

**San Bernardino International Airport Authority
(SBIAA)**


**General Aviation Infrastructure Improvements Project
Phase III – General Aviation Site Development
San Bernardino, CA**

**On-Site Water Improvements
Fire Flow Pressure Analysis**



July 28, 2014

This report has been prepared under the direction of the following Registered Civil Engineer. The undersigned attests to the technical information contained herein and the qualifications of any technical specialist providing engineering data upon which recommendations, conclusions, and decisions are based:


Ronald W. Sklepko, PE, RCE 46216

7-29-14



Submitted by
Parsons Brinckerhoff, Inc.
451 East Vanderbilt Way, Suite 200
San Bernardino, California 92408
Tel: 909-888-1106

The SBIAA General Aviation Infrastructure Improvements Project is a Utility and Road Rehabilitation Project along the north side of San Bernardino International Airport intended to provide new roads and utilities for development in and around SBIAA. There are 3 Phases to the project. Phase I was the removal of existing buildings in the project area, completed in 2013. Phase II is the construction of new public infrastructure (utilities and paving) north of SBIAA. Phase II will begin construction in August 2014. The water improvements being constructed in Phase II are designed for the anticipated fire demand requirements for Phase III.¹ Phase III concludes the project with construction of three general aviation hangars, pavement, and on-site utilities necessary to serve them.

A vicinity map on the front page of the included plans shows the general location of these improvements and the plans provide further construction information.

A pressure analysis using *Bentley WaterCAD* was completed for the project area. The model developed by Parsons Brinckerhoff is derived from the pressure model originally developed for the Phase II analysis, but with the private hangar fire line improvements added to the model. On the public side, the model includes 20" waterlines along Hangar Way and X St., 16" and 8" waterlines along U St., and a 12" waterline along Victoria Ave. On the private side, the model includes a pressure loop of 6", 8", and 10" waterlines surrounding the proposed hangars.

As the public waterlines are up to 600 feet away from the southernmost hangars, the fire line is connected to the public system in 2 locations so that water can be delivered from 2 directions in the event of a fire. Both of these connection points have double-check-detector-assemblies installed to prevent backflow. Looping the fire-line in this method is a common procedure, and SBIAA already has connections to the public waterline in this manner.

These tie-in locations are approximately 1000 feet apart. One is along Hangar Way, and the other is 250 feet east of the intersection of Victoria Ave. and U St.

A flow test to determine the pressure performance of the existing system was performed by San Bernardino Municipal Water Department. The vicinity map on the cover of this report shows the location of the flow test and the location of the elevated tank providing pressure to the system. The results from this test were used to generate a pressure performance curve to account for the loss in available pressure due to drawdown from the fire flow demand. The *Fire Flow Report* is included with this submittal package.

The system performance curve used for the system is as follows:

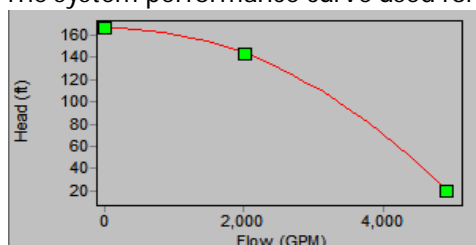


Figure 1: System Performance Curve

1. See SBIAA Phase II Rough Grading and Infrastructure - Water Improvements - Fire Flow Pressure Analysis, dated July 15, 2014 for Phase II analysis.

The attached *SBIAA General Aviation Improvements Project Phase III Fire Loop Pressure Exhibit* shows the construction limits separating SBIAA Phase II, SBIAA Phase III, and the County Facility. This report provides a detailed analysis of SBIAA Phase III but does not include flow demands for the County Facility which is being designed by a different engineering firm. However, all three areas were included in the model to better represent the proposed system.

There will be two different hangar styles constructed in Phase III. The northern and middle hangar buildings, B1 and C1, shown on the *SBIAA Phase III – Fire Hydrant Exhibit* consist of “T” hangar bays with each full building measuring 22,736 square feet. The southern hangar A1 is divided into rectangular bays totaling 42,350 square feet for the entire building; this hangar is used as the basis of the fire flow demand. Using this hangar has the added advantage that, since it is furthest from the public system, any head losses in the pipe network would be the most extreme at this point.

The on-site fire flow is based on the minimums shown in Table B105.1 of the California Building Code. Assuming a 50% reduction for sprinkled buildings, and 2 hydrants being used, 4,250 gallons is reduced to 1,063 gallons per hydrant. The relevant figures are indicated below.

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute) ^a	FLOW DURATION (hours)
Type IA and IB ^a	Type A and IIIA ^a	Type IV and V-A ^a	Type IIB and IIB ^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	3
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	
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	4
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	
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 *California Building Code*.

