GREAT BASIN ENGINEERING

WASHINGTON HEIGHTS CHURCH
1770 EAST 6200 SOUTH
SOUTH OGDEN CITY, UTAH
STORM WATER STUDY

Project No. 11N515
9-8-2011

General Site Information:

The proposed Washington Heights Church Addition is located just west of Highway 89 at approximately 6200 South. Construction will consist of a new addition to the existing Washington Heights Church, sidewalks, curb and gutter, underground utilities, and landscaped areas when completed. Although the disturbed portion of the site is relatively small, this site drains to an existing detention pond. Much of the adjacent land also drains into the existing pond. The overall drainage area that flows to the pond has an area of about 13 acres. Much of the storm water from the site will be collected in inlet boxes, or flow overland, and continue to the detention facility mentioned previously, and be released at 0.1 cfs per acre into an existing storm drain system on the north side of the property and will in this system in a historical fashion. The attached figure shows the study area and location of storm water outfall. Detention calculations have been provided for the site. (See attached calculations).

The proposed site is considered one detention area. A runoff coefficient of 0.15 was used for natural ground and landscaped areas. A runoff coefficient of 0.90 was used for asphalt, concrete, buildings, and other hard surfaced areas. A runoff coefficient of 0.6 was used for gravel, which equates to about 60% hardscape and 40% landscape. An average runoff coefficient of 0.63 was calculated for the site using these assumptions.

A time of concentration for the 100-year design storm may be used if pipe sizing calculations are necessary. Five minutes is the shortest time allowed using this method. Rainfall intensities were obtained from Wasatch Civil Engineering. The values obtained were interpolated as necessary.

Data showing area information, runoff coefficient, time of concentration, peak flow, and required detention for the site is also provided and can be found in the attached calculations.

Orifice Plate:

An orifice plate has historically been used to release flows from the existing detention facility. It is located at the manhole indicated on the attached figure. (See attached figure). The existing orifice plate is 5.62 inches in diameter. However, this orifice is too small to allow that 0.1 cfs/acre to leave the site. This orifice will be resized. The new diameter for the orifice is 4.59 inches. See the attached calculations. The top of water for the pond is set at an elevation of 4795.00 with one foot of freeboard.. The orifice plate allows for small flows to pass through without detention. As the rate of storm water into the detention basin increases, the orifice plate will restrict the flow. The maximum flow through the plate will come when the detention basin reaches the maximum design depth. A detail of the orifice plate is attached.

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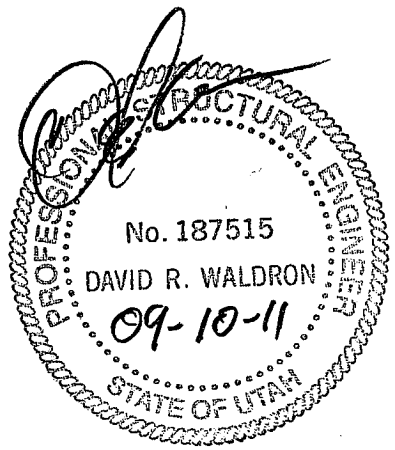
Required Detention:

The required detention for the 100-year storm with a release rate of 0.1 cfs/acre is 48,257 cubic feet for the pond. The available detention volume in the pond is 48,473 cubic feet. This volume meets the requirement. In the event the pond experiences a storm larger than the design storm water will then spill out to the southwest and continue in a historical fashion.

Great Basin Engineering, Inc.

Prepared by Ryan Bingham, P.E.

Reviewed by David Waldron, P.E.



