CITY OF ALBUQUERQUE

April 3, 2008

Dave Thompson, PE
Thompson Engineering Consultants, Inc.
PO Box 65760
Albuquerque, NM 87193

Re: Ahern Rentals Drainage Report
Engineer's Stamp dated 3-7-08, (M14/D03)

Dear Mr. Thompson,

Based on information contained in your submittal dated 3-7-08, the above referenced plan is approved for Preliminary Plat and Site Plan for Building Permit action by the DRB. It is also approved for Building Permit. Please include a copy of this plan in the construction sets prior to signoff by Hydrology.

Also, prior to Certificate of Occupancy release, Engineer Certification of the grading plan per the DPM checklist will be required.

If you have any questions, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham, PE
Principal Engineer, Planning Dept.
Development and Building Services

C: file

PO Box 1293

Albuquerque

NM 87103

www.cabq.gov

DRAINAGE INFORMATION SHEET
(REV. 1/28/2003rd)

PROJECT TITLE: AHERN RENTALS SITE ZONE MAP/DRG. FILE #: M 14 D003
DRB #: _____ EPC #: 1006819 WORK ORDER#: _____

LEGAL DESCRIPTION: LOTS 8, 9A, 10A, 11A, & C, BLOCK C, UNIT 1, SOUTH BROADWAY ACRES
CITY ADDRESS: 2920 BROADWAY SE

ENGINEERING FIRM: Thompson Engineering Consultants, Inc.
ADDRESS: P.O. Box 65760
CITY, STATE: Albuquerque, NM
CONTACT: David Thompson
PHONE: 271-2199
ZIP CODE: 87193

OWNER: Ahern Rentals
ADDRESS: 1611 W. Bonanza
CITY, STATE: Las Vegas, NV
CONTACT: Bruce Bilyeu
PHONE: (702) 858-2025
ZIP CODE: 89106

ARCHITECT: APTUS Architecture
ADDRESS: 1200 South 4th St, Suite 206
CITY, STATE: Las Vegas, NV
CONTACT: Kristen Neuman, AIA
PHONE: (702) 839-1200
ZIP CODE: 89104

SURVEYOR: Wayjohn Surveying, Inc.
ADDRESS: 330 Louisiana Blvd. NE
CITY, STATE: Albuquerque, NM
CONTACT: Thomas Johnston
PHONE: 255-2052
ZIP CODE: 87108

CONTRACTOR: _____
ADDRESS: _____
CITY, STATE: _____
CONTACT: _____
PHONE: _____
ZIP CODE: _____

CHECK TYPE OF SUBMITTAL:
- ____ DRAINAGE REPORT
- XX DRAINAGE PLAN 1st SUBMITTAL, REQUIRES TCL or equal
- ____ DRAINAGE PLAN RESUBMITTAL
- ____ CONCEPTUAL GRADING & DRAINAGE PLAN
- XX GRADING PLAN
- ____ EROSION CONTROL PLAN
- ____ ENGINEER'S CERTIFICATION (HYDROLOGY)
- ____ CLOMR/LOMR
- XX TRAFFIC CIRCULATION LAYOUT (TCL)
- ____ ENGINEER'S CERTIFICATION(TCL)
- ____ ENGINEER'S CERTIFICATION (DRB APPR. SITE PLAN)
- ____ OTHER

CHECK TYPE OF APPROVAL SOUGHT:
- ____ SIA/FINANCIAL GUARANTEE RELEASE
- XX PRELIMINARY PLAT APPROVAL
- ____ S. DEV. PLAN FOR SUB'D. APPROVAL
- XX S. DEV PLAN FOR BLDG. PERMIT APPROVAL $100
- ____ SECTOR PLAN APPROVAL
- XX FINAL PLAT APPROVAL
- ____ FOUNDATION PERMIT APPROVAL
- XX BUILDING PERMIT APPROVAL $50.00
- ____ CERTIFICATE OF OCCUPANCY (PERM.)
- ____ CERTIFICATE OF OCCUPANCY (TEMP.)
- XX GRADING PERMIT APPROVAL
- ____ PAVING PERMIT APPROVAL
- ____ WORK ORDER APPROVAL
- ____ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:
- ____ YES
- XX NO
- ____ COPY PROVIDED

Pd 150.-

RECEIVED
MAR 07 2008
HYDROLOGY SECTION

DATE SUBMITTED: March 7, 2008 BY: _____

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature, location and scope of the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan:** Required for approval of Site Development Plans greater than five acres
2. **Drainage Plans:** Required for building permits, grading permits, paving permits, and site plans less than five (5)
3. **Drainage Report:** Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or

DRAINAGE REPORT
FOR
AHERN RENTALS SITE

March 2008

DRAINAGE REPORT
FOR
AHERN RENTALS SITE

Prepared for:
AHERN RENTALS

Prepared by:
Thompson Engineering Consultants, Inc.
P.O. Box 65760
Albuquerque, NM 87193

March 2008

TABLE OF CONTENTS

LIST OF PLATES

LIST OF FIGURES

PAGE

LIST OF TABLES

PAGE

INTRODUCTION AND SITE LOCATION

The proposed Ahern Rental site is located on Broadway Boulevard SE just north of Wesmeco Road. The 4.26 acre property will be developed to serve Ahern equipment rentals and Ace Hardware store. This property is located within the "South Broadway Sector Development" area which includes a study report for Storm Drainage Management Infrastructure. This report specifically addresses the grading and drainage plan and analysis for Ahern Rentals Site.