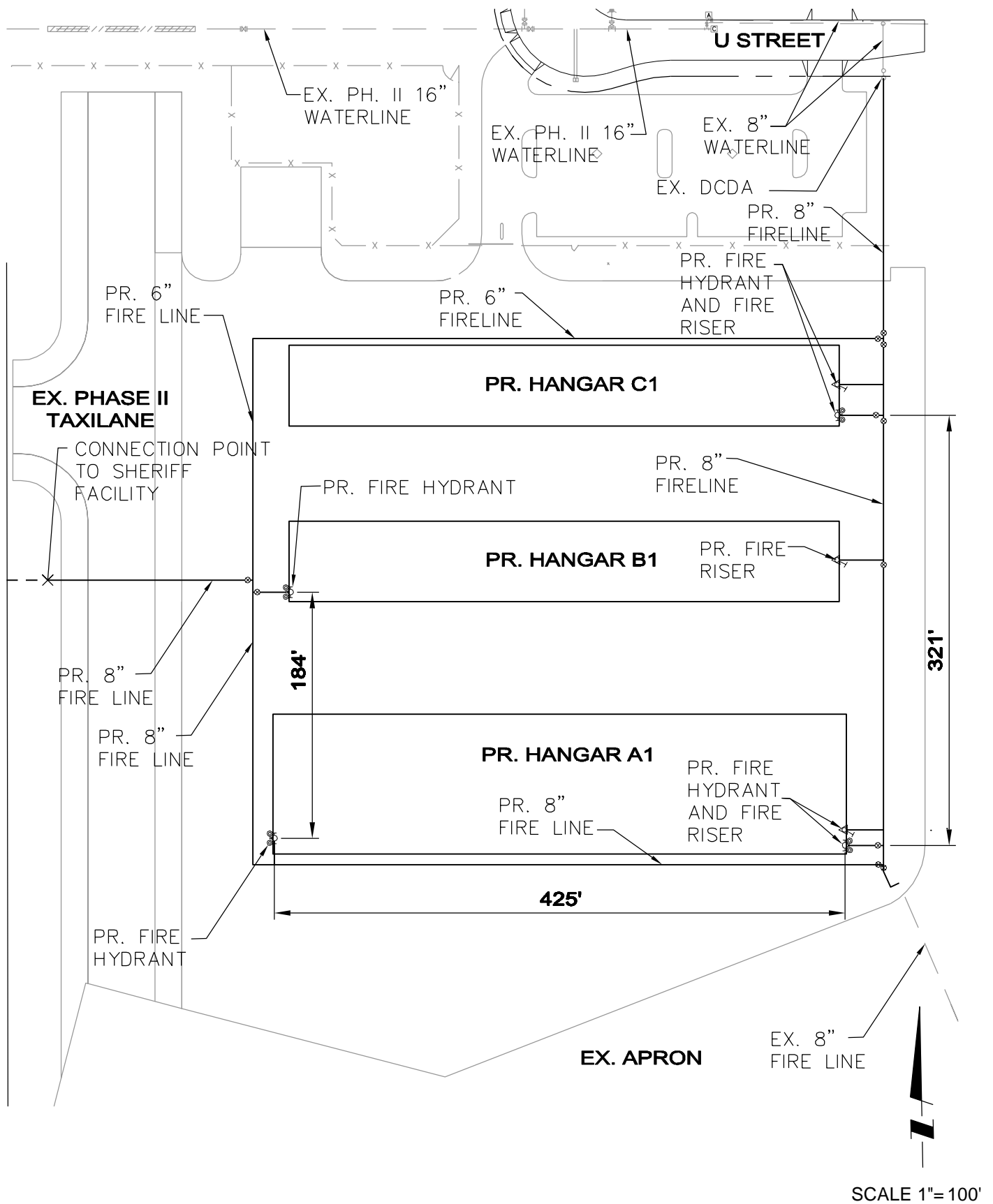
b. Measured at 20 psi residual pressure.

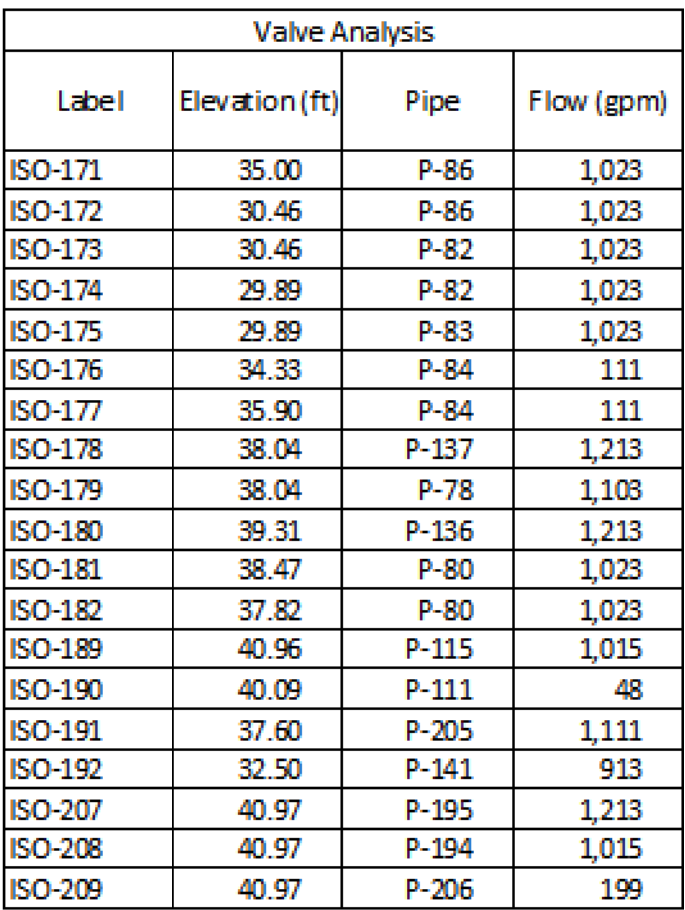
The attached *SBIAA Aviation Infrastructure Improvements Project Phase III Fire Pressure Loop Exhibit* shows the application of the fire demand at Nodes 108 and 112. The system is designed so that the pressure never drops below 20 psi in the event of a fire drawdown on the system. When the fire flow is applied at Nodes 108 and 112, the minimum pressure in the system is 48.8 psi, well above the 20 psi minimum residual required.

