CITY OF ALBUQUERQUE

Eugenio E. Valdez, P.E.
Wilson & Company, Inc.
4900 Lang Ave. NE
Albuquerque, NM 87109

Re: Lincoln Complex, Building M Renovation
Drainage Report/Grading and Drainage Plan
Engineer's Stamp Date 7-31-2015 (K15/D047B)

Dear Mr. Valdez,

Based upon the information provided in your submittal received 7/17/2015 and 8/3/2015, the above referenced report cannot be approved until the following comments are addressed:

- Please stamp the drainage report.
- Drainage report references flow numbers based on the 100yr/24hr storm. Please make sure all the flow calculations are based on the 100yr/6hr storm and volume calculations are based on the 100yr/24hr storm. The runoff calculations for the 100yr/6hr storm are using Type 2 Rainfall. Summary tables should indicate the 100yr/6hr storm for flows and 100yr/24hr storm for volumes.
- Provide an exhibit that clearly shows the pipe numbers and inlets number shown Table 4 & 5, Sheet 9 of the drainage report.
- First flush volume (0.34" x Impervious Area) must be provided for the new constructions and all the areas that are being reconstructed.
- Please provide all the sheets that are being referenced for details on the grading plans.
- An Erosion and Sediment Control Plan (ESC) submittal is also required for building permit approval. Please submit an ESC plan including a submittal sheet to Curtis Cherne for review and approval.

If you have any questions, you can contact me at 924-3695.

Sincerely,

Shahab Biazar, P.E.
City Engineer, Planning Dept.
Development and Building Services

C: File

PO Box 1293

Albuquerque

New Mexico 87103

www.cabq.gov

DRAINAGE REPORT FOR TRACTS A, B-1, AND C-1 SANDIA ADDITION

PREPARED FOR
SANDIA FOUNDATION

JULY 2015

Prepared By:

Floyd Development Services, *LLC*
918 Pinehurst Road
Rio Rancho, NM 87124

I, Hugh W. Floyd, hereby certify that I am a Registered Professional Engineer, registered in the State of New Mexico, and that the following report was prepared under my direction and is true and correct to the best of my knowledge and belief.

Hugh W. Floyd
NMPE # 16633

TABLE OF CONTENTS

FIGURES AND TABLES

TABLE OF CONTENTS

I. INTRODUCTION

The purpose of this report is to maintain compliance with the City of Albuquerque's regulations and to design a more efficient ponding system so that Sandia Foundation can better utilize their remaining property (Tract C-1).

The site is located on the west side of San Mateo Boulevard in between Lincoln Road and Mcleod Road. The site is shaped like an L with the long side running east west, as shown on Sheet 1 of Exhibit 1. ABF Terminal, which used to be known as Navajo Freight Lines Terminal, is located on the west side of the site and wraps around the northwest corner. The Golden Corral restaurant (Tract A) is located north of the long side and east of the short side. There is a storage facility on the south side of the site. Davita's Del Norte Dialysis Center is in the process of developing on the east side of the property, between Golden Corral and the storage facility. Entitlement and Engineering Solutions, Inc. (EES) recently submitted a drainage report for the Davita site (Tract B-1) dated 5/5/2015 and that report is referenced in Appendix A.

II. BACKGROUND AND EXISTING CONDITIONS

For many years the area now occupied by Golden Corral, Davita's developing site, and the remaining Tract (C-1), was used as a garden nursery. The area has historically drained to the west through the Navajo Terminals. In 1974 an existing 42 in. storm drain was removed from the Navajo Terminals site due to the construction of a new storm drain on San Mateo Boulevard. At the same time Kruger, Lake and Associates prepared a report and plan set for a smaller storm drain system through the Navajo Terminals site. Their report and plans are shown in Appendix A.2. As can be seen in the Kruger drainage study, the intention was to accommodate free discharge from the nursery site. They calculated a runoff discharge of 21 cfs using a C factor of 0.6 for the nursery site. This discharge is collected in two soil cement swales that were constructed per the 1974 plan for the Navajo Terminal site and are still in existence. These swales have two inlets that ultimately tie into an 18" storm drain that runs through the ABF/Navajo Terminal property, as shown on the plan sheet found in Appendix A.2. Figure 1 shows the nursery in 2002 and displays the extent of the buildings and hardscape. It should be noted that the impervious area is comparable to a fully developed commercial site.

Currently the site is zoned C-3 and has a consistent slope to the west at about 3%. On the south side of the property there is a wall 1 to 3 feet in height, which prevents runoff from transferring between the storage facility and the existing site. The runoff from Tract C-1 and the Davita site (Tract B-1) flows into two ponds. One pond is located in the southwest corner of the existing site and the other is in the northwest corner. The Golden Corral (Tract A) site has part of the site, the building, draining to San Mateo, a small portion of the parking lot draining to the existing soil cement swale, and the remainder draining to the existing ponds. The ponds were built in 2013 under emergency conditions when two large storms occurred back to back. Prior to the construction of the emergency ponds, Tract C-1 had three makeshift ponds that neared full capacity during the second 2013 storm. According to the Engineer's Report by Isaacson and

Arfman dated 09/24/2013, located in Appendix A.3, the berms surrounding the makeshift ponds began to fail as the pond's water level approached the top. It is also noted in the Temporary Detention plan sheet dated 08/27/2013, found in Appendix A.3, that repairs were made to the western shotcrete channel. It is believed that repairs were necessary due to settlement, which allowed water to "pipe" under the shotcrete channel.

III. METHODOLOGY

The proposed and existing conditions are modeled using AHYMO and the 100 year, 24 hour storm event in accordance with chapter 22 of the Albuquerque Design Process Manual (DPM). The AHYMO data are found in Appendix B.

The water quality pond volume is calculated using the first 0.34 inches of runoff multiplied by the impervious area of the site. In this report the calculations for the water quality ponding includes Davita's developing site since their report specifies to use the existing pond for their first flush. Table 3 on Sheet 1 of Exhibit 1 shows the water quality volume calculations.

The downstream capacity of the ABF Terminals storm drains was analyzed using the orifice and Bernoulli equations based on the City of Albuquerque DPM, Section 22.3B. Appendix C contains the orifice calculations used to develop rating curves for each proposed pond outlet and ABF inlet. Table 1 from Sheet 1 of Exhibit 1 shows the combined outlet rating curves for the northern and southern pipe outlets. Appendix C contains the downstream analysis used to determine the best fit flowrate.

IV. PROPOSED CONDITIONS

In the past, the ABF/Navajo Terminal site was designed to receive 21 cfs from the garden nursery site. The calculations in Appendix C indicate that a flowrate of about 10 cfs lets water flow into the storm drain system without causing significant cross parking lot flow. This report recognizes that the design of the downstream storm drain system is undersized and that a large runoff rate produces flow over the paved areas. Due to the problems in 2013 and an attempt to limit flows to a level that can be contained in the existing storm drain, the discharge rate is reduced from 21 cfs to 10 cfs.

The proposed pond is located in the northwest corner of Tract C-1, and extends along the western border. In the northwest corner the pond is V-shaped and 4 feet deep with 3:1 side slopes. Along the western border the pond is only 2 feet deep with 3:1 side slopes and a flat bottom. The pond is designed to retain 3718 cubic feet of water within the lowest 2 foot depth to account for the first flush. The elevation range of the water quality pond is from 5192 feet to 5194 feet. The upper portion of the pond is detention and has an elevation range of 5194 feet to 5195.8 feet. There are two outlets that allow water to discharge into the ABF Terminal storm drain system. Both outlets have a 12 inch pipe which tie into the back of the ABF Terminal inlets, one on the north and the other to the south. The north outlet has an elevation 5194 feet, and the southern outlet elevation is 5193 feet. Surrounding the southern outlet is a weir with a

top elevation of 5194 feet. The weir is used to maintain a water quality volume and to allow additional head on the outlet so that more water enters the system sooner. Table 1 on Sheet 1 of Exhibit 1 shows the storage rating curve of the proposed pond. On the northwest corner there will be an emergency spillway with a top elevation of 5195.8 that extends to the south along the western border.

V. SUMMARY AND CONCLUSION

The plan outlined in this report provides a pond that retains the required first flush volume for Tract C-1 and Tract B-1, as well as providing detention ponding adequate to limit the total discharge to a maximum rate of 10 cfs rather than the previous allowed 21 cfs. If a storm larger than the design caused the spillway to become activated then water will flow into the soil cement channel as it has historically done.

additional head on the outlet so that more water enters the system sooner. Table 1 on Sheet 1 of Exhibit 1 shows the storage rating curve of the proposed pond. On the northwest corner there will be an emergency spillway with a top elevation of 5195.8 that exends to the south along the western border

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The plan outlined in this report provides a pond that retains the required first flush volume for Tract C-1 and Tract B-1, as well as providing detention ponding adequate to limit the total discharge to a maximum rate of 10 cfs rather than the previous allowed 21 cfs.

