

Scottsdale Stadium

7408 East Osborn Road
City of Scottsdale, Maricopa County, Arizona
Dibble Project No. 1018089

Phase 1 Water Report

December 2018

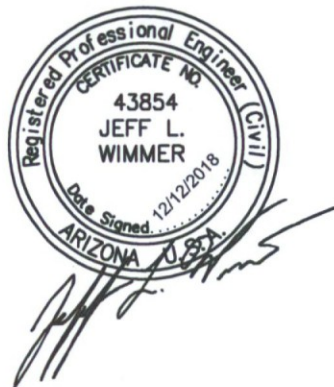
Prepared for:



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48-DR-2018
12/27/2018

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I. Project Description

The Scottsdale Stadium Multi-Use Event Center development is located at the northeast corner of Drinkwater Boulevard and Osborn Road in Scottsdale, Arizona. The facility serves as a baseball field for the San Francisco Giants' spring training and the Scottsdale Scorpions. Phase 1 of this project includes a proposed clubhouse/multi-use center in place of the existing building and parking lot east of the south entrance gate. The onsite development includes the new clubhouse/multi-use center and associated modifications to the adjacent west parking lot, a new pedestrian access way and mezzanine, and site utilities. See **Figure 1** for the project Location Map.



Figure 1 – Location Map

II. Water Design

A. Existing Conditions

There is an existing City of Scottsdale 8-inch water main in both Drinkwater Boulevard and Osborn Road. There is also a 12-inch water main in Osborn Road. Domestic service for the existing facility is provided via a 4-inch water line off the 8-inch main in Drinkwater Boulevard.

Building fire protection for the facility is provided by an 8-inch fire service line off Osborn Road. The fire pump is located on the east side of the facility in the electrical yard next to the existing clubhouse.

B. Proposed Conditions

The proposed clubhouse/multi-use facility includes a 4-inch water service connection and an 8-inch fire line connection from the 8-inch main in Osborn Road. The 4-inch water service will be connected to a 3-inch water meter. The backflow preventer for the fire line connection will be housed in a fire riser room at the northwest corner of the proposed building. A remote fire department connection (FDC) is provided at the south end of the building. The proposed utilities are shown in **Appendix A**. Plumbing calculations showing the sizing of the water meter and associated fixture counts of the proposed clubhouse by LSW Engineers are included in **Appendix G**.

C. Water Usage Demands

Based on Figure 6-1.2 of the 2018 City of Scottsdale Design Standards & Policies Manual (DS&PM), the average daily water demand can be calculated based on the building area (43,200 square-feet). The maximum daily demand and peak hour demand can be calculated using the peaking factors provided by the City of Scottsdale's Water Resources Department. A copy of Figure 6-1.2 of the DS&PM is included for reference in **Appendix B**.

Average Daily Demand (ADD)

$$\text{Average Day Demand} = 0.00111 \text{ gpm/sf} * 43,200 \text{ sf} = 47.952 \text{ gpm} \approx \mathbf{48 \text{ gpm}}$$

Maximum Daily Demand (MDD)

$$\text{Peaking factor} = 3 * \text{Average Day Demand}$$

$$\text{Maximum Day Demand} = 3 * 48 \text{ gpm} = \mathbf{144 \text{ gpm}}$$

Peak Hour Demand (PH)

$$\text{Peaking factor} = 6.75 * \text{Average Day Demand}$$

$$\text{Peak Hour Demand, Building} = 6.75 * 48 \text{ gpm} = \mathbf{324 \text{ gpm}}$$

As part of the Phase 1 development, there will be one large and two small hydrotherapy pools. The larger pool will have an approximate demand of 100 gpm and the smaller pools will each have an approximate demand of 50 gpm. For conservative estimation, 100 gpm for the larger pool will be used in combination with the building's peak daily demand.

$$\text{Peak Hour Demand, Total} = 324 \text{ gpm} + 100 \text{ gpm} = \mathbf{424 \text{ gpm}}$$

Fire Flow

Fire flow shall be based on the 2012 International Fire Code (IFC). The proposed building will be Type IIB and 43,200 square-feet. Based on Table B105.1 of the IFC, fire flow rate requirements for this building is 4,500 gallons per minute (GPM). However, according to Section B105.2 of the IFC, a fire-flow reduction of up to 75% is allowed when the building is provided with an automatic sprinkler system but shall not be less than 1,500 GPM. A 75% fire flow reduction results in a fire flow demand of 1,125 GPM, therefore, the minimum demand of 1,500 GPM will be used to model the fire flow condition on the site. A copy of the IFC fire flow requirements are included in **Appendix C**.

Per Table C102.1 of the 2018 IFC, for a fire flow requirement of 1,500 GPM, one (1) hydrant minimum is required, with a maximum hydrant spacing of 500-feet. There will be two (2) proposed fire hydrants at the northwest and southwest sides of the building, which will satisfy this requirement.

D. Water Model & Design Criteria

A water model of the proposed site conditions was prepared using EPA NET 2.0 to verify the size of the proposed water service connections. A separate model was created as a calibration to verify that the flow conditions of the existing system match the results of a fire hydrant flow test that was performed. Both existing and proposed models were calibrated by connecting a reservoir to feed the system and adjusting the head and lengths to replicate flows of the current and future site conditions.

The onsite water line will be designed to meet the following criteria based on the City of Scottsdale’s DS&PM and Engineering Standards:

- Static pressure in the distribution system shall not exceed 120 psi and maintain a minimum residual pressure of 50 psi at the highest, finished, floor level to be served by system pressure under normal daily operating conditions
- The system shall be designed to maintain 30 psi minimum pressure under design fire flow requirements

A fire hydrant flow test was conducted on the 8-inch water main along Osborn Road to verify static and residual pressure in the existing distribution system. Based on the results of the hydrant flow test, the static pressure in the system is approximately 87 psi. With one fire hydrant opened and flowing at approximately 1,990 GPM, the residual pressure of the system is 82 psi. This data was used to calibrate the water model. A copy of the fire hydrant flow test results is included in **Appendix D**. A copy of the water model results used as calibration for the existing site conditions is included in **Appendix E**. A copy of the water model results with the required demand scenarios for the proposed site conditions is included in **Appendix F**. A summary of the demands modeled are shown in **Table 1**.

Table 1 – Demand Scenarios

Scenario	Demand (gpm)
Average Day	48
Maximum Day	144
Peak Hour	424
Maximum Day + Fire	1,644

E. Results and Conclusion

The proposed onsite water service is sized to meet the demand of the proposed Scottsdale Stadium Phase 1 improvements for the average day, maximum day, peak hour, and fire flow conditions. The minimum pressure of the combined maximum day and fire flow scenario is 61.21 psi at the hydrant (FH1) and 80.75 psi at the building fire connection (Node 1), which satisfies the City's 30 psi minimum pressure requirement during fire flow scenarios. The minimum pressure of the peak hour demand scenario is 80.97 psi, which satisfies the City's 50 psi minimum pressure requirement. A summary of the minimum and maximum pressures for each demand scenario is provided in **Table 2**.

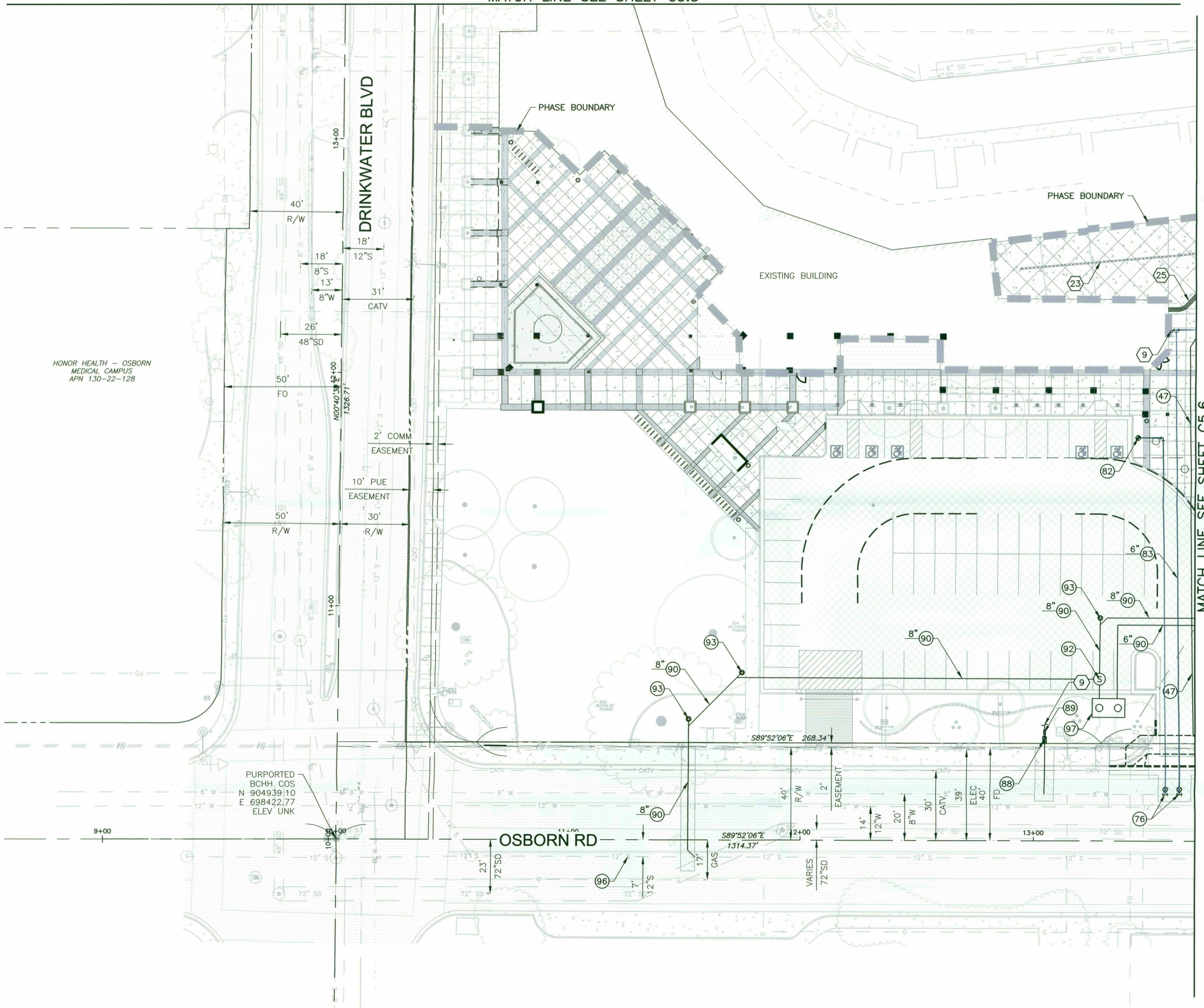
Table 2 – Demand Scenario Pressures

Scenario	Minimum Pressure (psi)	Maximum Pressure (psi)
Average Day	84.83	86.99
Maximum Day	84.80	86.92
Peak Hour	80.97	86.33
Maximum Day + Fire	61.21	82.87

Appendix A
Utility Plan

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MATCH LINE SEE SHEET C5.3



HONOR HEALTH - OSBORN MEDICAL CAMPUS APN 130-22-128

PURPORTED BCHH COS N 904939.10 E 698422.77 ELEV UNK

MATCH LINE SEE SHEET C5.6

- CONSTRUCTION NOTES**
- 47 RE-ROUTE EXST GAS LINE PER PLAN
 - 76 8"x6" STAINLESS STEEL TAPPING SLEEVE & VALVE W/BOX & COVER, MAG STD DET 340
 - 82 FIRE HYDRANT ASSEMBLY MAG STD DET 360
 - 83 FIRE LINE W/FITTINGS, DIP CL 350 W/POLYWRAP, SIZE PER PLAN
 - 88 2" IRRIGATION METER & SERVICE CONNECTION COS STD DET 2330
 - 89 2" REDUCED PRESSURE BACKFLOW ASSEMBLY COS STD DET 2354
 - 90 SEWER SERVICE LINE, PVC SDR 35 SIZE PER PLAN
 - 92 SEWER MANHOLE MAG STD DET 420, 422 & 424
 - 93 2-WAY SEWER CLEANOUT UPC LATEST EDITION
 - 97 GREASE INTERCEPTOR

- REFERENCE NOTES**
- 9 BUILDING SERVICE CONNECTION REFER TO PLUMBING PLANS
 - 23 STORM DRAIN IMPROVEMENTS REFER TO STORM DRAIN PLANS
 - 25 NEW TECH DUCT BANK REFER TO ARCHITECTURAL TECHNOLOGY SITE PLAN

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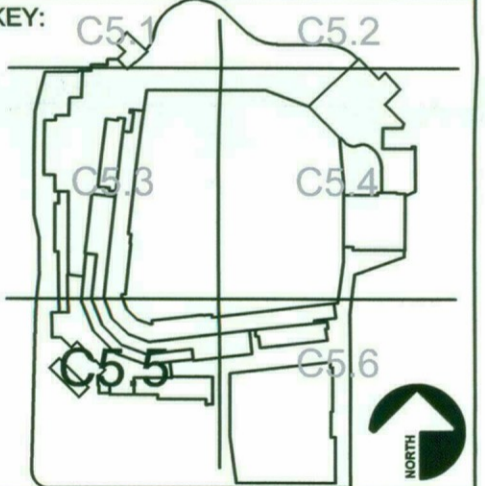
DD SET
NOT FOR CONSTRUCTION

City of Scottsdale
Stadium Multi-Use Event Center
7408 E Osborn Rd, Scottsdale, AZ 85251

REVISIONS

No.	Description	Date

DRB Submittal
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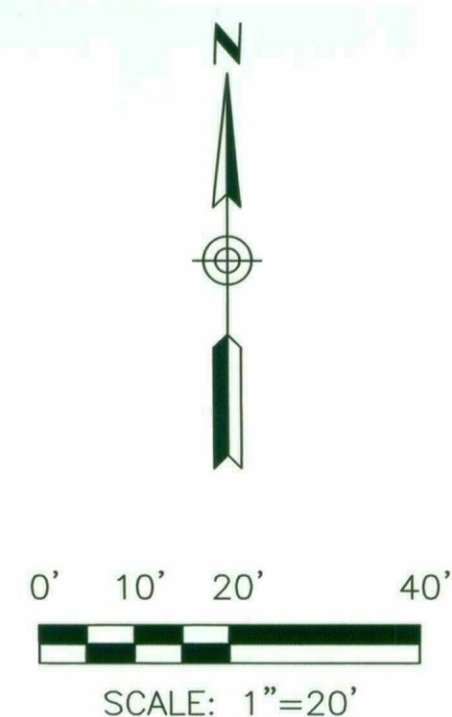


