Drainage Submittal

for

Smith's #485 - Fuel Center

6941 Montgomery Boulevard
Albuquerque, NM
August 27, 2014

Prepared for:
Smith's Food & Drug Stores
1550 South Redwood Rd.
Salt Lake City, UT 84104

ANDERSON WAHLEN & ASSOCIATES
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Table of Contents

Introduction

Smith's Food & Drug is proposing the addition of a fuel center at the northwest corner of Montgomery and Louisiana Boulevard, more particularly located at 6941 Montgomery Boulevard. The purpose of this report is to:

- Determine the peak flows that will result by developing the proposed site.
- Describe on-site surface and right-of-way improvements that will convey flows to Montgomery Boulevard.
- Determine the volume of storm water retention storage needed to manage the 90th percentile storm event for contributing impervious areas.
- Determine adequate sizing of storm drainage piping and improvements.

Background

The proposed site and re-development plan will occupy two existing parcels. The southern parcel currently developed as an existing car wash structure, and the northern parcel currently developed as a cabinet retail showroom building. The site is bordered by an existing building (Studio Pizazz Dance Studio) to the north, Louisiana Boulevard to the east, Montgomery Boulevard to the south and an existing building and parking lot (Optic Expressions Eyewear) to the west. Neither parcel in its current developed condition has storm water facilities that are piped directly to the existing public storm drain system in Louisiana Boulevard. No storm drain piping exists within the fronting portion of Montgomery Boulevard.

The existing properties, proposed to be combined, are comprised of impervious surface improvements covering roughly 91 percent of the site area. The remaining 9 percent of the primarily car wash site is landscaped with rock mulch, small trees and shrubs around the perimeter. The existing cabinet shop does not currently maintain landscaped areas.

Both properties direct storm water runoff generated on-site to the southwest into the existing Montgomery Boulevard curb and gutter via an existing vehicle access point and the Optic Expressions Eyewear parking lot. Storm water discharges from the subject site into Montgomery Boulevard combine with existing street runoff and adjacent private property discharge and are conveyed via the gutter system for approximately 1,530 lineal feet to the west. Montgomery Boulevard curb flows enter an existing storm drain catch basin at this western location.

Flood Hazard Certification

Floodplain information published for the site in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Bernalillo County, New Mexico and Incorporated Areas, Community Panel Number 35001C0139G, dated September 26, 2008 (See Appendix) provides flood zone designation information. The subject site is located in Zone X (not shaded) which is defined as, "Areas determined to be outside the 0.2% annual chance floodplain." The site does not lie within a Flood Hazard Area as

shown on the Federal Emergency Management Agency (FEMA) maps requiring no further flood-proofing or other flood mitigation.

Hydrologic Analysis

Design Storm: The site is located within Precipitation Zone 3 being in the area lying north of Interstate 40; between San Mateo and Eubank Boulevard as specified in Chapter 22, Section 2(A.1 & A.2) of the City of Albuquerque Development Process Manual (DPM). The principal design storm is the 100-year 6 hour event defined by the National Oceanic and Atmospheric Administration (NOAA) Atlas 2, Precipitation-Frequency Atlas of the Western United States, Vol. IV – New Mexico. Detention basin/retention basin designs are not proposed; however, the management requirement for the 90th percentile storm event for contributing impervious areas does provide a small on-site below grade retention system. Larger detention/retention systems are not proposed and therefore longer duration design storms are not considered in this analysis. Accordingly, the rainfall depths of interest for design purposes are the 10-Year, 6-Hour storm with a design depth of 1.73 inches and the 100-Year, 6-Hour storm with a design depth of 2.60 inches.

