

SAN ANTONIO WATER SYSTEM

Infrastructure Planning – GIS / Mapping Division

**CADD
STANDARDS**

INFRASTRUCTURE PLANNING

CADD STANDARDS

SAN ANTONIO WATER SYSTEM
2800 U.S. Hwy. 281 North
San Antonio, TX 78212
www.SAWS.org

Last Revised Thursday, May 17, 2007
Document1

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Introduction

Purpose

The purpose of this document is to set a basic CADD standard to ensure consistent electronic and paper deliverables throughout SAWS. This document will also ensure consultant electronic and paper deliverables concur with SAWS CADD standards. This document also establishes that all electronic CADD deliverables will be in Microstation DGN or AutoCAD DWG format.

Scope

The scope of this document is to standardize SAWS CADD products. These products include but are not limited to survey, design, overall utility layouts, and utility mapping files. This document also creates the level standards to be used and followed in all SAWS CADD products.

Supporting Files

Supporting Files-

The following files are available for downloading from the SAWS Website at www.saws.org/business_center/specs/cadd/

1. saws.cel - This file contains the cell library for wastewater, water, and recycle utilities.
2. hp650c.tbl - This file contains the color table for SAWS Level Symbology.
3. font.rsc - This is a resource file containing the font library.
4. water.dgn - This is the water and design seed file.
5. sewer.dgn - This is the sewer design seed file.
6. recycle.dgn - This is the recycle design seed file.
7. O_Util.pdf – This file is an example of an Overall Utility Layout Plan.
8. O_Util_A.pdf – This file is an example of an Overall Utility Layout Plan with aerial.

Naming Standards

The digital file is to contain the overall utility layout plan and all design sheets. The naming standard for all electronic files is as follows:

Format: yy-####.dgn

Example: 98-1001.dgn

Overall Utility Layout Plan

The overall utility layout plan is now required to be submitted as an As-Built.
Requirements:

1. Overall utility layout plan must be in real world coordinates – NAD 1983 State Plane, Texas South Central, FIPS 4204, Survey Feet.
2. All utility symbols and level symbology must conform to the SAWS CADD Standards.
3. All other non-utility information placed on the Overall Utility Layout Plan must be placed on levels not used by the SAWS CADD Standards.
4. Horizontal control points shall be provided in NAD 1983 State Plane, Texas South Central, FIPS 4204, Survey Feet. A minimum of two x,y coordinates will be required on all jobs.
5. Working Units, Coordinate Readout and Active Scale shall conform to SAWS standard design seed files.

Section

1

MicroStation/AutoCAD Standards

Water Level Symbology Table

Level or Layer	Weight	Style or Type	Color	Font or Style	Height & Width	Cell or Block	Description
1	1	3	16				<6" CI
			6				<6" AC
			3				<6" GI
			17				<6" STL
			19				<6" PVC
			7				<6" DI
2	2	0	16				6" CI
			7				6" DI
			6				6" AC
			17				6" STL
			3				6" GI
			5				6" CSC
			19				6" PVC
3	2	0	16				8" CI
			7				8" DI
			6				8" AC
			17				8" STL
			5				8" CSC
			19				8" PVC
4	2	0	16				10" CI
			7				10" DI
			6				10" AC

Level or Layer	Weight	Style or Type	Color	Font or Style	Height & Width	Cell or Block	Description
4			17				10" STL
			5				10" CSC
			19				10" PVC
5	2	0	16				12" CI
			7				12" DI
			6				12" AC
			17				12" STL
			5				12" CSC
			19				12" PVC
6	2	0	16				16" CI
			7				16" DI
			6				16" AC
			5				16" CSC
			17				16" STL
			19				16" PVC
7	3	0	16				20" CI
			7				20" DI
			6				20" AC
			5				20" CSC
			19				20" PVC
			17				20" STL
8	3	0	16				24" CI
			7				24" DI
			6				24" AC
			5				24" CSC
			19				24" PVC
			17				24" STL
9	3	0	16				30" CI
			7				30" DI
			6				30" AC
			5				30" CSC

Level or Layer	Weight	Style or Type	Color	Font or Style	Height & Width	Cell or Block	Description
			17				30" STL
10	3	0	16				36" CI
			7				36" DI
			6				36" AC
			5				36" CSC
			17				36" STL
11	3	0	5				42" CSC
			7				42" DI
			17				42" STL
12	3	0	5				48" CSC
			7				48" DI
			17				48" STL
13	3	0	5				54" CSC
			17				54" STL
14	3	0	5				60" CSC
			17				60" STL
15	3	0	5				72" CSC
			5				72" STL
16	3	0	17				66" CSC
			5				66" STL
17							Open
18						FVAL	Fire Hydrant Valve
19						SVAL	Service Level Valve
20						SCADA	SCADA
	0	0	7				SCADA Leader Line
	1			23	8		SCADA text
21	0	0	34	56			PRO RATA Line
	12	1	34				Fire Hydrant Line
22	2	0	7				Fire Hydrant Lateral
23							Open

Level or Layer	Weight	Style or Type	Color	Font or Style	Height & Width	Cell or Block	Description
24	2	0	0			PR_VAL	Pressure Release Valve
25							Open
26	0	0	31	23	7		Misc. Text
27	1	0	26	23	10		Main Size and Type
28	0	0	0			TS	Tapping Sleeve
29	0	0	0			DVAL	Division Valve
30	0	0	0			BOTC	Blow-off Tapped Cap
						OUTLET	Flanged Outlet
						TEE	Tee
						CPLG	Cast Coupling
						90	90 Degree (1/4) Bend
						45	45 Degree (1/8) Bend
						22.5	22.5 Degree (1/16) Bend
						11.25	11.25 Degree (1/32) Bend
						VB	Vertical Bend
						CROSS	Cross
						OFF	Offset Bend
						PLUG	Cap & Plug
31	1	0	26	23	10		Job Number
32	0	0	31	23		AH	Arrow Head
					7		Main Measurements
33	2	0	59	11			Pump Station
					10		Pump Station Annotation
34	3	0	18	12	12		Pressure Zone Annotation
35	0	0	0			RED	Reducer
36	0	0	0			BO	Blow-off Valve
37	0	0	0			VAL	Main Line Valves
38	0	0	0			FH	Fire Hydrants
39	0	0	0			AR	Air Release Valve
40	1	0	2				Single Service Line COP
	2	0	7				LG DI SERVICE

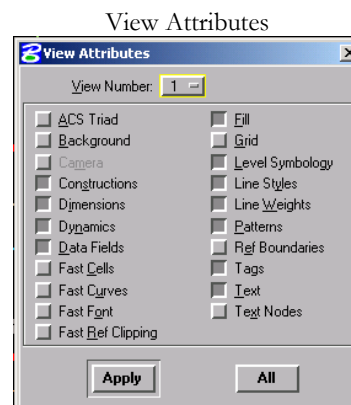
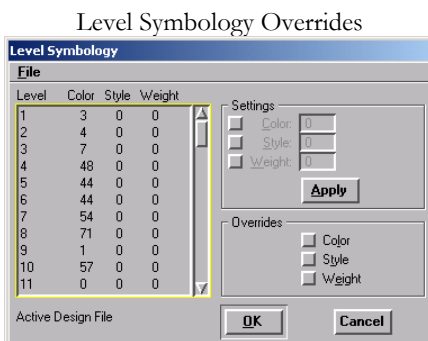
Level or Layer	Weight	Style or Type	Color	Font or Style	Height & Width	Cell or Block	Description
	1	3	7				DI SERVICE <6"
	1	3	16				CI SERVICE <6"
	1	0	2			DS	Dual Service line
41							Address
42	0	0	18	23	8		Tap Numbers
43							Open
44	0	3	59				RCP Conduit
		0		23	7		RCP Conduit Annotation
45	0	0	4	12	12		Tag Number
							Leader
46	1	0	31			Well	Well Symbol
47	0	0	30				SAWS Property
				5	8		SAWS Property Annotation
48	0	3	30				SAWS Easements
		0		23	6		SAWS Easement Annotation
49	3	0	18	23	30	Bexmet	"Served by Bexar Met" text
50	2	0	4	1	13		Street Annotation
51							Open
52	3	3	43				Proposed Main
				43	13		Proposed Main Annotation
							Proposed Fire Hydrant / Valve
53	0	0	0			IVAL	Interconnection Valve
54							Open
55							Open
56							Open
57							Open
58	0	0	0				Base Map Features
59	0	0	0				Miscellaneous – (For Features not defined)

Level or Layer	Weight	Style or Type	Color	Font or Style	Height & Width	Cell or Block	Description
60	0	0	0				Existing Topology
61	0	0	0				Survey Data
62	0	0	0				Blow-up Detail
63	0	0	0				Grid Layout
*	3	3	*				Pro-rata
							Elements that need to be tagged

Color Table:

\hp650c.tbl

Additional Settings:



Water Cell Library

1. Cell Library - \saws.cel

DIAGRAM 1

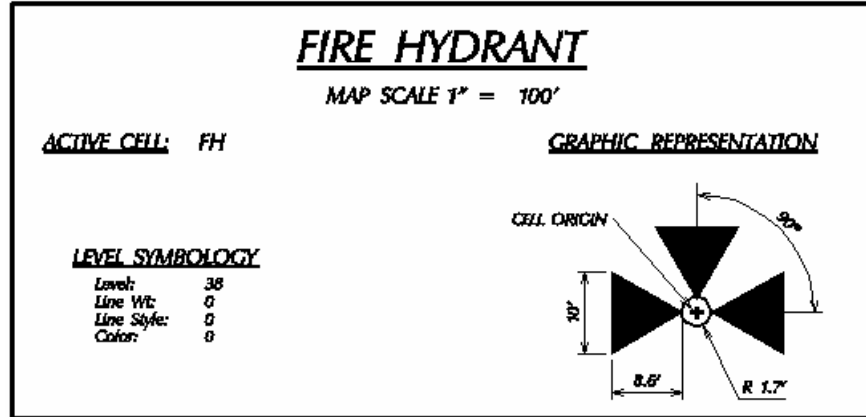


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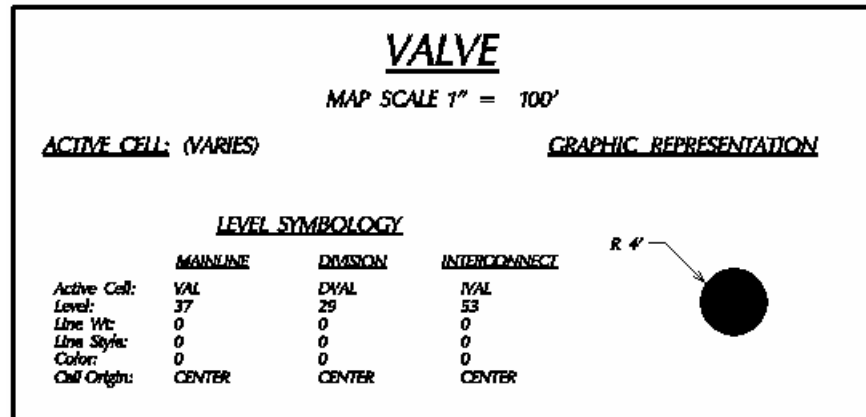
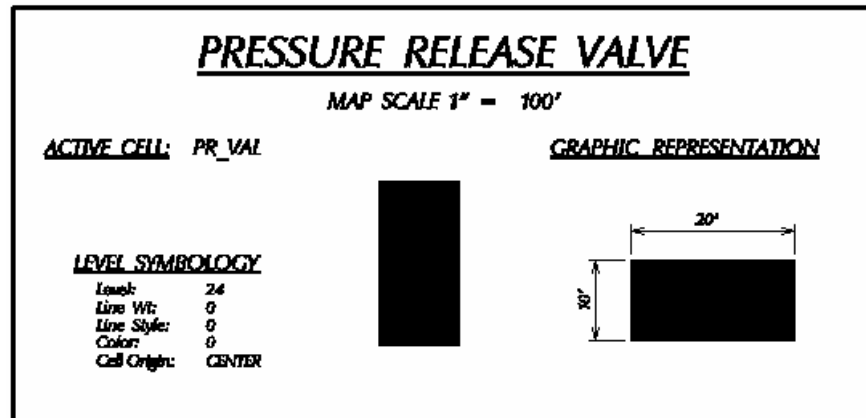


