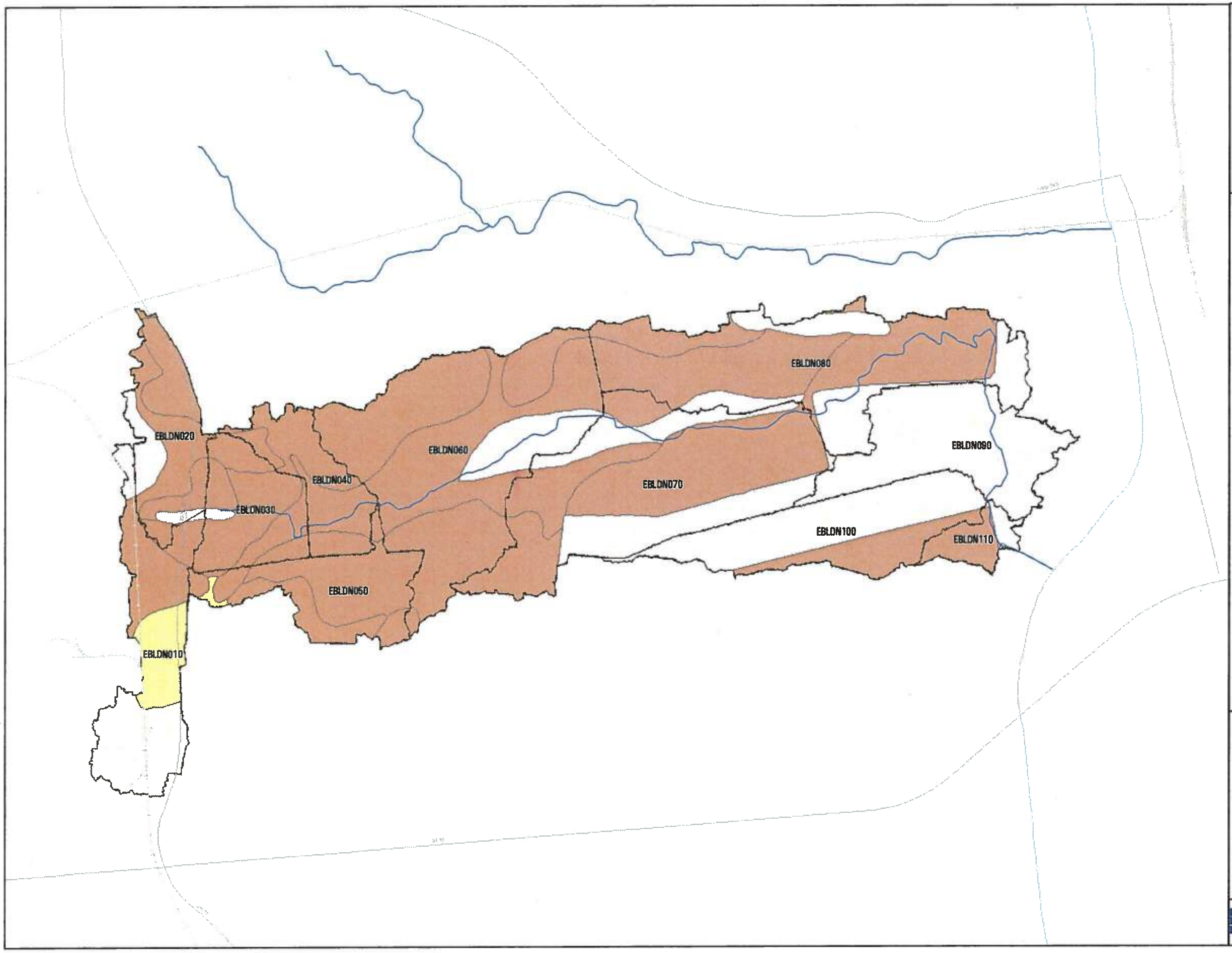
Percent of map unit: 10 percent

Data Source Information

Soil Survey Area: Travis County, Texas
Survey Area Data: Version 15, Sep 29, 2014

Exhibit H.6

Effective HEC-HMS Model Soil Map



FEMA FIS Restudy
Travis Co, TX

Soil Type

Hydrologic Soil Group

- 🟩 A
- 🟨 B
- 🟫 C
- ☐ D
- Highways
- Railroads

Figure 4.
East Bouldin Hydrologic Soils Map

1 inch equals 1,500 feet

Halff Associates
ENGINEERS · ARCHITECTS · SCIENTISTS · PLANNERS · SURVEYORS

Exhibit H.7

Technical Release-55 Table 2-2a:

Runoff Curve Numbers for Urban Areas

Table 2-2a Runoff curve numbers for urban areas [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

---

[1] Average runoff condition, and $I_a = 0.2S$.

[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Exhibit H.8

Technical Release-55 Appendix A:

Hydrologic Soil Groups

Appendix A Hydrologic Soil Groups

Soils are classified into hydrologic soil groups (HSG's) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSG's, which are A, B, C, and D, are one element used in determining runoff curve numbers (see chapter 2). For the convenience of TR-55 users, exhibit A-1 lists the HSG classification of United States soils.

The infiltration rate is the rate at which water enters the soil at the soil surface. It is controlled by surface conditions. HSG also indicates the transmission rate—the rate at which the water moves within the soil. This rate is controlled by the soil profile. Approximate numerical ranges for transmission rates shown in the HSG definitions were first published by Musgrave (USDA 1955). The four groups are defined by SCS soil scientists as follows:

Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).

Group B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).

Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).

Group D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

In exhibit A-1, some of the listed soils have an added modifier; for example, "Abrazo, gravelly." This refers to a gravelly phase of the Abrazo series that is found in SCS soil map legends.

Disturbed soil profiles

As a result of urbanization, the soil profile may be considerably altered and the listed group classification may no longer apply. In these circumstances, use the following to determine HSG according to the texture of the new surface soil, provided that significant compaction has not occurred (Brakensiek and Rawls 1983).

HSG	*Soil textures*
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

Drainage and group D soils

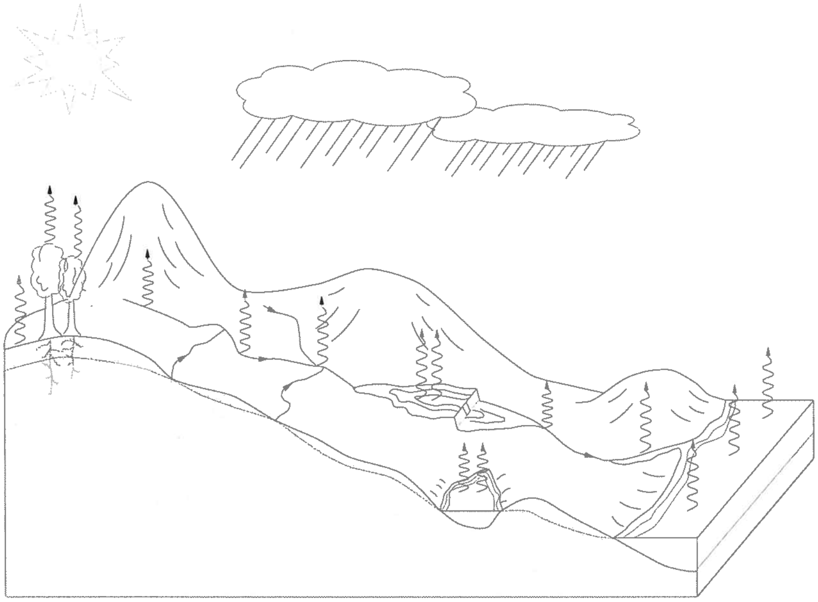
Some soils in the list are in group D because of a high water table that creates a drainage problem. Once these soils are effectively drained, they are placed in a different group. For example, Ackerman soil is classified as A/D. This indicates that the drained Ackerman soil is in group A and the undrained soil is in group D.

Exhibit H.9

HEC-HMS Technical Reference Manual

US Army Corps
of Engineers
Hydrologic Engineering Center

Hydrologic Modeling System
HEC-HMS



Technical Reference Manual

March 2000

Approved for Public Release – Distribution Unlimited

CPD-74B

this description is implicit in parameters of the model. In others, the description is provided in more common terms: channel width, bed slope, cross-section shape, or the equivalent.

- **Energy-loss model parameters**. All routing models incorporate some type of energy-loss model. The physically-based routing models, such as the kinematic-wave model and the Muskingum-Cunge model use Manning's equation and Manning's roughness coefficients (*n* values). Other models represent the energy loss empirically.
- **Initial conditions**. All routing models require initial conditions: the flow (or stage) at the downstream cross section of a channel prior to the first time period. For example, the initial downstream flow could be estimated as the baseflow within the channel at the start of the simulation, as the initial inflow, or as downstream flow likely to occur during a hypothetical event.
- **Boundary conditions**. The boundary conditions for routing models are the upstream inflow, lateral inflow, and tributary inflow hydrographs. These may be observed historical events, or they may be computed with the precipitation-runoff models included in the program.

Modified Puls Model

Basic Concepts and Equations

The Modified Puls routing method, also known as storage routing or level-pool routing, is based upon a finite difference approximation of the continuity equation, coupled with an empirical representation of the momentum equation (Chow, 1964; Henderson, 1966).

For the Modified Puls model, the continuity equation is written as

$$\frac{\partial Q}{\partial x}+\frac{\partial A}{\partial t}=0 \qquad (73)$$

This simplification assumes that the lateral inflow is insignificant, and it allows width to change with respect to location. Rearranging this equation and incorporating a finite-difference approximation for the partial derivatives yields:

$$\overline{I_t}-\overline{O_t}=\frac{\Delta S_t}{\Delta t} \qquad (74)$$

where $\overline{I_t}$ = average upstream flow (inflow to reach) during a period Δt; $\overline{O_t}$ = average downstream flow (outflow from reach) during the same period; and ΔS_t = change in storage in the reach during the period. Using a simple backward differencing scheme and rearranging the result to isolate the unknown values yields:

$$\left(\frac{S_t}{\Delta t}+\frac{O_t}{2}\right)=\left(\frac{I_{t-1}+I_t}{2}\right)+\left(\frac{S_{t-1}}{\Delta t}-\frac{O_{t-1}}{2}\right) \qquad (75)$$

Reach
Element
Δt

in which I_{t-1} and I_t = inflow hydrograph ordinates at times *t*-1 and *t*, respectively; O_{t-1} and O_t = outflow hydrograph ordinates at times *t*-1 and *t*, respectively; and S_{t-1} and S_t = storage in reach at times *t*-1 and *t*, respectively. At time *t*, all terms on the righthand side of this equation are known, and terms on the left-hand side are to be found. Thus, the equation has two unknowns at time *t*: S_t and O_t.

A functional relationship between storage and outflow is required to solve Equation 75. Once that function is established, it is substituted into Equation 75, reducing the equation to a nonlinear equation with a single unknown, O_t. This equation is solved recursively by the program, using a trial-and-error procedure. [Note that at the first time *t*, the outflow at time *t*-1 must be specified to permit recursive solution of the equation; this outflow is the initial outflow condition for the storage routing model.]

Defining the Storage-Outflow Relationship

The storage-outflow relationship required for the Modified Puls routing model can be determined with:

- **Water-surface profiles computed with a hydraulics model**. Steady-flow water surface profiles, computed for a range of discharges with programs like HEC-2 (USACE, 1990), HEC-RAS (USACE, 1998), or a similar model, define a relationship of storage to flow between two channel cross sections.

  Figure 25 illustrates this; it shows a set of water-surface profiles between cross section *A* and cross section *B* of a channel. These profiles were computed for a set of steady flows, Q_1, Q_2, Q_3, *and* Q_4.

  For each profile, the volume of water in the reach, S_i, can be computed, using solid geometry principles. In the simplest case, if the profile is approximately planar, the volume can be computed by multiplying the average cross-section area bounded by the water surface by the reach length. Otherwise, another numerical integration method can be used. If each computed volume is associated with the steady flow with which the profile is computed, the result is a set of points on the required storage-outflow relationship.

  This procedure can be used with existing or with proposed channel configurations. For example, to evaluate the impact of a proposed channel project, the channel cross sections can be modified, water surface profiles recalculated, and a revised storage-outflow relationship developed.

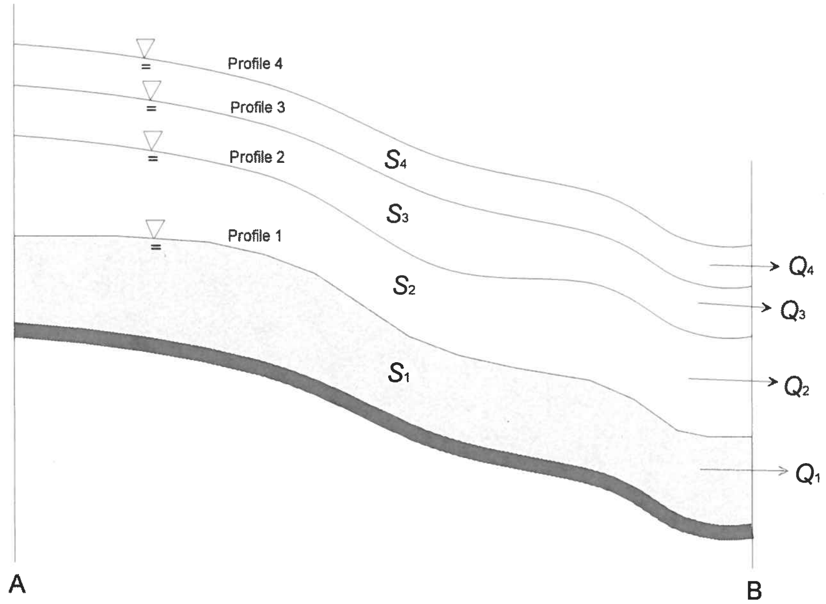


Figure 25. Steady-flow water-surface profiles and storage-outflow curve.

- **Historical observations of flow and stage**. Observed water surface profiles, obtained from high water marks, can be used to define the required storage-outflow relationships, in much the same manner that computed water-surface profiles are used. Each observed discharge-elevation pair provides information for establishing a point of the relationship.

  Sufficient stage data over a range of floods is required to establish the storage-outflow relationship in this manner. If only a limited set of observations is available, these may best be used to calibrate a water-surface profile-model for the channel reach of interest. Then that calibrated model can be exercised to establish the storage-outflow relationship as described above.

- **Calibration, using observed inflow and outflow hydrographs for the reach of interest**. Observed inflow and outflow hydrographs can be used to compute channel storage by an inverse process of flood routing. When both inflow and outflow are known, the change in storage can be computed using Equation 74. Then, the storage-outflow function can be developed empirically. Note that tributary inflow, if any, must also be accounted for in this calculation.

  Inflow and outflow hydrographs also can be used to find the storage-outflow function by trial-and-error. In that case, a candidate function is defined and used to route the inflow hydrograph. The outflow hydrograph thus computed is compared with the observed hydrograph. If the match is not adequate, the function is adjusted, and the process is repeated. Chapter 9 provides more information regarding this process, which is referred to as calibration.

Estimating Other Model Parameters

Chapter 6 of this manual describes how an accurate solution of the finite difference form of the kinematic-wave model requires careful selection of Δx and Δt; this is also true for solution of the storage-routing model equations. For the kinematic-wave model, an accurate solution can be found with a stable algorithm when $\Delta x/\Delta t \approx c$, where c = average wave speed over a distance increment Δx. This rule applies also with storage routing. As implemented in the program, Δx for the finite difference approximation of $\partial Q/\partial x$ is implicitly equal to the channel reach length, L, divided by an integer number of steps. The goal is to select the number of steps so that the travel time through the reach is approximately equal the time step Δt. This is given approximately by:

Reach Element Δt

$$steps = \frac{L}{c\Delta t} \qquad (76)$$

HMS time interval

The number of steps affects the computed attenuation of the hydrograph. As the number of routing steps increases, the amount of attenuation decreases. The maximum attenuation corresponds to one step; this is used commonly for routing though ponds, lakes, wide, flat floodplains, and channels in which the flow is heavily controlled by downstream conditions. Strelkoff (1980) suggests that for locally-controlled flow, typical of steeper channels:

$$steps = 2L\frac{S_0}{y_0} \qquad (77)$$

where y_o = normal depth associated with baseflow in the channel. EM 1110-2-1417 points out that this parameter, however, is best determined by calibration, using observed inflow and outflow hydrographs.

Muskingum Model

Basic Concepts and Equations

The Muskingum routing model, like the modified Puls model, uses a simple finite difference approximation of the continuity equation:

$$\left(\frac{I_{t-1}+I_t}{2}\right)-\left(\frac{O_{t-1}+O_t}{2}\right)=\left(\frac{S_t-S_{t-1}}{\Delta t}\right) \qquad (78)$$

Storage in the reach is modeled as the sum of prism storage and wedge storage. As shown in Figure 26, prism storage is the volume defined by a steady-flow water surface profile, while wedge storage is the additional volume under the profile of the flood wave. During rising stages of the flood, wedge storage is positive and is added to the prism storage. During the falling stages of a flood, the wedge storage is negative and is subtracted from the prism storage.

Exhibit H.10

Correspondence with WPD

From:	Hollon, Matt
Sent:	Monday, November 9, 2020 1:07 PM
To:	Dube, Kiersten; Dutton, Greg; Bates, Andrea
Cc:	Massie-Gore, Jennifer; Middleton, John
Subject:	RE: LDC revision question

Thanks for you question on this, Kiersten. Super interesting!

I'm going to defer to Greg on the best answer regarding the Neighborhood Plan-LDC interactions / potential overriding. Council still has not resolved the LDC Revision question re: how to respond to the Court decision to require notification and so forth. Council may take that back up in early 2021, but we're not sure.

Meanwhile, I'm betting you are trying to calculate the "fully developed conditions" impervious cover levels in the contributing area for your drainage model. When we were working on the LDC Revision analysis for Council, we did lots of number crunching on IC changes in local flood problem areas. In the vast majority of these drainage areas, the proposed IC levels were super close (little or no change) to existing maximum levels. This would mean the fully developed condition would be about the same. Obviously, we try to update these assumptions with new changes in realities on the ground (in this case, zoning maximums). But, since there has been no Council decision to adopt LDC Revision changes, I think it's appropriate for you to proceed in good faith with the current reality for IC maximums. (Again, I predict—but don't know—that IC won't change much for this area based on the LDC Revision.)

I'm cc-ing our colleague John Middleton, who is our Local Flood engineering guru, who might have thoughts (and corrections!) about how to go about doing these IC max calcs.

Matt

From: Dube, Kiersten <Kiersten.Dube@austintexas.gov>
Sent: Monday, November 9, 2020 12:49 PM
To: Dutton, Greg <Greg.Dutton@austintexas.gov>; Bates, Andrea <Andrea.Bates@austintexas.gov>; Hollon, Matt <Matt.Hollon@austintexas.gov>
Cc: Massie-Gore, Jennifer <Jennifer.Massie-Gore@austintexas.gov>
Subject: LDC revision question

Hi Andrea, Greg and Matt,

I'm working on a storm drain improvement project in the South Congress neighborhood and have a question regarding impervious cover limits. Some of the project area is subject to neighborhood plans adopted before 2009, which allow for SF-4 zoning (65% max impervious cover) in single family land use areas. Would the LDC revisions override the pre-2009 neighborhood plan impervious cover limits? The interactive LDC revision map shows that the single family area in question would be zoned:
R4 – 55% max IC
R2B – 45% max IC
RM1 – 60% max IC

Do you have any idea of the timeline for adopting the revised code?

Thank you,

Appendix I –
Annie Street Existing Storm Drain System Analysis

Exhibit I.1	**Map of Abandoned Lines**
Exhibit I.2	**Map of Existing Inlet Drainage Areas**
Exhibit I.3	**Inlet Calculations for Existing Storm Drain System and Ultimate Land Use Conditions**
Exhibit I.4	**Existing System Code Compliance Summary**
Exhibit I.5	**Drainage Criteria Manual Tables 2-1, 2-2 and 2-5**
Exhibit I.6	**Splash-over Velocity**
Exhibit I.7	**“a” Value Documentation**
Exhibit I.8	**Tailwater Conditions**
Exhibit I.9	**Storm Drain Pipe Data and Existing Storm Drain System Record Drawings**
Exhibit I.10	**StormCAD Profiles**

Exhibit I.1

Map of Abandoned Lines

ABANDONED LINES

East Bouldin Creek

Abandoned Storm Drain Lines

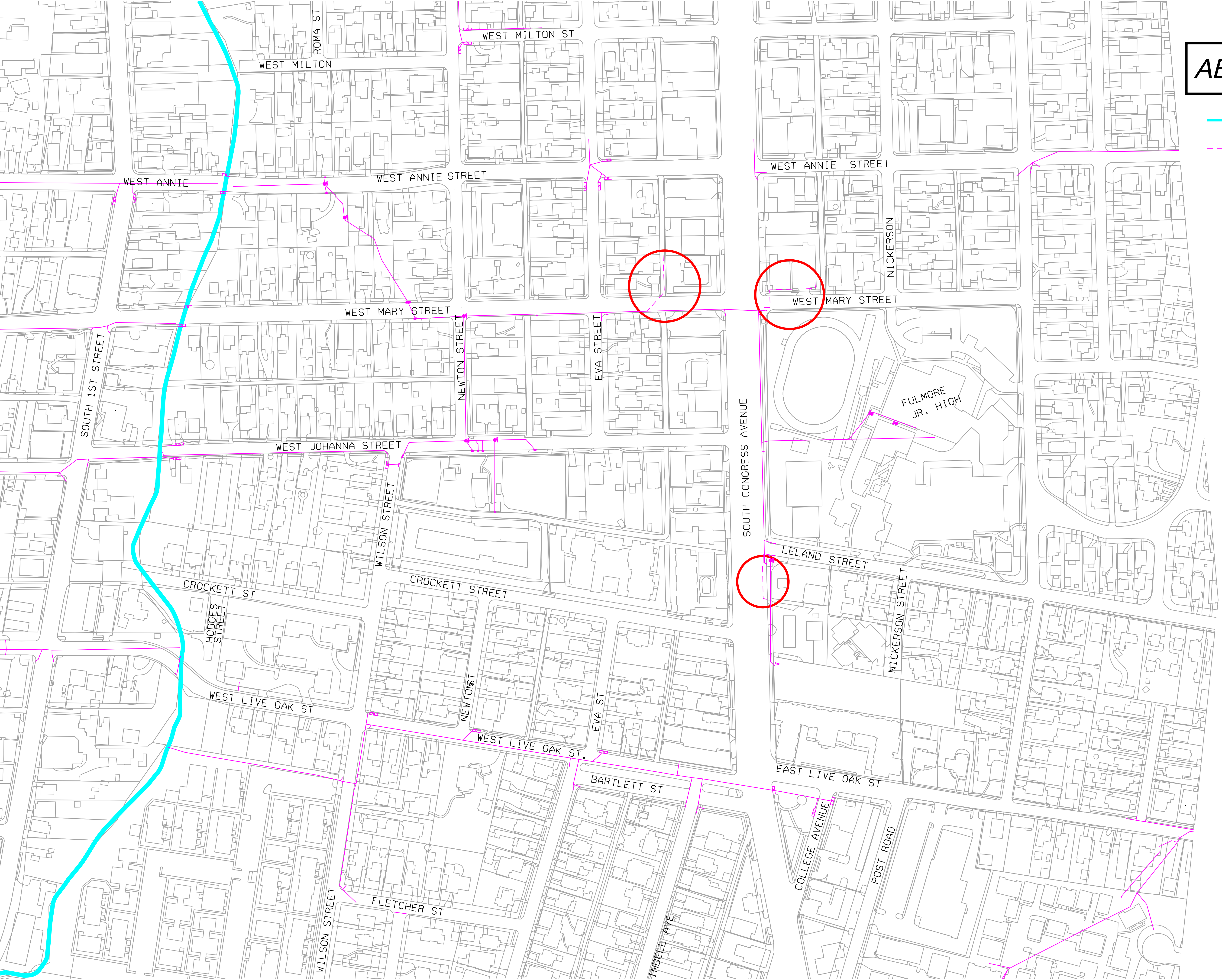
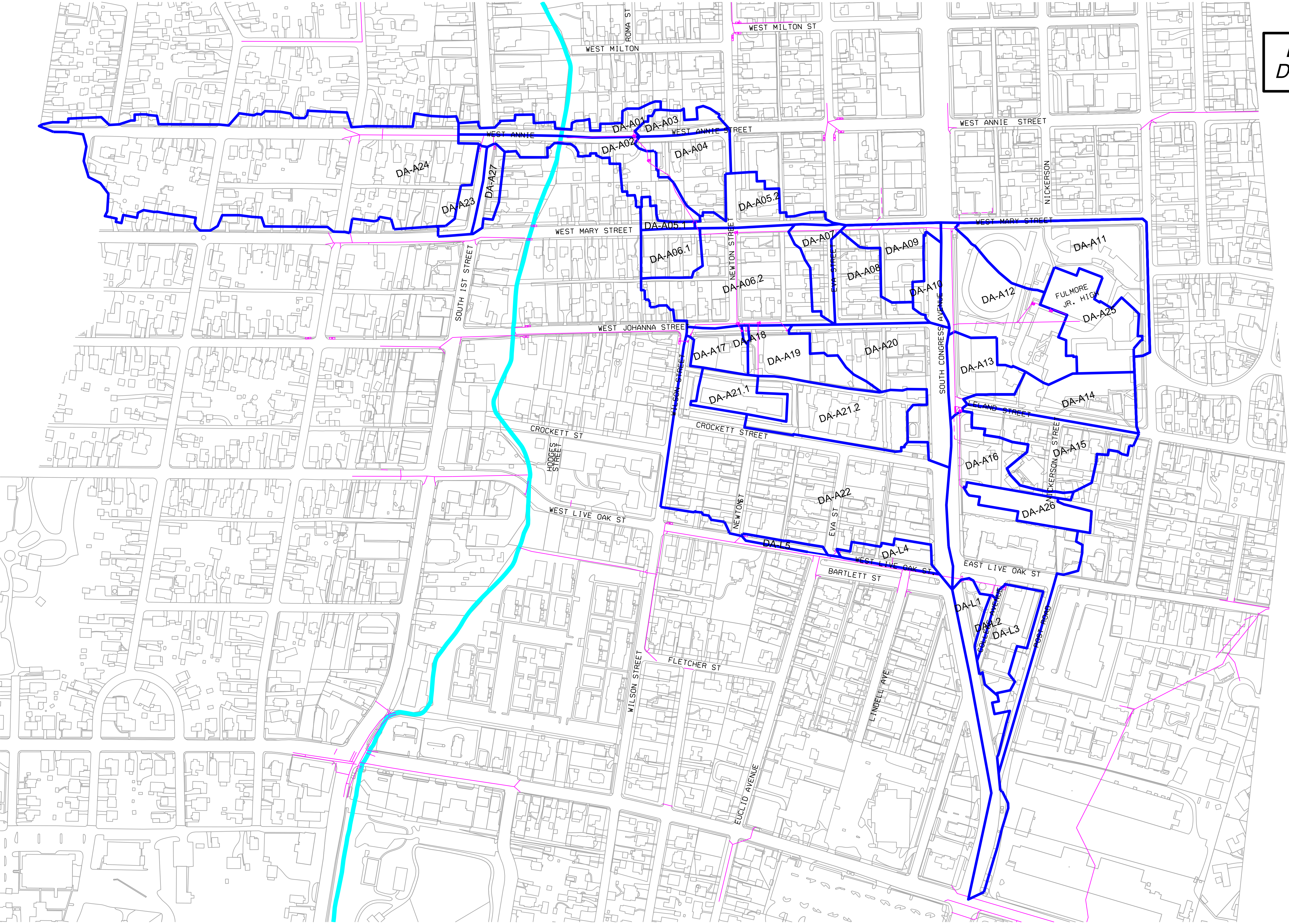


Exhibit I.2

Map of Existing Inlet Drainage Areas

EXISTING INLET DRAINAGE AREAS



East Bouldin Creek

Drainage Areas

Existing Storm Drain Lines

Exhibit I.3

Inlet Calculations for Existing Storm Drain System
and
Ultimate Land Use Conditions

Ultimate Development Conditions for Existing System

Name	Area	Area	Ex_%IC	Area 700	Area 800	Area not 700 or 800	%IC 700	%IC 800	Ult_%IC not 700 or 800	Ult_%IC	Area IC within 100
	SF	sq mi		SF	SF	SF					SF
Calc Notes -->	(1)	(2)	(3)	(4)	(5)	(6)	(15)	(16)	(17)	(18)	
DA-A01	35767	0.001283	75%	0	21305	14462	0%	83%	75%	79.9%	4685
DA-A02	72721	0.002609	47%	0	17693	55028	0%	83%	70%	72.7%	33003
DA-A03	22598	0.000811	56%	0	9961	12637	0%	85%	65%	73.7%	8336
DA-A04	65817	0.002361	~~39%~~	0	14299	51518	0%	69%	65%	66.0%	35701
DA-A05.1	9336	0.000335	~~70%~~	0	5442	3894	0%	90%	65%	79.7%	2243
DA-A05.2	45161	0.001620	~~64%~~	0	23552	21609	0%	83%	68%	75.9%	10739
DA-A06.1	36647	0.001315	~~46%~~	0	7494	29153	0%	69%	65%	65.8%	17401
DA-A06.2	163241	0.005855	46%	0	54064	109177	0%	74%	65%	67.8%	73861
DA-A07	33869	0.001215	60%	0	16989	16880	0%	68%	65%	66.5%	8213
DA-A08	60513	0.002171	59%	0	19947	40566	0%	72%	69%	69.6%	19386
DA-A09	52532	0.001884	85%	0	16957	35575	0%	85%	91%	89.1%	1342
DA-A10	23950	0.000859	97%	0	19674	4276	0%	97%	95%	96.2%	0
DA-A11	149109	0.005349	48%	0	25642	123467	0%	82%	80%	80.4%	0
DA-A12	138786	0.004978	53%	0	21558	117228	0%	89%	80%	81.3%	0
DA-A13	49355	0.001770	64%	0	13426	35929	0%	85%	80%	81.2%	0
DA-A14	79528	0.002853	80%	0	22904	56624	0%	77%	80%	79.1%	0
DA-A15	97857	0.003510	65%	0	21697	76160	0%	79%	74%	75.3%	24175
DA-A16	201385	0.007224	83%	0	74518	126867	0%	87%	94%	91.1%	997
DA-A17	30376	0.001090	61%	0	6213	24163	0%	91%	80%	82.2%	0
DA-A18	1334	0.000048	56%	0	798	536	0%	92%	80%	87.1%	0
DA-A19	57278	0.002055	60%	0	6885	50393	0%	66%	80%	78.3%	0
DA-A20	128669	0.004615	71%	0	59506	69163	0%	87%	88%	87.6%	0
DA-A21.1	39207	0.001406	92%	0	3762	35445	0%	75%	88%	86.7%	0
DA-A21.2	103937	0.003728	71%	0	14741	89196	0%	91%	85%	85.5%	0
DA-A22	393044	0.014099	59%	0	121890	271154	0%	84%	71%	75.4%	128073
DA-A23	20139	0.000722	93%	0	13597	6542	0%	94%	95%	94.0%	0
DA-A24	493273	0.017694	51%	0	141274	351999	0%	73%	69%	70.0%	175331
DA-A25	84148	0.003018	88%	0	0	84148	0%	0%	88%	88.0%	0
DA-A26	37114	0.001331	92%	0	0	37114	0%	0%	94%	94.5%	32
DA-A27	18792	0.000674	80%	0	8922	9870	0%	94%	95%	94.7%	0
DA-L1	72327	0.002594	82%	2969	62421	6937	18%	84%	95%	82.1%	0
DA-L2	5570	0.000200	76%	0	5570	0	0%	76%	0%	76.0%	0
DA-L3	51834	0.001859	79%	0	8674	43160	0%	85%	95%	93.3%	0
DA-L4	25220	0.000905	89%	0	11386	13834	0%	84%	88%	86.6%	1120
DA-L5	7467			0	7361	106	0%	83%	65%	83.1%	30

(1) Drainage Area
(2) Area (sq mi) = Area / 27,878,400
(3) Ex_%IC = 1 - (sum(remaining pervious area)) / Area
(4) Area 700 = area that is LU category 700
(5) Area 800 = area that is LU category 800
(6) Area not 700 or 800 = (Area) - (Area 700) - (Area 800)
(15) %IC 700 = 1 - (Area Pervious 700)/(Area 700)
(16) %IC 800 = 1 - (Area Pervious 800)/(Area 800)
(17) Ult_%IC not 700 or 800 = weighted average for area not within LU categories 700 or 800
(18) Ult_%IC = weighted average

Note: This tab assumes that the increase in impervious cover for SF lots is entirely concrete/roofs; for all other LU categories, the increase in impervious cover is the same proportion of asphalt/concrete as the existing conditions

Ref: Annie system Ult IC.xlsx

Existing %IC within LU Category 100 = 39%
Ultimate %IC within LU Category 100 = 65%

				Area of IC within each FLUM Category and DA (Ult Conditions)			Ultimate Development Conditions - Existing System					
	Total Area	Ult %IC	Total Area of IC for Ult conditions	100	All other LU Categories	Existing % of IC that is Asphalt	For LU 100, % of IC area that is Asphalt	Area Asphalt within LU 100	Area Asphalt within all other LU s	Total Area Asphalt within DA	Total Area Concrete within DA	Total Area Grass within DA
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
DA-A01	35767	79.9%	28572	4685	23887	43.5%	25.8%	1208	10384	11592	16979	7195
DA-A02	72721	72.7%	52887	33003	19884	18.7%	11.1%	3664	3721	7385	45502	19834
DA-A03	22598	73.7%	16650	8336	8314	27.9%	16.6%	1381	2323	3704	12946	5948
DA-A04	65817	66.0%	43412	35701	7711	13.5%	8.0%	2854	1039	3894	39518	22405
DA-A05.1	9336	79.7%	7437	2243	5194	37.5%	22.3%	499	1949	2449	4988	1899
DA-A05.2	45161	75.9%	34265	10739	23526	35.6%	21.1%	2268	8375	10643	23622	10896
DA-A06.1	36647	65.8%	24112	17401	6711	12.9%	7.6%	1329	864	2193	21919	12535
DA-A06.2	163241	67.8%	110746	73861	36885	19.8%	11.7%	8673	7301	15974	94772	52495
DA-A07	33869	66.5%	22506	8213	14293	27.8%	16.5%	1355	3975	5330	17176	11363
DA-A08	60513	69.6%	42114	19386	22728	23.5%	13.9%	2702	5341	8043	34071	18399
DA-A09	52532	89.1%	46826	1342	45484	51.9%	30.8%	413	23588	24001	22825	5706
DA-A10	23950	96.2%	23051	0	23051	94.0%	55.7%	0	21658	21658	1394	899
DA-A11	149109	80.4%	119848	0	119848	36.8%	21.8%	0	44120	44120	75728	29261
DA-A12	138786	81.3%	112899	0	112899	28.4%	16.9%	0	32086	32086	80813	25887
DA-A13	49355	81.2%	40092	0	40092	25.0%	14.8%	0	10020	10020	30072	9263
DA-A14	79528	79.1%	62890	0	62890	29.7%	17.6%	0	18679	18679	44212	16638
DA-A15	97857	75.3%	73643	24175	49468	28.3%	16.8%	4058	14000	18058	55585	24214
DA-A16	201385	91.1%	183449	997	182452	45.9%	27.2%	271	83751	84023	99426	17936
DA-A17	30376	82.2%	24979	0	24979	15.0%	8.9%	0	3758	3758	21221	5397
DA-A18	1334	87.1%	1162	0	1162	48.5%	28.8%	0	564	564	598	172
DA-A19	57278	78.3%	44849	0	44849	6.4%	3.8%	0	2876	2876	41973	12429
DA-A20	128669	87.6%	112725	0	112725	40.7%	24.1%	0	45868	45868	66857	15944
DA-A21.1	39207	86.7%	33989	0	33989	7.2%	4.3%	0	2446	2446	31543	5218
DA-A21.2	103937	85.5%	88826	0	88826	24.7%	14.7%	0	21970	21970	66855	15111
DA-A22	393044	75.4%	296161	128073	168088	28.8%	17.1%	21881	48413	70294	225867	96883
DA-A23	20139	94.0%	18930	0	18930	70.5%	41.8%	0	13340	13340	5590	1209
DA-A24	493273	70.0%	345125	175331	169794	21.3%	12.6%	22102	36084	58186	286939	148148
DA-A25	84148	88.0%	74046	0	74046	0.0%	0.0%	0	0	0	74046	10102
DA-A26	37114	94.5%	35066	32	35034	23.5%	13.9%	4	8235	8240	26827	2048
DA-A27	18792	94.7%	17804	0	17804	30.6%	18.2%	0	5454	5454	12351	988
DA-L1	72327	82.1%	59404	0	59404	80.0%	47.5%	0	47552	47552	11852	12923
DA-L2	5570	76.0%	4231	0	4231	61.2%	36.3%	0	2589	2589	1642	1339
DA-L3	51834	93.3%	48353	0	48353	76.0%	45.1%	0	36761	36761	11592	3481
DA-L4	25220	86.6%	21831	1120	20711	55.7%	33.0%	370	11530	11899	9931	3390
DA-L5	7467	83.1%	6205	30	6175	62.8%	37.2%	11	3878	3889	2316	1262

Equation

(1) Claculated elsewhere from FLUM
(2) Total area IC = total area x Ult % IC
(3) Claculated elsewhere from FLUM
(4) Area IC within all other FLUM cagegories except 100 = (2) - (3) or zero if result is negative
(5) Calculated from GIS files
(6) (6) = (5) x .39 / .65
(7) (7) = (6) x (3)
(8) (8) = (4) x (5)
(9) (9) = (7) + (8)
(10) (10) = (2) - (9)
(11) (11) = Total Area - (9) - (10)

Annie Street Storm Drain Improvements

C Values - Ultimate Development Conditions for Existing Storm Drain System

																						0.37	0.42	0.46	0.53						
																						0.25	0.30	0.34	0.41						
Drainage Input				Asphalt		Concrete		Grass		Total	Asphalt	Concrete	Grass	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	Combined				Grass Area	
Basin	Area (sf)	Drainage Area EX %IC	Area IC (sf)	Asph. % of IC	Asph.. Area (sf)	Conc. % of IC	Conc. Area (sf)	Grass Percentile	Grass Area (sf)	Area (acres)	Asp. Area (acres)	Conc. Area (acres)	Grass Area (acres)	Asph.C2	Asph.C10	Asph.C25	Asph. C100	Conc. C2	Conc. C10	Conc. C25	Conc. C100	Grass C2	Grass C10	Grass C25	Grass C100	Comb. C2	Comb. C10	Comb. C25	Comb. C100	Condition	Slope
DA-A01	35767				11592.40		16979.25		7195.35	0.82	0.27	0.39	0.17	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.66	0.73	0.78	0.87	Fair	average
DA-A02	72721				7385.31		45501.94		19833.75	1.67	0.17	1.04	0.46	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.63	0.71	0.75	0.84	Fair	average
DA-A03	22598				3704.10		12946.30		5947.60	0.52	0.09	0.30	0.14	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.37	0.42	0.46	0.53	0.65	0.72	0.77	0.85	Fair	steep
DA-A04	65817				3893.66		39518.39		22404.95	1.51	0.09	0.91	0.51	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.61	0.68	0.72	0.81	Fair	average
DA-A05.1	9336				2448.70		4988.05		1899.25	0.21	0.06	0.11	0.04	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.66	0.73	0.78	0.87	Fair	average
DA-A05.2	45161				10642.78		23622.02		10896.20	1.04	0.24	0.54	0.25	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.64	0.72	0.76	0.85	Fair	average
DA-A05	0				0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0	0	0	0	Fair	average
DA-A06.1	36647				2193.34		21918.76		12534.90	0.84	0.05	0.50	0.29	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.61	0.67	0.72	0.80	Fair	average
DA-A06.2	163241				15974.04		94772.36		52494.60	3.75	0.37	2.18	1.21	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.61	0.68	0.73	0.81	Fair	average
DA-A06	0				0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0	0	0	0	Fair	--
DA-A07	33869				5330.33		17175.67		11363.00	0.78	0.12	0.39	0.26	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.61	0.68	0.72	0.81	Fair	average
DA-A08	60513				8043.08		34070.62		18399.30	1.39	0.18	0.78	0.42	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.62	0.69	0.74	0.82	Fair	average
DA-A09	52532				24000.81		22825.29		5705.90	1.21	0.55	0.52	0.13	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.70	0.77	0.82	0.91	Fair	average
DA-A10	23950				21657.59		1393.66		898.75	0.55	0.50	0.03	0.02	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.71	0.79	0.84	0.93	Fair	flat
DA-A11	149109				44119.90		75727.70		29261.40	3.42	1.01	1.74	0.67	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.66	0.74	0.78	0.87	Fair	average
DA-A12	138786				32085.80		80812.80		25887.40	3.19	0.74	1.86	0.59	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.67	0.74	0.79	0.88	Fair	average
DA-A13	49355				10019.95		30072.05		9263.00	1.13	0.23	0.69	0.21	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.67	0.74	0.79	0.88	Fair	average
DA-A14	79528				18678.53		44211.67		16637.80	1.83	0.43	1.01	0.38	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.66	0.73	0.78	0.86	Fair	average
DA-A15	97857				18057.97		55584.73		24214.30	2.25	0.41	1.28	0.56	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.64	0.71	0.76	0.85	Fair	average
DA-A16	201385				84022.73		99426.47		17935.80	4.62	1.93	2.28	0.41	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.70	0.77	0.82	0.91	Fair	flat
DA-A17	30376				3758.09		21221.31		5396.60	0.70	0.09	0.49	0.12	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.67	0.75	0.80	0.88	Fair	average
DA-A18	1334				563.58		598.42		172.00	0.03	0.01	0.01	0.00	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.37	0.42	0.46	0.53	0.69	0.77	0.82	0.90	Fair	steep
DA-A19	57278				2876.01		41973.39		12428.60	1.31	0.07	0.96	0.29	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.66	0.73	0.78	0.86	Fair	average
DA-A20	128669				45868.40		66856.80		15943.80	2.95	1.05	1.53	0.37	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.69	0.77	0.82	0.90	Fair	average
DA-A21.1	39207				2445.53		31543.03		5218.44	0.90	0.06	0.72	0.12	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.69	0.77	0.82	0.90	Fair	average
DA-A21.2	103937				21970.38		66855.47		15111.15	2.39	0.50	1.53	0.35	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.68	0.76	0.81	0.90	Fair	average
DA-A21	0				0.00		0.00		0.00	0.00	0.00	0.00	0.00	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0	0	0	0	Fair	average
DA-A22	393044				70294.26		225866.89		96882.85	9.02	1.61	5.19	2.22	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.64	0.72	0.76	0.85	Fair	average
DA-A23	20139				13339.91		5589.94		1209.15	0.46	0.31	0.13	0.03	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.71	0.78	0.83	0.92	Fair	flat
DA-A24	493273				58186.31		286939.04		148147.65	11.32	1.34	6.59	3.40	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.62	0.69	0.74	0.82	Fair	average
DA-A25	84148				0.00		74046.32		10101.68	1.93	0.00	1.70	0.23	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.70	0.78	0.82	0.91	Fair	Average
DA-A26	37114				8239.55		26826.50		2047.95	0.85	0.19	0.62	0.05	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.33	0.38	0.42	0.49	0.72	0.80	0.85	0.94	Fair	Average
DA-A27	18792				5453.51		12350.94		987.55	0.43	0.13	0.28	0.02	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.72	0.80	0.85	0.93	Fair	flat
DA-L1	72327				47552.44		11851.76		12922.80	1.66	1.09	0.27	0.30	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.65	0.72	0.77	0.86	Fair	flat
DA-L2	5570				2588.73		1642.27		1339.00	0.13	0.06	0.04	0.03	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.62	0.69	0.74	0.83	Fair	flat
DA-L3	51834				36761.49		11591.51		3481.00	1.19	0.84	0.27	0.08	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.70	0.78	0.83	0.92	Fair	flat
DA-L4	25220				11899.41		9931.09		3389.50	0.58	0.27	0.23	0.08	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.67	0.75	0.80	0.89	Fair	flat
DA-L5	7467				3888.78		2316.12		1262.10	0.17	0.09	0.05	0.03	0.73	0.81	0.86	0.95	0.75	0.83	0.88	0.97	0.25	0.30	0.34	0.41	0.66	0.73	0.78	0.86	Fair	flat

Annie Street Storm Drain Improvements
Time of Concentration (Ultimate Development Conditions for Existing System)

Equation in cell ==>		**(1)**		**(2)**			**(3)**	**(4)**	**(5)**			**(6)**	**(7)**	**(8)**			**(9)**	**(10)**			**(9)**	**(10)**
Drainage Input					Sheet Flow - roof/pavement					Sheet Flow - overland					Shallow Conc. 1 - unpaved				Shallow Conc. 2 - unpaved			
Basin	Area (acres)	Calc. Tc	EBLDN Tc	Tc used mins	Sheet Flow Length (ft)	Sheet Flow Slope (ft/ft)	n	P	tc1 mins	Sheet Flow Length (ft)	Sheet Flow Slope (ft/ft)	n	P	tc1 mins	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc2 mins	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc3 mins
DA-A01	0.82	4.20		5.00	20.34	0.066	0.02	3.44	0.33	41.63	0.068	0.15	3.44	2.87	19.76	0.071	0.05	0.08	51.06	0.059	0.05	0.22
DA-A02	1.67	7.58		7.58	0.00	--	0.02	3.44	0.00	79.42	0.047	0.15	3.44	5.57	126.80	0.037	0.05	0.68	185.22	0.072	0.05	0.72
DA-A03	0.52	4.93		5.00	0.00	--	0.02	3.44	0.00	69.26	0.069	0.15	3.44	4.28	123.19	0.076	0.05	0.46	0.00	--	0.05	0.00
DA-A04	1.51	12.26		12.26	0.00	--	0.02	3.44	0.00	79.17	0.009	0.15	3.44	10.57	118.61	0.067	0.05	0.47	84.29	0.024	0.05	0.57
DA-A05	0.00	3.24		5.00	96.20	0.010	0.02	3.44	2.37	0.00	--	0.15	3.44	0.00	32.56	0.043	0.05	0.16	31.20	0.076	0.05	0.12
DA-A06	0.00	9.70		9.70	0.00	--	0.02	3.44	0.00	63.08	0.019	0.15	3.44	6.67	98.10	0.031	0.05	0.58	255.53	0.022	0.05	1.80
DA-A07	0.78	8.04		8.04	0.00	--	0.02	3.44	0.00	69.50	0.019	0.15	3.44	7.26	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A08	1.39	6.94		6.94	0.00	--	0.02	3.44	0.00	63.79	0.031	0.15	3.44	5.51	112.55	0.021	0.05	0.81	0.00	--	0.05	0.00
DA-A09	1.21	2.57		5.00	21.93	0.023	0.02	3.44	0.53	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A10	0.55	1.81		5.00	55.49	0.040	0.02	3.44	0.90	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A11	3.42	2.48		5.00	37.20	0.040	0.02	3.44	0.65	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A12	3.19	2.85		5.00	0.00	--	0.02	3.44	0.00	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A13	1.13	2.28		5.00	40.78	0.023	0.02	3.44	0.87	0.00	--	0.15	3.44	0.00	46.97	0.081	0.025	0.14	71.72	0.049	0.025	0.27
DA-A14	1.83	2.12		5.00	24.37	0.062	0.02	3.44	0.39	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A15	2.25	3.47		5.00	35.99	0.005	0.02	3.44	1.48	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A16	4.62	7.46		7.46	98.83	0.019	0.02	3.44	1.90	0.00	0.000	0.15	3.44	0.00	0.00	0.000	0.05	0.00	0.00	0.000	0.05	0.00
DA-A17	0.70	1.49		5.00	45.11	0.028	0.02	3.44	0.88	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A18	0.03	2.43		5.00	0.00	--	0.02	3.44	0.00	39.89	0.100	0.15	3.44	2.38	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A19	1.31	3.78		5.00	81.48	0.022	0.02	3.44	1.53	0.00	--	0.15	3.44	0.00	104.78	0.021	0.025	0.60	132.34	0.038	0.025	0.56
DA-A20	2.95	2.67		5.00	50.47	0.045	0.02	3.44	0.79	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A21	0.00	4.08		5.00	48.62	0.010	0.02	3.44	1.38	0.00	--	0.15	3.44	0.00	128.56	0.043	0.05	0.64	0.00	--	0.05	0.00
DA-A22	9.02	12.34	16.47	16.47	0.00	--	0.02	3.44	0.00	55.74	0.013	0.15	3.44	6.94	120.03	0.015	0.05	1.00	0.00	--	0.05	0.00
DA-A23	0.46	3.22		5.00	13.93	0.022	0.02	3.44	0.38	4.37	0.005	0.15	3.44	1.39	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A24	11.32	7.84		7.84	0.00	--	0.02	3.44	0.00	46.09	0.027	0.15	3.44	4.50	186.67	0.070	0.05	0.73	139.89	0.055	0.05	0.62
DA-A25	1.93	1.63	5.00	5.00	44.37	0.103	0.02	3.44	0.51	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A26	0.85	3.07		5.00	59.09	0.055	0.02	3.44	0.83	0.00	--	0.15	3.44	0.00	0.00	--	0.05	0.00	0.00	--	0.05	0.00
DA-A27	0.43	1.75		5.00	40.27	0.020	0.02	3.44	0.91	0.00	0.020	0.15	3.44	0.00	0.00	0.000	0.05	0.00	0.00	--	0.05	0.00
DA-L1	1.66	4.08		5.00	48.62	0.010	0.02	3.44	1.38	0.00	--	0.15	3.44	0.00	128.56	0.043	0.05	0.64	0.00	--	0.05	0.00
DA-L2	0.13	4.08		5.00	48.62	0.010	0.02	3.44	1.38	0.00	--	0.15	3.44	0.00	128.56	0.043	0.05	0.64	0.00	--	0.05	0.00
DA-L3	1.19	4.08		5.00	48.62	0.010	0.02	3.44	1.38	0.00	--	0.15	3.44	0.00	128.56	0.043	0.05	0.64	0.00	--	0.05	0.00
DA-L4	0.58	4.08		5.00	48.62	0.010	0.02	3.44	1.38	0.00	--	0.15	3.44	0.00	128.56	0.043	0.05	0.64	0.00	--	0.05	0.00
DA-L5	0.17	4.08		5.00	48.62	0.010	0.02	3.44	1.38	0.00	--	0.15	3.44	0.00	128.56	0.043	0.05	0.64	0.00	--	0.05	0.00
DA-A05.1	0.21	1.14		5.00	9.71	0.206	0.02	3.44	0.11	0.00	--	0.15	3.44	0.00	72.46	0.014	0.05	0.64	0.00	--	0.05	0.00
DA-A05.2	1.04	3.24		5.00	96.20	0.010	0.02	3.44	2.37	0.00	--	0.15	3.44	0.00	32.56	0.043	0.05	0.16	31.20	0.076	0.05	0.12
DA-A06.1	0.84	2.99		5.00	38.92	0.003	0.02	3.44	2.01	0.00	--	0.15	3.44	0.00	113.59	0.040	0.05	0.59	0.00	--	0.05	0.00
DA-A06.2	3.75	3.03		5.00	0.00	--	0.02	3.44	0.00	0.00	0.019	0.15	3.44	0.00	98.10	0.031	0.05	0.58	255.53	0.022	0.05	1.80
DA-A21.1	0.90	4.64		5.00	100.00	0.020	0.02	3.44	1.89	0.00	--	0.15	3.44	0.00	41.66	0.054	0.05	0.19	0.00	--	0.05	0.00
DA-A21.2	2.39	4.08		5.00	48.62	0.010	0.02	3.44	1.38	0.00	--	0.15	3.44	0.00	128.56	0.043	0.05	0.64	0.00	--	0.05	0.00

Equations

(1)	Calculated Tc = Sheet Flow Tc + Shallwo Concentrated Tc + Gutter Flow Tc
(2)	Tc used = min (5, Calculated Tc)
(3)	n = 0.020 for roofs/pavement
(4)	See DCM Table 2-3: 2-year 24-hour rainfall
(5)	DCM EQ 2-3: Sheet Flow Tc for roofs/pavement (mins) = $0.42 * (nL)^{0.8} / (P^{0.5} * S^{0.4})$
(6)	n = 0.15 for Grass, short-grass prairie; See DCM Table 2-2
(7)	See DCM Table 2-3: 2-year 24-hour rainfall
(8)	DCM EQ 2-3Sheet Flow for roofs/pavement (mins) = $0.42 * (nL)^{0.8} / (P^{0.5} * S^{0.4})$
(9)	Given in DCM Section 2.4.2.B
(10)	DCM EQ 2-4: Unpaved Shallow Concentrated Tc = $L / (60(16.1345)(S^{0.5}))$
(11)	Given in DCM Section 2.4.2.B; cells hilighted in green use the unpaved equation
(12)	DCM EQ 2-5: Paved Shallow Concentrated Tc = $L / (60(20.3282)(S^{0.5}))$; cells hilighted in green use the unpaved equation
(13)	$V = k * S^{0.5}$ Reference: Richard McCuen, Hydrologic Analysis and Design (New Jersey: Prentice Hall 1998), p. 143.
(14)	Tc = L / (60 * V)

Annie Street Storm Drain Improvements
Time of Concentration (Ultimate Development Conditions for Existing System)

Equation in cell ==>			(11)	(12)			(11)	(12)			(13)	(14)			(13)	(14)			(13)	(14)
	Shallow Conc. 3 - paved				Shallow Conc. 4 - paved				Gutter 1 (paved)				Gutter 2 (paved)				Gutter 3			
Basin	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc4 mins	Shallow Flow Length (ft)	Shallow Flow Slope (ft/ft)	n	tc5 mins	Channel Length (ft)	slope	Channel Min. V (fps)	tc6 mins	Channel Length (ft)	slope	Channel Min. V (fps)	tc7	Channel Length (ft)	slope	Channel Min. V (fps)	tc8
DA-A01	19.20	0.057	0.025	0.07	0.00	--	0.025	0.00	260.66	0.021	6.73	0.65	0.00	--	--	0.00	0.00	--	--	0.00
DA-A02	0.00	--	0.025	0.00	0.00	--	0.025	0.00	239.66	0.020	6.52	0.61	0.00	--	--	0.00	0.00	--	--	0.00
DA-A03	16.93	0.106	0.025	0.04	0.00	--	0.025	0.00	107.21	0.070	12.29	0.15	0.00	--	--	0.00	0.00	--	--	0.00
DA-A04	39.40	0.048	0.025	0.15	102.00	0.066	0.025	0.41	62.38	0.063	11.58	0.09	0.00	0.000	0.00	0.00	0.00	--	--	0.00
DA-A05	91.61	0.041	0.025	0.37	0.00	--	0.025	0.00	113.72	0.035	8.68	0.22	0.00	--	--	0.00	0.00	--	--	0.00
DA-A06	0.00	--	0.025	0.00	0.00	--	0.025	0.00	175.80	0.018	6.25	0.47	103.27	0.042	9.45	0.18	0.00	--	--	0.00
DA-A07	0.00	--	0.025	0.00	0.00	--	0.025	0.00	338.33	0.024	7.21	0.78	0.00	--	--	0.00	0.00	--	--	0.00
DA-A08	0.00	--	0.025	0.00	0.00	--	0.025	0.00	249.28	0.021	6.67	0.62	0.00	--	--	0.00	0.00	--	--	0.00
DA-A09	76.41	0.046	0.025	0.29	244.51	0.019	0.025	1.45	145.70	0.031	8.14	0.30	0.00	--	--	0.00	0.00	--	--	0.00
DA-A10	0.00	--	0.025	0.00	0.00	--	0.025	0.00	277.71	0.012	5.05	0.92	0.00	--	--	0.00	0.00	--	--	0.00
DA-A11	98.18	0.058	0.025	0.33	115.12	0.058	0.025	0.39	534.08	0.030	8.04	1.11	0.00	--	--	0.00	0.00	--	--	0.00
DA-A12	90.08	0.120	0.025	0.21	325.68	0.024	0.025	1.74	310.84	0.015	5.75	0.90	0.00	--	--	0.00	0.00	--	--	0.00
DA-A13	69.55	0.032	0.025	0.32	0.00	--	0.025	0.00	181.33	0.009	4.35	0.69	0.00	--	--	0.00	0.00	--	--	0.00
DA-A14	105.13	0.035	0.025	0.46	25.70	0.078	0.025	0.08	569.10	0.030	7.96	1.19	0.00	--	--	0.00	0.00	--	--	0.00
DA-A15	64.24	0.023	0.025	0.34	0.00	--	0.025	0.00	334.45	0.010	4.74	1.18	232.94	0.032	8.25	0.47	0.00	--	--	0.00
DA-A16	74.68	0.012	0.025	0.56	0.00	0.000	0.025	0.00	667.48	0.009	4.28	2.60	435.12	0.015	5.66	1.28	338.76	0.012	5.03	1.12
DA-A17	69.20	0.029	0.025	0.33	63.10	0.055	0.025	0.22	21.98	0.018	6.25	0.06	0.00	--	--	0.00	0.00	--	--	0.00
DA-A18	10.84	0.030	0.025	0.05	0.00	--	0.025	0.00	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-A19	124.09	0.026	0.025	0.79	41.19	0.072	0.025	0.16	82.03	0.040	9.29	0.15	0.00	--	--	0.00	0.00	--	--	0.00
DA-A20	277.07	0.023	0.025	1.49	0.00	--	0.025	0.00	193.00	0.033	8.43	0.38	0.00	--	--	0.00	0.00	--	--	0.00
DA-A21	160.83	0.024	0.025	0.86	270.05	0.034	0.025	1.20	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-A22	247.63	0.020	0.025	1.43	0.00	--	0.025	0.00	350.19	0.025	7.29	0.80	713.52	0.014	5.48	2.17	0.00	--	--	0.00
DA-A23	0.00	--	0.025	0.00	0.00	--	0.025	0.00	380.19	0.009	4.38	1.45	0.00	--	--	0.00	0.00	--	--	0.00
DA-A24	0.00	--	0.025	0.00	0.00	--	0.025	0.00	200.90	0.014	5.47	0.61	588.64	0.024	7.14	1.37	0.00	--	--	0.00
DA-A25	78.87	0.020	0.025	0.45	161.58	0.045	0.025	0.63	37.30	0.155	18.23	0.03	0.00	--	--	0.00	0.00	--	--	0.00
DA-A26	382.77	0.020	0.025	2.24	0.00	--	0.025	0.00	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-A27	0.00	0.000	0.025	0.00	0.00	0.000	0.025	0.00	238.53	0.010	4.74	0.84	0.00	0.000	0.00	0.00	0.00	0.00	0.00	0.00
DA-L1	160.83	0.024	0.025	0.86	270.05	0.034	0.025	1.20	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-L2	160.83	0.024	0.025	0.86	270.05	0.034	0.025	1.20	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-L3	160.83	0.024	0.025	0.86	270.05	0.034	0.025	1.20	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-L4	160.83	0.024	0.025	0.86	270.05	0.034	0.025	1.20	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-L5	160.83	0.024	0.025	0.86	270.05	0.034	0.025	1.20	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-A05.1	8.29	0.020	0.025	0.05	0.00	--	0.025	0.00	153.09	0.026	7.48	0.34	0.00	--	--	0.00	0.00	--	--	0.00
DA-A05.2	91.61	0.041	0.025	0.37	0.00	--	0.025	0.00	113.72	0.035	8.68	0.22	0.00	--	--	0.00	0.00	--	--	0.00
DA-A06.1	42.75	0.133	0.025	0.10	0.00	--	0.025	0.00	122.10	0.023	7.01	0.29	0.00	--	--	0.00	0.00	--	--	0.00
DA-A06.2	0.00	--	0.025	0.00	0.00	--	0.025	0.00	175.80	0.018	6.25	0.47	103.27	0.042	9.45	0.18	0.00	--	--	0.00
DA-A21.1	151.29	0.003	0.025	2.16	91.21	0.033	0.025	0.41	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00
DA-A21.2	160.83	0.024	0.025	0.86	270.05	0.034	0.025	1.20	0.00	--	--	0.00	0.00	--	--	0.00	0.00	--	--	0.00

