CITY OF ALBUQUERQUE

PLANNING DEPARTMENT – Development Review Services

Richard J. Berry, Mayor

January 6, 2015

Fred C. Arfman, P.E.
Isaacson & Arfman, P.A.
128 Monroe St NE
Albuquerque, NM 87108

RE: **Alameda Self Storage (C18D064A)**
Grading and Drainage Plan
Supplemental Information, Engineer's Stamp Date 12-15-2014

Dear Mr. Arfman:

Based upon the information provided in your submittal received 12-16-14, the above referenced plan cannot be approved for Building Permit until the following comments are addressed:

1. This plan is not consistent with the Fully Developed plan dated 5-16-05. Show how the fully developed condition is intended to change by sketching in the new building and crossing out the planned future building on the Fully Developed plan, which shows the overall site.
2. Show the contour elevation between the proposed building and the existing pond.
3. Show the scale used.
4. State how the first flush is to be handled. There is a calculation for it on page 2 of the report, but it needs to be adjusted for 3.3 Acres and verbiage needs to be added to state how it is being retained. How much volume is being retained below the bottom of the orifice opening? Is it enough to retain the first flush?
5. Does the inlet that this site discharges to have the capacity to capture the both the Alameda street flows and the discharge from this site. Provide documentation showing this inlet is designed to pick-up the discharge from this site or provide analysis showing so.
6. Show the connection detail from the 18" dia RCP stub to the 18" Dia ADS pipe.
7. Provide Alameda As-builts showing location and elevations of existing inlet, and the SD infrastructure.
8. Report refers to Appendix A, but no appendix is attached.
9. There is a "Drainage Letter Report for Alameda Boulevard San Pedro to Wyoming Project, CPN 7663.91" prepared by Thompson Engineering Consultants, dated January 2012. Page 2, Table 1 shows that this sub-basin, Basin 117.324, which encompasses the south half of this site is allowed 5.23 cfs (based on 1.37 acres) as opposed to 6.0 cfs. If adjusted for 1.53 Acres (Appendix I of 2005 drainage report), allowable discharge is 5.84 cfs. However, since the orifice plate limits the discharge to 5.36 cfs this is acceptable, but the report should be revised to state so.
10. Analysis on page 2 shows area as 2.9 Acres, but the 2005 report indicates 3.3 Acres. Using 3.3 Acres will increase the volume detained.

PO Box 1293

Albuquerque

New Mexico 87103

www.cabq.gov

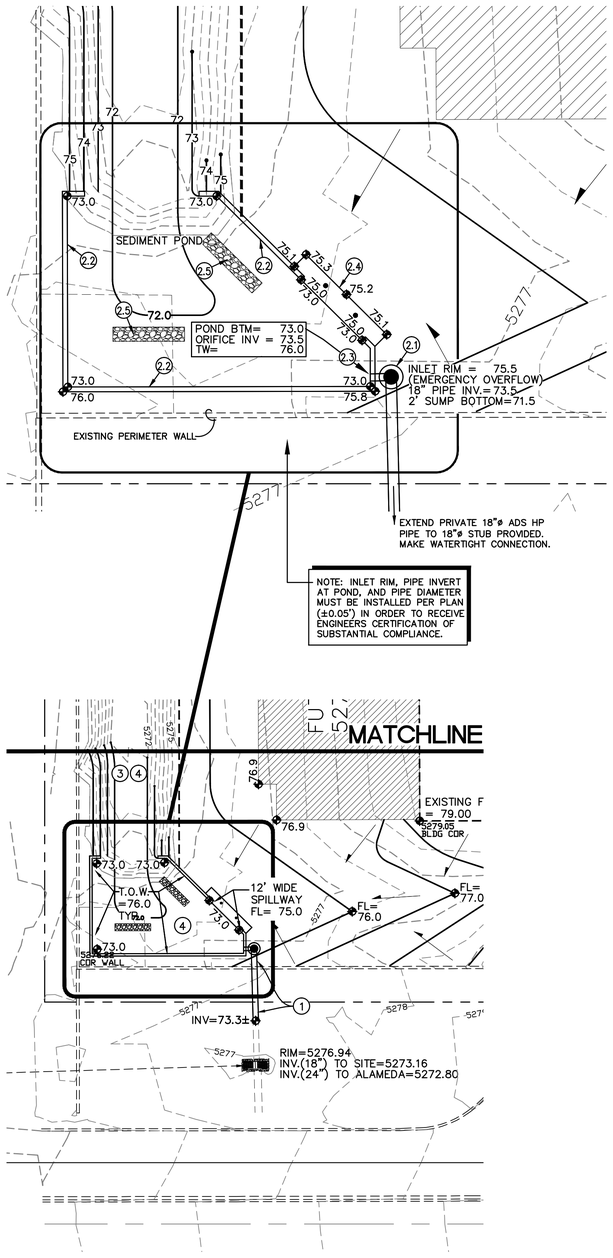
11. There needs to be a foot of freeboard at the pond. If the pond overtops, can the existing wall on the north, south, and west side of the pond contain the pond if the WSEL is 1 ft higher? Is it a concrete block wall?
12. The volume is calculated for the 6 hr. storm, but volume should be based on the on the design storm equal to or exceeding the evacuation time. What is the evacuation time of the pond?
13. Provide a section cut detail for the concrete spillway.
14. Indicate the Pond Volume, WSEL on the plans.