DIAGRAM 3



Water Cell Library (Continued)

DIAGRAM 4

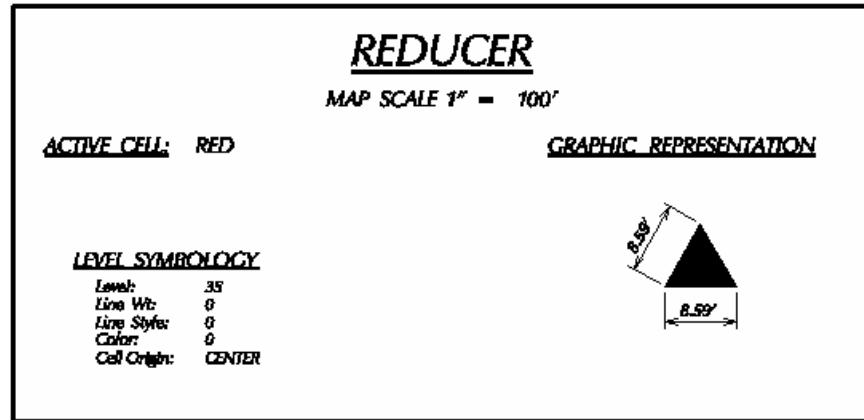


DIAGRAM 5

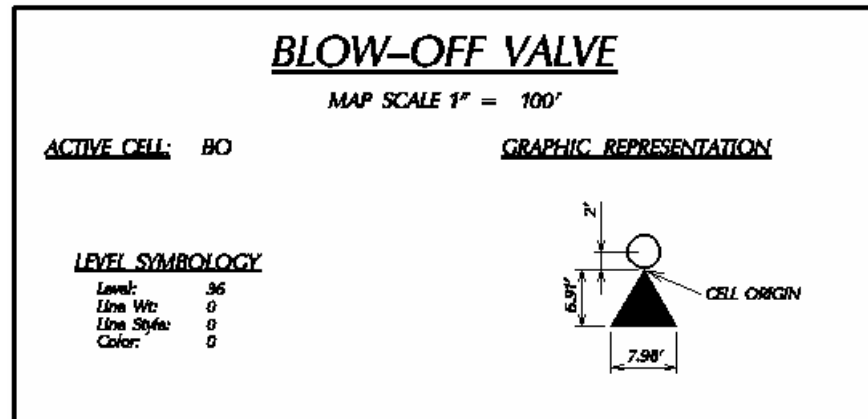
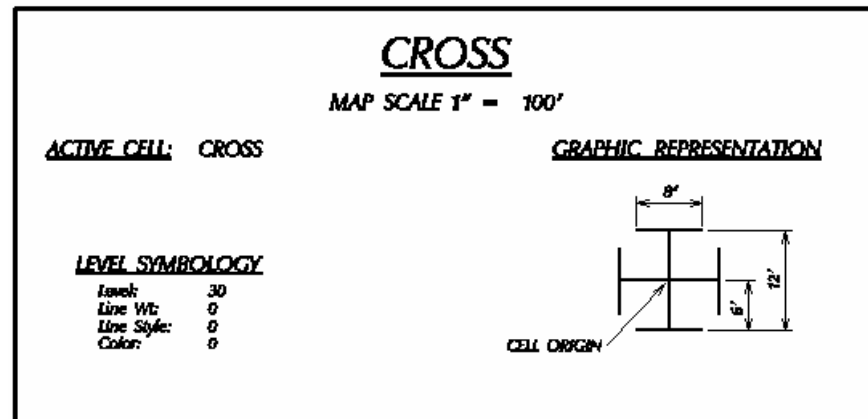


DIAGRAM 6



Water Cell Library (Continued)

DIAGRAM 7

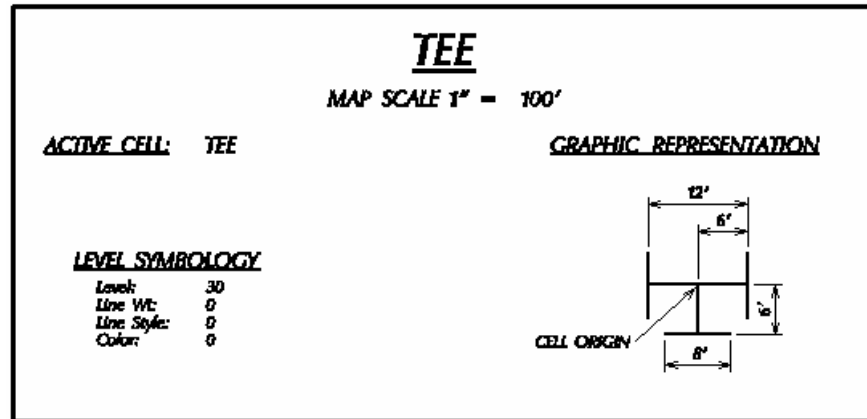


DIAGRAM 8

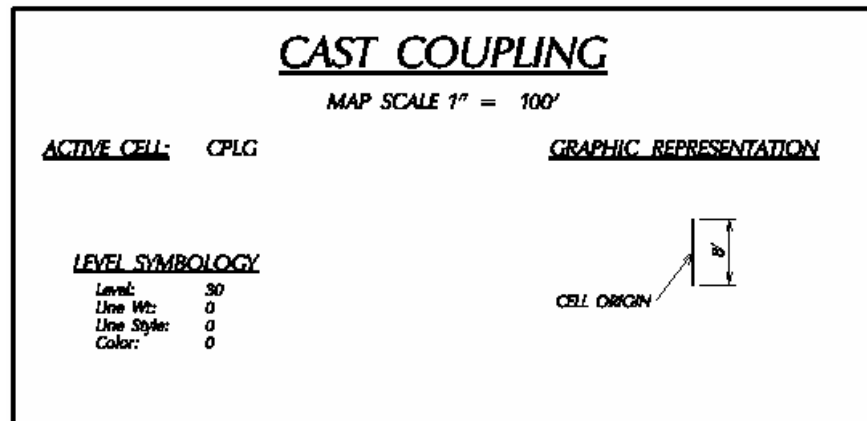
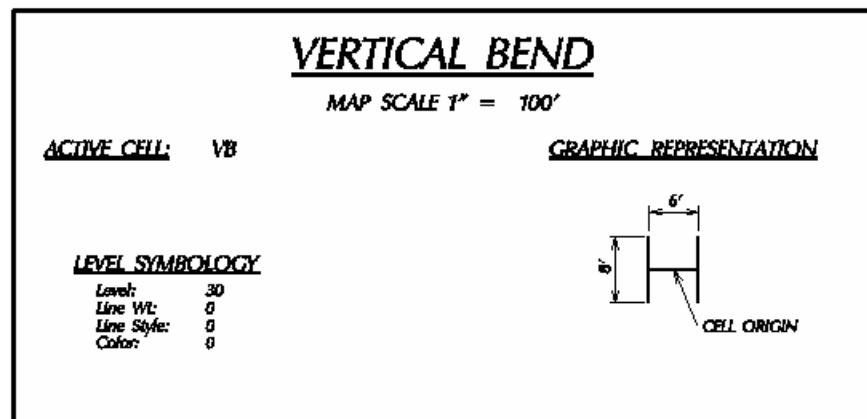


DIAGRAM 9



Water Cell Library (Continued)

DIAGRAM 10

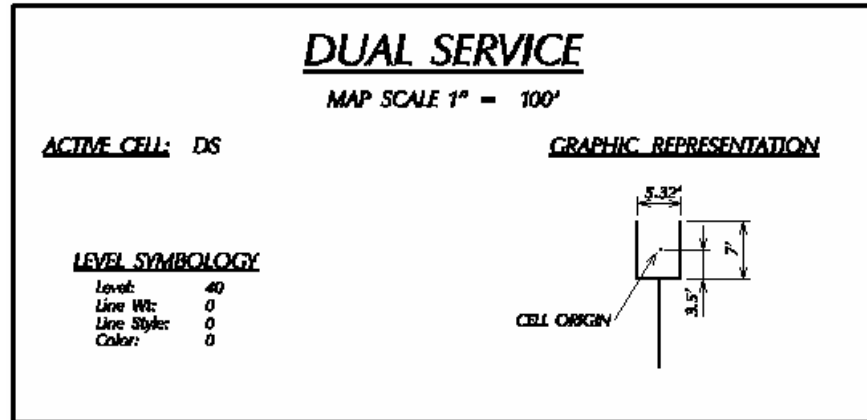


DIAGRAM 11

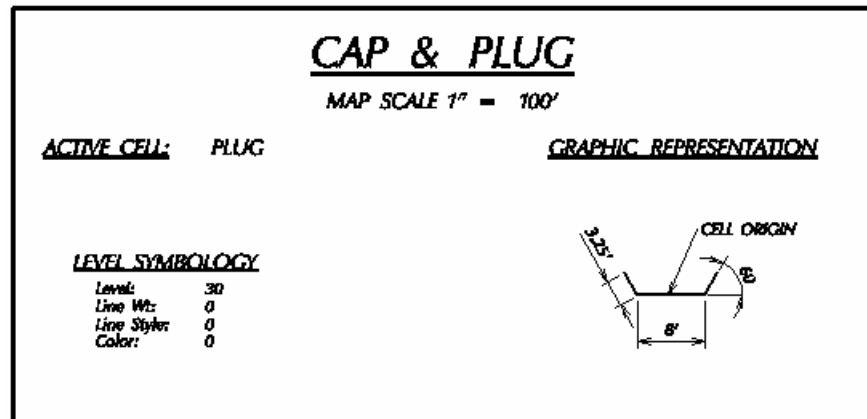
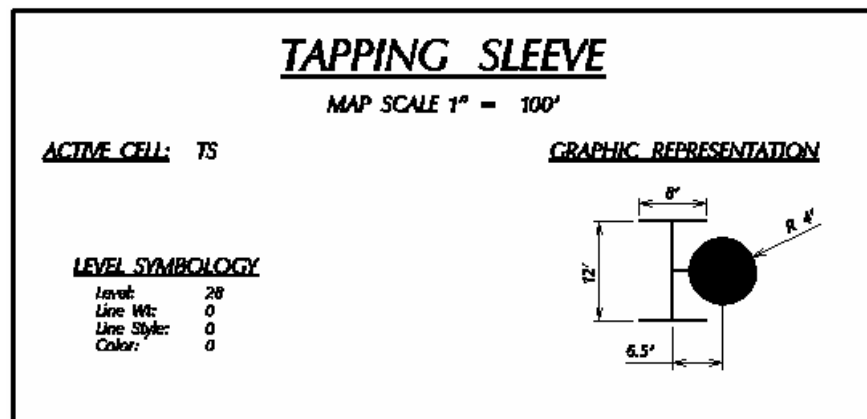


DIAGRAM 12



Water Cell Library (Continued)

