

CIVIL ENGINEERING



An Employee-Owned Company

LAND SURVEYING

MEMORANDUM

To: Kyle Donath – BG Architecture and Design
From: Roger Neal, P.E.
Project: 2231003.00
Date: February 6, 2023
Subject: Truscott Place – Stair Storm Drainage Calcs.

BG Architecture is working on the Truscott Housing complex doing repairs to the existing stairs that access the buildings. As part of this, HCE was requested provide an option for a drywell to drain one of the stairwells that is without a drain.

The flows entering the proposed drywell are only from dripping water off the stairs and walkway of the complex, therefore a smaller 30-inch drywell is proposed. The drywell will be placed at the lower level of the stair case with a perforated 21-inch lid to capture flows from the staircase. The total required volume is six cubic feet which is achieved at a depth of two feet. However, the drywell will be a minimum of five feet in depth to get below frost line. Calculations can be found in the attached appendix.

If the proposed drainage improvements are installed correctly, the system should function as previously approved and drain the lower level stairwell. Please contact us with questions or concerns.

Roger D. Neal, P.E.



For and on behalf of
High Country Engineering Inc.

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Appendix

Rational Method Calculations
Drywell Calculations
Exhibit

TRUSCOTT PLACE
DRAINAGE REPORT

								Type B Soils			
BASIN	AREA (S.F.)	AREA (ACRE)	IMPERVIOUS AREA (SF)	PERCENT IMPERVIOUS	EFFECTIVE IMPERVIOUS (%)	WQCV (Watershed inches)	WQCV (CF)	2 YR RUNOFF COEFFICIENT	5 YR RUNOFF COEFFICIENT	10 YR RUNOFF COEFFICIENT	100 YR RUNOFF COEFFICIENT
PR-1	142.0	0.003	142.0	100.0			0.0	0.84	0.86	0.87	0.90

TRUSCOTT PLACE

DRAINAGE REPORT

REACH	AREA IDENTIFIER	PR-1
OVERLAND FLOW	RATIONAL COEFFICIENT, C_s (TABLE 6-4 UDFCD)	0.86
	FLOW LENGTH, L (TOTAL <300 FT.) (ft.)	142.0
	LAND SLOPE, S (ft./ft.)	0.01
	T_o (MIN)	5.2
TRAVEL TIME	SURFACE DESCRIPTION	
	FLOW LENGTH, L (ft.)	
	FLOW SLOPE, S (ft./ft.)	
	CONVEYANCE COEFFICIENT, K (TABLE 3.3 URMP)	
	FLOW VELOCITY, V (fps.)	0
	$T_f = L/(60V)$ (min.)	0.0
T_c	(5 minute min.)	5.2
T_c	URBAN CHECK = $10+L/180$	10.8
		P_1 -2yr
		0.47
		P_1 -10yr
		0.77
		P_1 -100yr
		1.23
		2 YEAR INTENSITY
		2.38
		10 YEAR INTENSITY
		3.90
		100 YEAR INTENSITY
		6.22

$$T_o = \frac{0.395(1.1 - C_s)\sqrt{L_o}}{S_o^{0.33}} \quad \text{EQ 3-4}$$

$$T_f = \frac{L_f}{60V_f} \quad \text{EQ 3-5}$$

$$V_f = K\sqrt{S_f}$$

$$T_c = T_o + T_f \quad \text{EQ 3-6}$$

$$I = \frac{88.8P_1}{(10 + T_d)^{1.052}} \quad \text{EQ 2-1}$$

C= 5 YR runoff coefficient from City of Aspen Urban Runoff Management Plan

P TAKEN FROM TABLES 2.2 AND 2.3 WITHIN THE URMP

*INTENSITIES TAKEN FROM FIGURE 2.1 "IDF CURVES FOR ASPEN, COLORADO" FROM URMP

Table 2.2 Rainfall Intensity-Duration-Frequency in Aspen, Colorado

Return Period	Rainfall Intensity in inch/hr for Various Periods of Duration								
	5-min	10-min	15-min	30-min	1-hr (P_1)	2-hr	3-hr	6-hr	24-hr
2-yr	2.06	1.51	1.23	0.77	0.47	0.28	0.21	0.13	0.06
5-yr	2.98	2.17	1.77	1.09	0.64	0.36	0.26	0.16	0.07
10-yr	3.72	2.72	2.22	1.35	0.77	0.43	0.30	0.18	0.08
25-yr	4.75	3.47	2.82	1.71	0.95	0.53	0.36	0.21	0.09
50-yr	5.53	4.05	3.30	1.98	1.09	0.60	0.41	0.24	0.11
100-yr	6.32	4.63	3.76	2.24	1.23	0.67	0.45	0.26	0.12

Using the data in **Table 2.2** (derived from NOAA Atlas 14 Volume 8), the following equation was derived that can be used to determine intensities not shown in the IDF table or curve:

$$I = \frac{88.8P_1}{(10 + T_d)^{1.052}} \quad \text{(Equation 2-1)}$$

Where,

I = rainfall intensity (inch/hr),

P_1 = 1-hr rainfall depth (inches), and

T_d = duration or time of concentration (minutes).