METHODOLOGY

The hydrologic and hydraulic criteria in Section 22 of the City of Albuquerque Development Process Manual (DPM), entitled "Drainage, Flood Control, and Erosion Control," was followed to perform the analyses given in this report. The design storm used for both the existing undeveloped and developed conditions of the Ahern Rental Site is the 100-year, 6-hour storm event for peak flow computations.

A hydraulic analysis of the storm sewer collection system was performed to assist in the sizing of the infrastructure.

EXISTING DRAINAGE CONDITIONS

INTRODUCTION

The site drains from east to west at an average slope of about 1.5%. The site has an existing trailer that is used as an office for equipment rentals and rental equipment stored throughout. Currently there is a 30" storm drain that terminates at the intersection of Broadway and Wesmeco. This 30" storm drain runs west in Wesmeco and drains into the San Jose Drain.

The FEMA Flood Insurance Rate Map Number 35001C0342 E, effective date November 19, 2003, shown in Figure 1, indicates the presence of a Zone X flood hazard zone on the site. Zone X is an area in the 500-year flood or areas less than 1 foot deep 100-year flood.

OFF-SITE FLOWS

There is a small off-site basin that sheet flows onto the property from the east (refer to Figure 2). The basin has an area of 0.67 acres. The total runoff that reaches the site is 1.36 CFS.

ON-SITE FLOWS

For the existing conditions hydrologic analysis land treatment Types C & D are used since the existing site is partially developed. The peak flow from the site is 19.39 CFS.

Table 1 Existing Drainage Conditions

BASINS	Area (acres)	100yr-6hr Peak Flow (cfs)	100yr- 6hr Runoff Volume (cubic feet)	Land Treatment
10	1.26	5.14	7,885	40% C, 60%D
11	0.98	3.99	6,133	40% C, 60%D
20	0.81	3.30	5,069	40% C, 60%D
21	1.21	4.93	7,572	40% C, 60%D
OFFSITE	0.67	1.36	1,822	80%A, 10% C, 10% D

DEVELOPED DRAINAGE CONDITIONS

DRAINAGE BASIN DELINEATION

The exhibit at the end of the report shows that the site is divided into four drainage basins. Runoff from Basins 10 and 11 drains to storm drain system in the parking area north of the building. This storm drain discharges into the proposed 30" public storm drain extension to be located in Broadway Boulevard. Runoff from the off-site basin and Basin 21 drains to a pond located along the south boundary of the property. The outlet for the pond is a storm drain that continues west to a storm inlet at the western end of the parking area. Basin 20 drains directly into this storm inlet. Flows collected are conveyed in a storm drain system that discharges to the proposed 30" public storm drain in Broadway Boulevard.

HYDROLOGIC ANALYSIS

To determine the peak flows of each basin a hydrologic analysis was performed in accordance to section 22.2 of the Development Process Manual (DPM). The 100-year 6-hour storm was the basis for determining peak flows to size the storm sewer inlets (see Appendix A). The 100-year 6-hour storm was also the basis for determining peak flows to calculate the size of the proposed storm sewer lines and the detention ponds since they will evacuate within the 6 hour storm period (see Appendix A). The property is located in Zone 2, which has a 100-year 6-hour storm event of 2.35 inches.

The site was assigned land treatment values in accordance with Tables A-4 and A-5 of the DPM's section 22.2. Table 1 shows the Land Treatments and peak flows for each basin. See Appendix A for hydrologic calculations.