Sandia Foundation
San Mateo Site

Figure 1

Figure 1
Garden Nursery 2002

Sandia Foundation
San Mateo Site

Sheet 1 of Exhibit 1

TABLE 1 – WATER QUALITY AND STORAGE POND RATING CURVE

	Elev.	Area (sq. ft)	Vol (cu. Ft)	Cum. (cu. Ft.)	Cum. (Ac-ft)	Discharge N outlet (cfs)	Discharge S outlet (cfs)	Emergency Spillway	Combined Discharge (cfs)
Water Quality Pond	92	219.6	0.0	0.0	0.000	0.00	0.00	0.00	0.00
	93	1708.5	964.1	964.1	0.022	0.00	0.00	0.00	0.00
	94	3804.4	2756.5	3720.5	0.085	0.00	0.00	0.00	0.00
	94.25	4556.0	1045.1	4765.6	0.109	1.89	1.69	0.00	3.58
	94.5	5276.1	1229.0	5994.6	0.138	2.67	4.63	0.00	7.30
	95	6766.8	3010.7	9005.3	0.207	3.78	5.00	0.00	8.78
	95.5	8242.9	3752.4	12757.7	0.293	4.63	5.00	0.00	9.63
Max. WS Elev.	95.79				0.352	4.84	5.00	0.00	9.84
	96	9771.4	4503.6	17261.3	0.396	5.00	5.00	37.60	10.00
	96.5	8462.1	4558.4	21819.7	0.501	5.00	5.00	245.00	10.00

TABLE 2 – TREATMENT TYPE PERCENTAGES

Location	Area (Ac)	A	B	C	D
Tract A	2.506	0	0	5	95
Tract B-1	1.0455	0	5	15	80
Tract C-1	2.6442	0	12.5	12.5	75
Weighted Avg.	6.1957	0	10.4	9.9	83.9

TABLE 3 – WATER QUALITY VOLUME CALCULATIONS

Location	Area (ft^2)	%TTD	Area TTD	Runoff (in)	Volume (ft^3)
Tract B-1	45541.8	80	36433.44	0.34	1032.3
Tract C-1	115180.3	75	86385.23	0.34	2447.6
				Total Vol. =	3479.9

SHOTCRETE CHANNEL CAPACITY ANALYSIS

Manning Formula:

Circular Channel

Input

Depth	0.5 ft
Slope	0.021 ft/ft
Manning's n	0.013
Diameter	36 in

Output

Flow	5.84 cfs
Flow Area	0.774 sf
Velocity	7.54 fps
Velocity Head	0.883 ft
Top Width	2.24 ft
Froude Number	2.28
Critical Depth	0.758 ft
Critical Slope	0.00391 ft/ft