Land Treatments: The existing site contains 37,389 square feet (0.858 acres) of commercial designated land uses constructed with a small portion of pervious surface being primarily landscape rock mulch with some trees and shrubs upon 3,262 square feet (0.0749 acres) with the remainder of the site being impervious concrete and asphalt paved surfaces over 34,127 square feet (0.783 acres). On-site existing Land Treatments defined in Chapter 22, Section 2(A.3) of the City of Albuquerque DPM are Land Treatment Type C for pervious rock-mulch areas and Type D for impervious areas, pavement and roof. Existing site conditions are nine percent Type C and 91 percent Type D Land Treatment Types. The proposed site conditions will consist of roughly 11 percent pervious landscaped areas (Land Treatment Type C) and 89 percent impervious surfaces (Land Treatment Type D).

Excess Precipitation & Volumetric Runoff: Excess precipitation (runoff) is the depth of precipitation discharged after the initial volume of rainfall retained on the ground surface as depression storage and infiltration has been subtracted from the design storm unit hydrograph. The majority of the existing site is covered by impervious surfaces designated Land Treatment D. Land Treatment C (rock mulch landscape) is projected to generate 0.62 inches of excess precipitation for a 10-Year, 6-Hour Storm and 1.29 inches of excess precipitation for a 100-Year, 6-Hour Storm within Precipitation Zone 3. Land Treatment D (impervious surfaces) are anticipated to generate 1.50 inches excess precipitation for a 10-Year, 6-Hour Storm and 2.36 inches of excess precipitation for a 100-Year, 6-Hour Storm within the same Precipitation Zone.

The volume of runoff or excess precipitation has been calculated by summing the depth of rainfall over the two established land treatment types. The excess precipitation depth, volume and peak discharge generated by the existing developed and proposed developed site conditions are summarized in Table 1.

Table 1 - Existing Developed and Proposed Developed Excess Precipitation Volumes & Peak Discharge Rates.

	Excess Precipitation (Inches)	Volumetric Run-off (Acre-Feet)	Peak Discharge (cfs)
Existing Developed			
2-YR(90th Percentile)	0.34	0.0222 (Not Built)	N/A
10-Year, 6-Hour	1.42	0.102	2.81
100-Year, 6-Hour	2.27	0.162	4.19
Proposed Developed			
2-YR(90th Percentile)	0.34	0.0216	N/A
10-Year, 6-Hour	1.40	0.100	2.77
100-Year, 6-Hour	2.24	0.160	4.16

Final Demolition, Grading & Drainage and Utility Plans for the subject site have been provided for further review and consideration in the Appendix.

Proposed Conditions

Proposed site conditions involve combining the two parcels (car wash & cabinet showroom) into one developed site with slightly more landscaped area than the previous developed condition by removing portions of the existing drive approaches, walls separating the properties, and other impervious surfaces. This slight increase in landscaped surface areas decreases the existing design site precipitation depth, volume of runoff and peak discharge as depicted in Table 1.

Due to the nature of the commercial use being a fuel center, the drainage system is designed to isolate possible fuel spillage to the fronting roadway. While all protective measures and safety precautions will be implemented, discharge from under the canopy fueling areas will pass through a 550 gallon oil/water separator prior to discharge to the fronting Montgomery Boulevard curb and gutter. Drainage flows from the underground fuel tank filling area are also directed to the curb and gutter of Montgomery Boulevard. Should containment be required, such flows are more easily contained, managed and removed from the more than 1,500 lineal feet of fronting roadway curb and gutter prior to entering the first storm drain inlet. Roof drains and other paved areas are graded such that storm drain runoff will be captured by an on-site retention system sized to manage the 90th Percentile storm event discharge from impervious areas. Retained 90th percentile storm flows will percolate into the ground via a below grade retention system. Storm drain flows exceeding the provided 90th percentile storm retention volume will overflow the lowest elevation inlet catch basin and spill to the fronting curb and gutter along Montgomery Boulevard (See Appendix – Utility Plan).

All storm water runoff flows not entering the spill containment inlet piped to the fronting curb and gutter will be conveyed as surface flow to the 90th percentile storm water

retention basin. Once filled, the retention basin will overflow to the fronting roadway for the duration of the storm event. Overflow curb and gutter flows will be directed to Montgomery Boulevard via the proposed drive approach located in the same location as the existing Montgomery Boulevard drive approach. Existing low back curb and gutter remaining from previously abandoned drive approaches on Louisiana Boulevard will be removed and replaced with new curb, gutter and contiguous sidewalk fronting the proposed site.