Equations

(1) Calculated Tc = Sheet Flow Tc + Shallwo Concentrated Tc + Gutter Flow Tc
(2) Tc used = min (5, Calculated Tc)
(3) n = 0.020 for roofs/pavement
(4) See DCM Table 2-3: 2-year 24-hour rainfall
(5) DCM EQ 2-3: Sheet Flow Tc for roofs/pavement (mins) = $0.42 * (nL)^{0.8} / (P^{0.5} * S^{0.4})$
(6) n = 0.15 for Grass, short-grass prairie; See DCM Table 2-2
(7) See DCM Table 2-3: 2-year 24-hour rainfall
(8) DCM EQ 2-3Sheet Flow for roofs/pavement (mins) = $0.42 * (nL)^{0.8} / (P^{0.5} * S^{0.4})$
(9) Given in DCM Section 2.4.2.B
(10) DCM EQ 2-4: Unpaved Shallow Concentrated Tc = $L / (60(16.1345)(S^{0.5}))$
(11) Given in DCM Section 2.4.2.B; cells hilighted in green use the unpaved equation
(12) DCM EQ 2-5: Paved Shallow Concentrated Tc = $L / (60(20.3282)(S^{0.5}))$; cells hilighted in green use the unpaved equation
(13) $V = k * S^{0.5}$ Reference: Richard McCuen, Hydrologic Analysis and Design (New Jersey: Prentice Hall 1998), p. 143.
(14) Tc = L / (60 * V)

RUNOFF COMPUTATIONS (Ultimate Development Conditions for Existing System)

			2 Year Storm Event			10 Year Storm Event			25 Year Storm Event			100 Year Storm Event		
Drainage Area Number	Drainage Area (acres)	Time of Concentration Tc (min)	Runoff Coefficient C2	Intensity I2	Design Flow Q2 (cfs)	Runoff Coefficient C10	Intensity I10	Design Flow Q10 (cfs)	Runoff Coefficient C25	Intensity I25	Design Flow Q25 (cfs)	Runoff Coefficient C100	Intensity I100	Design Flow Q100 (cfs)
DA-A01	0.82	5.00	0.66	5.76	3.11	0.73	8.57	5.16	0.78	10.11	6.48	0.87	12.54	8.93
DA-A02	1.67	7.58	0.63	5.10	5.39	0.71	7.60	8.95	0.75	9.01	11.31	0.84	11.32	15.82
DA-A03	0.52	5.00	0.65	5.76	1.93	0.72	8.57	3.20	0.77	10.11	4.02	0.85	12.54	5.54
DA-A04	1.51	12.26	0.61	4.25	3.89	0.68	6.36	6.49	0.72	7.57	8.26	0.81	9.68	11.77
DA-A05.1	0.21	5.00	0.66	5.76	0.81	0.73	8.57	1.35	0.78	10.11	1.69	0.87	12.54	2.33
DA-A05.2	1.04	5.00	0.64	5.76	3.84	0.72	8.57	6.37	0.76	10.11	8.01	0.85	12.54	11.05
DA-A05	0.00	5.00	0.00	5.76	0.00	0.00	8.57	0.00	0.00	10.11	0.00	0.00	12.54	0.00
DA-A06.1	0.84	5.00	0.61	5.76	2.93	0.67	8.57	4.86	0.72	10.11	6.14	0.80	12.54	8.49
DA-A06.2	3.75	5.00	0.61	5.76	13.22	0.68	8.57	21.94	0.73	10.11	27.67	0.81	12.54	38.25
DA-A06	0.00	9.70	0.00	4.67	0.00	0.00	6.97	0.00	0.00	8.28	0.00	0.00	10.50	0.00
DA-A07	0.78	8.04	0.61	5.00	2.36	0.68	7.46	3.92	0.72	8.84	4.96	0.81	11.13	6.97
DA-A08	1.39	6.94	0.62	5.25	4.52	0.69	7.82	7.50	0.74	9.25	9.48	0.82	11.60	13.23
DA-A09	1.21	5.00	0.70	5.76	4.83	0.77	8.57	7.98	0.82	10.11	10.01	0.91	12.54	13.75
DA-A10	0.55	5.00	0.71	5.76	2.26	0.79	8.57	3.73	0.84	10.11	4.68	0.93	12.54	6.42
DA-A11	3.42	5.00	0.66	5.76	13.04	0.74	8.57	21.58	0.78	10.11	27.13	0.87	12.54	37.36
DA-A12	3.19	5.00	0.67	5.76	12.23	0.74	8.57	20.24	0.79	10.11	25.44	0.88	12.54	35.01
DA-A13	1.13	5.00	0.67	5.76	4.35	0.74	8.57	7.20	0.79	10.11	9.05	0.88	12.54	12.45
DA-A14	1.83	5.00	0.66	5.76	6.91	0.73	8.57	11.44	0.78	10.11	14.38	0.86	12.54	19.81
DA-A15	2.25	5.00	0.64	5.76	8.31	0.71	8.57	13.76	0.76	10.11	17.32	0.85	12.54	23.89
DA-A16	4.62	7.46	0.70	5.13	16.53	0.77	7.64	27.36	0.82	9.05	34.46	0.91	11.37	47.94
DA-A17	0.70	5.00	0.67	5.76	2.70	0.75	8.57	4.47	0.80	10.11	5.61	0.88	12.54	7.72
DA-A18	0.03	5.00	0.69	5.76	0.12	0.77	8.57	0.20	0.82	10.11	0.25	0.90	12.54	0.35
DA-A19	1.31	5.00	0.66	5.76	4.98	0.73	8.57	8.24	0.78	10.11	10.36	0.86	12.54	14.27
DA-A20	2.95	5.00	0.69	5.76	11.75	0.77	8.57	19.41	0.82	10.11	24.37	0.90	12.54	33.48
DA-A21.1	0.90	5.00	0.69	5.76	3.59	0.77	8.57	5.93	0.82	10.11	7.44	0.90	12.54	10.22
DA-A21.2	2.39	5.00	0.68	5.76	9.40	0.76	8.57	15.54	0.81	10.11	19.52	0.90	12.54	26.82
DA-A21	0.00	5.00	0.00	5.76	0.00	0.00	8.57	0.00	0.00	10.11	0.00	0.00	12.54	0.00
DA-A22	9.02	16.47	0.64	3.72	21.56	0.72	5.57	35.98	0.76	6.66	45.85	0.85	8.59	65.76
DA-A23	0.46	5.00	0.71	5.76	1.88	0.78	8.57	3.11	0.83	10.11	3.90	0.92	12.54	5.35
DA-A24	11.32	7.84	0.62	5.04	35.50	0.69	7.52	58.96	0.74	8.91	74.62	0.82	11.21	104.58
DA-A25	1.93	5.00	0.70	5.76	7.78	0.78	8.57	12.84	0.82	10.11	16.11	0.91	12.54	22.11
DA-A26	0.85	5.00	0.72	5.76	3.54	0.80	8.57	5.85	0.85	10.11	7.32	0.94	12.54	10.04
DA-A27	0.43	5.00	0.72	5.76	1.78	0.80	8.57	2.94	0.85	10.11	3.69	0.93	12.54	5.06
DA-L1	1.66	5.00	0.65	5.76	6.19	0.72	8.57	10.27	0.77	10.11	12.93	0.86	12.54	17.85
DA-L2	0.13	5.00	0.62	5.76	0.46	0.69	8.57	0.76	0.74	10.11	0.96	0.83	12.54	1.33
DA-L3	1.19	5.00	0.70	5.76	4.81	0.78	8.57	7.95	0.83	10.11	9.98	0.92	12.54	13.71
DA-L4	0.58	5.00	0.67	5.76	2.24	0.75	8.57	3.72	0.80	10.11	4.67	0.89	12.54	6.43
DA-L5	0.17	5.00	0.66	5.76	0.65	0.73	8.57	1.07	0.78	10.11	1.35	0.86	12.54	1.86

From DCM Section 2.4.3, Table 2-5:

	2-year		10-year		25-year		100-year
a=	54.767	a=	70.820	a=	82.9360	a=	118.3000
b=	11.051	b=	10.396	b=	10.7460	b=	13.1850
c=	0.8116	c=	0.7725	c=	0.7634	c=	0.7736

Ultimate Development Conditions for Existing System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM

HEC-22 variable or EQ ==>						**Q**											**Q**			**S_L**
DCM Variable or EQ==>						**Q**											**Q**			**S_o**
GIS StormwaterInfrastructureFIELD ==>																				
Data Source ===>																		**DGN**	**DGN**	**DGN**	
Equation in cell ==>						**(1)**											**(2)**			**(3)**
DRAINAGE AREA	**INLET (StormCAD)**	**INLET GIS ID**	**STREET NAME**	**DRAINAGE AREA**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**2nd UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**3rd UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**4th UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**5th UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**	**Hig elev** *(ft)*	**low elev** *(ft)*	**length** *(ft)*	**SLOPE** *(ft/ft)* **$S_o = S_L$**
DA-L1	N/A		S. Congress	DA-L1	1.66	12.93	none										12.93	587.00	583.40	250.89	0.0143
DA-L2	N/A		College Ave	DA-L2	0.13	0.96	none										0.96	587.00	586.00	181.53	0.0055
DA-L3	N/A		College Ave	DA-L3	1.19	9.98	none										9.98	588.00	586.00	293.98	0.0068
DA-L4	N/A		Live Oak	DA-L4	0.58	4.67	none										4.67	579.00	577.00	130.84	0.0153
DA-L5	N/A		Live Oak	DA-L5	0.17	1.35	none										1.35	574.00	572.00	110.72	0.0181
DA-A26	I-A26		driveway	DA-A26	0.85	7.32	none										7.32	slope shown on as-builts			0.0050
DA-A15	**I-A15**	**2195**	Leland St.	DA-A15	2.25	17.32	none										17.32	582.00	577.00	112.78	0.0443
DA-A16	**I-A16**	**2196**	S. Congress Ave.	DA-A16	4.62	34.46	DA-L1	1.37	DA-L2	0.00	DA-L3	4.26	DA-A26	0.20	DA-A15	9.66	49.96	578.00	576.00	177.66	0.0113
DA-A14	**I-A14**	**2194**	Leland St.	DA-A14	1.83	14.38	none										14.38	582.00	576.00	119.82	0.0501
DA-A13	**I-A13**	**2193**	S. Congress Ave.	DA-A13	1.13	9.05	DA-A16	38.19	DA-A14	7.49							54.73	575.00	573.17	195.30	0.0094
DA-A23	**N/A**		S. 1st	DA-A23	0.46	3.90	none										3.90	521.00	519.43	126.16	0.0125
DA-A27	**N/A**		S. 1st	DA-A27	0.43	3.69	none										3.69	521.00	519.00	135.89	0.0147
DA-A09	**I-A9**	**2187**	Mary St.	DA-A09	1.21	10.01	DA-A10	2.86									12.87	560.00	555.30	137.90	0.0341
DA-A08	**I-A8**	**-**	Eva St.	DA-A08	1.39	9.48	none										9.48	558.00	554.50	178.98	0.0196
DA-A07	**I-A7**	**2186**	Mary St.	DA-A07	0.78	4.96	DA-A09	7.04	DA-A08	4.40							16.41	553.40	551.00	120.48	0.0199
Inlet 21823 (DS of grate inlet DA-A22)	**I-21823**		Wilson St	none	0.00	0.00	DA-A22	15.42									15.42	556.00	554.00	114.12	0.0175
DA-A20	**I-A20**	**310067**	Johanna St.	DA-A20	2.95	24.37	none										24.37	561.00	555.20	161.36	0.0359
DA-A04	**I-A4**	**2151**	Annie St.	DA-A04	1.51	8.26	none										8.26	527.00	517.00	137.77	0.0726
DA-A03	**I-A3**	**2152**	Annie St.	DA-A03	0.52	4.02	none										4.02	527.50	516.80	147.69	0.0724

100 YEAR STORM

DRAINAGE AREA	**INLET (StormCAD)**	**INLET GIS ID**	**STREET NAME**	**DRAINAGE AREA**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**2nd UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**3rd UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**4th UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**5th UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**	**Hig elev** *(ft)*	**low elev** *(ft)*	**length** *(ft)*	**SLOPE** *(ft/ft)* **$S_o = S_L$**
DA-L1	N/A		S. Congress	DA-L1	1.66	17.85	none										17.85	587.00	583.40	250.89	0.0143
DA-L2	N/A		College Ave	DA-L2	0.13	1.33	none										1.33	587.00	586.00	181.53	0.0055
DA-L3	N/A		College Ave	DA-L3	1.19	13.71	none										13.71	588.00	586.00	293.98	0.0068
DA-L4	N/A		Live Oak	DA-L4	0.58	6.43	none										6.43	579.00	577.00	130.84	0.0153
DA-L5	N/A		Live Oak	DA-L5	0.17	1.86	none										1.86	574.00	572.00	110.72	0.0181
DA-A26	I-A26		driveway	DA-A26	0.85	10.04	none										10.04	slope shown on as-builts			0.0050
DA-A15	**I-A15**	**2195**	Leland St.	DA-A15	2.25	23.89	none										23.89	582.00	577.00	112.78	0.0443
DA-A16	**I-A16**	**2196**	S. Congress Ave.	DA-A16	4.62	47.94	DA-L1	2.98	DA-L2	0.00	DA-L3	6.67	DA-A26	1.10	DA-A15	14.78	73.46	578.00	576.00	177.66	0.0113
DA-A14	**I-A14**	**2194**	Leland St.	DA-A14	1.83	19.81	none										19.81	582.00	576.00	119.82	0.0501
DA-A13	**I-A13**	**2193**	S. Congress Ave.	DA-A13	1.13	12.45	DA-A16	60.18	DA-A14	11.55							84.18	575.00	573.17	195.30	0.0094
DA-A23	**N/A**		S. 1st	DA-A23	0.46	5.35	none										5.35	521.00	519.43	126.16	0.0125
DA-A27	**N/A**		S. 1st	DA-A27	0.43	5.06	none										5.06	521.00	519.00	135.89	0.0147
DA-A09	**I-A9**	**2187**	Mary St.	DA-A09	1.21	13.75	DA-A10	4.22									17.96	560.00	555.30	137.90	0.0341
DA-A08	**I-A8**	**-**	Eva St.	DA-A08	1.39	13.23	none										13.23	558.00	554.50	178.98	0.0196
DA-A07	**I-A7**	**2186**	Mary St.	DA-A07	0.78	6.97	DA-A09	11.15	DA-A08	6.93							25.06	553.40	551.00	120.48	0.0199
Inlet 21823 (DS of grate inlet DA-A22)	**I-21823**		Wilson St	none	0.00	0.00	DA-A22	22.41									22.41	556.00	554.00	114.12	0.0175
DA-A20	**I-A20**	**310067**	Johanna St.	DA-A20	2.95	33.48	none										33.48	561.00	555.20	161.36	0.0359
DA-A04	**I-A4**	**2151**	Annie St.	DA-A04	1.51	11.77	none										11.77	527.00	517.00	137.77	0.0726
DA-A03	**I-A3**	**2152**	Annie St.	DA-A03	0.52	5.54	none										5.54	527.50	516.80	147.69	0.0724

Ultimate Development Conditions for Existing System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM

HEC-22 variable or EQ ==>					EQ 4-29 Figure 4-18.a							d			Sx	B EQ B-11	H EQ B-11						x and T EQ B-11				
DCM Variable or EQ:	W EQ 3-1				EQ 4-2 h			K_o	K_1	K_2	K_3	Y_o EQ 3-5			Sx	assumes crown to curb = street width/2; not true for streets with curb split	H EQ 3-1						S and T EQ 3-1				
GIS StormwaterInfrastructureFIELD ==>				Height																							
Data Source ===>	DGN	assumed				DGN	DGN	DCM							ESD Field Visit or as-builts												
Equation in cell ==>									(4)			(5)			(6)	(7)	(8)						(9)				
DRAINAGE AREA	Street Width (FOC-FOC)	Curb Height	Curb Height	CURB OPENING HEIGHT	CURB OPENING HEIGHT	Split	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH	Is Yo > 1.4*h?	Over Curb?	ESD Field Measured Street Cross Slope	Dist. Curb to Crown	Crown Height	Quadratic Formula = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a				T	PONDED WIDTH	Clear Width	Over Crown?		Outside ROW?
	(ft) W	(in)	(ft)	(in)	(ft) h	(ft) CS						(ft) Yo = d			Sx	(ft) B	(ft) H	a H / B^2	b -(2H/B)	c Yo	x1	x2	(ft) T				
DA-L1	78.0	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	2.74	0	0.5034		over curb	0.052	37.7	0.49	0.0003	-0.0258	0.5034	--	--	37.66	0.00	over crown		no
DA-L2	32.5	6.0	0.5	5.0	0.4	0.0	N/A	2.85	0.50	3.03	0	0.2667		no	0.032	16.3	0.45	0.0017	-0.0554	0.2667	26.6214	5.8786	5.88	10.37	no		no
DA-L3	32.5	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0	0.5582		over curb	0.053	16.3	0.45	0.0017	-0.0554	0.5582	--	--	16.25	0.00	over crown		no
DA-L4	34.3	6.0	0.5	6.5	0.5	0.0	N/A	2.89	0.50	2.99	0	0.3639		no	0.057	17.1	1.10	0.0038	-0.1285	0.3639	31.1339	3.1161	3.12	14.01	no		no
DA-L5	36.9	6.0	0.5	7.0	0.6	0.0	N/A	2.89	0.50	2.99	0	0.2336		no	0.035	18.5	0.85	0.0025	-0.0921	0.2336	34.1618	2.7382	2.74	15.71	no		no
DA-A26	24.0	6.0	0.5	7.0	0.6	0.0	N/A	2.85	0.50	3.03	0	0.3101		no	0.020	24.0	0.47	0.0008	-0.0392	0.3101	38.0002	9.9998	15.83	8.17	no		no
DA-A15	30.0	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0	0.4915		no	0.043	15.0	0.85	0.0038	-0.1133	0.4915	24.7422	5.2578	5.26	9.74	no		no
DA-A16	91.5	6.0	0.5	6.0	0.5	2.0	high	2.85	0.50	2.74	-0.043	0.9263	use orifice EQ	over curb	0.060	23.3	1.14	0.0021	-0.0979	0.9263	33.3591	13.2009	13.20	10.08	no		outside ROW
DA-A14	30.0	6.0	0.5	9.0	0.8	0.0	N/A	2.85	0.50	3.03	0	0.4530		no	0.044	15.0	0.85	0.0038	-0.1133	0.4530	25.2511	4.7489	4.75	10.25	no		no
DA-A13	91.5	6.0	0.5	7.0	0.6	2.5	high	2.85	0.50	2.74	-0.043	1.0083	use orifice EQ	over curb	0.101	30.8	1.28	0.0013	-0.0829	1.0083	44.8285	16.6915	16.69	14.07	no		outside ROW
DA-A23	45.5	6.0	0.5	5.0	0.4	0.0	N/A	2.84	0.50	2.83	0	0.3481		no	0.068	22.8	0.14	0.0003	-0.0120	0.3481	--	--	22.75	0.00	over crown		no
DA-A27	45.5	6.0	0.5	5.0	0.4	0.0	N/A	2.84	0.50	2.83	0	0.3315		no	0.054	22.8	0.14	0.0003	-0.0120	0.3315	--	--	22.75	0.00	over crown		no
DA-A09	41.0	6.0	0.5	5.0	0.4	0.0	N/A	2.85	0.50	2.89	0	0.4484		no	0.054	20.5	0.81	0.0019	-0.0790	0.4484	34.1962	6.8038	6.80	13.70	no		no
DA-A08	32.5	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0	0.4611		no	0.010	16.3	0.17	0.0006	-0.0209	0.4611	--	--	16.25	0.00	over crown		no
DA-A07	40.5	6.0	0.5	5.0	0.4	0.0	N/A	2.85	0.50	2.89	0	0.5352		over curb	0.045	20.3	0.94	0.0023	-0.0928	0.5352	33.5381	6.9619	6.96	13.29	no		no
Inlet 21823 (DS of grate inlet DA-A22)	29.8	8.0	0.7	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0	0.5513		no	0.035	14.9	0.34	0.0015	-0.0456	0.5513	--	--	14.90	0.00	over crown		no
DA-A20	32.0	6.0	0.5	6.0	0.5	0.5	low	2.70	0.50	2.74	-0.215	0.6661		over curb	0.027	16.0	0.68	0.0027	-0.0850	0.6661	18.2868	13.7132	13.71	2.29	no		outside ROW
DA-A04	40.0	6.0	0.5	5.0	0.4	0.0	N/A	2.85	0.50	2.89	0	0.3375		no	0.028	20.0	0.30	0.0008	-0.0300	0.3375	--	--	20.00	0.00	over crown		no
DA-A03	40.0	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0	0.2631		no	0.028	20.0	0.30	0.0008	-0.0300	0.2631	27.0148	12.9852	12.99	7.01	no		no

100 YEAR STORM

DRAINAGE AREA	Street Width (FOC-FOC)	Curb Height	Curb Height	CURB OPENING HEIGHT	CURB OPENING HEIGHT	Split	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH	Is Yo > 1.4*h?	Over Curb?	ESD Field Measured Street Cross Slope	Dist. Curb to Crown	Crown Height	Quadratic Formula = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a				T	PONDED WIDTH		Over Crown?	Depth Over Crown	Outside ROW?
	(ft) W	(in)	(ft)	(in)	(ft) h	(ft) CS						(ft) Yo = d			Sx	(ft) B	(ft) H	a H / B^2	b -(2H/B)	c Yo	x1	x2	(ft) T				
DA-L1	78.0	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	2.74	0	0.5662		over curb	0.052	37.7	0.49	0.0003	-0.0258	0.5662	--	--	37.66		over crown	0.08	no
DA-L2	32.5	6.0	0.5	5.0	0.4	0.0	N/A	2.85	0.50	3.03	0	0.2968		no	0.032	16.3	0.45	0.0017	-0.0554	0.2968	25.7303	6.7697	6.77		no	0.00	no
DA-L3	32.5	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0	0.6198		over curb	0.053	16.3	0.45	0.0017	-0.0554	0.6198	--	--	16.25		over crown	0.17	outside ROW
DA-L4	34.3	6.0	0.5	6.5	0.5	0.0	N/A	2.89	0.50	2.99	0	0.4049		no	0.057	17.1	1.10	0.0038	-0.1285	0.4049	30.7378	3.5122	3.51		no	0.00	no
DA-L5	36.9	6.0	0.5	7.0	0.6	0.0	N/A	2.89	0.50	2.99	0	0.2601		no	0.035	18.5	0.85	0.0025	-0.0921	0.2601	33.8205	3.0795	3.08		no	0.00	no
DA-A26	24.0	6.0	0.5	7.0	0.6	0.0	N/A	2.85	0.50	3.03	0	0.3490		no	0.020	24.0	0.47	0.0008	-0.0392	0.3490	36.1798	11.8202	17.82		no	0.00	no
DA-A15	30.0	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0	0.5464		over curb	0.043	15.0	0.85	0.0038	-0.1133	0.5464	23.9640	6.0360	6.04		no	0.00	no
DA-A16	91.5	6.0	0.5	6.0	0.5	2.0	high	2.85	0.50	2.74	-0.043	1.0663	use orifice EQ	over curb	0.060	23.3	1.14	0.0021	-0.0979	1.0663	29.2012	17.3588	17.36		no	0.00	outside ROW
DA-A14	30.0	6.0	0.5	9.0	0.8	0.0	N/A	2.85	0.50	3.03	0	0.5035		over curb	0.044	15.0	0.85	0.0038	-0.1133	0.5035	24.5771	5.4229	5.42		no	0.00	no
DA-A13	91.5	6.0	0.5	7.0	0.6	2.5	high	2.85	0.50	2.74	-0.043	1.1799	use orifice EQ	over curb	0.101	30.8	1.28	0.0013	-0.0829	1.1799	39.1610	22.3590	22.36		no	0.00	outside ROW
DA-A23	45.5	6.0	0.5	5.0	0.4	0.0	N/A	2.84	0.50	2.83	0	0.3893		no	0.068	22.8	0.14	0.0003	-0.0120	0.3893	--	--	22.75		over crown	0.25	no
DA-A27	45.5	6.0	0.5	5.0	0.4	0.0	N/A	2.84	0.50	2.83	0	0.3706		no	0.054	22.8	0.14	0.0003	-0.0120	0.3706	--	--	22.75		over crown	0.23	no
DA-A09	41.0	6.0	0.5	5.0	0.4	0.0	N/A	2.85	0.50	2.89	0	0.5033		over curb	0.054	20.5	0.81	0.0019	-0.0790	0.5033	33.1155	7.8845	7.88		no	0.00	no
DA-A08	32.5	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0	0.5147		over curb	0.010	16.3	0.17	0.0006	-0.0209	0.5147	--	--	16.25		over crown	0.34	no
DA-A07	40.5	6.0	0.5	5.0	0.4	0.0	N/A	2.85	0.50	2.89	0	0.6197	use orifice EQ	over curb	0.045	20.3	0.94	0.0023	-0.0928	0.6197	32.0714	8.4286	8.43		no	0.00	outside ROW
Inlet 21823 (DS of grate inlet DA-A22)	29.8	8.0	0.7	6.0	0.5	0.0	N/A	2.85	0.50	3.03	0	0.6236		no	0.035	14.9	0.34	0.0015	-0.0456	0.6236	--	--	14.90		over crown	0.28	outside ROW
DA-A20	32.0	6.0	0.5	6.0	0.5	0.5	low	2.70	0.50	2.74	-0.215	0.7480	use orifice EQ	over curb	0.027	16.0	0.68	0.0027	-0.0850	0.7480	--	--	16.00		over crown	0.07	outside ROW
DA-A04	40.0	6.0	0.5	5.0	0.4	0.0	N/A	2.85	0.50	2.89	0	0.3815		no	0.028	20.0	0.30	0.0008	-0.0300	0.3815	--	--	20.00		over crown	0.08	no
DA-A03	40.0	6.0	0.5	6.0	0.5	0.0	N/A	2.85	0.50	2.89	0	0.2940		no	0.028	20.0	0.30	0.0008	-0.0300	0.2940	22.8394	17.1606	17.16		no	0.00	no

Ultimate Development Conditions for Existing System

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

25 YEAR STORM

HEC-22 variable or E	L_T 4-22a		a Fig 4-13		W	S'w 4-24	Sw 4-4, 4-5, 4-6	Eo 4-4	Se 4-24	n	L_T 4-22a	?		L	E 4-23	Qi 4-14	Qb 4-15	
DCM Variable or EQ:	**K_T EQ 4-10**	**DIG Data instructions**			**W**	**S'w 4-9**	**Sw 4-9**	**Eo**	**Se 4-9**	**n**	**L_T 4-10**	**?**		**L**	**E 4-8**	**Qi**		
GIS StormwaterInfrastructureFIEL		**Depression_a**		**Width**									**st_length**					
Data Source ===>	**DCM**	**GIS or ESD field visit**		**GIS or ESD field visit**						**DCM**		**?**	**GIS or ESD field visit**					**ESD field visit**
Equation in cell ==>	**(10)**	**(11)**	**(12)**			**(13)**	**(14)**	**(15)**	**(16)**	**(17)**	**(18)**	**?**			**(19)**	**(20)**	**(21)**	
DRAINAGE AREA	**K_T**	**GUTTER DEPRESSION *(in)* a_{DIG}**	***(in)* a_{HEC22}**	**Gutter Depression Width *(in)***	**Gutter Depression Width *(ft)* W**	**S'w**	**Sw**	**Eo**	**Se**	**Manning's n n**	**INLET LENGTH FOR TOTAL CAPTURE L_T**	**CURB INLET REDUCTION FACTOR *(%)***	**CURB OPENING LENGTH *(in)***	**CURB OPENING LENGTH *(ft)* L**	**INLET EFFICIENCY E**	**INTERCEPTED FLOW *(cfs)* Qi**	**BYPASS FLOW *(cfs)* Qb**	**INLET TYPE**
DA-L1	0.6	2.0	1.1	18.0	1.50	0.06	0.11	0.11	0.06	0.016	32.38	0%	72	6.00	0.31	3.99	see COMBO for Intercepted and bypass flow	Type G-3
DA-L2	0.6	5.0	4.6	14.0	1.17	0.33	0.36	0.75	0.28	0.016	3.21	0%	61	5.08	1.00	0.96	0.00	Type G-1
DA-L3	0.6	6.0	5.1	17.0	1.42	0.30	0.35	0.29	0.14	0.016	13.72	0%	62	5.17	0.57	5.72	4.26	Type G-1
DA-L4	0.6	6.0	5.0	18.0	1.50	0.28	0.33	0.96	0.32	0.016	7.71	0%	28	2.33	0.48	2.23	see COMBO for Intercepted and bypass flow	Type G-3
DA-L5	0.6	7.0	6.5	15.0	1.25	0.43	0.47	0.98	0.46	0.016	3.89	0%	60	5.00	1.00	1.35	0.00	Type G-1
DA-A26	0.6	5.0	4.6	18.0	1.50	0.26	0.28	0.42	0.13	0.016	11.56	0%	120	10.00	0.97	7.12	0.20	Type G-1
DA-A15	0.6	7.0	6.2	18.0	1.50	0.35	0.39	0.87	0.34	0.016	17.75	0%	59	4.92	0.44	7.66	9.66	Type G-1
DA-A16	0.6	6.0	5.0	17.0	1.42	0.29	0.35	0.35	0.16	0.016	28.70	0%	36	3.00	0.18	See Calcs on Sump/Submerged tab		Type G-1
DA-A14	0.6	7.0	6.2	18.0	1.50	0.34	0.39	0.90	0.35	0.016	16.72	0%	61	5.08	0.48	6.89	7.49	Type G-1
DA-A13	0.6	5.0	3.2	18.0	1.50	0.18	0.28	0.25	0.14	0.016	30.28	0%	36	3.00	0.17	See Calcs on Sump/Submerged tab		Type G-1
DA-A23	0.6	5.0	4.0	14.0	1.17	0.29	0.36	0.15	0.11	0.016	12.67	0%	60	5.00	0.59	2.32	1.58	Type G-1
DA-A27	0.6	5.0	4.2	14.0	1.17	0.30	0.36	0.16	0.10	0.016	13.73	0%	60	5.00	0.56	2.06	1.63	Type G-1
DA-A09	0.6	5.0	4.2	14.0	1.17	0.30	0.36	0.58	0.23	0.016	18.45	0%	63	5.25	0.45	5.83	7.04	Type G-1
DA-A08	0.6	6.0	5.8	18.0	1.50	0.32	0.33	0.60	0.21	0.016	14.65	0%	61	5.08	0.54	5.08	4.40	Type G-1
DA-A07	0.6	6.0	5.2	17.0	1.42	0.31	0.35	0.69	0.26	0.016	16.14	0%	61	5.08	0.49	8.10	8.31	Type G-1
Inlet 21823 (DS of grate inlet DA-A22)	0.6	3.5	2.9	18.0	1.50	0.16	0.19	0.32	0.09	0.016	29.25	0%	88	7.33	0.41	6.25	9.17	Type G-1
DA-A20	0.6	6.0	5.5	18.0	1.50	0.31	0.33	0.47	0.17	0.016	29.32	0%	122	10.17	0.54	13.04	11.32	Type G-1
DA-A04	0.6	5.0	4.6	16.0	1.33	0.28	0.31	0.25	0.10	0.016	31.55	0%	73	6.08	0.32	2.64	5.62	Type G-1
DA-A03	0.6	7.0	6.5	17.0	1.42	0.38	0.41	0.50	0.22	0.016	14.54	0%	61	5.08	0.54	2.17	1.85	Type G-1

100 YEAR STORM

DRAINAGE AREA	K_T	GUTTER DEPRESSION *(in)* a_{DIG}	*(in)* a_{HEC22}	Gutter Depression Width *(in)*	Gutter Depression Width *(ft)* W	S'w	Sw	Eo	Se	Manning's n n	INLET LENGTH FOR TOTAL CAPTURE L_T	CURB INLET REDUCTION FACTOR *(%)*	CURB OPENING LENGTH *(in)*	CURB OPENING LENGTH *(ft)* L	INLET EFFICIENCY E	INTERCEPTED FLOW *(cfs)* Qi	BYPASS FLOW *(cfs)* Qb	INLET TYPE
DA-L1	0.6	2.0	1.1	18.0	1.50	0.06	0.11	0.11	0.06	0.016	37.07	0%	72	6.00	0.27	4.86	see COMBO for Intercepted and bypass flow	Type G-3
DA-L2	0.6	5.0	4.6	14.0	1.17	0.33	0.36	0.68	0.25	0.016	3.87	0%	61	5.08	1.00	1.33	0.00	Type G-1
DA-L3	0.6	6.0	5.1	17.0	1.42	0.30	0.35	0.29	0.14	0.016	15.68	0%	62	5.17	0.51	7.03	6.67	Type G-1
DA-L4	0.6	6.0	5.0	18.0	1.50	0.28	0.33	0.94	0.32	0.016	8.92	0%	28	2.33	0.42	2.70	see COMBO for Intercepted and bypass flow	Type G-3
DA-L5	0.6	7.0	6.5	15.0	1.25	0.43	0.47	0.97	0.46	0.016	4.48	0%	60	5.00	1.00	1.86	0.00	Type G-1
DA-A26	0.6	5.0	4.6	18.0	1.50	0.26	0.28	0.37	0.11	0.016	14.13	0%	120	10.00	0.89	8.94	1.10	Type G-1
DA-A15	0.6	7.0	6.2	18.0	1.50	0.35	0.39	0.81	0.32	0.016	20.99	0%	59	4.92	0.38	9.11	14.78	Type G-1
DA-A16	0.6	6.0	5.0	17.0	1.42	0.29	0.35	0.26	0.14	0.016	37.50	0%	36	3.00	0.14	See Calcs on Sump/Submerged tab		Type G-1
DA-A14	0.6	7.0	6.2	18.0	1.50	0.34	0.39	0.85	0.34	0.016	19.64	0%	61	5.08	0.42	8.25	11.55	Type G-1
DA-A13	0.6	5.0	3.2	18.0	1.50	0.18	0.28	0.18	0.13	0.016	38.07	0%	36	3.00	0.14	See Calcs on Sump/Submerged tab		Type G-1
DA-A23	0.6	5.0	4.0	14.0	1.17	0.29	0.36	0.15	0.11	0.016	14.47	0%	60	5.00	0.53	2.86	2.50	Type G-1
DA-A27	0.6	5.0	4.2	14.0	1.17	0.30	0.36	0.16	0.10	0.016	15.67	0%	60	5.00	0.50	2.53	2.53	Type G-1
DA-A09	0.6	5.0	4.2	14.0	1.17	0.30	0.36	0.50	0.21	0.016	22.55	0%	63	5.25	0.38	6.82	11.15	Type G-1
DA-A08	0.6	6.0	5.8	18.0	1.50	0.32	0.33	0.60	0.21	0.016	16.85	0%	61	5.08	0.48	6.30	6.93	Type G-1
DA-A07	0.6	6.0	5.2	17.0	1.42	0.31	0.35	0.60	0.23	0.016	20.76	0%	61	5.08	0.40	See Calcs on Sump/Submerged tab		Type G-1
Inlet 21823 (DS of grate inlet DA-A22)	0.6	3.5	2.9	18.0	1.50	0.16	0.19	0.32	0.09	0.016	34.22	0%	88	7.33	0.35	7.89	14.52	Type G-1
DA-A20	0.6	6.0	5.5	18.0	1.50	0.31	0.33	0.39	0.15	0.016	36.44	0%	122	10.17	0.45	See Calcs on Sump/Submerged tab		Type G-1
DA-A04	0.6	5.0	4.6	16.0	1.33	0.28	0.31	0.25	0.10	0.016	36.61	0%	73	6.08	0.28	3.28	8.49	Type G-1
DA-A03	0.6	7.0	6.5	17.0	1.42	0.38	0.41	0.37	0.17	0.016	19.49	0%	61	5.08	0.42	2.32	3.21	Type G-1

file: N:\Team3\WPD_EBC_Annie\Eng_Analysis\Prelim Eng Phase\Inlet Calcs_Ultimate Conditions_KD
tab: CURB Inlets On Grade_ULT

CURB INLETS ON GRADE, Type G-1 OR Type G-3, parabolic crown

Equations in cell

(1)	DCM EQ 2-1: Q_{peak} = CiA
(2)	Total flow = sum of discharge from drainage area and carry over flow
(3)	So = (high elev - low elev)/length
(4)	See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5)	DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
	For DA-A26 only, use straight crown equation since the driveway does not have a parabolic crown: HEC-22 EQ 4-3: d = T * Sx
(6)	Sx measured in Field by ESD 3-3-15 or 3-31-15
(7)	For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8)	measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9)	Hec-22 EQ B-11: Yo = (2H/B)*x - $(H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T =
	For DA-A26 only, use straight crown equation, HEC-22 EQ 4-2. If T calculated from HEC-22 EQ 4-2 is greater than B, use T=B
	HEC-22 EQ 4-2: $T = [Qn / (Ku * Sx^{1.67} * SL^{0.5})]^{0.375}$; where n = 0.012 (HEC-22 Table 4-3) and Ku = 0.5
(10)	Given in DCM EQ 4-10
(11)	a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
(12)	See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation
	$a_{HEC22} = a_{DIG}$ - W*Sx
(13)	DCM EQ 4-9: S'w = a_{HEC22} / (12*W)
(14)	DCM EQ 4-9Sw = S'w + Sx
(15)	HEC 22 EQ 4-4: For W < T, Eo = 1 / (1 + Sw/Sx/(((1 + Sw/Sx / (T/W))^2.67) - 1)); For T < W, Eo = 1
(16)	DCM EQ 4-9: Se = Sx + S'w*Eo
(17)	See DCM Table 2-2
(18)	DCM EQ 4-10: $L_T = K_T$ * Q^0.42 * S_L^0.3 * [1/ (n*Se)]^0.6
(19)	DCM EQ 4-8: E = 1 - [1 - (L/L_T)]^1.8
(20)	DCM EQ 4-14: Qi = E * Q
(21)	DCM EQ 4-15: Qb = Q - Qi

Ultimate Development Conditions for Existing System

GRATE INLETS ON GRADE, Type G-2 OR Type G-3, parabolic crown

25 YEAR STORM																							
HEC-22 variable or EQ ==>					**Q**			**Q**				**S_L**										**d**	
DCM Variable or EQ==>					**Q**			**Q**				**S_o**						**K_o**	**K_1**	**K_2**	**K_3**	**Y_o** EQ 3-5	
GIS StormwaterInfrastructureFIELD ==>																							
Data Source ===>									**DGN**	**DGN**	**DGN**		**DGN**	**assumed**		**DGN**	**DGN**	**DCM**					
Equation in cell ==>					**(1)**			**(2)**				**(3)**						**(4)**				**(5)**	
DRAINAGE AREA	**Drainage_ID (GIS)**	**INLET (StormCAD)**	**STREET NAME**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**	**Hig elev** *(ft)*	**low elev** *(ft)*	**length** *(ft)*	**SLOPE** *(ft/ft)* **$S_o = S_L$**	**Street Width (FOC-FOC)** *(ft)*	**Curb Height** *(in)*	**Curb Height** *(ft)*	**Split** *(ft)* **CS**	**High or low gutter**	**K_o**	**K_1**	**K_2**	**K_3**	**WATER FLOW DEPTH** *(ft)* **Yo = d**	**Over Curb?**
DA-L1	**18958**	N/A	S. Congress	1.66	12.93	none	0.00	12.93	587.00	583.40	250.89	0.0143	78.0	6.0	0.5	0.0	N/A	2.85	0.50	2.74	0.0	0.503	over curb
DA-L4	**none**	N/A	Live Oak	0.58	4.67	none	0.00	4.67	579.00	577.00	130.84	0.0153	34.3	6.0	0.5	0.0	N/A	2.89	0.50	2.99	0.0	0.364	no
DA-A10	**21855**	**I-A10**	S. Congress Ave.	0.55	4.68	none	0.00	4.68	569.50	566.50	127.35	0.0236	91.5	6.0	0.5	1.0	low	2.8	0.5	2.7	-0.159	0.374	no

100 YEAR STORM																							
HEC-22 variable or EQ ==>					**Q**			**Q**				**S_L**										**d**	
DCM Variable or EQ==>					**Q**			**Q**				**S_o**						**K_o**	**K_1**	**K_2**	**K_3**	**Y_o** EQ 3-5	
GIS StormwaterInfrastructureFIELD ==>																							
Data Source ===>									**DGN**	**DGN**	**DGN**		**DGN**	**assumed**		**DGN**	**DGN**	**DCM**					
Equation in cell ==>					**(1)**			**(2)**				**(3)**						**(4)**				**(5)**	
DRAINAGE AREA	**Drainage_ID (GIS)**	**INLET (StormCAD)**	**STREET NAME**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**	**Hig elev** *(ft)*	**low elev** *(ft)*	**length** *(ft)*	**SLOPE** *(ft/ft)* **$S_o = S_L$**	**Street Width (FOC-FOC)** *(ft)*	**Curb Height** *(in)*	**Curb Height** *(ft)*	**Split** *(ft)* **CS**	**High or low gutter**	**K_o**	**K_1**	**K_2**	**K_3**	**WATER FLOW DEPTH** *(ft)* **Yo = d**	**Over Curb?**
DA-L1	**18958**	N/A	S. Congress	1.66	17.85	none	0.00	17.85	587.00	583.40	250.89	0.0143	78.0	6.0	0.5	0.0	N/A	2.85	0.50	2.74	0.0	0.566	over curb
DA-L4	**none**	N/A	Live Oak	0.58	6.43	none	0.00	6.43	579.00	577.00	130.84	0.0153	34.3	6.0	0.5	0.0	N/A	2.89	0.50	2.99	0.0	0.405	no
DA-A10	**21855**	**I-A10**	S. Congress Ave.	0.55	6.42	none	0.00	6.42	569.50	566.50	127.35	0.0236	91.5	6.0	0.5	1.0	low	2.8	0.5	2.7	-0.159	0.421	no

Ultimate Development Conditions for Existing System

GRATE INLETS ON GRADE, Type G-2 OR Type G-3, parabolic crown

25 YEAR STORM

HEC-22 variable o	Sx	B EQ B-11	H EQ B-11						x and T EQ B-11			W		W	Eo EQ 4-16		R_f EQ 4-18	Ku EQ 4-19
DCM Variable or E	Sx	assumes crown to curb = street width/2; not true for streets with curb split	H EQ 3-1						S and T EQ 3-1			W		W				
GIS StormwaterInfrastructureFIELD ==>											Width		Width					
Data Source ===>											GIS or ESD field visit		GIS or ESD field visit				Vo Calcs	HEC-22
Equation in cell ==	(6)	(7)	(8)						(9)						(10)		(11)	(12)
DRAINAGE AREA	ESD Field Measured Street Cross Slope	Dist. Curb to Crown	Crown Height	Quadratic Formula T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a					PONDED WIDTH	Over Crown?	Gutter Depression Width	Gutter Depression Width	Grate Width	Grate Width		Splash Over Velocity		
	Sx	*(ft)* B	*(ft)* H	*a* H / B^2	*b* -(2H/B)	*c* Yo	*x1*	*x2*	*(ft)* T		*(in)*	*(ft)* W_{gutter}	*(in)*	*(ft)* W_{grate}	Eo	*(ft/s)* Vo	R_f	Ku
DA-L1	0.052	37.7	0.49	0.000	-0.026	0.503	--	--	37.66	over crown	18.0	1.50	18.00	1.50	0.10	8.7	1.00	0.15
DA-L4	0.057	17.1	1.10	0.004	-0.128	0.364	31.134	3.116	3.12	no	18.0	1.50	15.00	1.25	0.75	5.1	0.72	0.15
DA-A10	0.116	50.4	2.20	0.001	-0.087	0.374	96.314	4.486	4.49	no	18.0	1.50	15.00	1.25	0.58	4.70	0.92	0.15

100 YEAR STORM

HEC-22 variable o	Sx	B EQ B-11	H EQ B-11						x and T EQ B-11			W		W	Eo EQ 4-16		R_f EQ 4-18	Ku EQ 4-19
DCM Variable or E	Sx	assumes crown to curb = street width/2; not true for streets with curb split	H EQ 3-1						S and T EQ 3-1			W		W				
GIS StormwaterInfrastructureFIELD ==>											Width		Width					
Data Source ===>											GIS or ESD field visit		GIS or ESD field visit				Vo Calcs	HEC-22
Equation in cell ==	(6)	(7)	(8)						(9)						(10)		(11)	(12)
DRAINAGE AREA	ESD Field Measured Street Cross Slope	Dist. Curb to Crown	Crown Height	Quadratic Formula T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a					PONDED WIDTH	Over Crown?	Gutter Depression Width	Gutter Depression Width	Grate Width	Grate Width		Splash Over Velocity		
	Sx	*(ft)* B	*(ft)* H	*a* H / B^2	*b* -(2H/B)	*c* Yo	*x1*	*x2*	*(ft)* T		*(in)*	*(ft)* W_{gutter}	*(in)*	*(ft)* W_{grate}	Eo	*(ft/s)* Vo	R_f	Ku
DA-L1	0.052	37.7	0.49	0.000	-0.026	0.566	--	--	37.66	over crown	18.0	1.50	18.00	1.50	0.10	8.70	1.00	0.15
DA-L4	0.057	17.1	1.10	0.004	-0.128	0.405	30.738	3.512	3.51	no	18.0	1.50	15.00	1.25	0.69	5.10	0.65	0.15
DA-A10	0.116	50.4	2.20	0.001	-0.087	0.421	95.728	5.072	5.07	no	18.0	1.50	15.00	1.25	0.53	4.70	0.88	0.15

Ultimate Development Conditions for Existing System

GRATE INLETS ON GRADE, Type G-2 OR Type G-3, parabolic crown

25 YEAR STORM

HEC-22 variable or EQ =	L EQ 4-19		V EQ 4-18	R_s EQ 4-19			See "Aw and Aw' notes" tab			Aw' EQ 4-20a	Aw EQ 4-20a	Eo' EQ 4-20a	E EQ 4-20		Qi EQ 4-21	Qb	
DCM Variable or EQ==>					DIG Data Instructions									4.3.2.B	Qi		
GIS StormwaterInfrastructureFIELD ==>					Depression_a												
Data Source ===>					GIS or ESD field visit					DGN	DGN			DCM			ESD field visit
Equation in cell ==>		(13)	(14)	(15)	(16)		(17)			(18)	(19)	(20)	(21)	(22)	(23)	(24)	
DRAINAGE AREA	Grate Length (ft) L	Gutter (Street) Area in Flow (sq ft)	Gutter Velocity (ft/s) V	R_s	GUTTER DEPRESSION (in) a_{DIG}	(ft) a_{DIG}	θ	(ft) x	(ft) y	Grate width flow area Aw'	Depressed Gutter width flow area Aw	Eo'	E	GRATE INLET REDUCTION FACTOR (%)	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
DA-L1	5.00	9.48	1.36	0.89	2.00	0.17	0.11	1.49	0.17	0.88	0.88	0.10	0.90	35%	7.57	see COMBO for Intercepted and bypass flow	Type G-3
DA-L4	2.25	0.57	8.24	0.05	6.00	0.50	0.32	1.42	0.47	0.89	0.92	0.72	0.53	35%	1.62	see COMBO for Intercepted and bypass flow	Type G-3
DA-A10	2.00	0.84	5.58	0.15	1.00	0.08	0.06	1.50	0.08	0.62	0.62	0.58	0.60	35%	1.82	2.86	Type G-2

100 YEAR STORM

HEC-22 variable or EQ =	L EQ 4-19		V EQ 4-18	R_s EQ 4-19			See "Aw and Aw' notes" tab			Aw' EQ 4-20a	Aw EQ 4-20a	Eo' EQ 4-20a	E EQ 4-20		Qi EQ 4-21	Qb	
DCM Variable or EQ==>					DIG Data Instructions									4.3.2.B	Qi		
GIS StormwaterInfrastructureFIELD ==>					Depression_a												
Data Source ===>					GIS or ESD field visit					DGN	DGN			DCM			ESD field visit
Equation in cell ==>		(13)	(14)	(15)	(16)		(17)			(18)	(19)	(20)	(21)	(22)	(23)	(24)	
DRAINAGE AREA	Grate Length (ft) L	Gutter (Street) Area in Flow (sq ft)	Gutter Velocity (ft/s) V	R_s	GUTTER DEPRESSION (in) a_{DIG}	(ft) a_{DIG}	θ	(ft) x	(ft) y	Grate width flow area Aw'	Depressed Gutter width flow area Aw	Eo'	E	GRATE INLET REDUCTION FACTOR (%)	INTERCEPTED FLOW (cfs) Qi	BYPASS FLOW (cfs) Qb	INLET TYPE
DA-L1	5.00	10.66	1.67	0.85	2.00	0.17	0.11	1.49	0.17	0.97	0.97	0.10	0.86	35%	10.01	see COMBO for Intercepted and bypass flow	Type G-3
DA-L4	2.25	0.71	9.04	0.04	6.00	0.50	0.32	1.42	0.47	0.95	0.98	0.67	0.45	35%	1.86	see COMBO for Intercepted and bypass flow	Type G-3
DA-A10	2.00	1.07	6.02	0.13	1.00	0.08	0.06	1.50	0.08	0.69	0.69	0.53	0.53	35%	2.20	4.22	Type G-2

GRATE INLETS ON GRADE, Type G-2 OR Type G-3, parabolic crown

Equations in cell

(1) DCM EQ 2-1: Q_{peak} = CiA
(2) Total flow = sum of discharge from drainage area and carry over flow
(3) So = (high elev - low elev)/length
(4) See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)
(5) DCM EQ 3-5:Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2]
(6) Sx measured in Field by ESD 3-3-15 or 3-31-15
(7) For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file
(8) measured in field, lidar or record drawing; see "Crown Height Calcs" tab
(9) Hec-22 EQ B-11: Yo = (2H/B)*x - $(H/B^2)*x^2$; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B
(10) HEC-22 EQ 4-16: Eo = 1 - (1 - W_{grate}/T)^2.67
(11) HEC-22 EQ 4-18: If assume velocity in gutter is equal or less than splash over velocity, then R_f = 1; if not, Rf = 1 - Ku *(V - Vo), where Ku = 0.09; ref HEC-12 Chart 7 for Vo; minimum Rf = 0
(12) Ku is given in HEC-22 EQ 4-19
(13) gutter (and street) area in flow approximated by = 0.5 * (ponded width) * (water flow depth) = 0.5 * T * Yo; true area would be found by integrating parabolic equation
(14) HEC-22 EQ 4-18: V = (total gutter flow)/(gutter area in flow)
(15) HEC-22 EQ 4-10: Rs = ratio of side flow intercepted to total side flow = 1 / [1 + (Ku * V^1.8) / (Sx * L^2.3)]
(16) a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)
(17) Parameters used to calculate Aw'; see image on "Aw and Aw' notes" tab
θ = arctan(a_{DIG} / Wgutter)
x = cos(θ) * Wgrate
y = sin(θ) * Wgrate
(18) See HEC-22 EQ 4-20a and "Aw and Aw' notes" tab. Grate width flow area = x * (Yo + a_{DIG} - y) + 0.5 * x * y
(19) See HEC-22 EQ 4-20a and "Aw and Aw' notes" tab. Depressed Gutter width flow area = Yo * Wgutter + 0.5 * a_{DIG} * Wgutter
(20) HEC-22 EQ 4-20a: Eo' = Eo * (Aw' / Aw)
(21) HEC-22 EQ 4-20: E = Rf * Eo' + Rs * (1 - Eo')
(22) See DCM 4.3.2.B
(23) HEC-22 EQ 4-21: Qi = (1-0.35)*Q*E
(24) DCM EQ 4-15: Qb = Q - Qi

Ultimate Development Conditions for Existing System

GRATE INLETS ON GRADE, Type G-2 V-shaped gutter

25 YEAR STORM

HEC-22 variable or EQ ==>					Q					Q				S_L			Fig 4-1 (b.2) Sx1	Fig 4-1 (b.2) Sx2	EQ 4-7 Sx	Fig 4-1 (b.2)			EQ 4-2	T' EQ 4-2, EX 4-3
DCM Variable or EQ==>					Q					Q				S_o			Sx1	Sx2						
GIS StormwaterInfrastructureFIELD ==>																								
Data Source ===>											DGN	DGN	DGN		DGN	assumed 6"				DGN	DGN	DCM	HEC-22	
Equation in cell ==>					(1)					(2)				(3)					(4)	(5)	(5)	(6)	(7)	(8)
DRAINAGE AREA	**Drainage_ID (GIS)**	**INLET ID (StormCAD)**	**STREET NAME**	**DRAINAGE AREA *(ac.)***	**DISCHARGE FROM DRAINAGE AREA *(cfs)***	**1st UPSTREAM INLET /DRAINAGE AREA**	**1st CARRY OVER FLOW *(cfs)***	**2nd UPSTREAM INLET /DRAINAGE AREA**	**2nd CARRY OVER FLOW *(cfs)***	**TOTAL RUNOFF *(cfs)* Q**	**Hig elev *(ft)***	**low elev *(ft)***	**length *(ft)***	**SLOPE *(ft/ft)* $S_o = S_L$**	**Street Width (FOC-FOC) *(ft)***	**Curb Height *(in)***	**Parking lane cross slope Sx1**	**Street Cross Slope Sx2**	**Sx**	***(ft)* AB**	***(ft)* BC**	**Manning's n n**	**Ku**	**HYPOTHETICAL PONDED WIDTH *(ft)* T'**
DA-A22	**402356**	**N/A**	Wilson St	9.02	45.85	DA-L4	0.82	DA-L5	0.00	23.33	556.00	554.00	114.12	0.0175	29.8	8.0	0.028	0.054	0.018	9.0	14.0	0.016	0.56	22.4
DA-A17	**402403**	**I-A17**	Johanna St.	0.70	5.61	Inlet 21823 (DS of grate inlet DA-A22)	9.17			14.79	553.50	550.00	161.82	0.0216	30.5	6.0	0.042	0.064	0.025	9.0	18.0	0.016	0.56	14.8