AHYMO SUMMARY RESULTS

```
                                                    SF6.SUM
AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) -                    - VERSION:  1997.02c      RUN DATE (MON/DAY/YR) =03/23/2008
INPUT FILE = SF6.hym                                                                  USER NO.= AHYMO-C-9803C01UNMLIB-AH

                                FROM  TO                    PEAK      RUNOFF                TIME TO   CFS      PAGE =   1
                HYDROGRAPH      ID    ID        AREA        DISCHARGE VOLUME    RUNOFF      PEAK      PER
COMMAND         IDENTIFICATION  NO.   NO.     (SQ MI)       (CFS)     (AC-FT)   (INCHES)    (HOURS)   ACRE      NOTATION

*S*             PROJECT NAME: Sandia Foundation, San Mateo Tract C
*S*             JOB NO.
*S*             DATE: June 2015
*S*
*S*
RAINFALL  TYPE= 2                                                                                 RAIN24=   2.750
*SEDIMENT BULK          CODE=1  FACTOR=1.06
*S**** COMPUTE BASIN-Sub 1 - Golden Corral
COMPUTE NM HYD          GC      -     1       .00321      9.37      .420      2.44760   1.500     4.557 PER IMP=  95.00
*S**** COMPUTE BASIN-Sub 2 - Davita
COMPUTE NM HYD          DAVITA  -     2       .00163      4.49      .193      2.21888   1.500     4.294 PER IMP=  80.00
*S**** COMPUTE BASIN-Sub 3 - Sandia Foundation Tract C
COMPUTE NM HYD          TRCT    -     3       .00413     10.97      .468      2.12187   1.500     4.147 PER IMP=  75.00
ADD HYD                 1.20    1& 2  4       .00485     13.86      .613      2.37039   1.500     4.469
ADD HYD                 3.40    3& 4  5       .00898     24.83     1.080      2.25600   1.500     4.321
*S Water Quality Pond and Storage
ROUTE RESERVOIR         SO1.00  5     6       .00898      9.84     1.004      2.09718   1.750     1.712 AC-FT=     .352
FINISH
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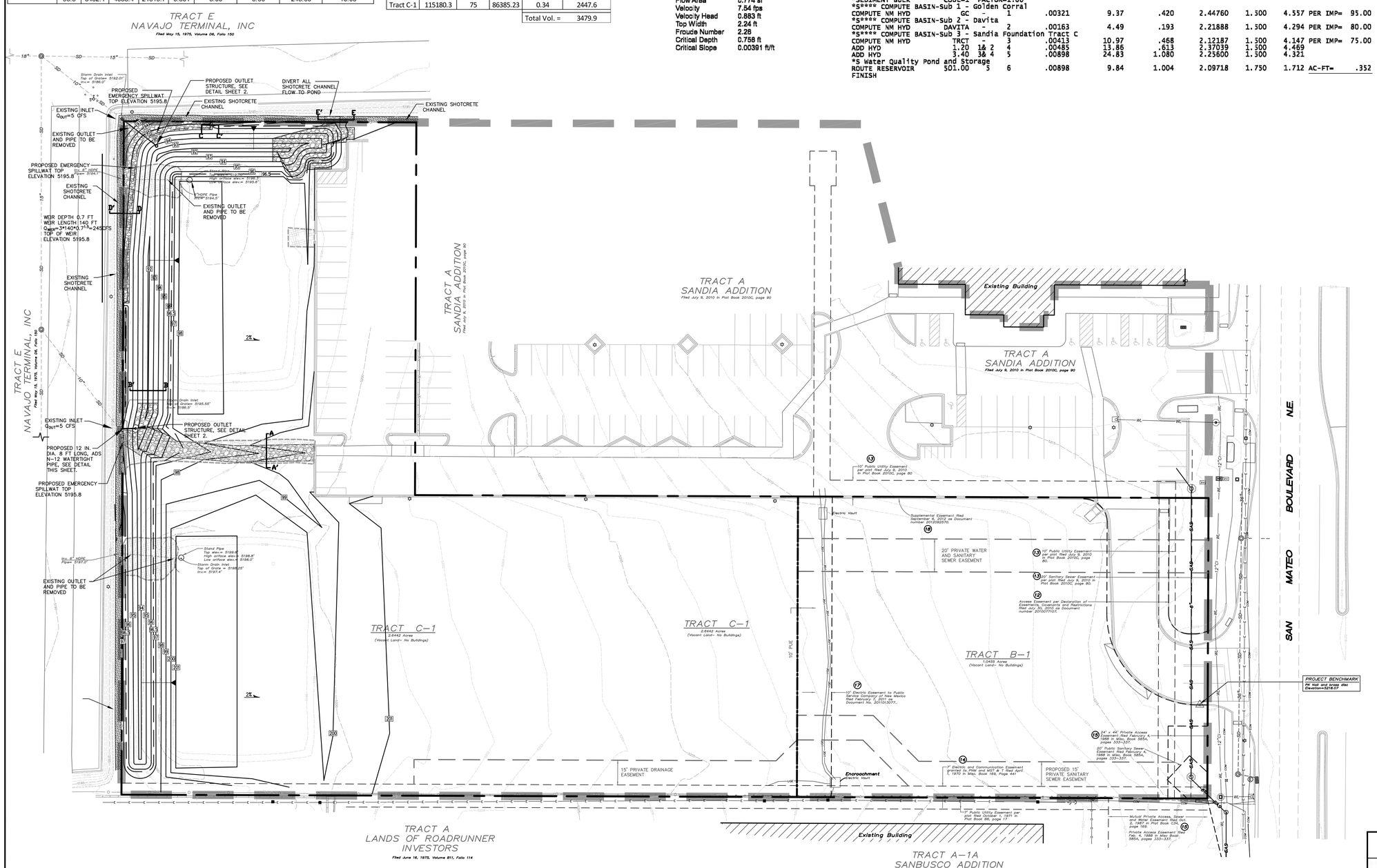
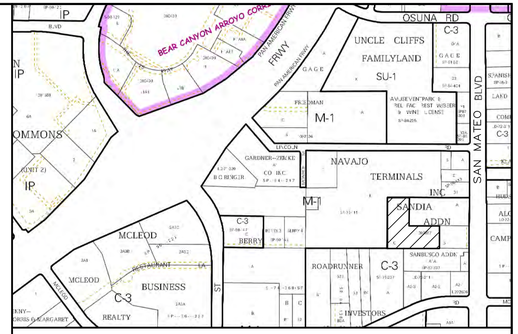
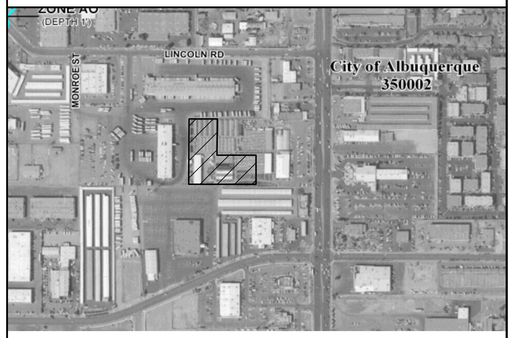




VICINITY MAP: F-17-Z



FIRM MAP: 35001C0139G

LEGAL DESCRIPTION:

TRACTS A, B-1, AND C-1
SANDIA ADDITION
CITY OF ALBUQUERQUE
BERNALILLO COUNTY, NEW MEXICO

LEGEND

- PROPERTY BOUNDARY
- SUBBASIN BOUNDARY
- MAJOR CONTOURS PER SURV-TEK SURVEY 2015
- MINOR CONTOURS PER SURV-TEK SURVEY 2015
- PROPOSED POND CONTOURS

GRAPHIC SCALE

30 0 15 30 60 120

(IN FEET)
1 inch = 30 ft.

ENGINEER'S SEAL

HUGH W. FLOYD
NEW MEXICO
16633
LICENSED PROFESSIONAL ENGINEER

HUGH W. FLOYD
P.E. 16633

TRACTS A, B-1, AND C-1
SANDIA ADDITION

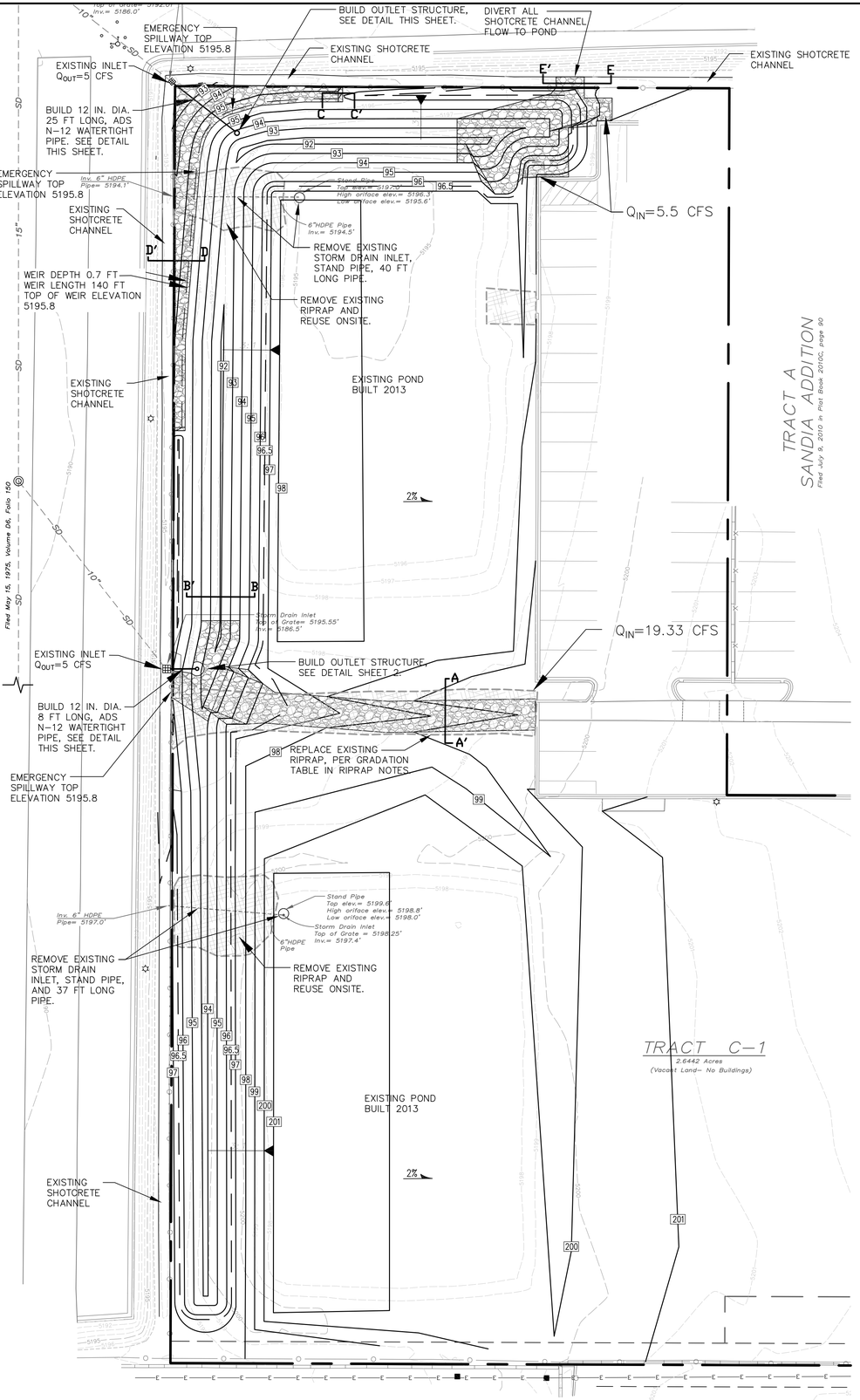
EXHIBIT 1
DRAINAGE PLAN

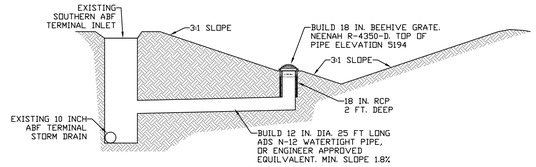
FLOYD DEVELOPMENT SERVICES, LLC
DEVELOPMENT, ENGINEERING, & WATERSHED CONSULTING
918 PINEHURST RD SE, SUITE 102
RIO RANCHO, NM 87124
HUGH@DEVELOPNM.COM
505-366-4187

DRAWN BY SMT
DATE 07-28-15
SF-SanMateo(1).dwg
SHEET # 1 of 2
JOB # 013-15-300

Sandia Foundation
San Mateo Site

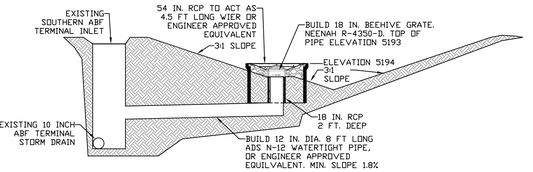
Sheet 2 of Exhibit 1





NORTHERN OUTLET STRUCTURE

NTS



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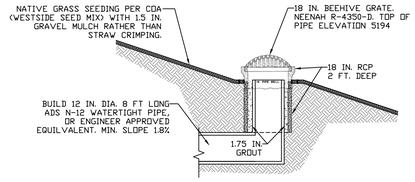

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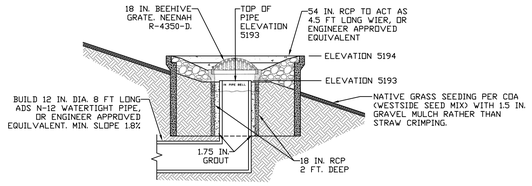

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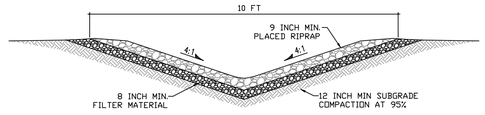
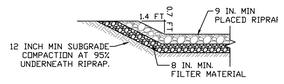


MIDWAY RUNDOWN CROSS SECTION A'-A

NTS

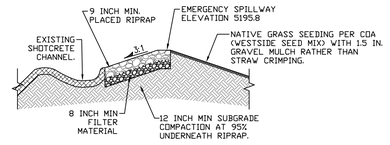
POND CROSS SECTION B'-B

NTS



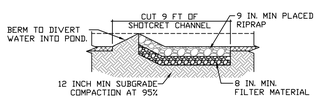
SPILLWAY CROSS SECTION C'-C

NTS



SPILLWAY CROSS SECTION D'-D

NTS



BERM CROSS SECTION E'-E

NTS

RIPRAP NOTES:

ALL RIP-RAP SHALL CONSIST OF 9" OF RIP-RAP OVER 8" OF FILTER MATERIAL.

RIP-RAP

RIP-RAP SHALL CONSIST OF CRUSHED ROCK MEETING THE FOLLOWING GRADATION, OR ENGINEER APPROVED EQUIVALENT.

MAX. DIMENSION	% SMALLER
12"	100
9"	50-60
6"	30-45
3"	10

FILTER MATERIAL

FILTER MATERIAL SHALL CONSIST OF CRUSHED BASALT ROCK MEETING THE FOLLOWING GRADATION, OR ENGINEER APPROVED EQUIVALENT.

U.S. STANDARD SIEVE SIZE	PASSING BY WEIGHT
1"	100
1/2"	45-65
#4	25-45
#40	0-20
#200	0-5

FILTER MATERIAL SHALL BE PLACED UNDER THE RIP-RAP CHANNEL PAVEMENT AS SHOWN HEREON. THE SUBGRADES SHALL BE PROCESSED TO A 12" MIN. DEPTH AND COMPACTED TO 95% MIN. RELATIVE DENSITY PER ASTM D 1557. THE FILTER MATERIAL SHALL BE TAMPED AND SHAPED TO FORM A SMOOTH, EVEN, AND FIRM FOUNDATION FOR THE OVERLYING RIP-RAP. THE CONTRACTOR'S OPERATIONS AND METHODS OF PLACING SHALL PREVENT SEGREGATION OF THE MATERIALS. THE FILTER MATERIAL SHALL BE PLACED AND TAMPED IN THE VOIDS OF THE RIP-RAP.