DIAGRAM 13

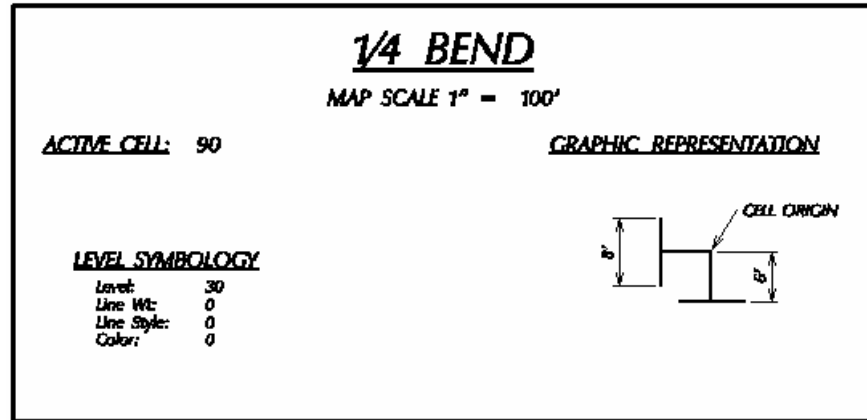


DIAGRAM 14

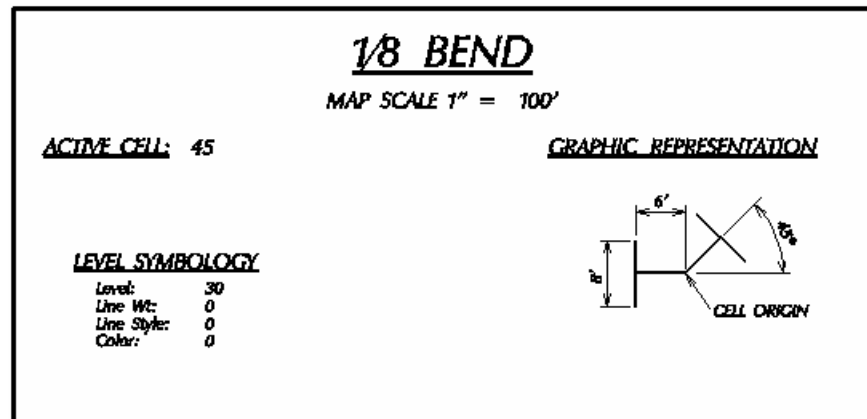
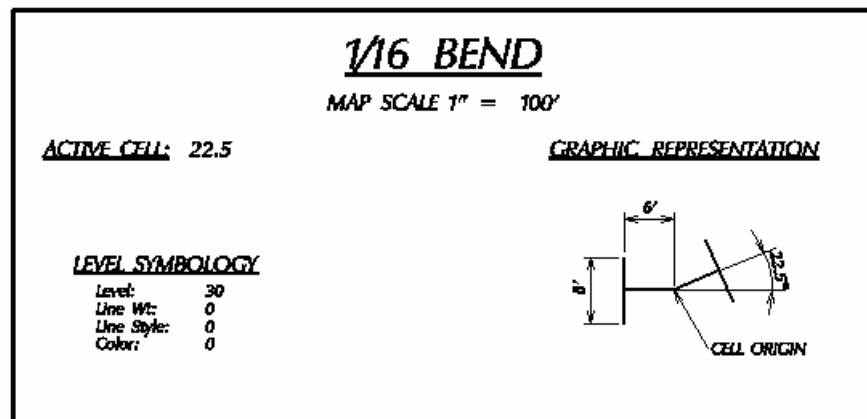


DIAGRAM 15



Water Cell Library (Continued)

DIAGRAM 16

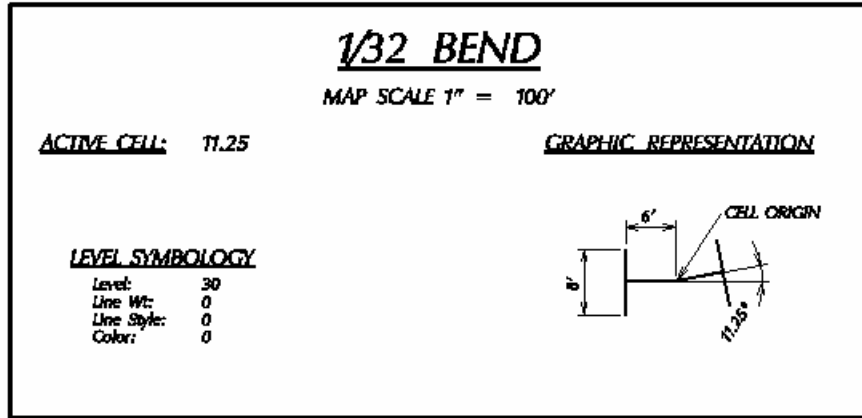


DIAGRAM 17

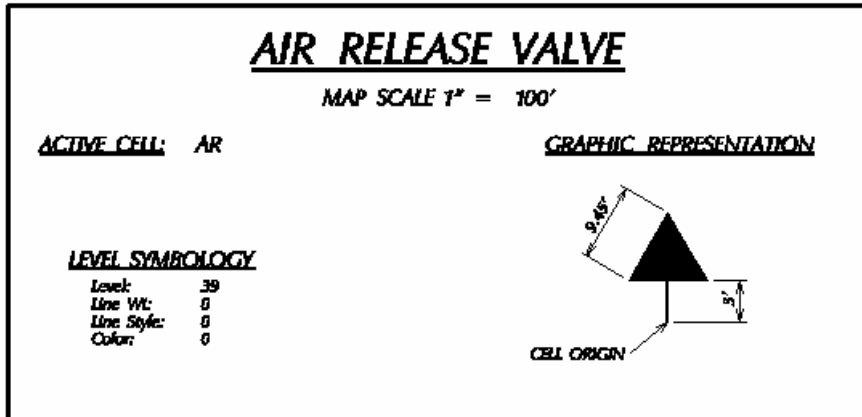
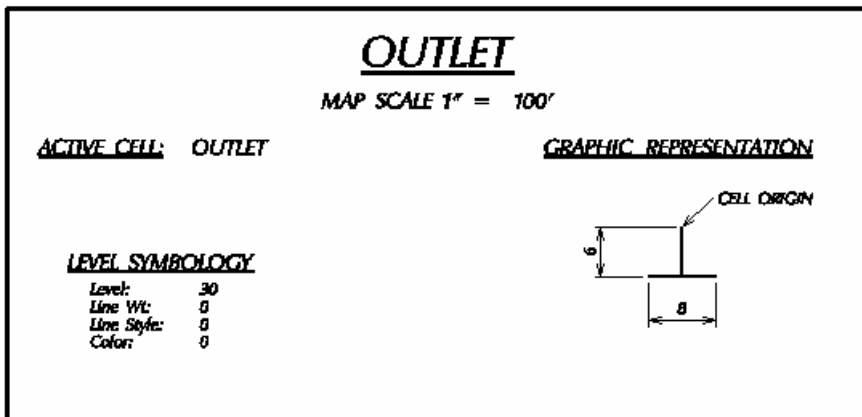


DIAGRAM 18



Water Cell Library (Continued)

DIAGRAM 19

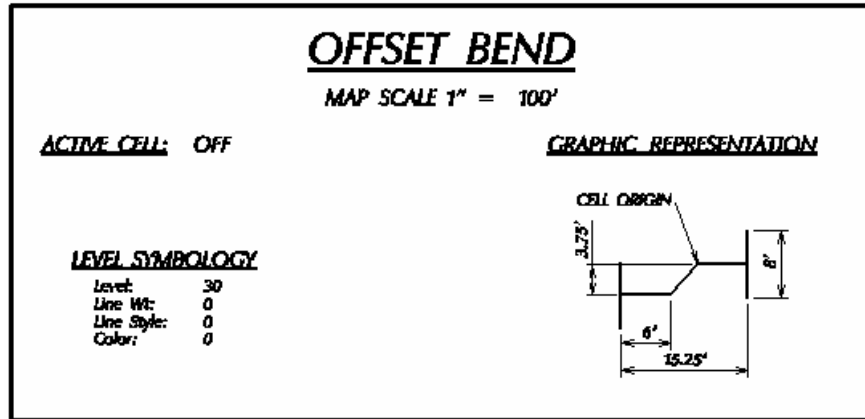


DIAGRAM 20

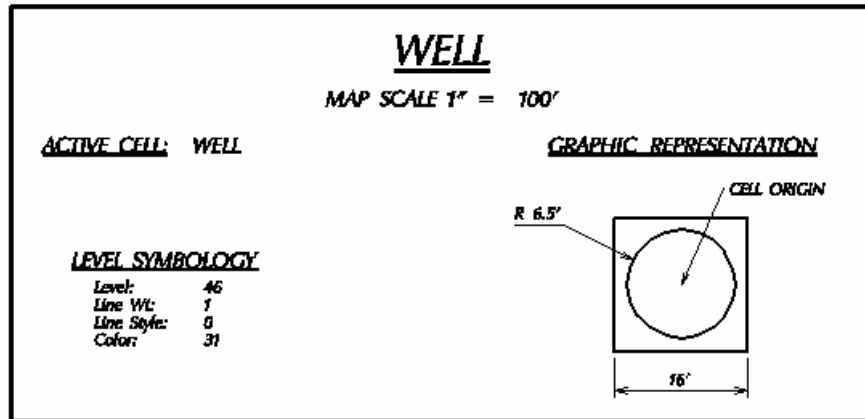
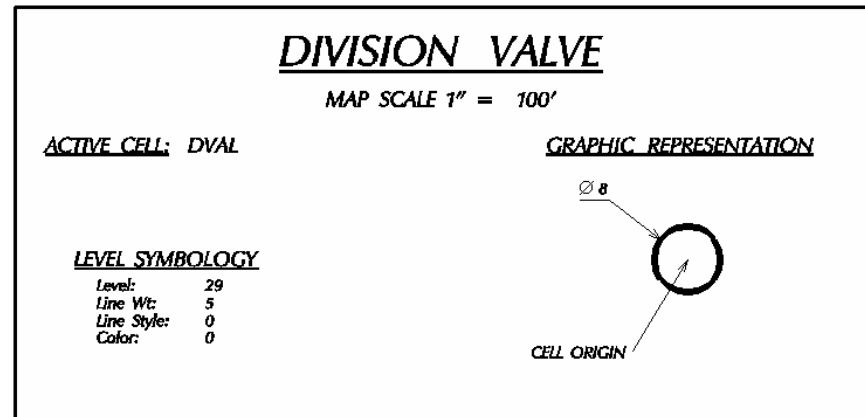


DIAGRAM 21



Water Placement Rules

Number	Object Name	Placement Rule	Exhibit
1	Mains	<ul style="list-style-type: none"> If a water main exists 1' to 10' from the property line, place the main 10' from the property line. 	1
		<ul style="list-style-type: none"> If a water main exists 11' to 14' from the property line, place the main 14' from the property line. 	2
		<ul style="list-style-type: none"> If a water main exists greater than 14' from the property line, then place the main at the exact distance. 	3
		<ul style="list-style-type: none"> Only "linestrings" are used to digitize water mains. 	N/A
		<ul style="list-style-type: none"> Water mains are to be continuous for a job excluding intersections. 	N/A
		<ul style="list-style-type: none"> A vertex is placed at the origin of each cell. 	N/A
2	Annotation *Note: all annotation will be placed with a center-center justification.	<ul style="list-style-type: none"> Annotation is placed so that the association to its given object is clear. 	N/A
		<ul style="list-style-type: none"> Annotation is placed to be readable from east and south of the map border. The annotation will rotate at the north and south position. 	4
		<ul style="list-style-type: none"> Tap numbers are perpendicular to the water main and placed in the back of the lot in line with the service line. 	5
		<ul style="list-style-type: none"> Main size and material annotation are placed parallel to the main, a minimum of once per block map, and on either side of a coupling, reducer or job change, if space is available. 	5
		<ul style="list-style-type: none"> Job numbers are placed parallel along the water main at a minimum of once per Block Map. The job number also is placed at a job change if space is available. 	5
		<ul style="list-style-type: none"> The street names are copied from the base block map and placed in the water file where they are needed. Street names should be adjusted to avoid overstrikes. 	6