100 YEAR STORM

Equation in cell ==>					(1)					(2)				(3)					(4)	(5)	(5)	(6)	(7)	(8)
DRAINAGE AREA	**Drainage_ID (GIS)**	**INLET ID (StormCAD)**	**STREET NAME**	**DRAINAGE AREA *(ac.)***	**DISCHARGE FROM DRAINAGE AREA *(cfs)***	**1st UPSTREAM INLET /DRAINAGE AREA**	**1st CARRY OVER FLOW *(cfs)***	**2nd UPSTREAM INLET /DRAINAGE AREA**	**2nd CARRY OVER FLOW *(cfs)***	**TOTAL RUNOFF *(cfs)* Q**	**Hig elev *(ft)***	**low elev *(ft)***	**length *(ft)***	**SLOPE *(ft/ft)* $S_o = S_L$**	**Street Width (FOC-FOC) *(ft)***	**Curb Height *(in)***	**Parking lane cross slope Sx1**	**Street Cross Slope Sx2**	**Sx**	***(ft)* AB**	***(ft)* BC**	**Manning's n n**	**Ku**	**HYPOTHETICAL PONDED WIDTH *(ft)* T'**
DA-A22	**402356**	**N/A**	Wilson St	9.02	65.76	DA-L4	1.86	DA-L5	0.00	33.81	556.00	554.00	114.12	0.0175	29.8	8.0	0.028	0.054	0.018	9.0	14.0	0.016	0.56	25.7
DA-A17	**402403**	**I-A17**	Johanna St.	0.70	7.72	Inlet 21823 (DS of grate inlet DA-A22)	14.52			22.23	553.50	550.00	161.82	0.0216	30.5	6.0	0.042	0.064	0.025	9.0	18.0	0.016	0.56	17.3

Ultimate Development Conditions for Existing System

GRATE INLETS ON GRADE, Type G-2 V-shaped gutter

25 YEAR STORM

HEC-22 variable or EQ ==>			W		W	Eo EQ 4-16	R_f EQ 4-18	Ku EQ 4-19		L EQ 4-19	V EQ 4-18	R_s EQ 4-19	E EQ 4-20		Qi EQ 4-21	Qb	
DCM Variable or EQ==>			W		W									4.3.2.B	Qi		
GIS StormwaterInfrastructureFIELD ==>																	
Data Source ===>				ESD field visit			Vo Calcs	HEC-22	ESD field visit					DCM			ESD field visit
Equation in cell ==	(9)	(10)				(11)	(12)	(13)			(14)	(15)	(16)	(17)	(18)	(19)	
DRAINAGE AREA	MAXIMUM PONDED WIDTH *(ft)* Tmax	PONDED WIDTH *(ft)* T	Gutter Depression Width *(ft)* W_{gutter}	Grate Width *(in)*	Grate Width *(ft)* W_{grate}	Eo	R_f	Ku	Grate Length *(in)*	Grate Length *(ft)* L	Gutter Velocity *(ft/s)* V	R_s	E	GRATE INLET REDUCTION FACTOR *(%)*	INTERCEPTED FLOW *(cfs)* Qi	BYPASS FLOW *(cfs)* Qb	INLET TYPE
DA-A22	23.0	22.4	0.00	18.00	1.50	0.17	1.0	0.15	108.00	9.00	6.13	0.424	0.52	35%	7.91	15.42	Type G-2
DA-A17	27.0	14.8	0.00	18.00	1.50	0.25	1.0	0.15	36.00	3.00	6.81	0.063	0.29	35%	2.83	11.95	Type G-2

100 YEAR STORM

Equation in cell ==	(9)	(10)				(11)	(12)	(13)			(14)	(15)	(16)	(17)	(18)	(19)	
DRAINAGE AREA	MAXIMUM PONDED WIDTH *(ft)* Tmax	PONDED WIDTH *(ft)* T	Gutter Depression Width *(ft)* W_{gutter}	Grate Width *(in)*	Grate Width *(ft)* W_{grate}	Eo	R_f	Ku	Grate Length *(in)*	Grate Length *(ft)* L	Gutter Velocity *(ft/s)* V	R_s	E	GRATE INLET REDUCTION FACTOR *(%)*	INTERCEPTED FLOW *(cfs)* Qi	BYPASS FLOW *(cfs)* Qb	INLET TYPE
DA-A22	23.0	23.0	0.00	18.00	1.50	0.16	1.0	0.15	108.00	9.00	6.13	0.424	0.52	35%	11.41	22.41	Type G-2
DA-A17	27.0	17.3	0.00	18.00	1.50	0.22	1.0	0.15	36.00	3.00	6.81	0.063	0.26	35%	3.82	18.41	Type G-2

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tab: GRATE Inlets_Grade_Vgutter_ULT

GRATE INLETS ON GRADE, Type G-2 V-shaped gutter

Equations in cell

(1) DCM EQ 2-1: Q_{peak} = CiA
(2) Total flow = sum of discharge from drainage area and carry over flow; for DA-A22, sum of discharge from drainage area and carry over flow was multiplied by 50% since half the flow goes to curb inlets on west side of Wilson
(3) So = (high elev - low elev)/length
(4) Sx = (Sx1 * Sx2) / (Sx1 + Sx2)
(5) See HEC-22 Figure 4-1.b.2; AB = width of parking lane between grate inlet and curb; BC = distance crown to grate inlet
(6) See DCM Table 2-2
(7) Given in HEC-22 EQ 4-2
(8) HEC-22 EQ 4-2 and EX 4-3: T' = [(Q * n)/(Ku * Sx^1.67 * So^0.5)]^0.375
(9) T,max = AB + BC
(10) T = min(T',Tmax)
(11) HEC-22 EQ 4-16: Eo = 1 - (1 - W_{grate}/T)^2.67
(12) If assume velocity in gutter is equal or less than splash over velocity, then R_f = 1
(13) Ku is given in HEC-22 EQ 4-19
(14) V calculated similarly to TR-55 Figure 3-1; V = k * $S^{0.5}$ where k = 46.3 for paved gutter; Ref: Hydrologic Analysis and Design by R. H. McCuen EQ 3-46 and Table 3-14.
(15) HEC-22 EQ 4-19: Rs = ratio of side flow intercepted to total side flow = 1 / [1 + (Ku * V^1.8) / (Sx * L^2.3)]
(16) HEC-22 EQ 4-20: E = Rf * Eo + Rs * (1 - Eo)
(17) See DCM 4.3.2.B
(18) DCM EQ 4-14: Qi = E * Q * Reduction Factor
(19) DCM EQ 4-15: Qb = Q - Qi

Ultimate Development Conditions for Existing System

COMBINATION INLETS ON GRADE, Type G-3, parabolic crown

Equations in cell

(1) DCM EQ 2-1: $Q_{peak} = CiA$
(2) Total flow = sum of discharge from drainage area and carry over flow
(3) Qi = Qi,curb + Qi,grate
(4) DCM EQ 4-15: Qb = Q - Qi

25 YEAR STORM															
Equation in cell ==>						**(1)**			**(2)**				**(3)**	**(4)**	
DRAINAGE AREA	**Drainage_ID (GIS)**	**INLET ID (StormCAD)**	**STREET NAME**	**DRAINAGE AREA**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**		**CURB INTERCEPTED FLOW** *(cfs)* **Qi,curb**	**GRATE INTERCEPTED FLOW** *(cfs)* **Qi,grate**	**TOTAL INTERCEPTED FLOW** *(cfs)* **Qi**	**BYPASS FLOW** *(cfs)* **Qb**	**INLET TYPE**
DA-L1	**18958**	N/A	S. Congress	DA-L1	1.66	12.93	none		12.93		3.99	7.57	11.56	1.37	Type G-3
DA-L4	**none**	N/A	Live Oak	DA-L4	0.58	4.67	none		4.67		2.23	1.62	3.85	0.82	Type G-3

100 YEAR STORM															
Equation in cell ==>						**(1)**			**(2)**				**(3)**	**(4)**	
DRAINAGE AREA	**Drainage_ID (GIS)**	**INLET ID (StormCAD)**	**STREET NAME**	**DRAINAGE AREA**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM INLET /DRAINAGE AREA**	**CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**		**CURB INTERCEPTED FLOW** *(cfs)* **Qi,curb**	**GRATE INTERCEPTED FLOW** *(cfs)* **Qi,grate**	**TOTAL INTERCEPTED FLOW** *(cfs)* **Qi**	**BYPASS FLOW** *(cfs)* **Qb**	**INLET TYPE**
DA-L1	**18958**	N/A	S. Congress	DA-L1	1.66	17.85	none		17.85		4.86	10.01	14.87	2.98	Type G-3
DA-L4	**none**	N/A	Live Oak	DA-L4	0.58	6.43	none		6.43		2.70	1.86	4.57	1.86	Type G-3

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tab: COMBO Inlets On Grade_ULT

Ultimate Development Conditions for Existing System

CURB INLETS IN SUMPS, Type S-1, parabolic crown and SUBMERGED CURB INLETS ON GRADE, parabolic crown

25 YEAR STORM

HEC-22 variable or EQ ==>																**Q**							
DCM Variable or EQ==>																**Q**							
GIS StormwaterInfrastructureFIELD ==>																							
Equation in cell ==>					**(1)**											**(2)**				**(3)**			
DRAINAGE AREA	**Drainage_ID (GIS)**	**INLET (StormCAD)**	**STREET**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM DRAINAGE AREA**	**1st CARRY OVER FLOW** *(cfs)*	**2nd UPSTREAM DRAINAGE AREA**	**2nd CARRY OVER FLOW** *(cfs)*	**3rd UPSTREAM DRAINAGE AREA**	**3rd CARRY OVER FLOW** *(cfs)*	**4th UPSTREAM DRAINAGE AREA**	**4th CARRY OVER FLOW** *(cfs)*	**5th UPSTREAM DRAINAGE AREA**	**5th CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**	**Hig elev** *(ft)*	**low elev** *(ft)*	**length** *(ft)*	**SLOPE** *(ft/ft)* $S_o = S_L$	**Street Width (FOC-FOC)** *(ft)*	**Curb Height** *(in)*	**Curb Height** *(ft)*
DA-A01	228169	-	Annie	0.82	6.48	DA-A03	1.85									8.34	513.00	510.00	129.13	0.023	40.0	6.0	0.5
DA-A02	228166	-	Annie	1.67	11.31	DA-A04	5.62	DA-A23	1.58	DA-A27	1.63					20.15	513.00	510.00	239.26	0.013	40.0	6.0	0.5
DA-A05.1		*N/A*	Mary	0.21	1.69	none										1.69	539.00	536.00	117.67	0.025	41.5	6.0	0.5
DA-A05.2		*N/A*	Mary	1.04	8.01	none										8.01	539.00	536.00	87.15	0.034	41.5	6.0	0.5
DA-A05	23328	I-A5	Mary	0.00	0.00	DA-A05.1	1.69	DA-A05.2	8.01							9.71	539.00	536.00	87.15	0.034	41.5	6.0	0.5
DA-A06.1		*N/A*	Mary	0.84	6.14	none										6.14	539.00	536.00	124.66	0.024	41.5	6.0	0.5
DA-A06.2		*N/A*	Mary	3.75	27.67	none										27.67	539.00	536.00	76.85	0.039	41.5	6.0	0.5
DA-A06	21847	I-A6	Mary	0.00	0.00	DA-A06.1	6.14	DA-A06.2	27.67	DA-A07	8.31					42.11	539.00	536.00	76.85	0.039	41.5	6.0	0.5
DA-A11	21880	I-A11	Mary	3.42	27.13	none										27.13	570.00	567.50	114.36	0.022	37.0	6.0	0.5
DA-A12	21879	I-A12	Congress	3.19	25.44	DA-A13	42.37									67.81	570.00	567.50	117.12	0.021	91.5	6.0	0.5
DA-A18	21827	I-A18	Johanna	0.03	0.25	DA-A17	11.95									12.20	553.50	550.00	161.82	0.022	32.0	9.5	0.8
DA-A19	21826	I-A19	Johanna	1.31	10.36	DA-A20	11.32									21.68	553.50	550.00	94.36	0.037	32.0	6.0	0.5
DA-A21.1		*N/A*	Alley	0.90	7.44	none										7.44	557.00	555.00	106.48	0.019	38.1	6.0	0.5
DA-A21.2		*N/A*	Alley	2.39	19.52	none										19.52	558.00	555.00	107.69	0.028	38.1	6.0	0.5
DA-A21	21824	I-A21	Alley	0.00	0.00	DA-A21.1	7.44	DA-A21.2	19.52							26.96	558.00	555.00	107.69	0.028	38.1	6.0	0.5
DA-A16		I-A16	Congress	4.62	34.46	DA-L1	1.37	DA-L2	0.00	DA-L3	4.26	DA-A26	0.20	DA-A15	9.66	49.96				0.011	91.5	6.0	0.500
DA-A13		I-A13	Congress	1.13	9.05	DA-A16	38.19	DA-A14	7.49							54.73				0.009	91.5	6.0	0.500

100 YEAR STORM

DRAINAGE AREA	**Drainage_ID (GIS)**	**INLET (StormCAD)**	**STREET**	**DRAINAGE AREA** *(ac.)*	**DISCHARGE FROM DRAINAGE AREA** *(cfs)*	**1st UPSTREAM DRAINAGE AREA**	**1st CARRY OVER FLOW** *(cfs)*	**2nd UPSTREAM DRAINAGE AREA**	**2nd CARRY OVER FLOW** *(cfs)*	**3rd UPSTREAM DRAINAGE AREA**	**3rd CARRY OVER FLOW** *(cfs)*	**4th UPSTREAM DRAINAGE AREA**	**4th CARRY OVER FLOW** *(cfs)*	**5th UPSTREAM DRAINAGE AREA**	**5th CARRY OVER FLOW** *(cfs)*	**TOTAL RUNOFF** *(cfs)* **Q**	**Hig elev** *(ft)*	**low elev** *(ft)*	**length** *(ft)*	**SLOPE** *(ft/ft)* $S_o = S_L$	**Street Width (FOC-FOC)** *(ft)*	**Curb Height** *(in)*	**Curb Height** *(ft)*
DA-A01	228169	-	Annie	0.82	6.48	DA-A03	14.52									21.00	513.00	510.00	129.13	0.023	40.0	6.0	0.5
DA-A02	228166	-	Annie	1.67	11.31	DA-A04	0.00	DA-A23	0.00	DA-A27	11.55					22.87	513.00	510.00	239.26	0.013	40.0	6.0	0.5
DA-A05.1		*N/A*	Mary	0.21	2.33	none										2.33	539.00	536.00	117.67	0.025	41.5	6.0	0.5
DA-A05.2		*N/A*	Mary	1.04	11.05	none										11.05	539.00	536.00	87.15	0.034	41.5	6.0	0.5
DA-A05	23328	I-A5	Mary	0.00	0.00	DA-A05.1	2.33	DA-A05.2	11.05							13.38	539.00	536.00	87.15	0.034	41.5	6.0	0.5
DA-A06.1		*N/A*	Mary	0.84	8.49	none										8.49	539.00	536.00	124.66	0.024	41.5	6.0	0.5
DA-A06.2		*N/A*	Mary	3.75	38.25	none										38.25	539.00	536.00	76.85	0.039	41.5	6.0	0.5
DA-A06	21847	I-A6	Mary	0.00	0.00	DA-A06.1	8.49	DA-A06.2	38.25	DA-A07	17.44					64.19	539.00	536.00	76.85	0.039	41.5	6.0	0.5
DA-A11	21880	I-A11	Mary	3.42	37.36	none										37.36	570.00	567.50	114.36	0.022	37.0	6.0	0.5
DA-A12	21879	I-A12	Congress	3.19	35.01	DA-A13	69.67									104.67	570.00	567.50	117.12	0.021	91.5	6.0	0.5
DA-A18	21827	I-A18	Johanna	0.03	0.35	DA-A17	18.41									18.76	553.50	550.00	161.82	0.022	32.0	9.5	0.8
DA-A19	21826	I-A19	Johanna	1.31	14.27	DA-A20	23.15									37.41	553.50	550.00	94.36	0.037	32.0	6.0	0.5
DA-A21.1		*N/A*	Alley	0.90	10.22	none										10.22	557.00	555.00	106.48	0.019	38.1	6.0	0.5
DA-A21.2		*N/A*	Alley	2.39	26.82	none										26.82	558.00	555.00	107.69	0.028	38.1	6.0	0.5
DA-A21	21824	I-A21	Alley	0.00	0.00	DA-A21.1	10.22	DA-A21.2	26.82							37.04	558.00	555.00	107.69	0.028	38.1	6.0	0.5
DA-A16		I-A16	Congress	4.62	47.94	DA-L1	2.98	DA-L2	0.00	DA-L3	6.67	DA-A26	1.10	DA-A15	14.78	73.46				0.011	91.5	6.0	0.500
DA-A13		I-A13	Congress	1.13	12.45	DA-A16	60.18	DA-A14	11.55							84.18				0.009	91.5	6.0	0.500
DA-A07		I-A7	Mary	0.78	6.97	DA-A09	11.15	DA-A08	6.93							25.06				0.0199	40.50	6.00	0.50
DA-A20		I-A20	Johanna	2.95	33.48	none										33.48				0.0359	32.00	6.00	0.50

Ultimate Development Conditions for Existing System

CURB INLETS IN SUMPS, Type S-1, parabolic crown and SUBMERGED CURB INLETS ON GRADE, parabolic crown

25 YEAR STORM

HEC-22 variable or EQ ==>							d		Sx	B EQ B-11	H EQ B-11						T EQ 4-3				
DCM Variable or EQ==>			K_o	K_1	K_2	K_3	Y_o EQ 3-5		Sx	assumes crown to curb = street width/2; not true for streets with curb split	H EQ 3-1										
GIS StormwaterInfrastructureFIELD ==>																					
Equation in cell ==>				(4)			(5)		(6)	(7)	(8)						(9)				
DRAINAGE AREA	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Over Curb?	ESD Field Measured Street Cross Slope Sx	Dist. Curb to Crown (ft) B	Crown Height (ft) H	Quadratic Formula T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a					PONDED WIDTH (ft) T	CLEAR WIDTH (ft)	Over Crown?		
												a H / B^2	b -(2H/B)	c Yo	x1	x2					
DA-A01	0.0		2.85	0.50	2.89	0.000	0.412	**no**	0.029	20.0	0.74	0.002	-0.074	0.412	33.309	6.691	6.7	**13.3**	no		
DA-A02	0.0		2.85	0.50	2.89	0.000	0.622	**over curb**	0.029	20.0	0.74	0.002	-0.074	0.622	27.970	12.030	12.0	**8.0**	no		
DA-A05.1	0.0		2.85	0.50	2.89	0.000	0.234	**no**	0.022	20.8	0.44	0.001	-0.042	0.234	34.958	6.542	6.5	**14.2**	no		
DA-A05.2	0.0		2.85	0.50	2.89	0.000	0.380	**no**	0.022	20.8	0.44	0.001	-0.042	0.380	28.417	13.083	13.1	**7.7**	no		
DA-A05	0.0		2.85	0.50	2.89	0.000	0.380		0.022												
DA-A06.1	0.0		2.85	0.50	2.89	0.000	0.369	**no**	0.017	20.8	0.44	0.001	-0.042	0.369	29.110	12.390	12.4	**8.4**	no		
DA-A06.2	0.0		2.85	0.50	2.89	0.000	0.571	**over curb**	0.017	20.8	0.44	0.001	-0.042	0.571	--	--	20.8	**0.0**	over crown		
DA-A06	0.0		2.85	0.50	2.89	0.000	0.571		0.017												
DA-A11	0.0		2.89	0.50	2.99	0.000	0.617	**over curb**	0.022	18.5	0.30	0.001	-0.032	0.617	--	--	18.5	**0.0**	over crown		
DA-A12	1.0	high	2.85	0.50	2.74	-0.043	0.889	**over curb**	0.018	43.5	1.41	0.001	-0.065	0.889	69.949	17.051	17.1	**26.4**	no		
DA-A18	0.0		2.85	0.50	3.03	0.000	0.493	**no**	0.039	16.0	0.60	0.002	-0.075	0.493	22.761	9.239	9.2	**6.8**	no		
DA-A19	0.0		2.85	0.50	3.03	0.000	0.545	**over curb**	0.048	16.0	0.54	0.002	-0.068	0.545	--	--	16.0	**0.0**	over crown		
DA-A21.1	0.0		2.89	0.50	2.99	0.000	0.411	**no**	0.090	38.1	1.45	N/A, crown not parabolic					4.6	**33.5**	no		
DA-A21.2	0.0		2.89	0.50	2.99	0.000	0.531	**over curb**	0.090	38.1	1.45	N/A, crown not parabolic					5.9	**32.2**	no		
DA-A21	0.0		2.89	0.50	2.99	0.000	0.531		0.090												
DA-A16	2.0	high	2.85	0.50	2.74	-0.043	0.926	**over curb**	0.060	23.3	1.14	0.002	-0.098	0.926	33.359	13.201	13.2	**10.1**	no		
DA-A13	2.5	high	2.85	0.50	2.74	-0.043	1.008	**over curb**	0.101	30.8	1.28	0.001	-0.083	1.008	44.829	16.691	16.7	**14.1**	no		

100 YEAR STORM

DRAINAGE AREA	Split (ft) CS	High or low gutter	K_o	K_1	K_2	K_3	WATER FLOW DEPTH (ft) Yo = d	Over Curb?	ESD Field Measured Street Cross Slope Sx	Dist. Curb to Crown (ft) B	Crown Height (ft) H	Quadratic Formula T = min(x1, x2); x = [-b +/- (b^2 - 4ac)^0.5] / 2a					PONDED WIDTH (ft) T	CLEAR WIDTH (ft)	Over Crown?	Depth Over Crown	Outside ROW?
												a H / B^2	b -(2H/B)	c Yo	x1	x2					
DA-A01	0.0		2.85	0.50	2.89	0.000	0.568	over curb	0.029	20.0	0.74	0.002	-0.074	0.568	29.654	10.346	10.3	9.7	no		
DA-A02	0.0		2.85	0.50	2.89	0.000	0.650	over curb	0.029	20.0	0.74	0.002	-0.074	0.650	26.959	13.041	13.0	7.0	no		
DA-A05.1	0.0		2.85	0.50	2.89	0.000	0.261	no	0.022	20.8	0.44	0.001	-0.042	0.261	33.983	7.517	7.5	13.2	no		
DA-A05.2	0.0		2.85	0.50	2.89	0.000	0.425	no	0.022	20.8	0.44	0.001	-0.042	0.425	24.632	16.868	16.9	3.9	no		
DA-A05	0.0		2.85	0.50	2.89	0.000	0.425		0.022											**0.4**	**no**
DA-A06.1	0.0		2.85	0.50	2.89	0.000	0.412	no	0.017	20.8	0.44	0.001	-0.042	0.412	25.946	15.554	15.6	5.2	no		
DA-A06.2	0.0		2.85	0.50	2.89	0.000	0.639	over curb	0.017	20.8	0.44	0.001	-0.042	0.639	--	--	20.8	0.0	over crown		
DA-A06	0.0		2.85	0.50	2.89	0.000	0.639		0.017											**0.2**	**outsied ROW**
DA-A11	0.0		2.89	0.50	2.99	0.000	0.687	over curb	0.022	18.5	0.30	0.001	-0.032	0.687	--	--	18.5	0.0	over crown	**0.4**	**outsied ROW**
DA-A12	1.0	high	2.85	0.50	2.74	-0.043	1.041	over curb	0.018	43.5	1.41	0.001	-0.065	1.041	65.743	21.257	21.3	22.2	no	**0.0**	**outsied ROW**
DA-A18	0.0		2.85	0.50	3.03	0.000	0.568	no	0.039	16.0	0.60	0.002	-0.075	0.568	19.695	12.305	12.3	3.7	no	**0.0**	**no**
DA-A19	0.0		2.85	0.50	3.03	0.000	0.653	over curb	0.048	16.0	0.54	0.002	-0.068	0.653	--	--	16.0	0.0	over crown	**0.1**	**outsied ROW**
DA-A21.1	0.0		2.89	0.50	2.99	0.000	0.457	no	0.090	38.1	1.45	0.001	-0.076	0.457	69.633	6.567	6.6	31.5	no		
DA-A21.2	0.0		2.89	0.50	2.99	0.000	0.591	over curb	0.090	38.1	1.45	0.001	-0.076	0.591	67.433	8.767	8.8	29.3	no		
DA-A21	0.0		2.89	0.50	2.99	0.000	0.591		0.090											**0.0**	**outsied ROW**
DA-A16	2.0	high	2.85	0.50	2.74	-0.043	1.066	over curb	0.060	23.3	1.14	0.002	-0.098	1.066	29.201	17.359	17.4	5.9	no	**0.0**	**outsied ROW**
DA-A13	2.5	high	2.85	0.50	2.74	-0.043	1.180	over curb	0.101	30.8	1.28	0.001	-0.083	1.180	39.161	22.359	22.4	8.4	no	**0.0**	**outsied ROW**
DA-A07	0.00		2.85	0.50	2.89	0.00	0.620	over curb	0.045	20.25	0.94	0.002	-0.093	0.620	32.071	8.429	8.4	11.8	no	**0.0**	**outsied ROW**
DA-A20	0.50	low	2.70	0.50	2.74	-0.22	0.748	over curb	0.027	16.00	0.68	0.003	-0.085	0.748	--	--	16.0	0.0	over crown	**0.1**	**outsied ROW**

Ultimate Development Conditions for Existing System

CURB INLETS IN SUMPS, Type S-1, parabolic crown and SUBMERGED CURB INLETS ON GRADE, parabolic crown

25 YEAR STORM

HEC-22 variable or EQ ==>		a Fig 4-13		h EQ 4-29, Fig 4-18.a				L			EQ 4-29	EQ 4-28, 4-30 Cw	d_o EQ 4-31a	Co EQ 4-31		?	EQ 4-28	EQ 4-29		
DCM Variable or EQ	DIG instructions			EQ 4-2 h				L			EQ 4-2	EQ 4-1, 4-3 Cw	d_o EQ 4-4a	Co EQ 4-4		?	EQ 4-1	EQ 4-4a		
GIS StormwaterInfra	Depression_a		Height		Width		st_length													
Equation in cell ==>	(10)	(11)									(12)	(13)	(14)	(15)			(16)	(17)	(18)	
DRAINAGE AREA	GUTTER DEPRESSION (in) a_{DIG}	(in) a_{HEC22}	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Gutter Depression Width (in)	Gutter Depression Width (ft) W	CURB INLET LENGTH (in)	CURB INLET LENGTH (ft) L	(ft) $h + a_{HEC22}/12$	(ft) 1.4*h	If d > 1.4*h, use orifice EQ Else, use weir EQ	WEIR COEFFICIENT Cw	EFFECTIVE HEAD ON ORIFICE (ft) d_o	ORIFICE COEFFICIENT Co	GRAVITY (ft/s^2) g	CURB INLET REDUCTION FACTOR (%)	MAXIMUM CAPACITY FLOW WEIR EQ (cfs) Qi	MAXIMUM CAPACITY FLOW ORIFICE EQ (cfs) Qi	OVER CAPACITY FLOW (cfs) Q_{over}	INLET TYPE
DA-A01	2.25	1.79	5.75	0.48	16.00	1.33	122.0	10.17	0.63	0.67	weir EQ	2.30	0.32	0.67	32.2		7.65	----	0.69	TYPE S-1
DA-A02	2.50	1.98	6.00	0.50	18.00	1.50	120.0	10.00	0.66	0.70	weir EQ	2.30	0.54	0.67	32.2		14.35	----	5.80	TYPE S-1
DA-A05.1																				
DA-A05.2																				
DA-A05	5.00	4.60	6.00	0.50	18.00	1.50	120.0	10.00	0.88	0.70	weir EQ	2.30	0.51	0.67	32.2		6.84	----	2.86	TYPE S-1
DA-A06.1																				
DA-A06.2																				
DA-A06	8.00	7.68	7.00	0.58	19.00	1.58	63.0	5.25	1.22	0.82	weir EQ	2.30	0.92	0.67	32.2		8.03	----	34.08	TYPE S-1
DA-A11	4.00	3.63	6.00	0.50	17.00	1.42	34.0	2.83	0.80	0.70	weir EQ	2.30	0.67	0.67	32.2		6.01	----	21.12	TYPE S-1
DA-A12	1.50	1.23	4.50	0.38	15.00	1.25	36.00	3.00	0.48	0.53	orifice EQ	2.30	0.80	0.67	32.2		----	6.50	61.31	TYPE S-1
DA-A18	7.25	6.59	10.00	0.83	17.00	1.42	53.00	4.42	1.38	1.17	weir EQ	2.30	0.63	0.67	32.2		5.54	----	6.66	TYPE S-1
DA-A19	6.75	5.89	7.00	0.58	18.00	1.50	62.00	5.17	1.07	0.82	weir EQ	2.30	0.74	0.67	32.2		7.28	----	14.40	TYPE S-1
DA-A21.1																				
DA-A21.2																				
DA-A21	3.00	1.38	6.00	0.50	18.00	1.50	60.00	5.00	0.62	0.70	weir EQ	2.30	0.40	0.67	32.2		6.85	----	20.10	TYPE S-1
DA-A16	6.00	4.98	6.00	0.50	17.00	1.42	36.00	3.00	0.92	0.70	orifice EQ	N/A	1.09	0.67	32.2		----	11.77	38.19	TYPE G-1
DA-A13	5.00	3.18	7.00	0.58	18.00	1.50	36.00	3.00	0.85	0.82	orifice EQ	N/A	0.98	0.67	32.2		----	12.36	42.37	TYPE-G1

100 YEAR STORM

DRAINAGE AREA	GUTTER DEPRESSION (in) a_{DIG}	(in) a_{HEC22}	CURB OPENING HEIGHT (in)	CURB OPENING HEIGHT (ft) h	Gutter Depression Width (in)	Gutter Depression Width (ft) W	CURB INLET LENGTH (in)	CURB INLET LENGTH (ft) L	(ft) $h + a_{HEC22}/12$	(ft) 1.4*h	If d > 1.4*h, use orifice EQ Else, use weir EQ	WEIR COEFFICIENT Cw	EFFECTIVE HEAD ON ORIFICE (ft) d_o	ORIFICE COEFFICIENT Co	GRAVITY (ft/s^2) g	CURB INLET REDUCTION FACTOR (%)	MAXIMUM CAPACITY FLOW WEIR EQ (cfs) Qi	MAXIMUM CAPACITY FLOW ORIFICE EQ (cfs) Qi	OVER CAPACITY FLOW (cfs) Q_{over}	INLET TYPE
DA-A01	2.25	1.79	5.75	0.48	16.00	1.33	122.0	10.17	0.63	0.67	weir EQ	2.30	0.48	0.67	32.2		12.36	----	8.64	TYPE S-1
DA-A02	2.50	1.98	6.00	0.50	18.00	1.50	120.0	10.00	0.66	0.70	weir EQ	2.30	0.57	0.67	32.2		15.32	----	7.55	TYPE S-1
DA-A05.1																				
DA-A05.2																				
DA-A05	5.00	4.60	6.00	0.50	18.00	1.50	120.0	10.00	0.88	0.70	weir EQ	2.30	0.56	0.67	32.2		8.08	----	5.30	TYPE S-1
DA-A06.1																				
DA-A06.2																				
DA-A06	8.00	7.68	7.00	0.58	19.00	1.58	63.0	5.25	1.22	0.82	weir EQ	2.30	0.99	0.67	32.2		9.51	----	54.68	TYPE S-1
DA-A11	4.00	3.63	6.00	0.50	17.00	1.42	34.0	2.83	0.80	0.70	weir EQ	2.30	0.74	0.67	32.2		7.05	----	30.30	TYPE S-1
DA-A12	1.50	1.23	4.50	0.38	15.00	1.25	36.00	3.00	0.48	0.53	orifice EQ	2.30	0.96	0.67	32.2		----	7.74	96.94	TYPE S-1
DA-A18	7.25	6.59	10.00	0.83	17.00	1.42	53.00	4.42	1.38	1.17	weir EQ	2.30	0.70	0.67	32.2		6.86	----	11.90	TYPE S-1
DA-A19	6.75	5.89	7.00	0.58	18.00	1.50	62.00	5.17	1.07	0.82	weir EQ	2.30	0.85	0.67	32.2		9.54	----	27.88	TYPE S-1
DA-A21.1																				
DA-A21.2																				
DA-A21	3.00	1.38	6.00	0.50	18.00	1.50	60.00	5.00	0.62	0.70	weir EQ	2.30	0.46	0.67	32.2		8.04	----	29.00	TYPE S-1
DA-A16	6.00	4.98	6.00	0.50	17.00	1.42	36.00	3.00	0.92	0.70	orifice EQ	N/A	1.23	0.67	32.2		----	13.28	60.18	TYPE G-1
DA-A13	5.00	3.18	7.00	0.58	18.00	1.50	36.00	3.00	0.85	0.82	orifice EQ	N/A	1.15	0.67	32.2		----	14.52	69.67	TYPE-G1
DA-A07	6.00	5.24	5.00	0.42	17.00	1.42	61.00	5.08	0.85	0.58	orifice EQ	N/A	0.85	0.67	32.2		----	7.62	17.44	TYPE-G1
DA-A20	6.00	5.51	6.00	0.50	18.00	1.50	122.00	10.17	0.96	0.70	orifice EQ	N/A	0.96	0.67	32.2		----	10.33	23.15	TYPE-G1

CURB INLETS IN SUMPS, Type S-1, parabolic crown and SUBMERGED CURB INLETS ON GRADE, parabolic crown

Equations in Cells

(1) DCM EQ 2-1: Q_{peak} = CiA

(2) Total flow = sum of discharge from drainage area and carry over flow

(3) So = (high elev - low elev)/length

(4) See DCM Table 3-2 (no split) or Table 3-3 (split, high gutter) or Table 3-4 (split, low gutter)

(5) DCM EQ 3-5: Yo = 10^[(logQ - Ko - K1 * log So - K3*CS)/K2] ; for inlets in sag, Yo = maximum of Yo values calculated for both side of inlet

(6) Sx measured in Field by ESD 3-3-15 or 3-31-15

(7) For all streets except Congress, B = W/2 = Street Width / 2; for Congress, B = crown to curb distance measured on DGN file

(8) measured in field, lidar or record drawing; see "Crown Height Calcs" tab

(9) HEC-22 EQ B-11: Yo = (2H/B)*x - (H/B2)*x2 ; same as DCM EQ 3-1 except allows for crown not at centerline of street; use quadratic equation to solve for x; T is the minimum of x1 or x2; if Yo > H, T = B

(10) a_{DIG} was measured in the field by ESD or DIG Data consultants. a_{DIG} = (upstream curb height) - (depth from top of curb to inlet gutter)

(11) See HEC-22 Fig 4-13. a_{HEC22} is the difference between the inlet edge of gutter elevation and the projected street slope elevation

$a_{HEC22} = a_{DIG}$ - W*Sx

(12) If d > 1.4*h, use orifice EQ, else use weir EQ

(13) See DCM EQ 4-1: For depressed curb inlet, Cw = 2.3; for curb inlets without depression, Cw = 3.0

(14) HEC-22 EQ 4-31a or DCM EQ 4-4a: $d_o = d_i$ - (h/2); where di = Yo + a_{HEC22}/12

(15) See DCM EQ 4-4: Co = 0.67

(16) DCM EQ 4-1: Qi = Cw * (L + 1.8*W) * $d^{1.5}$

(17) DCM EQ 4-4a: Qi = Co * h * L * $(2*g*do)^{0.5}$

(18) Qover = Q - Qi

Exhibit I.4

Existing System Code Compliance Summary

Summary of Street Flow for Exising Storm Drain Configuration and Existing Land UseConditions

Note: Calculations in this spreadsheet assume the pipe system is suffient to convey flow captured by the inlets. However, the pipes are also undersized as shown in StormCAD profiles in Appendix I.1

				Street Geometry Summary						
Drainage Area	**Inlet Type**	**Street Name**	**Street Classification**	**Longitudinal Slope**	**Street Width** *(ft)*	**Distance Curb to Crown** *(ft)*	**Curb Height** *(ft)*	**Crown Height** *(ft)*	**DCM Minimum Gutter Slope**	**DCM 3.3.1 Meets Gutter Slope Criteria?**
DA-A10	grate inlet on grade	Congress	A30 - Major Arterials and County Roads (FM)	2.4%	91.5	50.4	0.5	2.2	0.4%	Yes
DA-A01	curb inlet in sump	Annie	A45 - City Collector	2.3%	40.0	20.0	0.5	0.7	0.4%	Yes
DA-A02	curb inlet in sump	Annie	A45 - City Collector	1.3%	40.0	20.0	0.5	0.7	0.4%	Yes
DA-A05	curb inlet in sump	Mary	A45 - City Collector	3.4%	41.5	20.8	0.5	0.4	0.4%	Yes
DA-A06	curb inlet in sump	Mary	A45 - City Collector	3.9%	41.5	20.8	0.5	0.4	0.4%	Yes
DA-A11	curb inlet in sump	Mary	A45 - City Collector	2.2%	37.0	18.5	0.5	0.3	0.4%	Yes
DA-A12	curb inlet in sump	Congress	A30 - Major Arterials and County Roads (FM)	2.1%	91.5	43.5	0.5	1.4	0.4%	Yes
DA-A18	curb inlet in sump	Johanna	A45 - City Collector	2.2%	37.0	18.5	0.8	0.6	0.4%	Yes
DA-A19	curb inlet in sump	Johanna	A45 - City Collector	3.7%	37.0	18.5	0.5	0.5	0.4%	Yes
DA-A21	curb inlet in sump	Alley	N/A	2.8%	38.1	38.1	0.5	1.5	0.4%	Yes
DA-A13	curb inlet on grade	Congress	A30 - Major Arterials and County Roads (FM)	0.9%	91.5	30.8	0.5	1.3	0.4%	Yes
DA-A16	curb inlet on grade	Congress	A30 - Major Arterials and County Roads (FM)	1.1%	91.5	23.3	0.5	1.1	0.4%	Yes
DA-A03	curb inlet on grade	Annie	A45 - City Collector	7.2%	40.0	20.0	0.5	0.3	0.4%	Yes
DA-A04	curb inlet on grade	Annie	A45 - City Collector	7.3%	40.0	20.0	0.5	0.3	0.4%	Yes
DA-A07	curb inlet on grade	Mary	A45 - City Collector	2.0%	40.5	20.3	0.5	0.9	0.4%	Yes
DA-A08	curb inlet on grade	Eva	A40 - Local City/County Street	2.0%	32.5	16.3	0.5	0.2	0.4%	Yes
DA-A09	curb inlet on grade	Mary	A45 - City Collector	3.4%	41.0	20.5	0.5	0.8	0.4%	Yes
DA-A14	curb inlet on grade	Leland	A40 - Local City/County Street	5.0%	30.0	15.0	0.5	0.9	0.4%	Yes
DA-A15	curb inlet on grade	Leland	A40 - Local City/County Street	4.4%	30.0	15.0	0.5	0.9	0.4%	Yes
DA-A20	curb inlet on grade	Johanna	A45 - City Collector	3.6%	32.0	16.0	0.5	0.7	0.4%	Yes
Inlet 21823 (DS of grate inlet DA-A22)	curb inlet on grade	Wilson	A40 - Local City/County Street	1.8%	29.8	14.9	0.7	0.3	0.4%	Yes

Summary of Street Flow for Exising Storm Drain Configuration and Ultimate Land UseConditions

	25 Year Storm							100 Year Storm						
Drainage Area	25 YR Flow Depth Yo (ft)	DCM 3.2.0 Meets Over Curb Criteria?	Spread T (ft)	Clear Width From Crown (ft)	DCM Minimum Clear Width - From Crown (ft)	DCM Minimum Clear Width - Total Clear Width (ft)	DCM 3.2.0 Meets Clear Width Criteria?	100 YR Flow Depth Yo (ft)	Water Depth Over Crown (ft)	DCM Maximum Depth Above Crown	DCM 3.2.0 Meets Over Crown Criteria?	Ground Height at ROW (ft)	Water Depth Over/Under ROW Ground Height (ft)	DCM 3.2.0 Water Contained within ROW?
DA-A10	0.37		4.5	45.9	12.00		Yes	0.42	below crown	0.5	Yes	0.58	-0.16	Yes
DA-A05	0.38		13.1	7.7		12.00	See Total Clear Width Analysis	0.42	below crown	0.5	Yes	0.50	-0.08	No**
DA-A06	0.57	over curb	20.8	0.0		12.00	See Total Clear Width Analysis	0.64	0.20	0.5	Yes	0.58	0.06	No
DA-A11	0.62	over curb	18.5	0.0		12.00	Cannot determine*	0.69	0.39	0.5	Yes	0.58	0.10	No
DA-A12	0.89	over curb	17.1	26.4	12.00		Yes	1.04	below crown	0.5	Yes	0.58	0.46	No
DA-A18	0.49		9.2	9.3		12.00	Cannot determine*	0.57	below crown	0.5	Yes	0.58	-0.02	Yes
DA-A19	0.55	over curb	16.0	2.5		12.00	Cannot determine*	0.65	0.11	0.5	Yes	0.58	0.07	No
DA-A21	0.53	over curb	5.9	32.2			No criteria for alleys	0.59	below crown	0.5	Yes	0.58	0.01	No
DA-A13	1.01	over curb	16.7	14.1	12.00		Yes	1.18	below crown	0.5	Yes	0.58	0.60	No
DA-A16	0.93	over curb	13.2	10.1	12.00		No	1.07	below crown	0.5	Yes	0.58	0.48	No
DA-A03	0.26		13.0	7.0		12.00	See Total Clear Width Analysis	0.29	below crown	0.5	Yes	0.58	-0.29	Yes
DA-A04	0.34		20.0	0.0		12.00	See Total Clear Width Analysis	0.38	0.08	0.5	Yes	0.58	-0.20	Yes
DA-A07	0.54	over curb	7.0	13.3		12.00	Cannot determine*	0.62	below crown	0.5	Yes	0.58	0.04	No
DA-A08	0.46		16.3	0.0	0.00		Yes	0.51	0.34	0.5	Yes	0.58	-0.07	Yes
DA-A09	0.45		6.8	13.7		12.00	Cannot determine*	0.50	below crown	0.5	Yes	0.58	-0.08	Yes
DA-A14	0.45		4.7	10.3	0.00		Yes	0.50	below crown	0.5	Yes	0.58	-0.08	Yes
DA-A15	0.49		5.3	9.7	0.00		Yes	0.55	below crown	0.5	Yes	0.58	-0.04	Yes
DA-A20	0.67	over curb	13.7	2.3		12.00	Cannot determine*	0.75	0.07	0.5	Yes	0.58	0.16	No
Inlet 21823 (DS of grate inlet DA-A22)	0.55		14.9	0.0	0.00		Yes	0.62	0.28	0.5	Yes	0.58	0.04	No

*Total clear width can only be determined if there are inlets on opposides of the street

**Due to undersized storm drain, water at this location is not contained within the ROW. See flooding complaint from 304 Mary St.

Summary of Street Flow for Exising Storm Drain Configuration and Ultimate Land UseConditions

Total Clear Width Analysis

Street Name	Location	Drainage Areas	Street Classification	DCM Minimum Clear Width - Total Clear Width *(ft)*	25-year Total Clear Width *(ft)*	DCM 3.2.0 Meets Clear Width Criteria?
Annie	407 Annie, between EBC and Newton	DA-A03 and DA-A04	A45 - City Collector	12.0	7.0	No
Mary	304 Mary, between EBC and Newton	DA-A05 and DA-A06	A45 - City Collector	12.0	7.7	No
Leland	just east of Congress	DA-A14 and DA-A15	A40 - Local City/County Street	0.0	20.0	Yes

Exhibit I.5

Drainage Criteria Manual Tables 2-1, 2-2 and 2-5

TABLE 2-1 RATIONAL METHOD RUNOFF COEFFICIENTS FOR COMPOSITE ANALYSIS Runoff Coefficient (C)							
Character of Surface	Return Period						
	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years	500 Years
DEVELOPED							
Asphaltic	0.73	0.77	0.81	0.86	0.90	0.95	1.00
Concrete	0.75	0.80	0.83	0.88	0.92	0.97	1.00
Grass Areas (Lawns, Parks, etc.)							
Poor Condition*							
Flat, 0-2%	0.32	0.34	0.37	0.40	0.44	0.47	0.58
Average, 2-7%	0.37	0.40	0.43	0.46	0.49	0.53	0.61
Steep, over 7%	0.40	0.43	0.45	0.49	0.52	0.55	0.62
Fair Condition**	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Good Condition***							
Flat, 0-2%	0.21	0.23	0.25	0.29	0.32	0.36	0.49
Average, 2-7%	0.29	0.32	0.35	0.39	0.42	0.46	0.56

Steep, over 7%	0.34	0.37	0.40	0.44	0.47	0.51	0.58
UNDEVELOPED							
Cultivated							
Flat, 0-2%	0.31	0.34	0.36	0.40	0.43	0.47	0.57
Average, 2-7%	0.35	0.38	0.41	0.44	0.48	0.51	0.60
Steep, over 7%	0.39	.042	0.44	0.48	0.51	0.54	0.61
Pasture/Range							
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.410.53	
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.490.58	
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Forest/Woodlands							
Flat, 0-7%	0.22	0.25	0.28	0.31	0.35	0.39	0.48
Average, 2-7%	0.31	0.34	0.36	0.40	0.43	0.47	0.56
Steep, over 7%	0.35	0.39	0.41	0.45	0.48	0.52	0.58
Assumptions:							
1. Composite "C" value for developed conditions (C_{DEV}) is : $C_{DEV} = IC_1 + (1-I)C_2$							
	Where: I = Impervious cover, percent C_1 = "C" value for impervious cover C_2 = "C" value for pervious area (grass, lawns, parks, etc.)						
2. For maximum allowable impervious coverage values for various land use types, refer to the City of Austin Zoning Ordinance.							

* Grass cover less than 50 percent of the area.
** Grass cover on 50 to 75 percent of the area.
*** Grass cover larger than 75 percent of the area.
Source: 1. Rossmiller, R.L. "The Rational Formula Revisited." 2. City of Austin, Watershed Engineering Division

TABLE 2-2
Manning's "n" for overland flow

Manning's "n"[1]	Surface Description
0.015	Concrete (rough or smoothed finish)
0.016	Asphalt
0.05	Fallow (no residue)
	Cultivated Soils:
0.06	Residue Cover ≤ 20%
0.17	Residue cover > 20%
	Grass:
0.15	Short-grass prairie
0.24	Dense grasses[2]
0.13	Range (natural)
	Woods:[3]
0.40	Light underbrush
0.80	Dense underbrush

1 The Manning's n values are a composite of information compiled by Engman (1986).

2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.

3 When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

Table 2-5

Austin Intensity-Duration-Frequency Curve Coefficients

Return Period	Fitting parameters for IDF equation (2-8)		
Year	a	b	c
2	54.767	11.051	0.8116
5	62.981	10.477	0.7820
10	70.820	10.396	0.7725
25	82.936	10.746	0.7634
50	100.60	12.172	0.7712
100	118.30	13.185	0.7736
250	150.10	14.892	0.7822
500	188.00	17.233	0.7959

Source: Asquith, W.H., "Depth-Duration Frequency and Intensity-Duration Frequency for Austin and Travis County, Texas, 2001".

The a, b and c parameters listed in Table 2-5 were derived using nonlinear regression methods and the data included in Table 2-4. The IDF curves and the IDF equations are applicable for all design frequencies shown. They are required for use in determining peak flows by the Rational Method or other appropriate methods.

Exhibit I.6

Splash-over Velocity

Splash Over Velocity Analysis

Ref: HEC-22

Coefficients are from Table 7-6 of the Urban Drainage and Flood Control District's (UDFCD) Criteria Manual. UDFCD was established by the Colorado legislature in 1969 and covers a 1608 square mile area including Denver.

UDFCD Equation 7-20: $Vo = \alpha + \beta Le - \gamma(Le)^2 + \eta(Le)^3$

DA-A17	α	β	γ	η	Le	Vo		V,25	V,100
					ft	fps		fps	fps
Bar P-1-7/8	2.22	4.03	0.65	0.06	3	10.08		6.81	6.81
Bar P-1-1/8	1.76	3.12	0.45	0.03	3	7.88			
Bar P-1-7/8-4	0.74	2.44	0.27	0.02	3	6.17			

Velocity in Gutter slower than splashover velocity; Rf = 1.0

DA-L1	α	β	γ	η	Le	Vo		V,25	V,100
					ft	fps		fps	fps
Bar P-1-7/8-4	0.74	2.44	0.27	0.02	5	8.69		1.36	1.67

Velocity in Gutter slower than splashover velocity; Rf = 1.0

DA-L4	α	β	γ	η	Le	Vo		V,25	V,100
					ft	fps		fps	fps
Bar P-1-7/8-4	0.74	2.44	0.27	0.02	2.25	5.09		8.24	9.04

Velocity in gutter faster than splashover velocity; Rf calculation includes Vo

DA-A10	α	β	γ	η	Le	Vo		V,25	V,100
					ft	fps		fps	fps
Bar P-1-7/8-4	0.74	2.44	0.27	0.02	2	4.70		5.58	6.03

Velocity in gutter faster than splashover velocity; Rf calculation includes Vo

DA-A22	α	β	γ	η	Le	Vo		V,25	V,100
					ft	fps		fps	fps
Bar P-1-7/8	2.22	4.03	0.65	0.06	9	29.58		6.13	6.13
Bar P-1-1/8	1.76	3.12	0.45	0.03	9	15.26			
curved vane	0.3	4.85	1.31	0.15	9	47.19			
45 deg tilt bar	0.99	2.64	0.36	0.03	9	17.46			
Bar P-1-7/8-4	0.74	2.44	0.27	0.02	9	15.41			
30 deg tilt bar	0.51	2.34	0.2	0.01	9	12.66			

Velocity in Gutter slower than splashover velocity; Rf = 1.0

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The splash-over velocity is defined as the minimum velocity where some of the water will begin to skip over the full length of the grate. This velocity is a function of the grate length and type. The splash-over velocity can be determined using this empirical formula (Guo 1999):

$$V_o = \alpha + \beta L_e - \gamma L_e^2 + \eta L_e^3 \qquad \text{Equation 7-20}$$

Where:

V_o = splash-over velocity (ft/sec)

L_e = effective length of grate inlet (ft)

$\alpha, \beta, \gamma, \eta$ = constants from Table 7-6.

The splash-over velocity constants for the CDOT Type 13 and the Denver No. 16 grates were derived during the UDFCD-CSU study and are valid for effective lengths up to 15 feet, while the splash-over velocity constants for all other inlet grates are valid only for effective lengths up to four feet. Beyond the maximum effective lengths for which these constants have been validated through physical modeling, the splash-over velocity may be estimated as that maximum validated velocity plus 0.2 ft/s for each additional foot of effective inlet length.

Photograph 7-4. Gutter/street slope is a major design factor for both street and inlet capacity.

Table 7-6. Splash-over velocity constants for various types of inlet grates

Type of Grate	α	β	γ	η
CDOT/Denver 13Valley Grate	0.00	0.680	0.060	0.0023
CDOT Type C Standard Grate	2.22	4.03	0.65	0.06
CDOT Type C Close Mesh Grate	0.74	2.44	0.27	0.02
Denver No. 16 Valley Grate	0.00	0.815	0.074	0.003
Directional Cast Vane Grate	0.30	4.85	1.31	0.15
Directional 45-Degree Bar Grate	0.99	2.64	0.36	0.03
Directional 30-Degree Bar Grate	0.51	2.34	0.2	0.01
Reticuline Riveted Grate	0.28	2.28	0.18	0.01
Wheat Ridge Directional Grate	0.00	0.815	0.074	0.003
1-7/8” Bar Grate, Crossbars @ 8”	2.22	4.03	0.65	0.06
1-7/8” Bar Grate, Crossbars @ 4”	0.74	2.44	0.27	0.02
1-1/8” Bar Grate, Crossbars @ 8”	1.76	3.12	0.45	0.03

The ratio of the side flow intercepted by the inlet to total side flow, R_x, is expressed as:

$$R_x = \frac{1}{1 + \dfrac{0.15V^{1.8}}{S_x L^{2.3}}} \qquad \text{Equation 7-21}$$

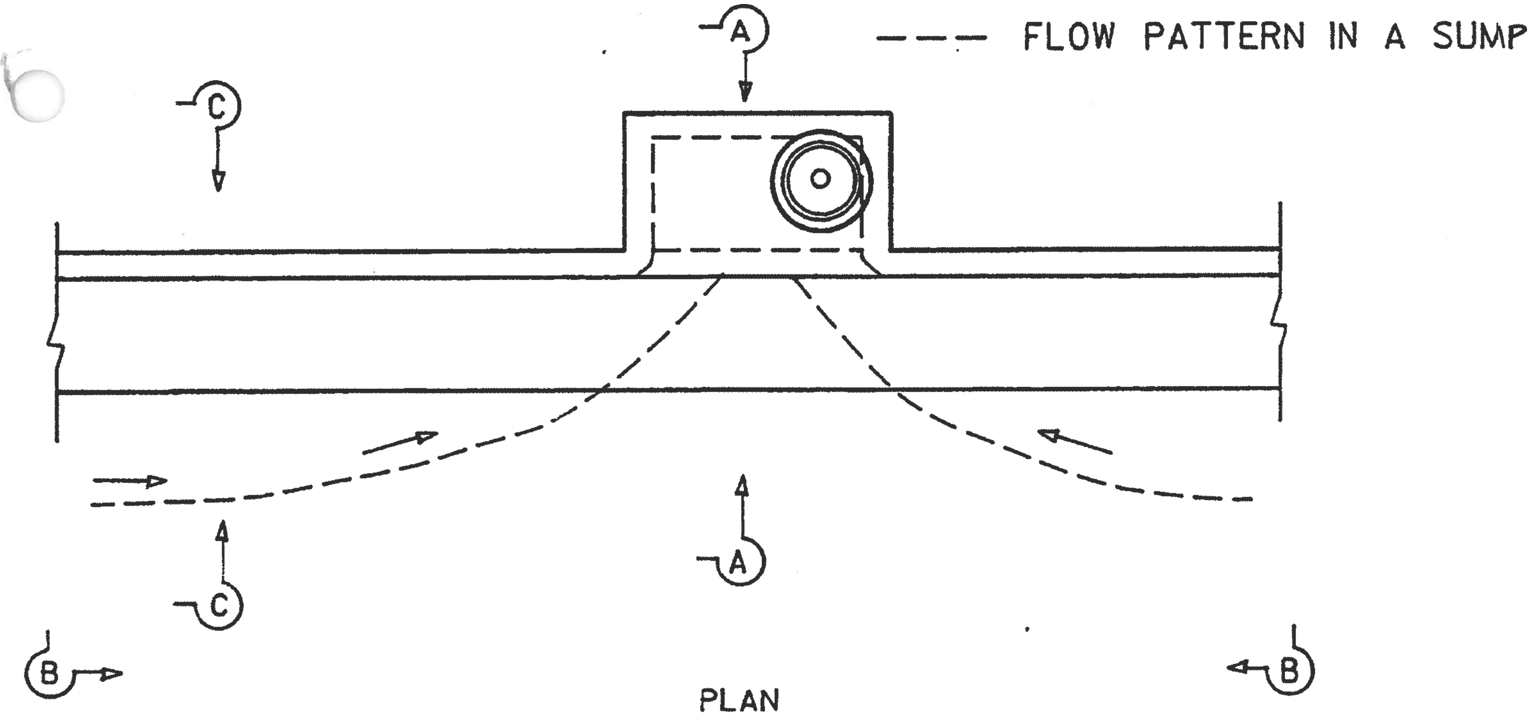
Where:

V = velocity of flow in the gutter (ft/sec)

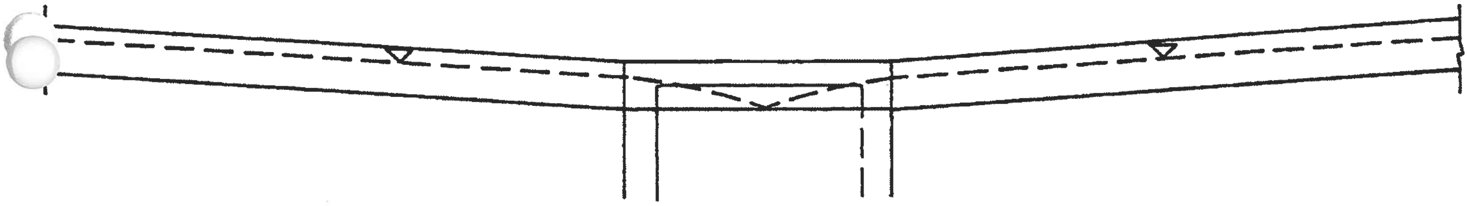
Exhibit I.7

“a” Value Documentation

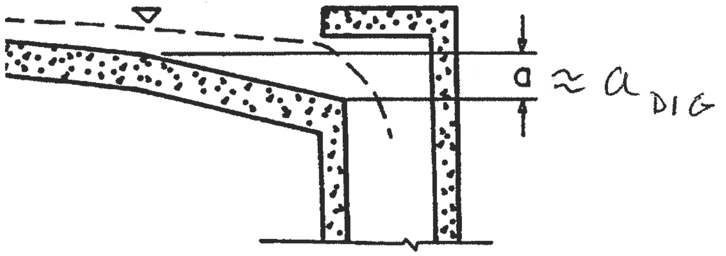
DCM Fig 4-1

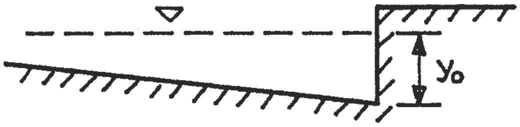


PLAN



SECTION B-B





SECTION C-C

SECTION A-A

y_o: WATER DEPTH IN THE APPROACH GUTTER

a: GUTTER DEPRESSION (5")

Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

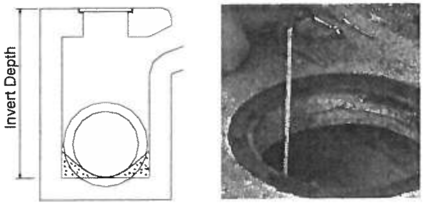
DIG Data

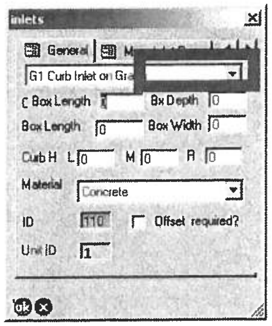
Inlet

Depth [to_bottom]: the vertical distance from the top of the slab for curb inlets, or street for grate inlets, to the invert of the outgoing pipe of an inlet box.