RIPRAP CROSS SECTION

NTS

LEGEND

- PROPERTY BOUNDARY
- 5820 MAJOR CONTOURS PER SURV-TEK SURVEY 2015
- 5821 MINOR CONTOURS PER SURV-TEK SURVEY 2015
- 96 PROPOSED POND CONTOURS

N

GRAPHIC SCALE

20 0 10 20 40 80

(IN FEET)
1 inch = 20 ft.

ENGINEER'S SEAL

HUGH W. FLOYD NEW MEXICO 16633 PROFESSIONAL ENGINEER

HUGH W. FLOYD
P.E. 16633

TRACTS A, B-1, AND C-1 SANDIA ADDITION

EXHIBIT 1
GRADING PLAN

FLOYD DEVELOPMENT SERVICES, LLC
DEVELOPMENT, ENGINEERING, & WATERSHED CONSULTING
918 PINEHURST RD SE, SUITE 102
RIO RANCHO, NM 87124
HUGH@DEVELOPNM.COM
505-366-4187

DRAWN BY SMT
DATE 08-18-15
SF-SanMateo(1).dwg
SHEET # 2 of 2
JOB # 013-15-300

Appendix A

Background Reports

Appendix A.1

Davita's Del Norte Dialysis Center Drainage Report

See DVD

Appendix A.2

Navajo Freight Lines Terminals Drainage Study

A DRAINAGE STUDY

OF

NAVAJO FREIGHT LINES' TERMINAL SITE

AT

SAN MATEO AND LINCOLN ROAD, N. E.
ALBUQUERQUE, NEW MEXICO

Kruger, Lake and Associates
Architects and Engineers
601 San Pedro Dr. NE.
Albuquerque, New Mexico 87108

Tel: 505 / 265-8452. -53

December 29, 1973
(Revised January 29, 1974)

I N D E X

A DRAINAGE STUDY

NAVAJO FREIGHT LINES TERMINAL SITE
San Mateo and Lincoln Road, N. E.
Albuquerque, New Mexico

A. GENERAL INFORMATION

1. Legal Description: See Legal description on Plot Plan, (Exhibit "A").

2. Location: The area concerned in this study is bordered on the east by San Mateo Blvd. NE. and on the north by Lincoln Rd. NE.

3. Contributing Drainage Areas: Approximately 43 acres between San Pedro Dr., NE. and San Mateo Blvd., NE., contribute to the run-off through the subject property as indicated on the attached topo map, (Exhibit "B").

4. Arroyos: A small arroyo flows through the site covered by this study.

5. San Mateo Diversion Storm Sewer: The City of Albuquerque has designed a storm sewer along the west right-of-way of San Mateo to divert the arroyo flowing through this land to Bear Canyon Arroyo. This sewer will be constructed under the Cities Block-to-Block Contract. Navajo Freight Lines, Inc., is participating in the cost of this storm sewer.

B. RUNOFF FORMULA

Runoff quantities are calculated by the rational formula - $Q = C \cdot I \cdot A$.

1. Coefficients (C):

a.	Roofs	.95
b.	Paved Areas	.90
c.	Developed Residential Areas	.65
d.	Nursery Areas	.60
e.	Drive-In Theater (Paved and Gravel)	.80
f.	Undeveloped Areas	.30

2. Intensity of Rainfall: (I = 5.4"/hr.)
Assume 10 minutes duration $i = \frac{189}{t + 25} = \frac{189}{10+25} = 5.4$"/hour.

i = 5.4 in./hr

C. RUNOFF CALCULATIONS - See Sheets 3 and 4.

D. RUNOFF CALCULATIONS AFTER CONSTRUCTION are based on Project Site Plans - See Exhibit "A".

E. RUNOFF CALCULATIONS PRIOR TO CONSTRUCTION are based on a preliminary area topographical map prepared by Bohannan, Westman, Huston (See Exhibit "B").

F. CONCLUSIONS

1. The quantity of runoff flow in the arroyo at Point "B", the low point at the west end of the property has been reduced from 196.2 c.f.s., prior to construction, to 84.5 c.f.s. after construction is completed.

2. The quantity of flow on to Lincoln Road has been increased by only a fraction (.70 c.f.s.). When curb and gutter has been installed on San Mateo and a water stop constructed at San Mateo and Lincoln, the total flow in Lincoln Road will be less than at present.

3. We feel that all requirements of the 1972-2 AMAFCA Drainage Resolution have been met by our design.

N. J. Kruger, President
KRUGER, LAKE and ASSOCIATES
Architects and Engineers

REGISTERED PROFESSIONAL ARCHITECTURAL ENGINEER
N. J. KRUGER
NO.
804
STATE OF NEW MEXICO

RUN OFF CALCULATIONS 12-15-78 MJE

A. FLOW IN ARROYO PRIOR TO CONSTRUCTION D.C.L.A.

1. AT POINT "A" (OUTLET OF CULVERT)

WATER STORED AT ALL INTERSECTIONS ON SAN PEDRO.

AREA OF WATER SHED BETWEEN SAN PEDRO & SAN MATEO (EXHIBIT 'B')

FROM PRELIMINARY TOPO MAP BY BOHANNAN-HUSTON

① DWELL	900 x 1000 = 900,000 / 43,560 =	20.6 A	C = .65	
② DWELL-IN	700 x 950 =	15.25 A	C = .80	
③ NON-IMPROVED	400 x 800	7.3 A	C = .50	

$Q_{100} = 20.6 \times .65 \times 5.4 = 72.8$ c.f.s.

$Q_{25} = 15.25 \times .80 \times 5.4 = 66.0$ ✓

$Q_{5} = 7.3 \times .50 \times 5.4 = 17.0$ ✓

TOTAL FLOW AT "A" = 156.0 c.f.s.

2. FLOW AT POINT "B" SEE EXHIBIT 'B'

① NURSERY	700 x 400	6.43 A	C = .60	
② UNIMPROVED	340 x 370	2.88		
③ "	320 x 340	2.20		
④ "	300 x 450	2.98	12.34	C = .50
⑤ "	280 x 450	2.18		
⑥ "	250 x 400	2.10		
⑦ STREET	450 x 100	1.05 A		C = .90