Water Placement Rules (Continued)

Number	Object Name	Placement Rule	Exhibit
2	Annotation *Note: all annotation will be placed with a center-center justification	<ul style="list-style-type: none"> Main dimensions are placed between the main and the property line to identify the distance from the property line to the main as noted on the As-Built. Main dimensions should also be placed between fittings to identify the length of main as noted on the As-Built. 	6
		<ul style="list-style-type: none"> Tag numbers are used to identify a valve, fire hydrant, and air release valve, and/ or blow off. Tag numbers should be unique within the block map and numbered sequentially. Tag numbers should not be duplicated and reused. 	N/A
3	Fire Hydrants	<ul style="list-style-type: none"> Fire hydrants are placed as per source. 	6
4	Cap & Plug	<ul style="list-style-type: none"> Cap and plugs are placed as per source. The origin is placed at the end of the main. 	7
5	Blow-off Valve	<ul style="list-style-type: none"> Blow-off valves are placed as per source. The origin is placed at the end of the main. 	8
6	Valve	<ul style="list-style-type: none"> Valves are placed as per source on the water main. The valve's origin is snapped to a vertex on the water main. 	8
7	Reducer	<ul style="list-style-type: none"> Reducers are placed as per source on the water main. The reducer's origin is snapped to a vertex on the water main. 	9
8	Air Release Valve	<ul style="list-style-type: none"> Air release valves are placed as per source on the water main. The air release valve's origin is snapped to a vertex on the water main. 	10
9	Service line	<ul style="list-style-type: none"> Service lines are placed as per source extending 8' inside the property line. 	10
10	Dual service	<ul style="list-style-type: none"> Dual Service lines are placed as per source. Extend service line to main. 	10
11	Pressure Zone Annotation	<ul style="list-style-type: none"> Pressure zones annotation are placed as per source and pass through closed division valves. 	11
12	Pump Station	<ul style="list-style-type: none"> Placed as per source. 	12
13	Well	<ul style="list-style-type: none"> Placed as per source. 	12
14	RCP Conduit	<ul style="list-style-type: none"> Placed as per source. 	13
15	Flanged Outlet	<ul style="list-style-type: none"> Placed as per source and the origin is snapped to the water main at a vertex. 	14
16	Tee	<ul style="list-style-type: none"> Placed as per source and the origin is snapped to the water main at a vertex. 	15
17	Bend - 1/4	<ul style="list-style-type: none"> Placed as per source and the origin is snapped to the water main at a vertex. 	15

Water Placement Rules (Continued)

Number	Object Name	Placement Rule	Exhibit
18	Bend – 1/8	Placed as per source and the origin is snapped to the water main at a vertex.	16
19	Bend – 1/16	Placed as per source and the origin is snapped to the water main at a vertex.	17
20	Bend – 1/32	Placed as per source and the origin is snapped to the water main at a vertex.	17
21	Vertical Bend	Placed as per source and the origin is snapped to the water main at a vertex.	18
22	Cross	Placed as per source and the origin is snapped to the water main at a vertex.	19
23	Offset Bend	Placed as per source and the origin is snapped to the water main at a vertex.	19
24	Cast Coupling	Placed as per source and the origin is snapped to the water main at a vertex.	19
25	Jumper	Modify a main by inserting vertexes to show that two mains crossing each other are not connected. This is for graphical information only.	20

Water Placement Exhibits

EXHIBIT 1

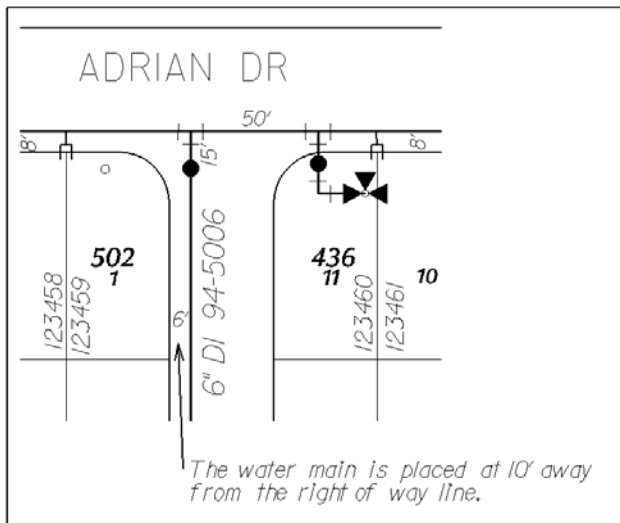
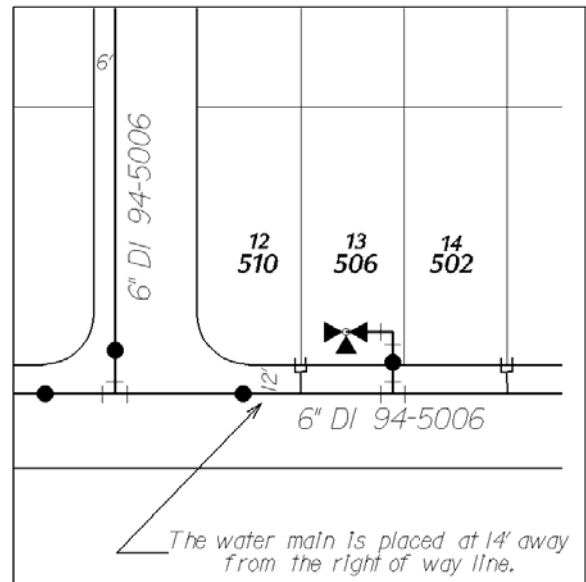


EXHIBIT 2



Water Placement Exhibits (Continued)

EXHIBIT 3

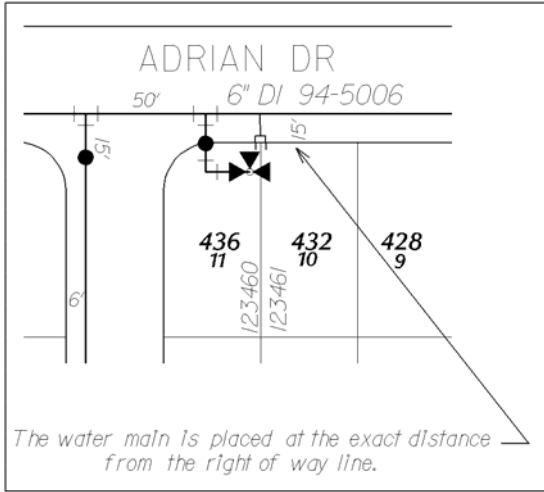


EXHIBIT 4

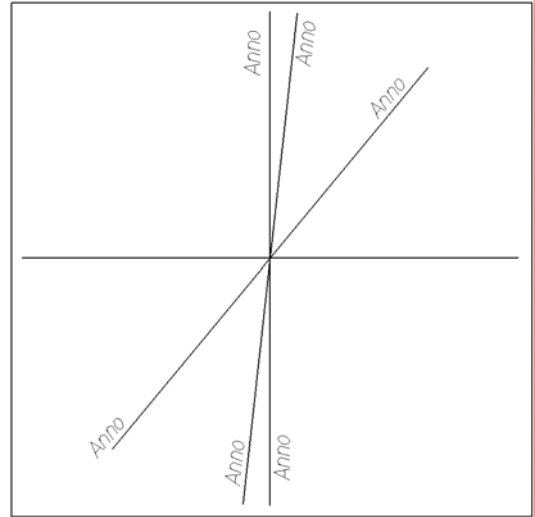


EXHIBIT 5

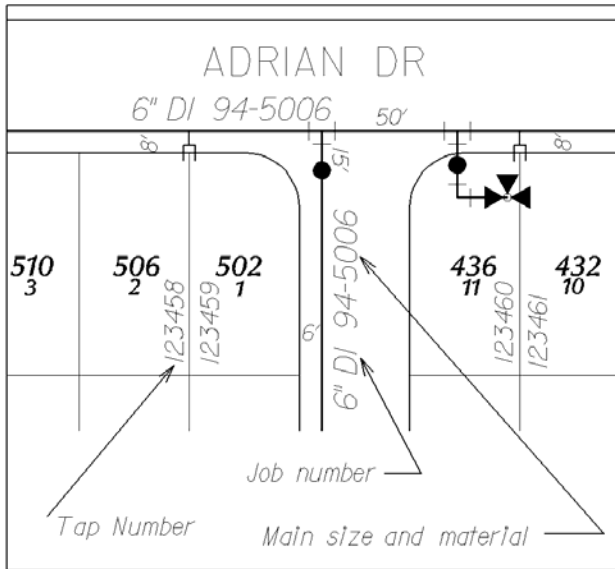
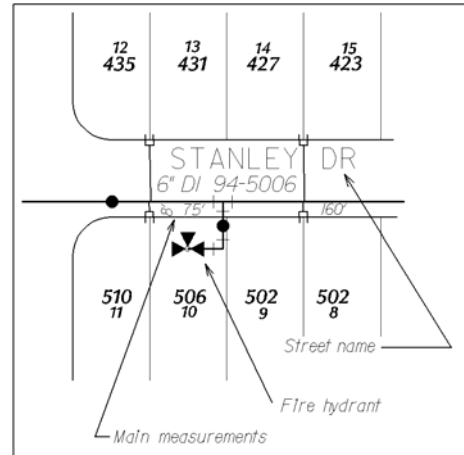


EXHIBIT 6



Water Placement Exhibits (Continued)

EXHIBIT 7

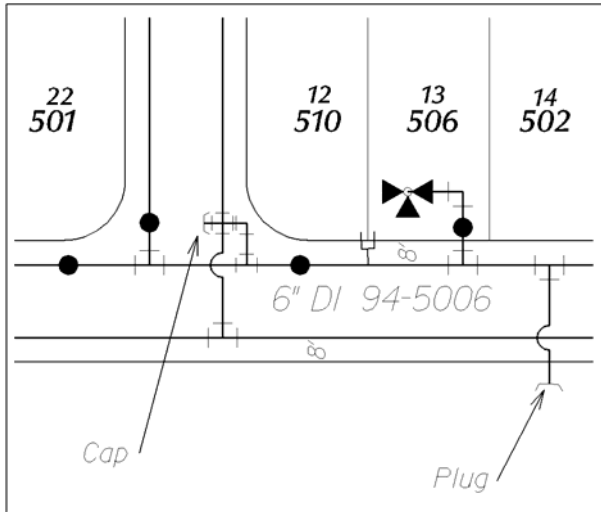


EXHIBIT 8

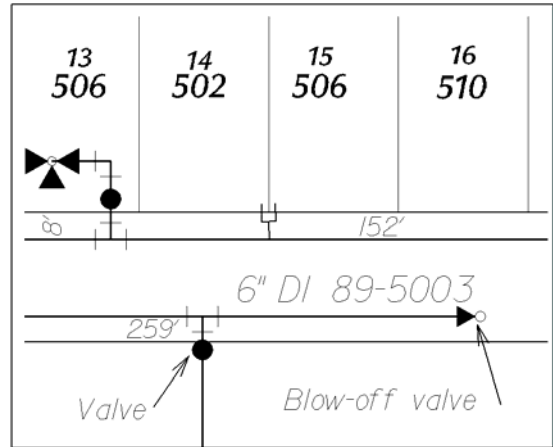


EXHIBIT 9

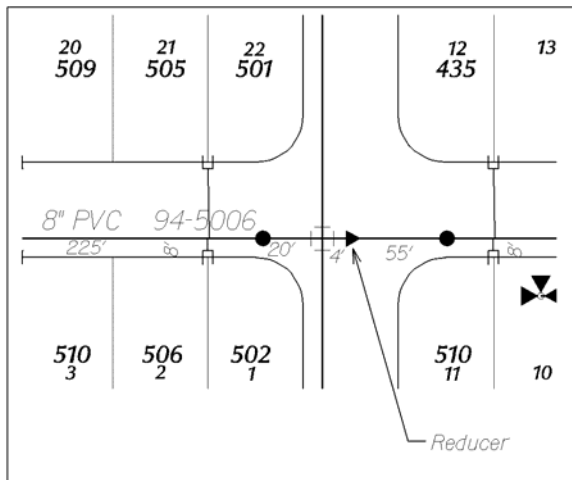
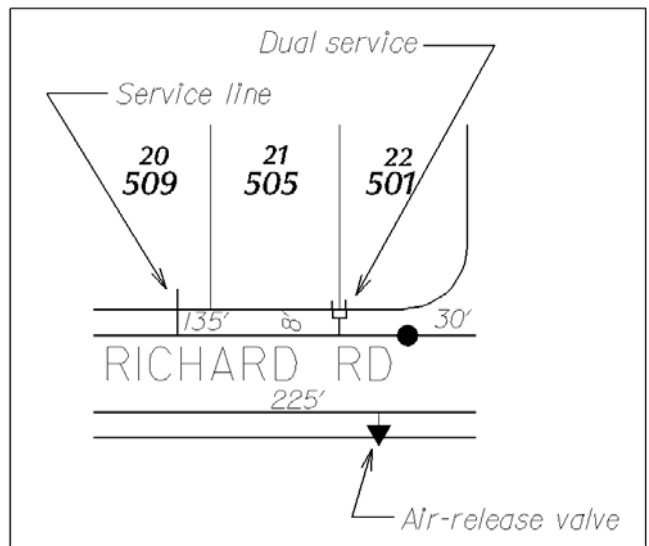