Table 3.3 Conveyance Coefficients for SCS Upland Method

Linings for Conveyance	Conveyance Coefficient
Meadow (rough bushes)	2.5
Tillage (crop fields, mountain vegetation)	4.5
Lawn (turf strip, gravel pavement)	7.0
Bare Soils (unlined ditches)	10.0
Grass Lined Swale (grass ditches)	15.0
Paved Water Way (street gutters)	20.0

Hydrology Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

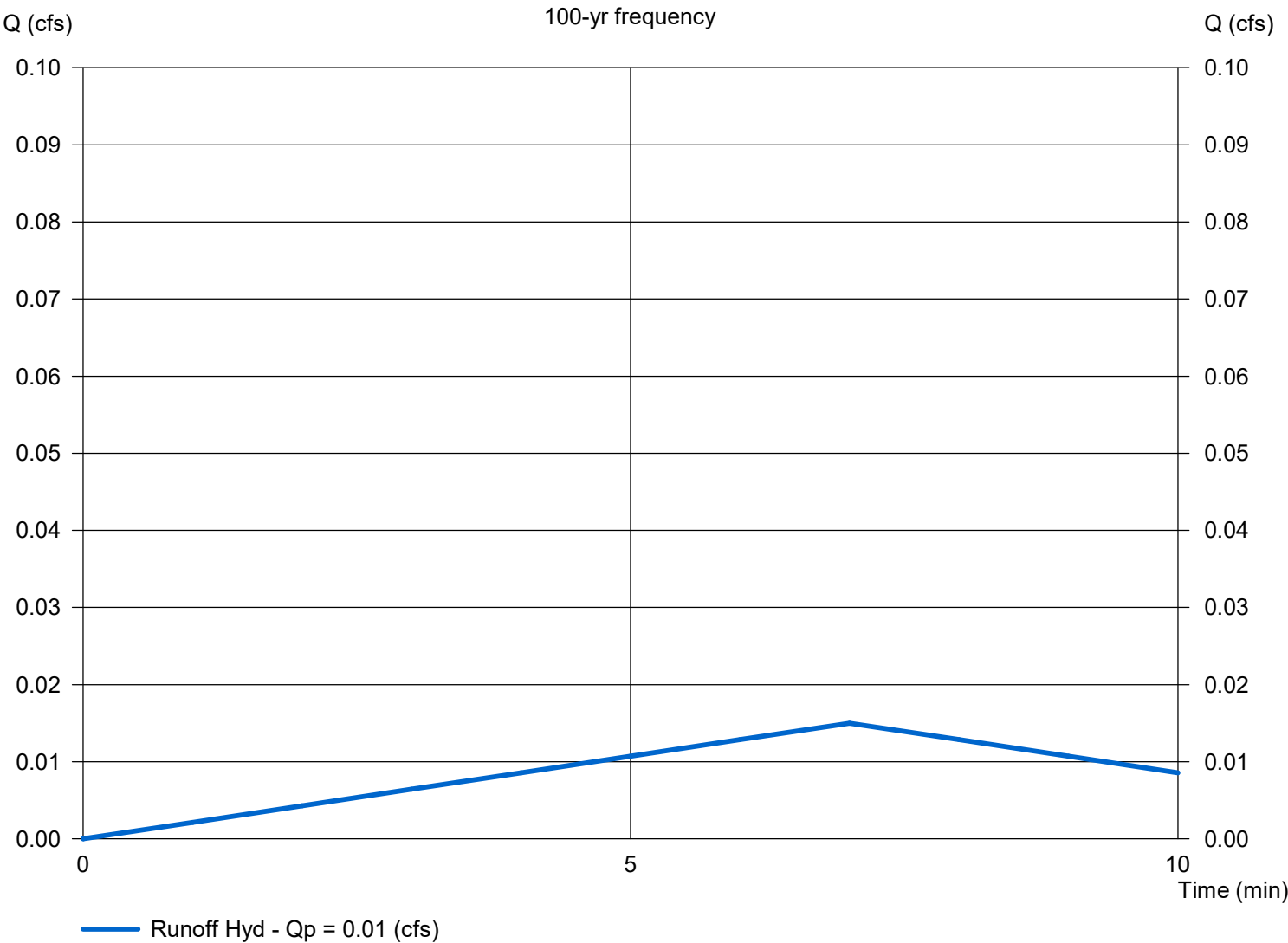
Thursday, Feb 2 2023

PROPOSED DRYWELL

Hydrograph type	= Rational	Peak discharge (cfs)	= 0.015
Storm frequency (yrs)	= 100	Time interval (min)	= 1
Drainage area (ac)	= 0.003	Runoff coeff. (C)	= 0.9
Rainfall Inten (in/hr)	= 5.554	Tc by User (min)	= 7
IDF Curve	= CITY OF ASPEN.IDF	Rec limb factor	= 1.00

Hydrograph Volume = 6 (cuft); 0.000 (acft)

Runoff Hydrograph



Truscott Place
DRAINAGE STUDY DRYWELL CALCULATIONS

February 2, 2023

HCE #: 2231003

Drywell Calculations

Calculation of Drywell and Gravel

Variables					Concrete Cylinder Thickness (in)
Volume to Detain (cf)	Width of Gravel (ft)	Depth of gravel Below M.H. (ft)	Dia of M.H.	Percent Voids (%)	
6.0	0.5	1	2.5	30	6