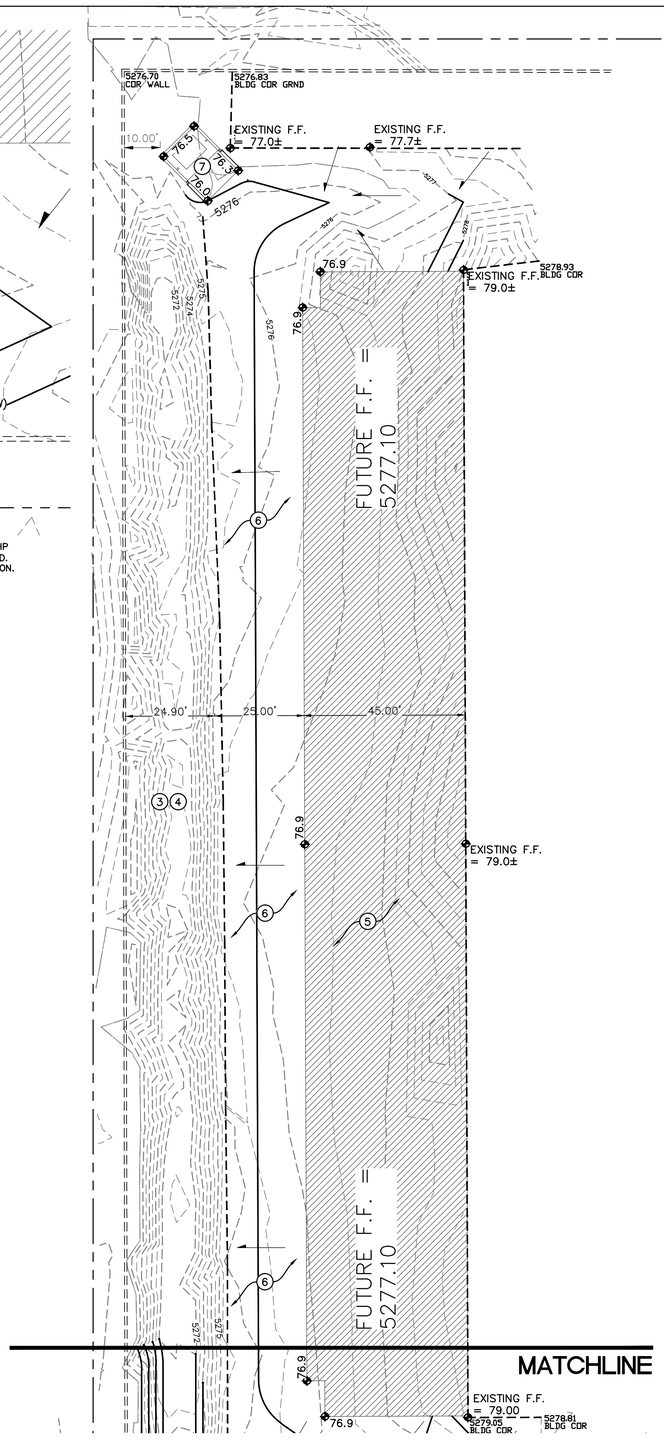
If you have any questions, you can contact me at 924-3695.

Sincerely,

Rita Harmon, P.E.
Senior Engineer, Planning Dept.
Development Review Services

Orig: Drainage file
c.pdf: via Email: Recipient, Monica Ortiz





KEYED NOTES

PHASE 1:

1. REMOVE EXISTING PERIMETER WALL AS NEEDED. INSTALL 18"ø RCP STORM DRAIN (20 LF±) BETWEEN ALAMEDA STORM DRAIN STUB AND ON-SITE STORM DRAIN INLET. S.O.19 PERMIT IS REQUIRED FOR CONSTRUCTION WITHIN THE R.O.W. (SEE FORM BELOW.) SEE CG-501 FOR ADDITIONAL INFORMATION.