Water Block Design

Proposed drive approach locations will be constructed with modified water blocks. The existing drive approach onto Montgomery Boulevard will remain essential unchanged from existing conditions to maintain the existing clearance heights for vehicles passing under the existing overhead, billboard sign. The topography of the site is such that finished elevations at the right-of-way/property line along Montgomery Boulevard are greater than 10.5 inches.

The proposed drive approach into the site from Louisiana Boulevard will utilize the existing drive approach into the "Studio Pizazz" dance studio site. Cross access has been established by agreement. The existing access point is not developed with a 10.5 inch water block. Existing site grading constraints and existing building elevations limit the ability to propose major elevation changes necessary for full height water block at the lowest point of the access. Proposed grading plans provide for a 4.5 inch water block based upon the following:

a. Gutter flow depth and width of spread along the west side of Louisiana Boulevard is substantially reduced by the existing catch basin inlet immediately north of the subject site access point (See Appendix – Demolition & Utility Plans). The presence of the catch basin immediately adjacent decreases tributary gutter flow depth and width of spread immediately upstream;

b. Site topography and grading constraints associated with the existing, cantilevered, overhead billboard sign, not owned/controlled by the Applicant, limits raising the overall site elevations. Raising the site reduces overhead clearance for the billboard sign and forces the access point closer to the Montgomery & Louisiana Boulevard intersection, and creates access approach slope not conducive to the intended use;

c. Moving the access point further south to a lower elevation reduces access spacing from the intersection and reduces vehicle storage available to the proposed median modifications necessary for safe and effective full movement access from Louisiana Boulevard.

Depth of flow calculations for Montgomery & Louisiana Boulevard may be determined upon request. Due to the quantification of tributary flows from other adjacent

developments being beyond the scope of this analysis, a gutter depth of flow analysis has not been completed for Montgomery or Louisiana Boulevard at this time.

2-Year Storm On-Site Retention

Proposed site storm water improvements include specific storm water facilities for the management of the 90th Percentile Storm Event by retaining the volume of water generated by this event on-site. These facilities retain the "first flush" and control runoff generated by contributing impervious surfaces. First Flush is defined by the City of Albuquerque as the storm water runoff during the early stages of a storm equal to or less than runoff from the 90th Percentile Storm Event that can deliver a potentially high concentration of pollutants due to the washing effect of runoff from impervious areas directly connected to the storm drainage system. The method of determining this volume to be retained is determined by the Rational Method as described in the City of Albuquerque, New Mexico Development Process Manual Volume-II Design Process, Chapter 22 Drainage, Flood Control and Erosion Control, Section 2 Hydrology.

Proposed Site Impervious Area = 33,138 sf
90th Percentile (2-Year) Storm Depth = 0.44 inches
Initial Abstraction – Treatment Type D – impervious = 0.1 inches

Depth of Direct Runoff = (0.44 inches – 0.10 inches) = 0.34 inches

Volume of Direct Runoff = (0.34 inches))*(1 ft/12 inches) * (33,138 sf)
= **939 cubic feet**

First Flush Retention Facility: StormTech Subsurface Storm Water Management MC4500 Chamber, Endcaps, pipes, catch basins, and cleanout manholes.

Volume Provided:	Catch basins, pipe, & cleanout volume =	467 cf
	MC 4500 End cap & section volume =	556 cf
	Provided:	1,023 cf

A copy of the final Utility Plan has been provided in the Appendix for more information regarding the configuration of the piping, catch basins, cleanout manholes and StormTech Chambers.

Oil Water Separator

Proposed Utility Plans provide for the installation of an "Oldcastle Precast Oil / Water Separator 577-SA 900 Gallon – American Petroleum Institute (API) Style" oil water separator. This oil water separator provides a 900 gallon maximum volume oil water separator with a 67 gallon per minute flow rate at 15 minute retention time capacity. More simply stated, the design flow rate is a slightly greater volume of water generated

by dumping thirteen five gallon buckets of water every minute under the canopy area. The maximum oil storage volume provided is 500 gallons.