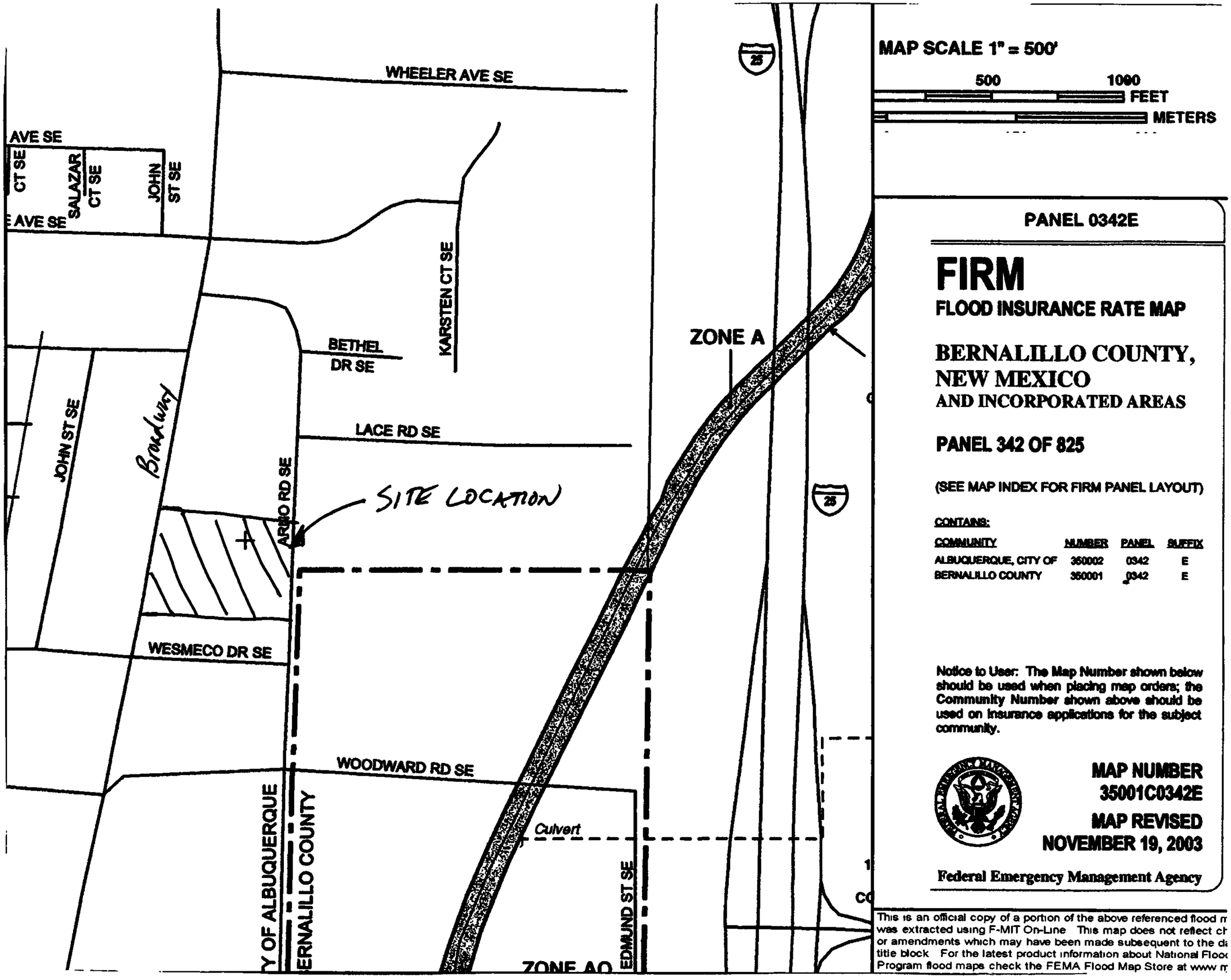

Figure 1 FEMA Flood Insurance Rate Map

FIGURE 2 OFF-SITE BASIN

OFF-SITE BASIN AREA= 0.67 ACRE

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N

SCALE: 1"=150'

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Table 2 Developed Drainage Conditions

BASINS	Area (acres)	100yr-6hr Peak Flow (cfs)	100yr- 6hr Runoff Volume (cubic feet)	Land Treatment
10	1.26	5.46	8,777	15% B, 85% D
11	0.98	4.39	7,108	9.1% B, 90.9% D
20	0.81	3.66	5,946	7.3% B, 92.7% D
21	1.21	5.24	8,405	15.4% B, 84.6% D
OFFSITE	0.67	1.36	1,822	80% A, 10% C, 10% D

DRAINAGE CONCEPT

Introduction

This property is located within the "South Broadway Sector Development Area Study and Design Analysis for Storm Drainage" area (see Appendix C). According to the South Broadway Study, this site is included in Basin SJH-109 which drains to Broadway. Runoff from Broadway is collected by the existing 30" storm drain in Wesmeco that discharges into the San Jose Drain. According to preliminary discussions with City Hydrology staff, this site is allowed a discharge rate of 2 cfs per acre. The existing storm drain in Wesmeco will be extended in Broadway to the site to collect the allowable discharge from the site. Based on 2 cfs per acre discharge rate, including the offsite basin, the total allowable discharge from this site is 9.88 cfs.

The drainage concept for this site includes collecting the runoff from the site in private storm drain systems and conveying the allowable flows to the proposed extension of the Broadway storm drain from Wesmeco to the site. At the on-site storm inlets ponding will occur in the parking area and in landscaped ponds. Orifice plates at the storm inlet outlet pipe will be used to control peak flows that reach the inlets.