2. CONSTRUCT ON-SITE STORM DRAIN SYSTEM TO INCLUDE:
   - 2.1. STORM DRAIN INLET WITH EMERGENCY OVERFLOW DOMED GRATE.
   - 2.2. POND PERIMETER WALLS (SEE CG-501 FOR DIMENSIONS).
   - 2.3. 12" OUTLET.
   - 2.4. CONCRETE SPILLWAY WITH BOLLARDS @ 6' O.C.
   - 2.5. 10'X2'X6'DEEP (MINIMUM) PERCOLATION TRENCH (2 LOCATIONS).

   SEE CG-501 FOR DIMENSIONS. STRUCTURAL DESIGN BY OTHERS.

   NOTE: DUE TO MAXIMUM ALLOWABLE DISCHARGE CAPACITY REQUIREMENTS, PRIVATE STORM DRAIN AND ORIFICE RIM, INVERT, AND DIAMETERS MUST BE WITHIN 0.05±' TO BE CONSIDERED 'IN SUBSTANTIAL COMPLIANCE' FOR ENGINEER'S CERTIFICATION.

3. EXISTING ON-SITE POND MUST BE MAINTAINED AT EXISTING ELEVATIONS FOR STORMWATER DETENTION.
4. POND BOTTOM (EXISTING AND PROPOSED) TO BE PERVIOUS MATERIAL (DIRT, GRAVEL, ETC.) TO MAINTAIN INFILTRATION OF RETAINED PORTION. OWNER TO MAINTAIN TO ELEVATIONS SHOWN.
5. GRADE PAD FOR FUTURE BUILDING.
6. OWNER TO FINE GRADE AROUND NEW BUILDING AND TRANSITION TO EXISTING POND AT ELEVATIONS SHOWN. PAVEMENT MATERIAL IS OWNER'S OPTION. NOTE: ANY PAVEMENT IN THIS AREA IS TO BE CONSIDERED TEMPORARY AND WILL NEED TO BE REMOVED AND REGRADED IF ADDITIONAL WEST END IMPROVEMENTS ARE CONSTRUCTED IN THE FUTURE (ONCE OAKLAND STORM DRAIN SYSTEM IS AVAILABLE).
7. OWNER TO RELOCATE DUMPSTER PAD TO THIS LOCATION AND CONSTRUCT PAD BASED ON OWNER COORDINATED MEETING WITH C.O.A. SOLID WASTE DEPT.

VICINITY MAP

PROJECT DATA

LEGAL DESCRIPTION: LOT 22A, BLOCK 28, NORTH ALBUQUERQUE ACRES, TRACT A, UNIT B

FLOOD ZONE: PER BERNALILLO COUNTY FIRM MAP 35001C0137H, EFFECTIVE ON 08/16/2012, THE SITE IS LOCATED WITHIN FLOODZONE 'X' DESIGNATED AS AREAS DETERMINED TO BE OUTSIDE 500-YEAR FLOODPLAIN.

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

SURVEYOR: DAVID COOPER
SIERRA LAND SURVEYING, INC.
1452 S. ST. FRANCIS DRIVE
SANTA FE, NM 87505
PHONE: (505) 983-5932

BENCHMARK: CITY OF ALBUQUERQUE 9-C18. AN ALUMINUM CAP LOCATED IN THE SOUTHWEST OF THE INTERSECTION OF SAN PEDRO AVENUE & WILSHIRE AVENUE NE. ELEVATION 5232.47 (ADJUSTED NAVD88).

LEGEND

- 5277 — EXISTING CONTOUR
- 75 — PROPOSED CONTOUR
- INFILTRATION TRENCH (SEE CG-501)
- ◆75.0 PROPOSED SPOT ELEVATION
- PROPOSED FLOW ARROW

S.O.19 : NOTICE TO CONTRACTORS

1	AN EXCAVATION / CONSTRUCTION PERMIT WILL BE REQUIRED BEFORE BEGINNING ANY WORK WITHIN THE CITY RIGHT-OF-WAY.
2	ALL WORK DETAILED ON THESE PLANS TO BE PERFORMED, EXCEPT AS OTHERWISE STATED OR PROVIDED FOR HEREON, SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CITY OF ALBUQUERQUE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, 1986 EDITION AS REVISED THROUGH UPDATE #8.
3	TWO WORKING DAYS PRIOR TO ANY EXCAVATION, THE CONTRACTOR MUST CONTACT NEW MEXICO ONE CALL SYSTEM (CALL '811') FOR LOCATION OF EXISTING UTILITIES.
4	PRIOR TO CONSTRUCTION, THE CONTRACTOR SHALL EXCAVATE AND VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL CONSTRUCTIONS. SHOULD A CONFLICT EXIST, THE CONTRACTOR SHALL NOTIFY THE ENGINEER SO THAT THE CONFLICT CAN BE RESOLVED WITH A MINIMUM AMOUNT OF DELAY.
5	BACKFILL COMPACTION SHALL BE ACCORDING TO TRAFFIC / STREET USE.
6	MAINTENANCE OF THESE FACILITIES SHALL BE THE RESPONSIBILITY OF THE OWNER OF THE PROPERTY SERVED.
7	WORK ON ARTERIAL STREETS SHALL BE PERFORMED ON A 24-HOUR BASIS.