The subject oil water separator is specified to only treat under canopy or covered concrete pavement area drainage flows which consists of a number of possible sources, such as: wind-blown rainfall under the canopy; excessive parking area runoff passing under the canopy, water main breaks, small fuel spills during vehicle fueling, moisture dripping from parked cars being fueled under the canopy during rain/snow events and other maintenance flows that may periodically pass through the separator. The separator is designed to provide separation for minor fuel spills, water dripping from vehicles and wind-blown rainfall under the canopy.

The separator is connected to the under canopy catch basin by 6-inch diameter polyvinyl chloride storm drain piping with a capacity of 4.5 cfs or 2,020 gpm (wier flow) to 1.0 cfs or 449 gpm (orifice flow) depending on the amount of water ponded above the inlet pipe and the cleanliness of the pipe opening at the time of discharge. Treated flows are discharged to the fronting roadway curb and gutter. Oil water treatment during greater than design flow events would not result in oil / water separation treatment. Conveyed flows exceeding treatment capacity will pass through the separator to the fronting roadway curb and gutter until such time that the flow capacity returned to design conditions. Ponding over the catch basin inlet will only reach a depth of 2.5 inches. Ponded depths greater than 2.5 inches above the grate will spill from under the canopy and travel over asphalt surfaces to the fronting roadway.

Accordingly, the oil / water separator is considered adequately sized for under canopy or covered drainage areas for the design center under canopy drainage operations and provides an initial form of fuel spill containment isolation of 500 gallons and oil / water separation for flows less than 67 gallons per minute with 15 minute retention time.

Storm Drain Pipe Sizing

Storm drain pipe sizing is typically designed to convey the minor storm event or events equal to or less than a 10-Year Return Period peak discharge rate. The site is broken into drainage areas tributary to catch basins for the management of the 90th percentile storm event, roof drains, under canopy drainage and spill containment areas. Each area tributary to the catch basins is comprised of drainage areas smaller than the overall site thereby generating flows less than the overall site design. Discharge exceeding provided pipe and inlet capacities will be conveyed to the fronting roadway without flooding on-site and off-site facilities. The **proposed site 10-Year, 6-Hour Storm peak discharge flow rate for the entire site is 2.77 cubic feet per second**. Discharge capacities for 12-inch diameter pipes constructed at 0.5% provide a full flowing pipe capacity of 2.52 cubic feet per second. The minimum pipe slope for the 12-inch storm drain piping on-site is 0.75% which provides a full flow discharge capacity of 3.08 cubic feet per second. The pipes provided will convey the tributary 10-Year, 6-Hour storm peak flow rates.

Storm flows exceeding the capacity of the two 4" pipes discharging to the Montgomery Boulevard curb and gutter will bubble out of the on-site curb inlet, flow to the on-site 90th Percentile Storm Water Management retention basin until full and then spill out to the fronting Montgomery Boulevard curb and gutter via the proposed drive approach.