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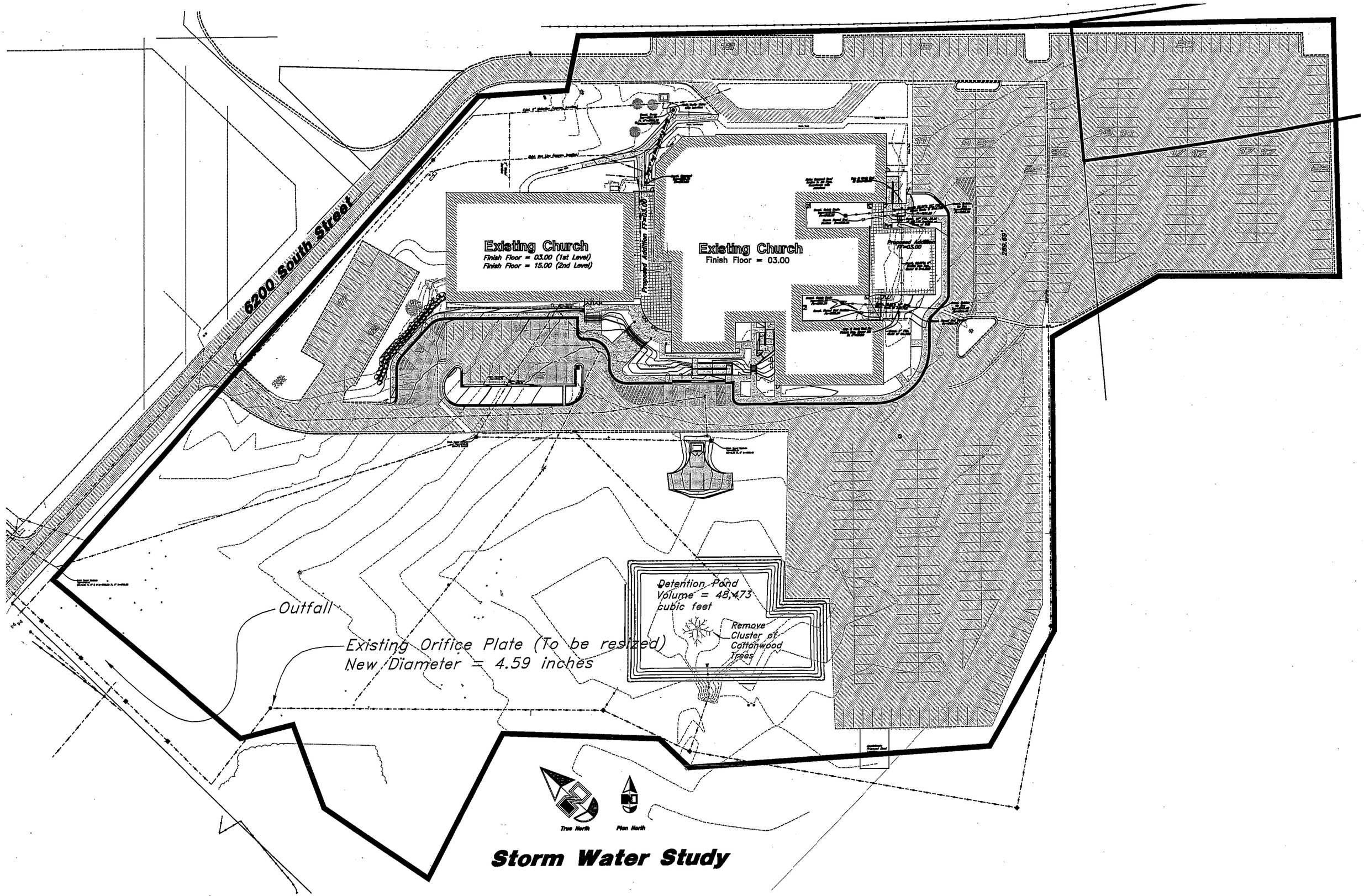


Storm Water Study

Storm Water Study
Washington Heights Church
1770 East 6200 South, South Ogden, Utah
S4.dwg
8/31/2011