Curb Inlet with a manhole cover is present, this single measurement is taken from the surface of the inlet top to the bottom of the catch basin, measurement is taken through the manhole opening at the edge of the manhole cover closest to the pipe outlet.

For curb inlet with manhole present:



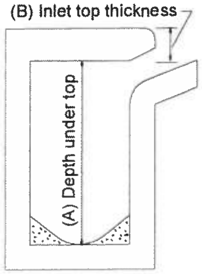


G1 Curb Inlet on Gra
C Box Length
Bx Depth 0
Box Length 0
Box Width 0
Curb H L 0 M 0 R 0
Material Concrete
ID 110
☐ Offset required?
Unit ID 1

Increment = ¼”
QC Tolerance = 6”

For curb inlet with no manhole:
(A) + (B) = Depth

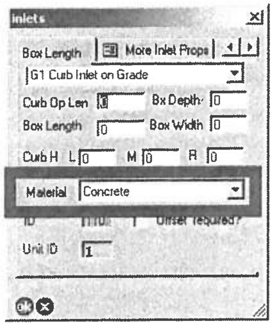
Curb Inlet with no manhole cover, depth is taken in two parts. (A) First from the curb opening at the center of the inlet, measure from the underside of the inlet top to the catch basin bottom, (B) second measure the thickness of the top slab. Both measurements are added to get Depth.



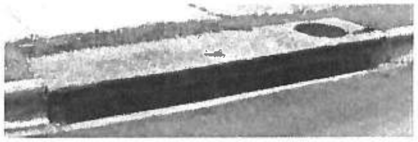
This measurement is the most difficult to make. The inlet may have debris or no access because of fabric screens at the curb, hard screens within the catch basin, bars on the curb face, or appurtenances to keep debris from entering the system.

Inlets

Material [material]: Structural material of inlets is mostly concrete; however, brick or metal may be observed. Devices used to enhance flow capture and prevent debris from entering the inlet may be present. Notes placed in the comment section should be added indicate presence of these devices (photos should clearly capture them).



Box Length
G1 Curb Inlet on Grade
Curb Op Len 0
Bx Depth 0
Box Length 0
Box Width 0
Curb H L 0 M 0 R 0
Material Concrete
Unit ID 1

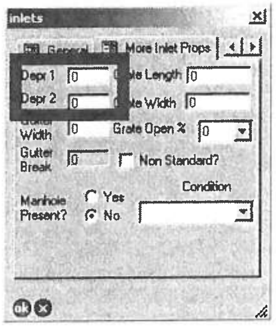


QC Tolerance = match

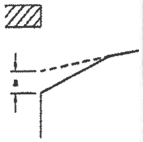
Inlets

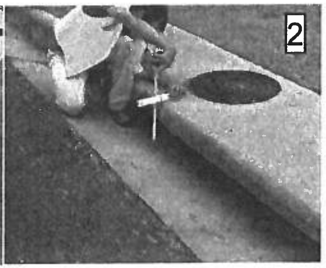
Depressed Amount [depression]: The depth (a) the street is sunk or depressed below the planar surface of the street. The depression increases the efficiency stormwater is captured.

This parameter is the difference of two measurements: (1) the height at the midpoint and (2) the upstream end of the inlet, both taken from the top of curb to the horizontal gutter surface. The gutter is a hard surface, and the inlet top typically is a concrete surface.



Depr 1 0
Depr 2 0
Grate Length 0
Grate Width 0
Gutter Width 0
Grate Open % 0
Gutter Break 0
☐ Non Standard?
Manhole Present? ○ Yes ● No





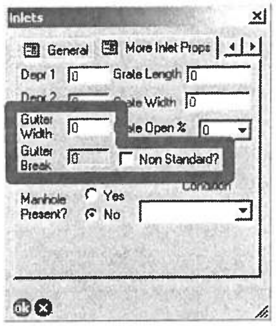
Increment = ¼”
QC Tolerance = 2”

The point at which the depression begins is difficult to assess. The streets may have severe grades; curbs, streets, and gutters may be damaged or poorly constructed; streets, inlets, and depressions may have atypical shapes (i.e., non linear edges); and the gutter may not be straight along the inlet.

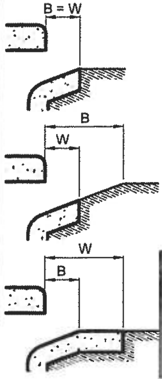
Inlets

Gutter Width [width]: the width (W) of the gutter in front of the inlet opening. The gutter is the concrete part of the street edges where water is conveyed and typically has a slope greater than the street cross slope.

Depression Break [break]: the distance (B) where the slope of the depression break from the slope of the street, it is where the depression begins. An inlet is non-standard when the break and width are not equal.



Depr 1 0
Depr 2
Grate Length 0
Grate Width 0
Gutter Width 0
Grate Open % 0
Gutter Break 0
☐ Non Standard?
Manhole Present? ○ Yes ● No



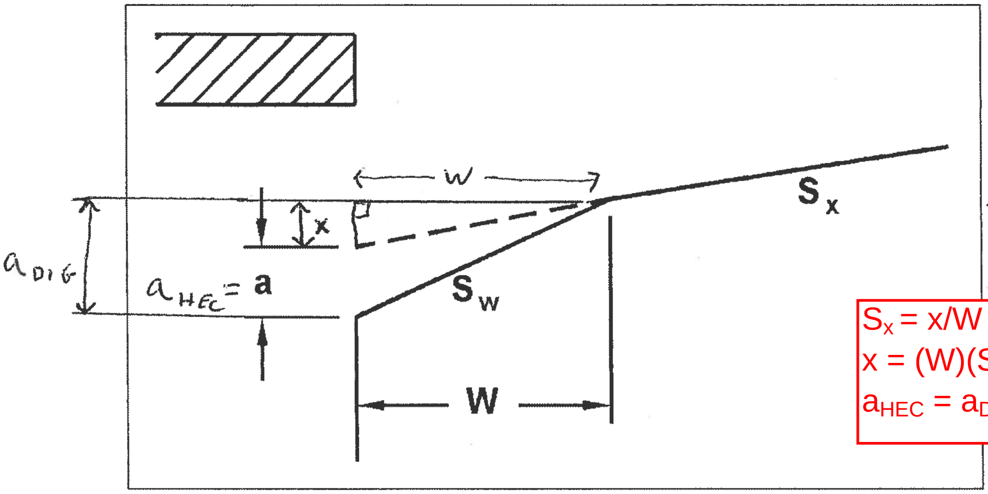
Increment = ¼”
QC Tolerance = 3”

Measurements are taken at mid-length of the inlet opening and from the edge of the concrete gutter at the street transition to the plane of the inlet opening. The break is measured from the inlet opening to the point where the depression slope begins, typically a curved edge (use the mid-point of the arc). Measurement difficulties are from the angled gutters and street; the street or gutter could be damaged at the inlet; street resurfacing could elevate the street above the gutter; the area is paved over, and other structural anomalies.

HEC-22

a_{DIG} to a_{HEC} Conversion Equation

Figure 4-13 shows the depressed curb inlet for Equation 4-24. E_o is the same ratio as used to compute the frontal flow interception of a grate inlet.



$S_x = \frac{x}{W}$

$x = W \cdot S_x$

$a_{HEC} = a_{DIG} - W \cdot$

$S_x = x/W$
$x = (W)(S_x)$
$a_{HEC} = a_{DIG} - (W)(S_x)$

Figure 4-13. Depressed curb opening inlet.

As seen from Chart 7, the length of curb opening required for total interception can be significantly reduced by increasing the cross slope or the equivalent cross slope. The equivalent cross slope can be increased by use of a continuously depressed gutter section or a locally depressed gutter section.

Using the equivalent cross slope, S_e, Equation 4-22 becomes:

$$L_T = K_T Q^{0.42} S_L^{0.3} [1 / (n S_e)]^{0.6} \quad (4\text{-}22a)$$

where:

K_T = 0.817 (0.6 in English Units)

Equation 4-23 is applicable with either straight cross slopes or composite cross slopes. Charts 7 and 8 are applicable to depressed curb-opening inlets using S_e rather than S_x.

Equation 4-24 uses the ratio, E_o, in the computation of the equivalent cross slope, S_e. Example 4-9a demonstrates the procedure to determine spread and then the example uses Chart 2 to determine E_o. Example 4-9b demonstrates the use of these relationships to design length of a curb opening inlet.

Example 4-9a

Given: *A curb-opening inlet with the following characteristics:*

S_L = 0.01 m/m (ft/ft)
S_x = 0.02 m/m (ft/ft)
Q = 0.05 m³/s (1.77 ft³/s)
n = 0.016

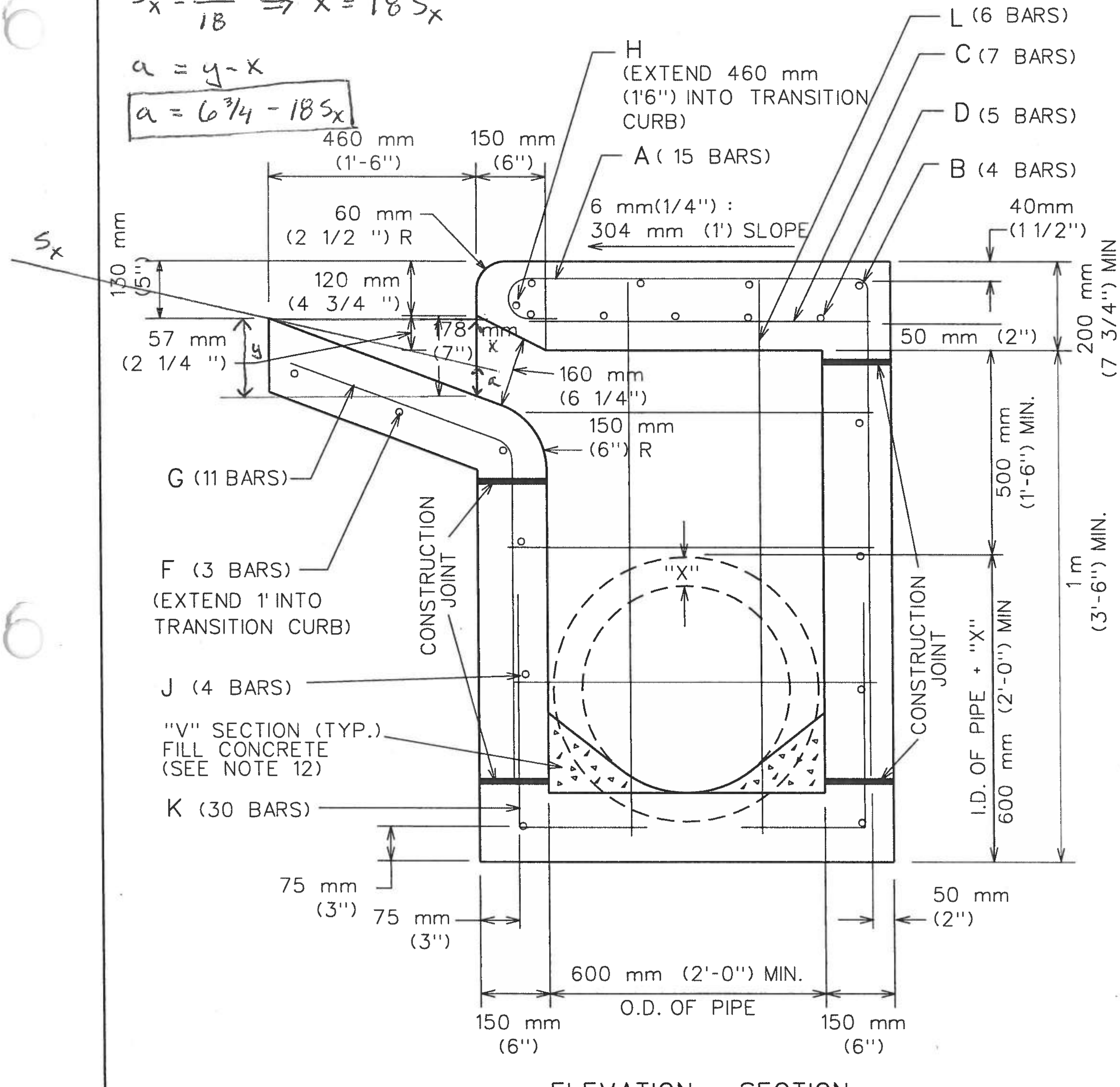
$y = (4\,3/4 + 7) - 5 = 6\,3/4''$

$S_x = \frac{x}{18} \Rightarrow x = 18 S_x$

$a = y - x$

$\boxed{a = 6\,3/4 - 18 S_x}$

Proposed Inlet a_{HEC} Equation



ELEVATION - SECTION

CITY OF AUSTIN
DEPARTMENT OF PUBLIC WORKS

TYPICAL DETAILS FOR CURB INLET

RECORD COPY SIGNED
BY BILL GARDNER

12/09/08
ADOPTED

THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.

STANDARD NO.
508S-3
2 OF 4

Exhibit I.8

Tailwater Conditions

Tailwater Coincidental Occurance Analysis

Ref: HEC-22 Table 7-3 and City of Grand Prairie Drainage Design Manual Table 8.6

Ref:

EBLDN010	4590200	SF
EBLDN020	3180750	SF
EBLDN030	2853844	SF
EBLDN040	2410200	SF
EBLDN050	3429500	SF
EBLDN060	10624050	SF
EBLDN-A	5539727	SF
EBLDN-B	1833447	SF
EBLDN-G	248097	SF
EBLDN-F	734427	SF
EBLDN-H	579249	SF
EBLDN-L	567898	SF
EBLDN-J	42247	SF
EBLDN-K	65108	SF
Total =	36698744	SF
Total EBC watershed upstream of Annie System =	**842**	**AC**
Annie System	**48**	**AC**
Area Ratio = upstream area : annie system area	**17.6**	**: 1**

Conclusion:

For StormCAD 100-year scenairo, use 50-year HEC-RAS water surface elevations

For StormCAD 25-year scenairo, use 10-year HEC-RAS water surface elevations

Outfall	**HEC-RAS River Station**	**10-year WSEL**	**50-year WSEL**
Milton	9537	508.18	509.98
Annie	9807	511.74	513.31
Mary	10171	516.81	518.15
Crockett	10809	520.90	522.51

table can be used to establish an appropriate design tailwater elevation for a storm drainage system based on the expected coincident storm frequency on the outfall channel. For example, if the receiving stream has a drainage area of 200 hectares and the storm drainage system has a drainage area of 2 hectares, the ratio of receiving area to storm drainage area is 200 to 2 which equals 100 to 1. From Table 7-3 and considering a 10-year design storm occurring over both areas, the flow rate in the main stream will be equal to that of a five year storm when the drainage system flow rate reaches its 10-year peak flow at the outfall. Conversely, when the flow rate in the main channel reaches its 10-year peak flow rate, the flow rate from the storm drainage system will have fallen to the 5-year peak flow rate discharge. This is because the drainage areas are different sizes, and the time to peak for each drainage area is different.

Table 7-3. Frequencies for Coincidental Occurrence.

Area Ratio	Frequencies for Coincidental Occurrence			
	10-Year Design		100-Year Design	
	Main Stream	Tributary	Main Stream	Tributary
10,000 to 1	1	10	2	100
	10	1	100	2
1,000 to 1	2	10	10	100
	10	2	100	10
100 to 1	5	10	25	100
	10	5	100	25
10 to 1	10	10	50	100
	10	10	100	50
1 to 1	10	10	100	100
	10	10	100	100

There may be instances in which an excessive tailwater causes flow to back up the storm drainage system and out of inlets and access holes, creating unexpected and perhaps hazardous flooding conditions. The potential for this should be considered. Flap gates placed at the outlet can sometimes alleviate this condition; otherwise, it may be necessary to isolate the storm drain from the outfall by use of a pump station.

Energy dissipation may be required to protect the storm drain outlet. Protection is usually required at the outlet to prevent erosion of the outfall bed and banks. Riprap aprons or energy dissipators should be provided if high velocities are expected (see HEC-14, "Hydraulic Design of Energy Dissipators for Culverts and Channels"(35) for guidance with designing an appropriate dissipator).

The **orientation of the outfall** is another important design consideration. Where practical, the outlet of the storm drain should be positioned in the outfall channel so that it is pointed in a downstream direction. This will reduce turbulence and the potential for excessive erosion. If the outfall structure cannot be oriented in a downstream direction, the potential for outlet scour must be considered. For example, where a storm drain outfall discharges perpendicular to the direction of flow of the receiving channel, care must be taken to avoid erosion on the opposite channel bank. If erosion potential exists, a channel bank lining of riprap or other suitable material should be installed on the bank. Alternatively, an energy dissipator structure could be used at the storm drain outlet.

8.6 Starting Tailwater Conditions

These guidelines may be used to determine coincident flood flows in a receiving stream at the confluence with a tributary. The flood elevation for the coincident flow in the receiving stream may be used for starting hydraulic grade line calculations for closed storm drain systems. These guidelines may only be used if the receiving stream has an upstream drainage of 200-acres or greater and are limited to closed storm drain systems draining 200 acres or less.

Table 8.6
Receiving Stream Coincident Frequency Flood

Tributary Frequency Flood (years)	**Basin Area Ratio**				
	≤ 3:1	>3:1	>50:1	>500:1	>5,000:1
1	1	1	1	1	1
2	2	1	1	1	1
5	5	2	2	1	1
10	10	5	5	2	1
25	25	10	10	5	2
50	50	25	10	10	2
100	100	50	25	10	2

The coincident frequency flood for a receiving stream is presented in Table 8.6 as a function of the flood frequency in the tributary and the basin area ratio. The basin area ratio is the drainage area of the receiving stream upstream of the confluence divided by the drainage area of the tributary.

An exception to the use of this guideline to determine a coincident flood is for the evaluation of the maximum velocity requirement for a tributary. When evaluating the maximum velocity requirement in a tributary, the flow in the receiving stream downstream of the confluence should be assumed to be the same as in the tributary.

Exhibit I.9

Storm Drain Pipe Data

and

Existing Storm Drain System Record Drawings

EXISTING SYSTEM StormCAD LABELS

East Bouldin Creek

Existing Storm Drain Lines

Pipe Data Used in StormCAD

StormCAD ID	Diameter inches	Length feet	Downstream Pipe Invert Elev	Upstream Pipe Invert Elev	Pipe Segment Slope	HMS Reache Name
SS-A01	36	100	502.46	504.60	2.14%	Annie Sys 1
SS-A02	36	50	504.60	504.90	0.60%	Annie Sys 2
SS-A03	36	86.5	504.90	510.86	6.89%	Annie Sys 3
Manhole						
SS-A04	30	103.12	511.48	516.59	4.95%	Annie Sys 4
Manhole						
SS-A05	30	95.03	516.78	521.49	4.95%	Annie Sys 4
SS-A06	30	187.1	521.49	529.01	4.02%	Annie Sys 4
Inlet box						
SS-A07	30	45.22	529.80	531.53	3.84%	Annie Sys 4
Inlet box						
SS-A08	30	122.5	531.53	535.00	2.83%	Annie Sys 4
Manhole						
SS-A09	24	103.1	535.50	541.75	6.06%	Annie Sys 5
SS-A10	24	86.61	541.75	544.35	3.00%	Annie Sys 6
SS-A11	24	13.39	544.35	544.75	3.00%	Annie Sys 6
SS-A12	24	100.00	544.75	547.25	2.50%	Annie Sys 6
SS-A13	24	54.61	547.25	548.89	3.00%	Annie Sys 6
SS-A14	24	14.52	548.89	549.32	3.00%	Annie Sys 6
SS-A15	24	30.86	549.32	550.25	3.00%	Annie Sys 6
SS-A16	24	50.00	550.25	552.00	3.50%	Annie Sys 6
SS-A17	24	66.00	552.00	555.03	4.60%	Annie Sys 6
SS-A18	24	150.77	555.03	559.72	3.11%	Annie Sys 6
SS-A19	24	10.06	559.72	560.09	3.62%	Annie Sys 7
SS-A20	24	89.11	560.09	563.31	3.62%	Annie Sys 7
SS-A21	24	9.10	563.31	563.41	1.03%	
SS-A22	24	334.61	563.41	566.84	1.03%	
SS-A23	24	24.32	566.84	567.09	1.03%	
SS-A24	24	231.98	567.09	569.46	1.03%	
SS-A25	24	34.8	569.46	569.82	1.03%	
SS-A26	24	24.3	569.82	570.07	1.03%	
SS-A27	30	322.71	536.60	544.47	2.44%	Annie Sys 8
SS-A28	18	29.08	544.79	546.00	4.16%	
SS-A29	18	183.5	544.47	551.27	3.70%	Annie Sys 9
SS-A30	24	22.89	544.47	544.97	2.17%	
SS-A31	24	19.07	544.97	545.38	2.17%	
SS-A32	24	30.27	545.38	546.04	2.17%	
SS-A33	18	28.43	545.47	546.70	4.34%	
SS-A34	15	26.12	546.13	548.06	7.39%	
SS-A35	18	115.84	546.54	552.69	5.31%	
SS-A36	24	185.83	546.04	549.74	1.99%	
SS-A37	18	15.08	512.48	514.51	13.46%	
SS-A38	18	21.61	512.48	513.59	5.14%	
SS-A39	15	3.48	545.10	547.12	58.16%	
SS-A40	15	15.96	549.64	552.64	18.80%	
SS-A41	15	4.37	550.07	552.80	62.43%	
SS-A42	15	15.21	560.84	564.74	25.66%	
SS-A43	15	19.47	564.06	565.17	5.68%	
SS-A44	15	3.93	564.16	564.75	15.18%	
SS-A45	15	5.05	567.84	570.28	48.39%	
SS-A46	15	26.38	570.21	574.37	15.75%	
SS-A47	15	10.26	570.57	573.70	30.50%	
SS-A48	15	12.73	573.70	575.64	15.26%	
SS-A49	15	5.6	570.82	574.38	63.57%	
SS-A50	15	14.76	573.70	573.80	0.68%	
SS-A51	18	263.32	573.80	575.10	0.49%	
SS-A52	18	16.74	575.10	575.90	4.78%	
SS-A53	15	50.00	567.59	569.85	4.52%	

path: N:\Team3\WPD_EBC_Annie\Eng_Analysis\Prelim Eng Phase\Storm Drain pipe data_KD
tab: pipe data

Record Drawing Notes

Storm CAD ID:	**SS-A1**
Diameter	shown on record drawing
Length	shown on record drawing
DS Invert Elev	shown on record drawing
US Invert Elev	shown on record drawing to center of MH; interpolated elev at end of pipe assuming 4' dia MH
Slope	calculated from elevations shown on plans; slopes shown on plans don't match calculated values
Other Notes	
Links	record drawing SSM-B-I-089

Storm CAD ID:	**SS-A2**
Diameter	shown on record drawing
Length	shown on record drawing
DS Invert Elev	shown on record drawing
US Invert Elev	shown on record drawing to center of MH; interpolated elev at end of pipe assuming 4' dia MH
Slope	calculated from elevations shown on plans; slopes shown on plans don't match calculated values
Other Notes	
Links	record drawing SSM-B-I-089

Storm CAD ID:	**SS-A3**
Diameter	shown on record drawing
Length	shown on record drawing
DS Invert Elev	shown on record drawing
US Invert Elev	shown on record drawing to center of MH; interpolated elev at end of pipe assuming 4' dia MH
Slope	calculated from elevations shown on plans; slopes shown on plans don't match calculated values
Other Notes	Unknown utility bore 21.9' west of MH
Links	record drawing SSM-B-I-089

Storm CAD ID:	**SS-A4**
Diameter	shown in Field Book
Length	measured on DGN file; length drawn based on video inspection info and record drawings
DS Invert Elev	FL shown in Field Book
US Invert Elev	calculated from DS Invert elev, length measured in DGN file and slope calculated as noted below
Slope	calculated from FL and length recorded in Field book
Other Notes	
Links	Field Book 1371 video inspection map

Storm CAD ID:	**SS-A5**
Diameter	Record drawing overall map of system
Length	measured on DGN file
DS Invert Elev	calculated from US invert Elev of SS-A4
US Invert Elev	calculated from DS Invert elev and slope
Slope	calculated from FL and length recorded in Field book; same as for SS-A4
Other Notes	
Links	Field Book 1371 video inspection map Record drawing overall map of system FOLDERRSN_10507807_a3343263

Storm CAD ID:	**SS-A6**
Diameter	record drawing overall map of system
Length	measured in DGN file
DS Invert Elev	match to US invert elev for SS-A5
US Invert Elev	DS invert + length * slope
Slope	calculated from FLs shown in Field book at 4+58 and 6+10.88 and length measured on DGN minus length removed from one side of SS-A7
Other Notes	
Links	Field Book 1371
	Record drawing overall map of system FOLDERRSN_10507807_a3343263

Storm CAD ID:	**SS-A7**
Diameter	shown in Field Book station notes
Length	measured on DGN file
DS Invert Elev	calculated based on FLs and length shown in field book for line crossing Mary
US Invert Elev	calculated based on FLs and length shown in field book for line crossing Mary
Slope	calculated based on FLs and length shown in field book for line crossing Mary
Other Notes	
Links	Field Book 1371

Storm CAD ID:	**SS-A8**
Diameter	record drawing overall map of system
Length	measured in DGN file
DS Invert Elev	assume same as US FL for SS-A7
US Invert Elev	FL shown in FB for pipe exiting MH to the east 1s 24" at 535.5; assume incoming pipe soffit matches: FL for 30" = 535.5 - 0.5 = 535.0
Slope	calculated from DGN length an invert elevs
Other Notes	
Links	Field Book 3133
	Record drawing overall map of system FOLDERRSN_10507807_a3343263

Storm CAD ID:	**SS-A9**
Diameter	shown in Field Book
Length	measured on DGN file
DS Invert Elev	FL shown in Field Book
US Invert Elev	calculated based on DS invert elev and slope
Slope	slope shown in Field Book
Other Notes	
Links	Field Book 3133

Storm CAD ID:	**SS-A10, SS-A11, SS-A12, SS-A13, SS-A14, SS-A15, SS-A16, SS-A17, SS-A18**
Diameter	shown in Field Book
Length	measured in DGN file
DS Invert Elev	same as US invert elev for previous pipe
US Invert Elev	calculated based on slope and length
Slope	shown in Field Book
Other Notes	
Links	Field Book 3133

Storm CAD ID:	**SS-A19, SS-A20**
Diameter	shown in Field Book
Length	measured in DGN file
DS Invert Elev	same as US invert elev of pervious pipe
US Invert Elev	SS-A20 US FL same as DS FL for SS-A21; DS FL for SS-A21 is interpolated based on FL shown in record drawing near intersecction of SS-A20 an dSS-A21 US FL SS-A20 = DS FL SS-A21 = 563.57 - .0103 * 25.04 = 563.31
Slope	calculated based on slope and length
Other Notes	
Links	Field Book 3133 record drawing SSM-B-1-0168

Storm CAD ID:	**SS-A21**
Diameter	shown on record drawing
Length	measured in DGN file
DS Invert Elev	DS invert elev for SS-A21 same as US elev for SS-A20
US Invert Elev	calculated based on slope
Slope	calculated based on FLs and length measured in DGN file; length shown on record drawings is too long, assume FLs in record drawings are correct and shown at correct location, but length is not accurate
Other Notes	
Links	record drawing SSM-B-1-0168

Storm CAD ID:	**SS-A22, SS-A23, SS-A24, SS-A25**
Diameter	shown on record drawing
Length	measured on DGN file
DS Invert Elev	DS invert elev matches US invert elev for previous pipe.
US Invert Elev	calculated from slope and length
Slope	same as for SS-A21
Other Notes	
Links	record drawing SSM-B-1-0168

Storm CAD ID:	**SS-A26**
Diameter	shown on record drawing
Length	measured on DGN file
DS Invert Elev	same as US invert elev for previous pipe
US Invert Elev	US invert for SS-A26 shwon on record drawing at 6+50
Slope	same as for SS-A21
Other Notes	
Links	record drawing SSM-B-1-0168

Storm CAD ID:	**SS-A27**
Diameter	shown in Field Book and plan view record drawing
Length	measured on DGN file
DS Invert Elev	DIG data manhole inspection report and Field Manhole GIS dataset (surface elevation entry on attribute table)
US Invert Elev	DIG data manhole inspection report and Field Manhole GIS dataset (surface elevation entry on attribute table)
Slope	calculated from length, DS elev and US elev
Other Notes	
Links	Field Book 1256 Record drawing overall map of system FOLDERRSN_10507807_a3343263 DS manhole inspection report MHI_09192006_242 US manhole inspection report MHI_09192006_243 DS Manhole elev Manhole%2021846 US manhole elev Manhole%2021831

Storm CAD ID:	**SS-A29**
Diameter	shown on record drawing overall plan
Length	measured on DGN file
DS Invert Elev	DIG data manhole inspection report and Field Manhole GIS dataset (surface elevation entry on attribute table)
US Invert Elev	DIG data Field Curb dataset: surface elevation minus depth to bottom
Slope	calculated based on DS invert elev and slope
Other Notes	
Links	Curb Inlet 21823
	Record drawing overall map of system FOLDERRSN_10507807_a3343263
	DS manhole inspection report \MHI_09192006_243
	DS manhole elev Manhole%2021831

Storm CAD ID:	**SS-A30, SS-A31, SS-A32**
Diameter	shown in record drawing
Length	measured on DGN file
DS Invert Elev	For SS-A30: Field Manhole surface elevation minus depth in DIG data manhole inspection report;
	For SS-A31 and SS-A32: DS invert elev = US invert elev of previous pipe
US Invert Elev	calculated US invert elev = DS invert elev + length * slope
Slope	slope calculated between MH at Johann/Newton and MH on Johanna based on DIG data manhole inspection form and Field Manhole data
Other Notes	
Links	Manhole 21830
	Manhole inspection form MHI_09192006_243
	Manhole 21831
	record drawing FOLDERRSN_5049252_PPC-1-A-7673~027

Storm CAD ID:	**SS-A33**
Diameter	shown on record drawings
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A30
US Invert Elev	Field Curb Inlet surface elevatin minus depth to bottom
Slope	calculated from length and elevs
Other Notes	
Links	Curb Inlet 21827
	record drawing FOLDERRSN_5049252_PPC-1-A-7673~027

Storm CAD ID:	**SS-A34**
Diameter	shown on record drawing overall plan
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A31
US Invert Elev	Field Curb Inlet surface elevatin minus depth to bottom
Slope	calculated based on DS invert elev and slope
Other Notes	
Links	record drawing FOLDERRSN_5049252_PPC-1-A-7673~027
	Curb Inlet 21826

Storm CAD ID:	**SS-A35**
Diameter	shown on record drawing
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A32
US Invert Elev	Field Curb Inlet data: surface elevation - depth to bottom
Slope	calculated from length and elevations
Other Notes	
Links	Manhole 21830
	Curb Inlet 402434
	record drawings FOLDERRSN_5049252_PPC-1-A-7673~027

Storm CAD ID:	**SS-A36**
Diameter	shown in Field Book
Length	measured on DGN file
DS Invert Elev	same as US invert elev for SS-A32
US Invert Elev	Field Curb Inlet surface elevation - depth to bottom = sump
Slope	calculated from length and elevations
Other Notes	
Links	Curb Inlet 21824

Storm CAD ID:	**SS-A37**
Diameter	WPD GIS Drainage Pipe 21645
Length	measured on DGN file
DS Invert Elev	match to soffit of DS end of SS-A4
US Invert Elev	Field Curb Inlet sump
Slope	calculated from length and elevations
Other Notes	
Links	Curb Inlet 21638

Storm CAD ID:	**SS-A38**
Diameter	WPD GIS Drainage Pipe 21644
Length	measured on DGN file
DS Invert Elev	match to soffit of DS end of SS-A4
US Invert Elev	Field Curb Inlet sump
Slope	calculated from length and elevations
Other Notes	
Links	Curb Inlet 21637

Storm CAD ID:	**SS-A39**
Diameter	shown on record drawings
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A10
US Invert Elev	Field Curb Inlet surface elevation - depth to bottom; sump elev gives negative slope
Slope	calculated from length and elevations
Other Notes	shown on record drawing as drop inlet
Links	Curb Inlet 21848
	record drawing PPC-1-A-1071~001

Storm CAD ID:	**SS-A40**
Diameter	no data, assume 15", same as other laterals on Mary St
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A13
US Invert Elev	Field Curb Inlet surface elevation - depth to bottom = Sump
Slope	calculated from length and elevations
Other Notes	
Links	Field Curb Inlet 100636

Storm CAD ID:	**SS-A41**
Diameter	no data, assume 15", same as other laterals on Mary St
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A14
US Invert Elev	Field Curb Inlet Sump
Slope	calculated from length and elevations
Other Notes	
Links	Curb Inlet 21854

Storm CAD ID:	**SS-A42**
Diameter	shown on record drawing
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A19
US Invert Elev	Field Grate Inlet sump
Slope	calculated from length and elevations
Other Notes	
Links	reocrd drawing SSM-B-1-0168
	Field Grate Inlet 102240

Storm CAD ID:	**SS-A43**
Diameter	no data, assume 15", same as lateral at Mary/Congress and Leland/Congress
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A20
US Invert Elev	Field Curb Inlet sump
Slope	calculated from length and elevations
Other Notes	
Links	Field Curb Inlet 101700
	reocrd drawing SSM-B-1-0168

Storm CAD ID:	**SS-A44**
Diameter	no data, assume 15", same as lateral at Mary/Congress and Leland/Congress
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A21
US Invert Elev	Field Curb Inlet sump data results in negative slope; invert elev = surface elevation + curb height - depth to bottom; see DIG data description that surface elevation is at pavement and depth to bottom is from rim
Slope	calculated from length and elevations
Other Notes	
Links	Field Curb Inlet 101642
	reocrd drawing SSM-B-1-0168

Storm CAD ID:	**SS-A45**
Diameter	no data, assume 15", same as lateral at Mary/Congress and Leland/Congress
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A23
US Invert Elev	Field Curb Inlet sump
Slope	calculated from length and elevations
Other Notes	
Links	reocrd drawing SSM-B-1-0168 Field Curb Inlet 100654

Storm CAD ID:	**SS-A46**
Diameter	no data, assume 15", same as lateral at Mary/Congress and Leland/Congress
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A24
US Invert Elev	Field Curb Inlet sump
Slope	calculated from length and elevations
Other Notes	
Links	reocrd drawing SSM-B-1-0168 Field Curb Inlet 101247

Storm CAD ID:	**SS-A47**
Diameter	shown on as-builts for BMW shop
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A25
US Invert Elev	shown on BMW shop as-builts Sta 1+89.24
Slope	calculated from length and elevations
Other Notes	
Links	reocrd drawing SSM-B-1-0168 Field Curb Inlet 100696 BMW shop as-builts SP-2012-0029C_0~011(3)

Storm CAD ID:	**SS-A48**
Diameter	shown on as-builts for BMW shop
Length	measured on DGN file
DS Invert Elev	shown on BMW shop as-builts Sta 1+89.24
US Invert Elev	Field Curb Inlet sump
Slope	calculated from length and elevations
Other Notes	
Links	reocrd drawing SSM-B-1-0168 Field Curb Inlet 100696 BMW shop as-builts SP-2012-0029C_0~011(3)

Storm CAD ID:	**SS-A49**
Diameter	no data, assume 15", same as lateral at Mary/Congress and Leland/Congress
Length	measured on DGN file
DS Invert Elev	match soffit to US end of SS-A26
US Invert Elev	Field Curb Inlet sump
Slope	calculated from length and elevations
Other Notes	
Links	reocrd drawing SSM-B-1-0168 Field Curb Inlet 100938

Storm CAD ID:	**SS-A50**
Diameter	shown on BMW shop as-builts
Length	shown on BMW shop as-builts = 206-2-189.24
DS Invert Elev	shown on BMW shop as-builts Sta 1+89.24
US Invert Elev	shown on BMW shop as-builts MH FL out
Slope	calculated from length and elevations
Other Notes	
Links	BMW shop as-builts SP-2012-0029C_0~011(3)

Storm CAD ID:	**SS-A51**
Diameter	shown on BMW shop as-builts
Length	shown on BMW shop as-builts = 471.32-206-2; sta 2+06 is to center of 4' MH
DS Invert Elev	shown on BMW shop as-builts sta 2+06
US Invert Elev	shown on BMW shop as-builts Sta 4+71.32
Slope	calculated from length and elevations
Other Notes	
Links	BMW shop as-builts SP-2012-0029C_0~011(3)

Storm CAD ID:	**SS-A52**
Diameter	shown on BMW shop as-builts
Length	BMW shop as-builts Sta 4+71.32 to sta 4+87.14
DS Invert Elev	shown at sta 4+71.32
US Invert Elev	show at sta 4+87.14
Slope	calculated from length and elevations
Other Notes	
Links	BMW shop as-builts SP-2012-0029C_0~011(3)

Storm CAD ID:	**SS-A53**
Diameter	shown on as-builts sheet 10
Length	per JMG, stop line 50 ft into Middle School Campus
DS Invert Elev	match soffit to US end of SS-A22
US Invert Elev	FL shown on as-built sheet 11 at Sta 1+00; interpolate US elev at 50 ft into campus
Slope	calculated from length and elevations
Other Notes	
Links	as-builts sheet 10 - SPL-SP-99-0009CX_0~010 as-builts sheet 11 - SPL-SP-99-0009CX_0~011

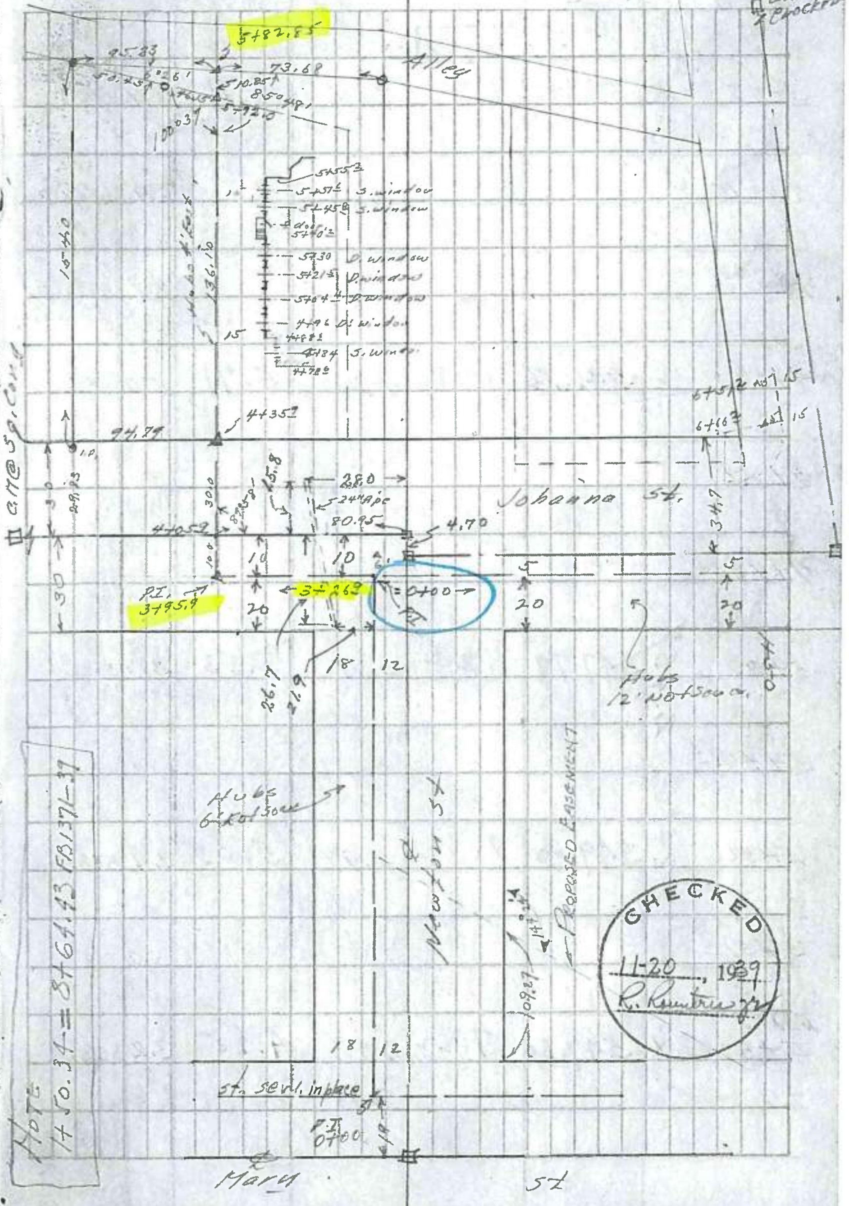
Knight
Spomberg

Newton St - W. Mary to Johanna St.
West Johanna St - Newton St East to Easement + So. with Easement.
Stakes for Storm Sewer.

Sta	+	H.I	-	Elev.	Gr.	
B.M. M-235	0.15	567.00		566.85		
T.P.	0.64	556.10	11.54	555.46		
T.P.	5.29	548.51	12.28	543.22		
0+00	537.00		6.41		7.3	541.2
0+50			4.94		6.8	541.7
1+00			4.45		6.2	542.3
1+50			3.37		5.8	542.7
2+00			3.67		5.2	543.3
2+50	* 539.50	9.01	2.85	6.16	4.6	543.9
T.P.	9.80	552.02	1.29	547.22		
3+00	542.10	14.92	9.80	5.12	10.6	546.4
P.I MH 3+26½ =0+00	543.50 544.00	13.52 13.02	8.11	5.41 4.91	8.3	548.7
3+50	544.90	12.12	7.91	4.21	8.1	548.9

30" @ 1.00%

24"@1.81% * 30"



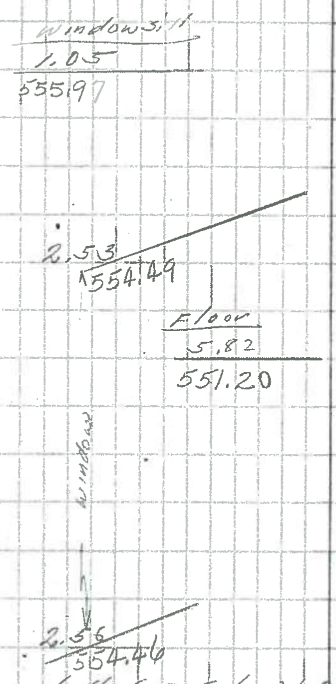
CHECKED
11-20, 1939
R. Rountree Jr.

FB 1256

INDEXED

Sta	+	H.I	–	Elev.		
		552.02				
MH 3+95⁷ *	545.25	11.77	7.66	4.11	6.9	550.1
4+30					6.9	550.1
4+35⁹					4.9	552.1
4+50	546.56	10.46	4.75	5.71	5.0	552.0
4+84						
4+96						
5+00	547.78	9.24	3.71	5.53	3.7	553.3
5+40²						
5+50	549.00	8.02	2.97	5.05	3.1	553.9
5+51⁵						
N Alley 5+82⁸⁵ *	549.80	7.22	2.97	4.25	3.2	553.8
T.P.			8.11	548.91		

24" @ 2.43'



const H.L. @ St 3+26⁷ = 0+00 p. 17

CHECKED
11-20 1934

FB 1256

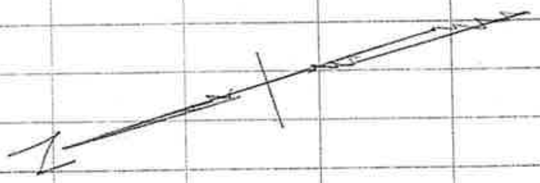
FB 3133

W. Mary St; Newton St; Ely; to West R.O.W. South Congress Ave; Stakes set to replace old 24" Storm Sewer in place. Also location of Sani. Sewer M.H.

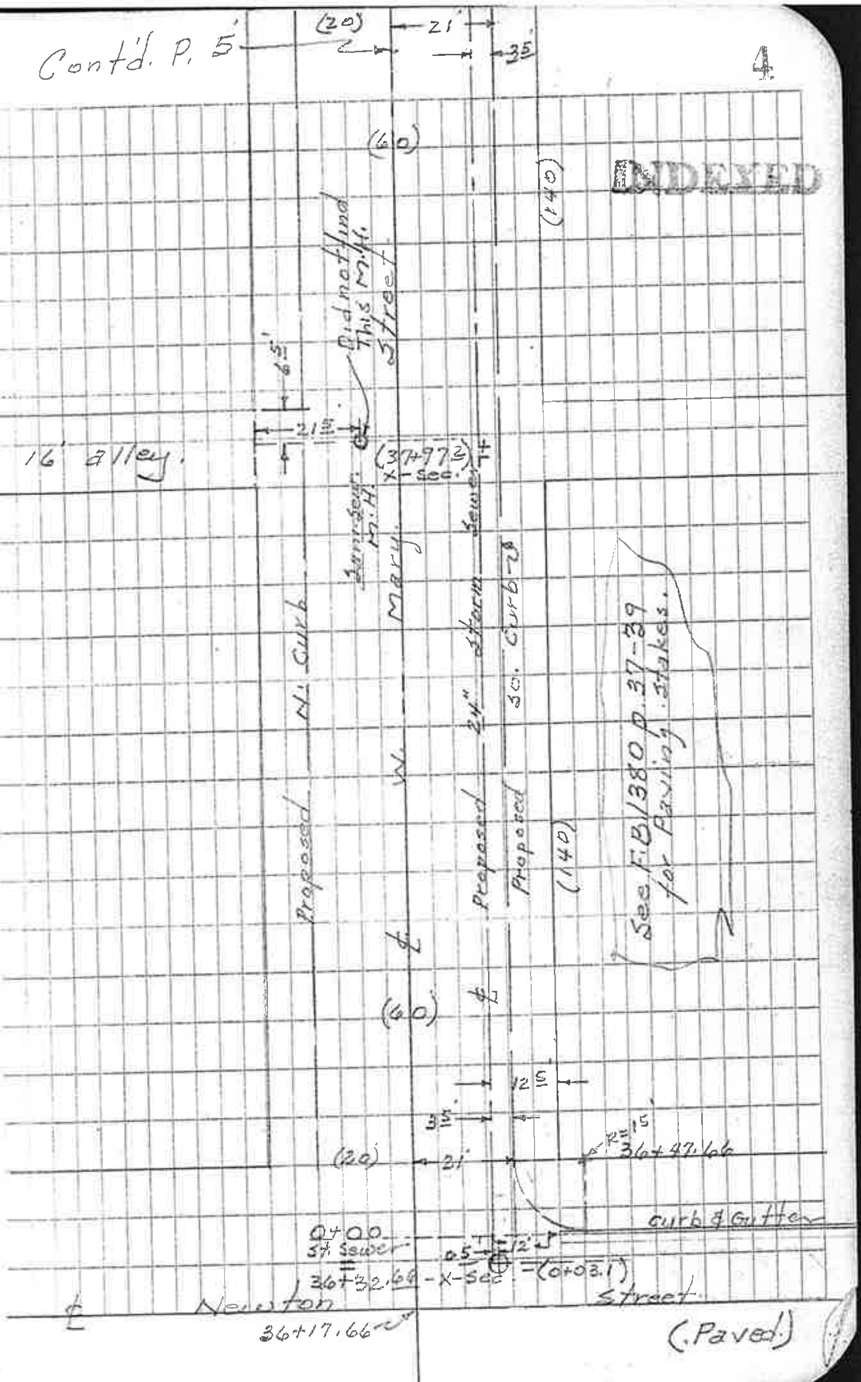
Stakes & profile for 667'± Storm Sewer.

5-4-70 {Sobeck
Fluitt
Glenewenkle
Foradory.

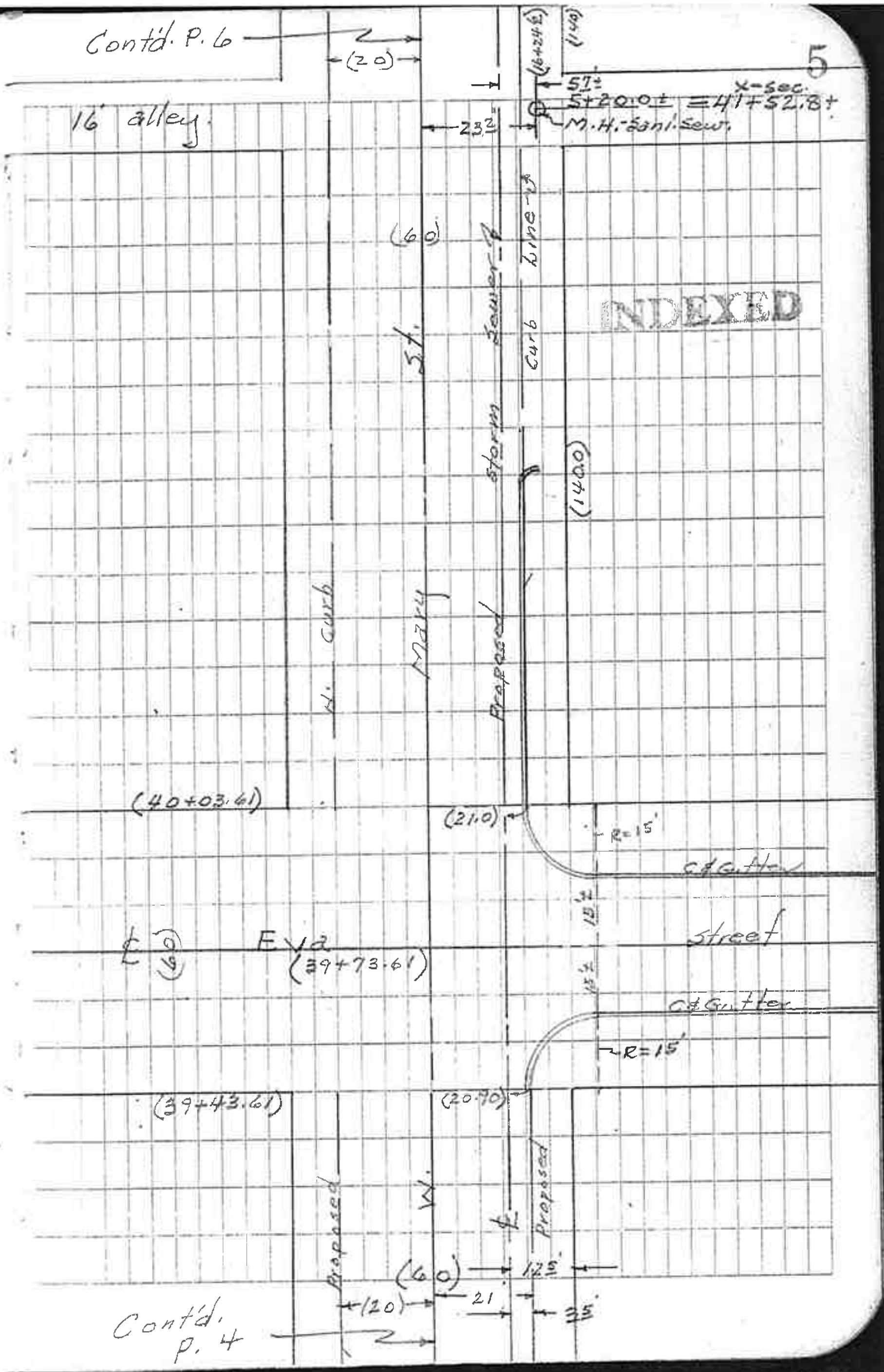
See F.B. 1380 p 37-39
" Paving strip plat.



Cont'd. P. 5

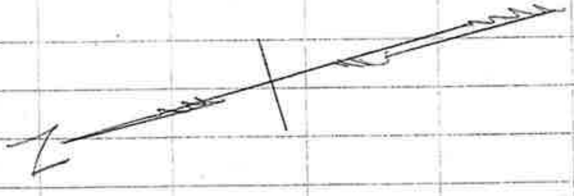


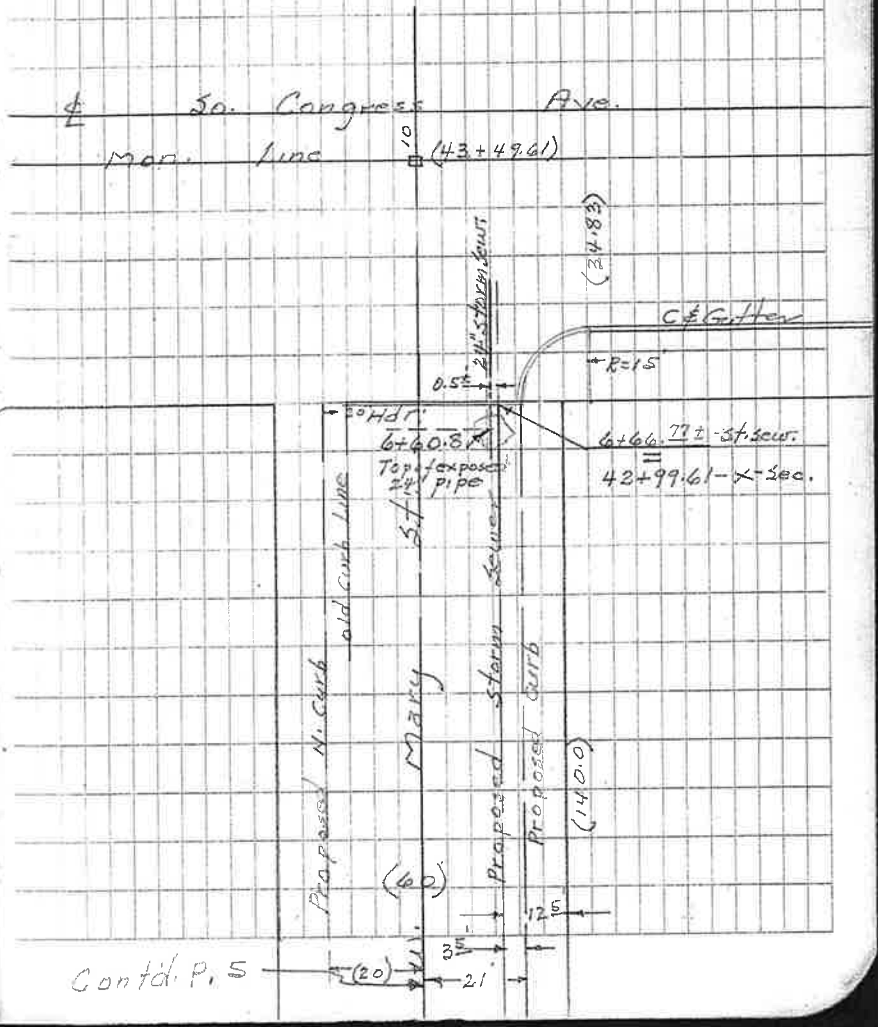
FB 3133


Cont'd. P. 6
(20)
(16+24±)
(140)
57±
X-sec.
5+20.0± = 41+52.8±
M.H.-Sani.Sewr.
23±
16' alley
(60)
St.
Mary
W. Curb
Proposed storm sewer ℄
Curb Line -2±
(1400)
(40+03.61)
(21.0)
R=15'
C&Gutter
15±
℄ (60) Eva Street
(39+73.61)
15±
C&Gutter
R=15'
(39+43.61)
(20.90)
Proposed
W.
℄
Proposed
(60)
12.5'
(20)
21
3.5'
Cont'd. p. 4

FB 3133

INDEXED





Contd. P. 6

Sta.	+	H.I.	−	Elev	
T.B.M	3.38	544.60		541.22	✓
	GRADE	GR. ROD	HUB	CUT	
			USE HUB @ 0+00		Grd. ℄
−(0+03±)	$536.^{25}$	8.35	Top M.H. Color 3.82 540.78	C−5.57	9.10 − Fl. Line of 24" pipe into E. side of Storm Sewer M.H. 535.50
			12'q±△		
0+00 @			2.78		3.9 540.7
T.P.	9.50	551.21	2.89+	541.71	✓
0+50	$539.^{45}$	11.76	5.28	C−6.48	7.5 543.7
1+00	$542.^{50}$	8.71	2.39	C−6.32	4.9 546.3
1+50	$544.^{00}$	7.21	0.81	C−6.40	3.2 548.0
T.P.	7.16	555.16	3.21	548.00	✓
2+00	$545.^{50}$	9.66	2.70	C−6.96	5.7 549.5

24" RCP @ 6.06%

24" RCP @ 3.00%

Contd. P. 8

FB 3133

INDEXED

Top Hub

Top Pipe

W. Mary & Newton St's; City of Austin Disc. in W. Curb of Newton St; 60'± south of ℄ W. Mary St; (F.B. 3080 p. 26) & 2980 p. 51

℄ hub @ 0+15 (Sewr)

℄ hub @ 1+50

Top 24" Pipe

2.6
2.7

5.3
5.5
549.66

FB 3133

Cont'd. P. 7

Sta		GRADE +	GR. ROD H.I.	HUB −	CUT Elev	Grd @ ℄	TOP HUB	TOP PIPE
	24" RCP @ 2.50%		555.16					
				12' o/s ℄'s				
2+50		$546.^{75}$	8.41	2.37	C-6.04 550.8	4.4	1.3 2.37	3.7 4.77 550.39
3+00		$548.^{00}$	7.16	1.23	C-5.93 552.2	3.0		
T.P.	24" RCP @ 3.00%	7.35	561.78	0.73	554.43 ✓		℄ hub @ 3+50	
3+50		$549.^{50}$	12.28	7.48	C-4.80 554.5	7.3		
4+00		$551.^{00}$	10.78	4.84	C-5.94 554.9	6.9	1.1 4.84	2.4 7.54 554.24
	24" RCP @ 3.50%							
4+50		$552.^{75}$	9.03	3.58	C-5.45 556.6	5.2		
	24" RCP @ 4.60%							
5+00		$555.^{05}$	6.73	10' o/s ℄△ 1.54	C-5.19 558.6	3.2	1.9 1.54	3.2 2.84 558.94
5+16		$555.^{85}$	5.93	USE HUB @ 5+00	C-4.39			
5+20± = 41+52.8± x-sec.					554.95	6.83	E. Line of Sani. Sewr. M.H.	