EXHIBIT 10



Water Placement Exhibits (Continued)

EXHIBIT 11

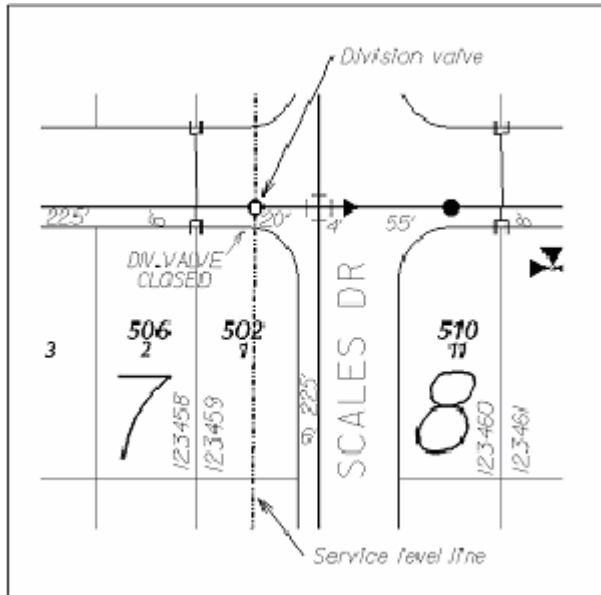


EXHIBIT 12

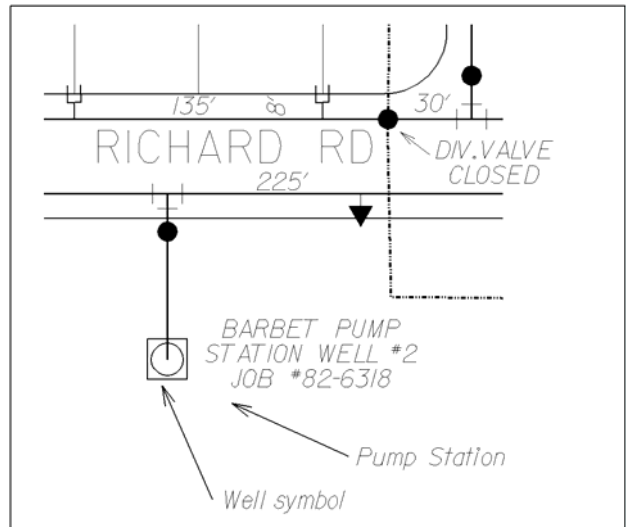


EXHIBIT 13

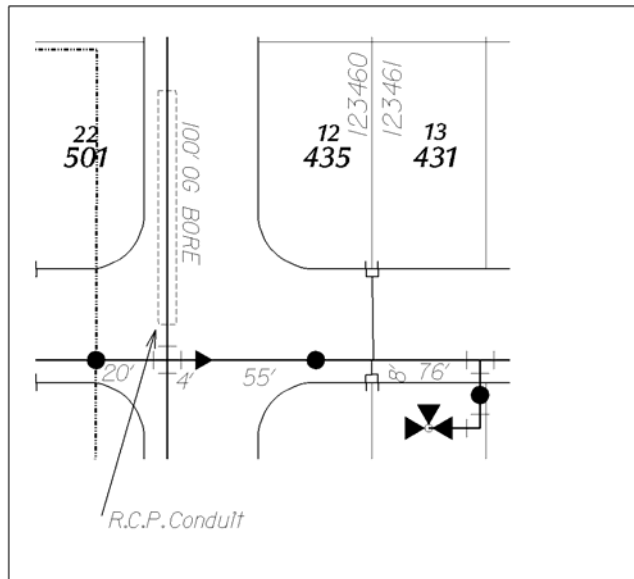
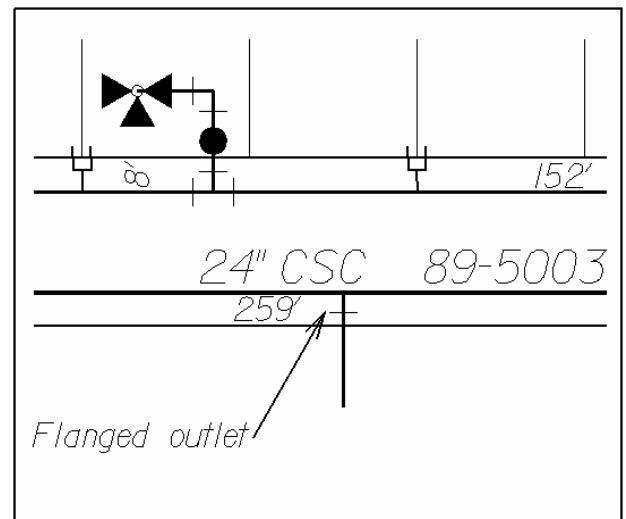


EXHIBIT 14



Water Placement Exhibits (Continued)

EXHIBIT 15

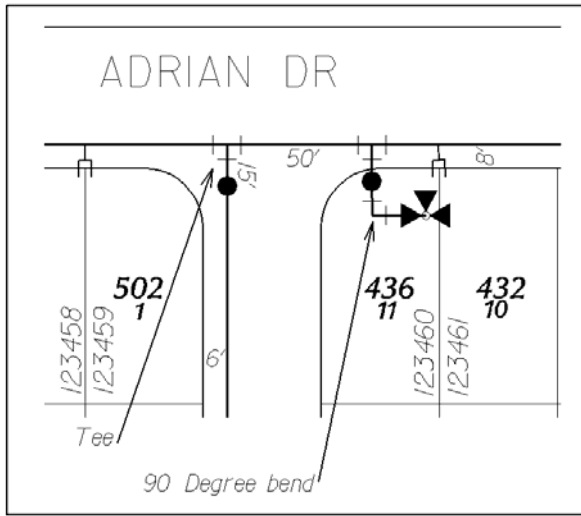


EXHIBIT 16

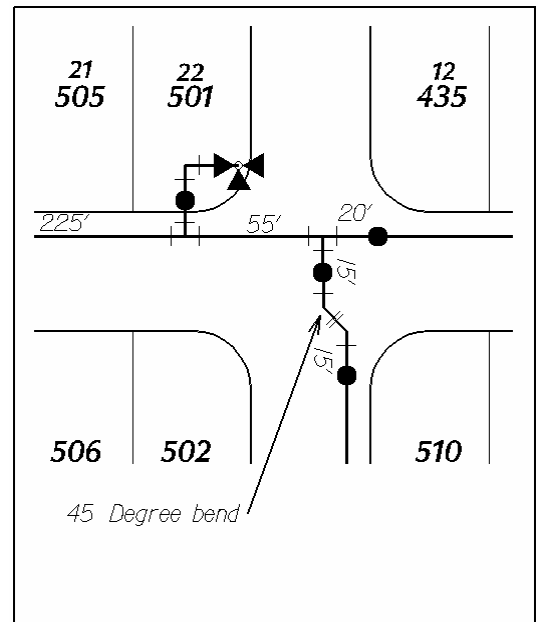


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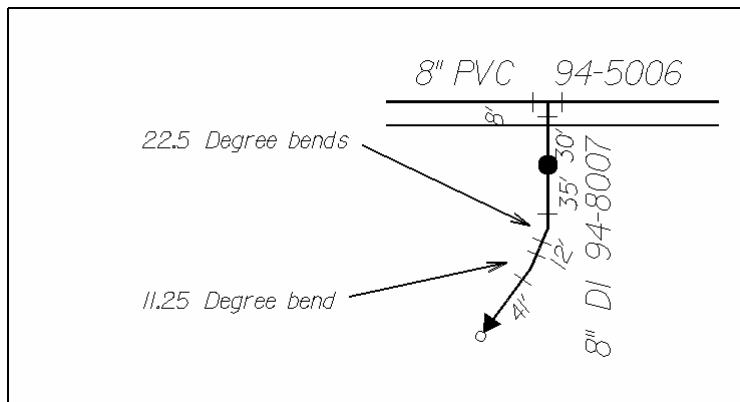
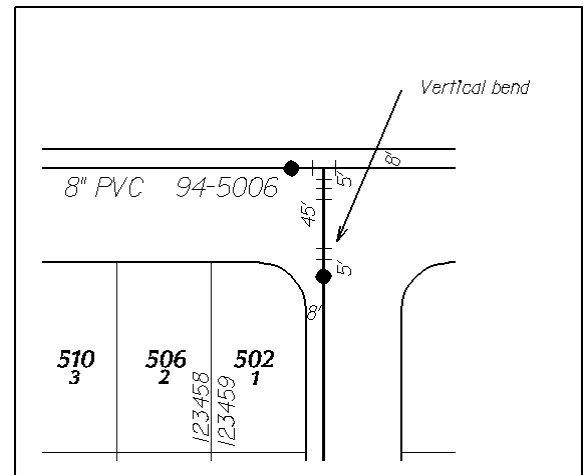


EXHIBIT 18



Water Placement Exhibits (Continued)

EXHIBIT 19

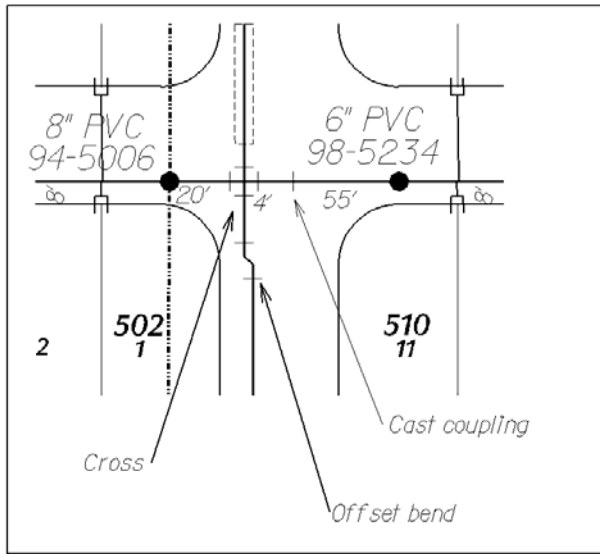
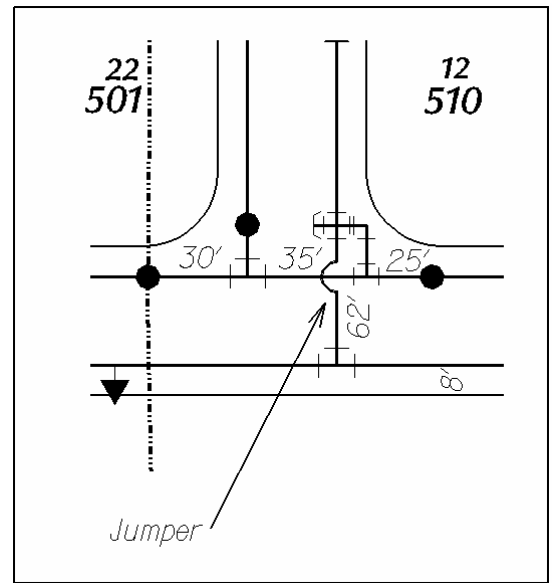