Area of M.H. (sqft) 4.9
Area of Gravel (sqft) 6.3
Area of Concrete Cylinder (sqft) 4.71
Volume of 6" PCC Slab (sqft) 2.5
Volume of Gravel Bottom 15.9

Depth Varied (ft)	Volume of Gravel (cf)	Vol of Gravel Voids (cf)	Vol of Drywell Conic Section (cf)	Vol of Drywell Cyl. Section (cf)	Vol of Drywell (cf)	Total Volume (cf)	Volume Met
1	0.0	0.0	0.0	0.0	0.0	0.0	no
2	0.0	0.0	0.0	4.9	2.5	2.5	no
3	0.0	0.0	0.0	9.8	7.4	7.4	Meets Min.
4	22.2	6.7	0.0	14.7	12.3	18.9	Meets Min.
5	28.5	8.5	0.0	19.6	17.2	25.7	Meets Min.
6	34.8	10.4	0.0	24.5	22.1	32.5	Meets Min.
7	41.0	12.3	0.0	29.5	27.0	39.3	Meets Min.
8	47.3	14.2	0.0	34.4	31.9	46.1	Meets Min.
9	53.6	16.1	0.0	39.3	36.8	52.9	Meets Min.
10	59.9	18.0	0.0	44.2	41.7	59.7	Meets Min.
11	66.2	19.9	0.0	49.1	46.6	66.5	Meets Min.
12	72.5	21.7	0.0	54.0	51.5	73.3	Meets Min.
13	78.7	23.6	0.0	58.9	56.5	80.1	Meets Min.
14	85.0	25.5	0.0	63.8	61.4	86.9	Meets Min.
15	91.3	27.4	0.0	68.7	66.3	93.7	Meets Min.

X' DIAMETER, Y' DEEP DRYWELL

Transmissivity Calc.

Depth of Gravel (ft)= 10

K from NRCS National Engineering Handbook, figure 3-10, soil class GM

AP=(VR)/(K)(43,200)