The following chart summarizes the system pressures base on the fire demand. This chart, along with 2 others providing information on the pipes and valves, is included on the *Aviation Infrastructure Improvements Project Phase III Fire Pressure Loop Exhibit*.

Node Analysis			
Label	Demand (D) (gpm)	Pressure (p) (psi)	Elevation: 1100+ (ft)
J-59	0	60.80	38.30
J-60	0	63.00	30.92
J-61	0	63.50	29.89
J-62	0	63.40	30.46
J-65	0	57.00	40.50
J-66	0	59.90	38.04
J-67	0	60.40	37.82
J-91	0	61.80	32.50
J-92	0	61.20	32.50
J-94	0	59.40	33.00
J-98	0	58.60	32.60
J-102	0	58.30	33.30
J-105	0	55.60	34.04
J-106	0	52.10	37.60
J-108	1063	50.00	37.40
J-112	1063	48.80	40.29
J-118	0	51.40	40.96
J-120	0	54.40	41.43
J-130	0	59.30	39.38
J-193	0	52.20	40.97
J-34	0	52.80	37.60

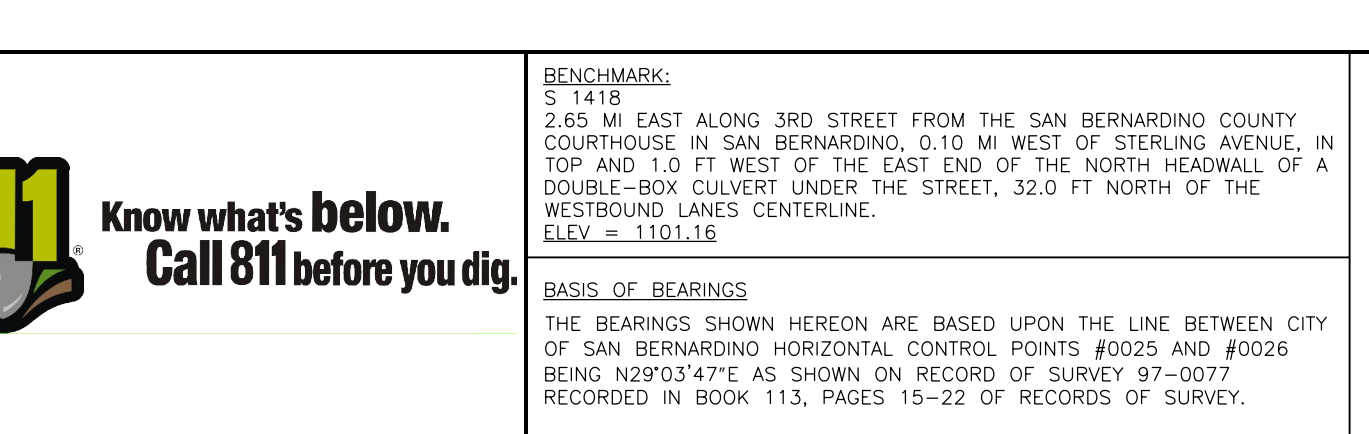
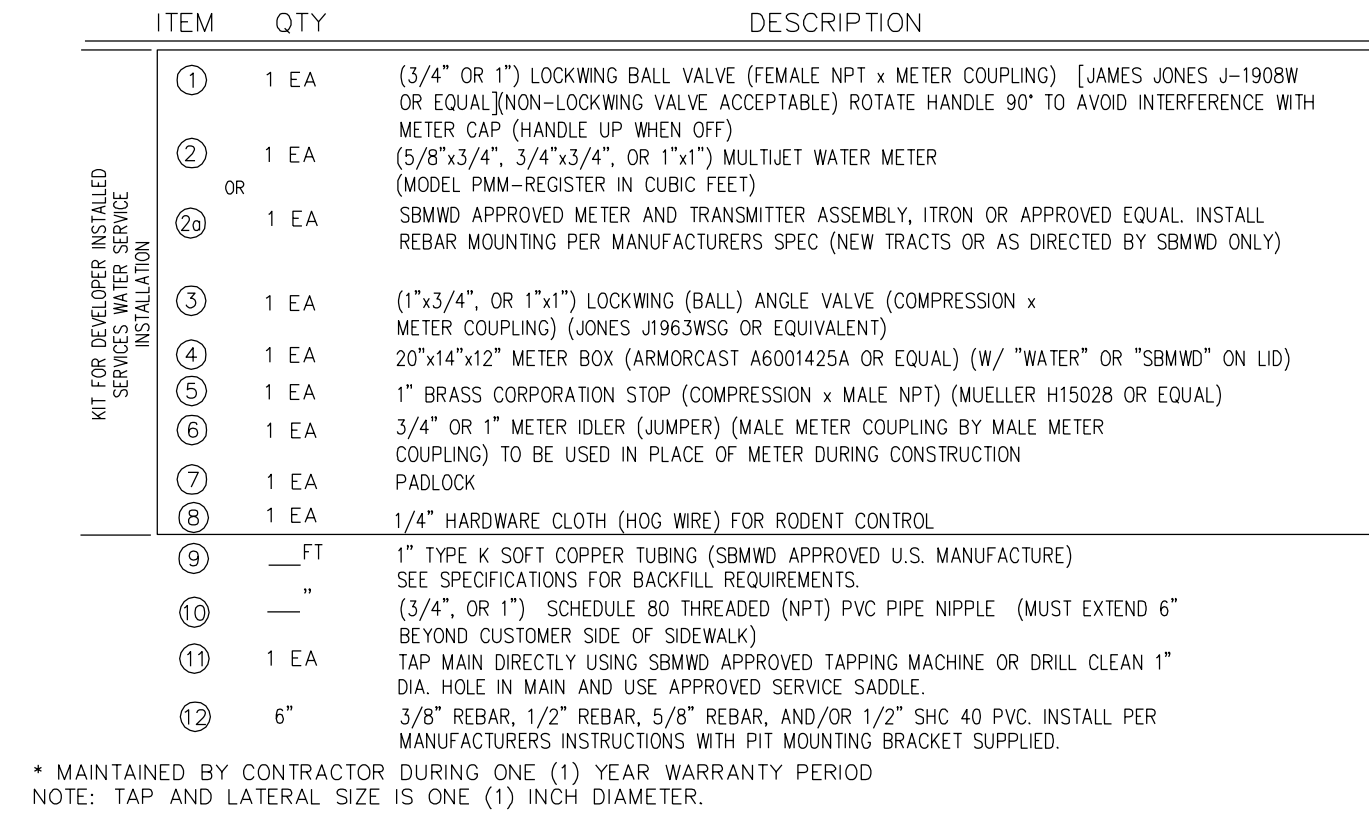
ATTACHMENTS