Cont'd. P. 9

Cont'd. P. 8

FB 3133

Sta.	+	H.I.			
		561.78			
	GRADE	GR. ROD	HUB	CUT	
T.P.	7.57	568.29	1.06	560.72	Grd. @ ℄
5+50	556.91	11.38	Nail-12' o/s 6.16	C-5.22	7.6
				560.7	
6+00	558.46	9.83	Nail-12' o/s 3.64	C-6.19	5.1
				563.2	
6+50	560.02	8.27	Nail-12' o/s 2.01	C-6.26	3.2
				565.0	
6+60.8	(CALCULATED) 560.51				2.6
				565.7	
6+66.77	560.55± Hookon±		12' o/s ℄ 0.82		Pvmt. 2.31
				565.98	
42+99.61 (ck)			1.98	566.31	566.29 — P.C. S. Curb F.B. 3080 p. 52

24" RCP @ 3.11%

Top of Pipe　　Top of Pipe

℄ △ @ 5+50

PLOTTED: 18 MAY '70 > GLV
CUTS: 19 MAY '70

~~2.5~~
2.01

~~6.0~~
5.51
562.78

Top of 24" st. Sewr. pipe
5.53 = 562.76 TOP EXIST. PIPE.
~~1.20~~ 2.25
~~6.73~~ - Fl. Line = 560.51 F.L. EXIST. PIPE.
7.78 =

Pvmt Hdr. & w. ℄ So. Cong. Ave.

CHECKED
-5-70
DH

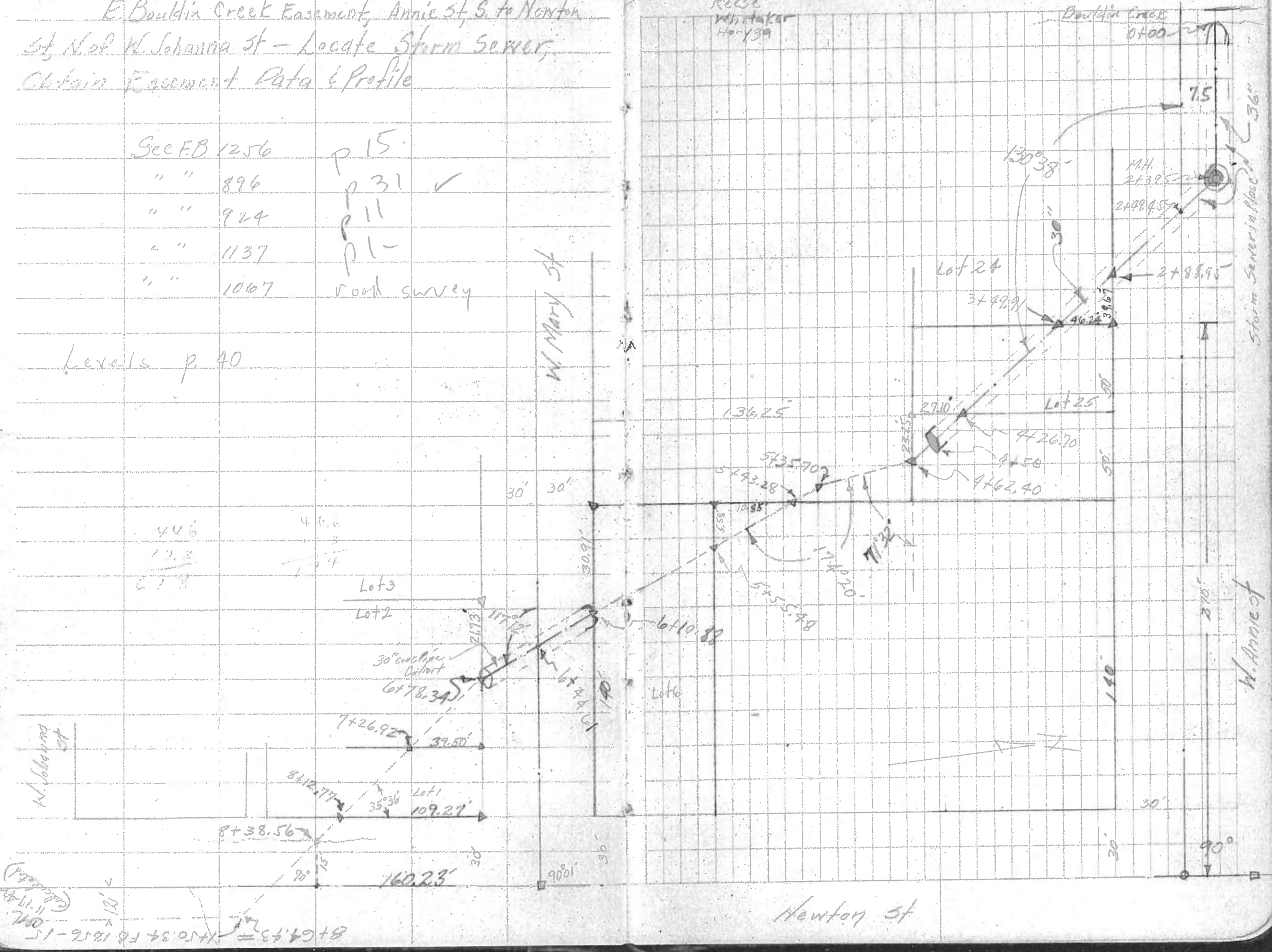
Young
McClamery
Reese
Whitaker
Hory 39

11/10/92

E. Bouldin Creek Easement, Annie St. S. to Newton St. N. of W. Johanna St. — Locate Storm Sewer, Obtain Easement Data & Profile

See F.B. 1256 p 15.
" " 896 p 31 ✓
" " 924 p 11
" " 1137 p 1–
" " 1067 road survey

Levels p. 40



FB 1371

INDEXED

Title & Sketch P. 39

M-234	0.73	563.17		562.44	
T.P.	0.00	551.59	11.58	551.59	
T.P.	2.57	544.79	9.37	542.22	
T.P.	0.18	531.92	13.05	531.74	
T.P.	0.94	519.83	13.03	518.89	
TBM Set	0.52	$\boxed{517.67}$	2.68	517.15	△ Cut on W. End Inlet S. Side W. Annie in Front of House #405
0+00			15.06	502.61	F.L. 36"
0+00			10.6	507.1	Ground
0+15			6.9	510.8	"
0+50			6.6	511.1	"
1+00			5.5	512.2	
1+50			4.3	513.4	
2+00					"
M.H 2+39.5			6.19	511.48	F.L.
2+39.5			1.0	516.7	Ground
T.P.	10.94	$\boxed{527.60}$	1.01	516.66	

M-235
566.85

		527.60			
2+50			10.5	517.1	"
2+68			10.4	517.2	"
2+79			8.3	519.3	
3+00			7.0	520.6	
3+20			6.6	521.0	
3+22			4.6	523.0	
3+50			4.2	523.4	
4+00			2.5	525.1	
4+50			1.3	526.3	"
4+58			1.3	526.3	"
T.P.	7.15	533.40	1.35	526.25	
4+58			11.10	522.3	F.L. 30"
P.I. 4+62.40			10.8	522.6	F.L. Ditch
5+00			9.8	523.6	" "

FB 1371

INDEXED

		$\boxed{533.40}$			
Rt. 5+35.70			8.4	525.0	″ ″
5+40			6.5	526.9	Ground
5+55			5.4	528.0	″
5+71			6.8	526.6	F.L. Ditch
6+10.88			6.6	526.8	″ ″
6+10.88			4.03	529.37	F.L. 30″
6+10.88			1.3	532.1	Ground
T.P.	11.67	$\boxed{543.80}$	1.27	532.13	
6+17			9.0	534.8	
6+27.4			6.65	537.15	Curb Inlet
6+27.4			7.83	535.97	Gut ″
℄ Mary 6+44.61			6.6	537.2	

FB 1371

		543.80				
6+61.8			7.70	536.10		Inlet Gut
6+61.8			6.51	537.29		" Curb
6+78.34			7.2	536.6		Ground
6+78.34			11.84	531.96		F.L. 30"
7+00			9.7	534.1		Ground
7+50			5.6	538.2		"
8+00			3.8	540.0		
PI. 8+12.77			2.8	541.0		
8+21			0.8	543.0		
8+31			0.0	543.8		"
8+38.56			1.4	542.4		F.L. W. Gut Newton
T.BM set	11.70	552.98	2.52	541.28		Knob on Mon Casting Mary & Newton
T.P.	13.18	565.96	0.20	552.78		
T.P.	3.56	568.14	1.38	564.58		
N/L 235			1.29	566.85	(566.85)	

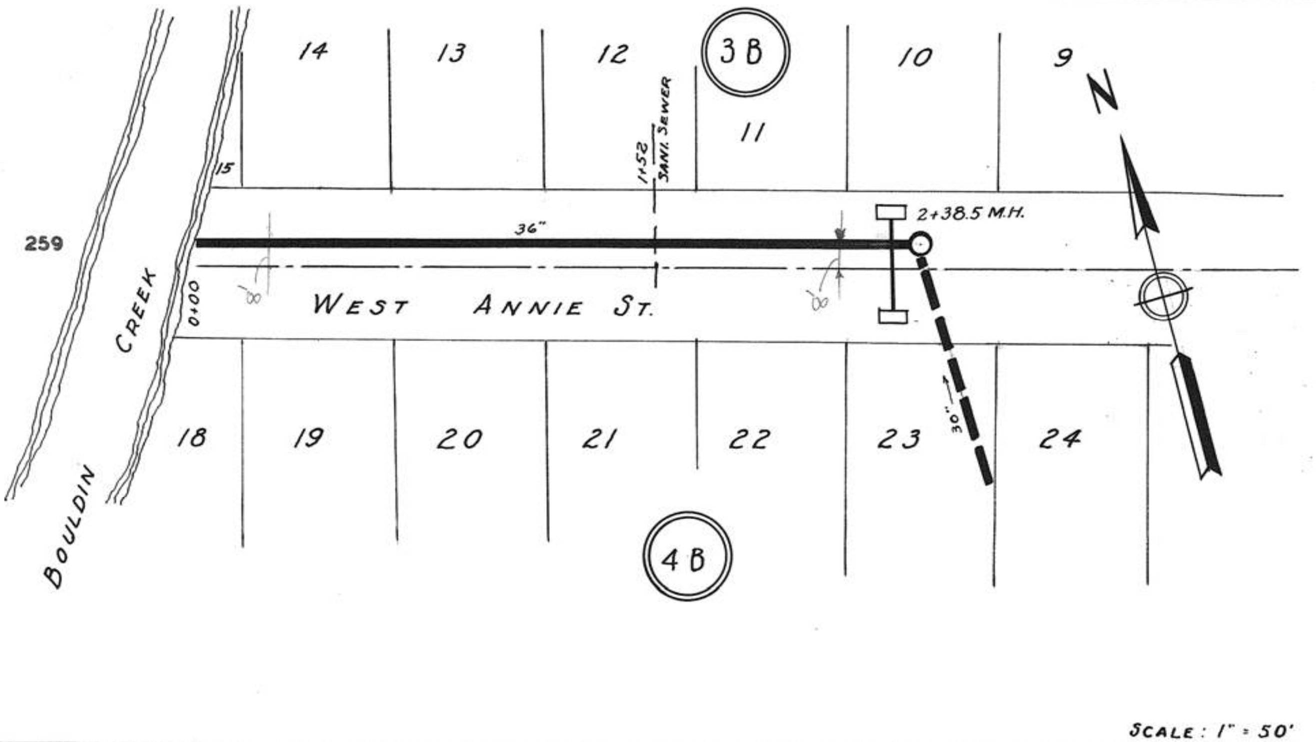
FORM ED-35N

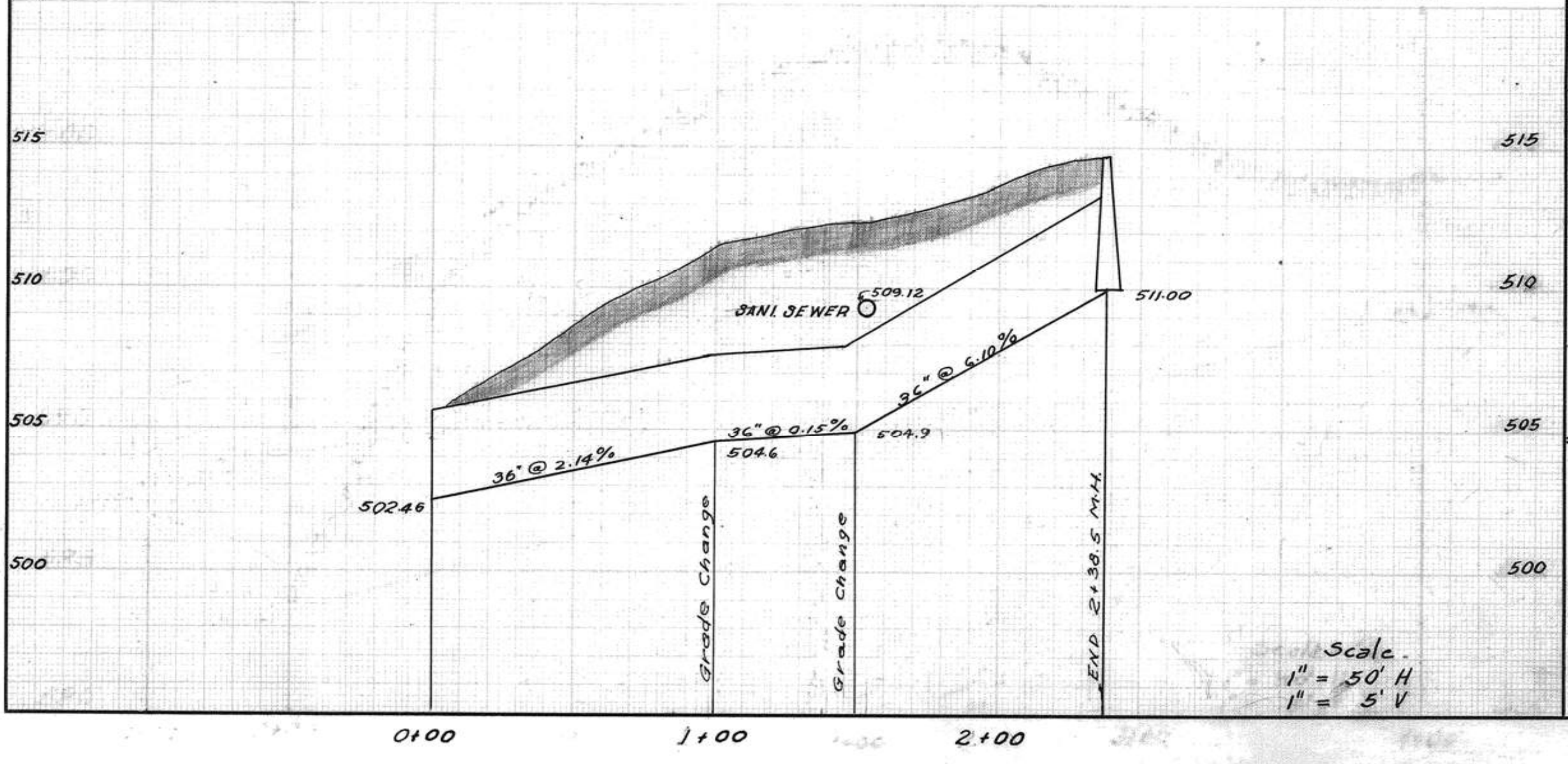
89

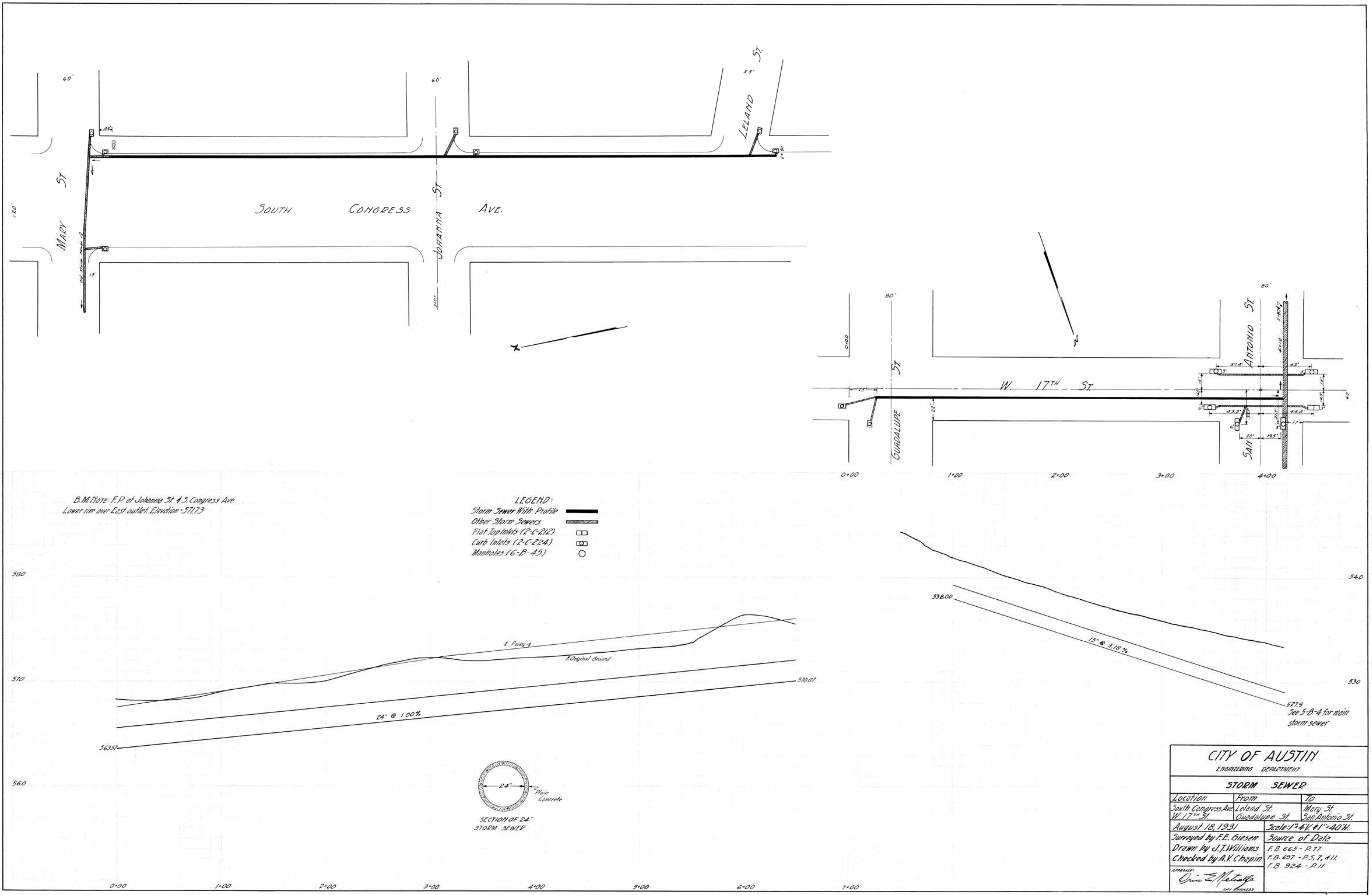
CITY OF AUSTIN, TEXAS
STORM SEWERS

LOCATION West Annie Street
FROM Lot 10 of 3B TO Boulden Creek
BUILT BY City Forces
DRAWN BY BEB 1941
WORK ORDER 19
CHECKED BY 19
SURVEYED BY J.M. Mitchell 1936
FIELD BOOK 896 PAGE 31

REMARKS	REVISIONS	W. O.	DATE	FD. BK.	PAGE
SECTION-122 & 123				1371	39







B.M. NOTE: F.P. at Johanna St. & S. Congress Ave.
Lower rim over East outlet. Elevation = 571.73

LEGEND:

Storm Sewer With Profile	▬
Other Storm Sewers	▨
Flat Top Inlets (2-C-212)	◫
Curb Inlets (2-C-224)	⊡
Manholes (6-B-45)	○

SECTION OF 24"
STORM SEWER

527.9
See 5-B-4 for main
storm sewer

CITY OF AUSTIN
ENGINEERING DEPARTMENT

STORM SEWER

Location	From	To
South Congress Ave. W. 17TH St.	Leland St. Guadalupe St.	Mary St. San Antonio St.

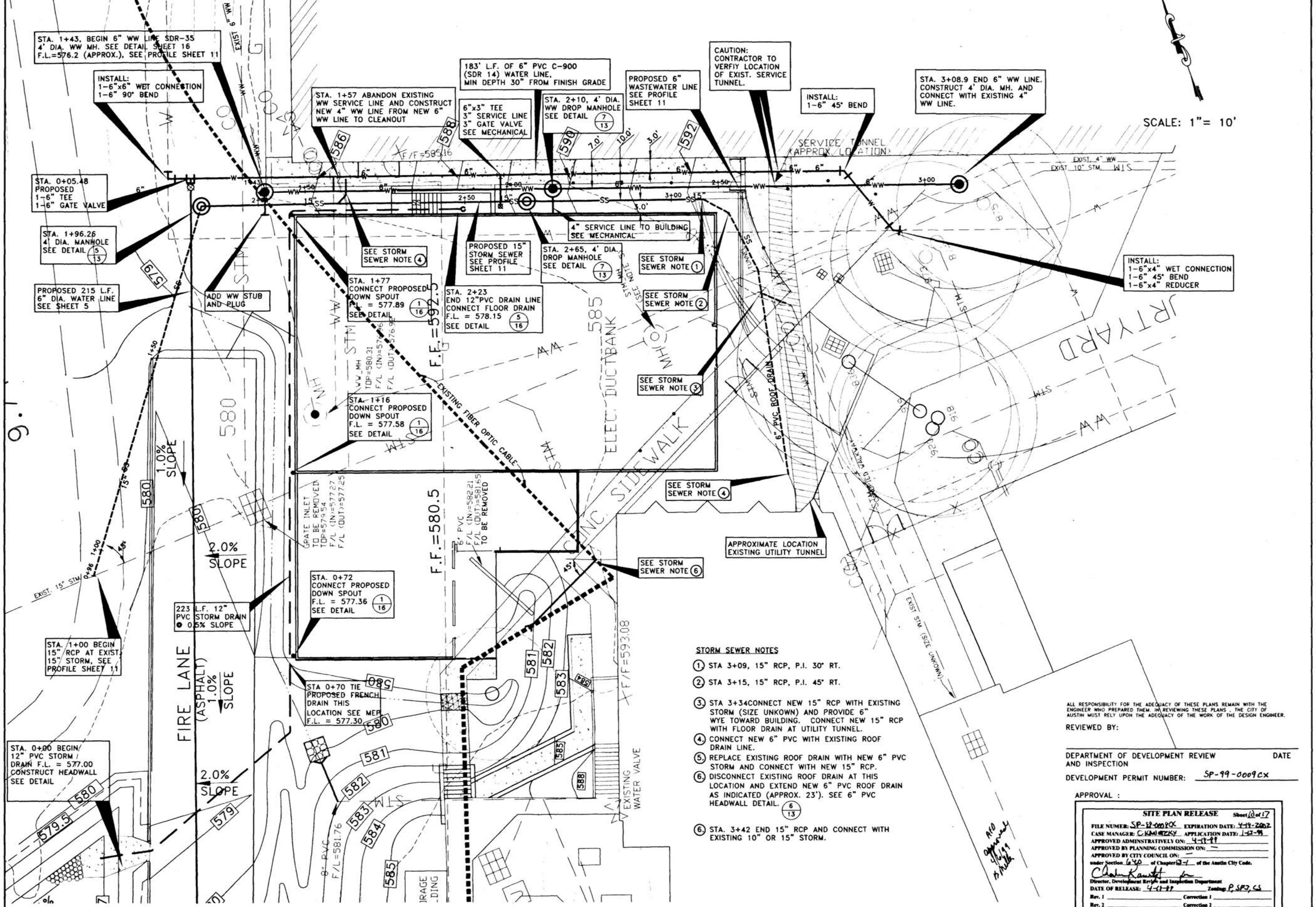
August 18, 1931
Scale: 1" = 4' V. & 1" = 40' H.

Surveyed by F.E. Giesen
Drawn by J.T. Williams
Checked by A.V. Chapin

Source of Data
F.B. 665 - P. 77
F.B. 697 - P. 5, 7, & 11.
F.B. 924 - P. 11

APPROVED:
Orin E. Metcalfe
CITY ENGINEER

168



STORM SEWER NOTES

① STA 3+09, 15" RCP, P.I. 30° RT.

② STA 3+15, 15" RCP, P.I. 45° RT.

③ STA 3+34CONNECT NEW 15" RCP WITH EXISTING STORM (SIZE UNKOWN) AND PROVIDE 6" WYE TOWARD BUILDING. CONNECT NEW 15" RCP WITH FLOOR DRAIN AT UTILITY TUNNEL.

④ CONNECT NEW 6" PVC WITH EXISTING ROOF DRAIN LINE.

⑤ REPLACE EXISTING ROOF DRAIN WITH NEW 6" PVC STORM AND CONNECT WITH NEW 15" RCP.

⑥ DISCONNECT EXISTING ROOF DRAIN AT THIS LOCATION AND EXTEND NEW 6" PVC ROOF DRAIN AS INDICATED (APPROX. 23'). SEE 6" PVC HEADWALL DETAIL. 6/13

⑥ STA. 3+42 END 15" RCP AND CONNECT WITH EXISTING 10" OR 15" STORM.

AFD approved 4/6/99 B. Mills

ALL RESPONSIBILITY FOR THE ADEQUACY OF THESE PLANS REMAIN WITH THE ENGINEER WHO PREPARED THEM. IN REVIEWING THESE PLANS , THE CITY OF AUSTIN MUST RELY UPON THE ADEQUACY OF THE WORK OF THE DESIGN ENGINEER.

REVIEWED BY:

DEPARTMENT OF DEVELOPMENT REVIEW AND INSPECTION DATE

DEVELOPMENT PERMIT NUMBER: SP-99-0009CX

APPROVAL :

SITE PLAN RELEASE Sheet 10 of 17

FILE NUMER: SP-99-0009CX EXPIRATION DATE: 4-19-2002
CASE MANAGER: C. KAWIECKY APPLICATION DATE: 1-12-99
APPROVED ADMINSTRATIVELY ON: 4-19-99
APPROVED BY PLANNING COMMISSION ON: —
APPROVED BY CITY COUNCIL ON: —
under Section 640 of Chapter 13-1 of the Austin City Code.
Chalen Kawitt for
Director, Development Review and Inspection Department
DATE OF RELEASE: 4-19-99 Zoning: P, SP3, CS
Rev. 1 ______ Correction 1 ______
Rev. 2 ______ Correction 2 ______
Rev. 3 ______ Correction 3 ______

NO.	CORRECTION DESCRIPTION	APPROVED BY	DATE
	CORRECTION		

RAYMOND M. CHAN 51415
Raymond Chan 4-5-99

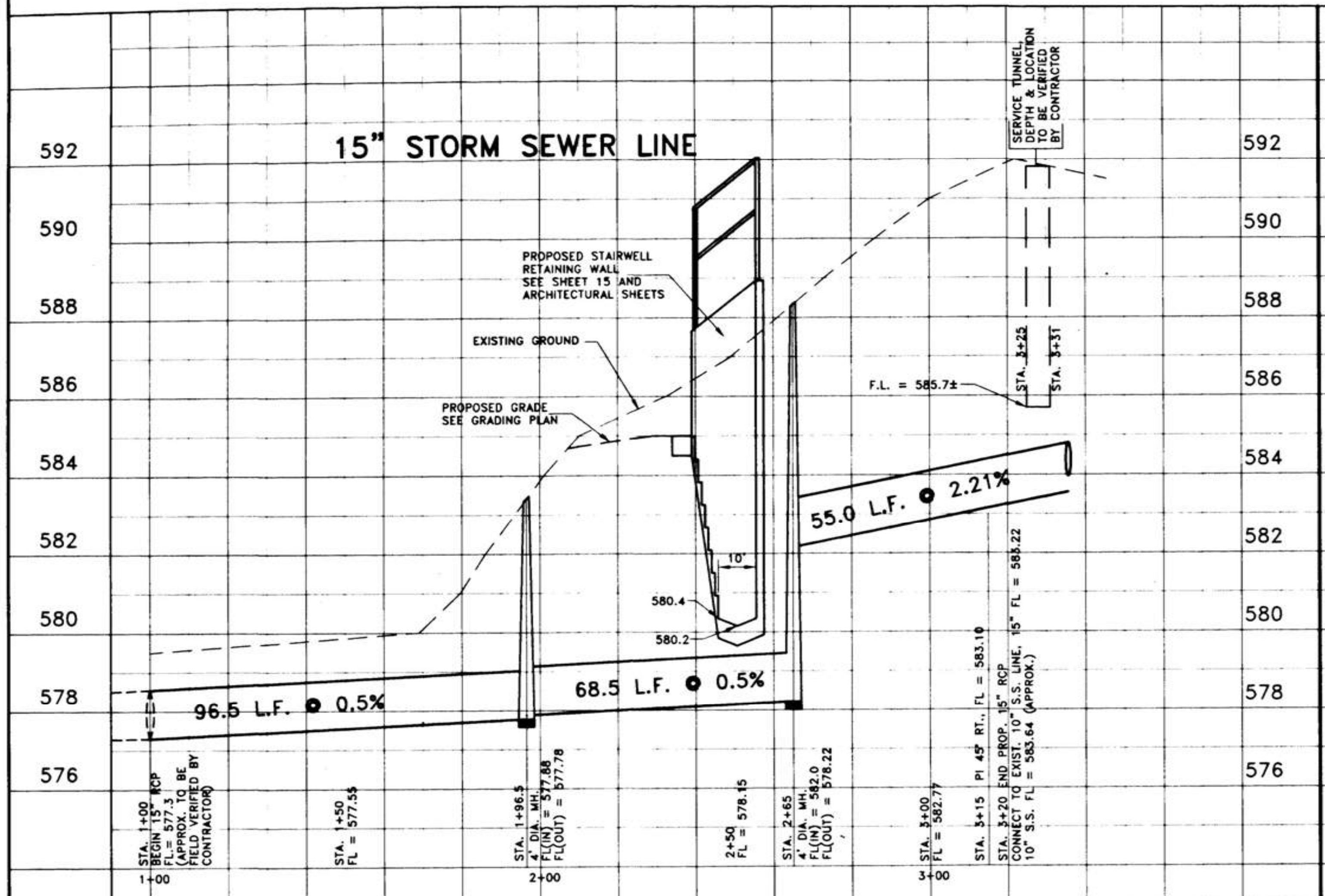
RAYMOND CHAN & ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS
1102 WEST AVENUE
AUSTIN, TEXAS 78701
PH. (512) 480-8155 FAX (512) 480-8811
E-MAIL : raymondc@rchanassociates.com

JOB: 201 EAST MARY STREET FULMORE MIDDLE SCHOOL BUILDING ADDITIONS AND RENOVATIONS
PROJECT: SITE DEVELOPMENT
SHEET: UTILITY PLAN

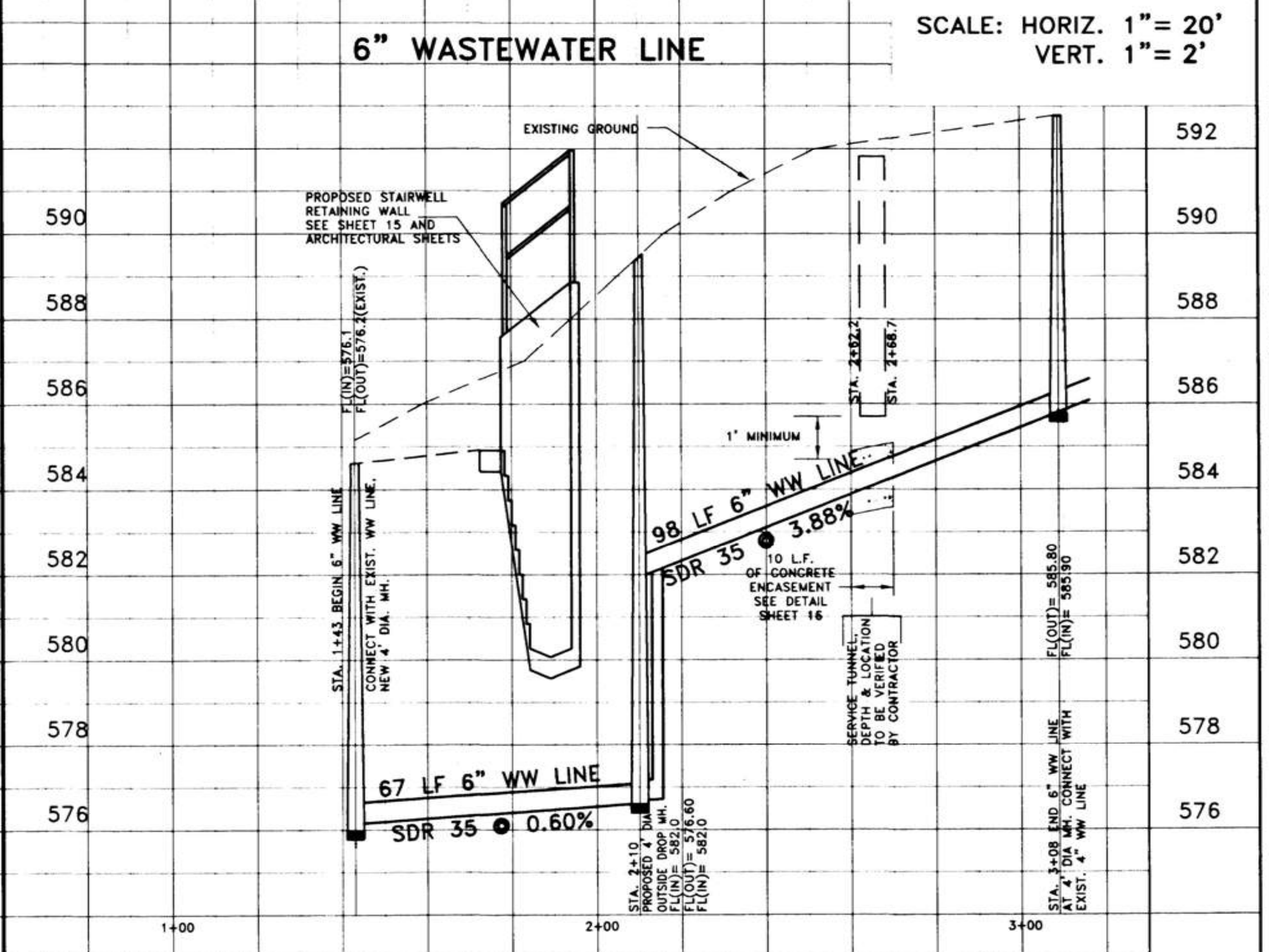
DATE: 02/01/99
UPDATED: XX/XX/XX
DESIGN: RC
DRAWN: JG
CHECKED: RC
CADD FILE: 10-UTILITY
CADD DIRECTORY: 01-JOBS\333-FULM

SHEET
10
OF
17

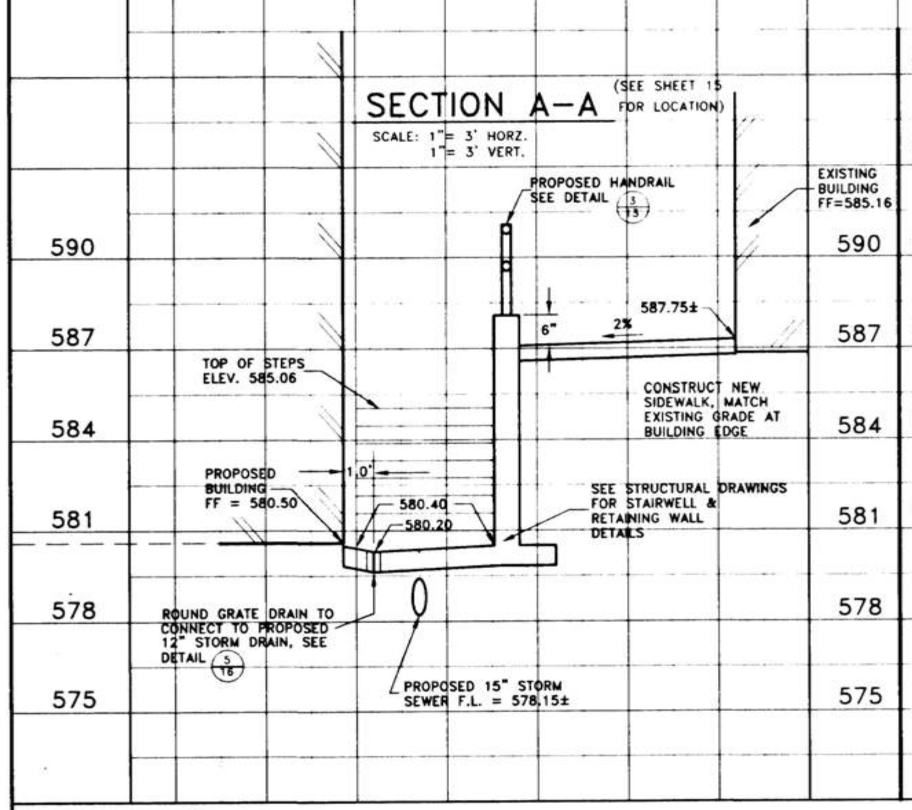
SCALE: HORIZ. 1"= 20'
VERT. 1"= 2'



15" STORM SEWER LINE



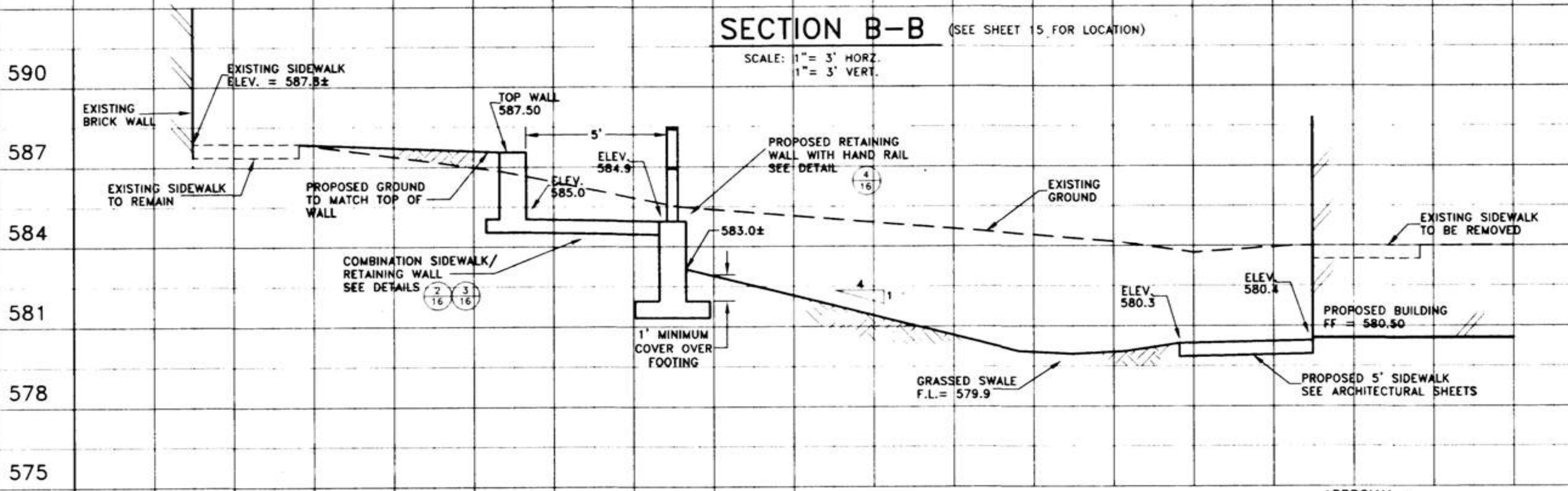
6" WASTEWATER LINE



SECTION A–A

(SEE SHEET 15 FOR LOCATION)

SCALE: 1"= 3' HORZ.
1"= 3' VERT.



SECTION B–B

(SEE SHEET 15 FOR LOCATION)

SCALE: 1"= 3' HORZ.
1"= 3' VERT.

ALL RESPONSIBILITY FOR THE ADEQUACY OF THESE PLANS REMAIN WITH THE ENGINEER WHO PREPARED THEM. IN REVIEWING THESE PLANS, THE CITY OF AUSTIN MUST RELY UPON THE ADEQUACY OF THE WORK OF THE DESIGN ENGINEER.

REVIEWED BY:

DEPARTMENT OF REVIEW AND INSPECTION DATE

DEVELOPMENT PERMIT NUMBER: SP-99-0009CX

APPROVAL :

SITE PLAN RELEASE Sheet 11 of 17

FILE NUMER: SP-99-0009CX EXPIRATION DATE: 4-19-2002
CASE MANAGER: C KANETZKY APPLICATION DATE: 1-13-99
APPROVED ADMINSTRATIVELY ON: 4-19-99
APPROVED BY PLANNING COMMISSION ON: –
APPROVED BY CITY COUNCIL ON: –
under Section 640 of Chapter 13-1 of the Austin City Code.
Clark Kanetzky for
Director, Development Review and Inspection Department
DATE OF RELEASE: 4-19-99 Zoning: P, SF3, CS
Rev. 1 ______ Correction 1 ______
Rev. 2 ______ Correction 2 ______
Rev. 3 ______ Correction 3 ______

NO.	CORRECTION DESCRIPTION	CORRECTION	APPROVED BY	DATE

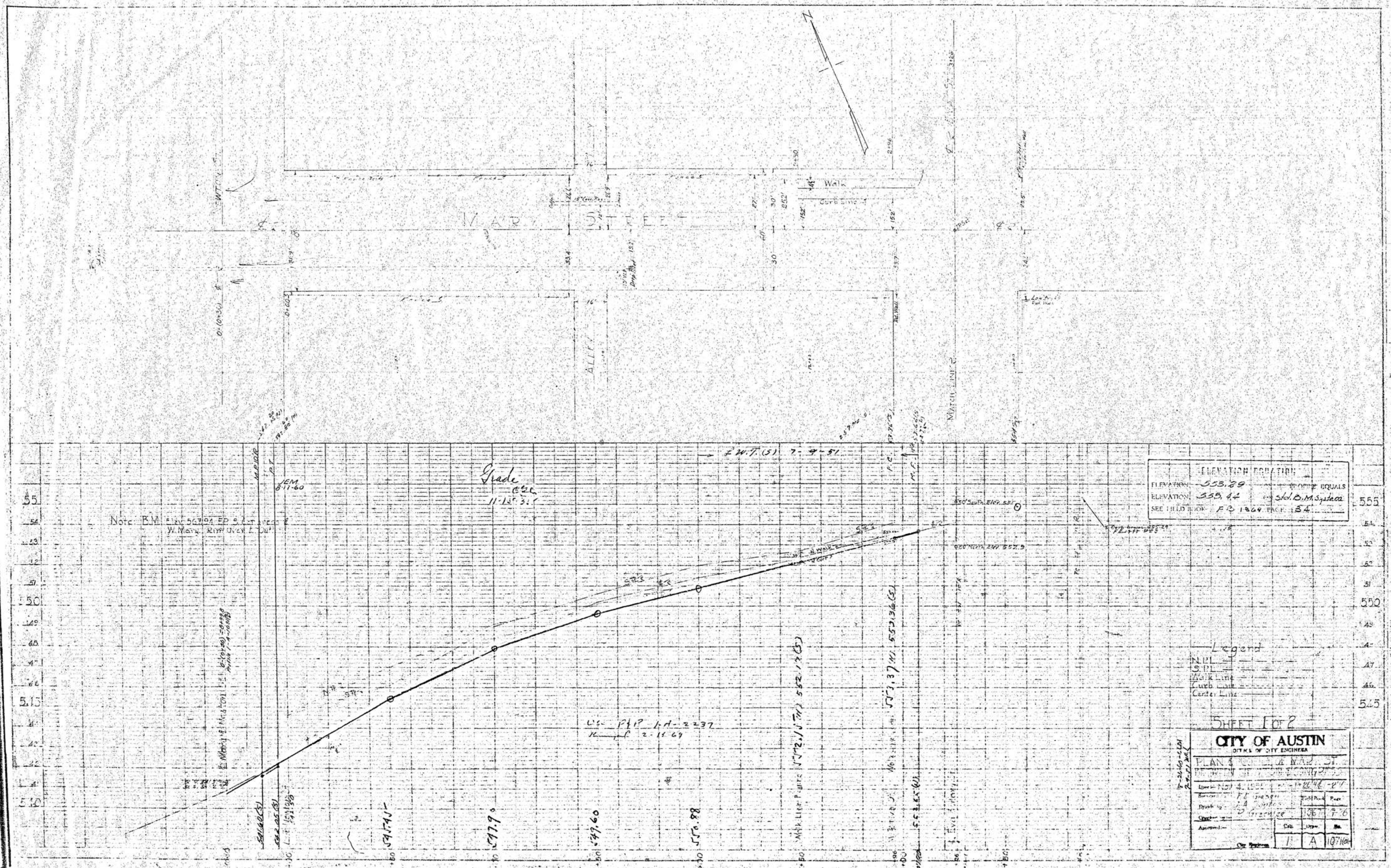
RAYMOND M. CHAN
51415
Raymond Chan
4-5-99

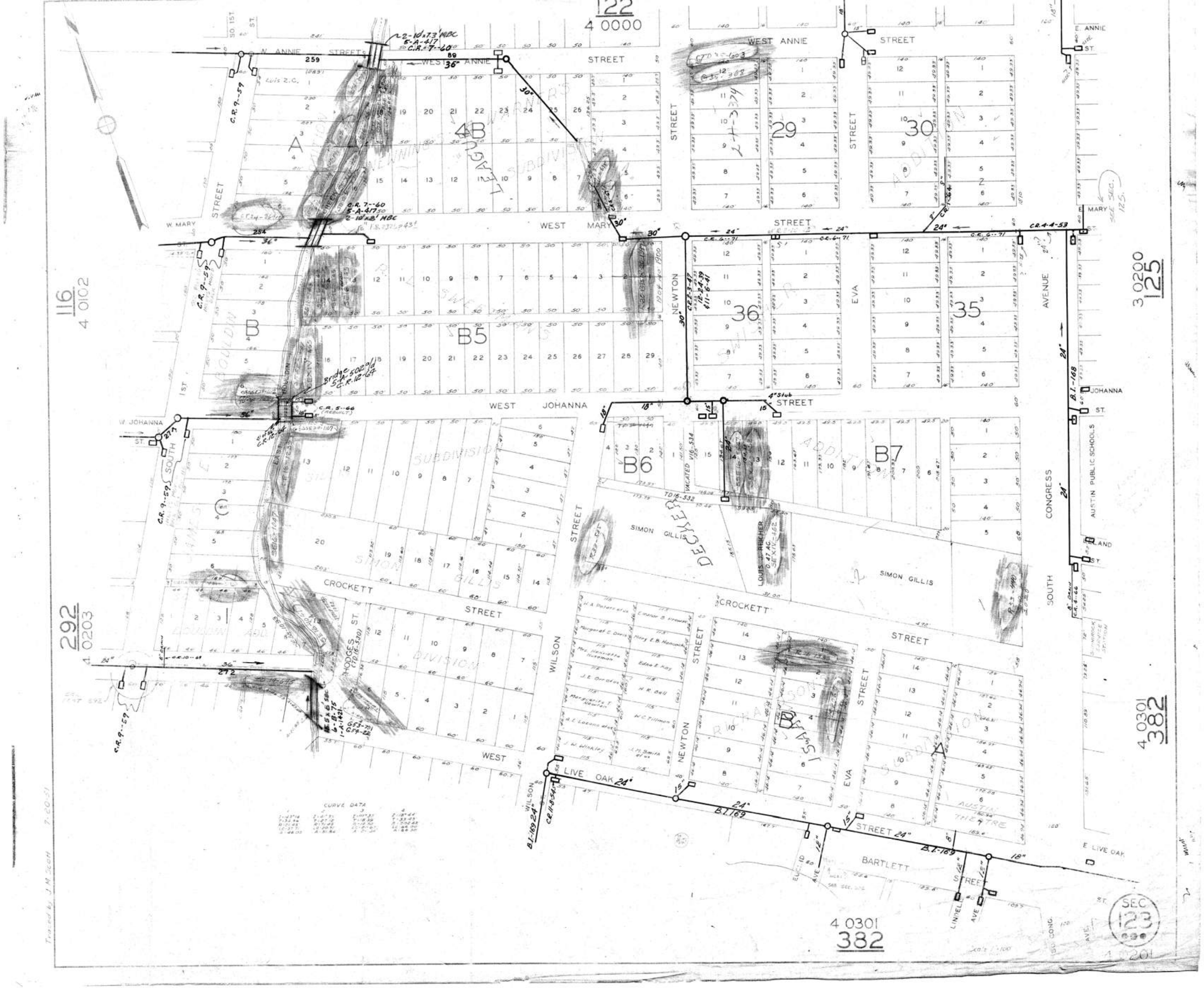
RAYMOND CHAN & ASSOCIATES, INC.
CONSULTING CIVIL ENGINEERS
1102 WEST AVENUE
AUSTIN, TEXAS 78701
PH. (512) 480-8155 FAX (512) 480-8811
E-MAIL : raymondc@rchanassociates.com

JOB: 201 EAST MARY STREET
FULMORE MIDDLE SCHOOL
BUILDING ADDITIONS AND RENOVATIONS
PROJECT: SITE DEVELOPMENT
SHEET: STORM SEWER AND WASTEWATER PROFILE

DATE: 02/01/99
UPDATED: XX/XX/XX
DESIGN: RC
DRAWN: MJ
CHECKED: RC
CADD FILE: 11-UTPROF
CADD DIRECTORY: 01-JOBS\333-FULM

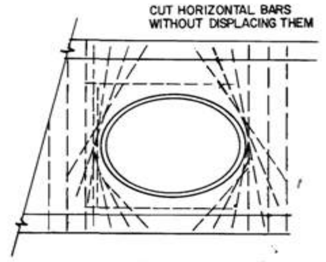
SHEET
11
OF
17


N
Mary Street
Alley
Fence
Walk
Curb Line
Match Line
Grade
11-13-51
JEM
8-11-60
Note: B.M. Elev. 567.04 E.D. & Cut Cross
W. Mary, Rim Over E. Out
U.S. P.I.P. LA-2237
2-11-69
Walk Line Points
ELEVATION EQUATION:
ELEVATION 553.29 PROFILE EQUALS
ELEVATION 555.44 Std. B.M. System
SEE FIELD BOOK FB 1364 PAGE 54
Legend
N.P.L.
S.P.L.
Walk Line
Curb Line
Center Line
555
550
545
540
541.45
547.90
549.60
550.98
552.17
553.37
553.36
Sheet 1 of 2
CITY OF AUSTIN
OFFICE OF CITY ENGINEER
PLAN & PROFILE OF MARY ST.
BETWEEN ST. ... & CONGRESS
Date Nov. 4, 1951
Surveyed by F.E. Granger
Drawn by J.A. ...
Checked by G. Granger
Field Book 1367
Page 76
Approved:
City Engineer
Cab. 1
Drw. A
No. 1071(a)

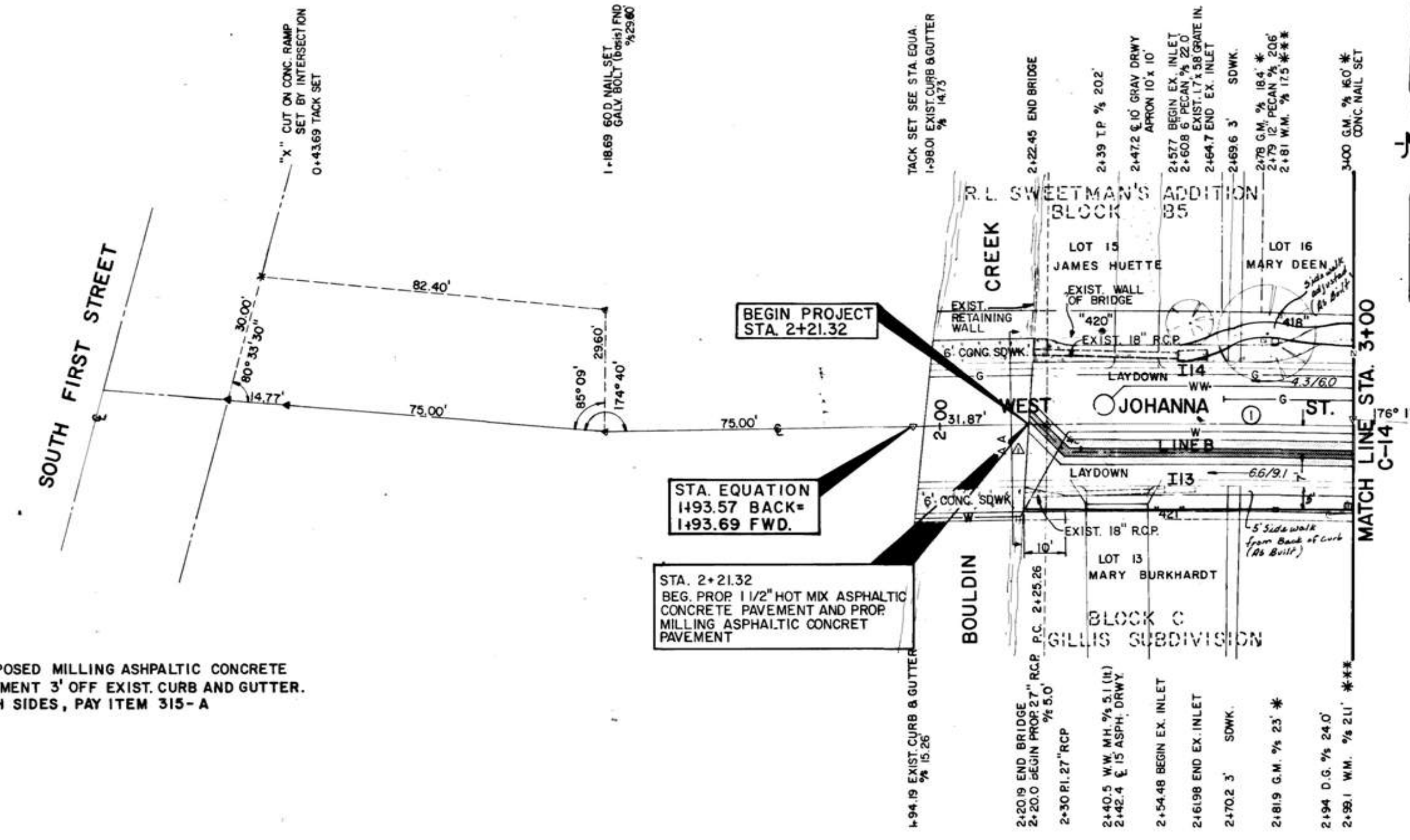


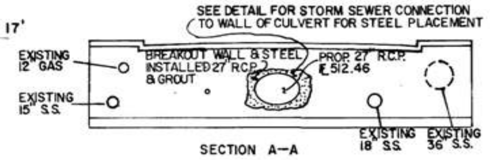
122
4 0000
116
4 0102
292
0203
3 0200
125
4 0301
382
4 0301
382
SEC
123
W. ANNIE STREET
WEST ANNIE STREET
WEST MARY STREET
W. MARY
E. MARY ST.
E. ANNIE ST.
WEST JOHANNA STREET
W. JOHANNA ST.
JOHANNA ST.
CROCKETT STREET
WEST LIVE OAK STREET
E LIVE OAK
BARTLETT STREET
NEWTON STREET
EVA STREET
WILSON STREET
SOUTH CONGRESS AVENUE
SOUTH 1ST STREET
HODGES ST.
EUCLID AVE.
LINDELL AVE.
AUSTIN PUBLIC SCHOOLS
ELAND ST.
NEWNING'S SUBDIVISION
SWISHER ADDITION
DECKER LEAGUE
SIMON GILLIS
LOUIS HEICHER
RICHARDSON SUBDIVISION
AUSTIN THEATRE
4B
B5
B6
B7
29
30
35
36
A
B
C
Bridge
CURVE DATA
36"
30"
24"
18"
15"
12"
C.R. 7-60
C.R. 9-59
C.R. 4-4-53
B.I. 168
B.I. 169
2-10'x13' MBC
2-10'x8' MBC