SHEET TITLE:
UTILITY PLAN

SHEET NUMBER:
C5.5

DRAWN BY: **TCW** REVIEWED BY: **JLW**

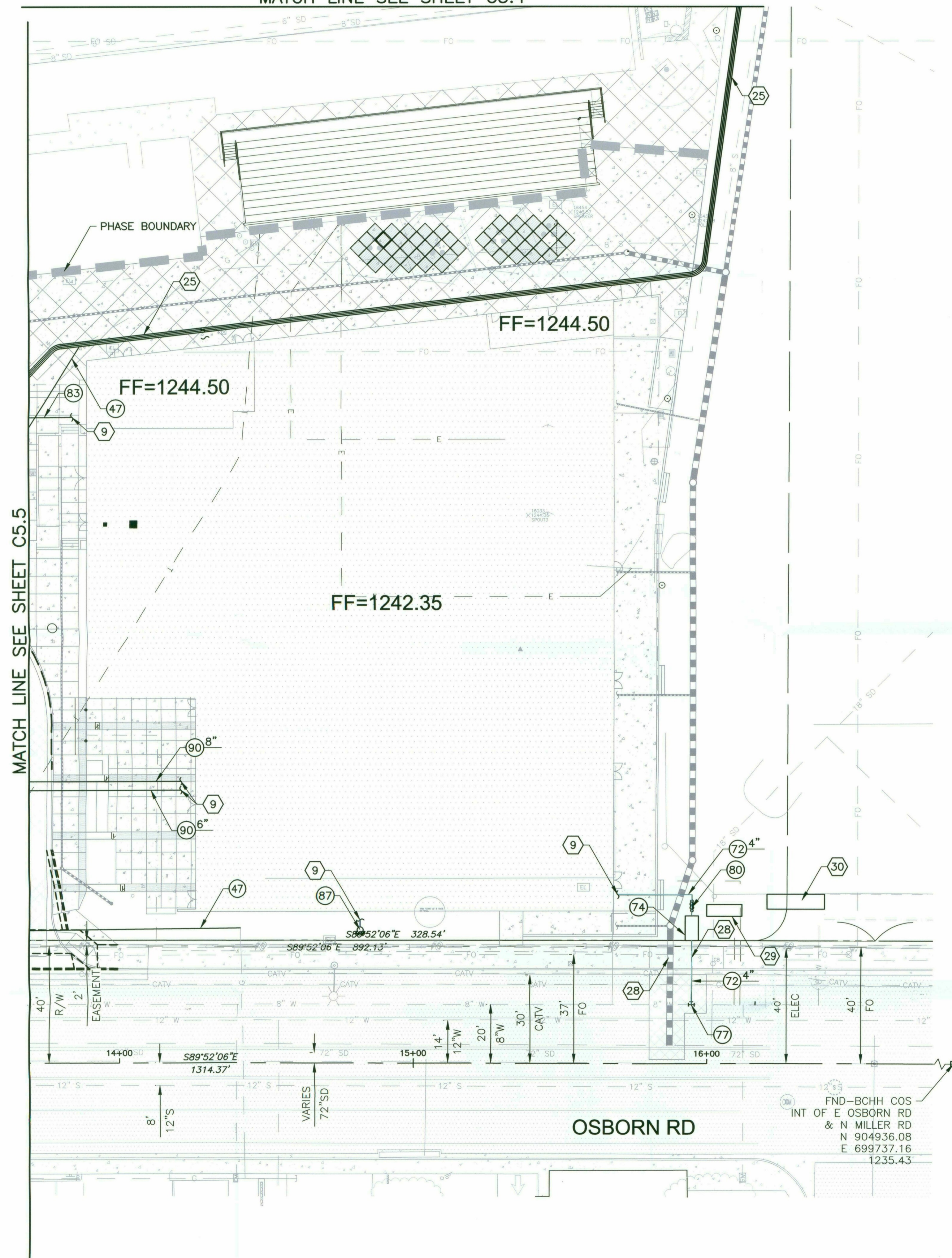
DATE: **10/31/18** PROJECT NUMBER: **1821.00**



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MATCH LINE SEE SHEET C5.4



FND-BCHH COS
INT OF E OSBORN RD
& N MILLER RD
N 904936.08
E 699737.16
1235.43

- CONSTRUCTION NOTES**
- 47 RE-ROUTE EXST GAS LINE PER PLAN
 - 72 WATER SERVICE LINE W/FITTINGS, DIP CL 350 SIZE PER PLAN
 - 74 3" WATER METER & VAULT COS STD DET 2345
 - 77 WATER SERVICE CONNECTION SIZE PER PLAN, COS STD DET 2330
 - 80 4" REDUCED PRESSURE BACKFLOW PREVENTER COS STD DET 2342
 - 83 FIRE LINE W/FITTINGS, DIP CL 350 W/POLYWRAP, SIZE PER PLAN
 - 87 REMOTE FIRE DEPARTMENT CONNECTION
 - 90 SEWER SERVICE LINE, PVC SDR 35 SIZE PER PLAN

- REFERENCE NOTES**
- 9 BUILDING SERVICE CONNECTION REFER TO PLUMBING PLANS
 - 25 NEW TECH DUCT BANK REFER TO ARCHITECTURAL TECHNOLOGY SITE PLAN
 - 28 EXCAVATE UNDER EXST CATCH BASIN WING TO INSTALL NEW PIPES PROTECT EXST CATCH BASIN WING IN PLACE
 - 29 GAS METER TO BE INSTALLED BY SOUTHWEST GAS
 - 30 ELECTRICAL SES REFER TO MEP PLANS



POPULOUS



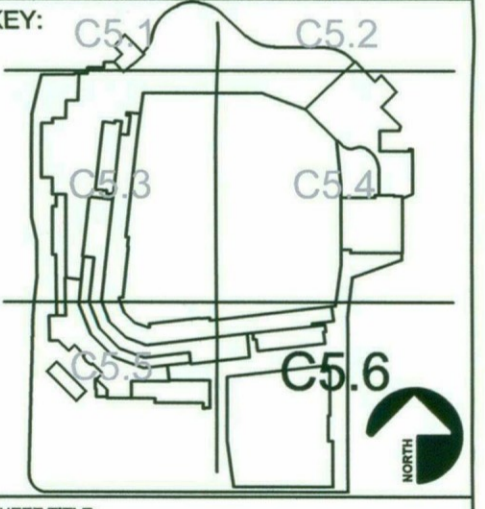
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City of Scottsdale
Stadium Multi-Use Event Center
7408 E Osborn Rd, Scottsdale, AZ 85251

REVISIONS

No.	Description	Date

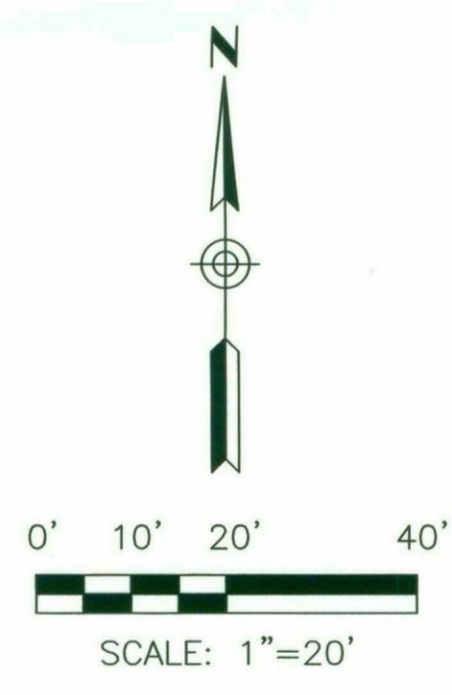
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SHEET NUMBER:
C5.6

DRAWN BY: TCW
REVIEWED BY: JLW

DATE: 10/31/18
PROJECT NUMBER: 1821.00



WATER

- d. Pipe flow velocity in feet per second (fps)
- e. Each pipe segment's head loss rate (ft. /1,000ft or psi/ft.)
- f. PRVs: Upstream and downstream pressures (psi or HGL elevation)
- g. Tanks: Inflow and outflow (gpm)
- h. Shows all units for the values presented or provide a legend on the diagram page that indicates the units used

AVERAGE DAY WATER DEMANDS ⁽¹⁾							
IN GALLONS PER DAY (GPD) ⁽²⁾				IN GALLONS PER MINUTE (GPM) ⁽²⁾⁽³⁾			
Land Use	Inside Use	Outside Use	Total Use	Inside Use	Outside Use	Total Use	Units
Residential Demand per Dwelling Unit							
< 2 dwelling unit per acre (DU/ac)	208.9	276.7	485.6	0.30	0.39	0.69	per unit
2 – 2.9 DU/ac	193.7	276.7	470.4	0.27	0.39	0.66	per unit
3 – 7.9 DU/ac	175.9	72.3	248.2	0.25	0.11	0.36	per unit
8 – 11.9 DU/ac	155.3	72.3	227.6	0.22	0.11	0.33	per unit
12 – 22 DU/ac	155.3	72.3	227.6	0.22	0.11	0.33	per unit
High Density Condominium (condo)	155.3	30	185.3	0.22	0.05	0.27	per unit
Resort Hotel (includes site amenities)	401.7	44.6	446.3	0.56	0.07	0.63	per room
Service and Employment							
Restaurant	1.2	0.1	1.3	1.67E-03	1.39E-04	1.81E-03	per square foot (sq.ft.)
Commercial/Retail	0.7	0.1	0.8	9.73E-04	1.39E-04	1.11E-03	per sq.ft.
Commercial High Rise	0.5	0.1	0.6	6.95E-04	1.39E-04	8.34E-04	per sq.ft.

AVERAGE DAY WATER DEMANDS ⁽¹⁾							
IN GALLONS PER DAY (GPD) ⁽²⁾				IN GALLONS PER MINUTE (GPM) ⁽²⁾⁽³⁾			
Office	0.5	0.1	0.6	6.95E-04	1.39E-04	8.34E-04	per sq.ft.
Institutional	670	670	1340	0.94	0.94	1.88	per acre
Industrial	873	154	1027	1.22	0.22	1.44	per acre
Research and Development	1092	192	1284	1.52	0.27	1.79	per acre
Special Use Areas							
Natural Area Open Space	0	0	0	0.0	0.0	0.0	per acre
Developed Open Space – Parks	0	1786	1786	0.0	2.49	2.49	per acre
Developed Open Space – Golf Course	0	4285	4285	0.0	5.96	5.96	per acre
Notes:							
(1) These values shall not be used directly for service line or water meter sizing.							
(2) Gallon per day values are provided for reference only. The instantaneous gallon per minute flow rates presented are intended for use in the required hydraulic modeling scenarios. The gpm values assume a 12-hour active water use period per 24-hour day. In large or specialty developments or master plans the hydraulic analysis criteria and parameters should be discussed with the Water Resources Department. Seasonal peaking should also be considered. Upon review, the Water Resources Department reserves the right to designate flows to be used in hydraulic modeling scenarios that may be different from those presented here.							
(3) The hydraulic modeling peaking factors used in select modeling scenarios are to be applied to the gpm values shown here. Max day and peak hour peaking factors can be found in Section 6-1.404.							

FIGURE 6-1.2 AVERAGE DAY WATER DEMANDS

Appendix C
IFC Fire Flow Requirements

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m²), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code*.

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by *fire walls* without openings, constructed in

accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings. The minimum fire-flow and flow duration requirements for one- and two-family *dwellings* having a fire-flow calculation area that does not exceed 3,600 square feet (344.5 m²) shall be 1,000 gallons per minute (3785.4 L/min) for 1 hour. Fire-flow and flow duration for *dwellings* having a fire-flow calculation area in excess of 3,600 square feet (344.5m²) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire-flow of 50 percent, as *approved*, is allowed when the building is equipped with an *approved automatic sprinkler system*.

B105.2 Buildings other than one- and two-family dwellings. The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings* shall be as specified in Table B105.1.

Exception: A reduction in required fire-flow of up to 75 percent, as *approved*, is allowed when the building is provided with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. The resulting fire-flow shall not be less than 1,500 gallons per minute (5678 L/min) for the prescribed duration as specified in Table B105.1.

SECTION B106 REFERENCED STANDARDS

ICC	IBC—12	International Building Code	B104.2, Table B105.1
ICC	IWUIC—12	International Wildland-Urban Interface Code	B103.3
NFPA	1142—12	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3

APPENDIX B

TABLE B105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute) ^b	FLOW DURATION (hours)
Type IA and IB ^a	Type IIA and IIIA ^a	Type IV and V-A ^a	Type IIB and IIIB ^a	Type V-B ^a		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	4
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

Appendix D
Fire Flow Test Results

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name:	Scottsdale Stadium
Project Address:	7408 East Osborn Road, Scottsdale, Arizona, 85251
Client Project No.:	1018089
Arizona Flow Testing Project No.:	18275
Flow Test Permit No.:	C55662
Date and time flow test conducted:	August 3, 2018 at 7:30 AM
Data is current and reliable until:	February 3, 2019
Conducted by:	Floyd Vaughan – Arizona Flow Testing, LLC (480-250-8154)
Witnessed by:	Brian Dick –City of Scottsdale-Inspector (602-228-2187)

Raw Test Data

Static Pressure: **87.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **82.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **28.0 PSI**
(Measured in pounds per square inch)

Diffuser Orifice Diameter: One 4-inch Hose Monster
(Measured in inches)

Coefficient of Diffuser: .7875

Flowing GPM: **1,990 GPM**
(Measured in gallons per minute)

GPM @ 20 PSI: **8,080 GPM**

Data with 15 PSI Safety Factor

Static Pressure: **72.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **67.0 PSI**
(Measured in pounds per square inch)

Distance between hydrants: Approx. 380 Feet

Main size: Not Provided

Flowing GPM: **1,990 GPM**

GPM @ 20 PSI: **7,046 GPM**

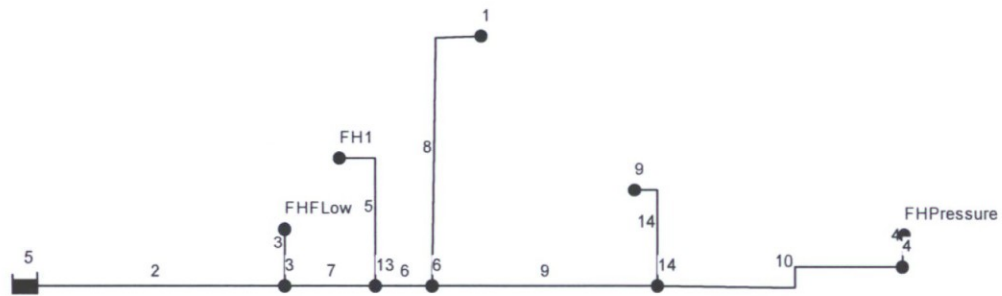
Scottsdale requires a maximum Static Pressure of 72 PSI for AFES Design.