**PARSONS
BRINCKERHOFF**
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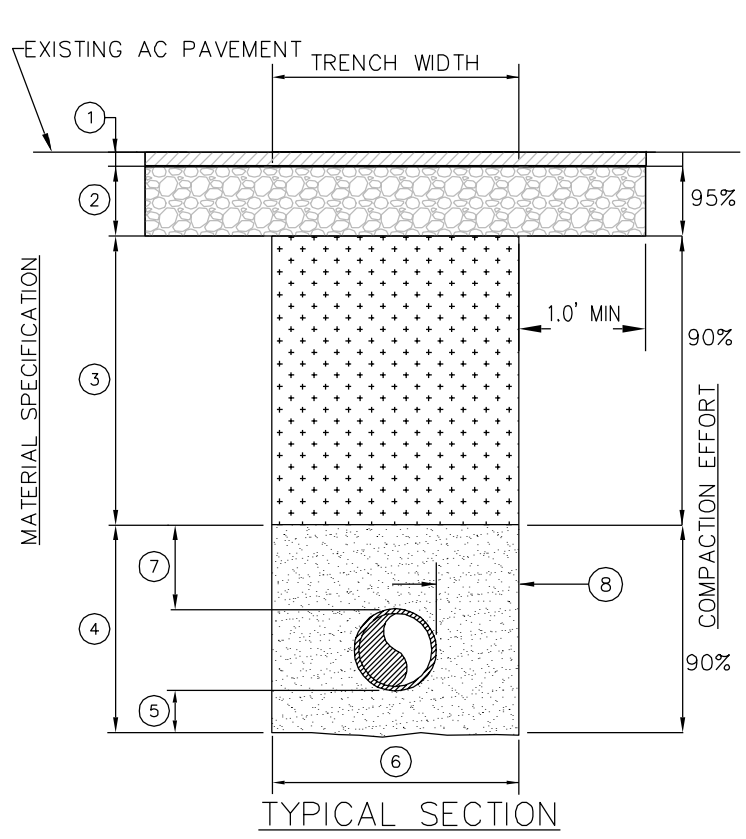




SBMWD W1.15

NOT TO SCALE



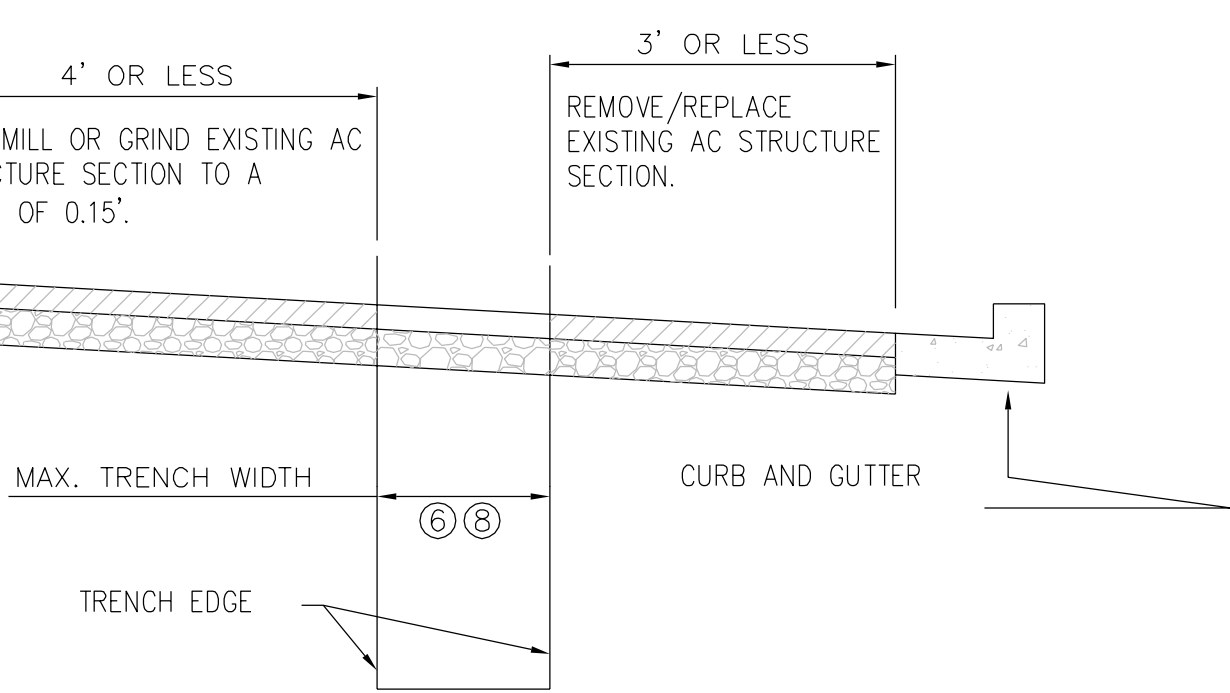


GENERAL RIGHT-OF-WAY TRENCH NOTES:

- ① ASPHALT PATCH 3 INCHES MINIMUM OR 1" GREATER THAN EXISTING AC., WHICHEVER IS GREATER. ASPHALT PATCH MAY BE ELIMINATED OUTSIDE THE ROADWAY PRISM. COLD MILL OR GRIND EXISTING ASPHALT CONCRETE PAVEMENT TO A DEPTH OF 0.15' WITHIN THE TRENCH AREA AND TO AT LEAST 1.0' BEYOND THE EDGES OF THE TRENCH, OR REMOVE FULL DEPTH OF ASPHALT CONCRETE SECTION WITHIN THE SAME LIMITS. FOR STREETS THAT HAVE BEEN RESURFACED WITHIN THE PAST THREE (3) YEARS PRIOR TO THIS TRENCH EXCAVATION (AS IDENTIFIED BY PUBLIC WORKS RECORDS), GRINDING SHALL BE EXTENDED A MINIMUM 1" BEYOND THE TRENCH LIMITS, OR A FULL TRAFFIC LANE WIDTH, WHICHEVER IS GREATER.
- EXISTING CONCRETE ROADWAYS SHALL BE REPLACED WITH CLASS 520-C-2500 CONCRETE OF EQUAL THICKNESS IN ACCORDANCE WITH GREENBOOK SECTION 201-11.2 AND INSTALLED IN ACCORDANCE WITH STANDARD PLAN 132-1 OF THE AMERICAN PUBLIC WORKS ASSOCIATION STANDARD PLANS FOR PUBLIC WORKS CONSTRUCTION, LATEST EDITION.
- ② ROAD BASE: CRUSHED AGGREGATE BASE (GREENBOOK SECTION 200-2.2) 4 INCHES OR MATCH EXISTING SECTION, WHICHEVER IS GREATER, 95% DENSITY, PLACED IN 4 INCH LIFTS. EXISTING CONCRETE ENCOUNTERED BENEATH THE ASPHALT PAVEMENT ROADWAY SHALL BE REPLACED WITH CRUSHED AGGREGATE BASE (GREENBOOK SECTION 200-2.2) TO A THICKNESS EQUAL TO THAT OF THE CONCRETE REMOVED.
- ③ TRENCH BACKFILL: SELECT BACKFILL, 90% DENSITY, PLACED IN 8 INCH LIFTS. IF TRENCH IS LOCATED OUTSIDE THE ROADWAY PRISM, SELECT BACKFILL MAY BE PLACED TO FINISH GRADE.
- ④ PIPE ZONE: SAND (SE 30), JETTED, PER SECTION 306-1.3 (GREEN BOOK), OR PLACED MECHANICALLY TO 90% DENSITY. PIPE ZONE SHALL CONSIST OF A 2-SACK 300 PSI (±) CONTROLLED LOW STRENGTH MATERIAL AS SPECIFIED IN SECTION 201-6 OF THE GREEN BOOK AT LOCATIONS SHOWN ON THE TABLE BELOW.
- | CLSM LIMITS - PIPE ZONE | |
|-------------------------|-----------------|
| FROM PIPE STATION | TO PIPE STATION |
| X+XX.XX | X+XX.XX |
- ⑤ FOUNDATION FILL: THE FILL MATERIAL SHALL BE THE SAME AS THE PIPE ZONE MATERIAL AROUND THE PIPE. A MINIMUM OF 6 INCHES OF FOUNDATION FILL IS REQUIRED, 90% DENSITY, JETTED PER SECTION 306-1.3 (GREEN BOOK) OR PLACED MECHANICALLY.
- ⑥ MINIMUM TRENCH WIDTH SHALL BE THE PIPE DIAMETER PLUS 2 FEET FOR ALL PIPE DIAMETERS. PIPE SHALL BE CENTERED IN THE TRENCH. TRENCH WIDTHS SHALL ALLOW PLACEMENT AND COMPACTION OF BACKFILL MATERIAL.
- ⑦ 12 INCHES MINIMUM.
- ⑧ MAXIMUM DISTANCE BETWEEN PIPE WALL AND TRENCH WALL SHALL BE 12".
- ⑨ MINIMUM COVER IS REFERENCED TO FUTURE FINISHED FINAL GRADES UNLESS OTHERWISE SHOWN ON PROFILE DRAWINGS.
- ⑩ SUPPORT PIPE WITH SANDBAGS AND SPOT LOAD PIPE AS REQUIRED DURING INSTALLATION OF CLSM IN PIPE ZONE AND PIPE BEDDING AREAS.
- ⑪ DIAGONAL PAVEMENT REPLACEMENT IS NOT PERMITTED
- * OR AS DIRECTED BY THE ENGINEER-SEE CITY STD. DWG. NO. 310

CITY ENGINEER

DATE



PAVEMENT REPLACEMENT LIMITS

GENERAL RIGHT-OF-WAY TRENCH NOTES:

- ① ASPHALT PATCH 3 INCHES MINIMUM OR MATCH THE EXISTING SECTION, WHICHEVER IS GREATER. ASPHALT PATCH MAY BE ELIMINATED OUTSIDE THE ROADWAY PRISM.
- ② ROAD BASE: CRUSHED ASPHALT AGGREGATE BASE (SECTION 200-2.2) 7 INCHES OR MATCH EXISTING SECTION, WHICHEVER IS GREATER, 95% DENSITY, PLACED IN 4 INCH LIFTS.
- ⑥ MINIMUM TRENCH WIDTH SHALL BE THE PIPE DIAMETER PLUS 2 FEET FOR ALL PIPE DIAMETERS. PIPE SHALL BE CENTERED IN THE TRENCH. TRENCH WIDTHS SHALL ALLOW PLACEMENT AND COMPACTION OF BACKFILL MATERIAL.
- ⑧ MAXIMUM DISTANCE BETWEEN PIPE WALL AND TRENCH WALL SHALL BE 12".
- ⑫ DIAGONAL PAVEMENT REPLACEMENT IS NOT PERMITTED
- * OR AS DIRECTED BY THE ENGINEER-SEE CITY STD. DWG. NO. 310