APPROVAL	NAME	DATE
INSPECTOR		

FRED C. ARFMAN NEW MEXICO 7322 LICENSED PROFESSIONAL ENGINEER
ISAACSON & ARFMAN, P.A.
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2007 CG-101.dwg Dec 15,2014

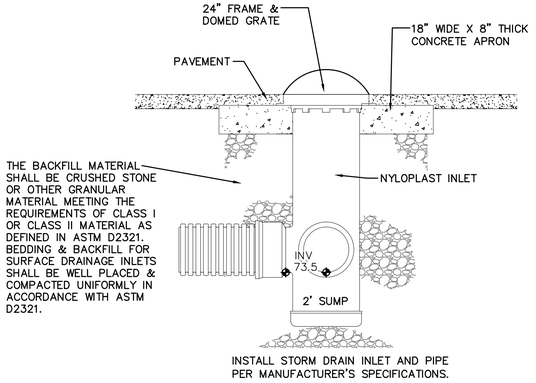
ALAMEDA SELF-STORAGE STORM DRAIN IMPROVEMENTS

PARKS CONSTRUCTION

GRADING AND DRAINAGE PLAN

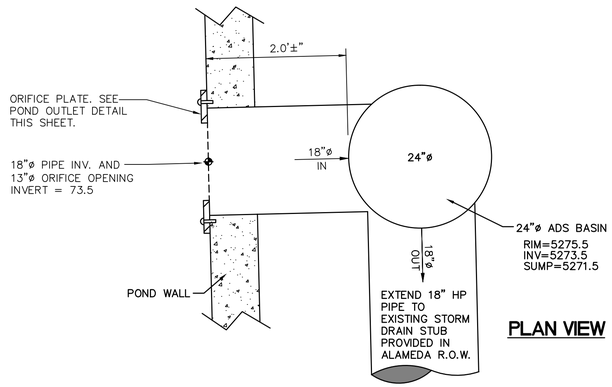
Date:	No.	Revision	Date	Job No.
12-12-14				2007
Drawn By: BJB				CG-101
Ckd By: FCA				SH. OF

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

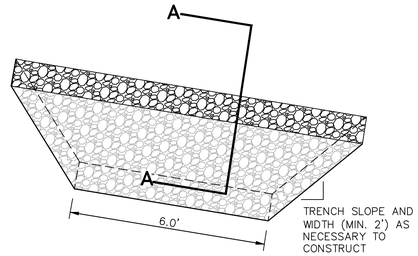


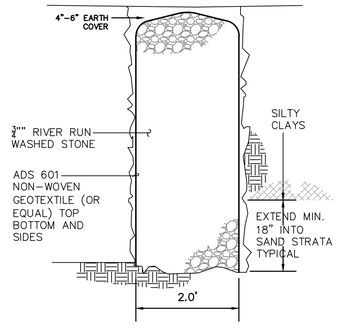
DRAINAGE INLET

SCALE: N.T.S.



PLAN VIEW

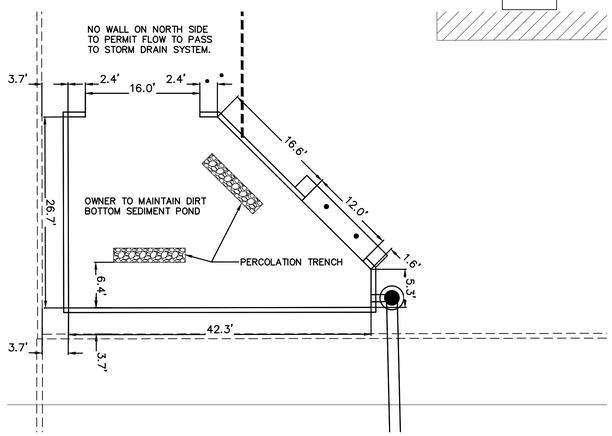


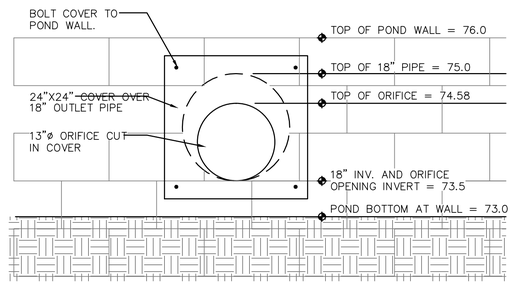


SECTION A-A

PERCOLATION TRENCH

SCALE: N.T.S.