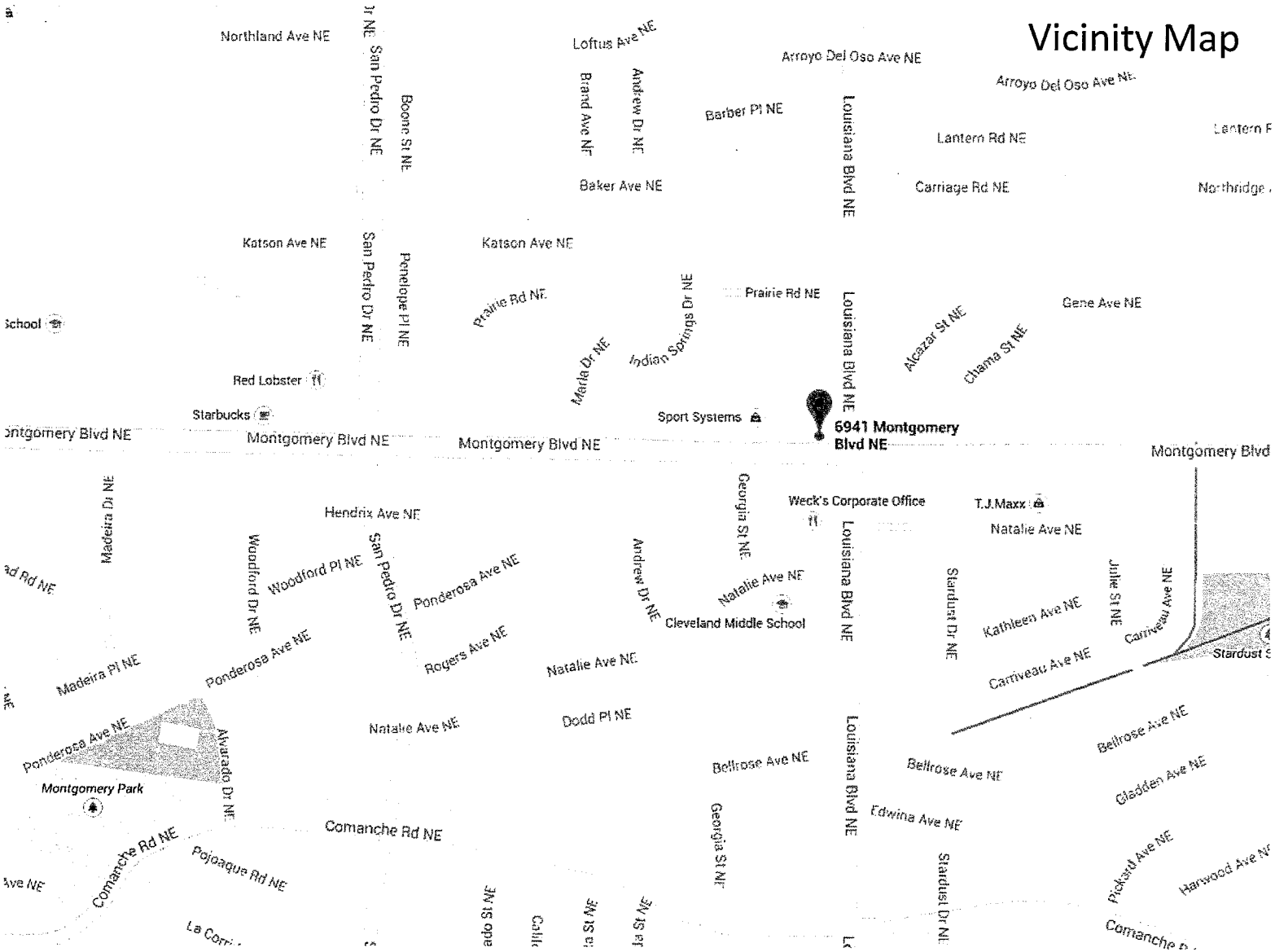
Conclusion

This analysis has been prepared in accordance with the requirements and specifications of Section 22.2 of the DPM. Existing developed conditions at the site generate a historical flow to the storm drain system in Montgomery Boulevard that will not be exceeded by the proposed development. Historic excess precipitation and the accompanying volume of excess precipitation and peak flow rates are slightly reduced as a result of increased landscape areas not currently present on the site. Treatment of runoff from under the fuel center canopy will occur by passing under canopy flows through an oil/water separator as shown on the Final Utility Plan (See Appendix).