Flow Test Location

North ↑



Appendix E
EPANET Calibration Results



1018089 Calibration_static.rpt

```
*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.0                                 *
*****
```

Input File: 1018089 Calibration.net

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
2	5	3	194.5	8
3	3	FHFlow	29	6
4	4	FHPressure	6	6
7	3	13	24.3	8
14	14	9	68	4
5	13	FH1	165	6
6	13	6	6	8
8	6	1	224.5	6
9	6	14	232	8
10	14	4	123.4	8

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality
FHFlow	0.00	1439.80	86.14	0.00
FHPressure	0.00	1439.80	87.01	0.00
3	0.00	1439.80	86.14	0.00
4	0.00	1439.80	87.01	0.00
9	0.00	1439.80	623.87	0.00
13	0.00	1439.80	86.57	0.00
14	0.00	1439.80	87.01	0.00
1	0.00	1439.80	623.87	0.00
FH1	0.00	1439.80	623.87	0.00
6	0.00	1439.80	623.87	0.00
5	0.00	1439.80	0.00	0.00 Reservoir

Link Results:

1018089 Calibration_static.rpt

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	0.00	0.00	0.00	Open
3	0.00	0.00	0.00	Open
4	0.00	0.00	0.00	Open
7	0.00	0.00	0.00	Open
14	0.00	0.00	0.00	Closed
5	0.00	0.00	0.00	Closed
6	0.00	0.00	0.00	Open
8	0.00	0.00	0.00	Closed
9	0.00	0.00	0.00	Open
10	0.00	0.00	0.00	Open

1018089 Calibration_residual.rpt

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.0                                 *
*****

```

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
2	5	3	194.5	8
3	3	FHFlow	29	6
4	4	FHPressure	6	6
7	3	13	24.3	8
14	14	9	68	4
5	13	FH1	165	6
6	13	6	6	8
8	6	1	224.5	6
9	6	14	232	8
10	14	4	123.4	8

Node Results:

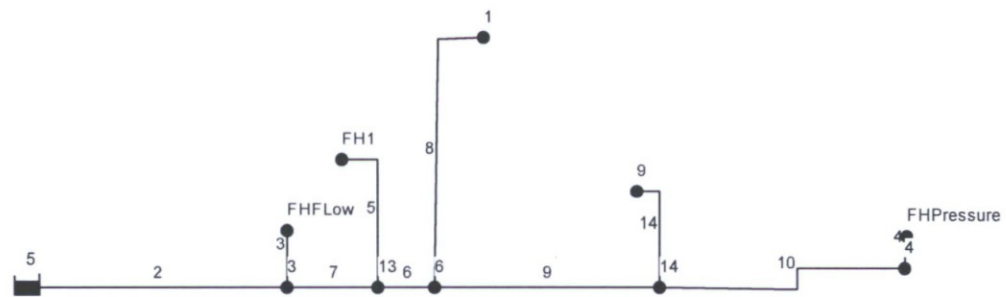
Node ID	Demand GPM	Head ft	Pressure psi	Quality
FHFlow	1990.00	1381.93	61.07	0.00
FHPressure	0.00	1428.22	81.99	0.00
3	0.00	1428.22	81.12	0.00
4	0.00	1428.22	81.99	0.00
9	0.00	1428.22	618.85	0.00
13	0.00	1428.22	81.56	0.00
14	0.00	1428.22	81.99	0.00
1	0.00	1428.22	618.85	0.00
FH1	0.00	1428.22	618.85	0.00
6	0.00	1428.22	618.85	0.00
5	-1990.00	1439.80	0.00	0.00 Reservoir

Link Results:

1018089 Calibration_residual.rpt

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	1990.00	12.70	59.53	Open
3	1990.00	22.58	1596.20	Open
4	0.00	0.00	0.00	Open
7	0.00	0.00	0.00	Open
14	0.00	0.00	0.00	Closed
5	0.00	0.00	0.00	Closed
6	0.00	0.00	0.00	Open
8	0.00	0.00	0.00	Closed
9	0.00	0.00	0.00	Open
10	0.00	0.00	0.00	Open

Appendix F
EPANET Demand Scenario Results



```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.0                                 *
*****

```

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
2	5	3	194.5	8
3	3	FHFlow	29	6
4	4	FHPressure	6	6
7	3	13	24.3	8
14	14	9	68	4
5	13	FH1	165	6
6	13	6	6	8
8	6	1	224.5	6
9	6	14	232	8
10	14	4	123.4	8

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality
FHFlow	0.00	1439.79	86.14	0.00
FHPressure	0.00	1439.77	86.99	0.00
3	0.00	1439.79	86.14	0.00
4	0.00	1439.77	86.99	0.00
9	48.00	1439.62	85.63	0.00
13	0.00	1439.79	86.57	0.00
14	0.00	1439.77	86.99	0.00
1	0.00	1439.79	84.83	0.00
FH1	0.00	1439.79	84.83	0.00
6	0.00	1439.79	86.57	0.00
5	-48.00	1439.80	0.00	0.00 Reservoir

Link Results:

1018089 ADD.rpt

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	48.00	0.31	0.06	Open
3	0.00	0.00	0.00	Open
4	0.00	0.00	0.00	Open
7	48.00	0.31	0.07	Open
14	48.00	1.23	2.23	Open
5	0.00	0.00	0.00	Open
6	48.00	0.31	0.06	Open
8	0.00	0.00	0.00	Open
9	48.00	0.31	0.06	Open
10	0.00	0.00	0.00	Open

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.0                                 *
*****

```

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
2	5	3	194.5	8
3	3	FHFlow	29	6
4	4	FHPressure	6	6
7	3	13	24.3	8
14	14	9	68	4
5	13	FH1	165	6
6	13	6	6	8
8	6	1	224.5	6
9	6	14	232	8
10	14	4	123.4	8

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality
FHFlow	0.00	1439.71	86.10	0.00
FHPressure	0.00	1439.59	86.92	0.00
3	0.00	1439.71	86.10	0.00
4	0.00	1439.59	86.92	0.00
9	144.00	1438.38	85.09	0.00
13	0.00	1439.70	86.53	0.00
14	0.00	1439.59	86.92	0.00
1	0.00	1439.70	84.80	0.00
FH1	0.00	1439.70	84.80	0.00
6	0.00	1439.70	86.53	0.00
5	-144.00	1439.80	0.00	0.00 Reservoir

Link Results:

1018089 MDD.rpt

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	144.00	0.92	0.45	Open
3	0.00	0.00	0.00	Open
4	0.00	0.00	0.00	Open
7	144.00	0.92	0.55	Open
14	144.00	3.68	17.81	Open
5	0.00	0.00	0.00	Open
6	144.00	0.92	0.43	Open
8	0.00	0.00	0.00	Open
9	144.00	0.92	0.45	Open
10	0.00	0.00	0.00	Open

1018089 PH.rpt

```
*****
*                               *
*             E P A N E T       *
*   Hydraulic and Water Quality *
*   Analysis for Pipe Networks  *
*             Version 2.0       *
*                               *
*****
```

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
2	5	3	194.5	8
3	3	FHFlow	29	6
4	4	FHPressure	6	6
7	3	13	24.3	8
14	14	9	68	4
5	13	FH1	165	6
6	13	6	6	8
8	6	1	224.5	6
9	6	14	232	8
10	14	4	123.4	8

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality
FHFlow	0.00	1439.15	85.86	0.00
FHPressure	0.00	1438.25	86.33	0.00
3	0.00	1439.15	85.86	0.00
4	0.00	1438.25	86.33	0.00
9	424.00	1428.87	80.97	0.00
13	0.00	1439.04	86.25	0.00
14	0.00	1438.25	86.33	0.00
1	0.00	1439.02	84.50	0.00
FH1	0.00	1439.04	84.51	0.00
6	0.00	1439.02	86.24	0.00
5	-424.00	1439.80	0.00	0.00 Reservoir

Link Results:

1018089 PH.rpt

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	424.00	2.71	3.37	Open
3	0.00	0.00	0.00	Open
4	0.00	0.00	0.00	Open
7	424.00	2.71	4.18	Open
14	424.00	10.83	137.92	Open
5	0.00	0.00	0.00	Open
6	424.00	2.71	3.26	Open
8	0.00	0.00	0.00	Open
9	424.00	2.71	3.35	Open
10	0.00	0.00	0.00	Open

1018089 MDD+Fire.rpt

```

*****
*                               E P A N E T                               *
*                               Hydraulic and Water Quality                 *
*                               Analysis for Pipe Networks                   *
*                               Version 2.0                                 *
*****
    
```

Link - Node Table:

Link ID	Start Node	End Node	Length ft	Diameter in
2	5	3	194.5	8
3	3	FHFlow	29	6
4	4	FHPressure	6	6
7	3	13	24.3	8
14	14	9	68	4
5	13	FH1	165	6
6	13	6	6	8
8	6	1	224.5	6
9	6	14	232	8
10	14	4	123.4	8

Node Results:

Node ID	Demand GPM	Head ft	Pressure psi	Quality
FHFlow	0.00	1431.68	82.62	0.00
FHPressure	0.00	1430.26	82.87	0.00
3	0.00	1431.68	82.62	0.00
4	0.00	1430.26	82.87	0.00
9	144.00	1429.05	81.05	0.00
13	0.00	1430.37	82.49	0.00
14	0.00	1430.26	82.87	0.00
1	0.00	1430.36	80.75	0.00
FH1	1500.00	1385.27	61.21	0.00
6	0.00	1430.36	82.49	0.00
5	-1644.01	1439.80	0.00	0.00 Reservoir

Link Results:

1018089 MDD+Fire.rpt

Link ID	Flow GPM	Velocity fps	Unit Headloss ft/Kft	Status
2	1644.01	10.49	41.74	Open
3	0.00	0.00	0.00	Open
4	0.00	0.00	0.00	Open
7	1644.00	10.49	54.05	Open
14	144.00	3.68	17.81	Open
5	1500.00	17.02	273.31	Open
6	144.00	0.92	0.45	Open
8	0.00	0.00	0.00	Open
9	144.00	0.92	0.45	Open
10	0.00	0.00	0.00	Open

Appendix G
LSW Engineers Plumbing Calculations

FIXTURE UNIT CALCULATION P3

			FU EACH		TOTAL FU	
MARK	DESCRIPTION	QTY	WASTE	WATER	WASTE	WATER
IMB-1	ICE MAKER BOX	1	0	0.5	0	0.5
LAV-1	LAVATORY	35	1	2	35	70
MS-1	MOP SINK	2	2	3	4	6
S-1	SINK	5	2	2	10	10
SH-1	SHOWER	23	2	4	46	92
UR-1	URINAL	13	2	5	26	65
WC-1	WATER CLOSET	26	4	10	104	260
HB-1	HOSE BIBB	5	0	5	0	25
HW	HYDROWORX INLET	1	115	28	115	28
TP	THERMAL PLUNGE	2	115	28	230	56
VAR	KITCHEN VARIOUS	15	0	1	0	15
DM	DISH MACHINE	1	2	3	2	3
		129			572	630.5

WATER CALCULATIONS

HORIZONTAL PIPE LENGTH

TAP TO METER	=	40 FT
METER TO LAST FIXTURE	=	250 FT
VERTICAL RISE	=	35 FT
VALVES AND FITTINGS	=	75 FT
TOTAL LENGTH	=	400 FT

P.S.I. LOSS

RISE 35' x 0.43	=	15.0 PSI
3" METER	=	6.0 PSI
TAP	=	2.5 PSI
FIXTURE	=	25.0 PSI
BACKFLOW PREVENTER	=	10.0 PSI
PRESSURE REDUCING VALVE	=	0.0 PSI
TOTAL LOSS	=	58.5 PSI

STREET PRESSURE	=	67.0 PSI
TOTAL LOSS	=	58.5 PSI
DIFFERENCE	=	8.5 PSI

$$\frac{8.5 \text{ PSI DIFFERENCE}}{400 \text{ FT TOTAL LENGTH}} \times 100 = 2.1 \text{ MAX P.S.I. DROP ALLOWABLE PER 100 FT OF PIPE}$$

Scottsdale Stadium

7408 East Osborn Road
City of Scottsdale, Maricopa County, Arizona
Dibble Project No. 1018089

Phase 1 Sewer Report

December 2018

Prepared for:



Submitted by:

Dibble
Engineering

7878 North 16th Street
Suite 300
Phoenix, AZ 85020
P. 602.957.1155
F. 602.957.2838
www.dibblecorp.com



48-DR-2018
12/27/2018

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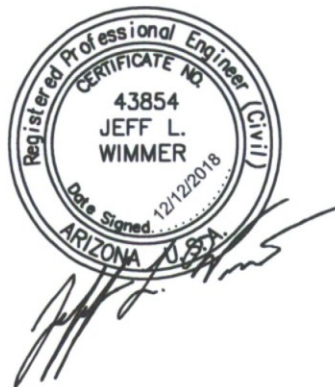
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II. Sewer Design	2
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B. Proposed Conditions	3
C. Existing vs. Proposed Demand	4
D. Design Criteria and Modeling.....	4
E. Results and Conclusion	4

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Appendices

-
- Appendix A – Utility Plan
 - Appendix B – City of Scottsdale Design Standards & Policies Manual
 - Appendix C – Hydraflow Express Results
 - Appendix D – Sewer flow test results (Pending)



I. Project Description

The Scottsdale Stadium Multi-Use Event Center development is located at the northeast corner of Drinkwater Boulevard and Osborn Road in Scottsdale, Arizona. The facility serves as a baseball field for the San Francisco Giants' spring training and the Scottsdale Scorpions. Phase 1 of this project includes a proposed clubhouse/multi-use center in place of the existing building and parking lot east of the south entrance gate. The onsite development includes the new clubhouse/multi-use center and associated modifications to the adjacent west parking lot, a new pedestrian access way and mezzanine, and site utilities. See **Figure 1** for the project Location Map.



Figure 1 – Location Map

II. Sewer Design

A. Existing Conditions

There is an existing City of Scottsdale 12-inch sewer main in Osborn Road. A 12-inch and 8-inch sewer line connect from the Osborn Road main and run parallel along Drinkwater Boulevard. There is also an existing 72-inch storm drain that runs south of the existing 12-inch sewer main along Osborn Road, then crosses at approximately 169-feet from the intersection of Osborn Road and Drinkwater Boulevard, runs north of the 12-inch main, and crosses again at 1,543-feet from the intersection and continues running south of the main. The portion in which the storm drain is running north of the sewer main, there is approximately a 3-inch clearance.

B. Proposed Conditions

The proposed clubhouse/multi-use facility will utilize an 8-inch sewer service connection that will connect to the existing 12-inch sewer main in Osborn Road. The connection to the main will occur where the 12-inch main is north of the existing 72-inch storm drain to allow for adequate clearance. There will be cleanouts at the pipe bends and a manhole joining a proposed 6-inch grease interceptor and 8-inch service. The proposed utilities are shown in **Appendix A**.

Based on Figure 7.1-2 of Section 7-1.403 of the City of Scottsdale's Design Standards & Policies Manual (DS&PM), the average day sewer demand for the commercial/retail space is 0.8 gallons per day per square-foot, with a peaking factor of 6, as specified by the City of Scottsdale's Water Resource Department. Average wastewater demand and peak wastewater demand can then be calculated using the proposed building area (43,200 square-feet).