PLAN		BY	DATE
NOTE BOOK No. 3580	SURVEYED	KURTYKA	8/83
	PLOTTED	C. STULL	5/84
	ALIGNMENT CHECKED		
	RT. OF WAY CHECKED		



DETAIL FOR STORM SEWER CONNECTION TO WALL OF CULVERT





SECTION A—A

PLAN LEGEND

DESCRIPTION	ABBREV.	SYMBOL
HUB SET	H.S.	○
CONC. MONUMENT	C.M.	■
NAIL		▲
IRON PIPE OR STEEL PIN	I.P./S.P.	●
BENCH MARK	B.M.	X
BORING		◎
WATER VALVE	W.V.	●
GAS VALVE	G.V.	∅
WATER METER	W.M.	□
GAS METER	G.M.	▣
ELECTRIC METER	E.M.	▫
TELEPHONE PEDESTAL	TEL. PED.	■
FIRE HYDRANT	F.H.	●
MAILBOX	M.B.	⊖
TELEPHONE OR POWER POLE	T.P./P.P.	◆
DOWN GUY	D.G.	→
MANHOLE COVER	M.H.	○
SIGN POST	SIGN	▽
WASTEWATER CLEAN OUT	C.O.	○
TRAFFIC SIGNAL POLE	T.S.P.	□
TRAFFIC CONTROLLER BOX	T.C.B.	⊠
TREE		✿
WIRE FENCE	——X——X——X——	
WOOD FENCE	——//——//——//——	
WATER LINE	——W——	
WASTEWATER LINE	——WW——	
GAS LINE	——G——	
EXIST. CURB & GUTTER	= = = = =	
BURIED TELEPHONE LINE	——T——	
BURIED ELECTRIC LINE	——E——	

TREE TO BE REMOVED ✿

NOTE: PROPOSED MILLING ASHPALTIC CONCRETE PAVEMENT 3' OFF EXIST. CURB AND GUTTER. BOTH SIDES, PAY ITEM 315-A

EXISTING CURVE DATA

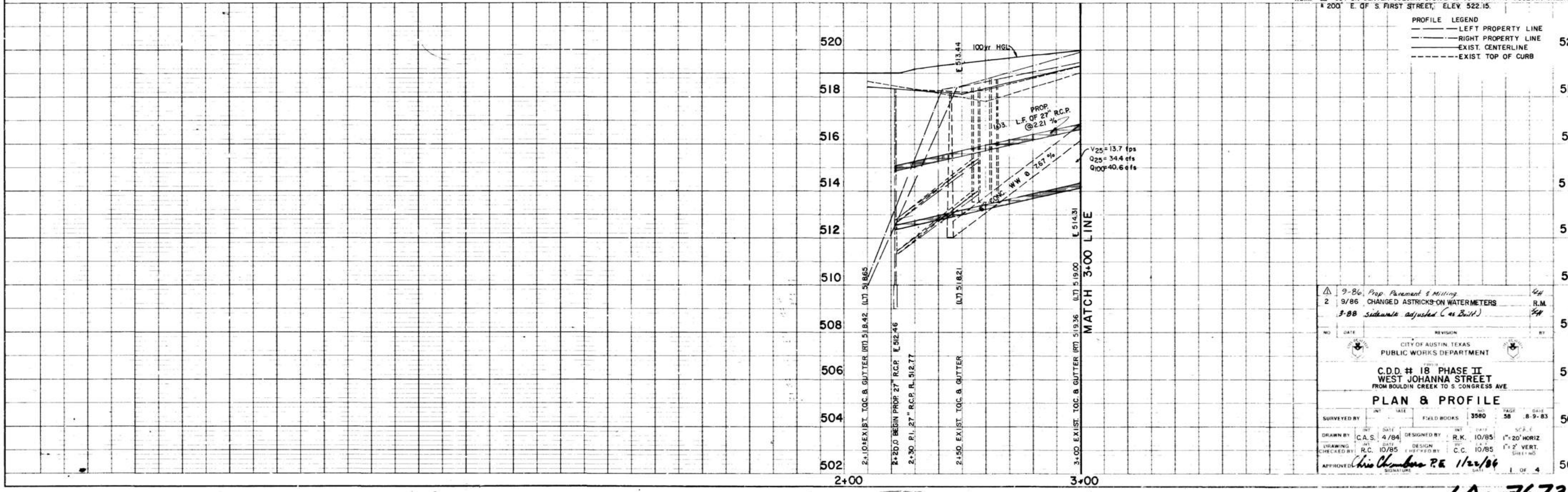
①

Δ 3° 32'
R 2,431.91'
T 75.00'
A 149.97'
C 149.95'

* TO BE ADJUSTED OR REMOVED BY OTHERS
** TO BE REMOVED BY CONTRACTOR
*** TO BE ADJUSTED BY CONTRACTOR

F.B. 3580 PG. 67
T.B.M. "Δ" CUT ON CENTER COLUMN S. SIDE W. JOHANNA AT BOULDIN CREEK ± 200' E. OF S. FIRST STREET, ELEV. 522.15

PROFILE		BY	DATE
NOTE BOOK No. 3580	SURVEYED	KURTYKA	8/83
	PLOTTED	C. STULL	5/84
	GRADES CHECKED		
	B.M.'s NOTED		
	STRUCTURE LOCATIONS CHECKED		



PROFILE LEGEND
———— LEFT PROPERTY LINE
—·—·— RIGHT PROPERTY LINE
—·—·— EXIST. CENTERLINE
– – – – EXIST. TOP OF CURB

NO	DATE	REVISION	BY
△	9-86	Prop. Pavement & Milling	4H
2	9/86	CHANGED ASTRICKS ON WATERMETERS	R.M.
	3-88	sidewalk adjusted (as Built)	4H

CITY OF AUSTIN, TEXAS
PUBLIC WORKS DEPARTMENT

C.D.D. # 18 PHASE II
WEST JOHANNA STREET
FROM BOULDIN CREEK TO S. CONGRESS AVE

PLAN & PROFILE

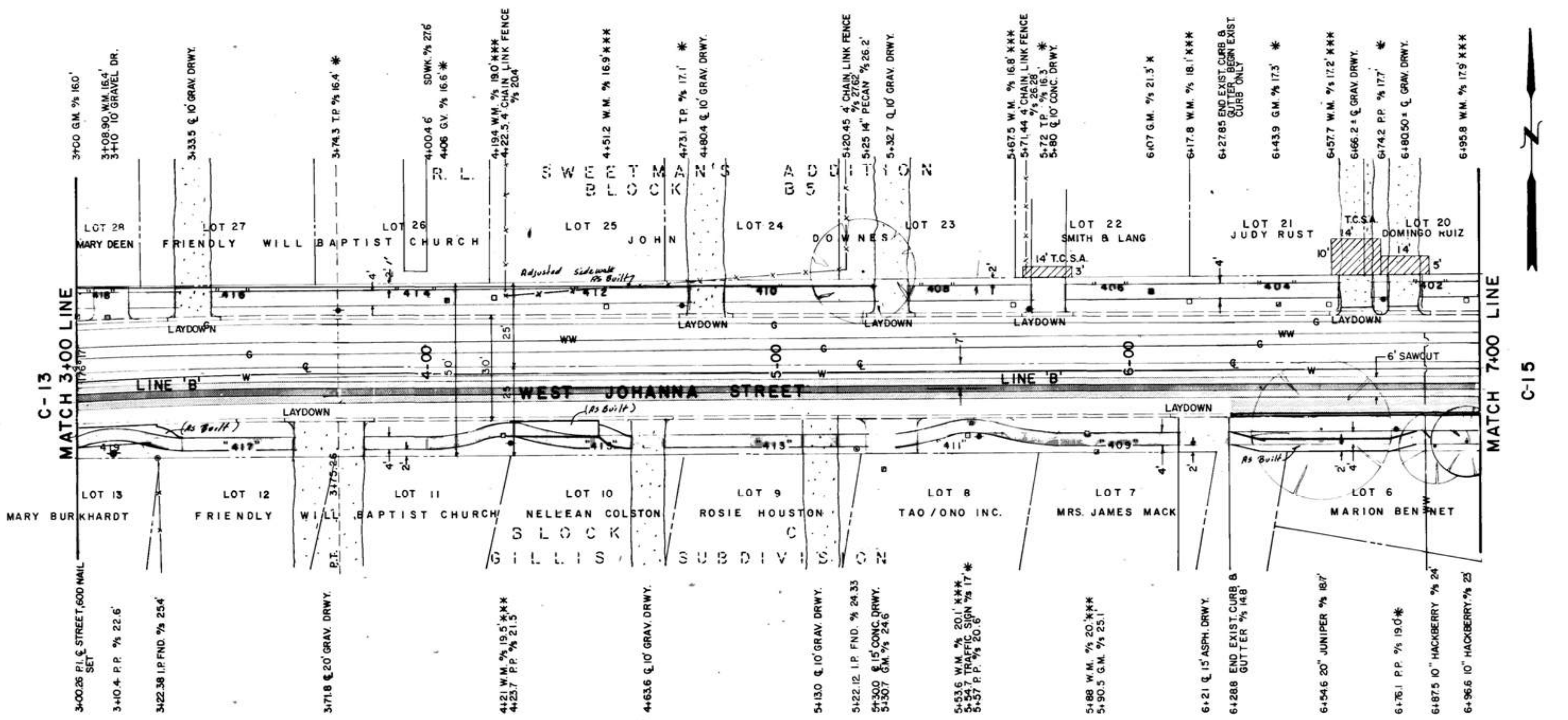
SURVEYED BY	INT	DATE	FIELD BOOKS	NO. 3580	PAGE 58	DATE 8-9-83
DRAWN BY	C.A.S.	4/84	DESIGNED BY	R.K.	10/85	SCALE 1" = 20' HORIZ
DRAWING CHECKED BY	R.C.	10/85	DESIGN CHECKED BY	C.C.	10/85	1" = 2' VERT.

APPROVED Chris Chambers P.E. 1/22/86 SIGNATURE DATE

SHEET NO. 1 OF 4

1A C-13 7673 (W)

PLAN
NOTE BOOK No. 3580
SURVEYED / PLOTTED / ALIGNMENT CHECKED / RT. OF WAY CHECKED
KURTYKA 8/83
C.STULL 4/84



F.B. 3580 PG. 67
T.B.M. X ON ARC OF CURB AT S.W. CORNER
WEST JOHANNA & WILSON STREETS
ELEV. 554.53

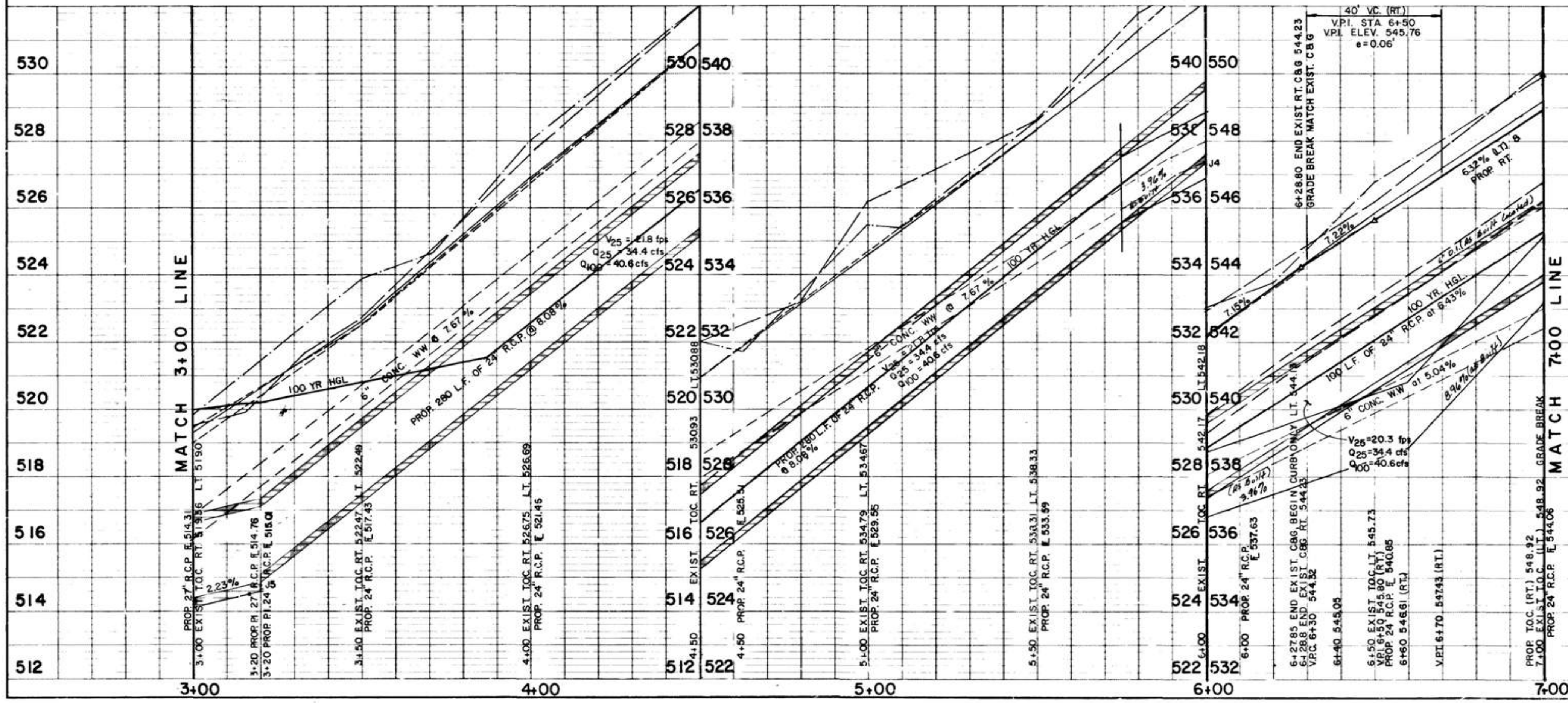
PLAN LEGEND

DESCRIPTION	ABBREV.	SYMBOL
HUB SET	H.S.	○
CONC. MONUMENT	C.M.	■
NAIL		▲
IRON PIPE OR STEEL PIN	I.P./S.P.	•
BENCH MARK	B.M.	X
BORING		◉
WATER VALVE	W.V.	●
GAS VALVE	G.V.	ø
WATER METER	W.M.	▫
GAS METER	G.M.	▪
ELECTRIC METER	E.M.	▫
TELEPHONE PEDESTAL	TEL.PED.	■
FIRE HYDRANT	F.H.	●
MAILBOX	M.B.	⊖
TELEPHONE OR POWER POLE	T.P./P.P.	◆
DOWN GUY	D.G.	→
MANHOLE COVER	M.H.	○
SIGN POST	SIGN	▽
WASTEWATER CLEAN OUT	C.O.	○
TRAFFIC SIGNAL POLE	T.S.P.	□
TRAFFIC CONTROLLER BOX	T.C.B.	⊠
TREE		✿
WIRE FENCE		——X——X——X——
WOOD FENCE		——//——//——//——
WATER LINE		——W——
WASTEWATER LINE		——WW——
GAS LINE		——G——
EXIST. CURB & GUTTER		= = = = =
BURIED TELEPHONE LINE		——T——
BURIED ELECTRIC LINE		——E——
BURIED TELEVISION LINE		——TV——
PROPERTY LINE		—— — — ——

* TO BE ADJUSTED OR REMOVED BY OTHERS
** TO BE REMOVED BY CONTRACTOR
*** TO BE ADJUSTED BY CONTRACTOR

TEMP. CONST. SPACE AGREEMENT T.C.S.A. ▨

PROFILE
NOTE BOOK No. 3580
SURVEYED / PLOTTED / GRADE CHECKED / R.W. NOTED / STRUCTURE LOCATIONS CHECKED
KURTYKA 8/83
C.STULL 4/84



PROFILE LEGEND
— — — — LEFT PROPERTY LINE
— · — · — RIGHT PROPERTY LINE
— — - — — EXIST. CENTERLINE
- - - - - - EXIST. TOP OF CURB

NO.	DATE	REVISION	BY
△	9-86	Prop. Pavement & Milling	
2	9/86	CHANGED ASTRICKS ON WATER METERS	R.M.
	3-88	Changed Pipe grade - adjust sidewalk (As Built)	

CITY OF AUSTIN TEXAS
PUBLIC WORKS DEPARTMENT

C.D.D. # 18 PHASE II
WEST JOHANNA STREET
FROM BOULDIN CREEK TO S CONGRESS AVE.

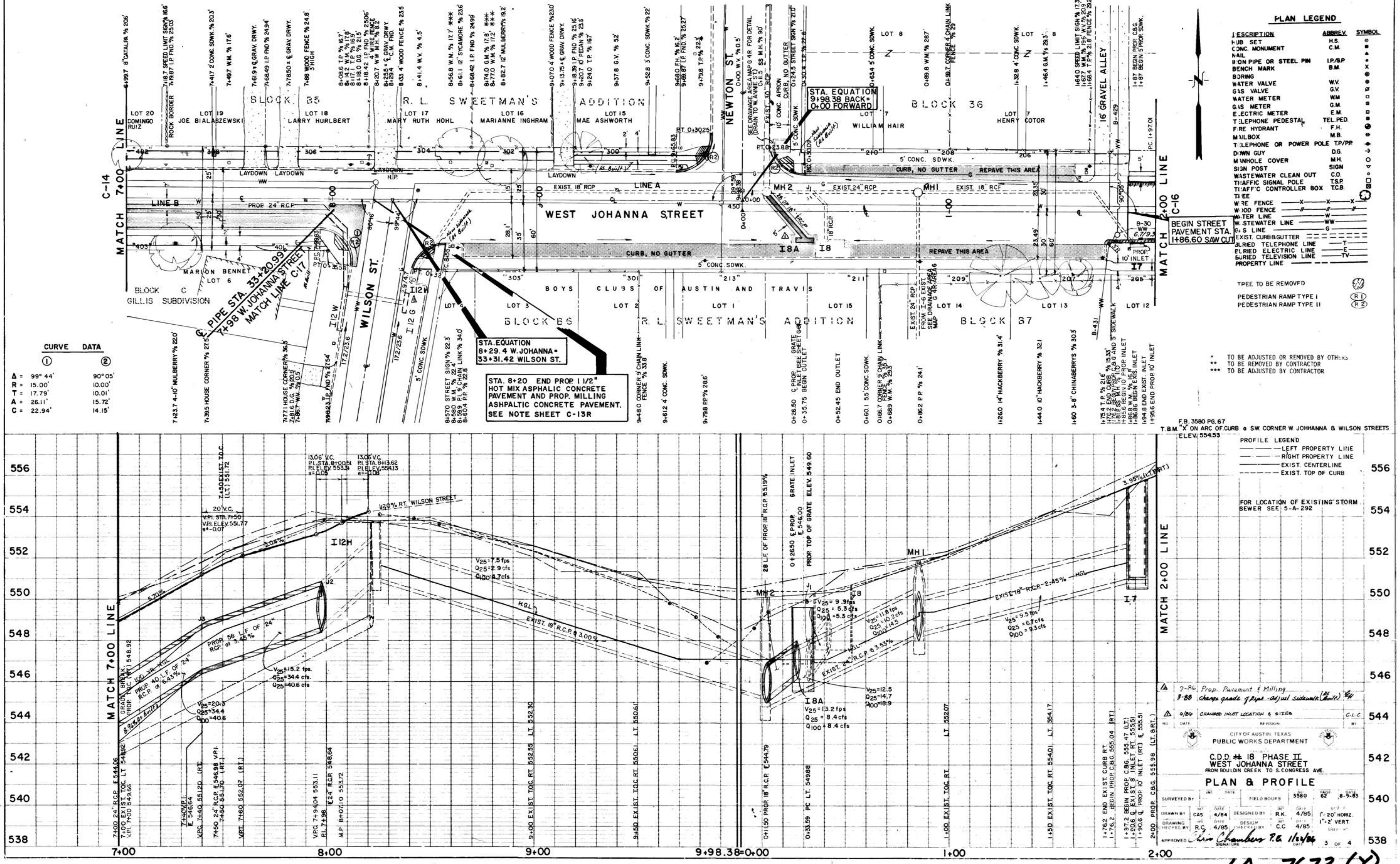
PLAN & PROFILE

	INT	DATE		INT	DATE	
SURVEYED BY			FIELD BOOKS	NO. 3580	PAGE 59	DATE 8-9-83
DRAWN BY	C.A.S.	4/84	DESIGNED BY	R.K.	4/85	SCALE 1" = 20' HORIZ.
DRAWING CHECKED BY	R.C.	4/85	DESIGN CHECKED BY	C.C.	4/95	1" = 2' VERT.
APPROVED	Chris Chambers P.E.	11/26/86				SHEET NO. 2 OF 4

1A 7673 (X) C-14R

PLAN	BY	DATE
SURVEYED	KURTYKA	8/83
PLOTTED	C. STULL	4/84
ALIGNMENT CHECKED		
RT. OF WAY CHECKED		
NOTE BOOK No. 3580		

PROFILE	BY	DATE
SURVEYED	KURTYKA	8/83
PLOTTED	C. STULL	4/84
GRADES CHECKED		
R.W. NOTED		
STRUCTURE LOCATIONS CHECKED		
NOTE BOOK No. 3580		



CURVE DATA

	①	②
Δ =	99° 44'	90° 05'
R =	15.00'	10.00'
T =	17.79'	10.01'
A =	26.11'	15.72'
C =	22.94'	14.15'

PLAN LEGEND

DESCRIPTION	ABBREV.	SYMBOL
HUB SET	H.S.	⊙
CONC. MONUMENT	C.M.	■
NAIL		▲
IRON PIPE OR STEEL PIN	I.P./S.P.	•
BENCH MARK	B.M.	X
BORING		◉
WATER VALVE	W.V.	●
GAS VALVE	G.V.	ø
WATER METER	W.M.	▫
GAS METER	G.M.	▪
ELECTRIC METER	E.M.	▫
TELEPHONE PEDESTAL	TEL.PED.	■
FIRE HYDRANT	F.H.	●
MAILBOX	M.B.	⊖
TELEPHONE OR POWER POLE	T.P./P.P.	◆
DOWN GUY	D.G.	→
MANHOLE COVER	M.H.	○
SIGN POST	SIGN	▽
WASTEWATER CLEAN OUT	C.O.	∘
TRAFFIC SIGNAL POLE	T.S.P.	□
TRAFFIC CONTROLLER BOX	T.C.B.	⊠
TREE		✿
WIRE FENCE		——X——X——X——
WOOD FENCE		——//——//——//——
WATER LINE		——W——
WASTEWATER LINE		——WW——
GAS LINE		——G——
EXIST. CURB & GUTTER		= = = = =
BURIED TELEPHONE LINE		——T——
BURIED ELECTRIC LINE		——E——
BURIED TELEVISION LINE		——TV——
PROPERTY LINE		—— — — ——

TREE TO BE REMOVED	✿
PEDESTRIAN RAMP TYPE I	(R1)
PEDESTRIAN RAMP TYPE II	(R2)

* TO BE ADJUSTED OR REMOVED BY OTHERS
** TO BE REMOVED BY CONTRACTOR
*** TO BE ADJUSTED BY CONTRACTOR

PROFILE LEGEND

- — — — — LEFT PROPERTY LINE
- — — — — RIGHT PROPERTY LINE
- ———— EXIST. CENTERLINE
- — — — — EXIST. TOP OF CURB

NO.	DATE	REVISION	BY
△	9-86 3-88	Prop. Pavement & Milling change grade of pipe - adjust sidewalk (As Built)	EH
△	6/86	CHANGED INLET LOCATION & SIZES	C.L.C.

CITY OF AUSTIN, TEXAS
PUBLIC WORKS DEPARTMENT

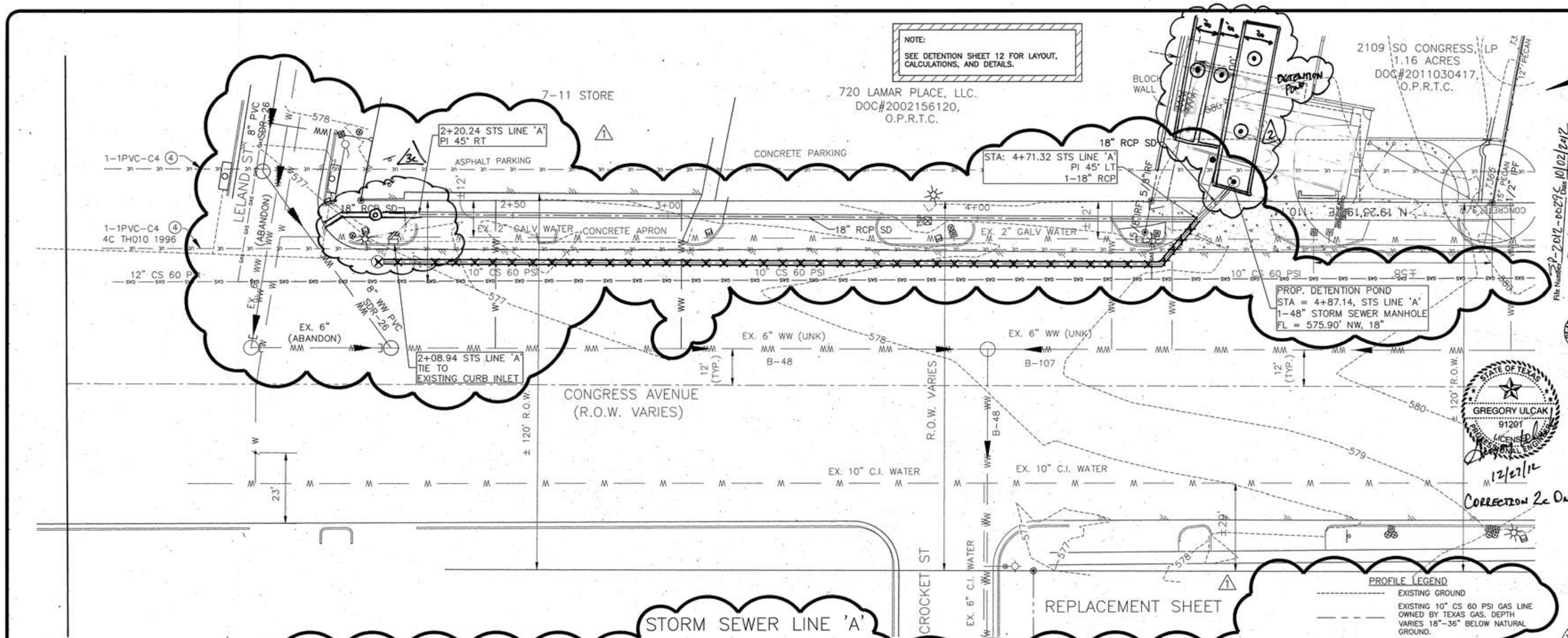
C.D.D. # 18 PHASE II
WEST JOHANNA STREET
FROM BOULDIN CREEK TO S. CONGRESS AVE.

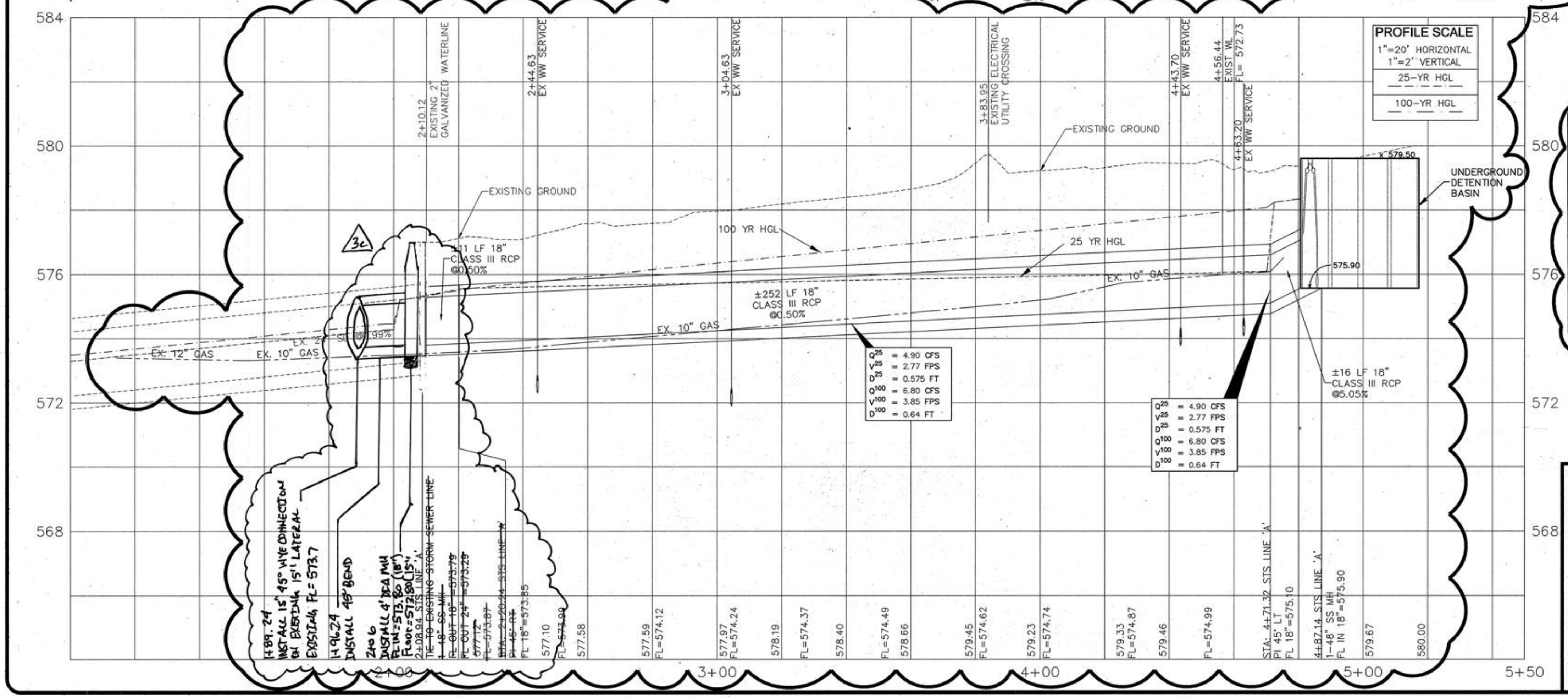
PLAN & PROFILE

	INT	DATE		INT	DATE	SCALE
SURVEYED BY			FIELD BOOKS	No. 3580	PAGE 62	DATE 8-9-83
DRAWN BY	CAS	4/84	DESIGNED BY	R.K.	4/85	1"=20' HORIZ.
DRAWING CHECKED BY	R.C.	4/85	DESIGN CHECKED BY	C.C.	4/85	1"=2' VERT.

APPROVED Chris Chambers P.E. 11/22/86
SIGNATURE DATE
SHEET No. 3 OF 4

1A C-15R 7673 (Y)





File Number SP-2012-0029C Date 10/02/2012
Project Name Ben's Workshop
Correction/Revision # 1 Page # 11
City of Austin Water & Wastewater Utility
Added 2inch waterline Relocation detail

GREGORY ULCAK 91201
12/27/12
CORRECTION 2c ONLY

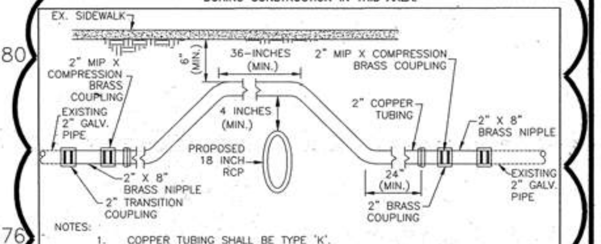
0 10 20 40

LEGEND

═	EXISTING CURB
---581---	EXISTING CONTOUR
—581—	PROPOSED CONTOUR
WW —●—	PROPOSED WASTEWATER LINE
—··—	PROPOSED WATER LINE
●	PROPOSED FIRE HYDRANT
SS ═●═	PROPOSED STORMSEWER
▭	PROPOSED STORMSEWER INLET
○ ×T383	TREE TO REMAIN
○ ×T384	TREE TO BE REMOVED
— UE —	UNDERGROUND ELECTRIC
— W —	EXISTING WATER LINE
— WW —	EXISTING WASTE WATER LINE
— - —	ROADWAY CENTERLINE

NOTES:

1. EXISTING WATER LINE FACILITIES INFORMATION WAS GATHERED FROM CITY OF AUSTIN WATER DEVELOPMENT 1860-SEC. 123; DATED 8-11-44 BOCK NO: 82132500. PAGE W3221-121 AND 1809, SEC. 124, DATED 12-05-32, BOOK 5018, PAGE 30.
2. EXISTING SANITARY SEWER FACILITIES INFORMATION WAS OBTAINED FROM CITY OF AUSTIN MAPS & RECORDS. "SEWER LOCATIONS" DATED 1929, LOCATION: SOUTH CONGRESS AVE & LINDELL AVE, ALLEY SEC. 382, SHEET B-107 JOB NO. T-22, D3795E AND "SEWER LOCATIONS" DATED FEB. 1929 REVISED: 8-31-47 AND 9-24-65 SEC. 382 & 125, SHEET NO. 48 LOCATION: CROCKET ST AND EVA ALLEY TO S. CONGRESS - S. CONGRESS AVE TO CROCKET TO LELAND-LELAND-S. CONGRESS TO NICKERSON JOB NO. T-22, T-52.
3. EXISTING CITY OF AUSTIN 2 INCH GALVANIZED WATER LINE. DEPTH OF WATER LINE SHALL BE CONFIRMED BY CONDUCTING A POT HOLE PRELIMINARY INVESTIGATION ANTICIPATES WATER LINE TO BE SHALLOW (APPROX. 12"). IN THE EVENT THE 2" WATER LINE BREAKS DURING CONSTRUCTION, THE CONTRACTOR SHALL REPLACE LINE WITH ONE 20-FOOT SEGMENT INCLUDING AN OFFSET IF NEEDED.
4. SIDEWALK WILL BE REPLACED TO EXISTING ELEVATIONS AND ADA STANDARDS.
5. CONTRACTOR TO VERIFY LOCATION OF 2" WATER LINE AND PROVIDE ADEQUATE PROTECTION VIA SHORING AND/OR OTHER METHODS AS APPROVED BY AUSTIN WATER UTILITY INSPECTOR AND ENGINEER. NOTE LINE WAS CONSTRUCTED IN 1932 AND IS POTENTIALLY BRITTLE.
6. IN THE EVENT THE WATERLINE IS IN DIRECT CONFLICT (WITHIN 6") WITH PROPOSED STORM SEWER, WATER LINE SHALL BE RELOCATED PER DETAIL ON THIS PAGE.
7. AUSTIN WATER UTILITY INSPECTOR MUST BE ON-SITE DURING CONSTRUCTION IN THIS AREA.



NOTES:
1. COPPER TUBING SHALL BE TYPE 'K'.
2. CONTRACTOR TO USE POLYETHYLENE FILM WRAP ON COPPER TUBING.
3. PLACEMENT AND CONSTRUCTION OF WATERLINE SHALL CONFORM WITH CITY OF AUSTIN STANDARD SPECIFICATIONS.

2-INCH WATERLINE RELOCATION DETAIL
N.T.S.

THE LOCATION OF EXISTING UNDERGROUND UTILITIES ARE APPROXIMATE. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING THE LOCATION OF UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR IS TOTALLY RESPONSIBLE FOR COORDINATING THE LOCATION, AND PRESERVATION OF EXISTING DRY UTILITIES (ELECTRIC, TELEPHONE, CABLE, ETC.).

SITE PLAN APPROVAL SHEET 11 OF 31
FILE NUMBER: SP-2012-0029C APPLICATION DATE: 1-26-2012
APPROVED BY COMMISSION ON: ______ UNDER SECTION 112 OF
CHAPTER 25-5 OF THE CITY OF AUSTIN CODE.
EXPIRATION DATE (25-5-81, LDC) ______ CASE MANAGER LYNDA COURTNEY
PROJECT EXPIRATION DATE (ORD.#970905-A) 1-26-2017 DWPZ ______ DDZ X
Director, Planning and Development Review
RELEASE FOR GENERAL COMPLIANCE: ______ ZONING CS-NU-V-NP & GR-MU-V-NP
Rev. 1 ______ Correction 1 10.4.12
Rev. 2 ______ Correction 2 12/31/12
Rev. 3 ______ Correction 3 m 10.3.14

Final plat must be recorded by the Project Expiration Date, if applicable. Subsequent Site Plans which do not comply with the Code current at the time of filing, and all required Building Permits and/or a notice of construction (if a building permit is not required), must also be approved prior to the Project Expiration Date.

REV. NO.	REVISION DESCRIPTION	APPROVED BY:	DATE
1	STORM LINE RELOCATION		8/9/12
2	RECONFIGURE DETENTION - SAME VOLUME		12/21/12

CobbFendley
Texas Registration No. 274
505 East Huntland Drive, Suite 485
Austin, Texas 78752
512.834.9798 | fax 512.834.9553
www.cobbfendley.com

BEN'S WORKSHOP
STORM SEWER PLAN AND PROFILE

JAMAIL & SMITH CONSTRUCTION

JENNIFER J. PAISLEY 91109

THESE DESIGN DOCUMENTS ARE NOT TO BE USED FOR CONSTRUCTION PRIOR TO REGULATORY SIGNATURE AND PERMIT.

SHEET
11
of 31

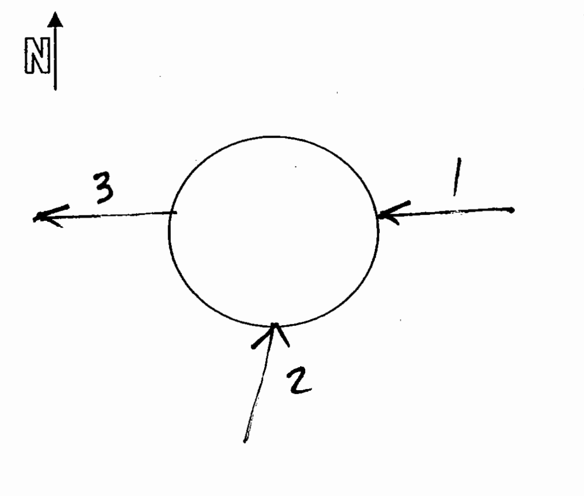
PARSONS

Austin Manhole Inspection Form

Manhole ID	242	**Date**	9/19/06
Photo ID	5	**Time**	1212
Location / Street Name	NEWTON + MARY	**Personnel**	Ezio JASON

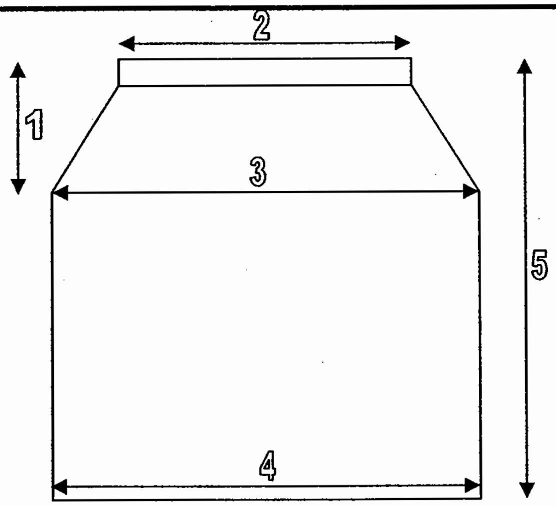
Structure Conditions	[✓ Good]	Fair	Poor
Notes			

Flow Obstructions	[✓ None]	Soil	Trash	Hard Debris	Standing Water	Other
Notes						

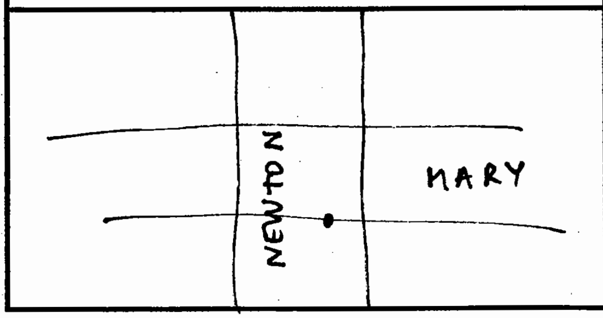


Number of pipes	3				
Pipe #	**Material**	**Diameter**		**Depth**	
1	C	21	IN	6.2	FT
2	C	24	IN	5.8	FT
3	C	2.5	FT	6.8	FT

PVC, C = Concrete, M = Corrugated Metal



Shaft Material	BRICK	
Bolted Cover	Y	[✓ N]
Paved Over	Y	[✓ N]
1	Cone Depth	3.7 FT
2	Cover Diameter	24 IN
3	Bottom of Cone	3 FT
4	Smallest Diameter	3 FT
5	Total Depth	6.8 FT
Notes		



Sketch of manhole location including roads/intersection.

Notes

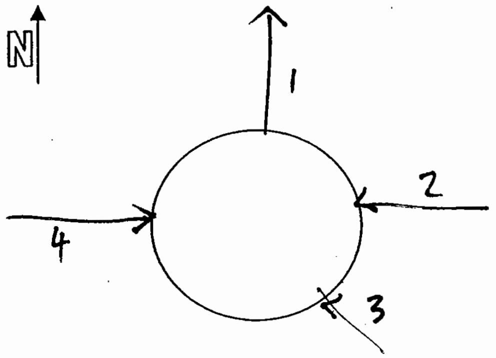
PARSONS

Austin Manhole Inspection Form

Manhole ID	243	**Date**	9/19/06
Photo ID	6	**Time**	1225
Location / Street Name	NEWTON + JOHANNA	**Personnel**	Ezio, JASON

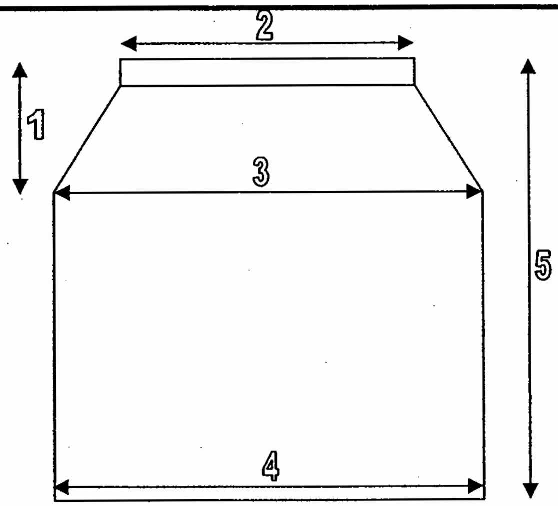
Structure Conditions	Good	[✓ Fair]	Poor
Notes			

Flow Obstructions	[✓ None]	Soil	Trash	Hard Debris	Standing Water	Other
Notes						



Number of pipes	4			
Pipe #	**Material**	**Diameter**		**Depth**	
1	C	2	FT	5.1	FT
2	C	21	IN	5.1	FT
3	C	21	IN	5.1	FT
4	C	15	IN	5.1	FT

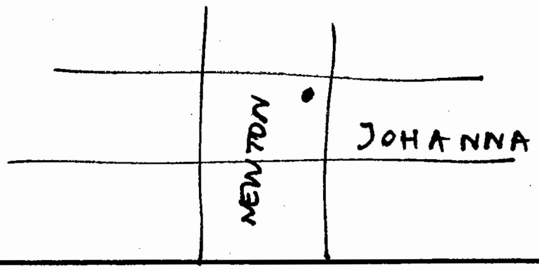
PVC, C = Concrete, M = Corrugated Metal



Shaft Material	BRICK	
Bolted Cover	Y	[✓ N]
Paved Over	Y	[✓ N]

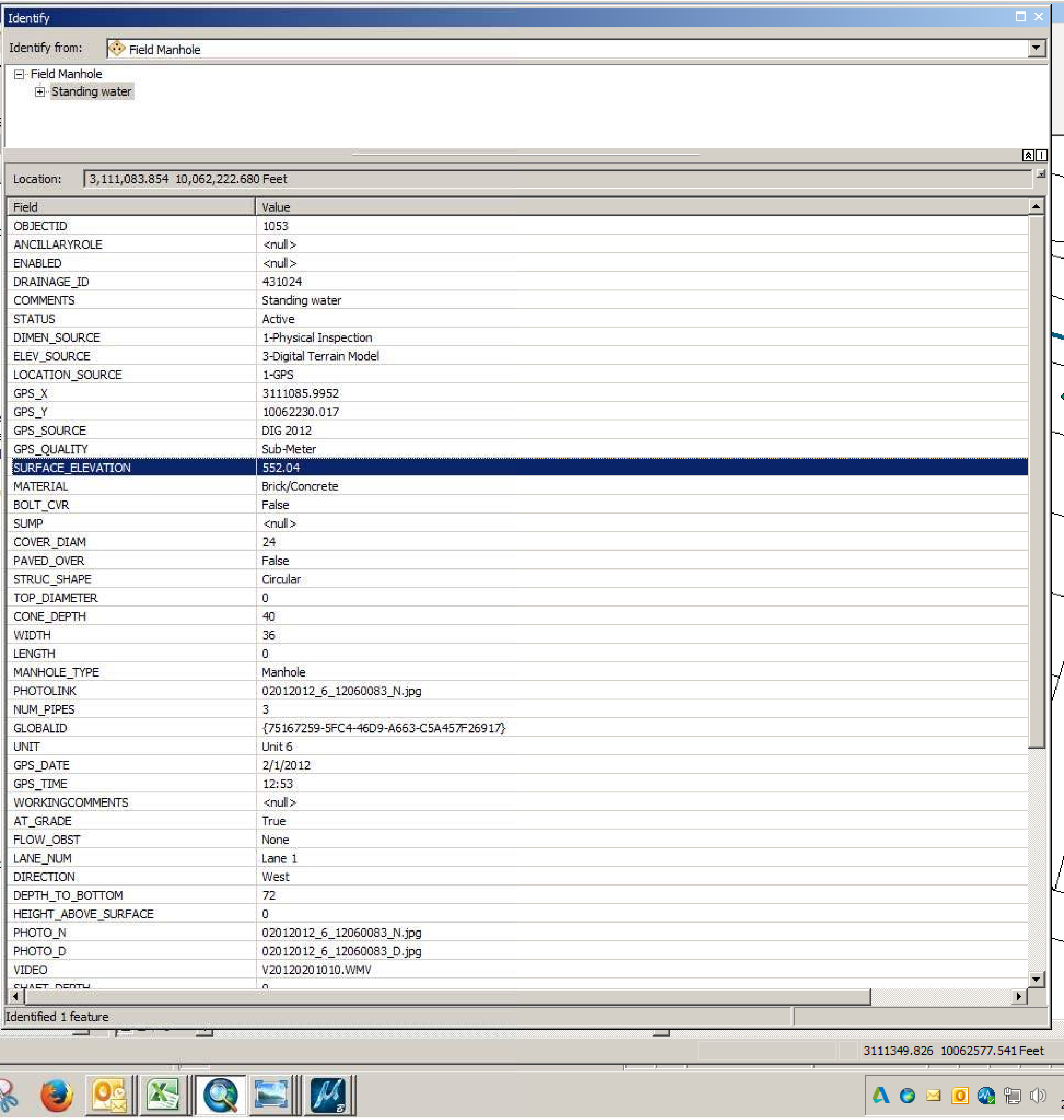
1 Cone Depth 3.1 FT
2 Cover Diameter 24 IN
3 Bottom of Cone 2.5 FT
4 Smallest Diameter 2.2 FT
5 Total Depth 5.1 FT

Notes



Sketch of manhole location including roads/intersection.

Notes

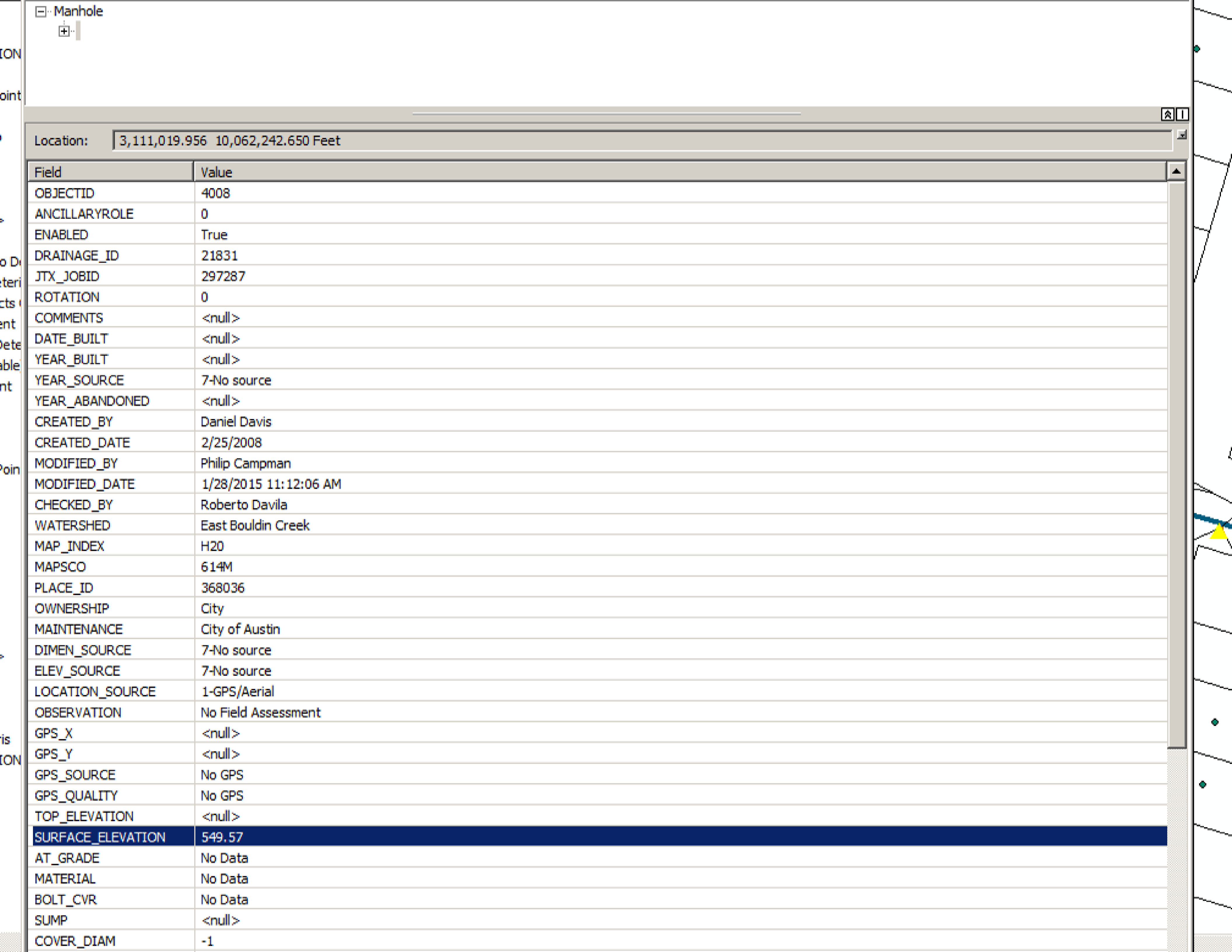


Identify from: Field Manhole

Field Manhole

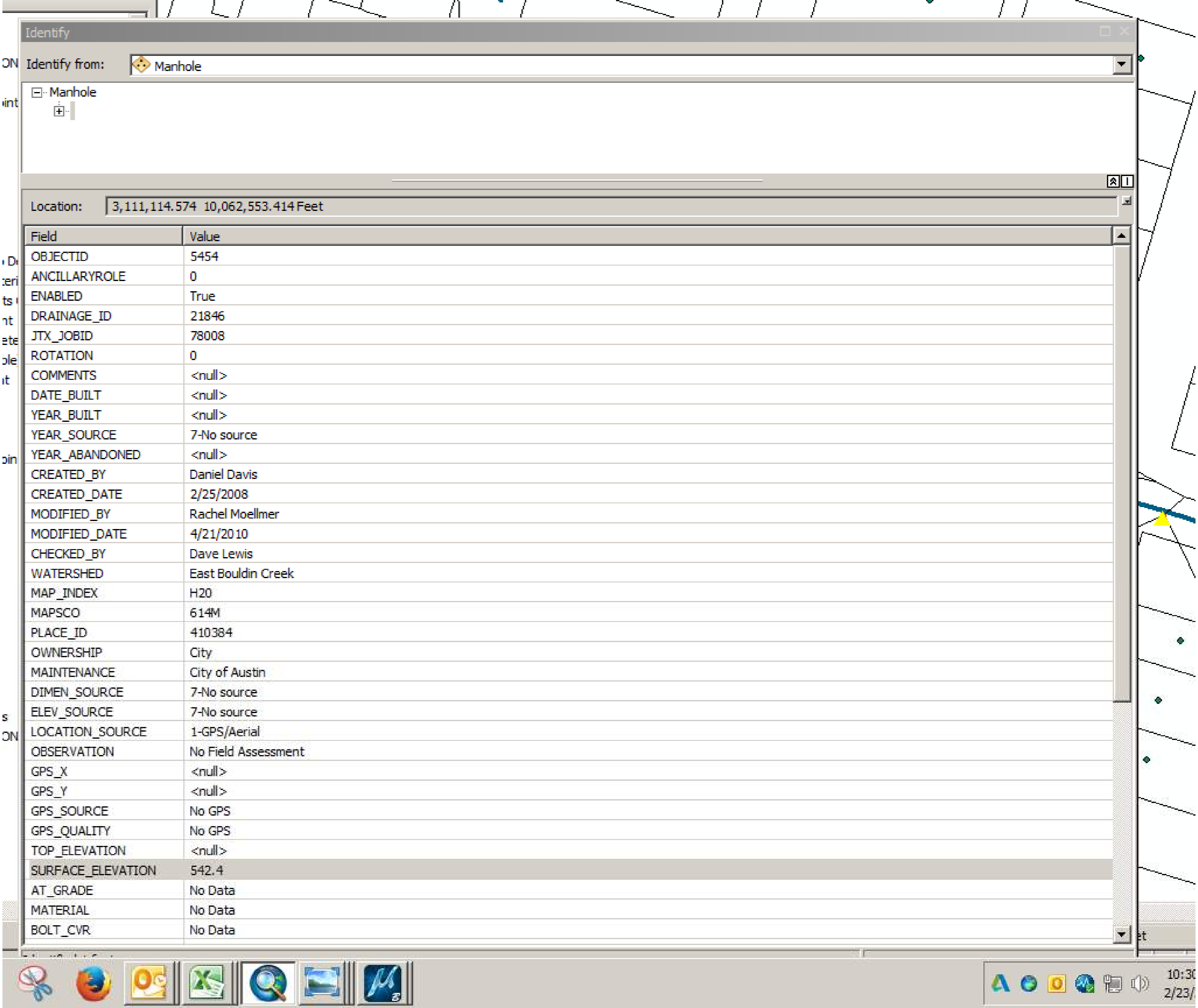
Location: 3,111,083.854 10,062,222.680 Feet

Field	Value
OBJECTID	1053
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	431024
COMMENTS	Standing water
STATUS	Active
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111085.9952
GPS_Y	10062230.017
GPS_SOURCE	DIG 2012
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	552.04
MATERIAL	Brick/Concrete
BOLT_CVR	False
SUMP	<null>
COVER_DIAM	24
PAVED_OVER	False
STRUC_SHAPE	Circular
TOP_DIAMETER	0
CONE_DEPTH	40
WIDTH	36
LENGTH	0
MANHOLE_TYPE	Manhole
PHOTOLINK	02012012_6_12060083_N.jpg
NUM_PIPES	3
GLOBALID	{75167259-5FC4-46D9-A663-C5A457F26917}
UNIT	Unit 6
GPS_DATE	2/1/2012
GPS_TIME	12:53
WORKINGCOMMENTS	<null>
AT_GRADE	True
FLOW_OBST	None
LANE_NUM	Lane 1
DIRECTION	West
DEPTH_TO_BOTTOM	72
HEIGHT_ABOVE_SURFACE	0
PHOTO_N	02012012_6_12060083_N.jpg
PHOTO_D	02012012_6_12060083_D.jpg
VIDEO	V20120201010.WMV