Basins 10 and 11 drain into a storm drain system located north of the building. The storm drain system starts at the low end of the two docks directly north of the building. Runoff from these docks will drain into storm inlets and will be conveyed by an 8" corrugated polyethelyne pipe (CPEP) to the nest storm inlet located in the north parking lot. In the dock area, 200 cubic feet of ponding will be at the surface of the inlet. The storm inlet to the north drains the north eastern portion of the site. To control the flows discharging from the inlet at a maximum rate of 2.0 cfs, an orifice plate will be placed on the 12" CPEP leaving an opening of 3 inches. A total of 2,640 cubic feet of ponding will surround the storm inlet in the parking area with a depth of 0.7 feet. In Basin 10, the parking area directly north of the building will drain a curb opening at the west end north to the pond located in the northwest corner of the site. The remaining north parking area

will drain directly into the pond. All flows will reach the pond via concrete rundowns. The pond in the northwest corner of the site will have a storm inlet at the bottom of the pond to drain the pond into the storm drain system. The majority of the runoff will pond in the landscaped area. A small portion of the pond will occur in the parking area with a depth of 0.7 feet. The pond will have a volume of 3,700 cubic feet and a depth of 2.8 feet. To control the flows discharging from the inlet an orifice plate will be placed on the 18" RCP leaving an opening of 6 inches. A total of 4.5 cfs will discharge through the 18" RCP to the proposed 30" RCP public storm drain in Broadway.

Basins 20, 21, and the off-site basin will drain into a storm drain system located south of the building. The off-site basin will drain onto the site overland from the east. Runoff from the off-site basin and from basin 21 will drain to a 4 foot-wide concrete valley gutter located east of the building. This concrete valley gutter will drain from north to south into a ponding area located along the south property line. All flows will reach the pond via concrete rundowns. A storm inlet is located at the west end of the pond to drain the volume detained in the pond. The majority of the pond is located in the landscaped area south of the parking area. A small portion of the pond is in the parking area with depth of 0.7 feet. The pond will have a volume of 6,460 cubic feet and a depth of 2.8 feet. To control the flows discharging from the inlet at a maximum rate of 1.72 cfs, an orifice plate will be placed on the 12" RCP leaving an opening of 3 inches. Runoff from basin 20 will drain directly to a storm inlet located at the southeast corner of the parking area. There will be no ponding in the parking area above the storm inlet. To control the flows discharging from the inlet an orifice plate will be placed on the 18" RCP leaving an opening of 6 inches. A total of 5.38 cfs will discharge through the 18" RCP to the proposed 30" RCP public storm drain in Broadway.

Storm Drain Hydraulic Analysis

A hydraulic analysis of the on-site private storm drains was completed. All storm drains shown on the grading and drainage plan (Plate 1) were sized as gravity pipes. The storm drains range in size from 8" diameter to 18" diameter. Please refer to Appendix B for the hydraulic analysis.

Grading and Drainage Plan

Plate 1 shows the Grading and Drainage Plan for the site. The grading plan shows that the site will drain from east to west to private storm drain systems in the parking areas and landscaped areas which will connect to the proposed public storm drain in Broadway Boulevard.

APPENDIX A
HYDROLOGIC CALCULATIONS

100-YEAR HYDROLOGIC CALCULATIONS

BASIN #	AREA (acre)	LAND TREATMENT A (%)	B (%)	C (%)	D (%)	WEIGHTED E (in)	100-YEAR PRECIPITATION V (6-hr) (acre-ft)	V (6-hr) (cu-ft)	V(24-hr) (acre-ft)	V(24-hr) (cu-ft)	Q (cfs)
EXISTING CONDITIONS											
OFFSITE	0.6700	80.00	0.00	10.00	10.00	0.75	0.04	1,822	0.04	1,919	1.36
BASIN 10	1.2600	0.00	0.00	40.00	60.00	1.72	0.18	7,885	0.21	8,983	5.14
BASIN 11	0.9800	0.00	0.00	40.00	60.00	1.72	0.14	6,133	0.16	6,987	3.99
BASIN 20	0.8100	0.00	0.00	40.00	60.00	1.72	0.12	5,069	0.13	5,775	3.30
BASIN 21	1.2100	0.00	0.00	40.00	60.00	1.72	0.17	7,572	0.20	8,626	4.93
TOTAL RUNOFF	4.93						0.65	28,481	0.74	32,290	18.73
PROPOSED CONDITIONS											
OFFSITE	0.6700	80.00	0.00	10.00	10.00	0.75	0.04	1,822	0.04	1,919	1.36
BASIN 10	1.2600	0.00	15.00	0.00	85.00	1.92	0.20	8,777	0.24	10,332	5.46
BASIN 11	0.9800	0.00	9.10	0.00	90.90	2.00	0.16	7,108	0.19	8,401	4.39
BASIN 20	0.8100	0.00	7.30	0.00	92.70	2.02	0.14	5,946	0.16	7,036	3.66
BASIN 21	1.2100	0.00	15.40	0.00	84.60	1.91	0.19	8,405	0.23	9,892	5.24
TOTAL RUNOFF	4.93						0.74	32,058	0.86	37,580	20.12
EXCESS PRECIP.		0.53	0.78	1.13	2.12	E_I (in)					
PEAK DISCHARGE		1.56	2.28	3.14	4.7	Q_{PI} (cfs)					