As part of the Phase 1 development, there will also be one large and two smaller hydrotherapy pools. The larger pool will have a demand of 100 gpm and the two smaller pools will each have a demand of 50 gpm. For conservative estimation, the 100 gpm demand for the larger pool will be used in the demand calculation, with an additional 10 gpm for drain/hose/cleaning. There will also be additional concurrent loads for the kitchen and laundry. A copy of Figure 7.1-2 of the DS&PM is included in **Appendix B**.

$$\text{Average daily wastewater demand} = 0.8 \text{ gpd/sf} * 43,200 \text{ sf} = 34,560 \text{ gpd}$$

Using a peaking factor of 6, the peak daily wastewater demand is calculated:

$$34,560 \text{ gpd} * 6 = 207,360 \text{ gpd}$$

This can then be converted to gpm:

$$207,360 \text{ gpd} * \frac{1 \text{ day}}{24 \text{ hr}} * \frac{1 \text{ hr}}{60 \text{ min}} = 144 \text{ gpm}$$

With the additional demand of the hydrotherapy pool (100 gpm), associated pool/spa filter backwash (10 gpm), kitchen (15 gpm), and laundry (20 gpm), the peak daily demand is calculated:

$$144 \text{ gpm} + 100 \text{ gpm} + 10 \text{ gpm} + 15 \text{ gpm} + 20 \text{ gpm} = \mathbf{289 \text{ gpm}}$$

The peak sewer demand in cfs is:

$$289 \text{ gpm} * \frac{1 \text{ ft}^3}{7.48 \text{ gallons}} * \frac{1 \text{ min}}{60 \text{ sec}} = \mathbf{0.644 \text{ cfs}}$$

C. Existing vs. Proposed Demand

The existing building size is 6,258 square-feet. The existing building's average day sewer demand is assumed to have been calculated using an average day sewer demand of 0.5 gallons per day per square-foot, with a peaking factor of 3 for commercial/retail space. The average day demand and peak demand for the existing building can be calculated.

$$\text{Average daily wastewater demand} = 0.5 \text{ gpd/sf} * 6,258 \text{ sf} = 3,129 \text{ gpd}$$

Using a peaking factor of 3, the peak daily wastewater demand is calculated:

$$3,129 \text{ gpd} * 3 = 9,387 \text{ gpd}$$

This can then be converted to gpm:

$$9,387 \text{ gpd} * \frac{1 \text{ day}}{24 \text{ hr}} * \frac{1 \text{ hr}}{60 \text{ min}} = 6.519 \approx 7 \text{ gpm}$$

The additional increase in peak sewer demand from the existing building can be calculated:

$$289 \text{ gpm} - 7 \text{ gpm} = \mathbf{282 \text{ gpm}}$$

The proposed building will increase the peak sewer demand by 282 gpm.

D. Design Criteria and Modeling

The on-site sewer line will be designed to meet the following criteria per *City of Scottsdale DS&PM*:

- Manning's "n" value of 0.013 shall be used
- Pipes shall have a maximum d/D value of 0.65 in the ultimate peak condition
- Pipes shall have mean full flow velocity of between 2.5 to 10 feet per second

The proposed 8-inch sewer service was tested in Hydraflow Express to ensure it meet the design criteria and can sustain the anticipated wastewater demand. The 8-inch service will maintain a 1% slope. The Hydraflow Express Results are provided in **Appendix C**.

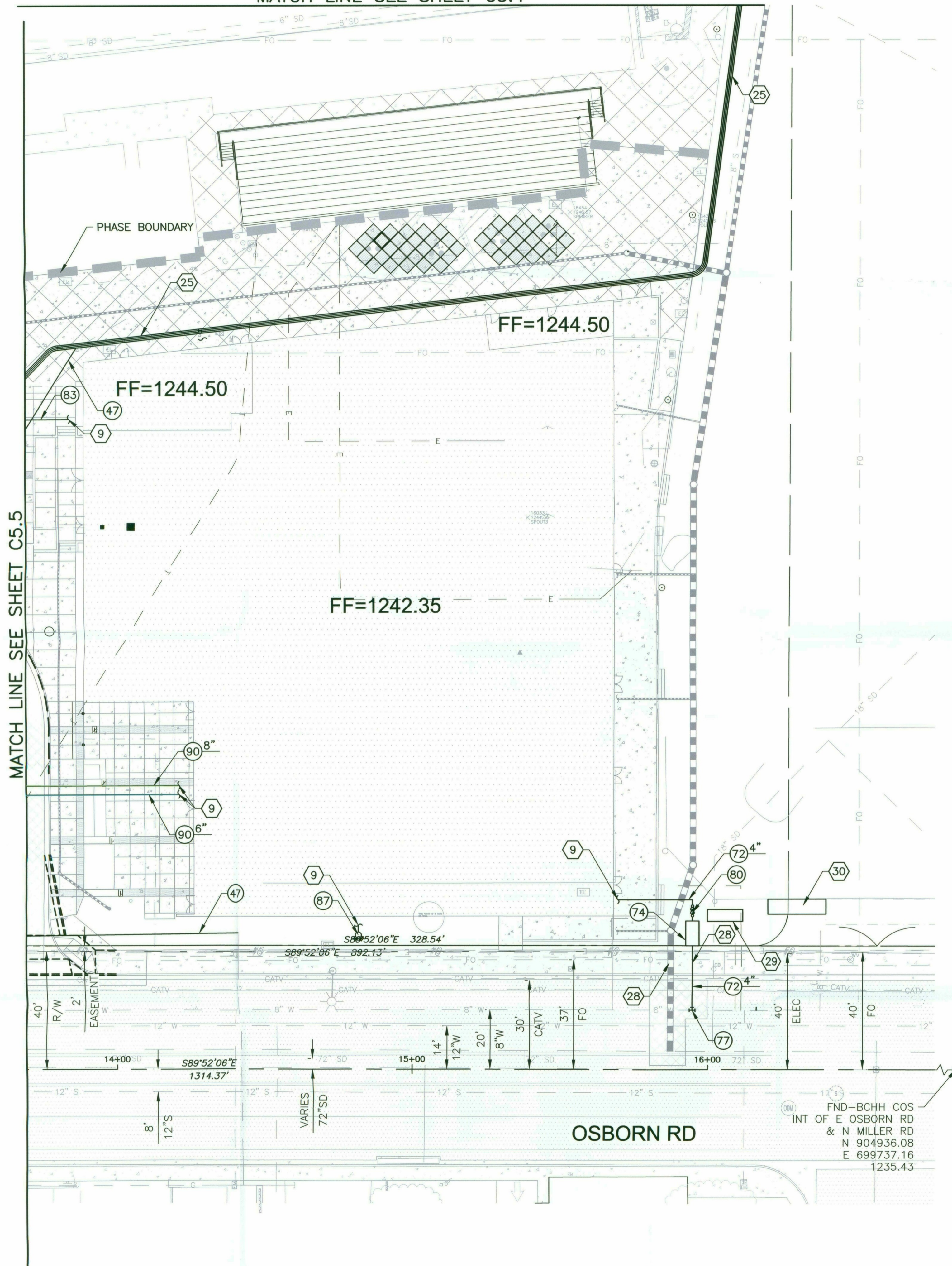
E. Results and Conclusion

The proposed onsite sewer service is sized to meet the demand of the proposed Scottsdale Stadium Phase 1 improvements for peak sewer demand conditions. A sewer flow monitoring test is in progress for the existing 12-inch sewer main along Osborn Road ensure that the City of Scottsdale's existing system can sustain the additional flows from the Scottsdale Stadium project. This report will be amended to include the results of the test.

Appendix A
Preliminary Utility Plan

10/19/2018 2:31:51 PM

MATCH LINE SEE SHEET C5.4



- CONSTRUCTION NOTES**
- (47) RE-ROUTE EXST GAS LINE PER PLAN
 - (72) WATER SERVICE LINE W/FITTINGS, DIP CL 350 SIZE PER PLAN
 - (74) 3" WATER METER & VAULT COS STD DET 2345
 - (77) WATER SERVICE CONNECTION SIZE PER PLAN, COS STD DET 2330
 - (80) 4" REDUCED PRESSURE BACKFLOW PREVENTER COS STD DET 2342
 - (83) FIRE LINE W/FITTINGS, DIP CL 350 W/POLYWRAP, SIZE PER PLAN
 - (87) REMOTE FIRE DEPARTMENT CONNECTION
 - (90) SEWER SERVICE LINE, PVC SDR 35 SIZE PER PLAN

- REFERENCE NOTES**
- (9) BUILDING SERVICE CONNECTION REFER TO PLUMBING PLANS
 - (25) NEW TECH DUCT BANK REFER TO ARCHITECTURAL TECHNOLOGY SITE PLAN
 - (28) EXCAVATE UNDER EXST CATCH BASIN WING TO INSTALL NEW PIPES PROTECT EXST CATCH BASIN WING IN PLACE
 - (29) GAS METER TO BE INSTALLED BY SOUTHWEST GAS
 - (30) ELECTRICAL SES REFER TO MEP PLANS

DWL
ARCHITECTS + PLANNERS, INC.
2333 N. Central Ave.
Phoenix, AZ 85004
tel 602.264.9731
dwlarchitects.com

POPULOUS
Dibble Engineering
7270 North 24th Street
Suite 300
Phoenix, AZ 85016
P 602.957.2389

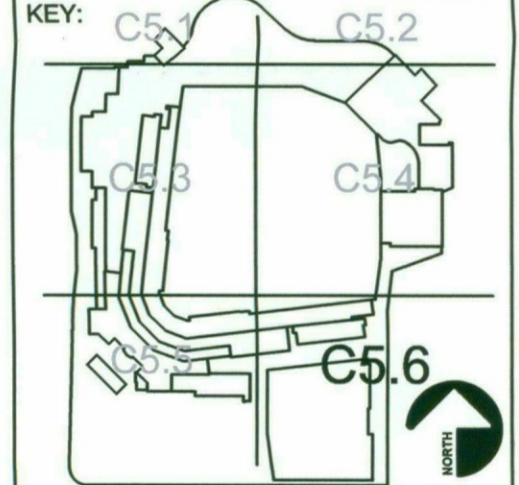
DD SET
NOT FOR CONSTRUCTION

City of Scottsdale
Stadium Multi-Use Event Center
7408 E Osborn Rd, Scottsdale, AZ 85251

REVISIONS

No.	Description	Date

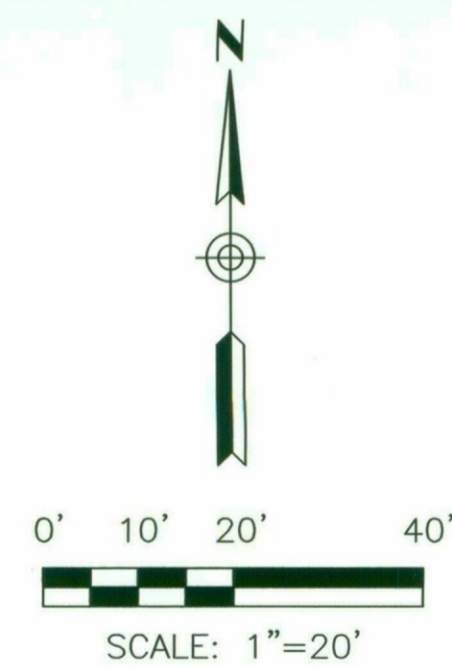
DRB Submittal
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DWL ARCHITECTS + PLANNERS, INC.



SHEET TITLE:
UTILITY PLAN

SHEET NUMBER:
C5.6

DRAWN BY: TCW REVIEWED BY: JLW
DATE: 10/31/18 PROJECT NUMBER: 1821.00



Contact Arizona 811 at least two full working days before you begin excavation

ARIZONA811
Call 811 or click Arizona811.com

LAND USE	DEMAND (gpd)	DESIGN PEAKING FACTOR
Commercial/Retail	0.5 per sq. ft.	3
Office	0.4 per sq. ft.	3
Restaurant	1.2 per sq. ft.	6
High Density Condominium (Condo)	140 per unit	4.5
Resort Hotel (includes site amenities)	380 per room.	4.5
School: without cafeteria	30 per student	6
School: with cafeteria	50 per student	6
Cultural	0.1 per sq. ft.	3
Clubhouse for Subdivision	100 per patron x 2	4.5
Golf Course	patrons per du per day	
Fitness Center/ Spa/ Health club	0.8 per sq. ft.	3.5

FIGURE 7-1.2 AVERAGE DAY SEWER DEMAND IN GALLONS PER DAY & PEAKING FACTORS BY LAND USE

HYDRAULIC DESIGN

7-1.404

No public SS lines will be less than 8 inches in diameter unless permission is received in writing from the Water Resources Department.

SS lines shall be designed and constructed to give mean full flow velocities equal to or greater than 2.5 fps, based upon Manning’s Formula, using an “n” value of 0.013.

To prevent abrasion and erosion of the pipe material, the maximum velocity will be limited to 10 fps at estimated peak flow. Where velocities exceed this maximum figure, submit a hydraulic analysis along with construction recommendations to the Water Resources Department for consideration. In no case will velocities greater than 15 fps be allowed.

Actual velocities shall be analyzed for minimum, average day and peak day design flow conditions for each reach of pipe.

The SS system shall be designed to achieve uniform flow velocities through consistent slopes. Abrupt changes in slope shall be evaluated for hydraulic jump.

The depth to diameter ratio (d/D) for gravity SS pipes 12 inches in diameter and less shall not exceed 0.65 in the ultimate peak flow condition. This d/D ratio includes an allowance for system infiltration and inflow.

The d/D for gravity drains greater than 12 inches diameter shall not exceed 0.70 for the ultimate peak flow condition. This d/D includes an allowance for system infiltration and inflow.

Measures to mitigate hydrogen sulfide shall be analyzed at manhole drops, abrupt changes in pipe slope or direction and at changes in pipe diameter.

MANHOLES AND CLEAN OUTS

7-1.405

Manholes in city streets shall be located near the center of the inside traffic lane, rather than on or near the line separating traffic lanes. Manholes shall not be in bike trails, equestrian trails, sidewalks, crosswalks or wash crossings. Manholes are required at all