Location: 3,111,019.956 10,062,242.650 Feet

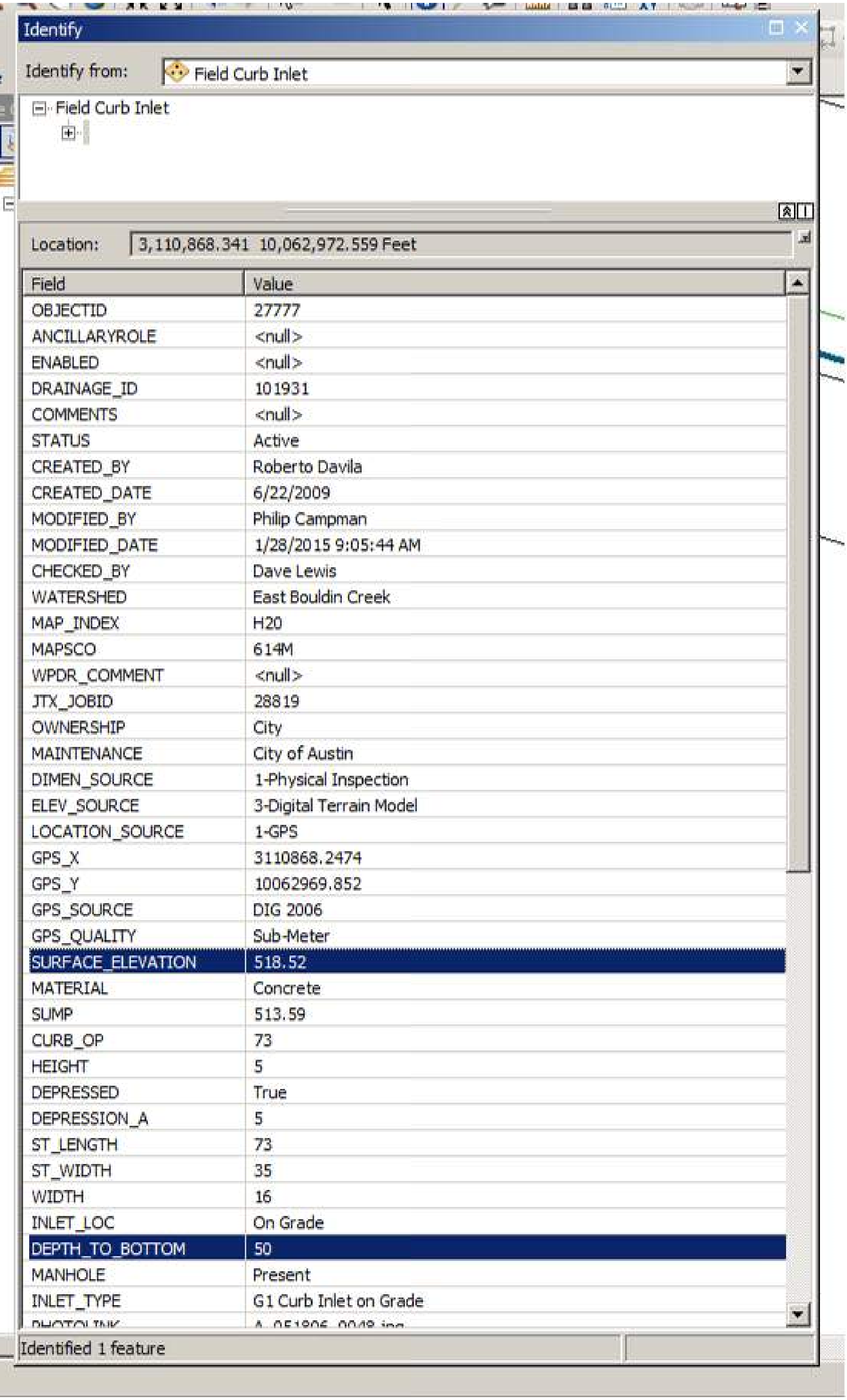
Field	Value
OBJECTID	4008
ANCILLARYROLE	0
ENABLED	True
DRAINAGE_ID	21831
JTX_JOBID	297287
ROTATION	0
COMMENTS	<null>
DATE_BUILT	<null>
YEAR_BUILT	<null>
YEAR_SOURCE	7-No source
YEAR_ABANDONED	<null>
CREATED_BY	Daniel Davis
CREATED_DATE	2/25/2008
MODIFIED_BY	Philip Campman
MODIFIED_DATE	1/28/2015 11:12:06 AM
CHECKED_BY	Roberto Davila
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
PLACE_ID	368036
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	7-No source
ELEV_SOURCE	7-No source
LOCATION_SOURCE	1-GPS/Aerial
OBSERVATION	No Field Assessment
GPS_X	<null>
GPS_Y	<null>
GPS_SOURCE	No GPS
GPS_QUALITY	No GPS
TOP_ELEVATION	<null>
SURFACE_ELEVATION	549.57
AT_GRADE	No Data
MATERIAL	No Data
BOLT_CVR	No Data
SUMP	<null>
COVER_DIAM	-1



Identify from: Manhole

Location: 3,111,114.574 10,062,553.414 Feet

Field	Value
OBJECTID	5454
ANCILLARYROLE	0
ENABLED	True
DRAINAGE_ID	21846
JTX_JOBID	78008
ROTATION	0
COMMENTS	<null>
DATE_BUILT	<null>
YEAR_BUILT	<null>
YEAR_SOURCE	7-No source
YEAR_ABANDONED	<null>
CREATED_BY	Daniel Davis
CREATED_DATE	2/25/2008
MODIFIED_BY	Rachel Moellmer
MODIFIED_DATE	4/21/2010
CHECKED_BY	Dave Lewis
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
PLACE_ID	410384
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	7-No source
ELEV_SOURCE	7-No source
LOCATION_SOURCE	1-GPS/Aerial
OBSERVATION	No Field Assessment
GPS_X	<null>
GPS_Y	<null>
GPS_SOURCE	No GPS
GPS_QUALITY	No GPS
TOP_ELEVATION	<null>
SURFACE_ELEVATION	542.4
AT_GRADE	No Data
MATERIAL	No Data
BOLT_CVR	No Data



Identify from: Field Curb Inlet

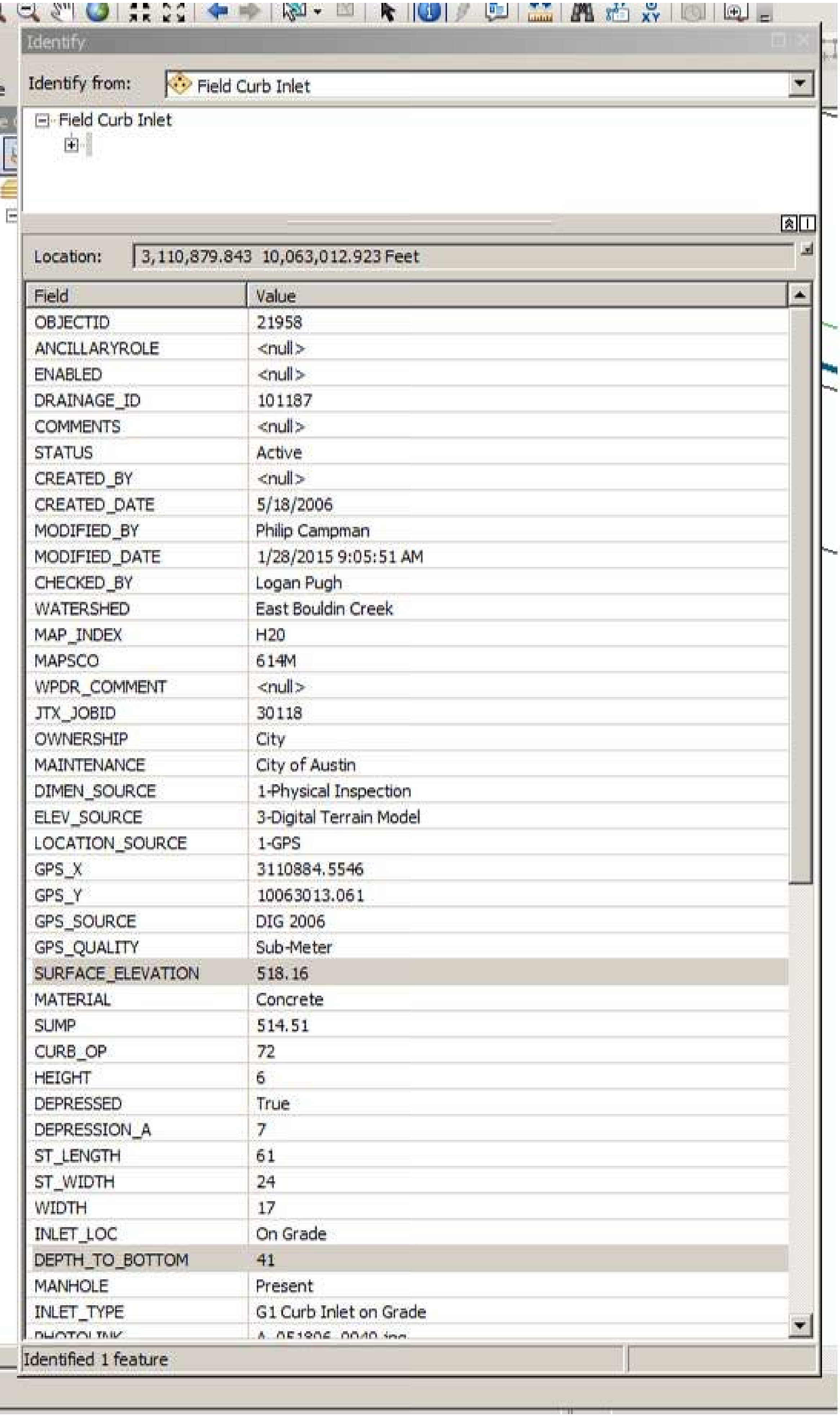
Location: 3,110,868.341 10,062,972.559 Feet

Field	Value
OBJECTID	27777
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	101931
COMMENTS	<null>
STATUS	Active
CREATED_BY	Roberto Davila
CREATED_DATE	6/22/2009
MODIFIED_BY	Philip Campman
MODIFIED_DATE	1/28/2015 9:05:44 AM
CHECKED_BY	Dave Lewis
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	<null>
JTX_JOBID	28819
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3110868.2474
GPS_Y	10062969.852
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	518.52
MATERIAL	Concrete
SUMP	513.59
CURB_OP	73
HEIGHT	5
DEPRESSED	True
DEPRESSION_A	5
ST_LENGTH	73
ST_WIDTH	35
WIDTH	16
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	50
MANHOLE	Present
INLET_TYPE	G1 Curb Inlet on Grade
PHOTOLINK	A_051806_0048.jpg

Identified 1 feature

Curb Inlet 21637

Curb Inlet 21638



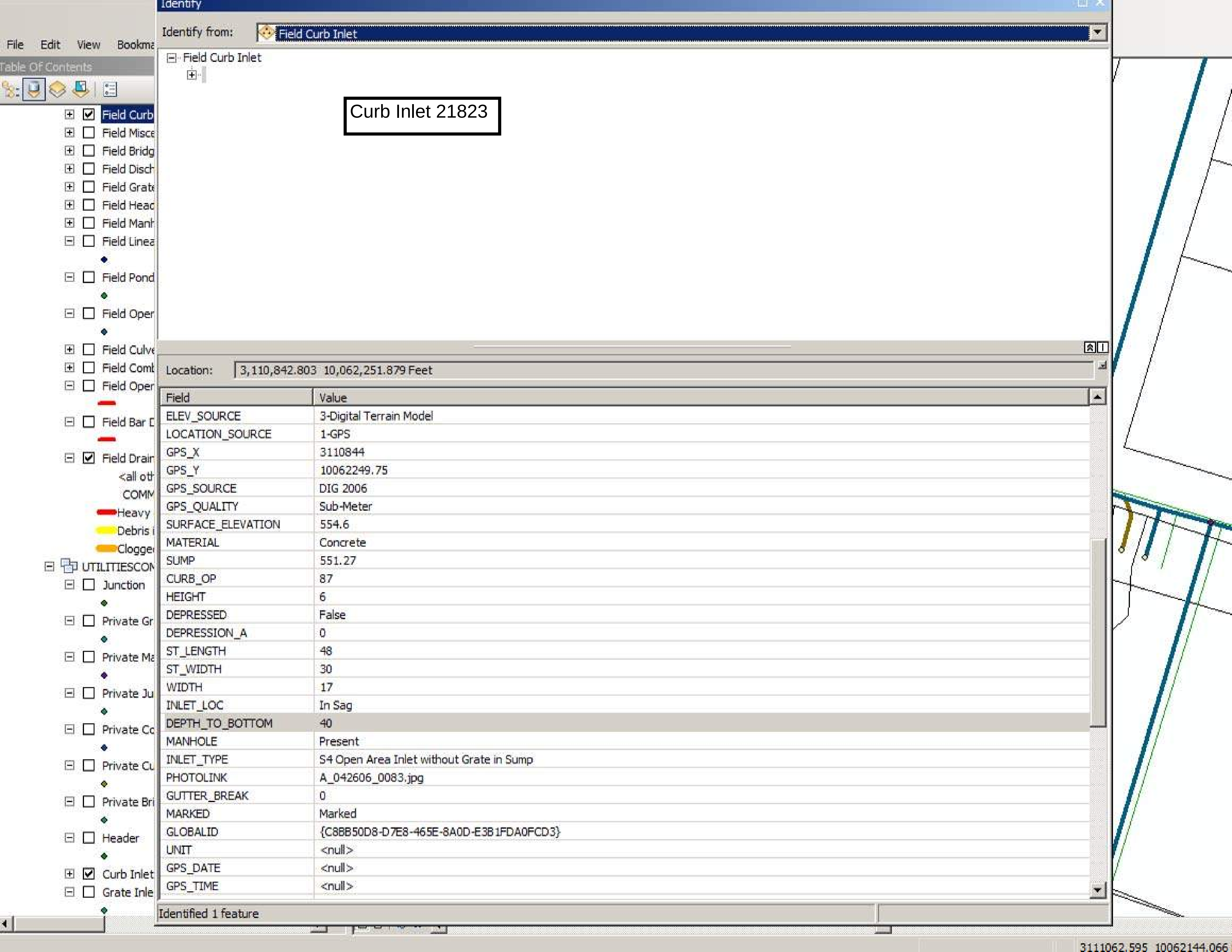
Identify from: Field Curb Inlet

Field Curb Inlet

Location: 3,110,879.843 10,063,012.923 Feet

Field	Value
OBJECTID	21958
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	101187
COMMENTS	<null>
STATUS	Active
CREATED_BY	<null>
CREATED_DATE	5/18/2006
MODIFIED_BY	Philip Campman
MODIFIED_DATE	1/28/2015 9:05:51 AM
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	<null>
JTX_JOBID	30118
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3110884.5546
GPS_Y	10063013.061
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	518.16
MATERIAL	Concrete
SUMP	514.51
CURB_OP	72
HEIGHT	6
DEPRESSED	True
DEPRESSION_A	7
ST_LENGTH	61
ST_WIDTH	24
WIDTH	17
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	41
MANHOLE	Present
INLET_TYPE	G1 Curb Inlet on Grade

Identified 1 feature



Identify from: Field Curb Inlet

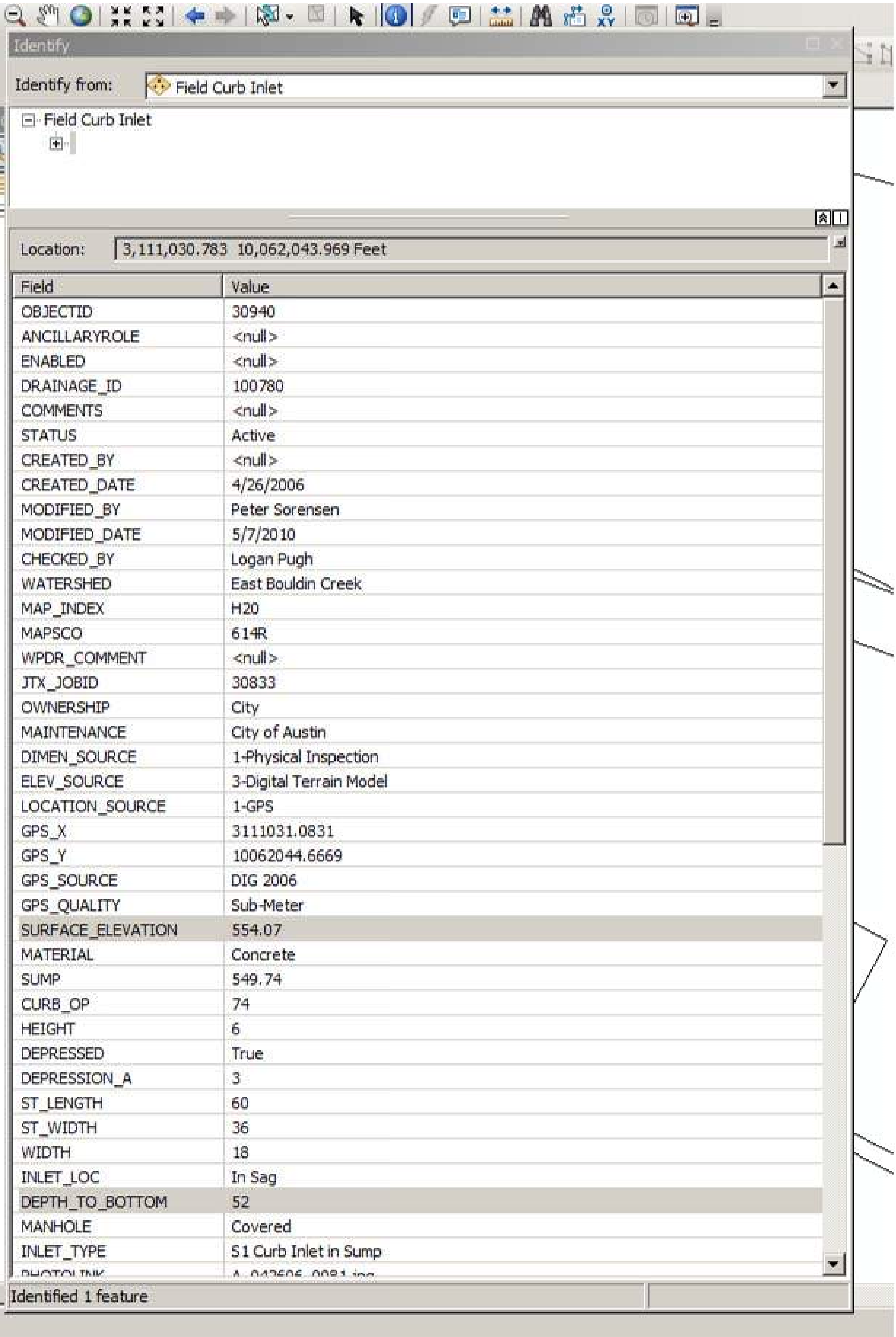
Curb Inlet 21823

Location: 3,110,842.803 10,062,251.879 Feet

Field	Value
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3110844
GPS_Y	10062249.75
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	554.6
MATERIAL	Concrete
SUMP	551.27
CURB_OP	87
HEIGHT	6
DEPRESSED	False
DEPRESSION_A	0
ST_LENGTH	48
ST_WIDTH	30
WIDTH	17
INLET_LOC	In Sag
DEPTH_TO_BOTTOM	40
MANHOLE	Present
INLET_TYPE	S4 Open Area Inlet without Grate in Sump
PHOTOLINK	A_042606_0083.jpg
GUTTER_BREAK	0
MARKED	Marked
GLOBALID	{C8BB50D8-D7E8-465E-8A0D-E3B1FDA0FCD3}
UNIT	<null>
GPS_DATE	<null>
GPS_TIME	<null>

Identified 1 feature

Curb Inlet 21824



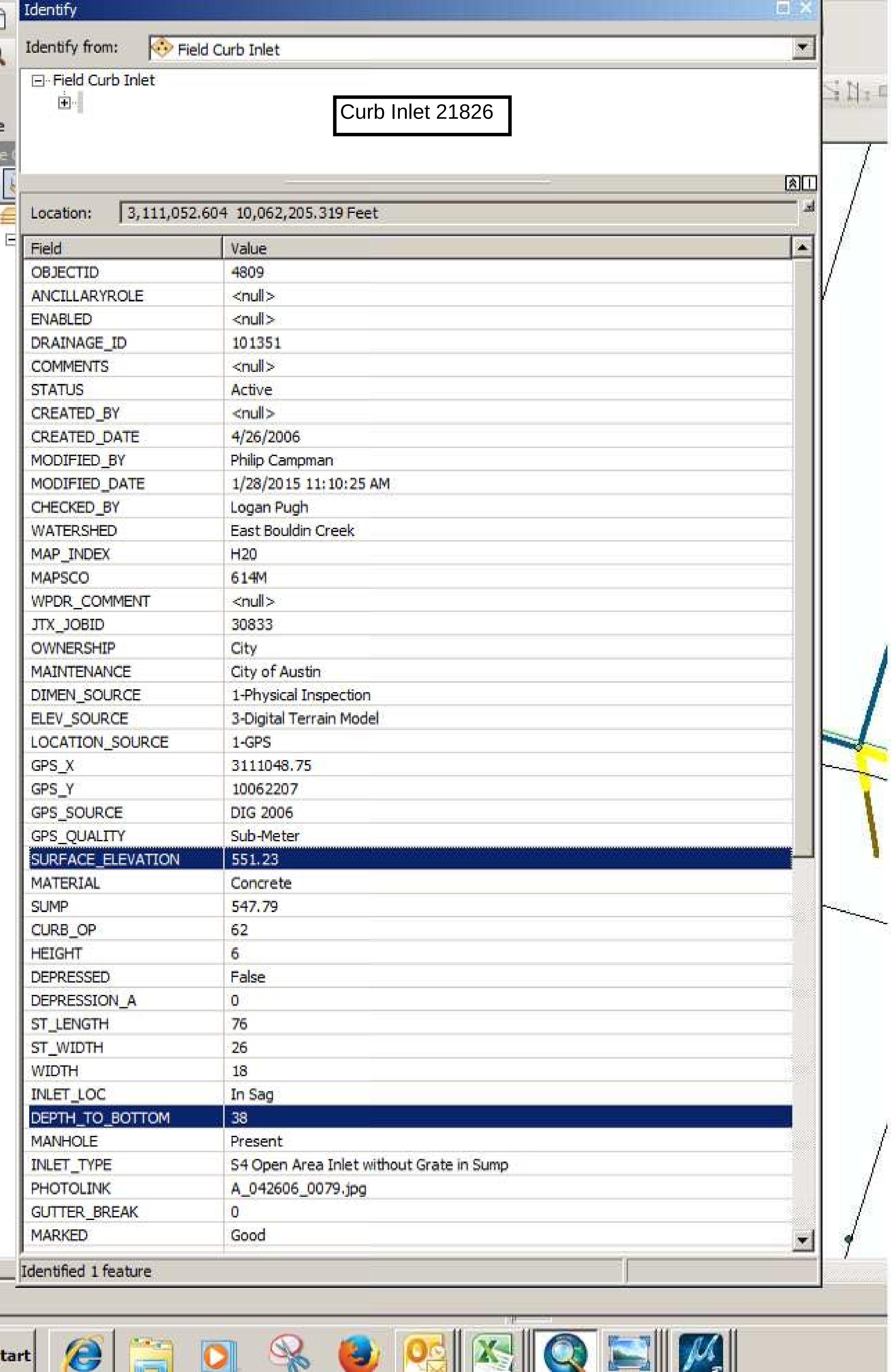
Identify from: Field Curb Inlet

Field Curb Inlet

Location: 3,111,030.783 10,062,043.969 Feet

Field	Value
OBJECTID	30940
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	100780
COMMENTS	<null>
STATUS	Active
CREATED_BY	<null>
CREATED_DATE	4/26/2006
MODIFIED_BY	Peter Sorensen
MODIFIED_DATE	5/7/2010
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614R
WPDR_COMMENT	<null>
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111031.0831
GPS_Y	10062044.6669
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	554.07
MATERIAL	Concrete
SUMP	549.74
CURB_OP	74
HEIGHT	6
DEPRESSED	True
DEPRESSION_A	3
ST_LENGTH	60
ST_WIDTH	36
WIDTH	18
INLET_LOC	In Sag
DEPTH_TO_BOTTOM	52
MANHOLE	Covered
INLET_TYPE	S1 Curb Inlet in Sump

Identified 1 feature



Identify from: Field Curb Inlet

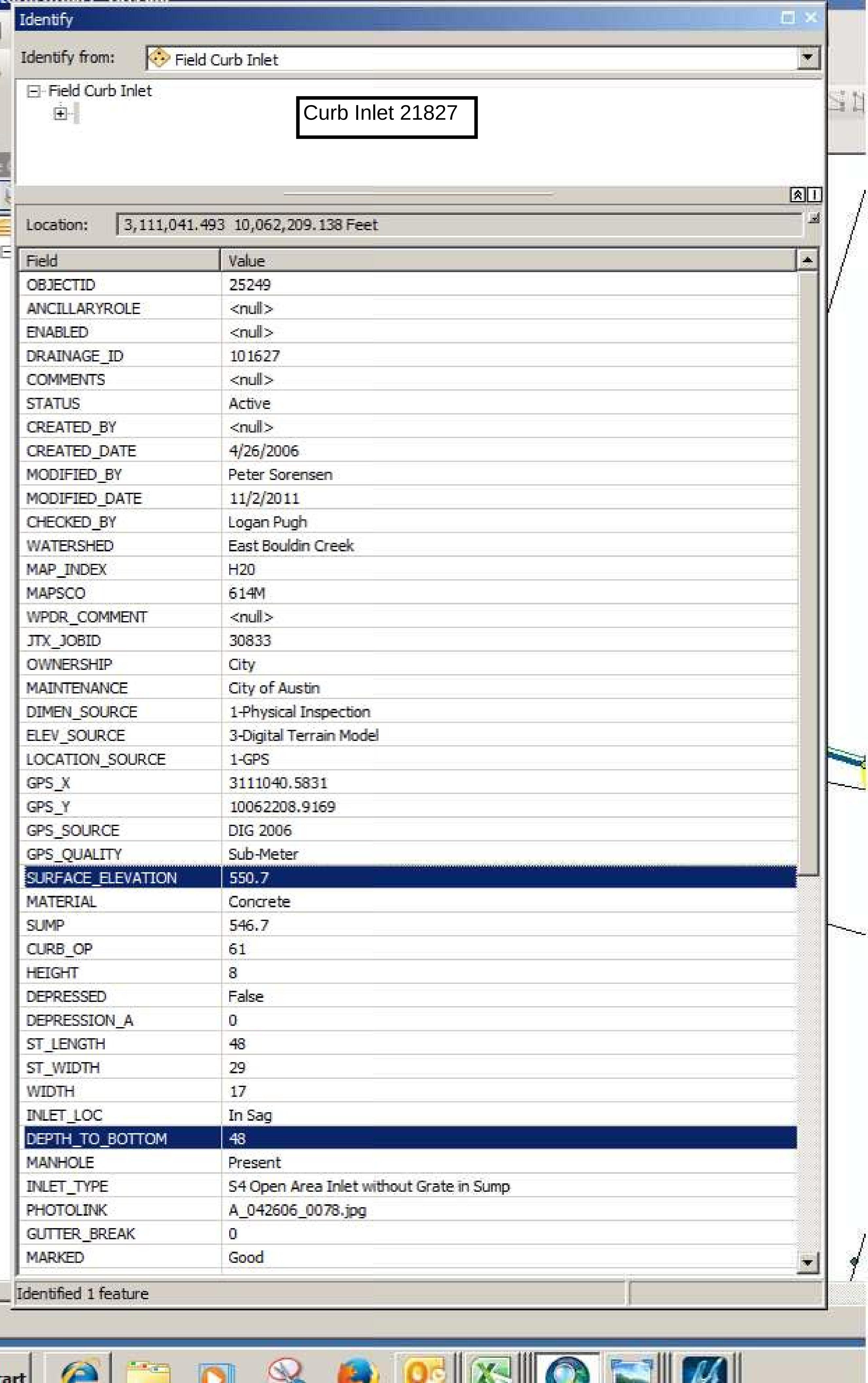
Field Curb Inlet

Curb Inlet 21826

Location: 3,111,052.604 10,062,205.319 Feet

Field	Value
OBJECTID	4809
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	101351
COMMENTS	<null>
STATUS	Active
CREATED_BY	<null>
CREATED_DATE	4/26/2006
MODIFIED_BY	Philip Campman
MODIFIED_DATE	1/28/2015 11:10:25 AM
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	<null>
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111048.75
GPS_Y	10062207
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	551.23
MATERIAL	Concrete
SUMP	547.79
CURB_OP	62
HEIGHT	6
DEPRESSED	False
DEPRESSION_A	0
ST_LENGTH	76
ST_WIDTH	26
WIDTH	18
INLET_LOC	In Sag
DEPTH_TO_BOTTOM	38
MANHOLE	Present
INLET_TYPE	S4 Open Area Inlet without Grate in Sump
PHOTOLINK	A_042606_0079.jpg
GUTTER_BREAK	0
MARKED	Good

Identified 1 feature



Identify from: Field Curb Inlet

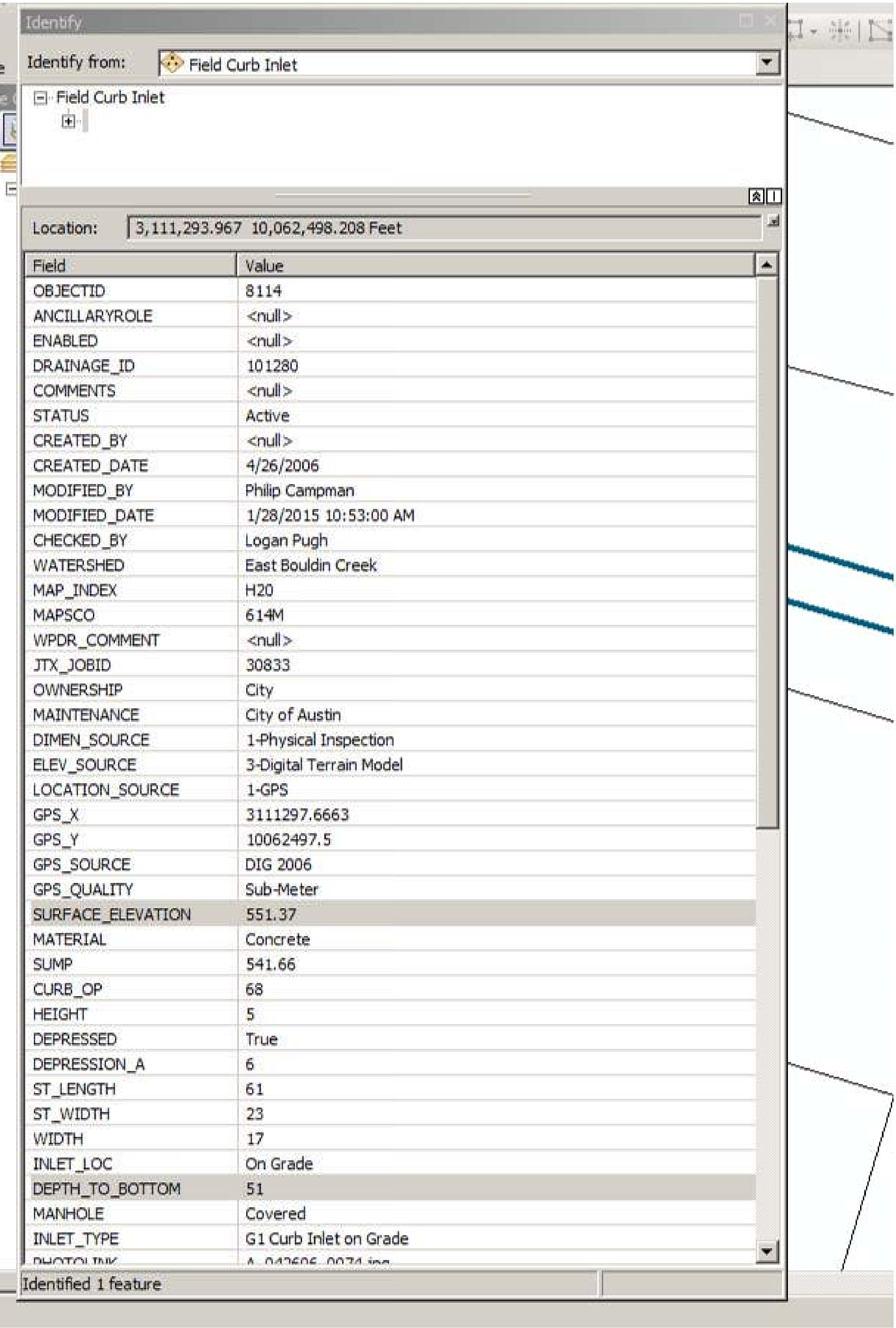
Curb Inlet 21827

Location: 3,111,041.493 10,062,209.138 Feet

Field	Value
OBJECTID	25249
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	101627
COMMENTS	<null>
STATUS	Active
CREATED_BY	<null>
CREATED_DATE	4/26/2006
MODIFIED_BY	Peter Sorensen
MODIFIED_DATE	11/2/2011
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	<null>
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111040.5831
GPS_Y	10062208.9169
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	550.7
MATERIAL	Concrete
SUMP	546.7
CURB_OP	61
HEIGHT	8
DEPRESSED	False
DEPRESSION_A	0
ST_LENGTH	48
ST_WIDTH	29
WIDTH	17
INLET_LOC	In Sag
DEPTH_TO_BOTTOM	48
MANHOLE	Present
INLET_TYPE	S4 Open Area Inlet without Grate in Sump
PHOTOLINK	A_042606_0078.jpg
GUTTER_BREAK	0
MARKED	Good

Identified 1 feature

Curb Inlet 21848



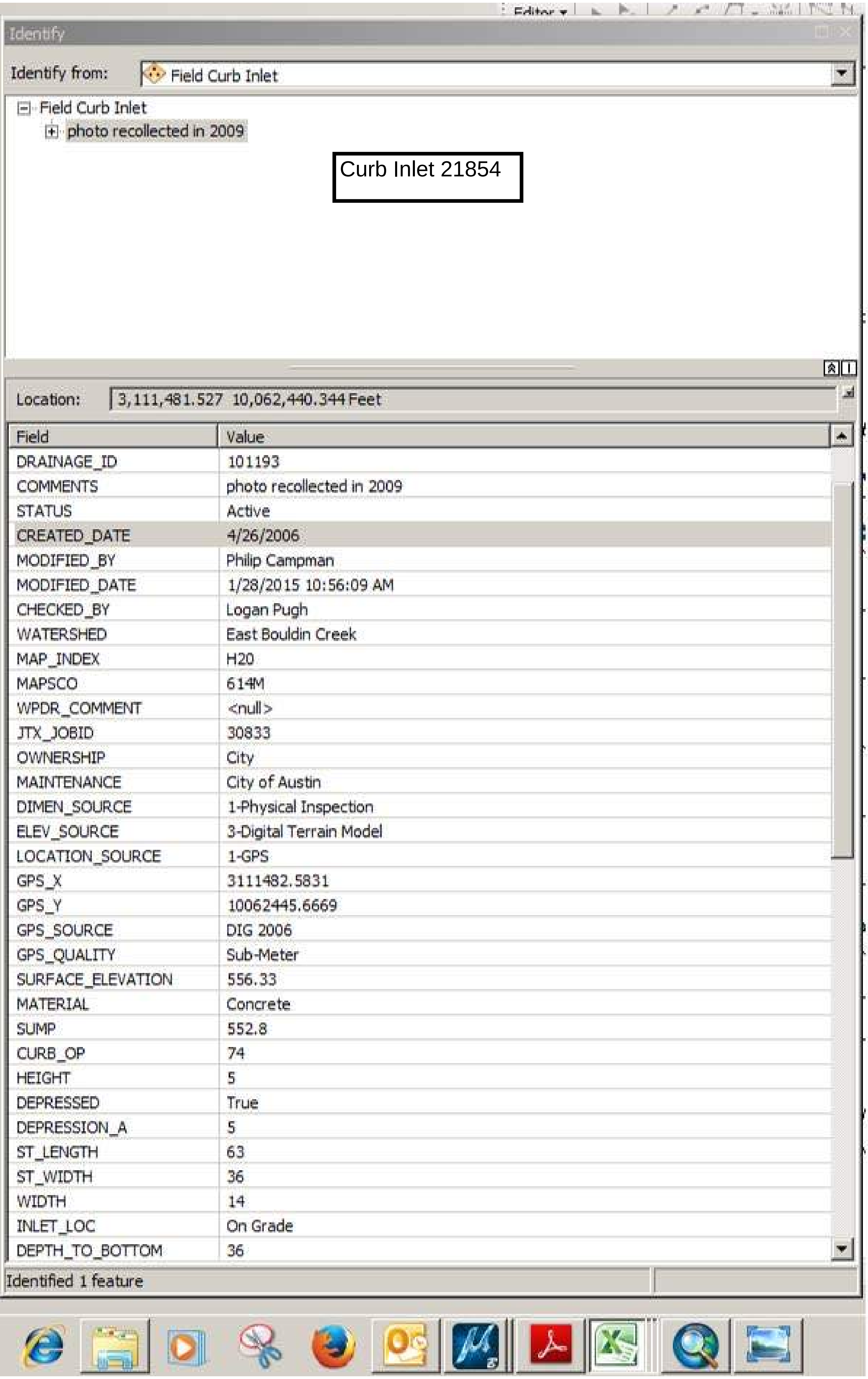
Identify from: Field Curb Inlet

Field Curb Inlet

Location: 3,111,293.967 10,062,498.208 Feet

Field	Value
OBJECTID	8114
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	101280
COMMENTS	<null>
STATUS	Active
CREATED_BY	<null>
CREATED_DATE	4/26/2006
MODIFIED_BY	Philip Campman
MODIFIED_DATE	1/28/2015 10:53:00 AM
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	<null>
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111297.6663
GPS_Y	10062497.5
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	551.37
MATERIAL	Concrete
SUMP	541.66
CURB_OP	68
HEIGHT	5
DEPRESSED	True
DEPRESSION_A	6
ST_LENGTH	61
ST_WIDTH	23
WIDTH	17
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	51
MANHOLE	Covered
INLET_TYPE	G1 Curb Inlet on Grade

Identified 1 feature



Identify from: Field Curb Inlet

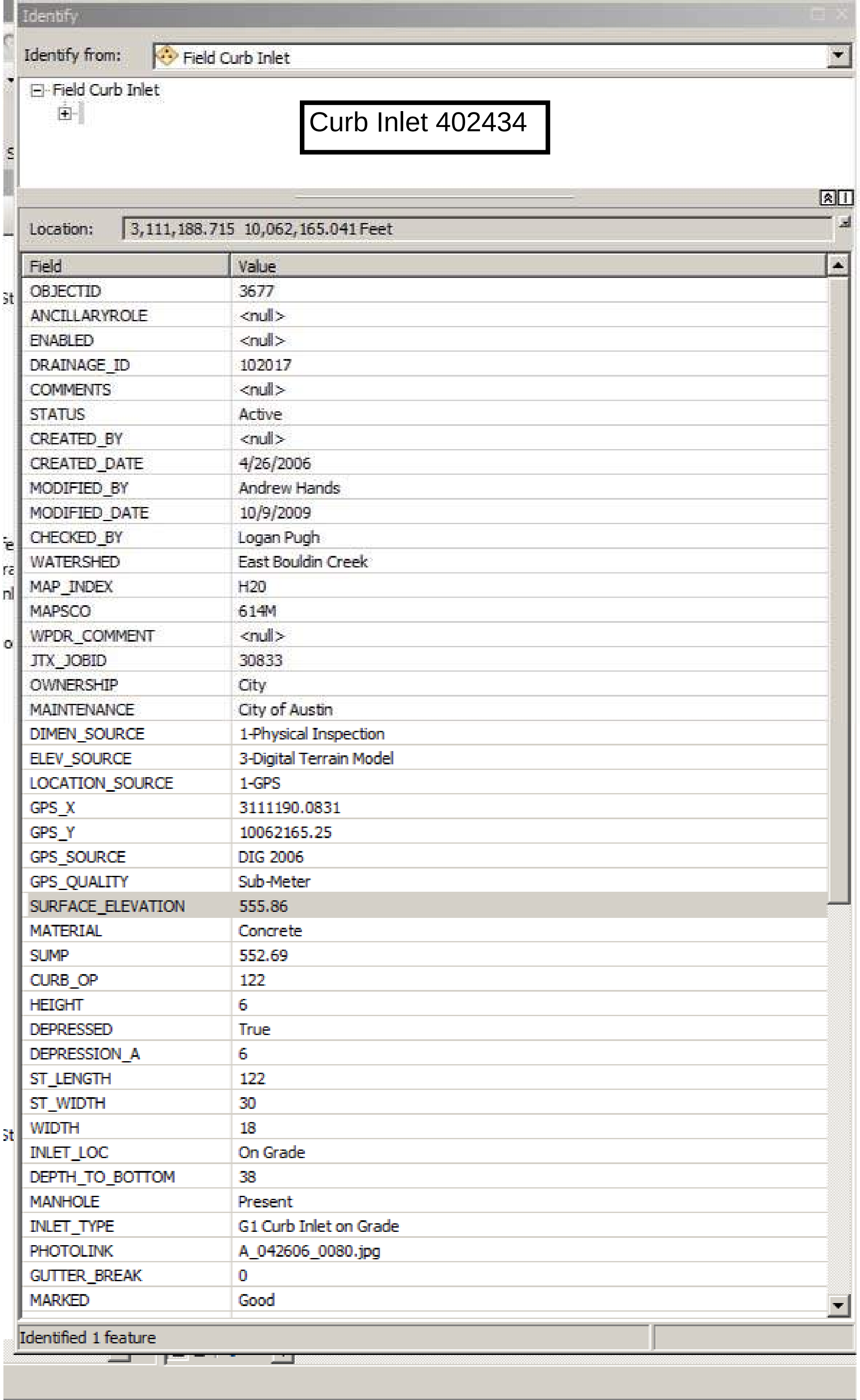
Field Curb Inlet
photo recollected in 2009

Curb Inlet 21854

Location: 3,111,481.527 10,062,440.344 Feet

Field	Value
DRAINAGE_ID	101193
COMMENTS	photo recollected in 2009
STATUS	Active
CREATED_DATE	4/26/2006
MODIFIED_BY	Philip Campman
MODIFIED_DATE	1/28/2015 10:56:09 AM
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	<null>
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111482.5831
GPS_Y	10062445.6669
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	556.33
MATERIAL	Concrete
SUMP	552.8
CURB_OP	74
HEIGHT	5
DEPRESSED	True
DEPRESSION_A	5
ST_LENGTH	63
ST_WIDTH	36
WIDTH	14
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	36

Identified 1 feature

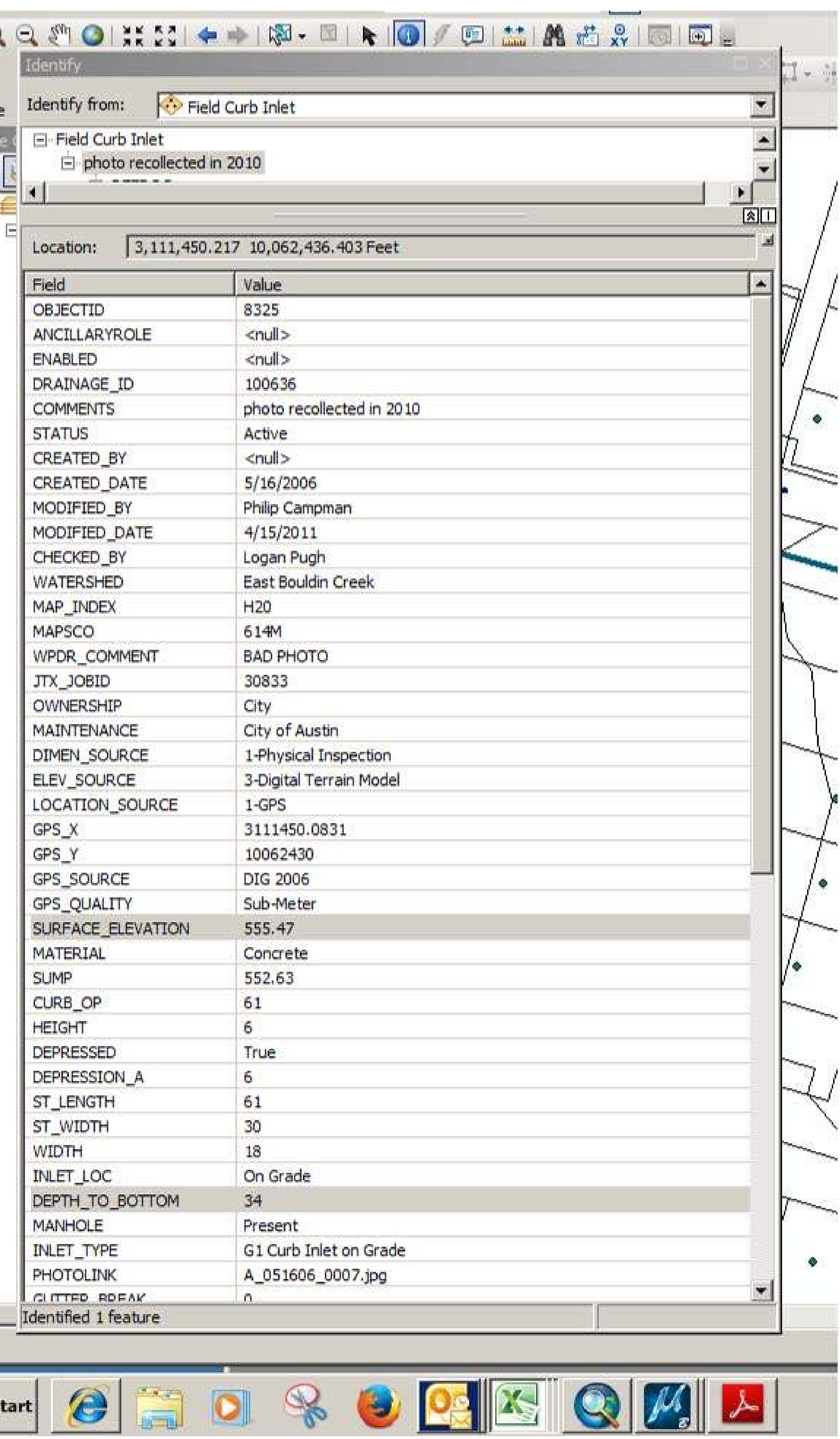


Curb Inlet 402434

Location: 3,111,188.715 10,062,165.041 Feet

Field	Value
OBJECTID	3677
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	102017
COMMENTS	<null>
STATUS	Active
CREATED_BY	<null>
CREATED_DATE	4/26/2006
MODIFIED_BY	Andrew Hands
MODIFIED_DATE	10/9/2009
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	<null>
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111190.0831
GPS_Y	10062165.25
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	555.86
MATERIAL	Concrete
SUMP	552.69
CURB_OP	122
HEIGHT	6
DEPRESSED	True
DEPRESSION_A	6
ST_LENGTH	122
ST_WIDTH	30
WIDTH	18
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	38
MANHOLE	Present
INLET_TYPE	G1 Curb Inlet on Grade
PHOTOLINK	A_042606_0080.jpg
GUTTER_BREAK	0
MARKED	Good

Identified 1 feature



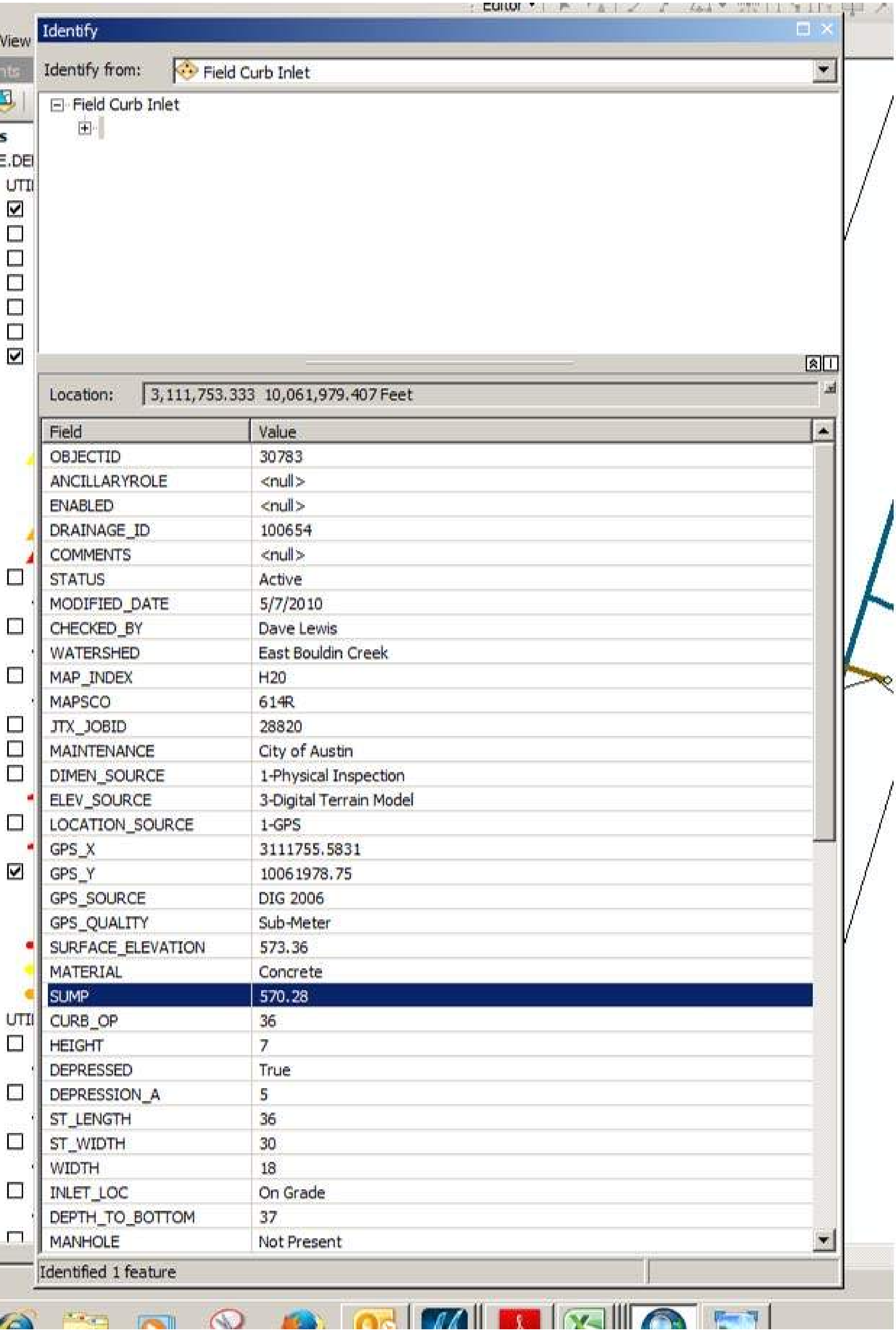
Identify from: Field Curb Inlet

- Field Curb Inlet
  - photo recollected in 2010

Location: 3,111,450.217 10,062,436.403 Feet

Field	Value
OBJECTID	8325
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	100636
COMMENTS	photo recollected in 2010
STATUS	Active
CREATED_BY	<null>
CREATED_DATE	5/16/2006
MODIFIED_BY	Philip Campman
MODIFIED_DATE	4/15/2011
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	BAD PHOTO
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111450.0831
GPS_Y	10062430
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	555.47
MATERIAL	Concrete
SUMP	552.63
CURB_OP	61
HEIGHT	6
DEPRESSED	True
DEPRESSION_A	6
ST_LENGTH	61
ST_WIDTH	30
WIDTH	18
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	34
MANHOLE	Present
INLET_TYPE	G1 Curb Inlet on Grade
PHOTOLINK	A_051606_0007.jpg
GUTTER_BREAK	0

Identified 1 feature

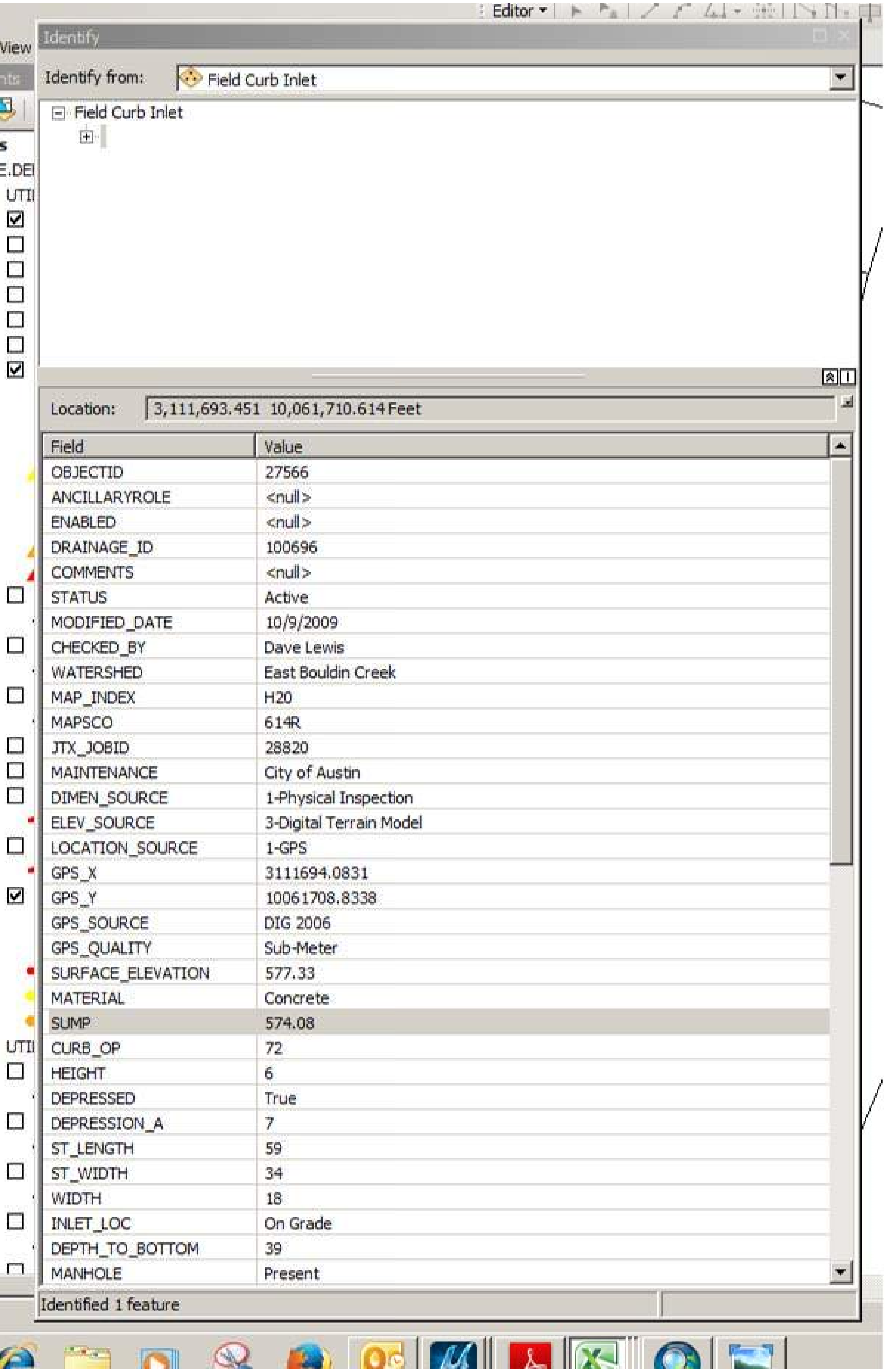


Identify from: Field Curb Inlet

Location: 3,111,753.333 10,061,979.407 Feet

Field	Value
OBJECTID	30783
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	100654
COMMENTS	<null>
STATUS	Active
MODIFIED_DATE	5/7/2010
CHECKED_BY	Dave Lewis
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614R
JTX_JOBID	28820
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111755.5831
GPS_Y	10061978.75
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	573.36
MATERIAL	Concrete
SUMP	570.28
CURB_OP	36
HEIGHT	7
DEPRESSED	True
DEPRESSION_A	5
ST_LENGTH	36
ST_WIDTH	30
WIDTH	18
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	37
MANHOLE	Not Present