FROM CULVERT PT "A" 1540 c.f.s.

$Q_4 = 6.43 \times .60 \times 5.4 = 21.0$ ✓

$Q_{5-6} = 12.34 \times .50 \times 5.4 = 30.2$ ✓

$Q_{10} = 1.05 \times .90 \times 5.4 = 5.0$ ✓

TOTAL FLOW AT PT "B" = 196.2 c.f.s.

TOTAL FLOW IN ARROYO PRIOR TO CONSTRUCTION

B. ANTICIPATED FLOW IN ARROYO AFTER CONSTRUCTION

1. ALL FLOW AT POINT "A" IS TO BE DIVERTED TO BEAR CANYON VIA NEW STORM SEWER ALONG SAN MATEO BY CITY OF ALBUQUERQUE

2. FLOW AT POINT "B". SB

① NURSERY	700 x 400	= 6.43 A.	C = .60	
② PAVED AREA	125 x 373	46,600		
③ " "	250 x 178	50,000		
" "	140 x 225	31,500		
" "	140 x 200	28,000		
④ " "	150 x 600	90,000	10.62 A	C = .90
⑤ " "	80 x 50	4000		
⑥ " "	450 x 306	137,700		
" "	350 x 60	21,000		
" "	280 x 75	21,000		
" "	170 x 36	6100		
" "	50 x 70	3500		
⑦ " "	100 x 77	7700		
⑧ NON-IMPROVED	500 x 380	190000	2.85 A	C = .50
⑨ " "	100 x 100	10000		
⑩ ROOF	80 x 240	19200	1.54 A	C = .90
⑪ "	90 x 400	36000		

Exhibit A of this drainage study shows this circled 1 in the same location as the old garden nursery.

89.50 cfs

21 cfs of the 89.5 cfs that goes into the Navajo Terminals storm drain system allowed to come from the garden nursery.

RUNOFF CALCULATIONS

$Q_1 = ciA = 0.6(5.4)(6.4) = 20.74$ cfs

21.0 cfs.

51.0 ✓

4.6 ✓

7.9 ✓

84.5

TOTAL AVAILABLE FLOW AT B = 84.52 cfs < 196.2 O.K.

C. FLOW ONTO LINCOLN, PRIOR TO CONSTRUCTION

⑤ UNIMPROVED 220 x 400 = 88,000 — 2.02 Ac. C = .30

⑥ 150 x 40 = 6,000
200 x 100 = 20,000
60 x 410 = 24,600

⑦ PAVED AREA 30 x 1250 = 37,500 = 1.55 Ac. C = .90

⑧ ROOF 10 x 10 x 4 = 4,000 = .464 Ac. C = .95

Q_{10} = 2.02 x .30 x 5.4 = 6.2

Q_6 = 1.55 x .90 x 5.4 = 7.5

Q_8 = .464 x .95 x 5.4 = 2.4

TOTAL FLOW ON TO LINCOLN = 16.6 cfs.

D. FLOW TO LINCOLN AFTER CONSTRUCTION

Ⓐ ROOF .464 A.

Ⓑ PAVED AREA 1.55 A.

Ⓒ " " 50 x 210 }
Ⓓ " " 280 x 45 } ROAD
" " 30 x 110 }

Ⓔ ROOF GOOD SE .178 A.

Ⓕ PAVED, 20 x 550 .16.4

Ⓖ LAWN 30 x 350 .242 A.

Q_6 = 2.4

Q_5 = 8.0

Q_{10} = .90 x .40 x 5.4 = 4.8

Q_E = .178 x .95 x 5.4 = .9

Q_F = .164 x .90 x 5.4 = .8

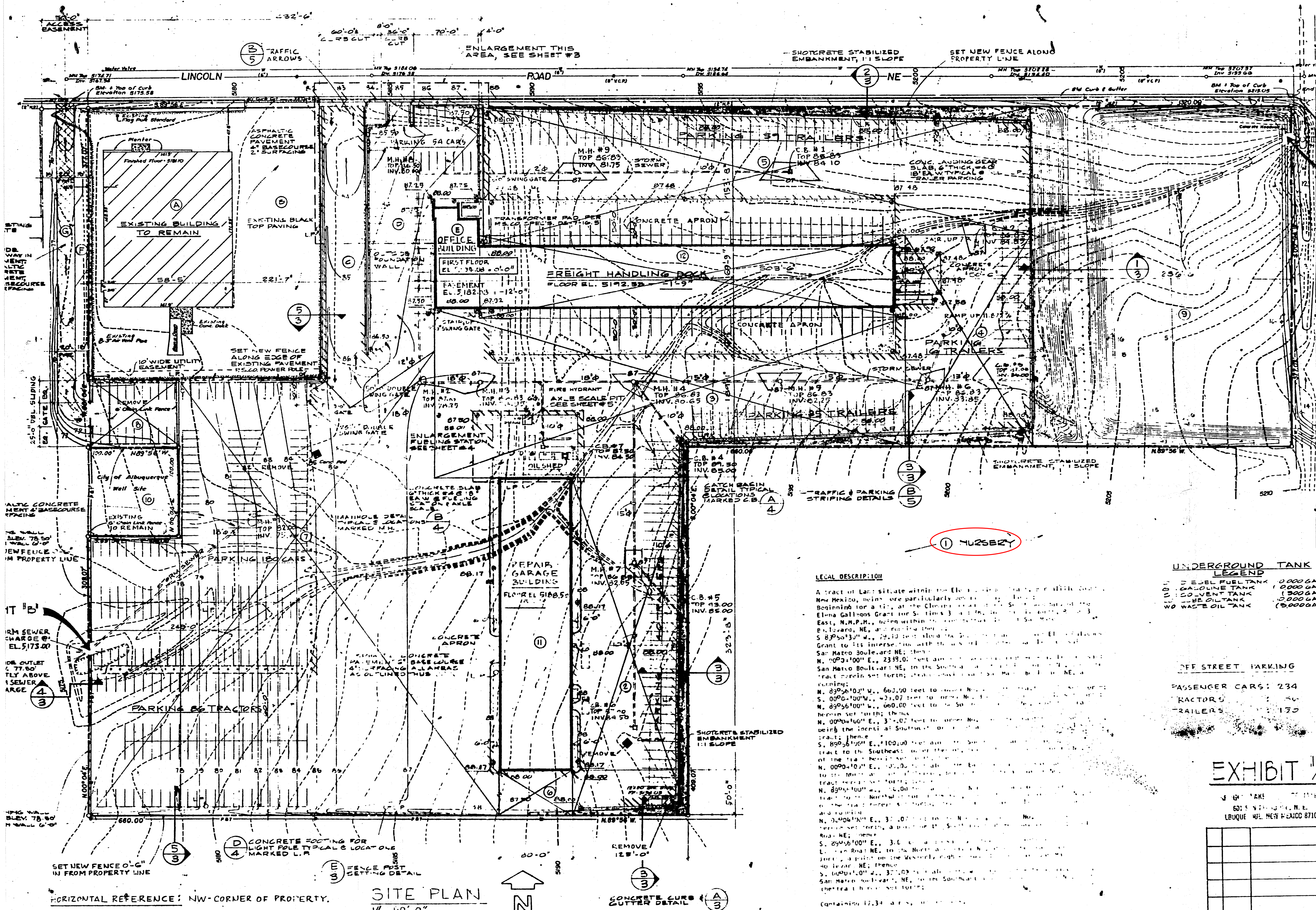
Q_G = .242 x .30 x 5.4 = .4

TOTAL FLOW ONTO LINCOLN = 17.3 CFS > 16.6 by .70 cfs. OK

REVISED: 1-29-94

Navajo Freight LinesTerminals Drainage Study

Plan SheetExhibit A



LINCOLN ROAD NE
SAN MATEO BOULEVARD
ACCESS EASEMENT
ENLARGEMENT THIS AREA, SEE SHEET #3
SHOTCRETE STABILIZED EMBANKMENT, 1:1 SLOPE
SET NEW FENCE ALONG PROPERTY LINE
TRAFFIC ARROWS
EXISTING BUILDING TO REMAIN
EXISTING BLACK TOP PAVING
ASPHALTIC CONCRETE PAVEMENT 4" BASECOURSE 2" SURFACING
SET NEW FENCE ALONG EDGE OF EXISTING PAVEMENT
10' WIDE UTILITY EASEMENT
PARKING 54 CARS
OFFICE BUILDING
FIRST FLOOR EL 5,194.08 = 0'-0"
BASEMENT EL. 5,182.08 = -12'-0"
FREIGHT HANDLING DOCK
FLOOR EL. 5192.33 = -1'-9"
PARKING 59 TRAILERS
CONCRETE APRON
PARKING 16 TRAILERS
PARKING 25 TRAILERS
CONC. LANDING GEAR SLAB, 6" THICK #4 @ 18" EA. W. TYPICAL @ ALL TRAILER PARKING
TRANSFORMER PAD PER P.S.CO. SPEC'S.
FIRE HYDRANT
AXLE SCALE PIT SEE SHEET #5
ENLARGEMENT FUELING STATION SEE SHEET #4
OIL SHED
City of Albuquerque Well Site
PARKING 180 CARS
PARKING 86 TRACTORS
REPAIR GARAGE BUILDING
FLOOR EL 5188.50
CONCRETE APRON
CATCH BASIN DETAIL TYPICAL @ LOCATIONS MARKED C.B.
MANHOLE DETAIL TYPICAL @ LOCATIONS MARKED M.H.
TRAFFIC & PARKING STRIPING DETAILS
CONCRETE FOOTING FOR LIGHT POLE TYPICAL @ LOCATIONS MARKED L.P.
FENCE POST SETTING DETAIL
CONCRETE CURB & GUTTER DETAIL
SET NEW FENCE 0'-6" IN FROM PROPERTY LINE
NEW MANHOLE AND 4'Ø STORM SEWER NORTH TO BEAR CAÑON BY CITY OF ALBUQUERQUE.
POINT 'A'
STORM SEWER DISCHARGE @ EL. 5,173.00
REMOVE 125'-0"
1 NURSERY
SITE PLAN
1" = 50'-0"
N

HORIZONTAL REFERENCE: NW-CORNER OF PROPERTY.

VERTICAL REFERENCE: BM + TOP OF CURB ELEV. 5,175.58' NORTH OF NW-CORNER OF PROPERTY.

DATUM FOR ALL BUILDINGS: FIRST FLOOR OF OFFICE B'LDG. EL. 0'-0"

LEGAL DESCRIPTION

A tract of Land situate within the Elena Gallegos Grant [illegible] New Mexico, being more particularly described [illegible]
Beginning for a tie, at the Closing corner [illegible] Elena Gallegos Grant for Sections 3 [illegible] East, N.M.P.M., being within [illegible] San Mateo Boulevard, NE, and running thence S 89°56'30" W., 79.10 feet along the [illegible] Grant to its intersection with the [illegible] San Mateo Boulevard NE; thence N. 00°04'00" E., 2339.0[illegible] feet along [illegible] San Mateo Boulevard NE, to the Southeast [illegible] tract herein set forth; [illegible] San Mateo Boulevard NE, and running:
N. 89°56'00" W., 660.00 feet to [illegible]