EXHIBIT 20



Section

2

MicroStation/AutoCAD Standards

Wastewater Level Symbology Table

Level or Layer	Color	Style or Type	Weight	Font or Style	Height & Width	Cell or Block	Description
1	48	0	2			MON_MH	Monolithic manhole
2	140	0	2	23	20		Street Name
3	240	0	2			BOXMH	Box structure manhole
4	0	0	0				Open
5	100	0	2			DRP_MH	Drop manhole
6	182	0	2			STD_MH	Standard manhole
7	0	0	0				Open
8	25	0	3				6" Sewer line
9	110	0	3				8" Sewer line
10	25	0	3				10" Sewer line
11	25	0	3				12" Sewer line
12	25	0	3				14" Sewer line
13	17	0	3				15" Sewer line
14	17	0	3				16" Sewer line
15	17	0	3				18" Sewer line
16	17	0	3				20" Sewer line
17	17	0	3				21" Sewer line
18	17	0	3				24" Sewer line
19	17	0	3				27" Sewer line
20	17	0	3				30" Sewer line
21	17	0	3				33" Sewer line
22	17	0	3				36" Sewer line
23	17	0	3				39" Sewer line
24	45	0	3				42" Sewer line
25	45	0	3				48" Sewer line
26	45	0	3				54" Sewer line
27	45	0	3				60" Sewer line

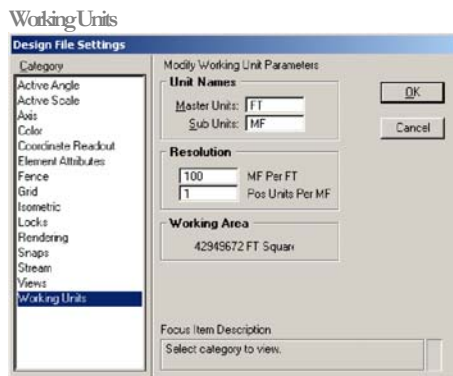
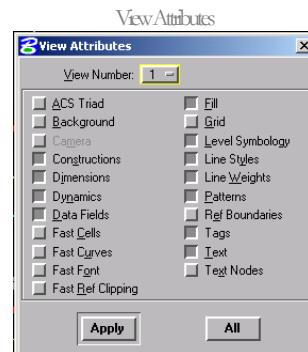
Wastewater Level Symbology Table (Continued)

Level or Layer	Color	Style or Type	Weight	Font or Style	Height & Width	Cell or Block	Description
28	45	0	3				66" Sewer line
29	45	0	3				72" Sewer line
30	45	0	3				84" Sewer line
31	45	0	3				90" + Sewer line
32	43	0	3				2" or 4" Forced main
33	43	0	3				6" or 8" Forced main
34	43	0	3				10" or 12" Forced main
35	43	0	3				14" or 15" Forced main
36	0	0	0	23	10		Forced main ID and Pipe length
37	56	0	3				Single, double, triple siphon
						ICHAMB	Siphon inlet chamber
						OCHAMB	Siphon outlet chamber
	56	0	1	23	9		Siphon ID
38	189	0	3				Interceptor
	189	0	1	23	9		Interceptor text
39	185	0	0				Service lateral
						STACK	Stacks
						AR	Air Release Valve
40	68	0	2			STUB	Stub out
						CLEOUT	Cleanout
		0	1			MIDDES	Intermediate invert designates
41	136	0	2			FAROW	Flow arrow
42	4	0	1	12	12		Tag Number
							Leader
43	43	0	2			LIFSTA	Lift station
				1	10		Lift station ID
44	28	0	1	23	10		Distance and slope
45	30	0	1	23	10		Pipe diameter
46	185	0	0	23	9		Lateral dimension
47	61	0	1	1	9		Top and Invert Elevations
							Stub Invert
48	2	0	0			HOLDTK	Holding Tank
				1	10		Holding Tank ID
49	48	0	2	1	10		Job Numbers
50	20	0	0				Open
51	238	0	0				Job Box
52	43	2	3				Proposed Main

Wastewater Level Symbology Table (Continued)

Level or Layer	Color	Style or Type	Weight	Font or Style	Height & Width	Cell or Block	Description
52	0	0	0	43	10		Proposed Main Annotation
53	0	0	0				Grid Layout
54	145	0	0	23	9		Lateral Job Number & GWO Number
55	20	3	0				Open
56	0	0	0				Open
57	0	0	0				Dimensions
58	0	0	0				Base map features
59	0	0	0				Miscellaneous – (for features not defined)
60	0	0	0				Existing Topology
61	0	0	0				Survey Data
62	59	3	0				R.C.P. Conduit
63	0	0	0				Open

Level Symbology Settings for DGN format:



Wastewater Cell Library

1. Cell Library: \saws.cel

DIAGRAM 1

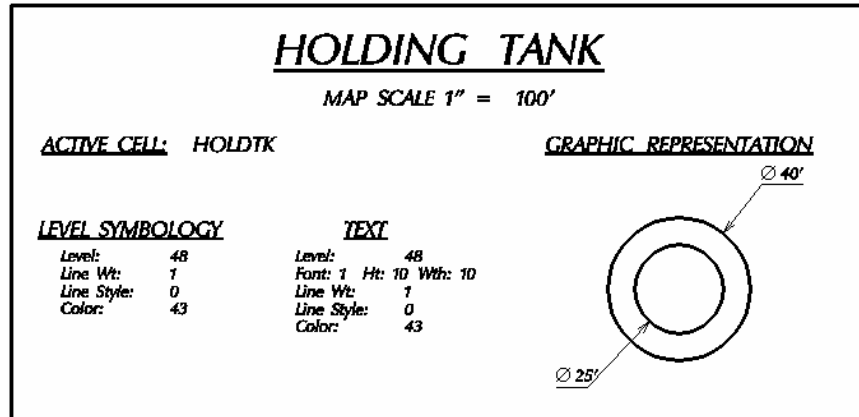


DIAGRAM 2

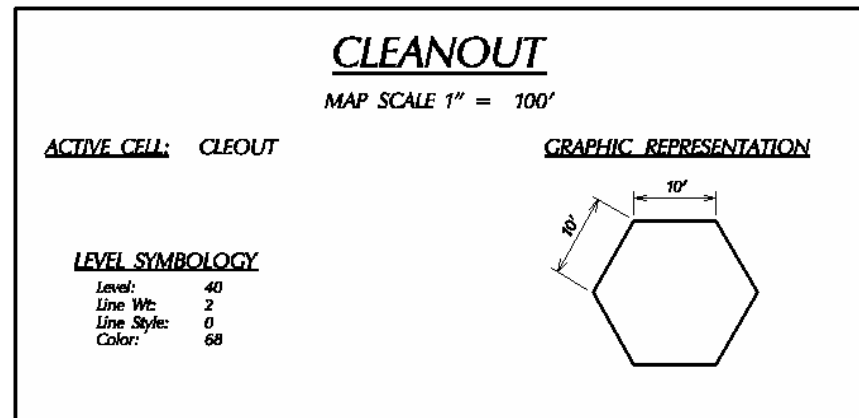


DIAGRAM 3

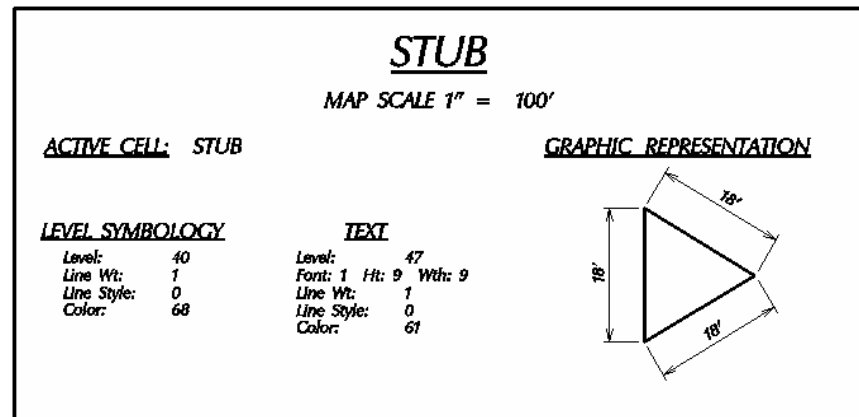


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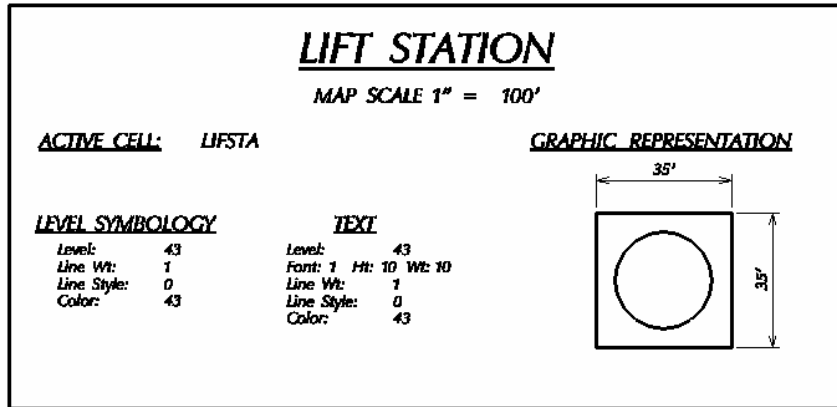


DIAGRAM 5

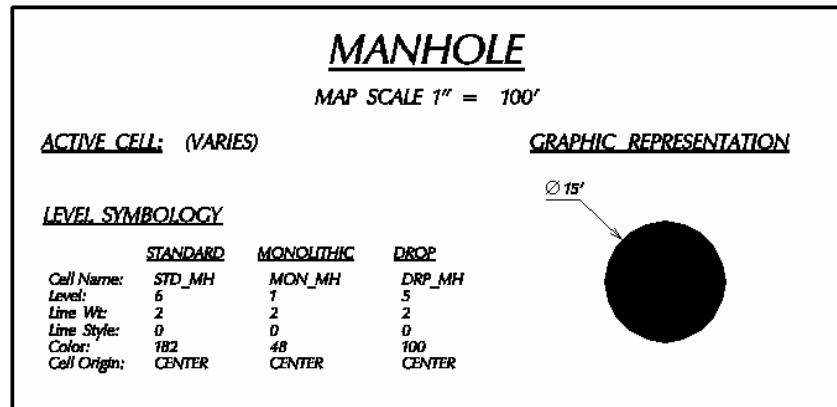


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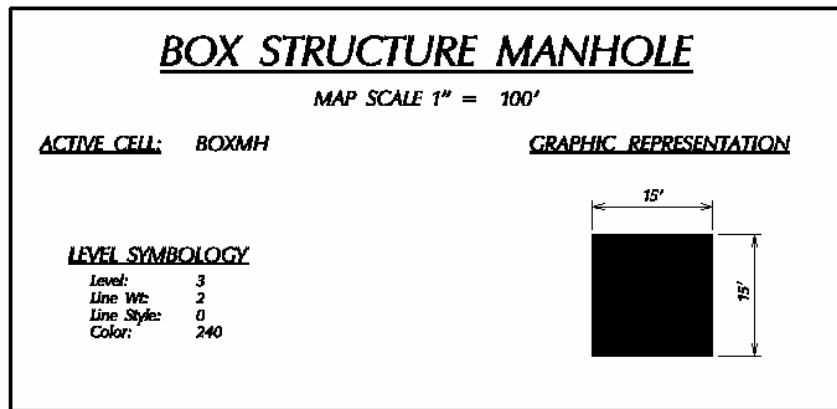