1 Detained Area

Hardscape Cd =	0.90
Landscape Cd =	0.15

Drainage Areas	Total Area (ft^2)	Total Area (acres)	Hardscape Area (ft^2)	Hardscape Area (acres)	Landscape Area (ft^2)	Landscape Area (acres)	C
Σ Det. Areas	569854	13.082	364155	8.360	205699	4.722	0.629
Σ All Areas	569854	13.082	364155	8.360	205699	4.722	0.629
A-1	569854	13.082	364155	8.360	205699	4.722	0.629

Washington Heights Church
Combined Detention Pond

C = 0.63
Area = 13.08 acres

Allowable Discharge Rate = 0.100 cfs/acre

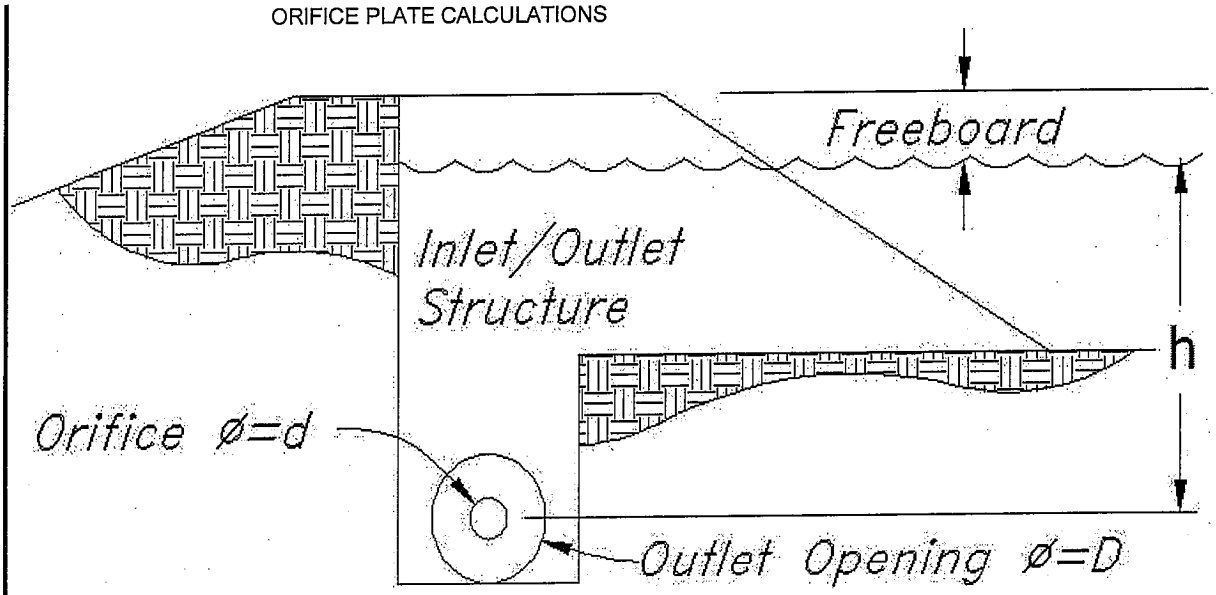
Total Release Rate = 1.308 cfs

Detention Pond Sized For The 100 Year Storm

Time	Rainfall Intensity	Accumulated Volume	OR Allowable Release	Needed Detention	Needed Detention	
min	in./hr.	(CF)	(CF)	(CF)	(acre-ft)	
5	6.45	15921	392	15529	0.356	
10	4.99	24668	785	23883	0.548	
15	4.02	29793	1177	28615	0.657	
20	3.38	33342	1570	31772	0.729	
25	2.94	36342	1962	34379	0.789	
30	2.64	39175	2355	36821	0.845	
35	2.42	41874	2747	39127	0.898	
40	2.24	44322	3140	41182	0.945	
45	2.09	46388	3532	42856	0.984	
50	1.94	48008	3925	44083	1.012	
55	1.81	49207	4317	44890	1.031	
60	1.69	50097	4710	45388	1.042	
90	1.24	55322	7064	48257	1.108	<- Max Detenti
120	0.92	54692	9419	45273	1.039	
180	0.65	57790	14129	43661	1.002	
360	0.37	65792	28257	37535	0.862	
720	0.21	74683	56514	18168	0.417	