S. 00°04'00" W., 409.07 feet to [illegible]
N. 89°56'00" W., 660.00 feet to the Southwest [illegible] herein set forth; thence
N. 00°04'00" E., 3[illegible].07 feet to corner No. [illegible] being the identical Southwest [illegible] tract; thence
S. 89°56'00" E., 100.00 feet along [illegible] tract to the Southeast corner of [illegible] of the tract herein set forth; thence
N. 00°04'00" E., [illegible] to the North [illegible] tract herein set forth; [illegible]
N. 89°56'00" W., [illegible] tract to the Northwest corner [illegible] of the tract herein set forth [illegible] and running
N. 00°04'00" E., 3[illegible] to [illegible] No. [illegible] herein set forth, a point on the South [illegible] Road NE; thence
S. 89°56'00" E., 3[illegible] along [illegible] Lincoln Road NE, to the North[illegible] forth, a point on the Westerly right [illegible] Boulevard NE; thence
S. 00°04'00" W., 3[illegible] along [illegible] San Mateo Boulevard, NE, to the Southeast [illegible] the tract herein set forth;

Containing 17.34 acres, [illegible]

UNDERGROUND TANK LEGEND

D	DIESEL FUEL TANK	(10,000 GALS.)
G	GASOLINE TANK	(10,000 GALS.)
S	SOLVENT TANK	(500 GALS.)
LO	LUBE OIL TANK	(10,000 GALS.)
WO	WASTE OIL TANK	(5,000 GALS.)

OFF STREET PARKING

PASSENGER CARS:	234
TRACTORS:	86
TRAILERS:	120

F17/D17

EXHIBIT "A"

[illegible] TRUCKING [illegible]
601 [illegible] N.E.
ALBUQUERQUE, NEW MEXICO 87108

REVISED: 1-28-74
COMM. NO 7312
DATE: 12-31-73

NO	DATE	DESCRIPTION	BY	CKD
		REVISIONS		

For Information Only

Z00436

Appendix A.3

Isaacson and Arfman Engineer's Report

Isaacson & Arfman, P.A. Consulting Engineering Associates

Thomas O. Isaacson, PE & LS • Fred C. Arfman, PE • Åsa Nilsson-Weber, PE

ENGINEER'S REPORT

Project: Sandia Foundation; San Mateo - Rowlands Tract Sept. 24, 2013

Owner: Sandia Foundation

Subject: Storm Water Flooding

Major Storm Event:

On September12, 2013 Albuquerque experienced the start of a three-day major storm event where 3.65 inches of rain fell in the approximate area of the subject Sandia Foundation (SF) site. This event was preceded by a rain on Sept 10th which dropped 1.04 inches of rain thereby saturating the soil at the site (Photo #1). A total rainfall amount of 5.07 inches was measured at the Albuquerque Weather Services Station located at Montgomery Blvd. and San Mateo Blvd. for this time period.

Site Visit (09-12-13):

Karen Hudson (SF representative) contacted Fred Arfman (FA) with Isaacson & Arfman PA to perform a site visit to assess the condition of the existing storm water containment berms as a follow up to a meeting with Zack Lacombe, Manager of the ABF Freight Lines Terminal, the property west of the SF site. The following observations and actions were undertaken:

- FA arrived on site at approximately 10:45 AM and located Zack and Payam Ghoreishi (PG), an earthwork contractor, observing the storm waters from the Golden Corral and the undeveloped SF property entering into the three existing makeshift ponds between the SF property and ABF.
- The ponds were partially full from the earlier rains and were reaching full capacity from the morning rains.
- Zack was very concerned that the ponds would fail causing the stored rainwater to flow onto the ABF site forcing him to close down the terminal's shops and effectively crippling the terminals productivity.
- PG called his office to get his personnel to the site to immediately begin work on reinforcing the makeshift berms. At this time Zack left the site. Laborers with shovels

arrived approximately 30 minutes later. It was before noon and the rains had started to let up after a storm duration of two hours.

- The ponds storm water levels reached the top of the berms and the interior berm between the middle pond and the north pond breached causing the water level in the north pond to rise (Photo #3). Payam and his laborers were directed to the pending breach point to reinforce the low point in the berm (Photo #2), now equal to the water level.

- PG and his laborers were then directed to the south end of the west berm of the middle pond. A controlled overflow outlet was excavated (Photo #5) to allow the captured storm waters to safely discharge into the ABF drainage rundown along the westerly property line of the SF property. Since the middle and north ponds were now connected, this outlet slowly relieved the pressure on both ponds.