POND WALL DIMENSIONS

SCALE: 1"=10'

POND ORIFICE OUTLET

SCALE: 1"=10'

Know what's below. Call before you dig.

GENERAL NOTES

A. THE CONTRACTOR SHALL ABIDE BY ALL STATE, LOCAL, AND FEDERAL LAWS, CODES, RULES AND REGULATIONS WHICH APPLY TO THE CONSTRUCTION OF THESE IMPROVEMENTS, INCLUDING EPA AND ADA REQUIREMENTS.

B. ALL SUBGRADE, OVEREXCAVATION, BACKFILL, AND FILL SHALL BE PLACED AND / OR COMPACTED PER THE GEOTECHNICAL REPORT AND CITY OF ALBUQUERQUE SPECIFICATIONS.

C. THE CONTRACTOR SHALL OBTAIN ALL REQUIRED PERMITS FOR THE PROJECT PRIOR TO COMMENCING CONSTRUCTION, OR PRIOR TO OCCUPANCY, AS APPROPRIATE.

D. COORDINATE WORK WITH SITE PLAN.

E. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY HORIZONTAL AND VERTICAL LOCATIONS OF ALL EXISTING OBSTRUCTIONS, AND THE CONDITION OF ALL EXISTING INFRASTRUCTURE PRIOR TO CONSTRUCTION. REPORT ALL DISCREPANCIES TO THE ENGINEER AND VERIFY THE ENGINEER'S INTENT BEFORE PROCEEDING.

F. THE CONTRACTOR SHALL NOT SCALE DRAWINGS. ONLY WRITTEN DIMENSIONS OR KEYED NOTES SHALL BE USED.

G. CONTRACTOR SHALL OBTAIN ALL REQUIRED INSPECTIONS OF THE WORK.

H. CONSTRUCTION ACTIVITY SHALL BE LIMITED TO THE PROPERTY AND/OR PROJECT LIMITS. ANY DAMAGE TO ADJACENT STRUCTURES RESULTING FROM THE CONSTRUCTION PROCESS SHALL BE REPAIRED OR REPLACED AT THE CONTRACTOR'S EXPENSE. CONTRACTOR SHALL BE RESPONSIBLE FOR DOCUMENTING EXISTING CONDITIONS PRIOR TO CONSTRUCTION.

I. THE CONTRACTOR SHALL OBTAIN BARRICADING PERMITS FROM THE APPROPRIATE AUTHORITIES PRIOR TO ANY CONSTRUCTION WORK ON OR ADJACENT TO EXISTING STREETS.

J. ALL TRASH, DEBRIS, & SURFACE VEGETATION SHALL BE LEGALLY DISPOSED OF.

K. PROPOSED SPOT AND CONTOUR ELEVATIONS 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.

L. IF FIELD GRADE ADJUSTMENTS ARE REQUIRED, THE CONTRACTOR SHALL NOTIFY THE ENGINEER.

M. 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. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION OF NECESSARY DRY UTILITY ADJUSTMENTS.

N. CONTRACTOR SHALL PROVIDE ALL OTHER CONSTRUCTION STAKING. CONTRACTOR SHALL LOCATE AND PRESERVE ALL BOUNDARY CORNERS AND REPLACE ANY LOST OR DISTURBED CORNERS AT CONTRACTOR'S SOLE EXPENSE. PROPERTY CORNERS SHALL ONLY BE RESET BY A REGISTERED LAND SURVEYOR.

O. A CURRENT STORMWATER CONTROL PERMIT, INCLUDING AN EROSION SEDIMENT CONTROL PLAN (E.S.C.) FOR EROSION AND SEDIMENT CONTROL IS REQUIRED FOR ALL CONSTRUCTION, DEMOLITION CLEARING, AND GRADING OPERATIONS THAT DISTURB THE SOIL ON ONE ACRE OR MORE OF LAND. OWNER WILL COORDINATE.

P. POST-CONSTRUCTION MAINTENANCE FOR PRIVATE STORMWATER FACILITIES WILL BE THE RESPONSIBILITY OF THE FACILITIES OWNER. PERIODIC INSPECTION AND CERTIFICATIONS OF THE FACILITIES MAY BE REQUIRED BY THE CITY ENGINEER.

Q. ADJUST ANY RIMS OF EXISTING UTILITY FEATURES AS NECESSARY TO MATCH NEW GRADES. UTILITIES IN PAVED AREAS SHALL BE HS-25 TRAFFIC RATED.

R. ALL NEW PAVEMENT SURFACES SHALL BE CONSTRUCTED WITH POSITIVE SLOPE AWAY FROM BUILDINGS AND POSITIVE SLOPE TOWARD EXISTING AND/OR PROPOSED DRAINAGE PATHS. PAVING AND ROADWAY GRADES SHALL BE ±0.1' FROM PLAN ELEVATIONS. BUILDING PAD ELEVATION SHALL BE ±0.05' FROM PLAN ELEVATION.