So, our detention pond needs to hold 48257 ft^3 of water

ORIFICE PLATE CALCULATIONS



$$Q = 0.62 \cdot A_o \cdot \sqrt{2 \cdot g \cdot h}$$

Q = Total Discharge Rate

$$A_o = \frac{\pi \cdot d^2}{4}$$

$$g = 32.2$$

h= 5.26

Q = 1.308

Solving for d, we have.....

$$d = \sqrt{\frac{4 \cdot Q}{0.62 \cdot \pi \cdot \sqrt{2 \cdot g \cdot h}}}$$

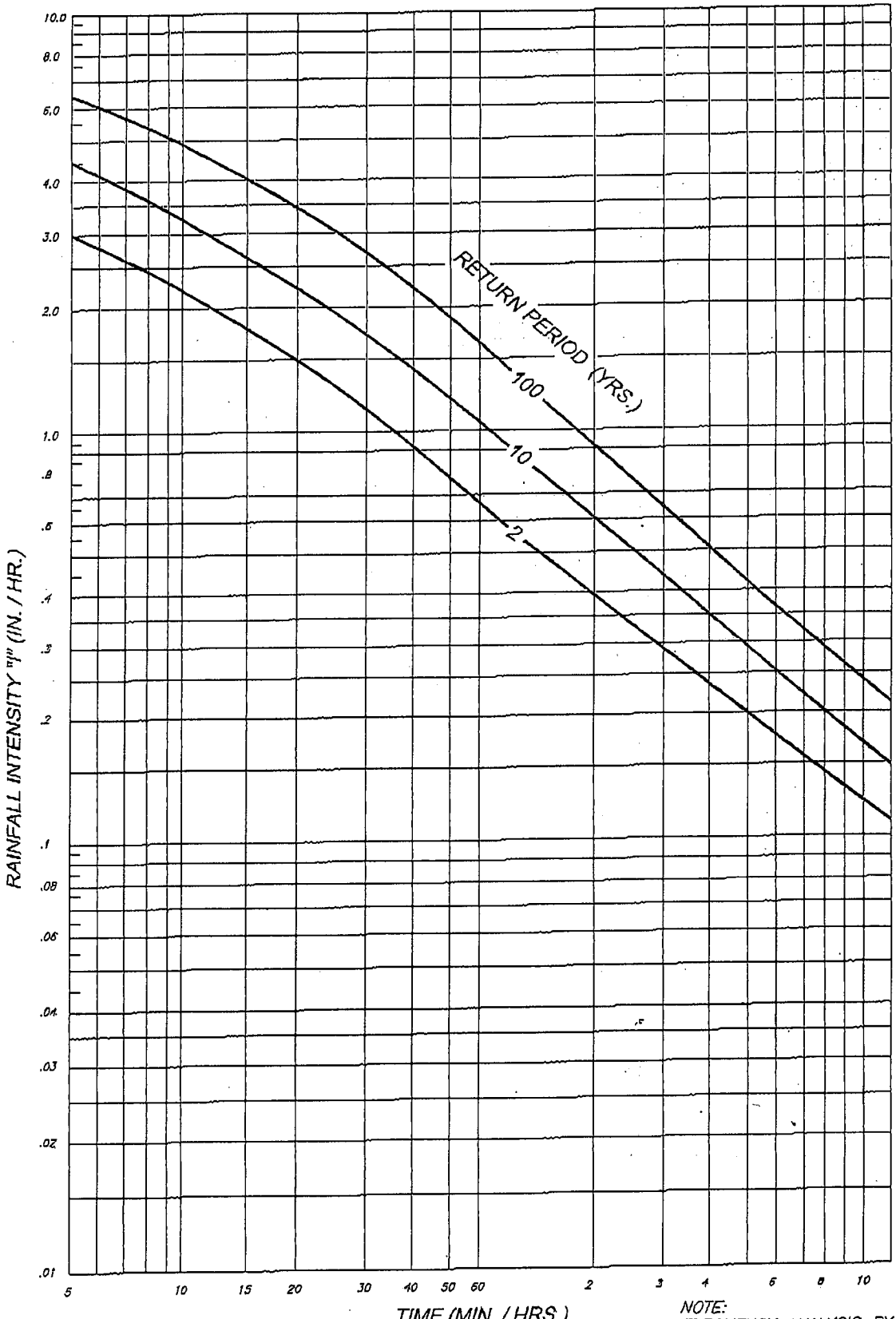
Substituting Q, G, and H, we have.....