DIAGRAM 7

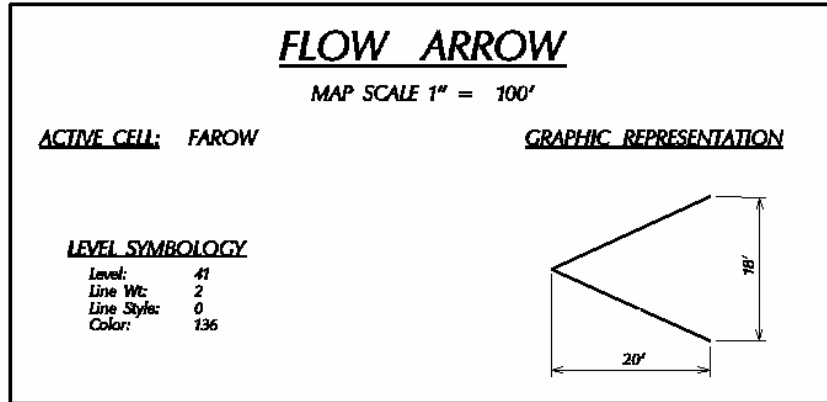


DIAGRAM 8

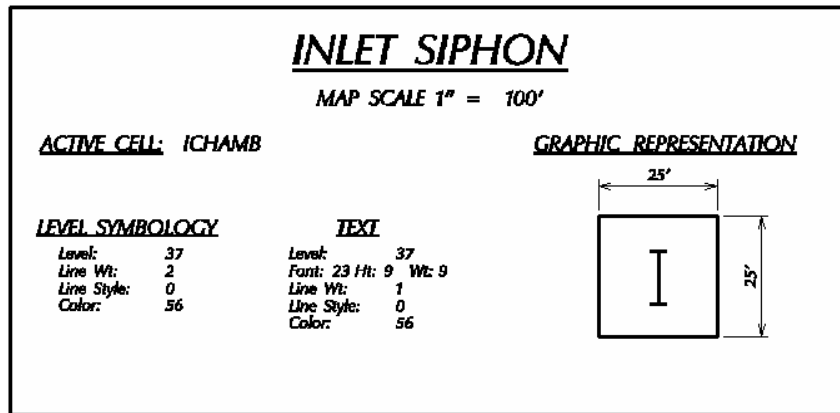


DIAGRAM 9

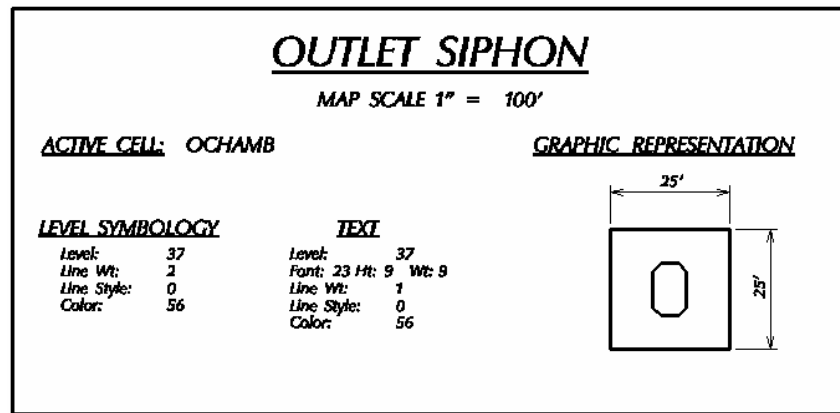


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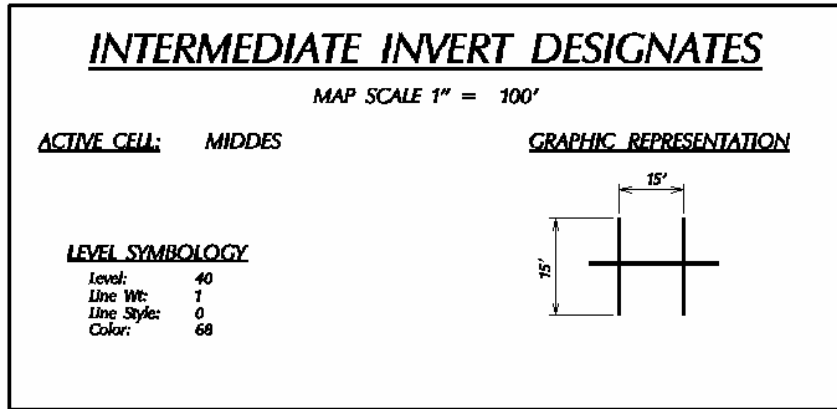
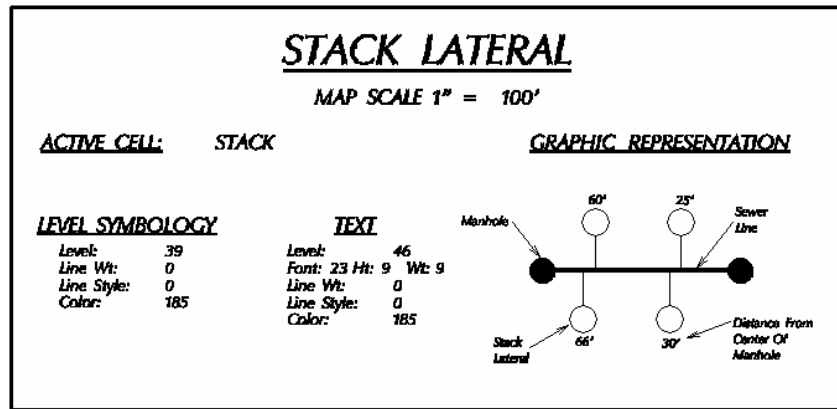


DIAGRAM 11



Wastewater Placement Rules

Number	Object Name	Placement Rule	Exhibit
1	Lines	▪ Sewer lines are to be drawn from manhole to manhole.	N/A
		▪ Only “line strings” are to be used to digitize sewer lines.	N/A
2	Annotation *Note: all annotation will be placed with a center-center justification	▪ Annotation is placed so that the association to its given object is clear.	1
		▪ Annotation is placed to be readable from east and south of the sheet border. The annotation will rotate at the north and south position.	2
		▪ Main sizes are placed parallel and above the sewer main.	3
		▪ Top of Manhole elevation is required. In and Out invert elevations are required where two main segments intersect at a manhole.	4
2 (Continued)	Annotation *Note: all annotation will be placed with a center-center justification	▪ Job Numbers are to be placed parallel to the sewer line at the beginning and end of a job and should be placed close to the main, if space is available.	5
		▪ Lateral stations are to be placed at the end of the lateral. Stations are to be determined from the down-flow manhole.	6
		▪ The street names are copied from the base block map and placed in the sewer file where they are needed. Street names should be adjusted to avoid overstrikes.	7
		▪ Distance and slope are required from structure to structure and are placed parallel and below the sewer main.	8
3	RCP Conduit	▪ Indicate length of bore and size, type and length of conduit.	N/A
4	Service Laterals	▪ Service laterals are placed as per construction. Snap to the sewer main at a vertex.	9
5	Stacks	▪ Stacks are represented with a circle at the end of the service lateral.	9

Wastewater Placement Exhibits

EXHIBIT 1

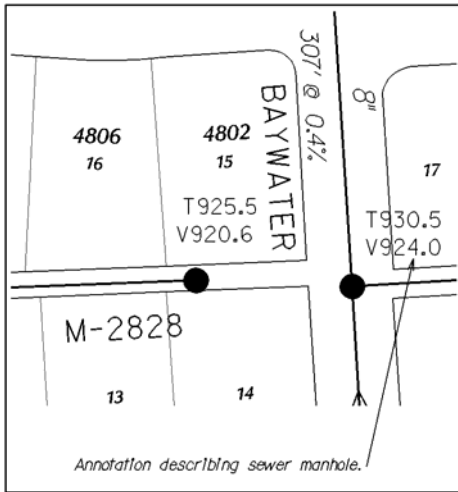


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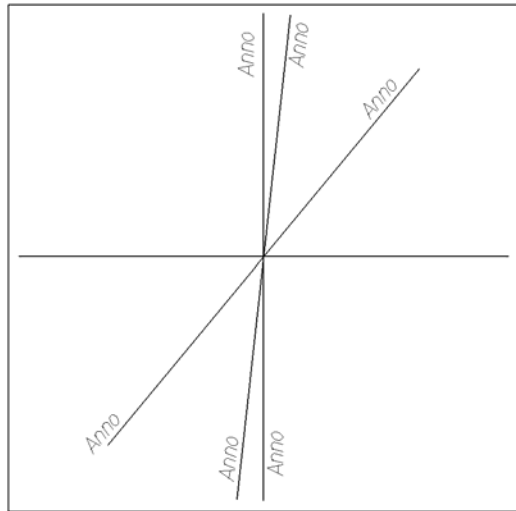


EXHIBIT 3

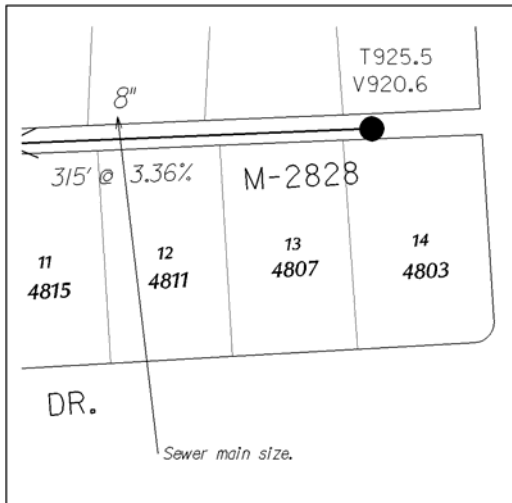
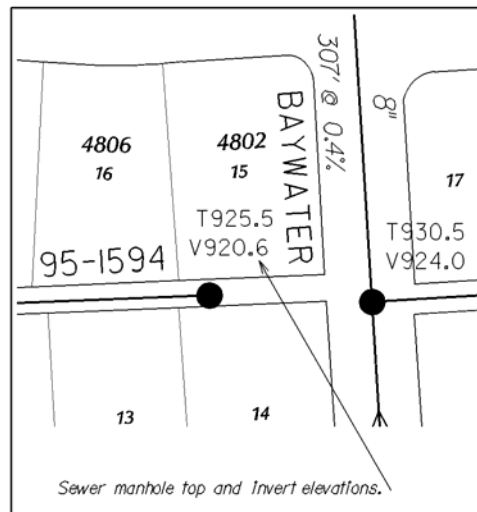


EXHIBIT 4



Wastewater Placement Exhibits (Continued)