S. WHERE GRADES BETWEEN NEW AND EXISTING ARE SHOWN AS 'MATCH' OR '±', TRANSITIONS SHALL BE SMOOTH.

T. ENGINEER RECOMMENDS THAT OWNER INSPECT SITE YEARLY AND AFTER EACH RAINFALL TO IDENTIFY AREAS OF EROSION AND INSTALL EROSION PROTECTION AS NEEDED.

U. ALL SITE PREPARATION, GRADING OPERATIONS, FOUNDATION CONSTRUCTION, AND PAVEMENT INSTALLATION WORK SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE GEOTECHNICAL REPORT, WHICH WILL BE PROVIDED BY THE OWNER.

V. ENGINEER'S CERTIFICATION CANNOT BE PROVIDED UNTIL ALL SITE DRAINAGE IMPROVEMENT WORK IS COMPLETE AND PERMANENT EROSION PROTECTION IS INSTALLED PER PLAN. LANDSCAPING IS NOT REQUIRED FOR CERTIFICATION.

STORM DRAIN NOTES

- INSTALL ALL STORM DRAIN INLETS AND PIPE PER ADS MANUFACTURER'S SPECIFICATIONS.
- ON-SITE PIPE SHALL BE ADS N-12 (WATERTIGHT) OR ENGINEER APPROVED EQUIVALENT. PIPE SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
- PIPE WITHIN ALAMEDA R.O.W. SHALL BE RCP OR ADS HP AS APPROVED BY C.O.A. HYDROLOGY. PIPE SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
- STORM DRAINS SHALL BE INSTALLED AT INVERTS AND SLOPES SPECIFIED ON THE PLANS. THE PIPE SHALL DRAIN AT A CONSTANT SLOPE BETWEEN FITTINGS AND MANHOLES. THE PIPE SHALL DRAIN TOWARD THE OUTLET AT ALL LOCATIONS.
- STORM DRAIN SYSTEM WILL REQUIRE REGULAR MAINTENANCE TO ENSURE PROPER FUNCTIONING DURING STORM EVENTS. ENGINEER RECOMMENDS THAT PROPERTY OWNER PUT IN PLACE INSPECTION AND MAINTENANCE CRITERIA SCHEDULED TO OCCUR MONTHLY AND AFTER EACH STORM EVENT.
- VIBRATORY COMPACTION SHALL NOT BE USED OVER IN-PLACE UTILITIES.
- ALL BACKFILL SHALL BE COMPACTED TO A MINIMUM 95% DENSITY PER ASTM D-1557.

STORM DRAIN NOTES

FRED C. ARFMAN NEW MEXICO 7322 LICENSED PROFESSIONAL ENGINEER
12-15-14
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2007 CG-101.dwg Dec 15,2014

ALAMEDA SELF-STORAGE STORM DRAIN IMPROVEMENTS

PARKS CONSTRUCTION

DRAINAGE DETAILS

Date:	No.	Revision	Date	Job No.
12-12-14				2007
Drawn By: BJB				CG-501
Ckd By: FCA				SH. OF

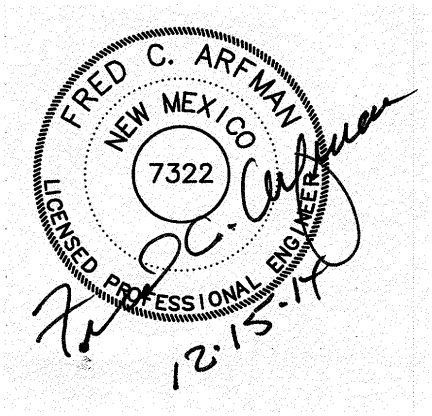
DECEMBER 12, 2014

SUPPLEMENTAL INFORMATION

FOR

ALAMEDA SELF STORAGE BUILDING ADDITIONS

6800 Oakland Ave. NE
Albuquerque, NM



PROJECT NO. 2007

BY

ISAACSON & ARFMAN, P.A.
Consulting Engineering Associates

Thomas O. Isaacson, PE(RET.) & LS(RET.)
Fred C. Arfman, PE
Åsa Nilsson-Weber, PE

I. INTRODUCTION

The Alameda Self-Storage facility was developed in 2006 with an interim drainage solution consisting of a private on-site stormwater retention facility along the west property line. The holding of developed storm waters was required due to limited downstream capacity in the rural type public roadways adjacent to the site and the absence of a storm drain extension from the public system(s) to the west.

The purpose of this report is to support the conversion of the existing on-site retention pond to an on-site detention pond based on the recently constructed public storm drain system in Alameda Blvd.