WEIGHTED E (in) = $(E_A)(\%A) + (E_B)(\%B) + (E_C)(\%C) + (E_D)(\%D)$
$V_{6\text{-HR}}$ (acre-ft) = (WEIGHTED E)(AREA)/12
V_{10DAY} (acre-ft) = $V_{6\text{-HR}} + (A_D)(P_{10DAY} - P_{6\text{-HR}})/12$
Q (cfs) = $(Q_{PA})(A_A) + (Q_{PB})(A_B) + (Q_{PC})(A_C) + (Q_{PD})(A_D)$

ZONE = 2
$P_{6\text{-HR}}$ (in.) = 2.35
$P_{24\text{-HR}}$ (in.) = 2.75
P_{10DAY} (in.) = 3.95

Basin 10 1.26 ac

Pervious Area (219)2 + 368 + 3827 + 3620 = 8253 SF = 0.1895 ac

15.0%

Basin 11 0.98 ac

Pervious Area 3653 + 219 = 3872 SF = 0.089 ac = 9.1%

Basin 20 0.81 ac

Pervious Area = 1245 + 1339 = 2584 SF = 0.0593 ac = 7.3%

Basin 21 1.21 ac

Pervious area 8107 SF = 0.1861 ac = 15.4%

EXAMPLE A-7

Find Q_P for a 100-year storm at a 120 acre watershed in zone 3, with a 2600 feet shallow concentrated flow upper subreach at 0.015 ft/ft slope and 1200 feet natural channel lower subreach at 0.02 ft/ft slope. The watershed is 50 percent treatment A, 20 percent treatment B, 10 percent treatment C and 20 percent treatment D.

Compute the time of concentration using Table B-1 from PART B as follows:

With a reach length longer than 2000 feet, use K = 3 for the portion below the first 2000 feet.

Since total reach length (2600 + 1200) is less than 4000 feet use equations b-1 and b-2 from PART B

t_c = ((2000 / (10 * 2 * √ (0.015))) + (600 / (10 * 3 √ (0.015))) +

(1200 / (10 * 3 * √ (0.02)))) / 3600 = 0.3507 hours

Compute the Intensity, I, using equation a-12 as follows:

I = $0.726 * \log_{10} (24.6 * 0.3507) * (1 / 0.3507) * 2.14$
= 4.15 inches/hour

Using equation a-11 and the percentage of treatment types:

A_A= 120 * 0.50 = 60 acres A_B = 120 * 0.20 = 24 acres
A_c = 120 * 0.10 = 12 inches A_D = 120 * 0.20 = 24 acres

Q_P = (0.35 * 4.15 * 60) + (0.48 * 4.15 * 24) + (0.64 * 4.15 * 12)
+ (0.93 * 4.15 * 24) = 259.46 cfs

A.8 HYDROGRAPH FOR SMALL WATERSHED

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

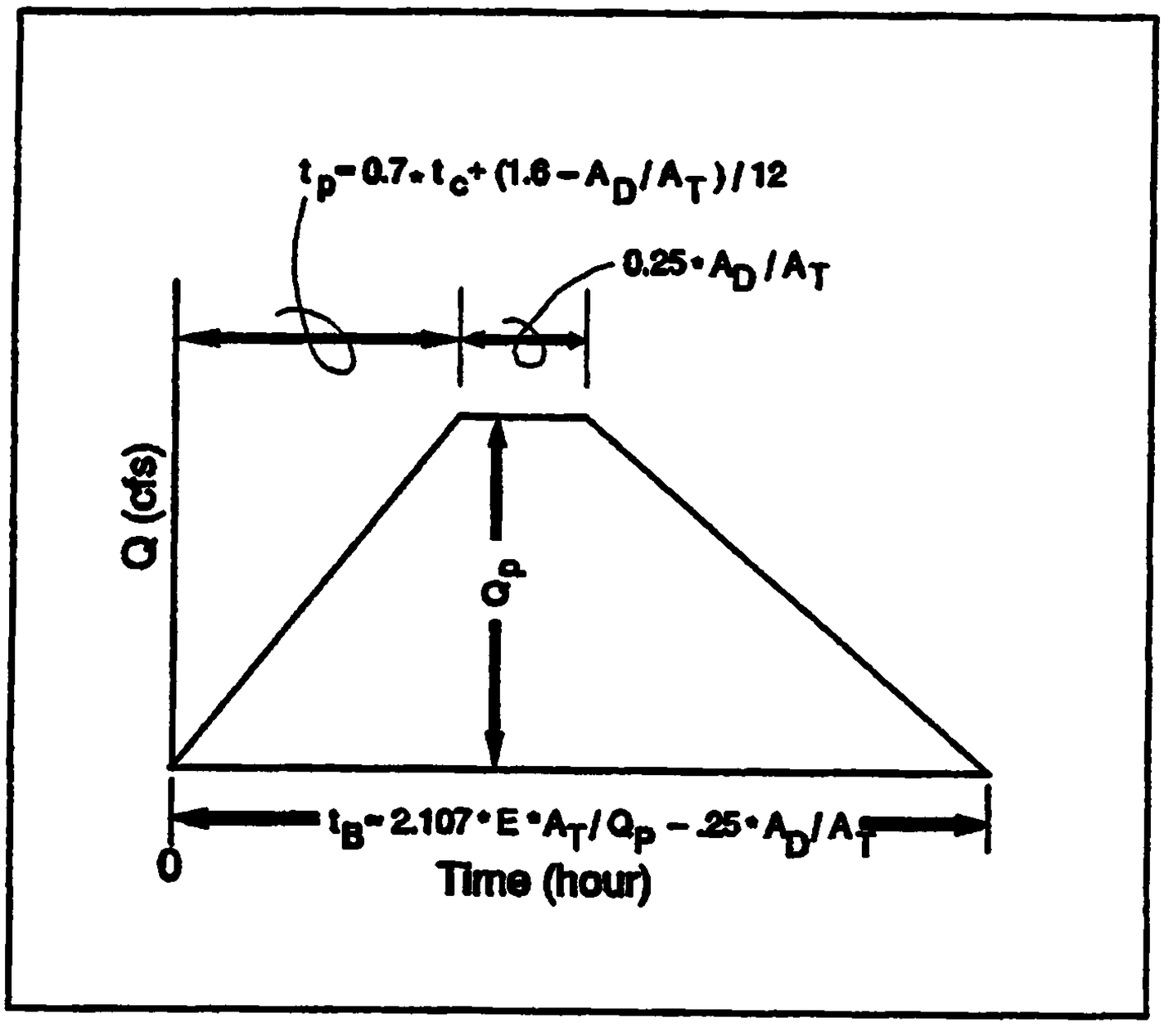
$$t_B = (2.107 * E * A_T / Q_P) - (0.25 * A_D / A_T) \qquad \text{(a-13)}$$