Appendix C
Hydraflow Express Results

Channel Report

8-inch

Circular

Diameter (ft) = 0.67

Invert Elev (ft) = 100.00

Slope (%) = 1.00

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 0.64

Highlighted

Depth (ft) = 0.35

Q (cfs) = 0.640

Area (sqft) = 0.19

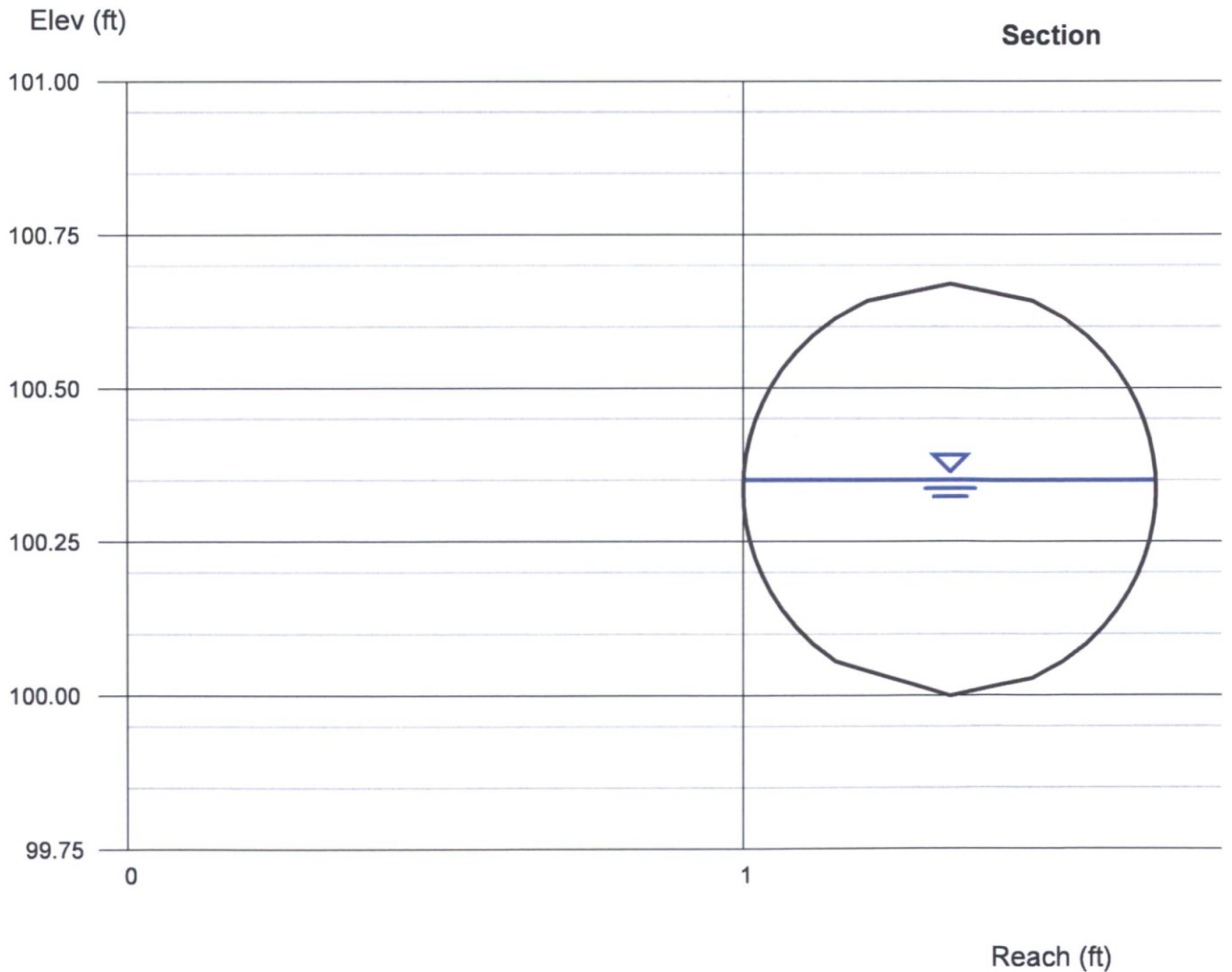
Velocity (ft/s) = 3.42

Wetted Perim (ft) = 1.09

Crit Depth, Yc (ft) = 0.38

Top Width (ft) = 0.67

EGL (ft) = 0.53



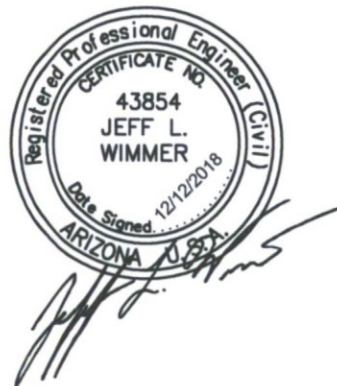
Appendix D
Sewer Flow Test Results

Scottsdale Stadium

7408 East Osborn Road
Scottsdale, Maricopa County, Arizona
Dibble Project No. 1018089

Phase 1 Drainage Report December 2018

Prepared for:



Submitted by:

**Dibble
Engineering**

7878 North 16th Street
Suite 300
Phoenix, AZ 85020
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Plan #	_____
Case #	<u>48-DR-2018</u>
Q-S #	_____
<input checked="" type="checkbox"/> Accepted	
<input type="checkbox"/> Corrections	
<u>N. Baronas</u>	<u>1-16-19</u>
Reviewed By	Date

**48-DR-2018
12/27/2018**

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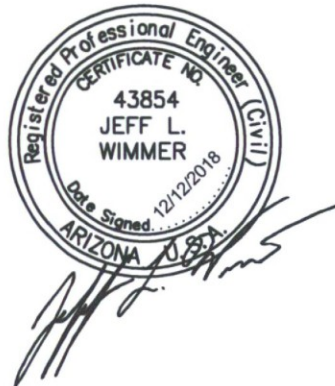
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- Appendix B - FEMA FIRMette Map
- Appendix C - Existing Conditions Map
- Appendix D - Grading & Drainage and Storm Drain Plans
- Appendix E - NOAA Atlas 14 Point Precipitation Data
- Appendix F - Rational Method Calculations
- Appendix G - Pipe Capacity Calculations



I. INTRODUCTION

A. General

This drainage report is prepared for the City of Scottsdale as part of the design for the Scottsdale Stadium Phase 1 improvements project in the City of Scottsdale, Maricopa County, Arizona. The Scottsdale Stadium Multi-Use Event Center development is located at the northeast corner of Drinkwater Boulevard and Osborn Road in Scottsdale, Arizona. The facility serves as a baseball field for the San Francisco Giants' spring training and the Scottsdale Scorpions. This project consists of construction of a new clubhouse/multi-use center, modifications to the adjacent parking lot and hardscape and the installation of site utilities.



Figure 1 – Location Map

B. Study Area

The site is generally located in the southeast $\frac{1}{4}$ of the northwest $\frac{1}{4}$ of Section 26, Township 2 North, Range 4 East of the Gila and Salt River Meridian, Maricopa County, City of Scottsdale, Arizona. The project site has an approximate latitude and longitude of 33.4879 and -111.9203, respectively, and is located on a property owned by the City of Scottsdale. The project site has Maricopa County Assessor's Parcel Numbers (APN) of 130-24-001A, 130-24-002C, 130-24-003D and 130-24-003E and consists of approximately 1.32 acres of the combined parcel area of approximately 26.84 acres.

C. Existing Conditions

The existing site consists of approximately 26.84 acres that is currently developed as a baseball stadium, which includes a baseball field, clubhouse, team store, concessions, training room and practice fields. See **Appendix A** for existing site aerial map.

According to Flood Insurance Rate Map (FIRM) Panel 04013C2235L, dated October 16, 2013, the project site is located within Federal Emergency Management Agency (FEMA) Flood Hazard Zone 'X'. Flood Zone 'X' is defined as areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. A FIRMette of the existing site can be found in **Appendix B**.

The east side of the project site currently drains southeast via surface runoff across the existing parking lot into the landscape area along Osborn Rd where it passes through openings in the existing site wall and outfalls onto Osborn Rd. The west side of the project site drains south and west via surface runoff onto Osborn Rd and Drinkwater Blvd, respectively, where it enters the City's storm drain system. The concourse and baseball fields drain to catch basins where the flow is conveyed to the City storm drain system along Osborn Rd. There is no on-site retention provided for stormwater runoff. See **Appendix C** for Existing Conditions Map.

According to stadium staff, the main baseball field does not drain adequately during large storm events. Existing 6-inch and 8-inch storm drain pipes in the main field currently collect storm water runoff from the field and the seating bowl. The storm water is conveyed east into an existing 12-inch pipe in the adjacent practice field where it flows south to a 72-inch storm drain pipe along Osborn Rd. After investigating the line with a camera, it was found that the 12-inch pipe in the practice field was partially blocked and exhibited some settlement in areas that caused storm water to back up onto the main field during larger storm events; this line will need to be replaced to improve drainage conditions in the field.

D. Proposed Conditions

The Storm Drain and Grading & Drainage Plans can be found in **Appendix D**. The existing 6-inch and 8-inch storm drain pipes in the main field will be extended east into the adjacent practice field where they will connect to a new 18-inch storm drain pipe that runs south along the warning track on the east side of the new building; the existing 12-inch pipe will be capped and abandoned in place.

The existing storm drain system in the concourse area north of the new building will be removed and relocated, and tie into a new 18-inch storm drain pipe that will run east and connect to the proposed 18-inch pipe that runs south along the east side of the new building. With this additional flow, the proposed pipe size will increase to 24 inches. This line will tie into an existing 72-inch storm drain pipe that runs west-east along Osborn Rd via a product called Inserta Tee. Roof drains from the new building will also tie into the new 24-inch line running south along the east side of the building.

The main entrance for the stadium is being relocated to the southwest corner of the site where existing hardscape is being re-designed. Stormwater will continue to drain along the surface and outfall onto Osborn Rd and Drinkwater Blvd. All other areas will match historical flow patterns and continue to surface

drain and enter the City's storm drain system south of the site. No additional stormwater retention will be provided on-site.

II. DESIGN CRITERIA

Drainage design for this project conforms to the outlined criteria as follows, where applicable. Guidelines have been assembled from the City of Scottsdale and Maricopa County standards. These design criteria conform to the requirements of the City of Scottsdale Design Standards & Policies Manual (DS&PM), revised January 2018, where applicable. Unless otherwise noted in the City's design standards, the design shall also be in accordance with the Flood Control Department of Maricopa County (FCDMC) Drainage Design Manual for Maricopa County, Arizona, 4th Edition, dated August 2013.

A. Rainfall

1. Rainfall Depth

Rainfall depth was determined to be 2.16 inches based on the 100-year, 2-hour storm event. Rainfall depth was determined using NOAA Atlas 14 Point Precipitation Frequency Estimates for Arizona and the project location.

2. Rainfall Intensity

Rainfall intensity was determined to be 5.67 in/hr based on the NOAA Atlas 14 Point Precipitation Frequency Estimates for Arizona and the project location. This is based on the 100-year design storm using the minimum Time of Concentration of 10 minutes, in accordance with the City's design criteria. The rainfall depth and intensity charts from NOAA are included in **Appendix E**.

B. Stormwater Storage Facilities & Grading Requirements

- All developments will be designed to have a positive outfall once the on-site storm water storage facilities are filled to design storm capacity.
- For sites that are less than one acre in size and are not likely to contribute stormwater contaminants to the city's municipal separate storm sewer system or waters of the U.S., the first flush volume may be waived, subject to prior approval by stormwater staff.
- The storage requirement is not applicable to undisturbed, natural areas. Such areas on a site may be excluded from the area used in the storage requirement calculation.
- The maximum allowable side slope of any basin shall be 4:1.

C. Runoff Coefficients

The existing site may be categorized as being fully-developed with parking lot, hardscape and structures. The runoff coefficient for paved streets, parking lots, roofs and driveways shall be 0.95, as defined by the City. The post-construction project site will replace the existing hardscape, parking lot and structures with new a new building, hardscape and parking lot, thus, the post-construction imperviousness will match the existing condition. The main baseball field consists of mostly turf and shall be analyzed using a runoff coefficient of 0.30, as defined by the City. The baseball field will not be impacted with Phase 1 improvements and will have the same imperviousness pre- and post-construction.

III. STUDY APPROACH

A. Methodology

1. Site Grading, Drainage & Retention

It was determined with the City that the first flush requirements would only encompass modifications to the parking lot. The disturbed area of the parking lot is 0.69 acre, which is less than the one-acre limit that would trigger the first flush retention criteria. Therefore, no first flush retention will be provided.

As previously mentioned, the post-construction improvements will not increase the existing surface imperviousness and the runoff coefficient of the site will remain 0.95. Therefore, the required pre- versus post-construction retention volume is zero. No additional on-site retention will be provided for this project.

2. Hydrology

Peak runoff for the site was determined using the Rational Method in accordance with the City of Scottsdale and the FCDMC:

$$Q = C * i * A$$

Where:

Q = Peak Flow (cfs)

C = Runoff Coefficient = 0.95

i = Rainfall Intensity = 5.67 in/hr

A = Area (acre)

Drainage areas were delineated using AutoCAD, based on the proposed grading model. The rainfall intensity, drainage area and runoff coefficient were input into an Excel spreadsheet to calculate peak flows. A minimum time of concentration of 10 minutes was used.

3. Hydraulics

The size of storm drain pipe was determined using Manning's Equation:

$$Q = VA = \left(\frac{1.49}{n}\right) AR^{2/3}\sqrt{S}$$

Where:

Q = Flow Rate (ft³/s)

V = Velocity (ft/s)

A = Flow Area (ft²)

n = Manning's Roughness Coefficient

R = Hydraulic Radius (ft)

S = Channel Slope (ft/ft)

B. Assumptions

The following design criteria were assumed for this project:

1. Peak discharge rates corresponding to a given intensity would occur only if the rainfall duration is at least equal to the time of concentration.
2. The calculated runoff is directly proportional to the rainfall intensity.
3. The frequency of occurrence for the peak discharge is the same as the frequency for the rainfall producing the event.

IV. RESULTS

A. Hydrology

Table 1 provides a peak flow summary for the existing main baseball field & seating bowl, the concourse area north of the new building and the new building. Refer to **Appendix F** for the Rational Method calculation results.

Table 1 – Peak Flow Rates

Drainage Area	Drainage Area (sq-ft)	Drainage Area (acre)	C-value	100-Yr Runoff Q (cfs)
Main Field & Seating Bowl	182,515	4.19	0.43	10.30
Concourse Area	11,400	0.262	0.95	1.41
New Building	32,683	0.750	0.95	4.04

B. Hydraulics

Refer to **Appendix G** for pipe capacity calculations for proposed storm drain pipe.

V. REFERENCES

1. Flood Control District of Maricopa County. *Drainage Policies and Standards for Maricopa County, Arizona*. August 15, 2013.
2. City of Scottsdale. *Design Standards & Policies Manual, Chapter 4: Grading & Drainage*. January 2018.

Appendix A
Existing Site Aerial Map



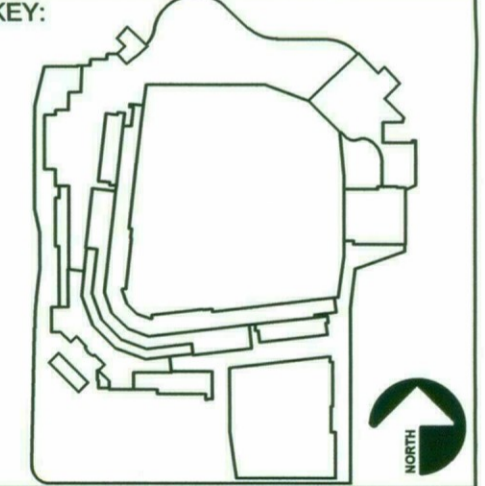
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*Scottsdale Stadium
Drainage Report*

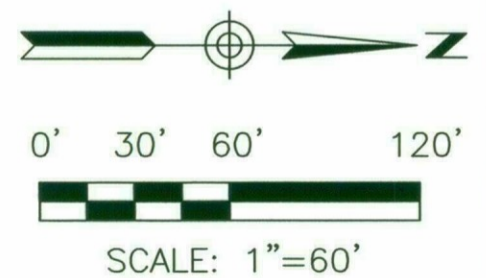


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SHEET TITLE:
AERIAL EXHIBIT



SHEET NUMBER:
EXHIBIT 1

DRAWN BY: TCW	REVIEWED BY: JLW
DATE: 10/31/18	PROJECT NUMBER: 1821.00

Appendix B
FEMA FIRMette Map

National Flood Hazard Layer FIRMette



33°29'32.16"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000

USGS The National Map: Orthoimagery. Data refreshed October 2017.