AP=Total area of sides (sf) 141.37

VR = runoff volume (cf) 6.0

K= Hydraulic Conductivity (ft/s) 0.000035

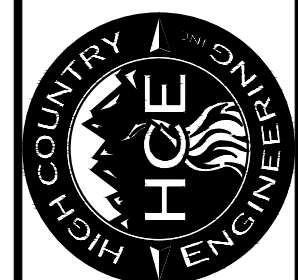
Area of Percolation Required (sf) 3.97



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NO.	DATE	REVISION	BY

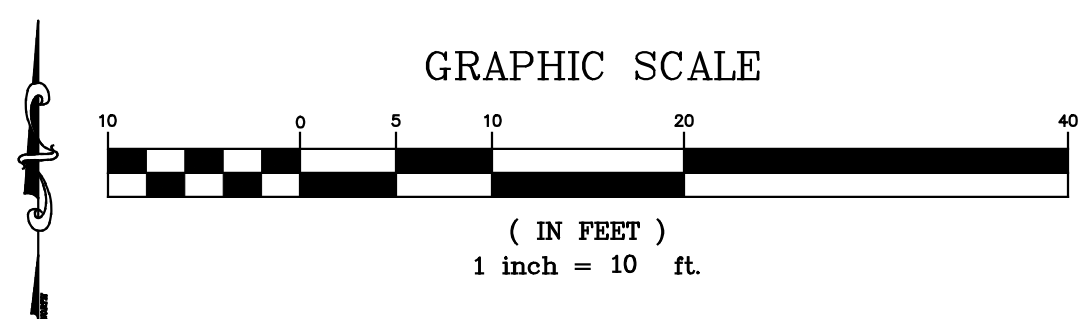
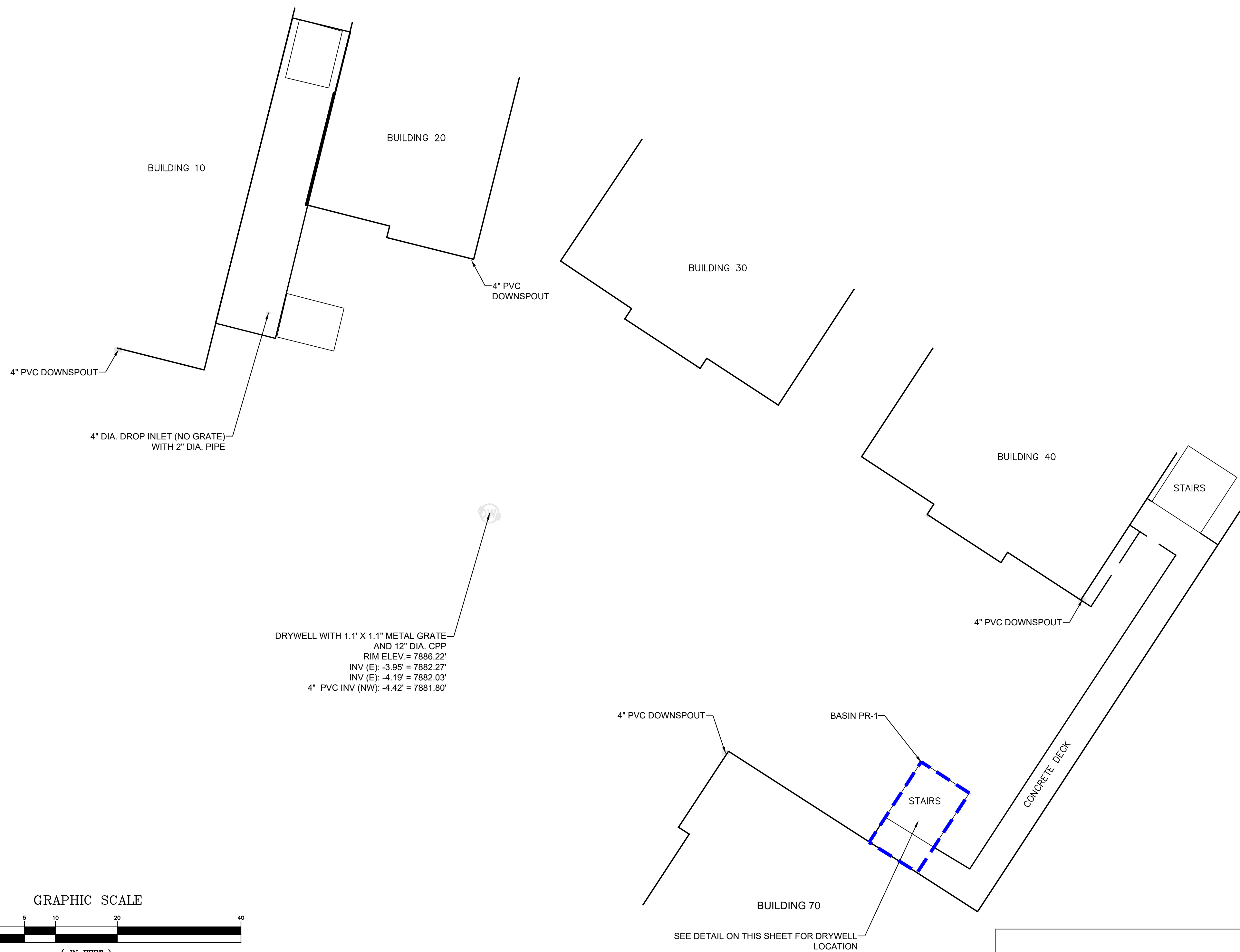
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CITY OF ASPEN
ASPEN, COLORADO
TRUSCOTT PLACE
BUILDING 70 DRYWELL
CITY OF ASPEN, COLORADO