- As soon as the outlet was conveying storm waters, it was noticed that the north berm of the southerly pond was breaching. Immediately, all those present worked to stop the breach by reconstructing the berm and placing rock from the adjacent rundown on the berm to fill in the breach. The breach was plugged (Photo #7).

- A backhoe from PG Enterprises arrived to fortify all of the areas that were compromised and then to stabilize the entire berm system (Photo #4).

- Two large capacity mobile pumps were placed at the NE corner of the north berm to drain the storm waters directly into the storm drain inlet on the ABF property (Photo #6).

Site Monitoring (09-13-13 through 09-16-13):

- The property was monitored by the personnel of PG Enterprises through the night and over the next four days (Photo #8).

- The ponds were continually drained of the captured storm waters and the berms inspected and maintained.

Conclusion:

- None of the ponded storm waters from the Sandia Foundation property entered onto the ABF facility other than at the drainage rundown and storm drain inlets constructed for this purpose.

- The ponds were continually drained from additional rains in order to keep the berms and the underlying earth from becoming overly saturated and prone for collapsing. As of 09-24-13, the areas are still too saturated to allow for reconstruction.

1: SEPTEMBER 10 - PRESTORM CONDITIONS

2: SEPTEMBER 12 - MANUAL FORTIFICATION OF BERMS

3: BREACH OF MIDDLE POND

4: FORTIFICATION OF BERMS – SOUTH POND

5: HAND EXCAVATED CONTROLLED RELEASE OUTLET

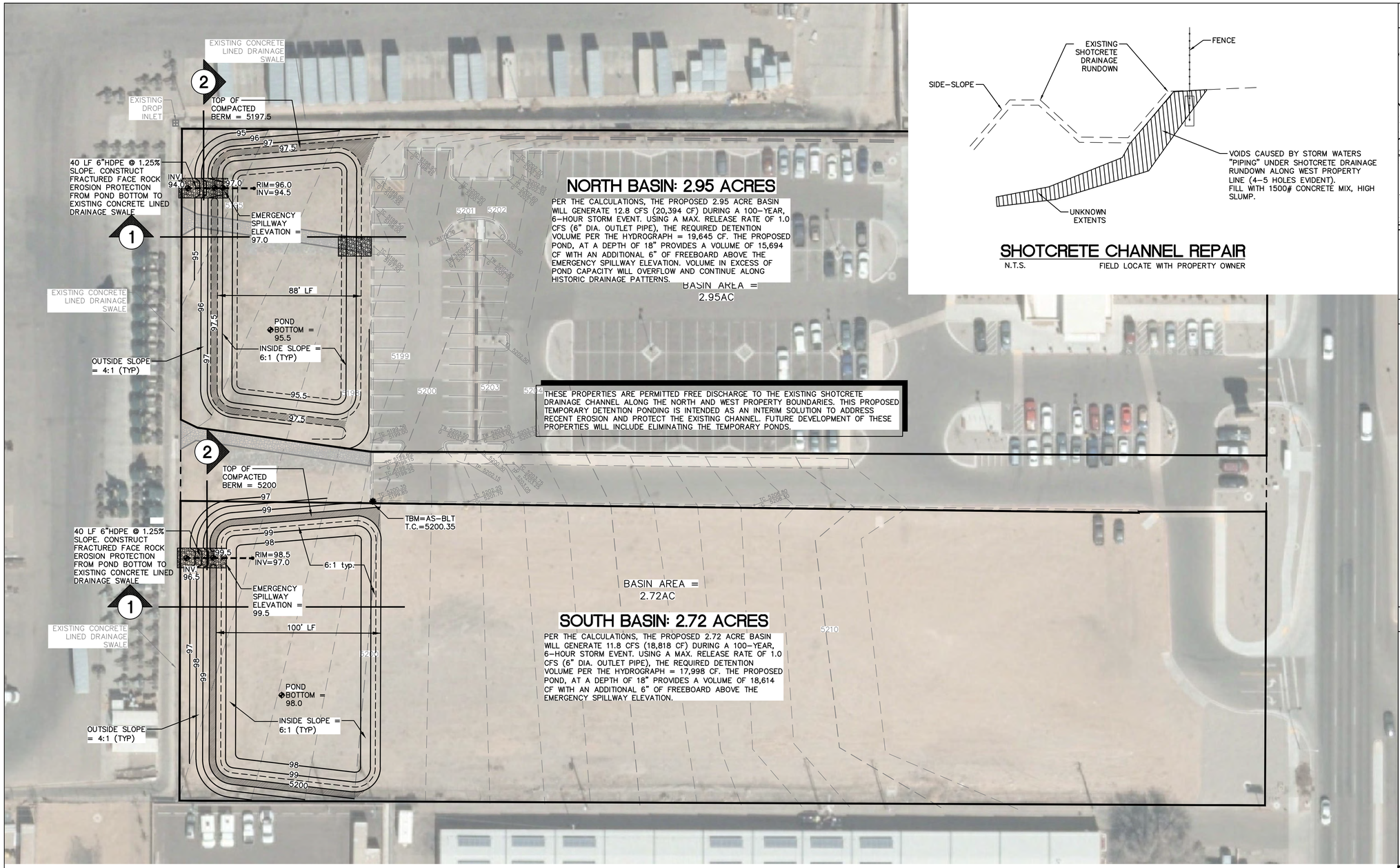
6: PUMP DISCHARGE TO EXISTING ABF INLET

7: SOUTH POND OVERFLOW TO EXISTING RUNDOWN

8: POST STORM WATER LEVEL WITH PUMPING

Isaacson And Arfman
Engineer's Report

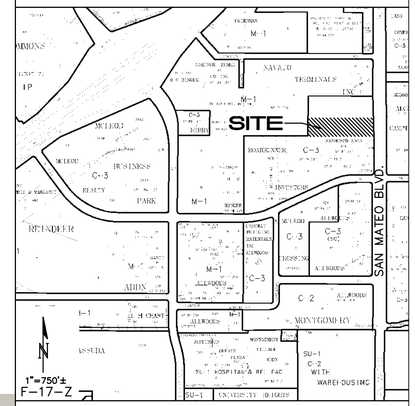
Temporary Detention
Plan Sheet



SHOTCRETE CHANNEL REPAIR

N.T.S. FIELD LOCATE WITH PROPERTY OWNER

VICINITY MAP



PROJECT DATA

LEGAL DESCRIPTION: TRACTS A, B AND C, SANDIA ADDITION, ALBUQUERQUE, BERNALILLO COUNTY, NM

ADDRESS: 5207 SAN MATEO BLVD. 87108

SITE AREA: 6.0± ACRES

FLOOD ZONE: PER BERNALILLO COUNTY FIRM MAP #35001C0139G, THE SITE IS LOCATED WITHIN FLOODZONE 'X' DESIGNATED AS AREAS DETERMINED TO BE OUTSIDE 500-YEAR FLOODPLAIN.

ENGINEER: FRED C. ARFMAN, PE
ISAACSON & ARFMAN, P.A.
128 MONROE ST NE, ABQ. NM 87108
PHONE: (505) 268-8828

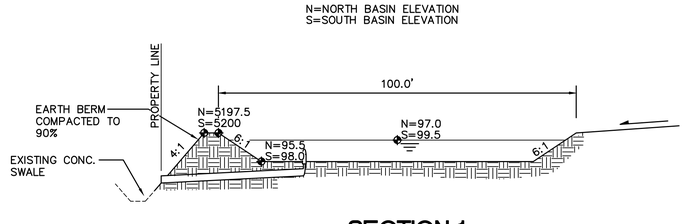
BENCHMARK: BASED ON THE DRAINAGE & GRADING PLAN SUBMITTED FOR GOLDEN CORRAL RESTAURANT STAMP DATE 6-1-10 WHICH WAS USED TO MASS GRADE THIS PROPERTY, BENCHMARK USED WAS NM 367-1, A BRASS TABLET STAMPED "NM-367-1" SET IN TOP OF A CONCRETE POST FLUSH WITH THE GROUND LOCATED IN THE NORTH SAN MATEO MEDIAN AT THE INTERSECTION WITH OSUNA RD. ELEVATION = 5213.212 (NAVD 1988)

GENERAL NOTES

A. FINAL GRADES SHOWN REPRESENT TOP OF FINISH MATERIAL (I.E. TOP OF CONCRETE, TOP OF CONCRETE BUILDING PAD, TOP OF PAVEMENT MATERIAL, TOP OF LANDSCAPING MATERIAL, ETC.). CONTRACTOR SHALL GRADE, COMPACT SUBGRADE AND DETERMINE EARTHWORK ESTIMATES BASED ON ELEVATIONS SHOWN MINUS FINISH MATERIAL THICKNESSES.

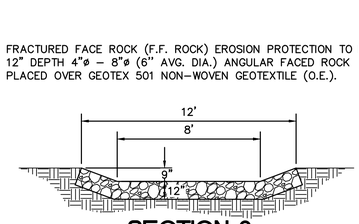
B. EXISTING UTILITY LINES ARE SHOWN IN AN APPROXIMATE MANNER ONLY AND MAY BE INCOMPLETE OR OBSOLETE. SUCH LINES MAY OR MAY NOT EXIST WHERE SHOWN OR NOT SHOWN. CONTRACTOR SHALL CONTACT NM-811 FOR UTILITY LINE SPOTS TWO WORKING DAYS PRIOR TO CONDUCTING SITE FIELD WORK. CONTRACTOR SHALL FIELD VERIFY AND LOCATE ALL UTILITIES PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION. CONTRACTOR IS FULLY RESPONSIBLE FOR ANY AND ALL DAMAGE CAUSED BY ITS FAILURE TO LOCATE, IDENTIFY AND PRESERVE ANY AND ALL EXISTING UTILITIES, PIPELINES, AND UNDERGROUND UTILITY LINES.

C. ENGINEER RECOMMENDS THAT OWNER MAINTAIN EROSION PROTECTION ELEMENTS. ENGINEER RECOMMENDS THAT OWNER INSPECT SITE YEARLY AND AFTER EACH RAINFALL TO IDENTIFY NEW AREAS OF EROSION AND INSTALL ADDITIONAL EROSION PROTECTION AS NEEDED BASED ON ACTUAL OCCURRENCES.



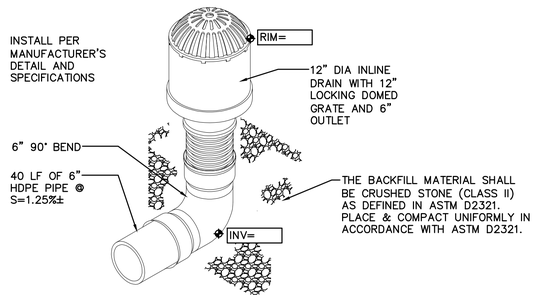
SECTION 1

N.T.S.

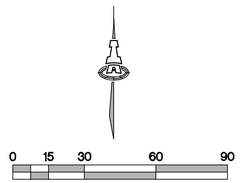


SECTION 2

N.T.S.



NYLOPLAST INLINE DRAIN WITH DOME GRATE



ISAACSON & ARFMAN, P.A.
Consulting Engineering Associates
128 Monroe Street N.E.
Albuquerque, New Mexico 87108
Ph. 505-268-8828 www.iacivil.com

1895 CG-101.dwg Aug 28,2013

5207 SAN MATEO ALBUQUERQUE, NM

SANDIA FOUNDATION

TEMPORARY DETENTION

Date:	No.	Revision	Date	Job No.
08-27-13				1985
Drawn By: BJB				CG-101
Ckd By: FCA				SH. OF

M:\CAD FILES\1800-1899\1895\dwgs\1895 CG-101.dwg, Layout1, 8/29/2013 9:03:45 AM

Appendix B

Hydrology

Sandia Foundation
San Mateo Site

AHYMO Input File