Where t_B is in hours, E is the excess precipitation in inches (from TABLE A-8), Q_P is the peak flow in cfs, A_D is the area in 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:

$$t_P = (0.7 * t_C) + ((1.6 - (A_D / A_T)) / 12) \qquad \text{(a-14)}$$

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 hydrograph will be trapezoidal. FIGURE A-3 shows the hydrograph in graphic form.

FIGURE A-3



Example A-8

Determine the hydrograph for Example A-5.

A_T = 14.0 acres A_D = 4.0 acres t_C = 0.2 hour Q_P = 37.24 cfs

E = ((3 * .44) + (5 * .67) + (2 * .99) + (4 * 1.97)) / (3 + 5 + 2 + 4) = 1.038 inches

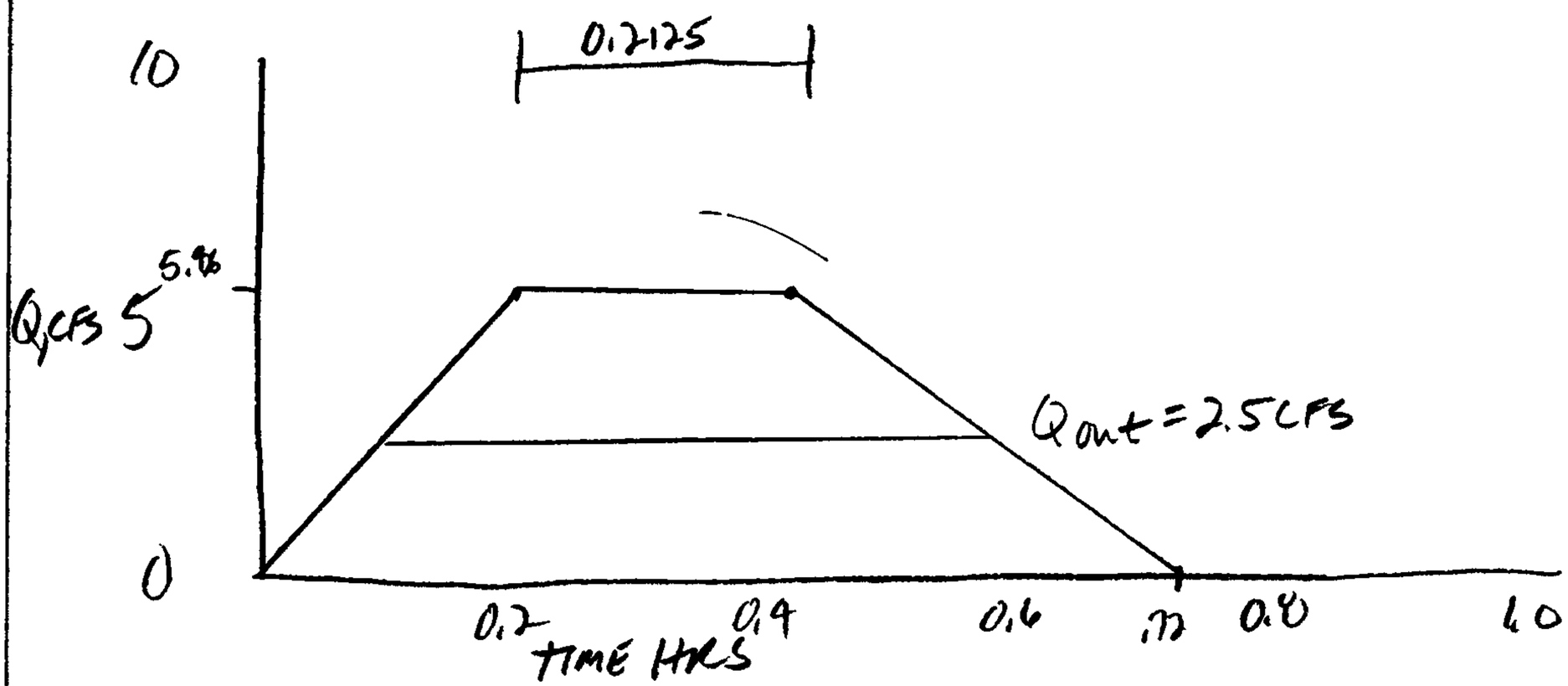
t_P = (0.7 * 0.2) + (1.6 - (4 / 14)) / 12) = 0.2495 hours