II. EXISTING CONDITIONS

The approved Grading and Drainage Plan (**C18/D64A –attached for information**) for the Alameda Self Storage facility (Property) prepared by this office (I&A Project Number 1418 dated May 2005) consisted of full build plan and an interim condition plan which required on-site retention ponding until proposed off-site public storm drain infrastructure was available to the site. Relevant pages from the 2005 Supplemental Information packet are included in Appendix A.

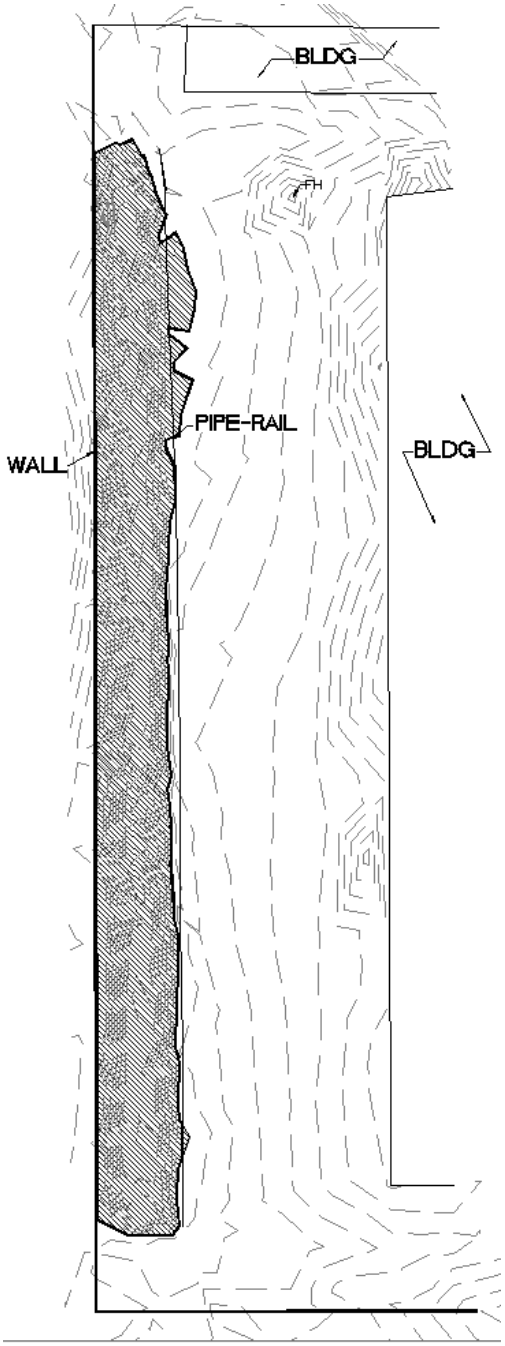
III. PROPOSED CONDITIONS

Per Page 2 of the 2005 supplemental information packet (see Appendix A):

> *"Once the Oakland Avenue and Alameda Blvd. storm drain systems are installed and functioning, the interim pond will no longer be required. The final site discharge will follow the Master Plan division of the property into a North basin which will drain to the Oakland storm sewer system and a South basin which will drain to the Alameda storm sewer system. At that time, the owner may construct the western two storage buildings.*
>
> *If the interim pond is removed and the final two storage buildings are constructed, the owner will provide on-site detention pond areas sized to discharge the Master Plan approved flowrates:*
>
> *North Basin: Per the calculations, the North Basin will generate 8.4 cfs. Per the Master Plan, the allowable discharge rate, bas3ed on a land treatment ration of A:0 B:16 C:34 D:50 will generate 7.0 cfs (see Exhibit J). Using an inflow/outflow Hydrograph, the north parking lot detention pond will be required to store 1263 cf (see Exhibit K).*
>
> *South Basin: Per the calculations, the South Basin will generate 7.3 cfs. Per the Master Plan, the allowable discharge rate, based on a land treatment ration of A:0 B:16 C:34 D:50 will generate 6.0 cfs (see Exhibit L).Using an inflow/outflow Hydrograph, the South detention pond will be required to store 1091 cf (see Exhibit M).*

The portion of the Alameda public storm drain adjacent to the Property was recently completed. This will allow the Property to repurpose the area previously used for retention ponding.

BASIN NO. INT		DESCRIPTION	100% TREATMENT 'D'
Area of basin flows =	125276 SF	=	2.9 Ac.
The following calculations are based on Treatment areas as shown in table to the right			LAND TREATMENT
Sub-basin Weighted Excess Precipitation (see formula above)			A = 0%
Weighted E =	2.36 in.		B = 0%
Sub-basin Volume of Runoff (see formula above)			C = 0%
V_{360} =	24638 CF		D = 100%
Sub-basin Peak Discharge Rate: (see formula above)			FIRST FLUSH VOL.
Q_P =	14.4 cfs		3549 CF



Extend 18" private storm drain to the provided storm drain stub. The retention pond will be converted to a detention pond.