```
*S*     PROJECT NAME: Sandia Foundation, San Mateo Tract C
*S*     JOB NO.
*S*     DATE: June 2015
*S*
*S*     INPUT FILE NAME: SF-SanMateo.hym
*S*     OUTPUT FILE NAME: SF-SanMateo.out
*S*     FILES LOCATION: 56-07-02 Floyd Development Services\Active Projects\ENG\AHYMO\SF-SanMateo
*S*
*S*
*S*
*S*
*******************************************************************************
*s*
*****************************************************
*
*
*       100 year storm event
RAINFALL             TYPE=2  RAIN QUARTER=0.0  RAIN ONE=2.01
                     RAIN SIX=2.35   RAIN DAY=2.75   DT=.05
*
*SEDIMENT BULK         CODE=1  FACTOR=1.06
*
*
*
*S**** COMPUTE BASIN-Sub 1 - Golden Corral
COMPUTE NM HYD       ID=1 HYD NO=GC DA=0.003214
                     PER A=0 PER B=0 PER C=5 PER D=95
                       TP=0.133 RAIN=-1
PRINT HYD            ID=1 CODE=10
*
*
*
*S**** COMPUTE BASIN-Sub 2 - Davita
COMPUTE NM HYD       ID=2 HYD NO=DAVITA DA=0.001634
                     PER A=0 PER B=5 PER C=15 PER D=80
                       TP=0.133 RAIN=-1
PRINT HYD            ID=2 CODE=10
*
*
*S**** COMPUTE BASIN-Sub 3 - Sandia Foundation Tract C
COMPUTE NM HYD       ID=3 HYD NO=TRCT C DA=0.004132
                     PER A=0 PER B=12.5 PER C=12.5 PER D=75
                       TP=0.133 RAIN=-1
PRINT HYD            ID=3 CODE=10
*
*
*
ADD HYD              ID=4 HYD=1.2 ID I=1 ID II=2
PRINT HYD            ID=4 CODE=10
*
*
ADD HYD              ID=5 HYD=3.4 ID I=3 ID II=4
PRINT HYD            ID=5 CODE=0
*
*
*
*S Water Quality Pond and Storage
ROUTE RESERVOIR ID=6  HYD=501    INFLOW ID=5  CODE=1
                        OUTFLOW(CFS)    STORAGE(AC FT)  ELEV(FT)
                        0.0                     0.0                     5192
                        0.01                    0.022                   5193
                        0.02                    0.085                   5194
                        3.5775          0.109                   5194.25
                        7.301                   0.138                   5194.5
                        8.78                    0.207                   5195
                        9.629                   0.293                   5195.5
                        10.0                    0.396                   5196
*
*
*
FINISH
```

Sandia Foundation
San Mateo Site

AHYMO Summary File

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02c RUN DATE (MON/DAY/YR) =03/23/2008
INPUT FILE = SF6.hym USER NO.= AHYMO-C-9803c01UNMLIB-AH

COMMAND	HYDROGRAPH IDENTIFICATION	FROM ID NO.	TO ID NO.	AREA (SQ MI)	PEAK DISCHARGE (CFS)	RUNOFF VOLUME (AC-FT)	RUNOFF (INCHES)	TIME TO PEAK (HOURS)	CFS PER ACRE	NOTATION
S	PROJECT NAME: Sandia Foundation, San Mateo Tract C									
S	JOB NO.									
S	DATE: June 2015									
S										
S	INPUT FILE NAME: SF-SanMateo.hym									
S	OUTPUT FILE NAME: SF-SanMateo.out									
S	56-07-02 Floyd Development Services\Active Projects\ENG\AHYM									
S										
S										
S										
S										
S										
S										
S										
S										
S										
RAINFALL TYPE= 2										RAIN24= 2.750
*SEDIMENT BULK	CODE=1 FACTOR=1.06									
*S**** COMPUTE BASIN-Sub 1 - Golden Corral										
COMPUTE NM HYD	GC	-	1	.00321	9.37	.420	2.44760	1.500	4.557	PER IMP= 95.00
*S**** COMPUTE BASIN-Sub 2 - Davita										
COMPUTE NM HYD	DAVITA	-	2	.00163	4.49	.193	2.21888	1.500	4.294	PER IMP= 80.00
*S**** COMPUTE BASIN-Sub 3 - Sandia Foundation Tract C										
COMPUTE NM HYD	TRCT	-	3	.00413	10.97	.468	2.12187	1.500	4.147	PER IMP= 75.00
ADD HYD	1.20	1& 2	4	.00485	13.86	.613	2.37039	1.500	4.469	
ADD HYD	3.40	3& 4	5	.00898	24.83	1.080	2.25600	1.500	4.321	
*S Water Quality Pond and Storage										
ROUTE RESERVOIR	501.00	5	6	.00898	9.84	1.004	2.09718	1.750	1.712	AC-FT= .352
FINISH										

Appendix C

Hydraulics

Sandia Foundation
San Mateo Site

Existing Downstream Capacity Analysis

Downstream Capacity

Analysis of existing ABF Terminal storm drain system

Elevations, lengths, and MH #s per Exhibit A of the Navajo Freight Lines Terminal Drainage Study revision dated 1/29/74 by Kruger, LAKE and ASSOCIATES Architects and Engineers.

The following MathCAD sheets are used to determine the downstream capacity by evaluating the hydraulic gradeline for a given flowrate. The equations used are from the City of Albuquerque Development Process Manual (DPM) Chapter 22, section 3B.

Point 1 is located at the Northern inlet, point 2 is located at MH #4

10 " diameter pipe leading from inlet to first manhole downstream

$L := 91$

$Z_1 := 5185$

$Z_2 := 5180.65$

$S_0 := \frac{(Z_1 - Z_2)}{L} = 0.048$

$Dia := 0.8333 \quad ft$

$R := \frac{Dia}{2} = 0.417 \quad ft$

$A := \pi \cdot R^2 = 0.545 \quad ft^2$

$Q := 5 \quad cfs$

$n := 0.013$

D2 represents the hydraulic gradeline at point 2. Assuming water elevation is half foot higher than top of MH #4.

$D_2 := 6.68$

$P_w := \pi \cdot \left(\frac{Dia}{2}\right) \cdot 2 = 2.618 \quad ft$

Assuming full pipe, therefor the circumference is used as the wetted perimeter

$R_h := \frac{A}{P_w} = 0.208 \quad ft$

$$S_f := \left[\frac{(Q \cdot n)}{1.486 A \cdot R_h^{\left(\frac{2}{3}\right)}}\right]^2 = 0.052$$

D1 represents the calculated difference between top of water elevation and invert. Assuming grate at northern inlet is covered to create more pressure.

$D_1 := D_2 - S_0 \cdot L + S_f \cdot L = 7.07$

Difference between top of proposed pond and invert at northern inlet = 10 ft

Sandia Foundation
San Mateo Site

Calculations for the Existing ABF Terminals Inlet Rating Curves

Calculations for ABF inlet
rating curves

Analysis for 10" outlet pipes from inlets

Existing Northern Inlet

AreaOrif := 0.5454 (ft)

C1 := 0.6 j := 0 .. 8

h :=

Elevation	h north (ft
5186	0
5187	0.5833
5188	1.5833
5189	2.5833
5190	3.5833
5191	4.5833
5192	5.5833
5193	6.5833

$Qmax := AreaOrif \cdot C1 \cdot \sqrt{2 \cdot 32.2 \cdot h}$

$$Qmax = \begin{pmatrix} 0 \\ 2.006 \\ 3.304 \\ 4.221 \\ 4.971 \\ 5.622 \\ 6.205 \\ 6.738 \end{pmatrix}$$

Existing Southern Inlet

AreaOrif := 0.5454 (ft)

C1 := 0.6 j := 0 .. 8

h1 :=

Elevation	h north (ft
5186	0
5187	0.0833
5188	1.0833
5189	2.0833
5190	3.0833
5191	4.0833
5192	5.0833
5193	6.0833

$Qmax1 := AreaOrif \cdot C1 \cdot \sqrt{2 \cdot 32.2 \cdot h1}$

$$Qmax1 = \begin{pmatrix} 0 \\ 0.758 \\ 2.733 \\ 3.79 \\ 4.611 \\ 5.307 \\ 5.921 \\ 6.477 \end{pmatrix}$$

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Calculations for the Proposed Pond Outlet Rating Curves

Calculations for proposed pond outlet rating curves

From pond to northern ABF Terminal inlet, through a 12 in. pipe

h :=

Elevation	Head (ft)
5194	0
5194.25	0.25
5194.5	0.5
5195	1
5195.5	1.5
5196	2

h1 := 1 ft
h2 := 2 ft

Weir Opening, Q=CwLH^1.5

Cw := 3
L := 7.9

$Q1 := Cw \cdot L \cdot (h1)^{1.5} = 23.7$ cfs

$Q2 := Cw \cdot L \cdot (h2)^{1.5} = 67.034$ cfs

Orifice Opening, Qorif=CA(2GH)^0.5

C := 0.6
A := 0.785

$Qorif1 := C \cdot A \cdot (2 \cdot 32.2 \cdot h1)^{0.5} = 3.78$ cfs

$Qorif2 := C \cdot A \cdot (2 \cdot 32.2 \cdot h2)^{0.5} = 5.345$ cfs

$$Qweir := Cw \cdot L \cdot (h)^{1.5} = \begin{pmatrix} 0 \\ 2.963 \\ 8.379 \\ 23.7 \\ 43.54 \\ 67.034 \end{pmatrix}$$

$$Qorif := C \cdot A \cdot (2 \cdot 32.2 \cdot h)^{0.5} = \begin{pmatrix} 0 \\ 1.89 \\ 2.673 \\ 3.78 \\ 4.629 \\ 5.345 \end{pmatrix}$$

Since the orifice equation produces smaller flowrates it is used rather than the weir equation for the 12 inch outlet pipes that lead to the ABF Terminal inlets.

Calculations for proposed
pond outlet rating curves

From pond to southern ABF Terminal inlet, through a 12 in. pipe

$$\begin{pmatrix} h_{weir} \\ h_{orifice} \end{pmatrix} :=$$

Elevation	Wier Head (ft)	Orifice Head (ft)
5194	0	1
5194.25	0.25	1.25
5194.5	0.5	1.5
5194.75	0.75	1.75
5195	1	2

Calculations for weir surrounding
southern 12 inch pipe outlet.

Weir Opening, Q=CwLH^1.5

$Cw := 3$
$L := 4.5$

Orifice Opening, Qorif=CA(2GH)^0.5

$C := 0.6$
$A := 0.785$

$$Qweir := Cw \cdot L \cdot \left(h_{weir}\right)^{1.5} = \begin{pmatrix} 0 \\ 1.6875 \\ 4.77297 \\ 8.76851 \\ 13.5 \end{pmatrix}$$

$$Qorif := C \cdot A \cdot \left(2 \cdot 32.2 \cdot h_{orifice}\right)^{0.5} = \begin{pmatrix} 3.78 \\ 4.226 \\ 4.629 \\ 5 \\ 5.345 \end{pmatrix}$$

Weir controls flowrate up until water level reaches 5194.5 ft.

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Minimum Slope Calculations for Proposed 12" Pipe

Manning Formula:

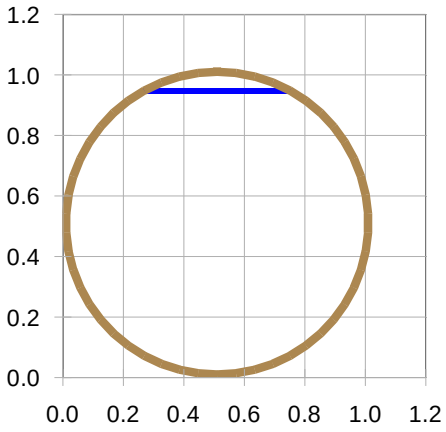
Circular Channel

Input

Flow	5 cfs
Slope	0.017022223 ft/ft
Manning's n	0.013
Diameter	12 in

Output

Depth	0.938 ft
Flow Area	0.765 sf
Velocity	6.53 fps
Velocity Head	0.664 ft
Top Width	0.482 ft
Froude Number	0.915
Critical Depth	0.917 ft
Critical Slope	0.0171 ft/ft



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Rundown and Spillway Calculations

Rundown Calculations

According to the drainage report from Davita's Del Norte Dialysis Center the flowrate coming into the pond on the northern entrance is about 5.5 cfs.

Weir Depth

$h1 := 1 \quad ft$

Weir Equation: Q=CwLH^1.5

$Cw := 3$

$L1 := 7.5$

$Q1 := Cw \cdot L1 \cdot (h1)^{1.5} = 22.5 \quad cfs$

A total of about 24.8 cfs enters the pond, about 19.33 cfs enters the pond at the midway rundown

Midway Rundown

Weir Depth

$h2 := 1 \quad ft$

Weir Equation: Q=CwLH^1.5

$Cw := 3$

$L2 := 14$

$Q1 := Cw \cdot L2 \cdot (h2)^{1.5} = 42 \quad cfs$

Spillway calculations

Northwest Corner Spillway

Weir Depth

$h3 := 0.7 \quad ft$

Weir Equation: Q=CwLH^1.5

$Cw := 3$

$L3 := 140$

$Q1 := Cw \cdot L3 \cdot (h3)^{1.5} = 245.97 \, cfs$

Midway Spillway

Weir Depth

$h4 := 0.7 \quad ft$

Weir Equation: Q=CwLH^1.5

$Cw := 3$

$L4 := 8.5$

$Q1 := Cw \cdot L4 \cdot (h4)^{1.5} = 14.934 \, cfs$