Appendix

Vicinity Map

Vicinity Map



FEMA Flood Insurance Rate Map

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

MAP SCALE 1" = 500'

50 0 500 1000 FEET

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0139G

FIRM

FLOOD INSURANCE RATE MAP

BERNALILLO COUNTY, NEW MEXICO AND INCORPORATED AREAS

PANEL 139 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0139	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
35001C0139G

MAP REVISED
SEPTEMBER 26, 2008

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

MAP SCALE 1" = 500'

50 0 500 1000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0139G

FIRM

FLOOD INSURANCE RATE MAP

BERNALILLO COUNTY, NEW MEXICO

AND INCORPORATED AREAS

PANEL 139 OF 825

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Final Demolition Plan
Final Grading & Drainage Plan
Final Utility Plan

Peak Runoff Calculations
Per
City of Albuquerque Development Process Manual (DPM)

Curtis Cheney-
(505)
924-3986

ANDERSON WAHLEN & ASSOCIATES
Great Basin Engineering South

Project Name Smith's #485 Fuel Center (Sheet 1 of 2) Date 8 July, '14

Site Address: 6941 Montgomery Blvd ⇒ Precipitation Zone 3

Existing Site Conditions:

Pervious Area: 3,262 s.f. Treatment Type C

Impervious Area: 34,127 s.f. Treatment Type D

Total Area: 37,389 s.f. (0.858 Acres)

Proposed Site Conditions:

Pervious Area: 4,251 s.f. Treatment Type C

Impervious Area: 33,138 s.f. Treatment Type D

Total Area: 37,389 s.f. (0.858 Acres)

Excess Precipitation & Volumetric Runoff

Existing Site Condition:

10-Year, 6-Hour:

$$E_{W_{360-10}} = \frac{0.62(3262) + 1.50(34,127)}{37,389}$$

$= 1.42$ inches

Excess Precip - Table A.8
10-Year, 6-Hour =
Treatment Type C: 0.62 in.
Treatment Type D: 1.50 in.

100-Year, 6 Hour
Treatment Type C: 1.29 in.
Treatment Type D: 2.36 in.

$$V_{360-10} = 1.42 \text{ in } (37,389 \text{ s.f.}) \left(\frac{1 \text{ Ac}}{43,560 \text{ s.f.}}\right)\left(\frac{1 \text{ ft}}{12 \text{ in}}\right) = 0.102 \text{ Ac-ft}$$

$$V_{360-100} = E_{W_{360-100}} \cdot A_{SITE} = \left[\frac{1.29(3262) + 2.36(34,127)}{37,389}\right] \cdot \frac{37,389}{43560(12)}$$

$= 0.162$ Ac-FT

$E_{W_{360-100}} = 2.27$ in

Existing Site Conditions:

$V_{360-10} = 0.102$ Ac-FT $V_{360-100} = 0.162$ Ac-FT

ANDERSON WAHLEN & ASSOCIATES
Great Basin Engineering South

Project Name SMITH'S #485 FUEL CENTER (SHEET 2 OF 2) Date 8 JULY, '14

EXCESS PRECIPITATION & VOLUMETRIC RUNOFF (CONT'D):

PROPOSED SITE CONDITIONS:

$$V_{360\text{-}10} = \frac{0.62(4251) + 1.50(33,138)}{(43,560)(12)} = 0.100 \text{ AC-FT}$$

$E_{W_{360\text{-}10}} = 1.40$ IN.

$$V_{360\text{-}100} = \frac{1.29(4251) + 2.36(33,138)}{(43,560)(12)} = 0.160 \text{ AC-FT}$$

$E_{W_{360\text{-}100}} = 2.24$ IN.

PEAK DISCHARGE FOR SMALL WATERSHEDS (A.6)
ASSUME: TIME OF CONCENTRATION, T_c = 12 MINUTES
ZONE 3 PRECIPITATION

TABLE A-9 PEAK DISCHARGE (CFS/ACRE)

10-YEAR, 6-HOUR
- TREATMENT TYPE C: 2.00
- TREATMENT TYPE D: 3.39

100-YEAR, 6-HOUR
- TREATMENT TYPE C: 3.45
- TREATMENT TYPE D: 5.02

EXISTING SITE CONDITION:

$$Q_{P_{360\text{-}10}} = \left[2.00(3,262) + 3.39(34,127)\right]\left[\frac{1 \text{ AC}}{43,560 \text{ FT}^2}\right] = 2.81 \text{ CFS}$$

$$Q_{P_{360\text{-}100}} = \frac{\left[3.45(3,262) + 5.02(34,127)\right]}{43,560} = 4.19 \text{ CFS}$$