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

- | | | |
|------------------------------------|--|--|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE)
<i>Zone A, V, A99</i> |
| | | With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i> |
| | | Regulatory Floodway |
| OTHER AREAS OF FLOOD HAZARD | | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile <i>Zone X</i> |
| | | Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i> |
| | | Area with Reduced Flood Risk due to Levee. See Notes, <i>Zone X</i> |
| | | Area with Flood Risk due to Levee <i>Zone D</i> |
| OTHER AREAS | | Area of Minimal Flood Hazard <i>Zone X</i> |
| | | Effective LOMRs |
| GENERAL STRUCTURES | | Channel, Culvert, or Storm Sewer |
| | | Levee, Dike, or Floodwall |
| OTHER FEATURES | | 20.2 Cross Sections with 1% Annual Chance Water Surface Elevation |
| | | 17.5 Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| MAP PANELS | | Digital Data Available |
| | | No Digital Data Available |
| | | Unmapped |



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/24/2018 at 7:00:43 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

111°54'56.80"W

Appendix C
Existing Conditions Map

FND-BCHH COS
W 1/4 CORNER
SECTION 26
T2N R4E

SCOTTSDALE ROAD

2658.49'
S00°09'27"W

FND-BCHH COS
NW CORNER
SECTION 26
T2N R4E



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CONSTRUCTION

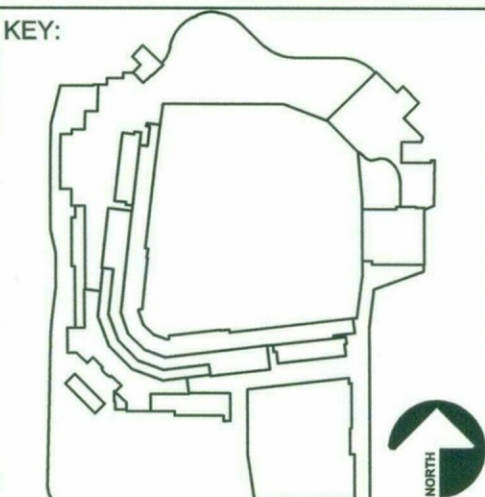
City of Scottsdale
Stadium Multi-Use Event Center
7408 E Osborn Rd, Scottsdale, AZ 85251

REVISIONS

No.	Description	Date

DRB
Submittal

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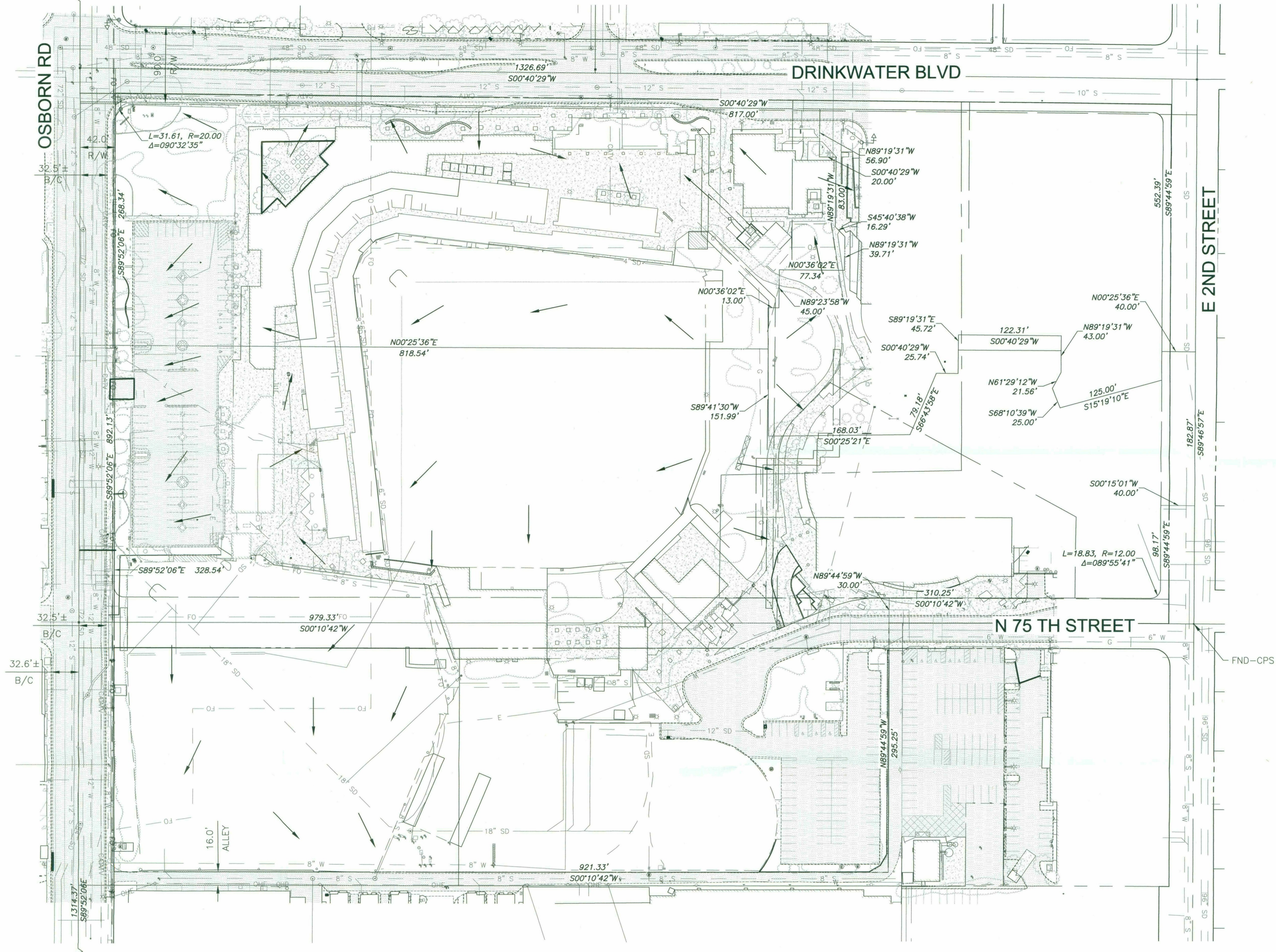


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**EXISTING
CONDITIONS
PLAN**

SHEET NUMBER:
C2.1

DRAWN BY: TCW	REVIEWED BY: JLW
DATE: 10/31/18	PROJECT NUMBER: 1821.00

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Appendix D
Grading & Drainage and Storm Drain Plans

MATCH LINE SEE SHEET C4.3

DRINKWATER BLVD

OSBORN RD

FF=1244.4±

EXISTING BUILDING

PHASE BOUNDARY

PHASE BOUNDARY

FND BCHH COS
N 904939.10
E 698422.77
ELEV 1242.50

N00°40'29"E
1326.69'

120.0'
R/W

150.0'
R/W

6.0' COMM
ESMT

30.0' PUE
ESMT

90.0'
R/W

S89°52'06"E
268.34'

120.0'
R/W

6.0' ESMT

S89°52'06"E
1314.37'

MATCH LINE SEE SHEET C4.6



POPULOUS

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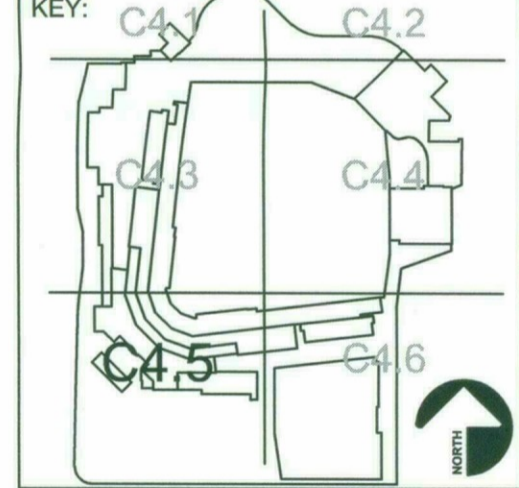
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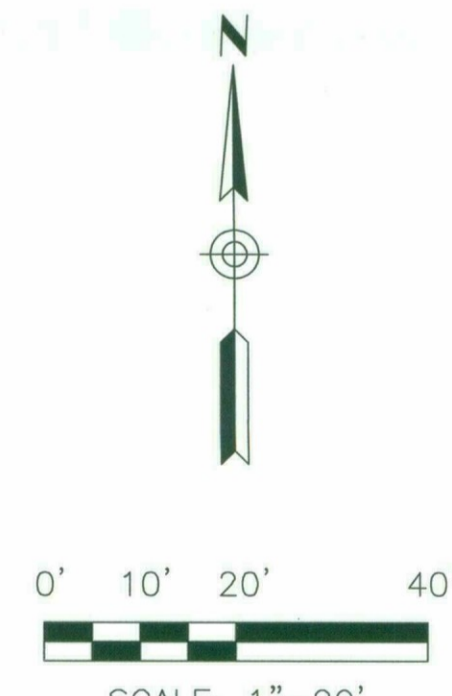


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GRADING & DRAINAGE PLAN

SHEET NUMBER:
C4.5

DRAWN BY: TCW
REVIEWED BY: JLW

DATE: 10/31/18
PROJECT NUMBER: 1821.00

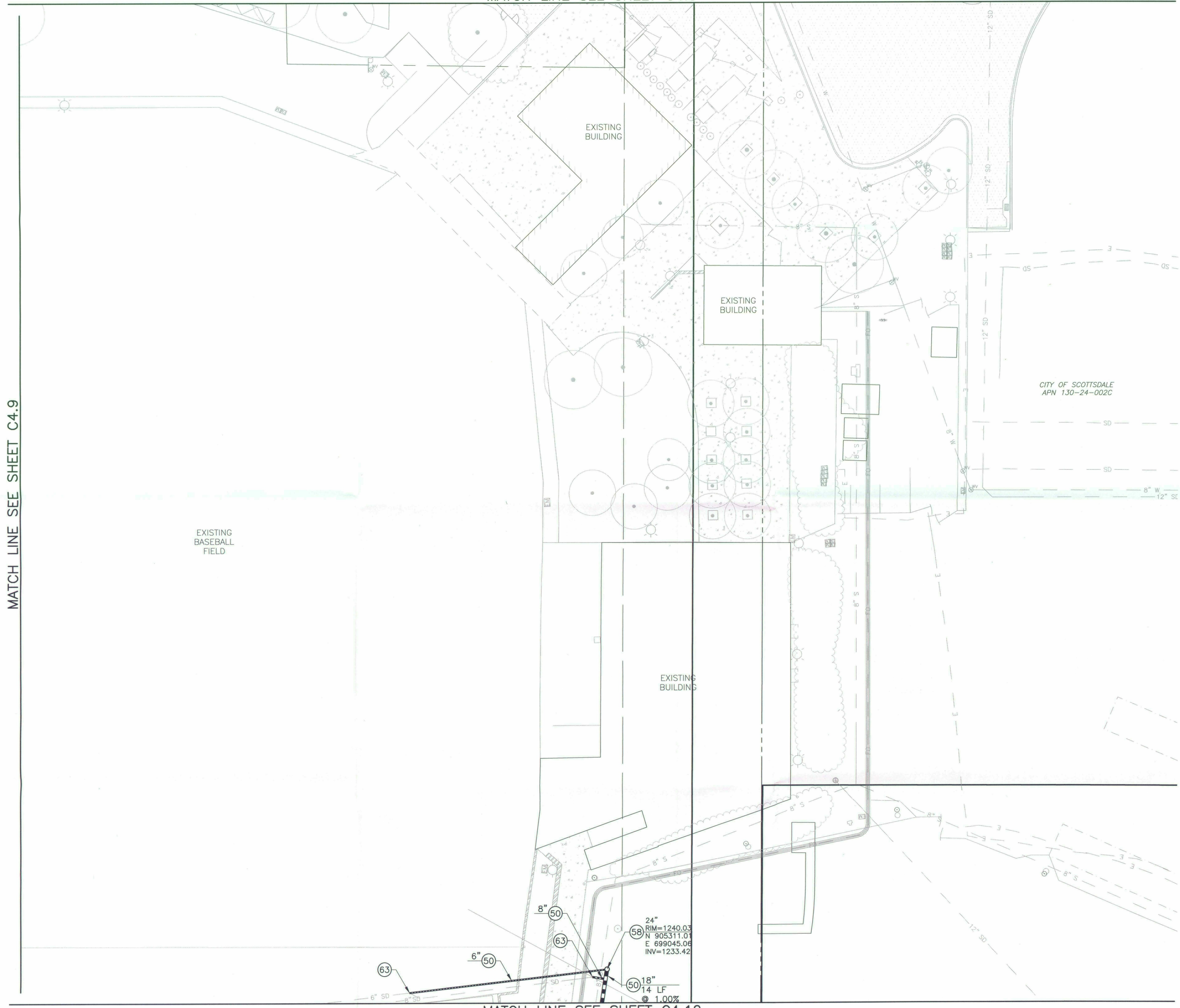


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MATCH LINE SEE SHEET C4.9

MATCH LINE SEE SHEET C4.8



MATCH LINE SEE SHEET C4.12

- CONSTRUCTION NOTES**
- 50 STORM DRAIN, HDPE (WATER TIGHT)
SIZE PER PLAN
ADS N-12 WT OR APPROVED EQUAL
 - 58 DRAIN BASIN W/SOLID LID (H-20 TRAFFIC)
& SUMP INSERT
ADS NYLOPLAST OR APPROVED EQUAL