t_B = (2.017 * 1.038 * 14 / 37.24) - (0.25 * 4 / 14) = 0.7157 hours

Duration of peak = 0.25 * 4 / 14 = 0.0714 hours

CAMPAD

Basin 10 1.26 ac



$t_p = 0.7 * tc + (1.6 - {}^{AD}/_{AT})/12$

$= 0.7 \times 0.2 + (1.6 - 0.85)/12 = 0.203$ hrs

$0.25 * {}^{AD}/_{AT} = 0.25 \times 0.85 = 0.2125$ hrs

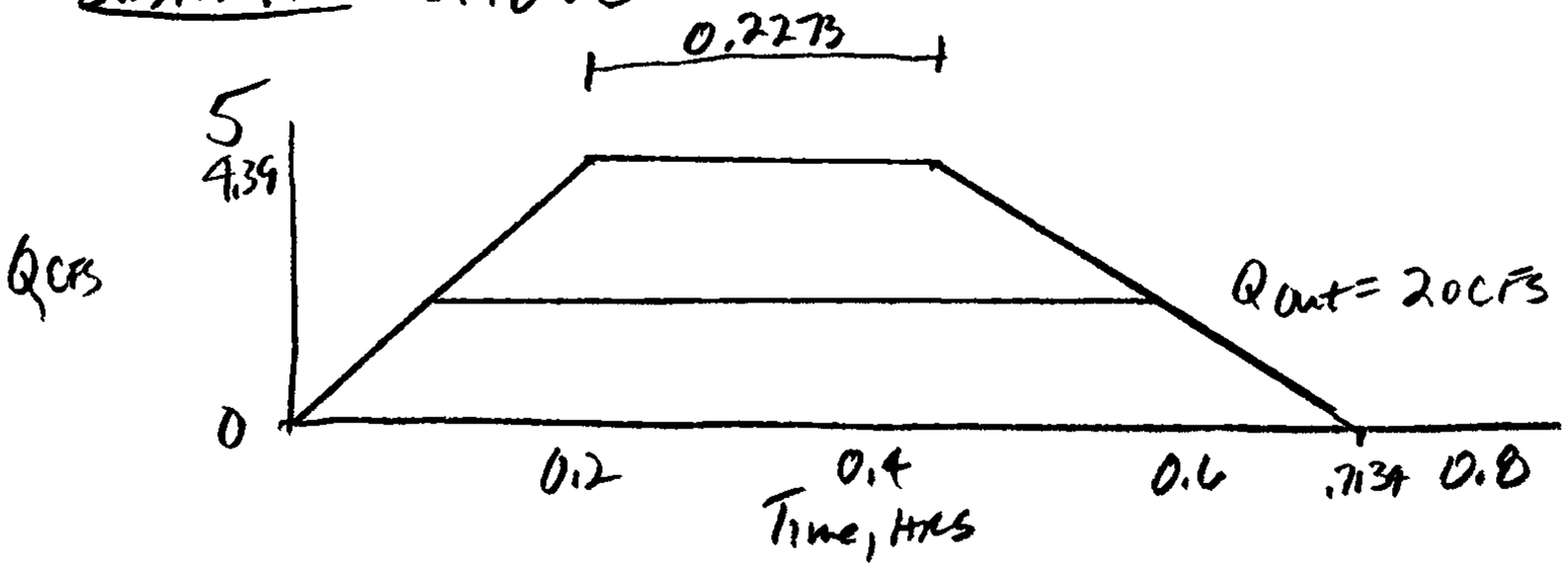
$t_B = (2.107 * E * {}^{AT}/_{Qp}) - (0.25 * {}^{AD}/_{AT})$

$= (2.107 * 1.92 * {}^{1.26}/_{5.46}) - 0.2125 = 0.721$ hrs

Total Volume = 9,174 CF

Volume detained = $\left(\frac{0.2125 + 0.48}{2}\right) \times (5.46 - 2.5) \times 3600 = 3690$ CF