d = 0.382 feet

OR

d = 4.585 inches

RYAN Saint Edget IDF



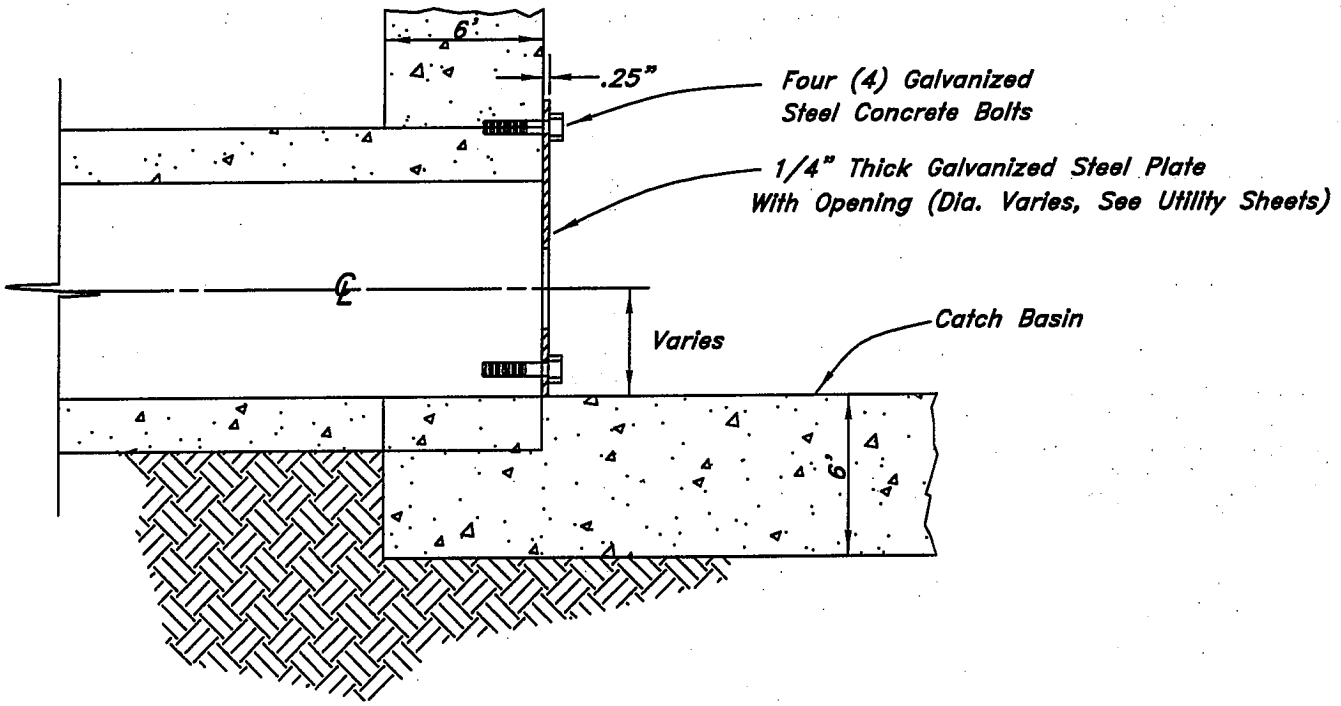
NOTE:
FREQUENCY ANALYSIS BY METHOD OF MAXIMUM VALUES – DATA FROM WEATHER BUREAU TECHNICAL PAPER NO. 28