POPULOUS



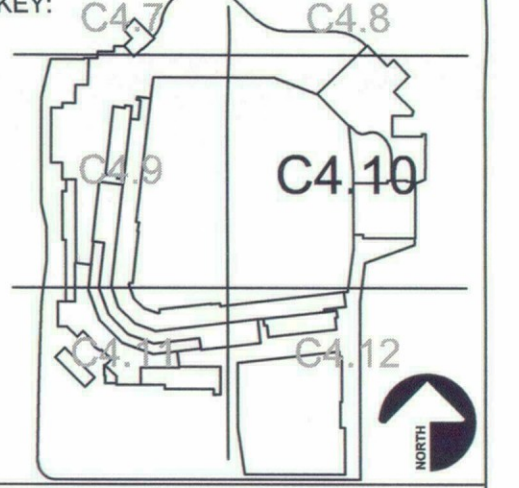
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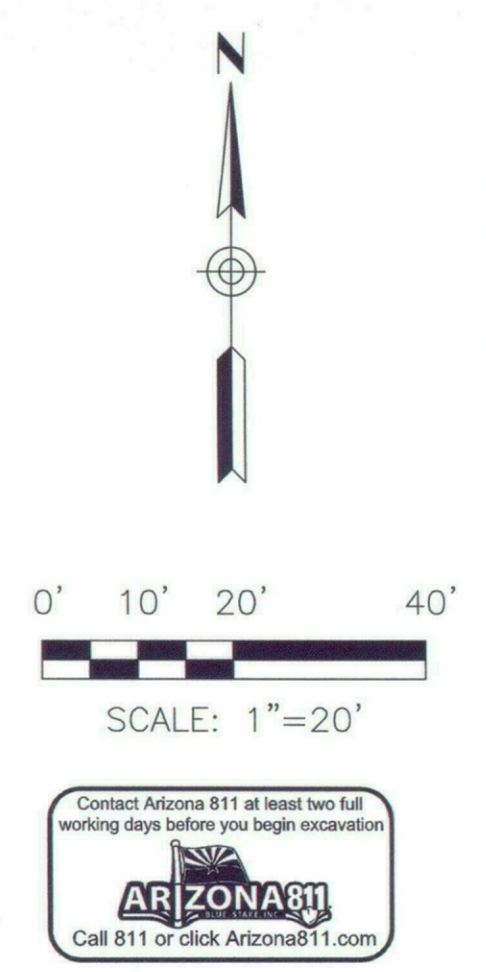
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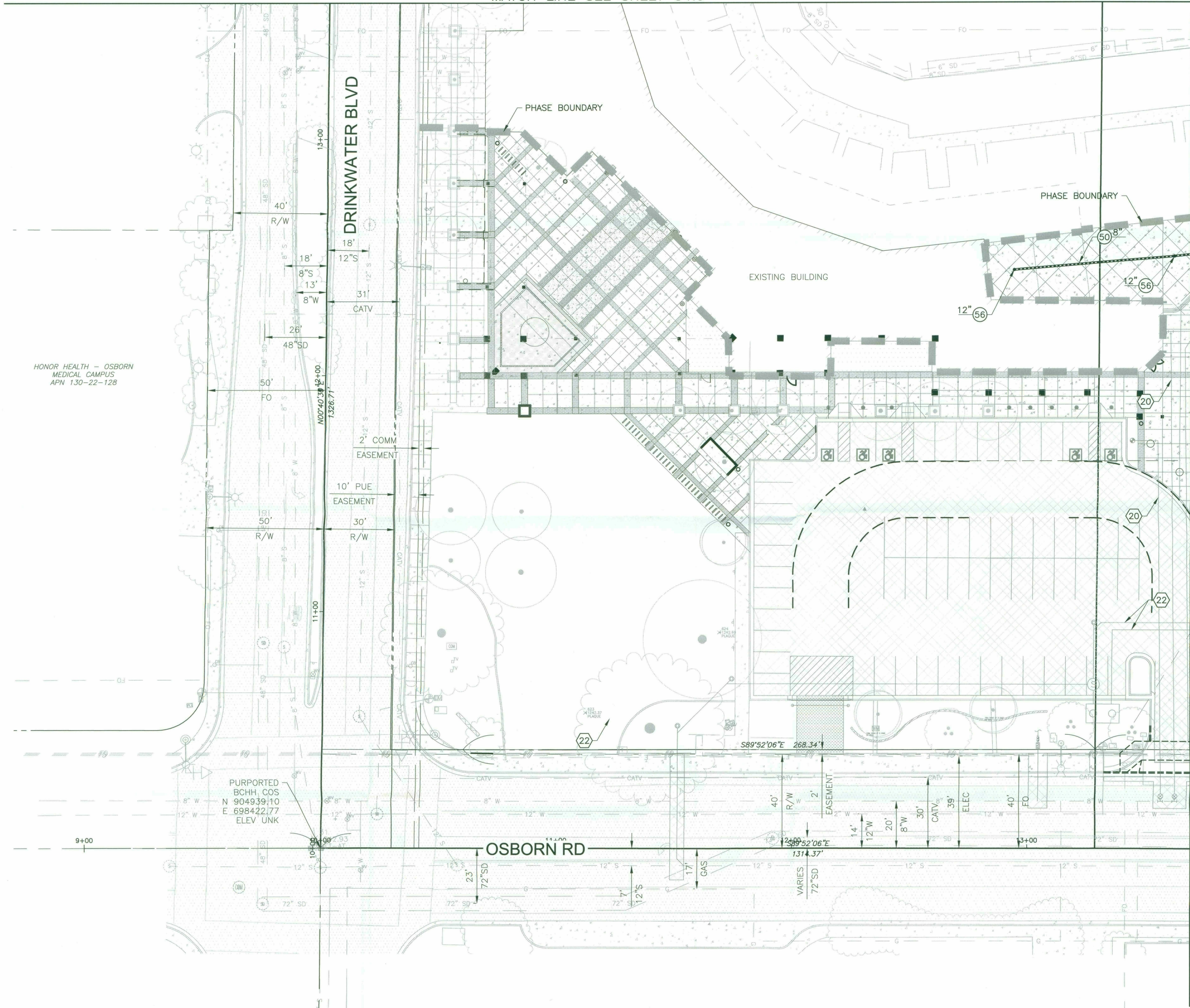
STORM DRAIN PLAN

SHEET NUMBER:
C4.10

DRAWN BY: TCW REVIEWED BY: JLW
 DATE: 10/31/18 PROJECT NUMBER: 1821.00



MATCH LINE SEE SHEET C4.9



MATCH LINE SEE SHEET C4.12

- CONSTRUCTION NOTES**
- 50 STORM DRAIN, HDPE (WATER TIGHT)
SIZE PER PLAN
ADS N-12 WT OR APPROVED EQUAL
 - 56 DRAIN BASIN W/GRATED LID (PEDESTRIAN)
& SUMP INSERT
ADS NYLOPLAST OR APPROVED EQUAL

- REFERENCE NOTES**
- 20 FIRE IMPROVEMENTS
REFER TO UTILITY PLANS
 - 22 SEWER IMPROVEMENTS
REFER TO UTILITY PLANS

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2333 N. Central Ave.
Phoenix, AZ 85004
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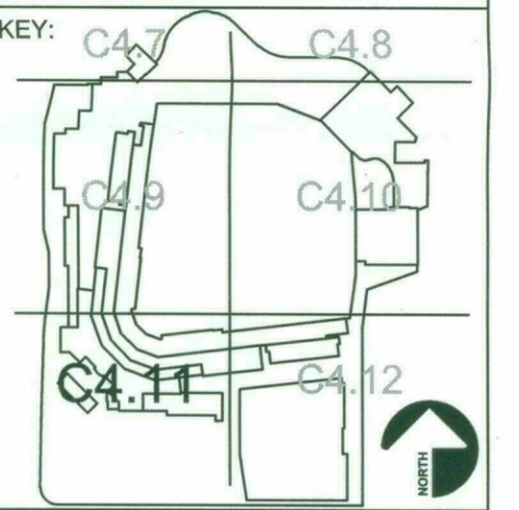
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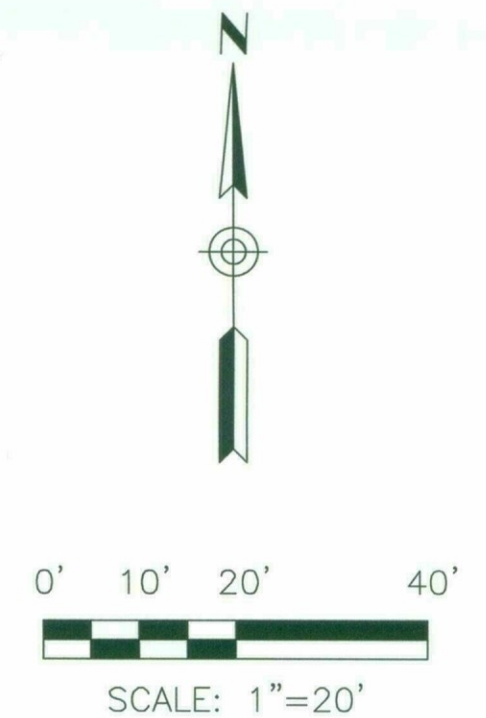
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DATE: 10/31/18	PROJECT NUMBER: 1821.00

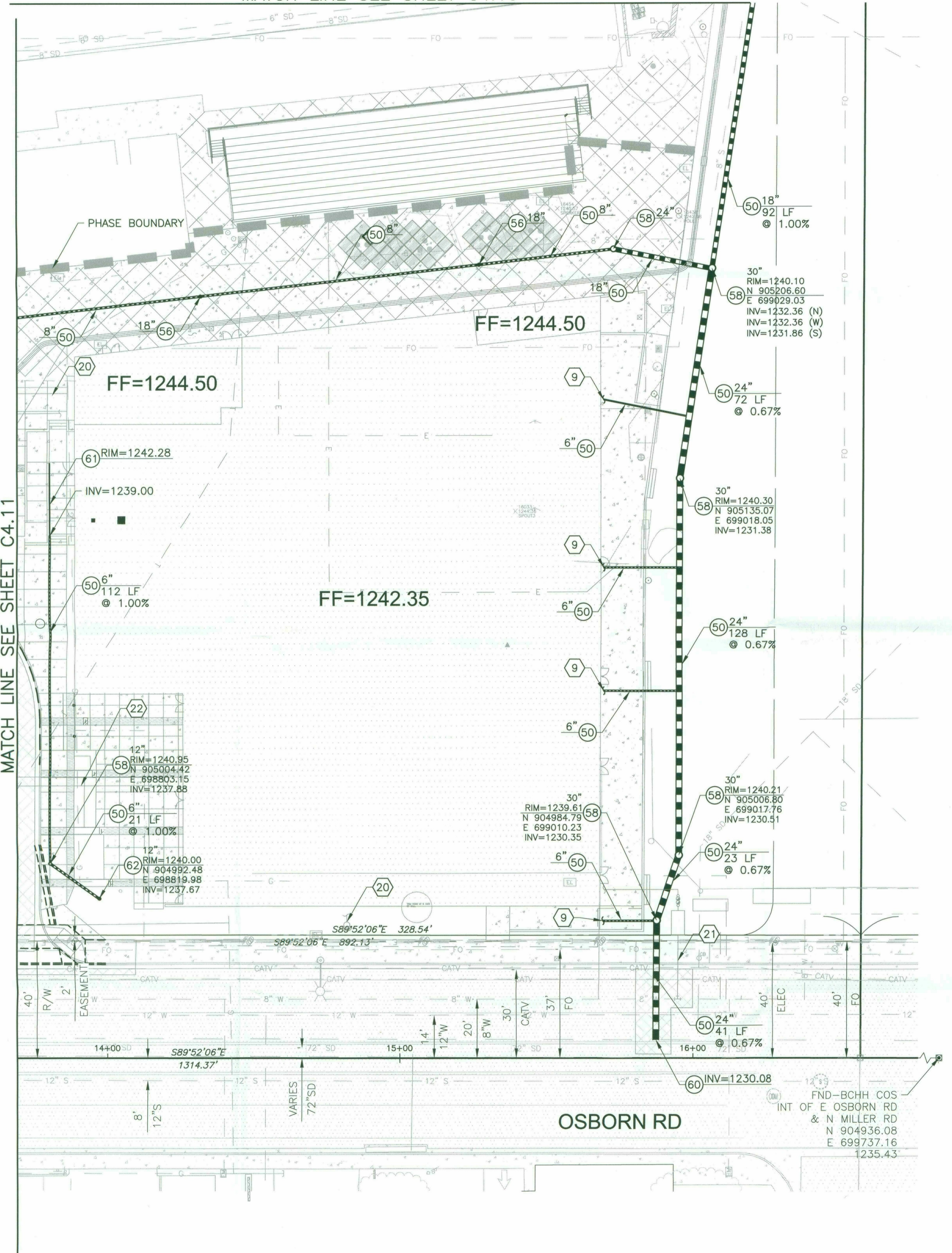


Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA 811
Call 811 or click Arizona811.com

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MATCH LINE SEE SHEET C4.10



MATCH LINE SEE SHEET C4.11

- CONSTRUCTION NOTES**
- 50 STORM DRAIN, HDPE (WATER TIGHT) SIZE PER PLAN ADS N-12 WT OR APPROVED EQUAL
 - 56 DRAIN BASIN W/GRATED LID (PEDESTRIAN) & SUMP INSERT ADS NYLOPLAST OR APPROVED EQUAL
 - 58 DRAIN BASIN W/SOLID LID (H-20 TRAFFIC) & SUMP INSERT ADS NYLOPLAST OR APPROVED EQUAL
 - 60 CONNECT NEW 24" STORM DRAIN PIPE TO EXST 72" STORM DRAIN PIPE
 - 61 CONNECT NEW 24" STORM DRAIN PIPE TO EXST 72" STORM DRAIN PIPE

- REFERENCE NOTES**
- 9 BUILDING SERVICE CONNECTION REFER TO PLUMBING PLANS
 - 20 FIRE IMPROVEMENTS REFER TO UTILITY PLANS
 - 21 WATER IMPROVEMENTS REFER TO UTILITY PLANS
 - 22 SEWER IMPROVEMENTS REFER TO UTILITY PLANS



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Dibble Engineering 7878 North 56th Street Suite 900 Phoenix, AZ 85018 P 602.987.5188

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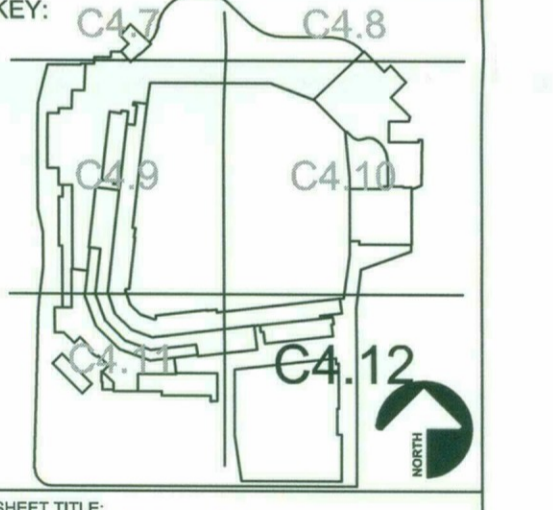
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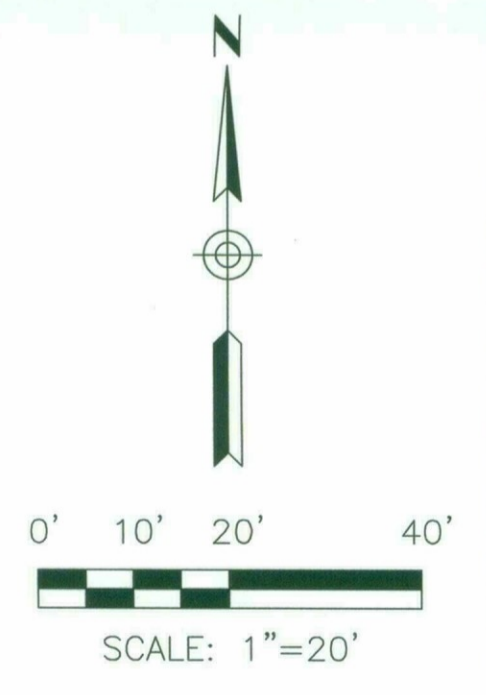