Based on calculations, the total area inside the perimeter walls of the self-storage facility is 2.9 acres. The 100-year 6-hour discharge rate (based on 100% Treatment 'D') = 14.4 cfs.

The allowable discharge to the public storm drain in Alameda is = 6.0 cfs. An 18" diameter outlet pipe with a 13" diameter orifice (invert of 5273.5) and a water surface elevation of 5275.5 has the capacity (orifice control) to discharge 5.36 cfs < 6.0 cfs allowed.

14.4 cfs – 5.36 cfs = 9.04 cfs to be detained. Per the inflow / outflow Hydrograph provided, the required detention volume will be 16,202 cf.

The hatched area shown at left represents the existing pond area required. Per the volume analysis below, in the existing condition, the available volume at elevation 5275.50 = 16,653. The proposed building will be constructed with a FF elevation of 5277 (1.5' above the high water surface elevation).

Elevation	Depth	Available Volume (CF)	
5274	2'	6697.35	CF
5274.5	2.5'	9538.29	CF
5275	3'	12829.59	CF
5275.5	3.5'	16653.06	CF
5276	4'	21578.13	CF
5276.5	4.5'	28457.46	CF
5277	5'	37958.49	CF

CALCULATIONS: 0 : 0

HYDROGRAPH FOR SMALL WATERSHED

DPM SECTION 22-2 * PAGE A-13/14

Base time, t_B, for a small watershed hydrograph is,

$tB = (2.107 * E * A / Q_P) - (0.25 * A_D / A)$

Where			
E	=	2.36	inches
A	=	2.88	acres
A_D	=	2.88	acres
Q_P	=	14.4	cfs

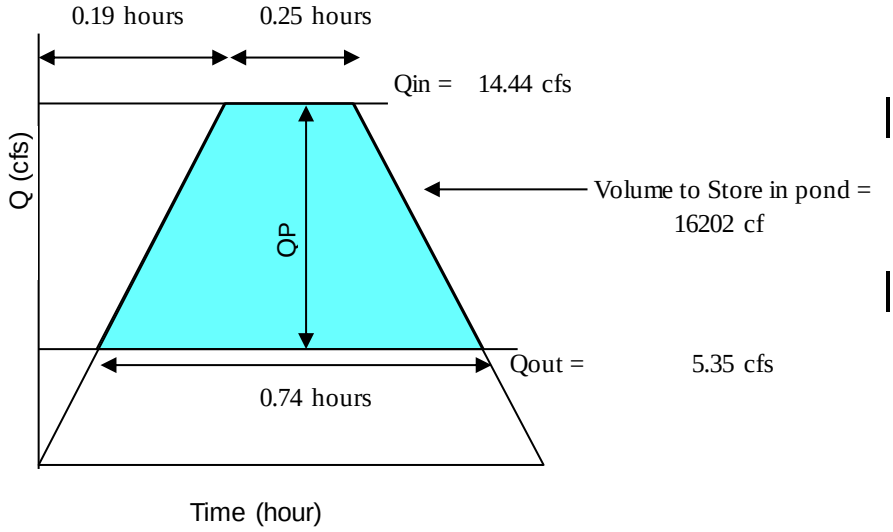
t_B	=	0.74	hours

E is the excess precipitation in inches (from DPM TABLE A-8), Q_P is the peak flow, A_D is the area (acres) of treatment D, and A_T is the total area in acres. Using the time of concentration, t_C (hours), the time to peak in hours is:

$t_P = (0.7 * tC) + ((1.6 - (A_D / A)) / 12)$

Where			
t_C	=	0.20	hours
t_P	=	0.19	hours

Continue the peak for $0.25 * A_D / A_T$ hours. When A_D is zero, the hydrograph will be triangular. When A_D is not zero, the hyrograph will be trapezoidal. see the graph below:



ORIFICE EQUATION - 13" ORIFICE IN POND WALL TO STORM DRAIN

The Orifice Equation is used to calculate the Flow at the opening of a Channel

$Q = C*A * (2*g*h) ^ 0.5$

Where	Q	=	5.36	cfs	
	C	=	0.6		(indicating that the opening will function at 60% capacity)
	A	=	0.92	sq.ft.	
	g	=	32.2	ft/sec^2	
	h	=	1.46	ft	depth of flow at opening from the center of culvert
		=			

18" outlet pipe
13" diameter hole cut orifice plate over outlet pipe
Invert of orifice opening = 73.5
Water Surface at emergency overflow = 75.5
Center of orifice = 74.04

At a head of 1.46' (75.5 - 74.04) a 13" dia. opening into the propose 15" RCP will pass 5.36 cfs. < 6 cfs