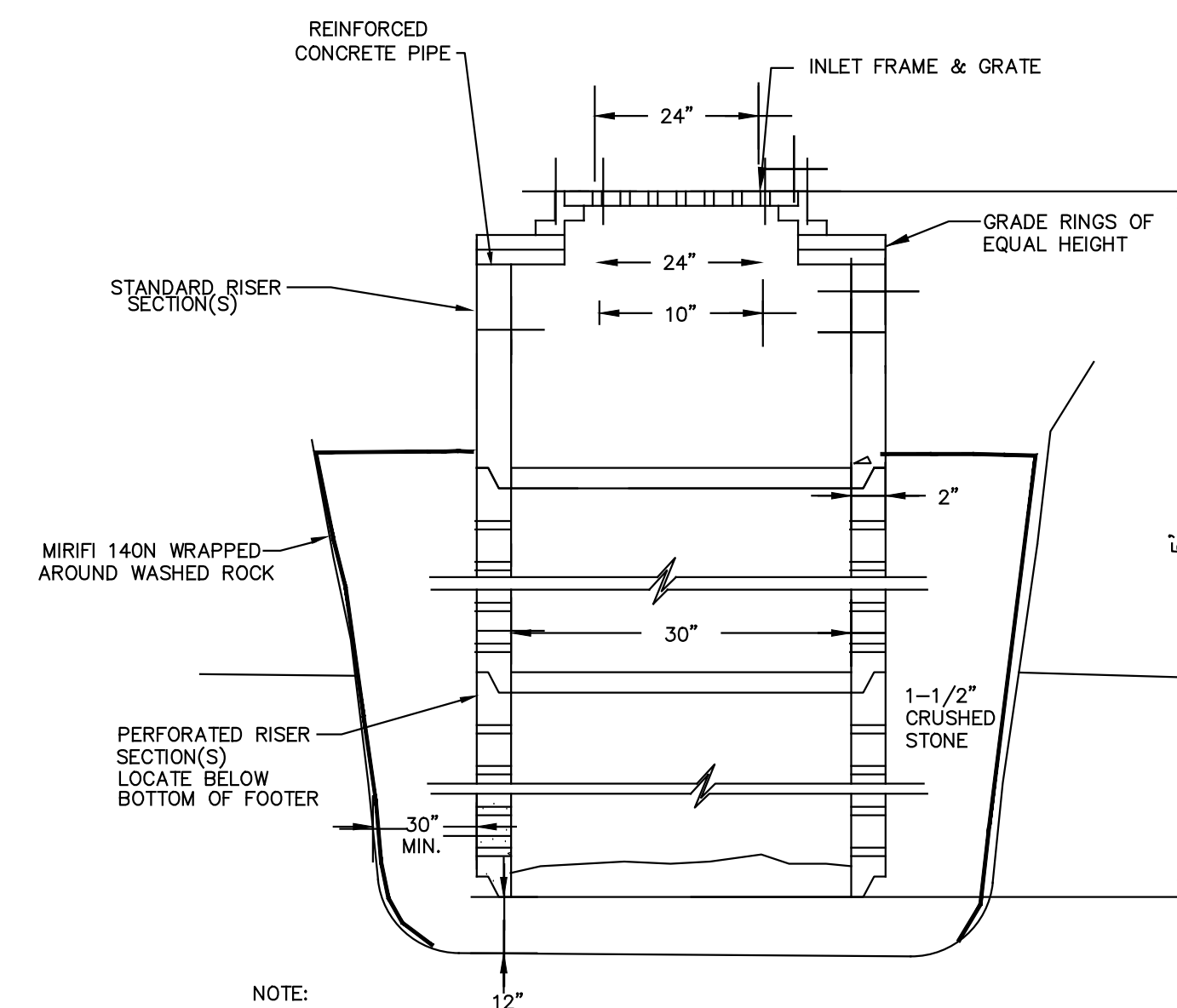
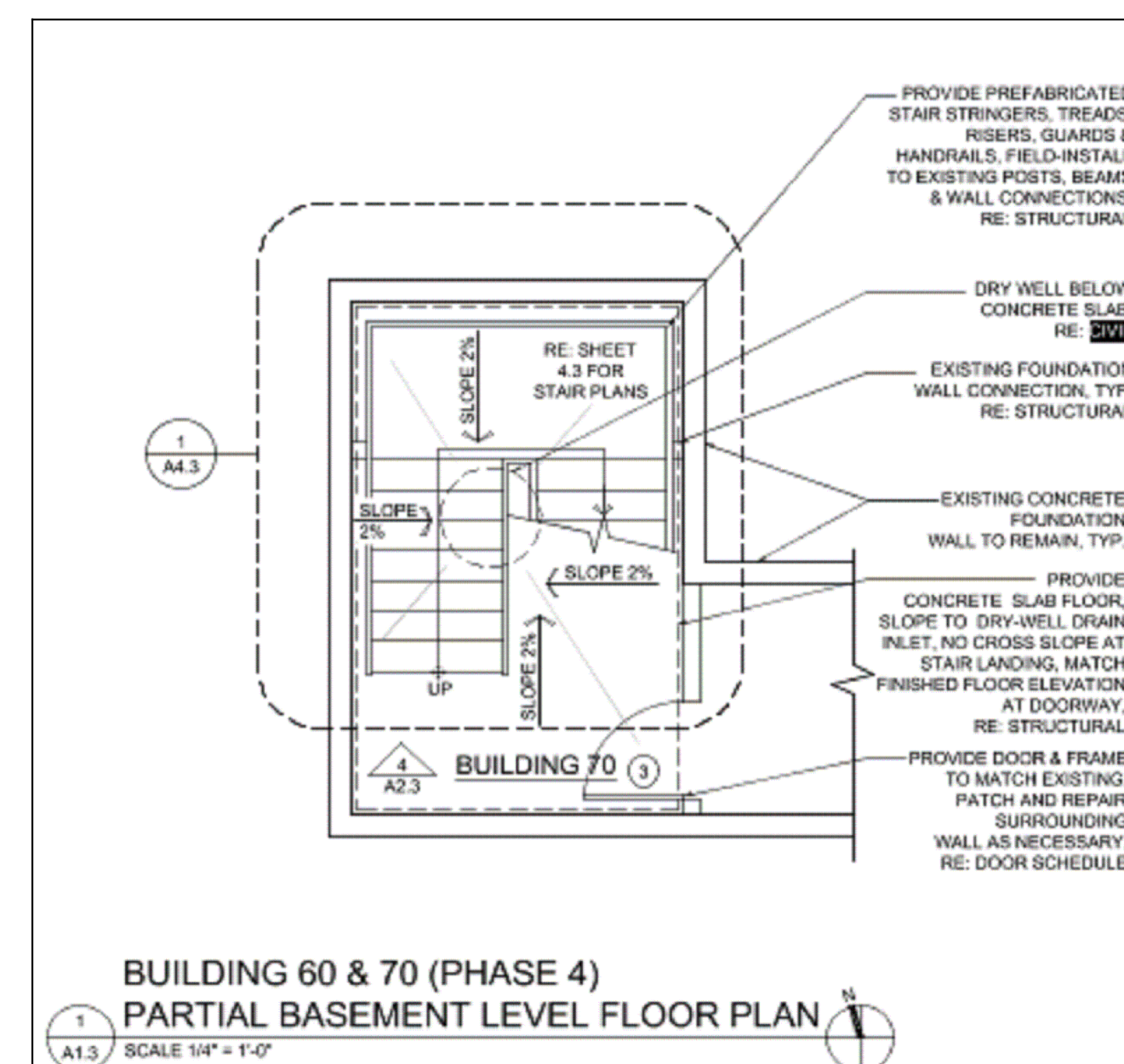
PROJECT NO.
2231003

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NOTE:

1. PRIOR TO DRYWELL CONSTRUCTION, A GEOTECH MUST PERFORM ON-SITE SOIL ANALYSIS TO VERIFY DRAINAGE CAPACITY PRIOR TO DEMOLITION OF EXISTING CONCRETE SLAB.



NOTE:

1. PRECAST CONCRETE SECTIONS TO MEET ASTM C-478.
2. BACKFILL EXCAVATION AROUND STRUCTURE WITH COMPACTED 1-1/2" WASHED STONE, TO TOP OF PERFORATED SECTIONS.
3. OVERALL DEPTH, MINIMUM OF 6' OR PER PLAN.
4. PERFORATED SECTION, 4 FT. MINIMUM INTO PERVIOUS ALLUVIUM.

PRECAST CONCRETE DRY WELL

N.T.S.