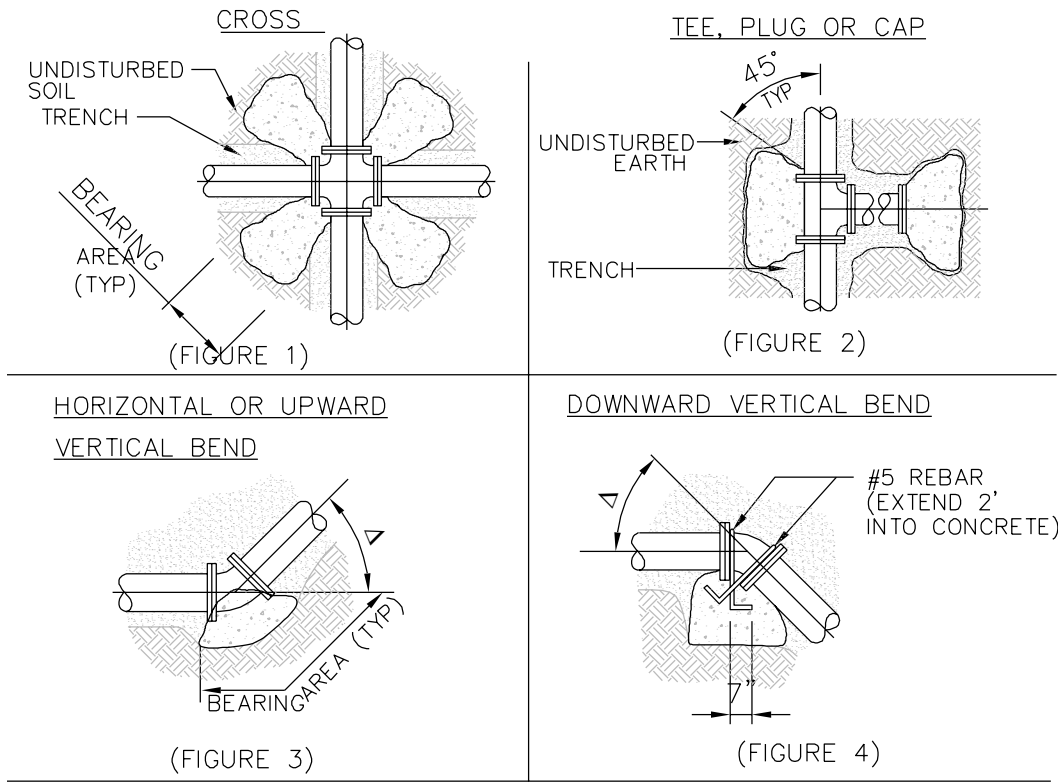
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CITY ENGINEER

DATE

SBMWD W5.1

NOT TO SCALE



NOTES:

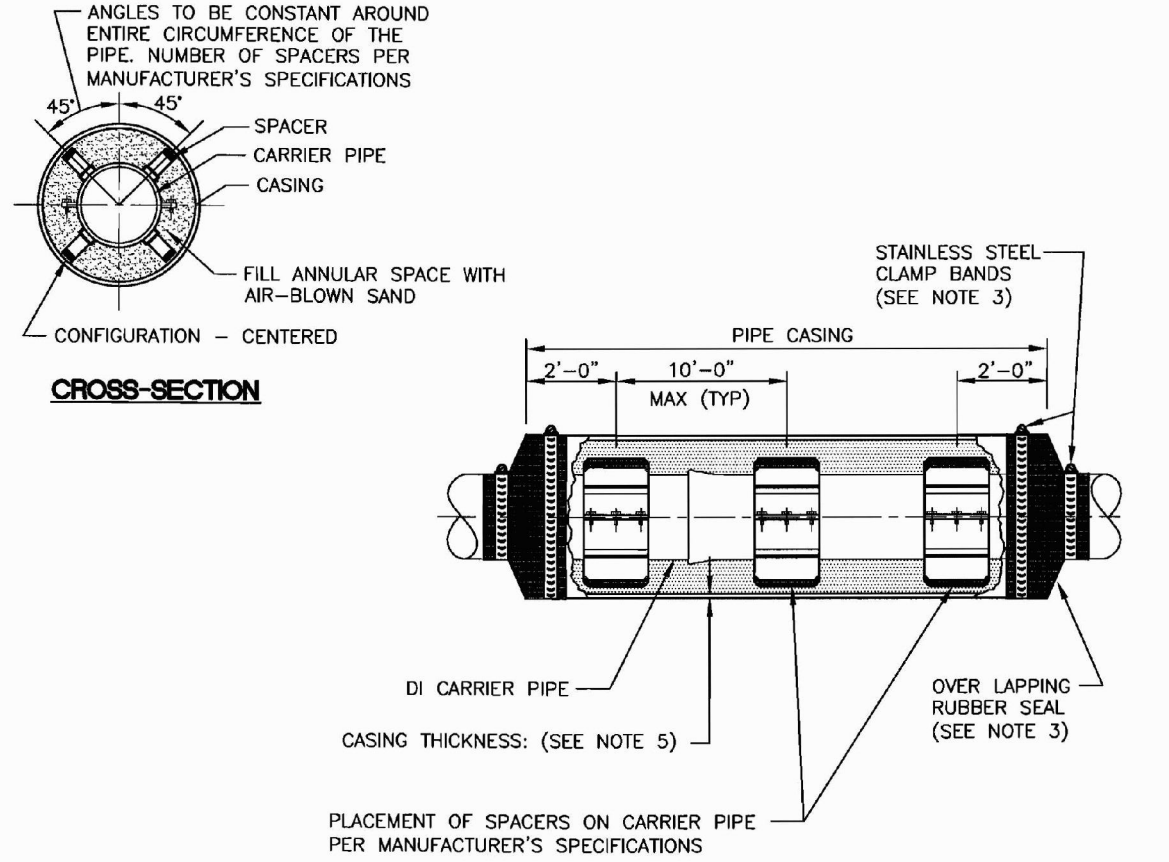
1. ALL CONCRETE SHALL BE 3000 PSI MINIMUM, 28 DAYS COMPRESSIVE STRENGTH. CONCRETE IS TO BE PLACED AGAINST UNDISTURBED EARTH. TABLE BELOW DENOTES MINIMUM BEARING AREA OR VOLUME OF THRUST BLOCK. SPECIAL DESIGN CALCULATIONS ARE TO BE SUBMITTED TO SBMWD FOR APPROVAL IF ALLOWABLE. SOIL BEARING CAPACITY IS LESS THAN 3000 PSF. ALL VERTICAL SURFACES NOT BEARING AGAINST UNDISTURBED EARTH SHALL BE FORMED. ALL THRUST BLOCKS SHALL BE PLACED IN THE PRESENCE OF AN SBMWD INSPECTOR.