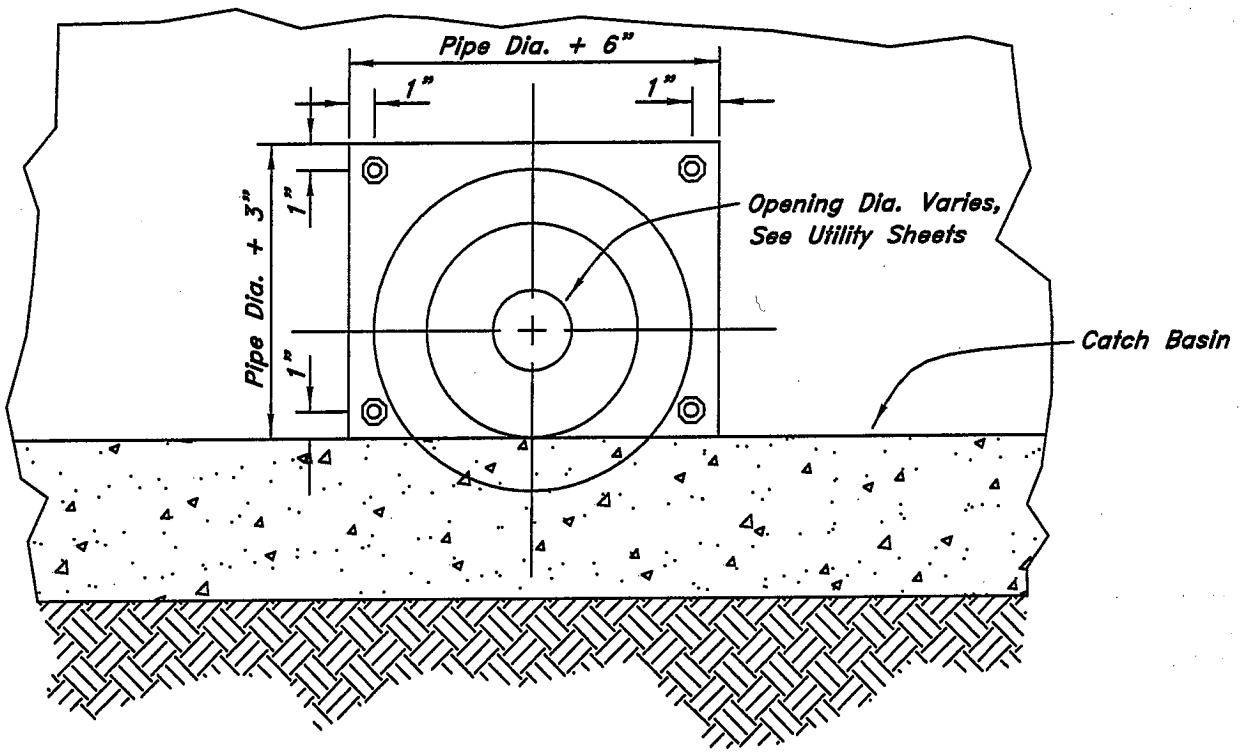
WC-CAD\05-MISC\300-STORM\WCE IDF CURVE.DWG

INTENSITY - DURATION - FREQUENCY CURVE

WASATCH CIVIL
Consulting Engineering
2320 SOUTH 1950 WEST, SUITE 1
ROY CITY, UTAH 84067 (801) 775-9191

SHEET: 1 OF 1 SHEETS





Orifice Plate Detail