PROPOSED SITE CONDITIONS:

$$Q_{P_{360\text{-}10}} = \frac{\left[2.00(4251) + 3.39(33,138)\right]}{43,560} = 2.77 \text{ CFS}$$

$$Q_{P_{360\text{-}100}} = \frac{\left[3.45(4251) + 5.02(33,138)\right]}{43,560} = 4.16 \text{ CFS}$$

Volume Calculation
for
On-site Management & Retention of 90th Percentile Storm Events
for Contributing Impervious Areas

ANDERSON WAHLEN & ASSOCIATES
Great Basin Engineering South

Project Name Smiths #485 - 90th Percentile Retention Volume Date 8 July, 2014

Site Address: 6491 Montgomery Blvd.

Required: Management of 90th Percentile Storm Events for Contributing Impervious Area.

Existing/Proposed Site Conditions:

Impervious Area (Proposed): 33,138 s.f.

Rational Method:
90th Percentile Storm Event = 0.44 inches

Paved Streets/Asphalt 100% Impervious
2 Yr Event C = 0.87 (Runoff Coefficient)

$$\text{Volume} = \frac{0.44 \text{ in}}{12 \text{ in/ft}} (0.87)(33{,}138 \text{ s.f.}) = 1{,}057 \text{ ft}^3 \leftarrow P = 0.383"$$

$$\text{Volume} = \frac{0.44}{12} (0.70)(33{,}138 \text{ ft}^2) = 850 \text{ ft}^3 \leftarrow P = 0.308"$$

↑ American Society of Eng., 1960
Design Manual for Storm Drainage
New York, NY.

Use Chapter 22, City of Albuquerque Development Process Manual

Initial Abstraction = 0.1 inches.

Storm Depth = 0.44 inches.

Direct Runoff = 0.44 - 0.1 = 0.34 inches.

$$\text{Volume} = \left(\frac{0.34 \text{ in}}{12 \text{ in/ft}}\right)(33{,}138 \text{ sf.}) = 939 \text{ ft}^3 \leftarrow P = 0.34 \text{ in.}$$

Retention Volume For 90% Storm Events

939 ft³

Storm Drain Pipe Sizing Calculations

ANDERSON WAHLEN & ASSOCIATES
Great Basin Engineering South

Project Name Smith's #485 Pipe Sizing Calculations Date Aug 25, 2014

Storm Drain Pipe Sizing:

Given: 10 year, 6 Hour Site Peak Discharge (see Hydrology Calcs.)

$Q_{PEAK} = 2.77$ cfs.
36010

Req.: Provide 12" ϕ Pipe Capacity

Manning's Equation:

$$Q = \frac{1.49}{n} R_h^{2/3} S^{1/2} A$$

Q = Discharge ft^3/sec
R_h = Hydraulic Radius
A = Pipe Cross Section Area
S = Slope (ft/ft)
n = Manning's Roughness Coefficient

$$R_h = \frac{A}{P} = \frac{\frac{\pi D^2}{4}}{\pi D} = \frac{D}{4}$$

$$= \frac{1'}{4} = 0.25'$$

$S_{MIN} = 0.005$

$$A = \frac{\pi D^2}{4} = \frac{\pi (1')^2}{4} = 0.7853\ ft^2$$

$$Q = \frac{1.49}{0.013}(0.25')^{2/3}(0.005)^{1/2}(0.785 ft^2) = 2.52\ ft^3/sec.$$

Onsite Drainage consists of 3 catch basin inlets.

Fuel Spill Containment:
Potential ~~west~~ Fuel Spills are directed to the fronting roadway for ease in cleanup.

Remaining Site Runoff routed through other two catch basins & roof drains for canopy.

- 10 year, six hour Site Discharge is less for tributary area flowrates than 12" ϕ pipe capacity.
∴ Storm Drain System is adequately sized.