PIPE ID	BEARING AREA IN SQ FT						CONC/CU YDS	
	FIGURE 1	FIGURE 2	FIGURE 3, Δ				FIGURE 4, Δ	
4"	1	2	90"	45"	22-1/2"	11-1/4"	45"	22-1/2"
6"	2	2	2	2	1	1	1.0	0.51-1/0.5
8"	3	5	7	4	2	1	3.0	1.5 1.0
10"	4	8	11	6	3	2	4.0	2.5 1.5
12"	6	11	15	8	4	2	6.0	3.0 1.5
16"	10	20	28	15	8	4	10.5	6.0 3.0
18"	13	25	35	19	10	5	13.5	7.5 3.5
20"	16	31	44	24	12	6	16.0	9.0 4.5
24"	22	44	63	34	17	9	23.5	12.5 6.5

2. USE OF THRUST BLOCKS REQUIRES PRIOR DEPARTMENT APPROVAL AND WILL BE EVALUATED ON A CASE BY CASE BASIS.

SBMWD W6.4A

NOT TO SCALE




NOTES:

1. DI PIPE JOINTS INSIDE PIPE CASING TO BE RESTRAINED (TYP).
2. INTERIOR OF CASING TO BE GROUND SMOOTH AND LUBRICATED FOR SPACER INSTALLATION.
3. RUBBER SEALS AND STAINLESS STEEL CLAMPS REQUIRED.
4. REDWOOD SKIDS CANNOT BE SUBSTITUTED FOR SPACERS
5. CASING THICKNESS (TO BE DETERMINED BY ENGINEER) NOT TO EXCEED DEFLECTION OF PIPE.
6. ALTERNATE CASING SIZE TO BE APPROVED BY DEPARTMENT ENGINEER ON A CASE BY CASE BASIS.

DI CARRIER PIPE	
12"	24"
16"	30"
18"	30"
20"	36"
24"	42"
30"	48"
36"	54"
48"	72"

SBMWD W6.17

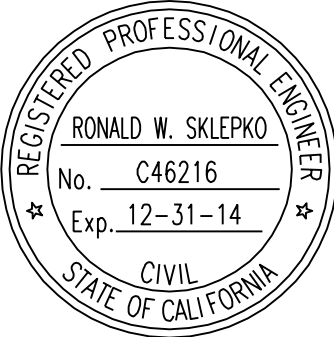
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MODIFIED



Know what's below.
Call 811 before you dig.

BENCHMARK:
S 1418
2.65 MI EAST ALONG 3RD STREET FROM THE SAN BERNARDINO COUNTY COURTHOUSE IN SAN BERNARDINO, 0.10 MI WEST OF STERLING AVENUE, IN TOP AND 1.0 FT WEST OF THE EAST END OF THE NORTH HEADWALL OF A DOUBLE-BOX CULVERT UNDER THE STREET, 32.0 FT NORTH OF THE WESTBOUND LANES CENTERLINE.
ELEV = 1101.15

BASIS OF BEARINGS
THE BEARINGS SHOWN HEREON ARE BASED UPON THE LINE BETWEEN CITY OF SAN BERNARDINO HORIZONTAL CONTROL POINTS #0025 AND #0026 BEING N29°03'47"E AS SHOWN ON RECORD OF SURVEY 97-0077 RECORDED IN BOOK 113, PAGES 15-22 OF RECORDS OF SURVEY.



PLANS PREPARED UNDER SUPERVISION OF:

PARSONS BRINCKERHOFF

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TEL: 909.888.1106 FAX: 909.889.1884

RONALD SKLEPKO R.C.E. No. C46216 Exp. 12-31-14


REVISION BLOCK			
MARK	DESCRIPTION	APPR	DATE

DESIGNED BY
DH

DRAWN BY
BW

CHECKED BY
RS

DATE
Apr. 2014



San Bernardino International Airport Authority

1601 E. Third ST.
San Bernardino, CA 92408
Tel.: 909-382-4100 Fax: 909-382-4106

General Aviation Infrastructure Improvements Project

PHASE 3 - GENERAL AVIATION SITE DEVELOPMENT

WATER PLAN DETAILS

SHEET TITLE:
WT-04

SHEET No.
20 OF 31

DP2 12-21

APN: 0136-371-33