EXHIBIT 5

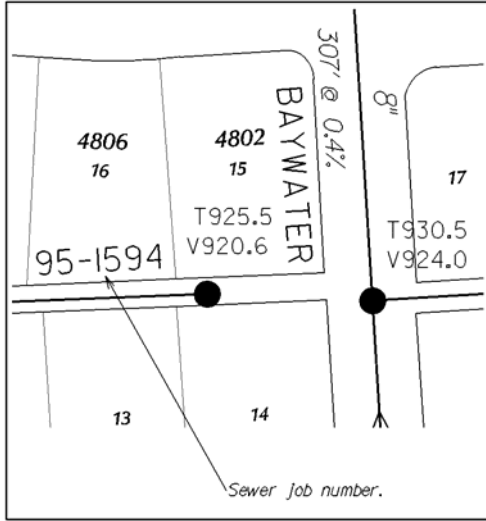


EXHIBIT 6

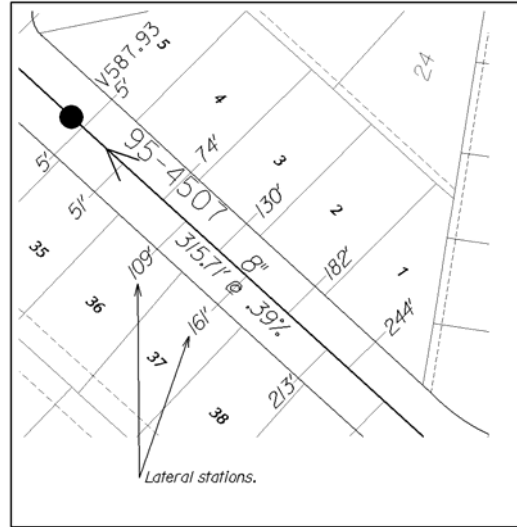


EXHIBIT 7

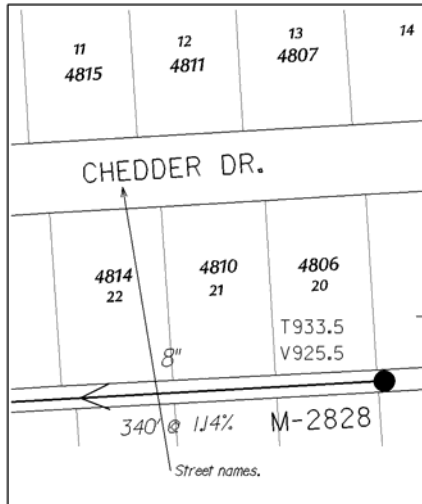
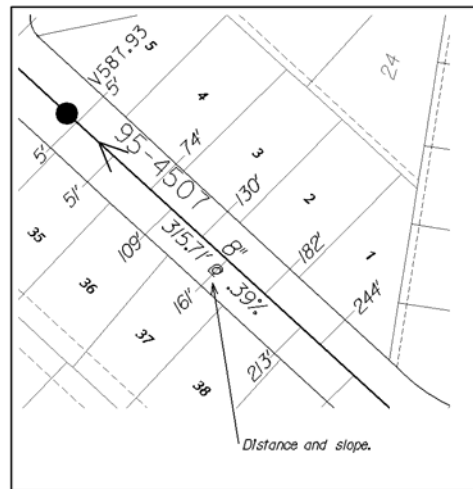
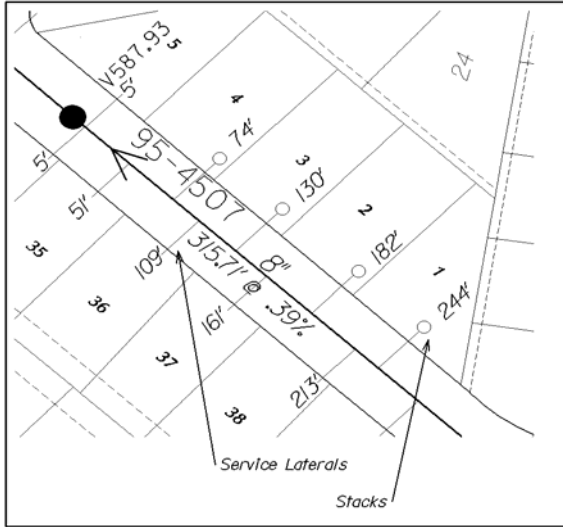


EXHIBIT 8



Wastewater Placement Exhibits (Continued)

EXHIBIT 9



Section

3

SAWS Utility Mapping Standards

Base

Base Level Standards

LV	WT	LC	CO	FT	HT&W	Cell Name	Description
1	1	0	3				Block Outline / R.O.W
2							Open
3	0	0	7	56	15		NCB Annotation
4	1	0	48				Bridges
5	1	6	44				River Outline
6	1	6	44				Creek
							Lake Boundary
	2	0	44	23	15		Creek, Lake, River Name
7	0	0	54	56	8		Lot Number
8	0	2	71				Railroad Tracks
	2	0		23	20		Railroad Name
9	2	6	1	23	10		City Limits
10	0	0	57				Lot/ Parcel Lines
		2					Subdivided Parcels
11	1	0	0				Map Available (N=NO)
12							Open
13	0	0	11	56	15		Block Annotation
14	1	4	16				Street Centerline
15	0	3	29				Easement Line
16	1	0	36	23	5		Easement Text
17	2	0	3				Building
				56	8		Building Annotation
18	0	0	63	11	20		Subdivision Name

Base Level Standards (Continued)

LV	WT	LC	CO	FT	HT&W	Cell Name	Description
19							Open
20	1	0	2			MOON	Corner Cell
21	0	0	60	56	10		House Number / Address
22							Open
23	3	7	1				County Line
24	0	3	57				Dash Lot Line
25	0	0	0				Street Dedication
26	1	0	36				Map Border
50	2	0	0	1	13		Street Annotation

Base Placement Rules

Number	Object Name	Placement Rule	Exhibit
1	Lines	<ul style="list-style-type: none"> Streets and property lines should be placed according to recorded plat and/or digital plat from the engineer or consultant. 	N/A
		<ul style="list-style-type: none"> All hydrology should be placed according to the recorded plat and/or digital plat from the engineer or consultant. 	N/A
2	Annotation * Note: all annotation will be placed with a center-center justification	<ul style="list-style-type: none"> Street name annotation should be placed along the street centerline. Street name annotation should be placed at least once per block map. 	30
		<ul style="list-style-type: none"> Addresses should be placed 60' off the front of the property line centered between the lot lines. 	31
		<ul style="list-style-type: none"> Lot numbers should be placed 75' off the front of the property line centered between the lot lines. 	31
		<ul style="list-style-type: none"> Block and NCB numbers should be placed within each block between the lots. The text "NCB" and Block" should not be included in the maps. 	32

Base Placement Rules (Continued)

Number	Object Name	Placement Rule	Exhibit
2 (Continued)	Annotation *Note: all annotation will be placed with a center-center justification	<ul style="list-style-type: none"> Water and sewer easement annotation should be placed parallel to the easement it belongs to. 	33
		<ul style="list-style-type: none"> Creek, river and lake annotation should be placed at least once per block map, where applicable. 	N/A
		<ul style="list-style-type: none"> County and city limit annotation should be placed at least once per block map, where applicable. 	N/A

Base Placement Exhibits

EXHIBIT 30

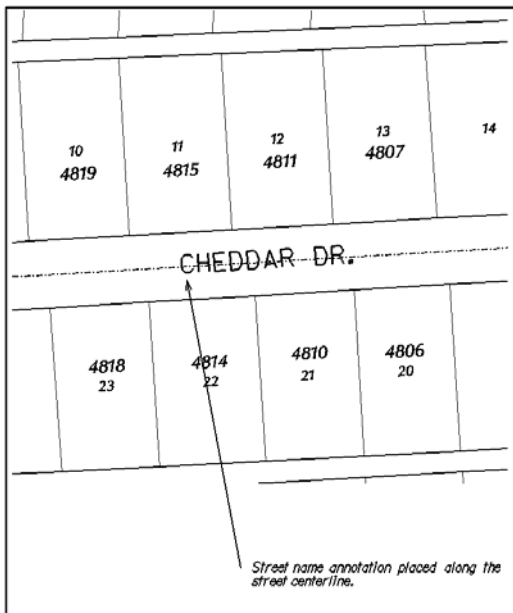
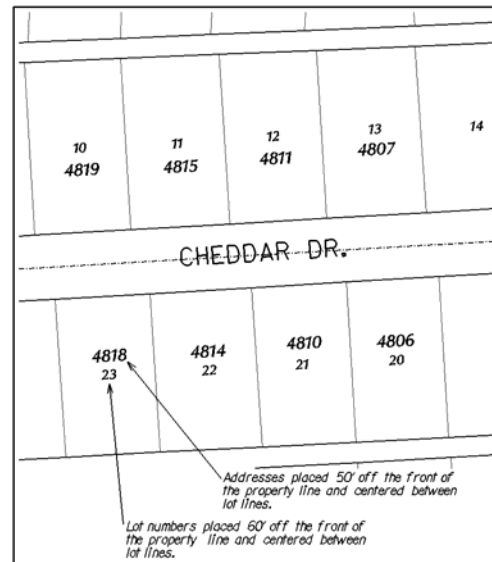


EXHIBIT 31



Base Placement Exhibits (Continued)

EXHIBIT 32

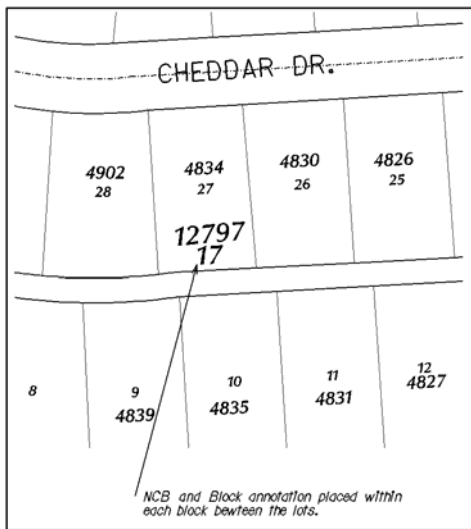
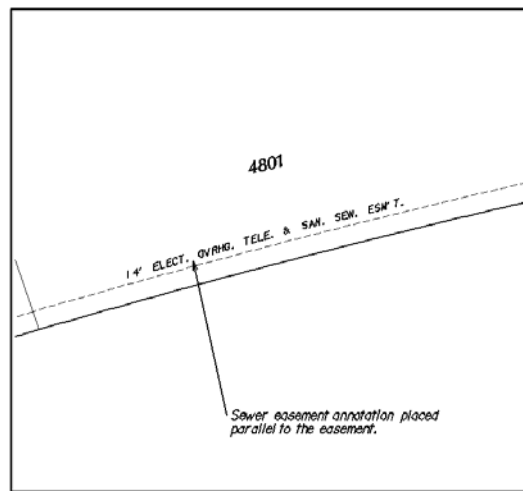


EXHIBIT 33



A

Air – Release Valve
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Annotation (Water)
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B

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Bend – 1/32
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 Placement Rule.....18

Bend – 1/4
 Cell Diagram13
 Placement Exhibit22
 Placement Rule.....17

Bend – 1/8
 Cell Diagram13
 Placement Exhibit22
 Placement Rule.....18

Bend – Offset
 Cell Diagram15
 Placement Exhibit23
 Placement Rule.....18

Bend – Vertical
 Cell Diagram11
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Blow-Off Valve
 Cell Diagram10
 Placement Exhibit20
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Box Structure Manhole
 Cell Diagram28

C

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Cap
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Cast Coupling
 Cell Diagram11
 Placement Exhibit23
 Placement Rule18

Cleanout
 Cell Diagram27

Cross
 Cell Diagram10
 Placement Exhibit23
 Placement Rule18

D

Division Valve
 Cell Diagram15
 Placement Exhibit21

Dual Service
 Cell Diagram12
 Placement Exhibit20
 Placement Rule17

F

Fire Hydrant
 Cell Diagram9
 Placement Exhibit19
 Placement Rule17

Flanged Outlet
 Placement Exhibit21
 Placement Rule17

Flow Arrow
 Cell Diagram29

H

Holding Tank
 Cell Diagram27

I

Inlet Siphon
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Intermediate Invert Designates
 Cell Diagram30

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M

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O

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P

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