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SHEET NUMBER:
C4.12

DRAWN BY: TCW REVIEWED BY: JLW

DATE: 10/31/18 PROJECT NUMBER: 1821.00



Appendix E
NOAA Atlas 14 Point Precipitation Data



NOAA Atlas 14, Volume 1, Version 5
 Location name: Scottsdale, Arizona, USA*
 Latitude: 33.488°, Longitude: -111.9203°
 Elevation: 1239.94 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.183 (0.154-0.224)	0.240 (0.202-0.292)	0.326 (0.273-0.396)	0.392 (0.326-0.474)	0.482 (0.393-0.579)	0.551 (0.444-0.659)	0.621 (0.492-0.742)	0.693 (0.539-0.826)	0.790 (0.598-0.943)	0.863 (0.641-1.03)
10-min	0.279 (0.234-0.340)	0.365 (0.307-0.445)	0.496 (0.415-0.603)	0.597 (0.496-0.721)	0.733 (0.599-0.881)	0.838 (0.676-1.00)	0.945 (0.748-1.13)	1.06 (0.821-1.26)	1.20 (0.911-1.43)	1.31 (0.976-1.57)
15-min	0.346 (0.290-0.422)	0.453 (0.381-0.552)	0.615 (0.514-0.747)	0.740 (0.614-0.894)	0.909 (0.742-1.09)	1.04 (0.838-1.24)	1.17 (0.927-1.40)	1.31 (1.02-1.56)	1.49 (1.13-1.78)	1.63 (1.21-1.95)
30-min	0.466 (0.390-0.568)	0.609 (0.513-0.742)	0.828 (0.692-1.01)	0.996 (0.827-1.20)	1.22 (0.999-1.47)	1.40 (1.13-1.68)	1.58 (1.25-1.88)	1.76 (1.37-2.10)	2.01 (1.52-2.39)	2.19 (1.63-2.62)
60-min	0.576 (0.483-0.703)	0.754 (0.635-0.919)	1.02 (0.857-1.24)	1.23 (1.02-1.49)	1.52 (1.24-1.82)	1.73 (1.40-2.07)	1.95 (1.55-2.33)	2.18 (1.70-2.60)	2.48 (1.88-2.96)	2.71 (2.02-3.25)
2-hr	0.668 (0.569-0.797)	0.865 (0.737-1.03)	1.16 (0.983-1.38)	1.38 (1.16-1.64)	1.69 (1.40-1.99)	1.92 (1.57-2.26)	2.16 (1.74-2.55)	2.41 (1.91-2.83)	2.74 (2.12-3.22)	3.00 (2.26-3.55)
3-hr	0.727 (0.617-0.876)	0.933 (0.794-1.13)	1.23 (1.04-1.48)	1.46 (1.22-1.75)	1.78 (1.48-2.12)	2.04 (1.67-2.42)	2.31 (1.85-2.74)	2.60 (2.04-3.07)	2.99 (2.28-3.54)	3.30 (2.46-3.92)
6-hr	0.875 (0.758-1.03)	1.11 (0.964-1.31)	1.42 (1.23-1.67)	1.67 (1.43-1.95)	2.01 (1.70-2.34)	2.28 (1.90-2.64)	2.56 (2.10-2.96)	2.84 (2.29-3.29)	3.23 (2.53-3.75)	3.54 (2.71-4.12)
12-hr	0.977 (0.855-1.14)	1.24 (1.08-1.44)	1.57 (1.36-1.81)	1.83 (1.58-2.11)	2.18 (1.86-2.50)	2.44 (2.07-2.81)	2.72 (2.27-3.13)	3.00 (2.47-3.45)	3.38 (2.71-3.90)	3.67 (2.89-4.27)
24-hr	1.16 (1.04-1.31)	1.48 (1.32-1.67)	1.92 (1.71-2.16)	2.26 (2.01-2.54)	2.74 (2.42-3.08)	3.12 (2.74-3.49)	3.52 (3.06-3.94)	3.93 (3.39-4.40)	4.49 (3.84-5.03)	4.93 (4.18-5.55)
2-day	1.26 (1.12-1.42)	1.61 (1.44-1.81)	2.11 (1.88-2.37)	2.51 (2.23-2.82)	3.07 (2.72-3.45)	3.52 (3.09-3.95)	3.99 (3.48-4.48)	4.48 (3.88-5.04)	5.17 (4.42-5.82)	5.72 (4.85-6.46)
3-day	1.33 (1.19-1.50)	1.70 (1.52-1.92)	2.24 (1.99-2.52)	2.67 (2.37-3.00)	3.28 (2.89-3.68)	3.77 (3.30-4.22)	4.29 (3.73-4.81)	4.83 (4.17-5.42)	5.60 (4.77-6.29)	6.22 (5.25-7.01)
4-day	1.40 (1.25-1.58)	1.79 (1.60-2.02)	2.37 (2.10-2.66)	2.83 (2.51-3.17)	3.48 (3.07-3.91)	4.01 (3.51-4.50)	4.58 (3.98-5.13)	5.18 (4.46-5.81)	6.02 (5.12-6.76)	6.71 (5.65-7.55)
7-day	1.56 (1.39-1.76)	1.99 (1.77-2.24)	2.62 (2.33-2.96)	3.14 (2.78-3.53)	3.87 (3.41-4.34)	4.45 (3.90-4.99)	5.08 (4.41-5.70)	5.74 (4.95-6.45)	6.67 (5.68-7.50)	7.43 (6.25-8.37)
10-day	1.69 (1.51-1.90)	2.16 (1.93-2.43)	2.85 (2.54-3.20)	3.41 (3.02-3.82)	4.19 (3.69-4.68)	4.81 (4.22-5.38)	5.48 (4.77-6.12)	6.17 (5.33-6.91)	7.15 (6.10-8.00)	7.93 (6.70-8.90)
20-day	2.08 (1.86-2.33)	2.67 (2.39-2.99)	3.53 (3.15-3.94)	4.18 (3.72-4.66)	5.05 (4.47-5.62)	5.72 (5.05-6.37)	6.40 (5.62-7.14)	7.09 (6.20-7.92)	8.02 (6.95-8.98)	8.74 (7.51-9.79)
30-day	2.42 (2.16-2.72)	3.12 (2.79-3.49)	4.11 (3.67-4.59)	4.87 (4.33-5.42)	5.88 (5.20-6.54)	6.65 (5.87-7.40)	7.45 (6.54-8.28)	8.26 (7.21-9.18)	9.35 (8.10-10.4)	10.2 (8.76-11.4)
45-day	2.81 (2.52-3.14)	3.62 (3.25-4.04)	4.77 (4.27-5.32)	5.62 (5.02-6.26)	6.74 (6.00-7.51)	7.58 (6.72-8.45)	8.43 (7.45-9.40)	9.28 (8.16-10.4)	10.4 (9.07-11.6)	11.2 (9.75-12.6)
60-day	3.11 (2.80-3.46)	4.01 (3.61-4.47)	5.28 (4.74-5.87)	6.20 (5.55-6.89)	7.39 (6.61-8.22)	8.28 (7.37-9.20)	9.17 (8.13-10.2)	10.0 (8.86-11.2)	11.2 (9.80-12.5)	12.0 (10.5-13.4)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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NOAA Atlas 14, Volume 1, Version 5
 Location name: Scottsdale, Arizona, USA*
 Latitude: 33.488°, Longitude: -111.9203°
 Elevation: 1239.94 ft**
 * source: ESRI Maps
 ** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.20 (1.85-2.69)	2.88 (2.42-3.50)	3.91 (3.28-4.75)	4.70 (3.91-5.69)	5.78 (4.72-6.95)	6.61 (5.33-7.91)	7.45 (5.90-8.90)	8.32 (6.47-9.91)	9.48 (7.18-11.3)	10.4 (7.69-12.4)
10-min	1.67 (1.40-2.04)	2.19 (1.84-2.67)	2.98 (2.49-3.62)	3.58 (2.98-4.33)	4.40 (3.59-5.29)	5.03 (4.06-6.02)	5.67 (4.49-6.77)	6.33 (4.93-7.54)	7.21 (5.47-8.60)	7.88 (5.86-9.43)
15-min	1.38 (1.16-1.69)	1.81 (1.52-2.21)	2.46 (2.06-2.99)	2.96 (2.46-3.58)	3.64 (2.97-4.37)	4.16 (3.35-4.98)	4.69 (3.71-5.60)	5.23 (4.07-6.24)	5.96 (4.52-7.11)	6.51 (4.84-7.79)
30-min	0.932 (0.780-1.14)	1.22 (1.03-1.48)	1.66 (1.38-2.01)	1.99 (1.65-2.41)	2.45 (2.00-2.94)	2.80 (2.26-3.35)	3.16 (2.50-3.77)	3.52 (2.74-4.20)	4.01 (3.04-4.79)	4.39 (3.26-5.25)
60-min	0.576 (0.483-0.703)	0.754 (0.635-0.919)	1.02 (0.857-1.24)	1.23 (1.02-1.49)	1.52 (1.24-1.82)	1.73 (1.40-2.07)	1.95 (1.55-2.33)	2.18 (1.70-2.60)	2.48 (1.88-2.96)	2.71 (2.02-3.25)
2-hr	0.334 (0.284-0.398)	0.432 (0.368-0.518)	0.579 (0.492-0.689)	0.690 (0.580-0.820)	0.844 (0.700-0.996)	0.960 (0.786-1.13)	1.08 (0.872-1.27)	1.20 (0.953-1.42)	1.37 (1.06-1.61)	1.50 (1.13-1.77)
3-hr	0.242 (0.205-0.292)	0.311 (0.264-0.376)	0.408 (0.346-0.492)	0.486 (0.407-0.582)	0.594 (0.491-0.707)	0.680 (0.554-0.807)	0.771 (0.617-0.913)	0.865 (0.681-1.02)	0.995 (0.759-1.18)	1.10 (0.819-1.31)
6-hr	0.146 (0.127-0.172)	0.185 (0.161-0.218)	0.238 (0.206-0.279)	0.279 (0.239-0.326)	0.336 (0.284-0.390)	0.381 (0.317-0.440)	0.427 (0.350-0.494)	0.475 (0.382-0.550)	0.540 (0.423-0.626)	0.591 (0.452-0.688)
12-hr	0.081 (0.071-0.094)	0.103 (0.090-0.119)	0.130 (0.113-0.150)	0.151 (0.131-0.175)	0.181 (0.154-0.208)	0.203 (0.172-0.233)	0.226 (0.188-0.259)	0.249 (0.205-0.286)	0.280 (0.225-0.324)	0.305 (0.240-0.355)
24-hr	0.048 (0.043-0.055)	0.062 (0.055-0.069)	0.080 (0.071-0.090)	0.094 (0.084-0.106)	0.114 (0.101-0.128)	0.130 (0.114-0.146)	0.147 (0.128-0.164)	0.164 (0.141-0.183)	0.187 (0.160-0.210)	0.206 (0.174-0.231)
2-day	0.026 (0.023-0.030)	0.033 (0.030-0.038)	0.044 (0.039-0.049)	0.052 (0.046-0.059)	0.064 (0.057-0.072)	0.073 (0.064-0.082)	0.083 (0.073-0.093)	0.093 (0.081-0.105)	0.108 (0.092-0.121)	0.119 (0.101-0.135)
3-day	0.018 (0.016-0.021)	0.024 (0.021-0.027)	0.031 (0.028-0.035)	0.037 (0.033-0.042)	0.046 (0.040-0.051)	0.052 (0.046-0.059)	0.060 (0.052-0.067)	0.067 (0.058-0.075)	0.078 (0.066-0.087)	0.086 (0.073-0.097)
4-day	0.015 (0.013-0.016)	0.019 (0.017-0.021)	0.025 (0.022-0.028)	0.029 (0.026-0.033)	0.036 (0.032-0.041)	0.042 (0.037-0.047)	0.048 (0.041-0.053)	0.054 (0.046-0.061)	0.063 (0.053-0.070)	0.070 (0.059-0.079)
7-day	0.009 (0.008-0.010)	0.012 (0.011-0.013)	0.016 (0.014-0.018)	0.019 (0.017-0.021)	0.023 (0.020-0.026)	0.026 (0.023-0.030)	0.030 (0.026-0.034)	0.034 (0.029-0.038)	0.040 (0.034-0.045)	0.044 (0.037-0.050)
10-day	0.007 (0.006-0.008)	0.009 (0.008-0.010)	0.012 (0.011-0.013)	0.014 (0.013-0.016)	0.017 (0.015-0.020)	0.020 (0.018-0.022)	0.023 (0.020-0.026)	0.026 (0.022-0.029)	0.030 (0.025-0.033)	0.033 (0.028-0.037)
20-day	0.004 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.007-0.008)	0.009 (0.008-0.010)	0.011 (0.009-0.012)	0.012 (0.011-0.013)	0.013 (0.012-0.015)	0.015 (0.013-0.016)	0.017 (0.014-0.019)	0.018 (0.016-0.020)
30-day	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.006 (0.005-0.006)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.009-0.011)	0.011 (0.010-0.013)	0.013 (0.011-0.014)	0.014 (0.012-0.016)
45-day	0.003 (0.002-0.003)	0.003 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.009 (0.008-0.010)	0.010 (0.008-0.011)	0.010 (0.009-0.012)
60-day	0.002 (0.002-0.002)	0.003 (0.003-0.003)	0.004 (0.003-0.004)	0.004 (0.004-0.005)	0.005 (0.005-0.006)	0.006 (0.005-0.006)	0.006 (0.006-0.007)	0.007 (0.006-0.008)	0.008 (0.007-0.009)	0.008 (0.007-0.009)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

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Appendix F
Rational Method Calculations



7878 N 16th St
Suite 300
Phoenix, Arizona 85020
phone 602.957.1155
fax 602.957.2838
www.dibblecorp.com

Site Peak Flow Calculations

Calc By: AWE
Dibble Project: 1018089

Main Field & Seating Bowl

Peak Flow = $Q = C \cdot i \cdot A$	
C Values (from FCDMC 100-yr storm)	
0.95	Pavement/Rooftops
0.30	Lawns/Golf Courses/Parks
i Value - Rainfall Intensity	
5.67 in/hr	Per NOAA 100-yr storm event, 10-min time of concentration
Area Values	
37,462 sq-ft	Pavement/Rooftops
145,053 sq-ft	Lawns/Golf Courses/Parks
PEAK FLOW	10.297 CFS

Notes:

¹ A 100-yr storm event was used to calculate the peak flow from the project site.



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Site Peak Flow Calculations

Calc By: AWE
Dibble Project: 1018089

North Concourse

Peak Flow = Q = C*i*A	
C Values (from FCDMC 100-yr storm)	
0.95	Pavement/Rooftops
i Value - Rainfall Intensity	
5.67 in/hr	Per NOAA 100-yr storm event, 10-min time of concentration
Area Values	
11,400 sq-ft	Pavement/Rooftops
PEAK FLOW	1.410 CFS

Notes:

¹ A 100-yr storm event was used to calculate the peak flow from the project site.



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Site Peak Flow Calculations

Calc By: AWE
Dibble Project: 1018089

New Building

Peak Flow = Q = C*i*A	
C Values (from FCDMC 100-yr storm)	
0.95	Pavement/Rooftops
i Value - Rainfall Intensity	
5.67 in/hr	Per NOAA 100-yr storm event, 10-min time of concentration
Area Values	
32,683 sq-ft	Pavement/Rooftops
PEAK FLOW	4.041 CFS

Notes:

¹ A 100-yr storm event was used to calculate the peak flow from the project site.

Appendix G
Pipe Capacity Calculations



7878 N 16th St
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**Manning's Equation Results
 For Open Channel Gravity Flow**

INPUT VALUES	
18	Pipe Diameter (inches)
0.0130	Manning's n Value
1.00%	Pipe Slope
1	Depth Ratio (d/D)
CALCULATED VALUES	
0.0100	Slope (ft/ft)
1.50	Pipe Diameter (ft)
1.50	Hydraulic Depth (ft)
360	Depth Angle (degrees)
6.28	Depth Angle (radians)
1.77	Flow Area (sq ft)
4.71	Wetted Perimeter (ft)
0.38	Hydraulic Radius (ft)
5.96	Velocity (ft/sec)
10.53	Flow Rate (cfs)
4,727	Flow Rate (gpm)
6.81	Flow Rate (mgd)
6,806,933	Flow Rate (GPD)
VELOCITY CHECKS	
OK	Min V (v > 2 fps)
OK	Max V (v < 9 fps)



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**Manning's Equation Results
 For Open Channel Gravity Flow**

INPUT VALUES	
24	Pipe Diameter (inches)
0.0130	Manning's n Value
0.67%	Pipe Slope
1	Depth Ratio (d/D)
CALCULATED VALUES	
0.0067	Slope (ft/ft)
2.00	Pipe Diameter (ft)
2.00	Hydraulic Depth (ft)
360	Depth Angle (degrees)
6.28	Depth Angle (radians)
3.14	Flow Area (sq ft)
6.28	Wetted Perimeter (ft)
0.50	Hydraulic Radius (ft)
5.91	Velocity (ft/sec)
18.57	Flow Rate (cfs)
8,333	Flow Rate (gpm)
12.00	Flow Rate (mgd)
11,999,382	Flow Rate (GPD)
VELOCITY CHECKS	
OK	Min V (v > 2 fps)
OK	Max V (v < 9 fps)