Identified 1 feature

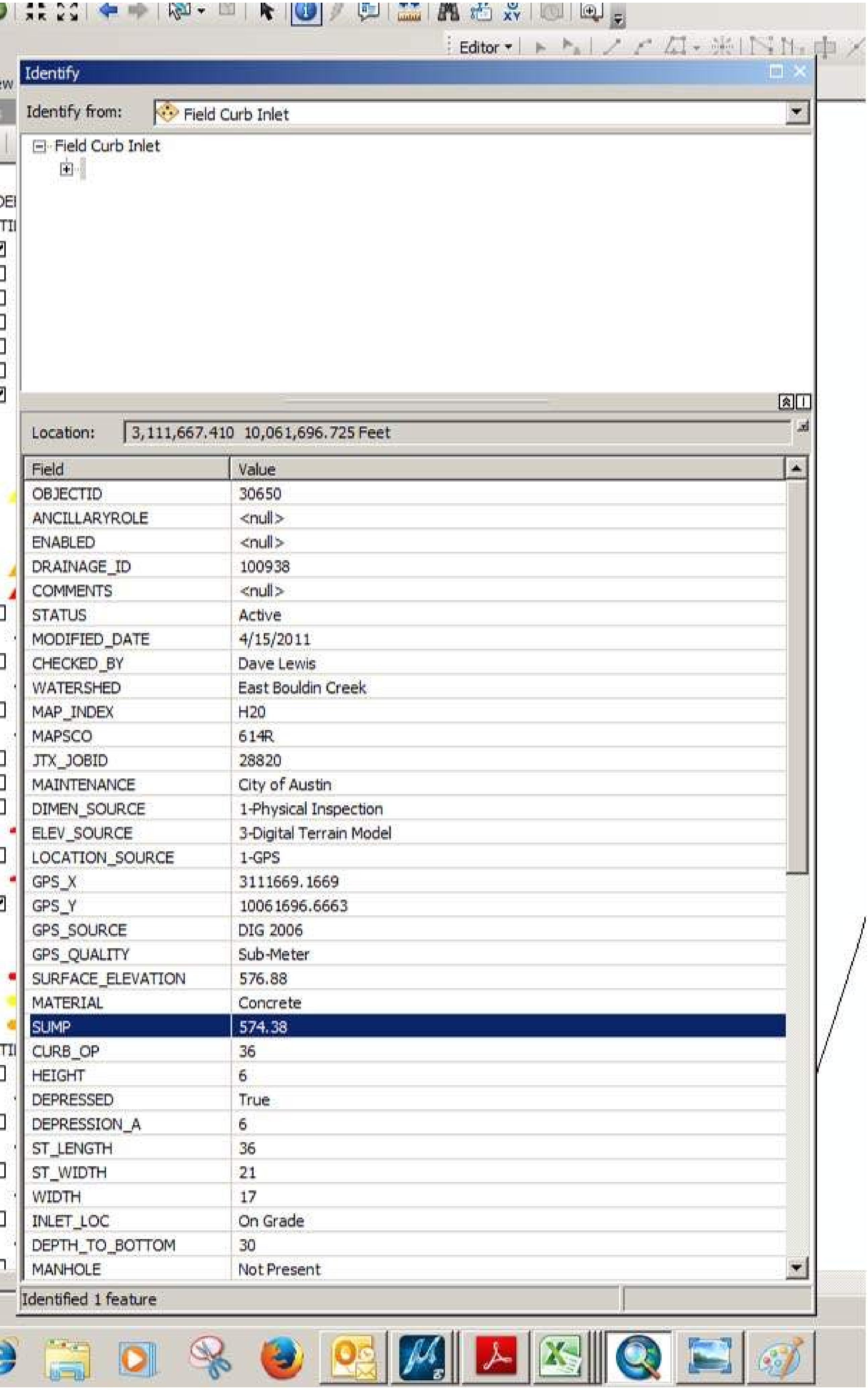


Identify from: Field Curb Inlet

Location: 3,111,693.451 10,061,710.614 Feet

Field	Value
OBJECTID	27566
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	100696
COMMENTS	<null>
STATUS	Active
MODIFIED_DATE	10/9/2009
CHECKED_BY	Dave Lewis
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614R
JTX_JOBID	28820
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111694.0831
GPS_Y	10061708.8338
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	577.33
MATERIAL	Concrete
SUMP	574.08
CURB_OP	72
HEIGHT	6
DEPRESSED	True
DEPRESSION_A	7
ST_LENGTH	59
ST_WIDTH	34
WIDTH	18
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	39
MANHOLE	Present

Identified 1 feature



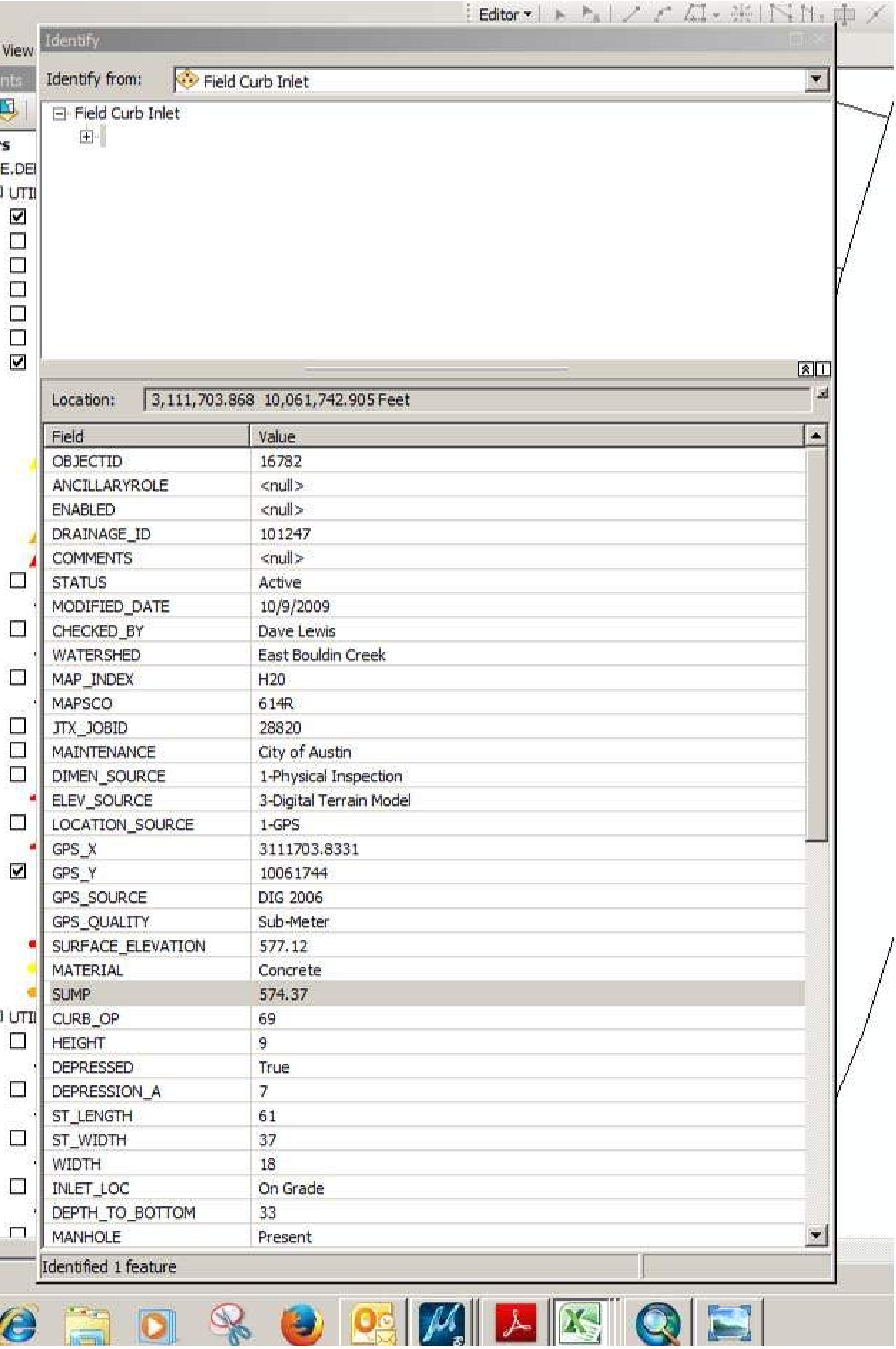
Identify from: Field Curb Inlet

Field Curb Inlet

Location: 3,111,667.410 10,061,696.725 Feet

Field	Value
OBJECTID	30650
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	100938
COMMENTS	<null>
STATUS	Active
MODIFIED_DATE	4/15/2011
CHECKED_BY	Dave Lewis
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614R
JTX_JOBID	28820
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111669.1669
GPS_Y	10061696.6663
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	576.88
MATERIAL	Concrete
SUMP	574.38
CURB_OP	36
HEIGHT	6
DEPRESSED	True
DEPRESSION_A	6
ST_LENGTH	36
ST_WIDTH	21
WIDTH	17
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	30
MANHOLE	Not Present

Identified 1 feature

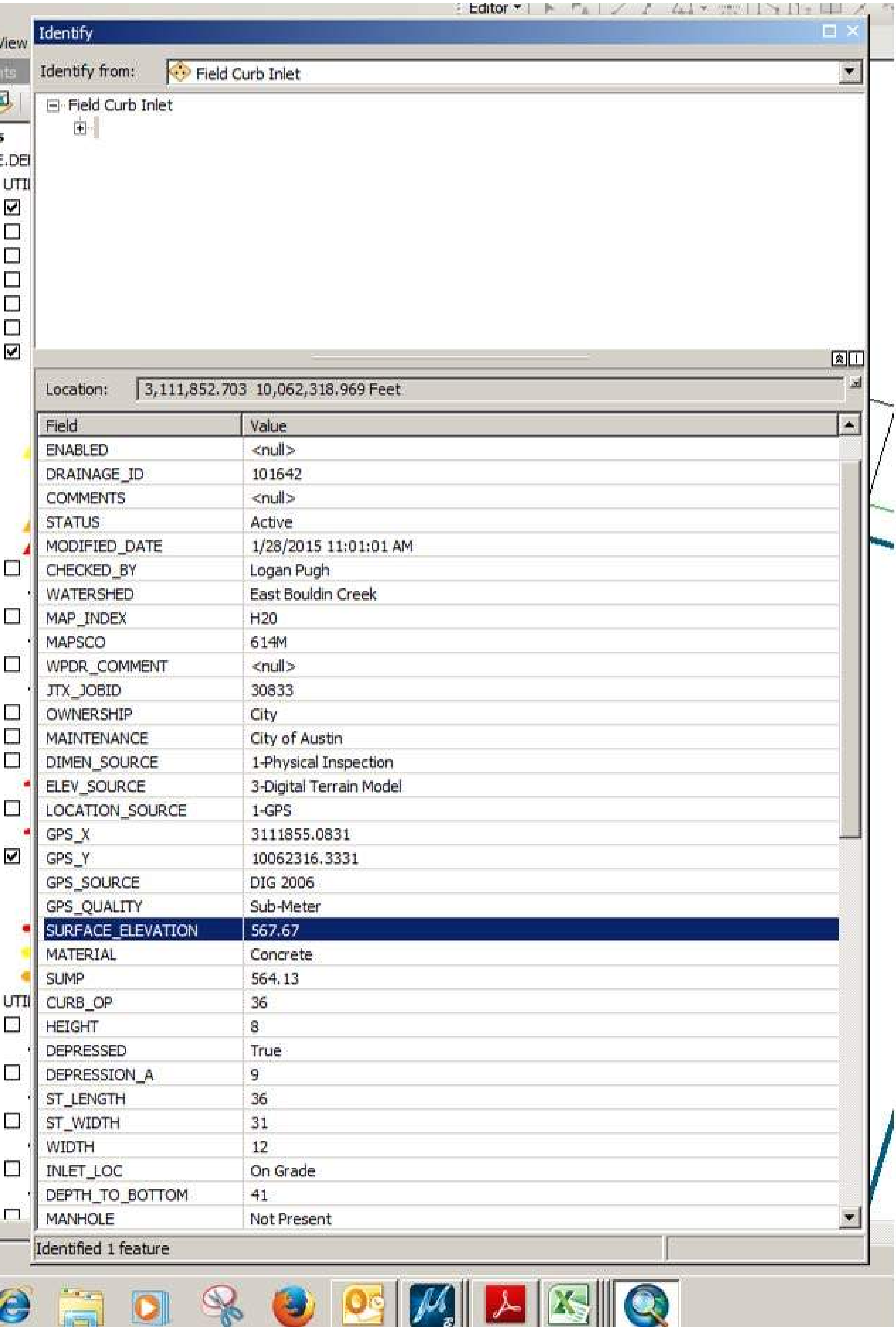


Identify from: Field Curb Inlet

Location: 3,111,703.868 10,061,742.905 Feet

Field	Value
OBJECTID	16782
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	101247
COMMENTS	<null>
STATUS	Active
MODIFIED_DATE	10/9/2009
CHECKED_BY	Dave Lewis
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614R
JTX_JOBID	28820
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111703.8331
GPS_Y	10061744
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	577.12
MATERIAL	Concrete
SUMP	574.37
CURB_OP	69
HEIGHT	9
DEPRESSED	True
DEPRESSION_A	7
ST_LENGTH	61
ST_WIDTH	37
WIDTH	18
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	33
MANHOLE	Present

Identified 1 feature



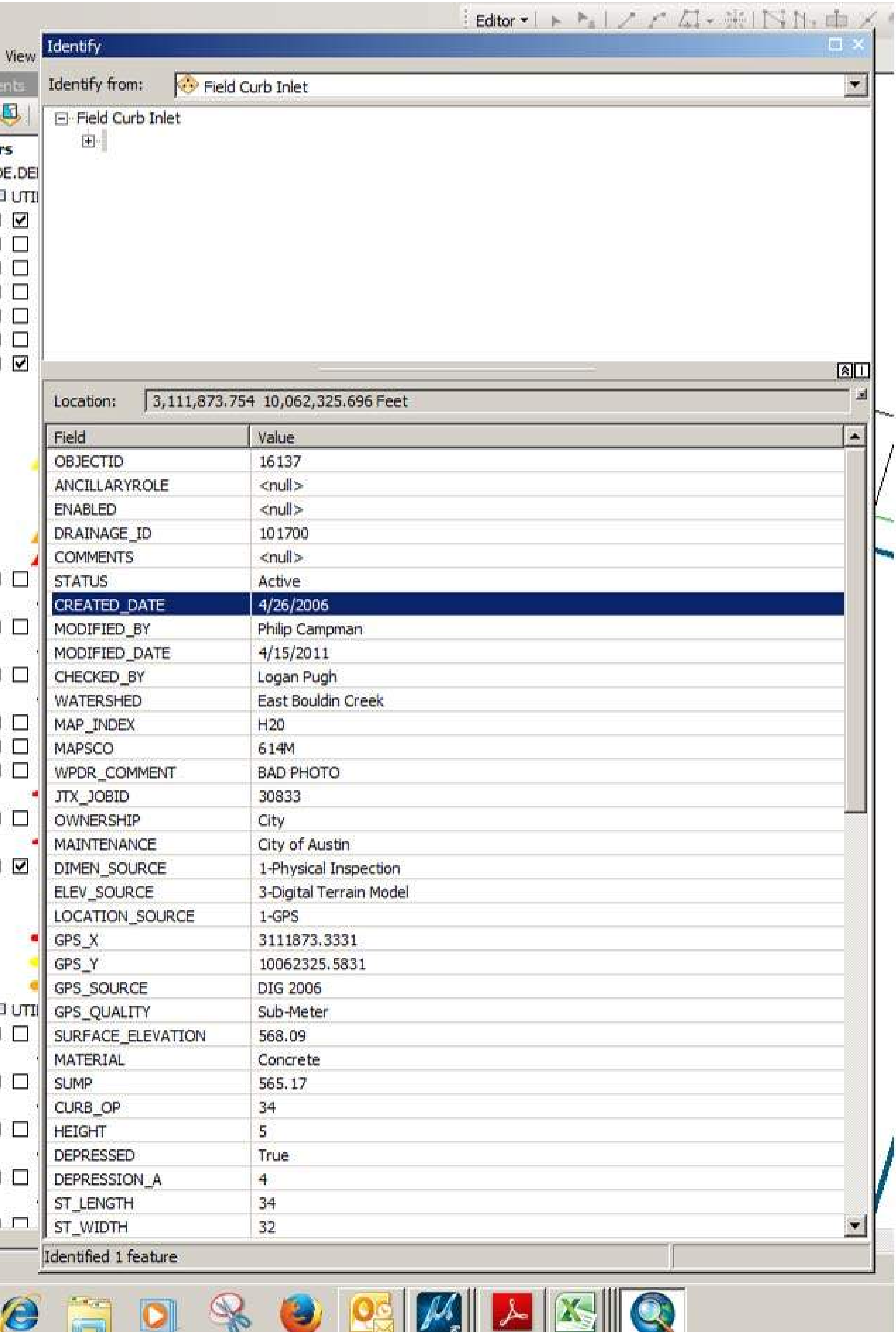
Identify from: Field Curb Inlet

Field Curb Inlet

Location: 3,111,852.703 10,062,318.969 Feet

Field	Value
ENABLED	<null>
DRAINAGE_ID	101642
COMMENTS	<null>
STATUS	Active
MODIFIED_DATE	1/28/2015 11:01:01 AM
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	<null>
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111855.0831
GPS_Y	10062316.3331
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	567.67
MATERIAL	Concrete
SUMP	564.13
CURB_OP	36
HEIGHT	8
DEPRESSED	True
DEPRESSION_A	9
ST_LENGTH	36
ST_WIDTH	31
WIDTH	12
INLET_LOC	On Grade
DEPTH_TO_BOTTOM	41
MANHOLE	Not Present

Identified 1 feature



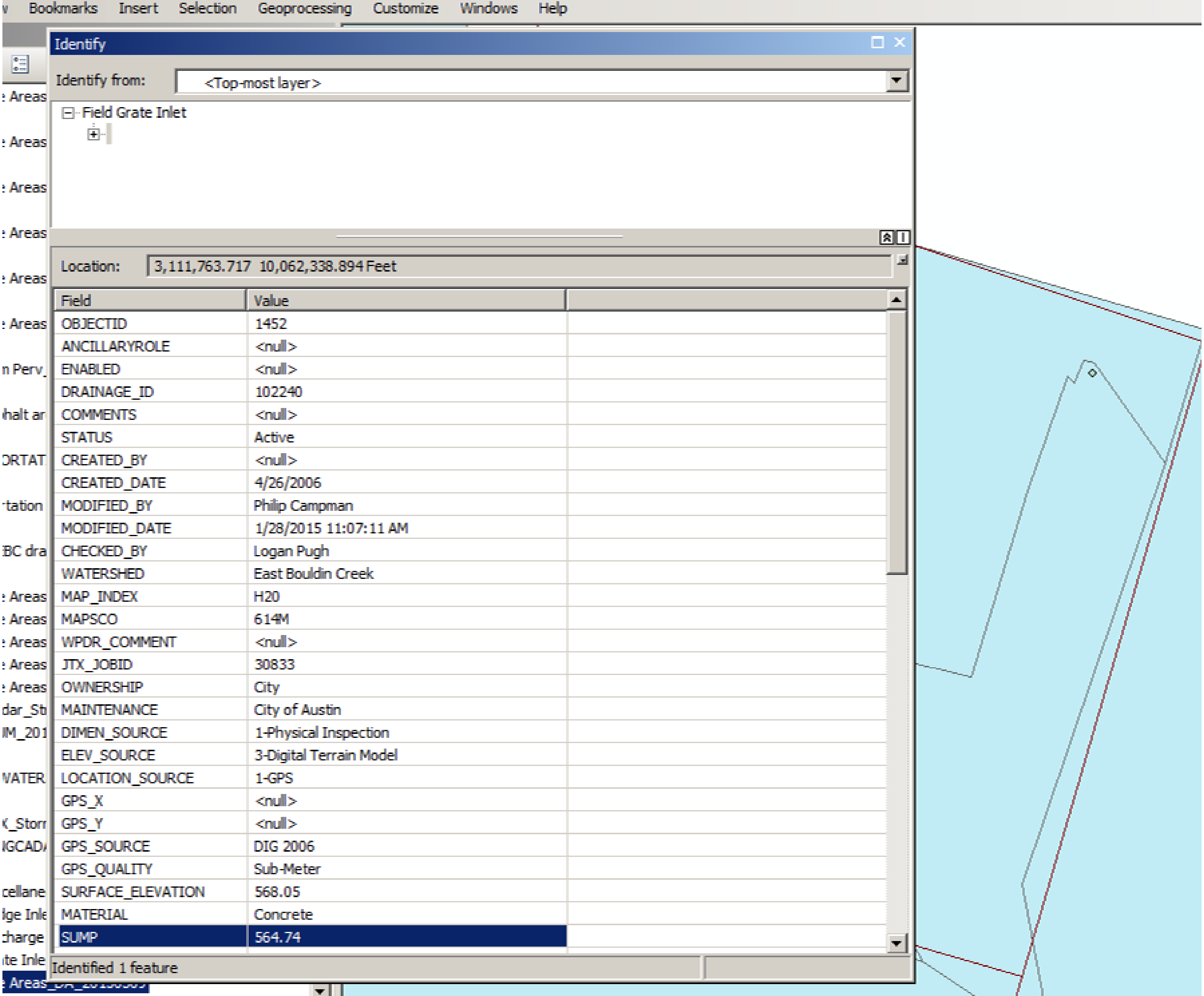
Identify from: Field Curb Inlet

⊟ Field Curb Inlet

Location: 3,111,873.754 10,062,325.696 Feet

Field	Value
OBJECTID	16137
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	101700
COMMENTS	<null>
STATUS	Active
CREATED_DATE	4/26/2006
MODIFIED_BY	Philip Campman
MODIFIED_DATE	4/15/2011
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	BAD PHOTO
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	3111873.3331
GPS_Y	10062325.5831
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	568.09
MATERIAL	Concrete
SUMP	565.17
CURB_OP	34
HEIGHT	5
DEPRESSED	True
DEPRESSION_A	4
ST_LENGTH	34
ST_WIDTH	32

Identified 1 feature



Identify from: <Top-most layer>

Field Grate Inlet

Location: 3,111,763.717 10,062,338.894 Feet

Field	Value
OBJECTID	1452
ANCILLARYROLE	<null>
ENABLED	<null>
DRAINAGE_ID	102240
COMMENTS	<null>
STATUS	Active
CREATED_BY	<null>
CREATED_DATE	4/26/2006
MODIFIED_BY	Philip Campman
MODIFIED_DATE	1/28/2015 11:07:11 AM
CHECKED_BY	Logan Pugh
WATERSHED	East Bouldin Creek
MAP_INDEX	H20
MAPSCO	614M
WPDR_COMMENT	<null>
JTX_JOBID	30833
OWNERSHIP	City
MAINTENANCE	City of Austin
DIMEN_SOURCE	1-Physical Inspection
ELEV_SOURCE	3-Digital Terrain Model
LOCATION_SOURCE	1-GPS
GPS_X	<null>
GPS_Y	<null>
GPS_SOURCE	DIG 2006
GPS_QUALITY	Sub-Meter
SURFACE_ELEVATION	568.05
MATERIAL	Concrete
SUMP	564.74

Identified 1 feature

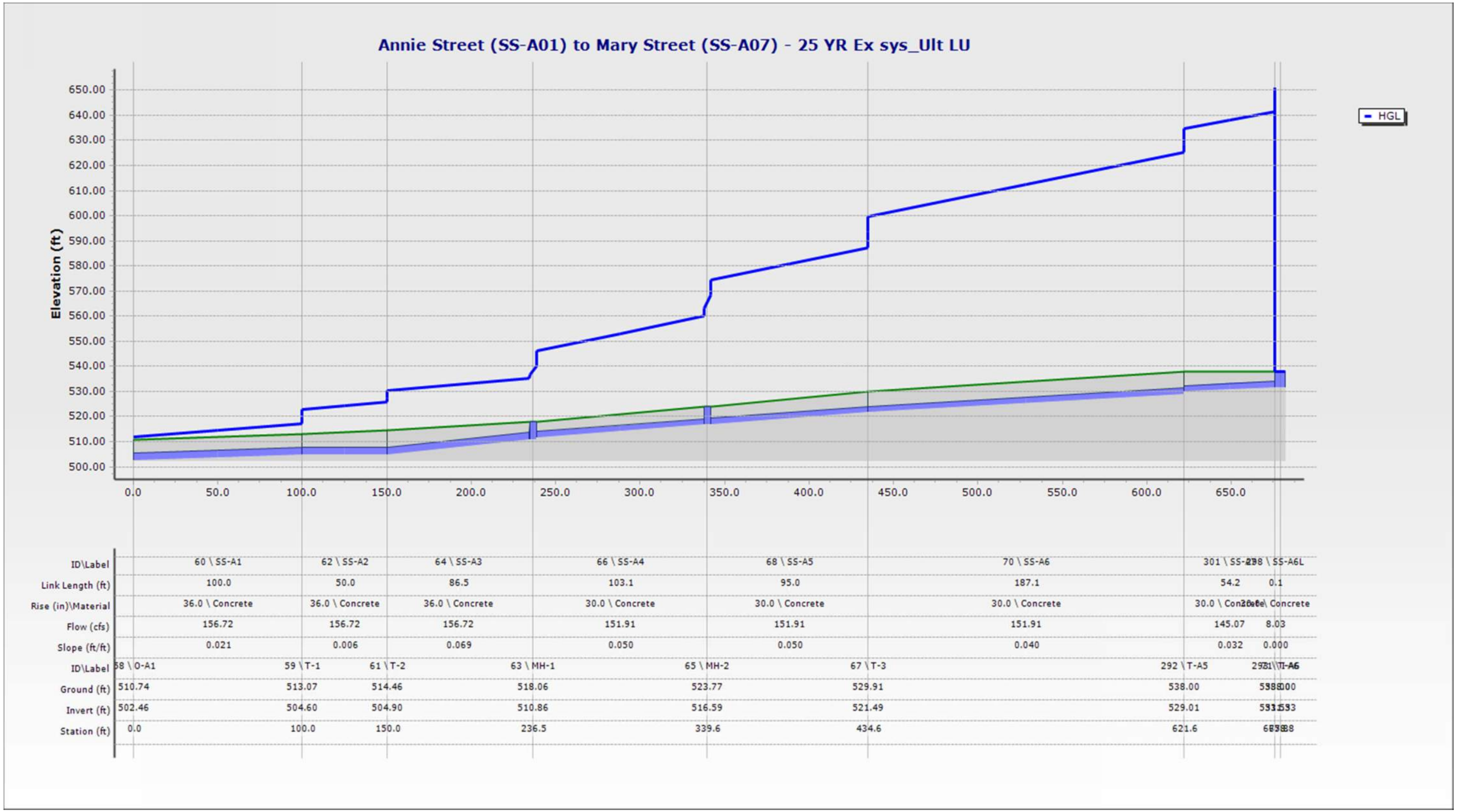
Exhibit I.10

StormCAD Profiles

EXISTING SYSTEM StormCAD LABELS

East Bouldin Creek

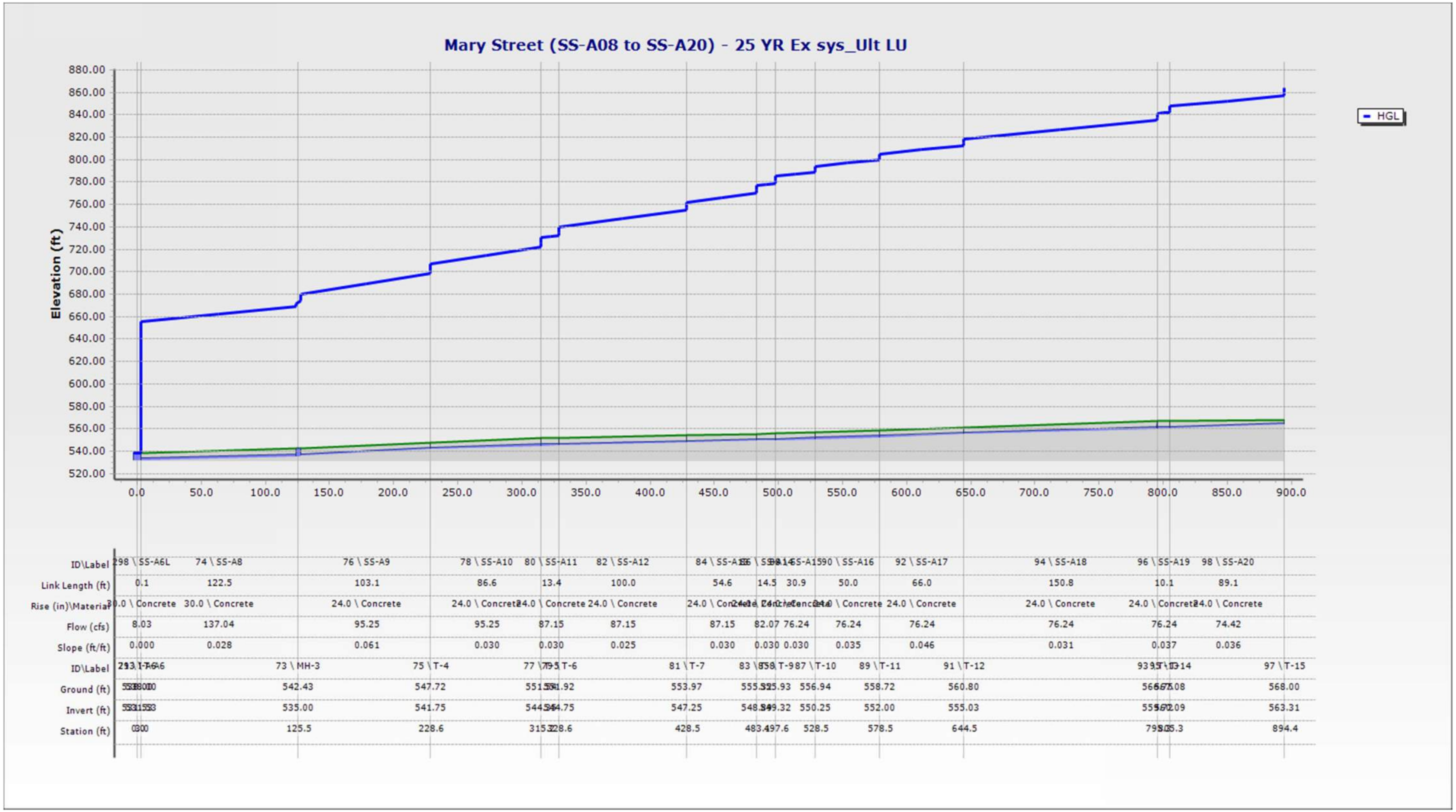
Existing Storm Drain Lines

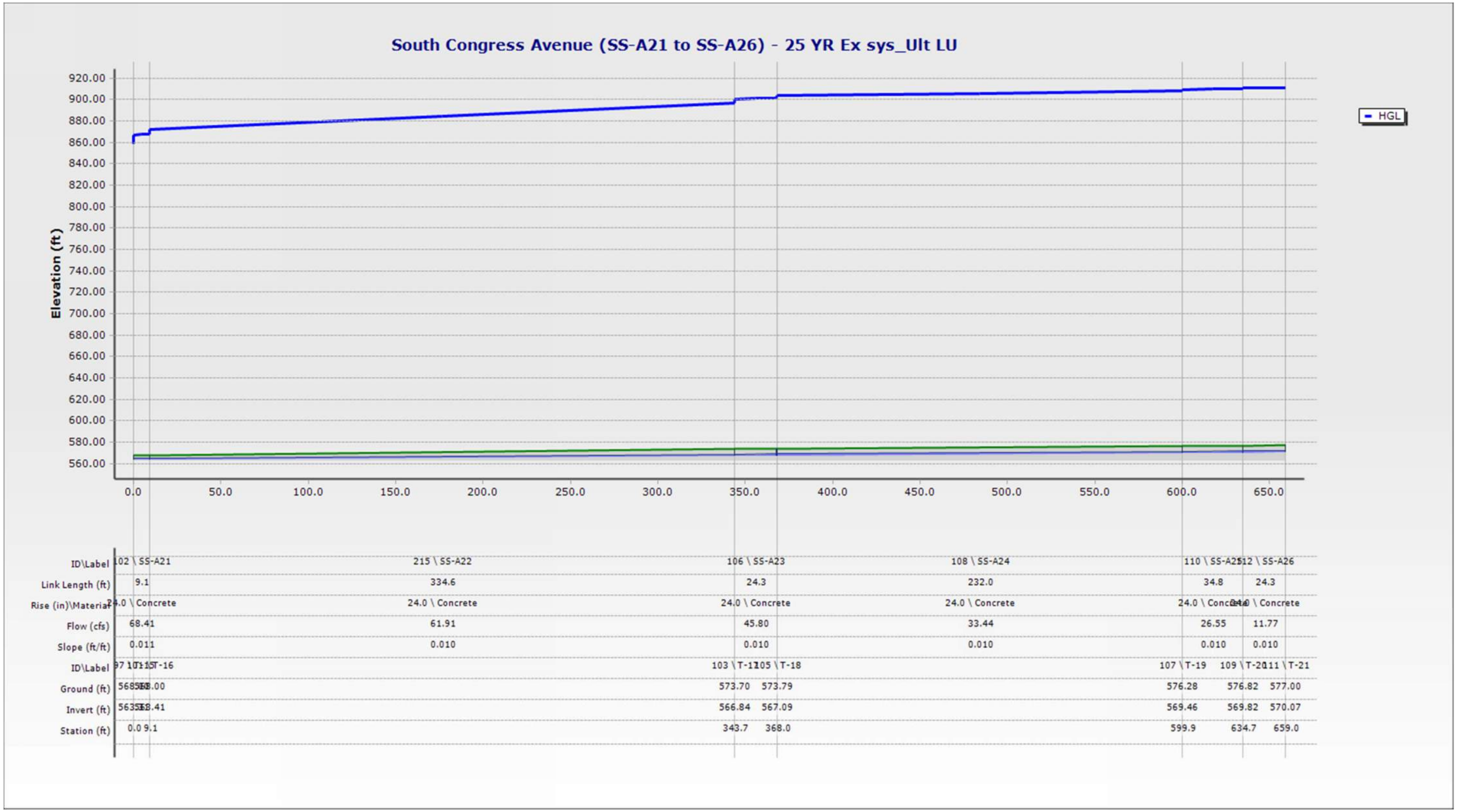


Annie Street (SS-A01) to Mary Street (SS-A07) - 25 YR Ex sys_Ult LU

ID\Label	60 \ SS-A1	62 \ SS-A2	64 \ SS-A3	66 \ SS-A4	68 \ SS-A5	70 \ SS-A6	301 \ SS-A298 \ SS-A6L	
Link Length (ft)	100.0	50.0	86.5	103.1	95.0	187.1	54.2	0.1
Rise (in)\Material	36.0 \ Concrete	36.0 \ Concrete	36.0 \ Concrete	30.0 \ Concrete	30.0 \ Concrete	30.0 \ Concrete	30.0 \ Con30.0e \ Concrete	
Flow (cfs)	156.72	156.72	156.72	151.91	151.91	151.91	145.07	8.03
Slope (ft/ft)	0.021	0.006	0.069	0.050	0.050	0.040	0.032	0.000

ID\Label	58 \ O-A1	59 \ T-1	61 \ T-2	63 \ MH-1	65 \ MH-2	67 \ T-3	292 \ T-A5	2931\\TI-A6
Ground (ft)	510.74	513.07	514.46	518.06	523.77	529.91	538.00	5388.00
Invert (ft)	502.46	504.60	504.90	510.86	516.59	521.49	529.01	5331.533
Station (ft)	0.0	100.0	150.0	236.5	339.6	434.6	621.6	67388

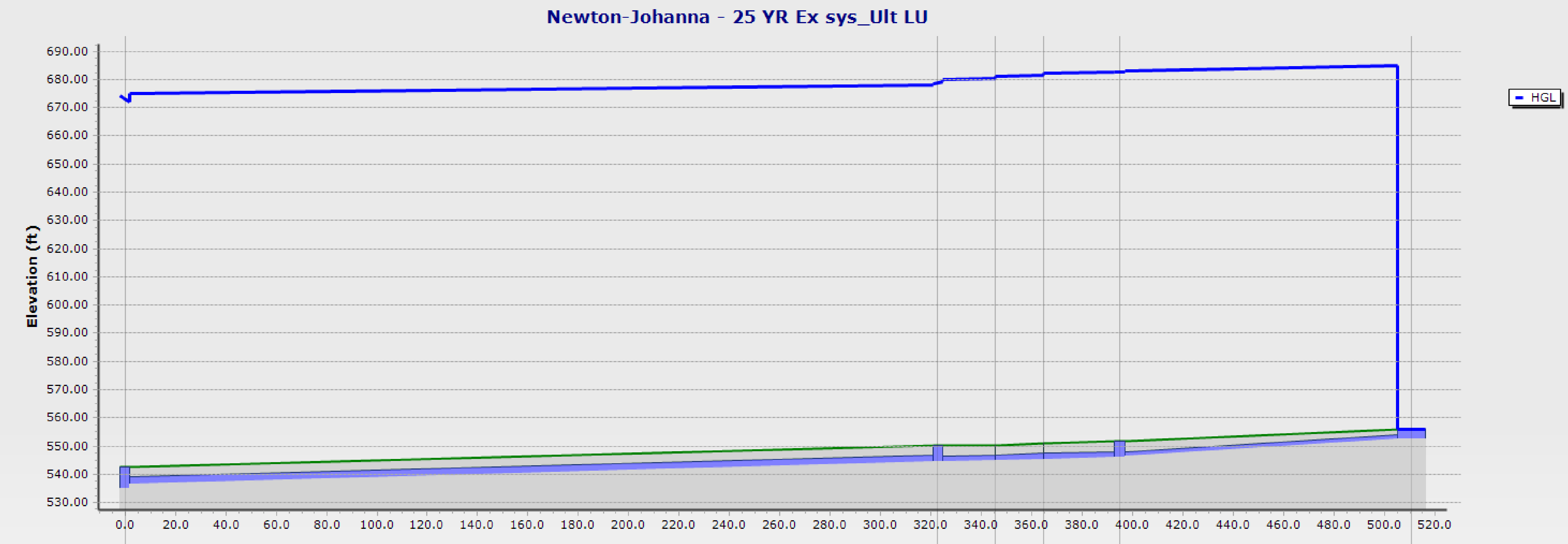

Mary Street (SS-A08 to SS-A20) - 25 YR Ex sys_Ult LU
Elevation (ft)
880.00
860.00
840.00
820.00
800.00
780.00
760.00
740.00
720.00
700.00
680.00
660.00
640.00
620.00
600.00
580.00
560.00
540.00
520.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
800.0
850.0
900.0
HGL
ID\Label 298 \ SS-A6L 74 \ SS-A8 76 \ SS-A9 78 \ SS-A10 80 \ SS-A11 82 \ SS-A12 84 \ SS-A186 \ SS88-A16S-A1590 \ SS-A16 92 \ SS-A17 94 \ SS-A18 96 \ SS-A19 98 \ SS-A20
Link Length (ft) 0.1 122.5 103.1 86.6 13.4 100.0 54.6 14.5 30.9 50.0 66.0 150.8 10.1 89.1
Rise (in)\Material 30.0 \ Concrete 30.0 \ Concrete 24.0 \ Concrete 24.0 \ Concrete24.0 \ Concrete 24.0 \ Concrete 24.0 \ Con24.0e\ 24.0\ Concrete24.0 \ Concrete 24.0 \ Concrete 24.0 \ Concrete 24.0 \ Concrete24.0 \ Concrete
Flow (cfs) 8.03 137.04 95.25 95.25 87.15 87.15 87.15 82.07 76.24 76.24 76.24 76.24 76.24 74.42
Slope (ft/ft) 0.000 0.028 0.061 0.030 0.030 0.025 0.030 0.030 0.030 0.035 0.046 0.031 0.037 0.036
ID\Label 213 \ T-A6 73 \ MH-3 75 \ T-4 77 \79 5 T-6 81 \ T-7 83 \ 85 8 T-987 \ T-10 89 \ T-11 91 \ T-12 93 95 \ T-14 97 \ T-15
Ground (ft) 538.00 542.43 547.72 551.551.92 553.97 555.555.93 556.94 558.72 560.80 566.675.08 568.00
Invert (ft) 531.53 535.00 541.75 544.544.75 547.25 548.549.32 550.25 552.00 555.03 559.562.09 563.31
Station (ft) 0.0 125.5 228.6 315.328.6 428.5 483.497.6 528.5 578.5 644.5 799.805.3 894.4



South Congress Avenue (SS-A21 to SS-A26) - 25 YR Ex sys_Ult LU

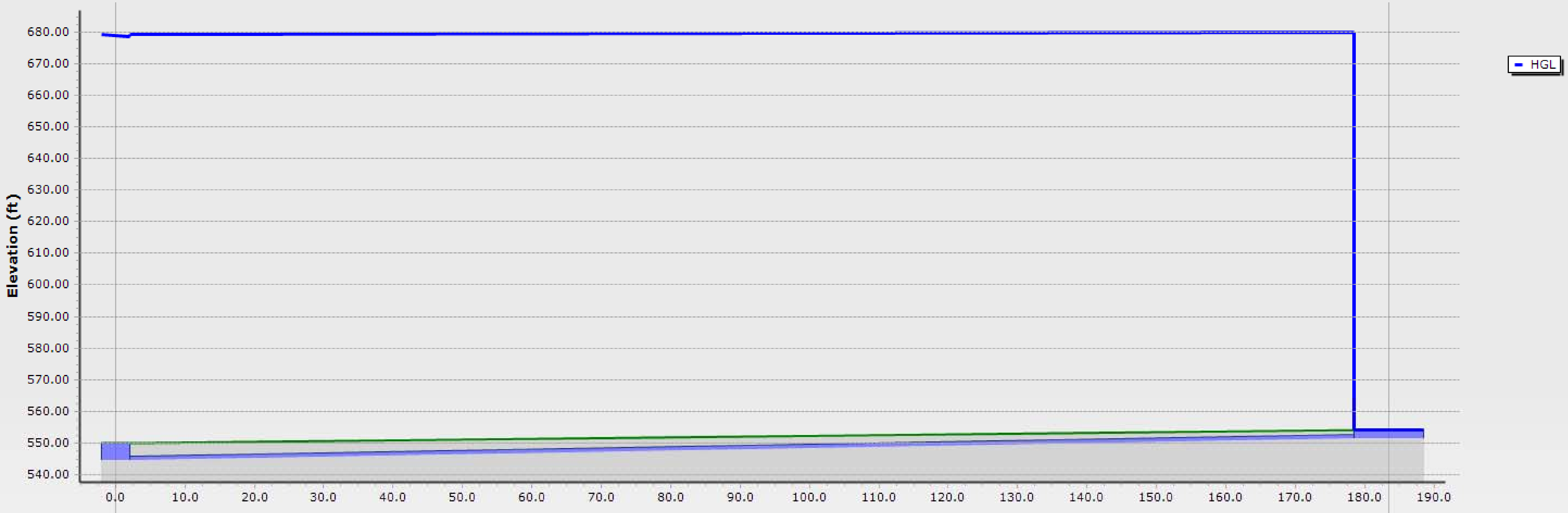
ID\Label	102 \ SS-A21	215 \ SS-A22	106 \ SS-A23	108 \ SS-A24	110 \ SS-A25	112 \ SS-A26
Link Length (ft)	9.1	334.6	24.3	232.0	34.8	24.3
Rise (in)\Material	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete
Flow (cfs)	68.41	61.91	45.80	33.44	26.55	11.77
Slope (ft/ft)	0.011	0.010	0.010	0.010	0.010	0.010

ID\Label	97 \ T-15	101 \ T-16	103 \ T-17	105 \ T-18	107 \ T-19	109 \ T-20	111 \ T-21
Ground (ft)	568[illegible]	568.00	573.70	573.79	576.28	576.82	577.00
Invert (ft)	563[illegible]	[illegible].41	566.84	567.09	569.46	569.82	570.07
Station (ft)	0.0	9.1	343.7	368.0	599.9	634.7	659.0



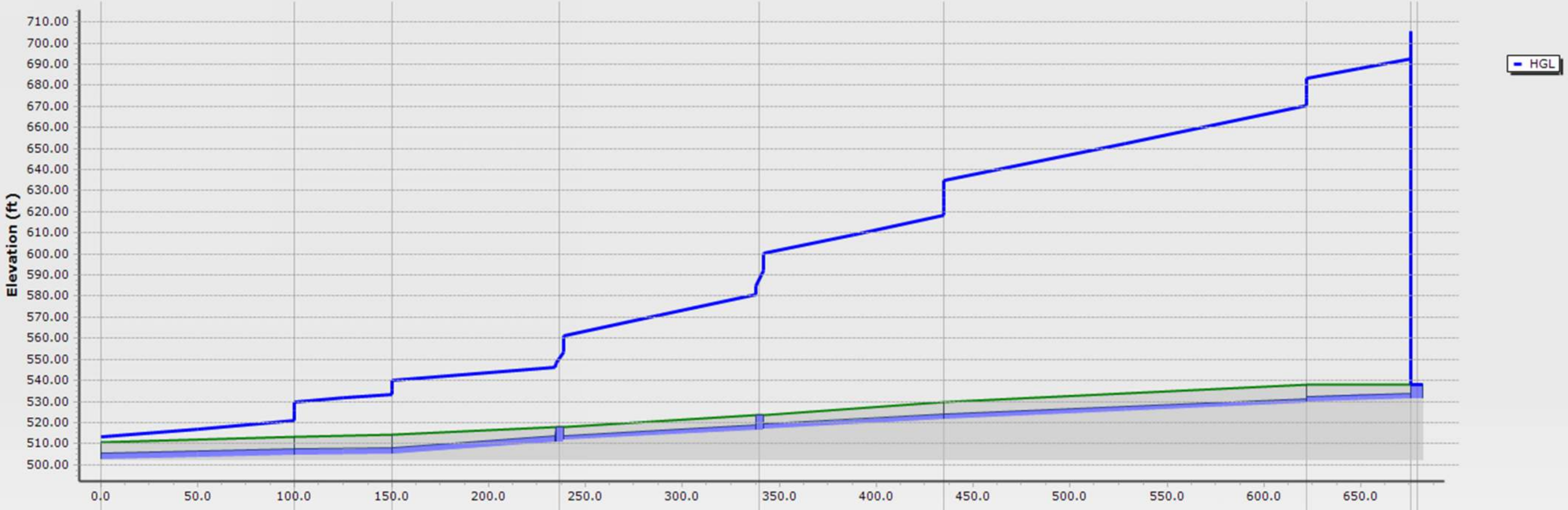
ID\Label		145 \ SS-A27		147 \ SS-A30		149 \ SS-A31		151 \ SS-A32		153 \ SS-A35	
Link Length (ft)		322.7		22.9		19.1		30.3		115.8	
Rise (in)\Material		30.0 \ Concrete		24.0 \ Concrete		24.0 \ Concrete		24.0 \ Concrete		18.0 \ Concrete	
Flow (cfs)		41.79		32.71		27.17		19.89		13.04	
Slope (ft/ft)		0.024		0.022		0.021		0.022		0.053	
ID\Label	73 \ MH-3		144 \ MH-8		146 \ T-28		148 \ T-29		150 \ MH-9		152 \ I-A20
Ground (ft)	542.43		550.04		550.31		550.91		551.87		555.94
Invert (ft)	535.00		544.47		544.97		545.38		546.04		552.69
Station (ft)	0.0		322.7		345.6		364.7		395.0		510.8

Johanna (Newton to Wilson) - 25 YR Ex sys_Ult LU



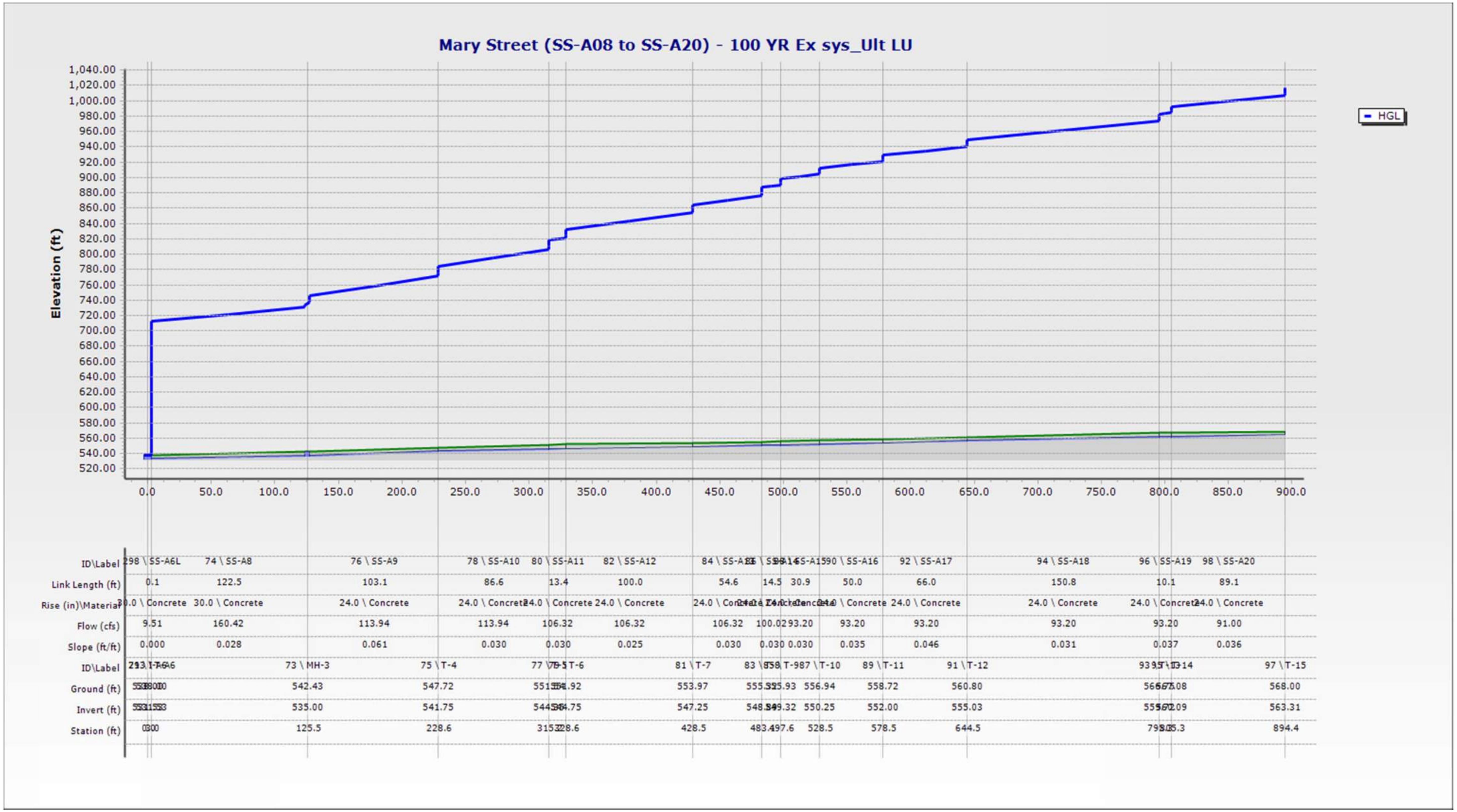
ID\Label		163 \ SS-A29	
Link Length (ft)		183.5	
Rise (in)\Material		18.0 \ Concrete	
Flow (cfs)		6.25	
Slope (ft/ft)		0.037	
ID\Label	144 \ MH-8		162 \ I-21823
Ground (ft)	550.04		554.22
Invert (ft)	544.47		551.27
Station (ft)	0.0		183.5

Annie Street (SS-A01) to Mary Street (SS-A07) - 100 YR Ex sys_Ult LU



ID\Label	60 \ SS-A1	62 \ SS-A2	64 \ SS-A3	66 \ SS-A4	68 \ SS-A5	70 \ SS-A6	301 \ SS-A[illegible]	[illegible] \ SS-A6L
Link Length (ft)	100.0	50.0	86.5	103.1	95.0	187.1	54.2	0.1
Rise (in)\Material	36.0 \ Concrete	36.0 \ Concrete	36.0 \ Concrete	30.0 \ Concrete	30.0 \ Concrete	30.0 \ Concrete	30.0 \ Con[illegible]	[illegible] \ Concrete
Flow (cfs)	183.61	183.61	183.61	178.01	178.01	178.01	169.93	9.51
Slope (ft/ft)	0.021	0.006	0.069	0.050	0.050	0.040	0.032	0.000

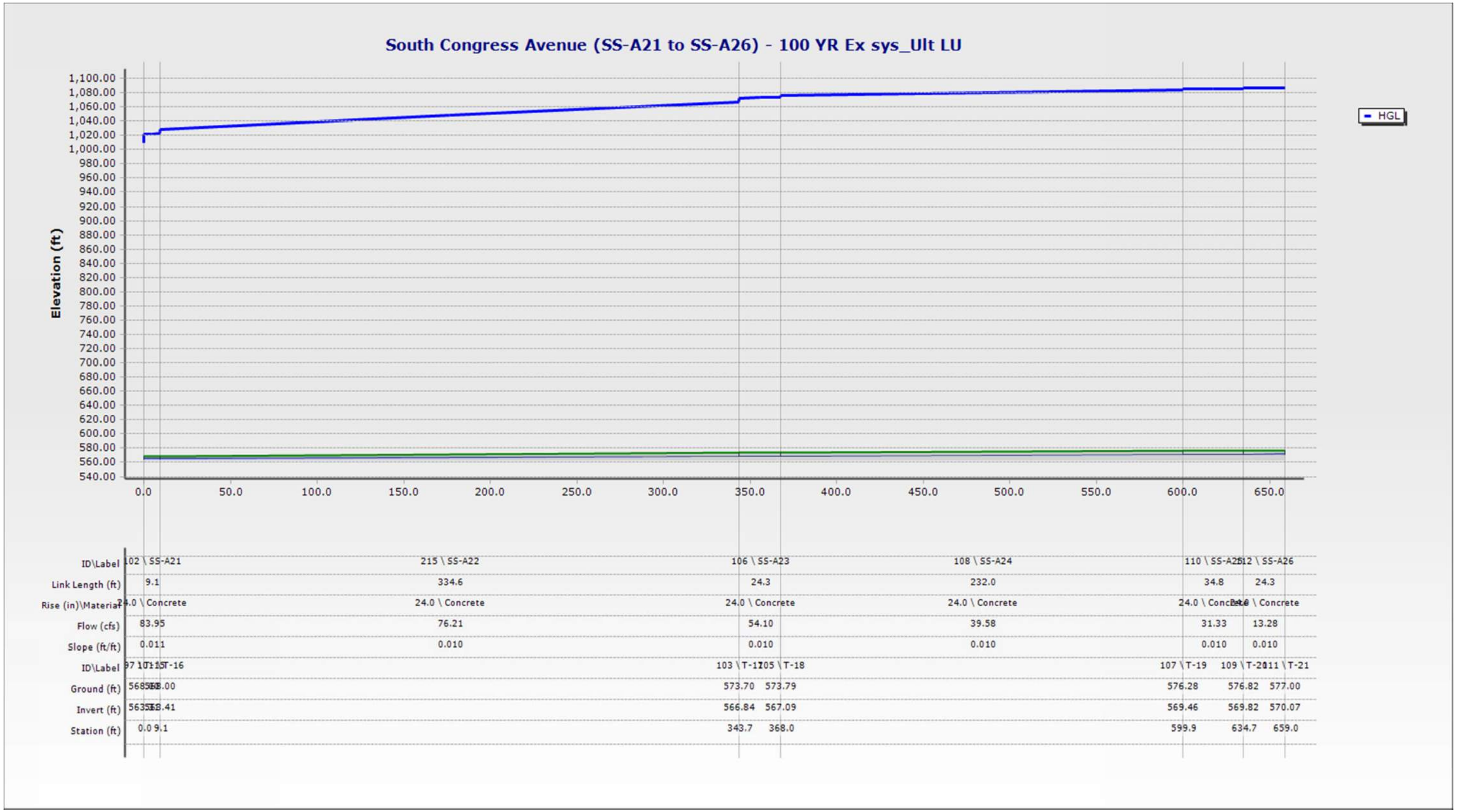
ID\Label	58 \ O-A1	59 \ T-1	61 \ T-2	63 \ MH-1	65 \ MH-2	67 \ T-3	292 \ T-A5	[illegible]
Ground (ft)	510.74	513.07	514.46	518.06	523.77	529.91	538.00	[illegible]
Invert (ft)	502.46	504.60	504.90	510.86	516.59	521.49	529.01	[illegible]
Station (ft)	0.0	100.0	150.0	236.5	339.6	434.6	621.6	[illegible]



Mary Street (SS-A08 to SS-A20) - 100 YR Ex sys_Ult LU

ID\Label	298 \ SS-A6L	74 \ SS-A8	76 \ SS-A9	78 \ SS-A10	80 \ SS-A11	82 \ SS-A12	84 \ SS-A13	86 \ SS-A14	88 \ SS-A15	90 \ SS-A16	92 \ SS-A17	94 \ SS-A18	96 \ SS-A19	98 \ SS-A20
Link Length (ft)	0.1	122.5	103.1	86.6	13.4	100.0	54.6	14.5	30.9	50.0	66.0	150.8	10.1	89.1
Rise (in)\Material	30.0 \ Concrete	30.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete	24.0 \ Concrete
Flow (cfs)	9.51	160.42	113.94	113.94	106.32	106.32	106.32	100.02	93.20	93.20	93.20	93.20	93.20	91.00
Slope (ft/ft)	0.000	0.028	0.061	0.030	0.030	0.025	0.030	0.030	0.030	0.035	0.046	0.031	0.037	0.036

ID\Label	[illegible]	[illegible]	73 \ MH-3	75 \ T-4	77 \ T-5	79 \ T-6	81 \ T-7	83 \ T-8	85 \ T-9	87 \ T-10	89 \ T-11	91 \ T-12	93 \ T-13	95 \ T-14	97 \ T-15
Ground (ft)	[illegible]	[illegible]	542.43	547.72	[illegible]	554.92	553.97	[illegible]	555.93	556.94	558.72	560.80	[illegible]	567.08	568.00
Invert (ft)	[illegible]	[illegible]	535.00	541.75	[illegible]	544.75	547.25	[illegible]	549.32	550.25	552.00	555.03	[illegible]	[illegible]	563.31
Station (ft)	[illegible]	[illegible]	125.5	228.6	[illegible]	328.6	428.5	483.4	497.6	528.5	578.5	644.5	[illegible]	805.3	894.4



South Congress Avenue (SS-A21 to SS-A26) - 100 YR Ex sys_Ult LU