Basin 11 0.98 ac



$t_p = 0.7 * 0.2 + (1.6 - 0.909)/12 = 0.1976 \simeq 0.20$

$0.25 * 0.909 = 0.2273$

$t_B = (2107 * 20 * {}^{0.98}/_{4.39}) - 0.2273 = 0.7134$

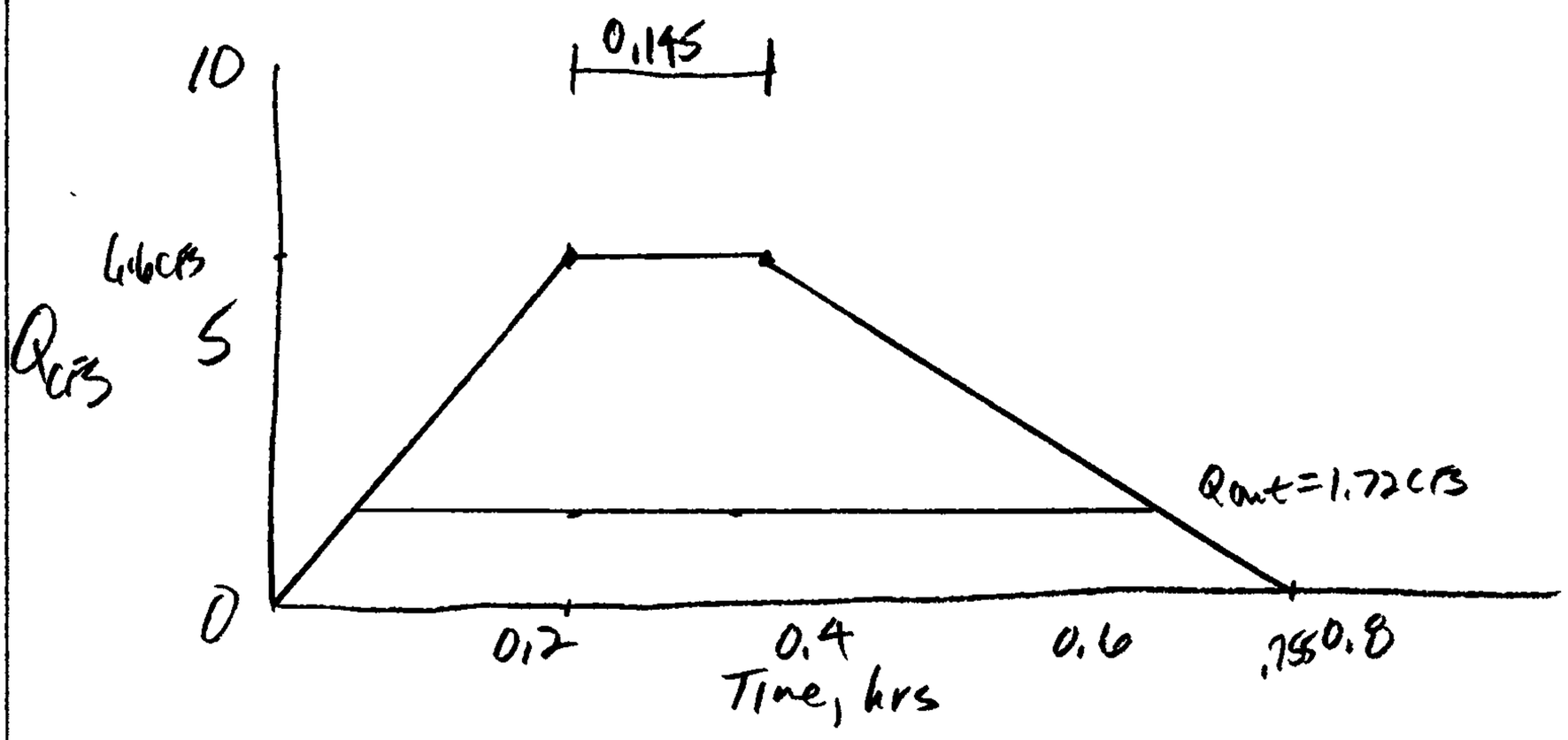
total Volume = 7,433 CF

Volume Detained = $\left(\frac{0.2273 + 0.48}{2}\right) * (4.39 - 2.0) \times 3600 = 3043$ CF

Ahern Site | | 3-5-08

CAMPAD

Basin 21 + Offsite Basin 1.88ac



$A_T = 1.21 + 0.67 = 1.88$ ac

$A_D = (1.21 \times 0896) + (0.67 \times 0.10) = 1.094$ ac

$A_D/A_T = 0.5798$

Weighted $E = \frac{(0.75 \times 0.67) + (1.91 \times 1.21)}{1.88} = 1.4966$

$t_p = 0.7 * 0.2 + (1.6 - 0.58)/12 = 0.225$

$0.25 * 0.58 = 0.145$

$t_B = (2.107 * 1.5 * {}^{1.88}/_{6.6}) - 0.145 = 0.755$

$Q_{out} = (1.88 + 0.81)\,2\,CFS/AC - 3.66 = 1.72\,CFS$

Total Volume = 10,692 CF

Detained Volume = $\left(\frac{0.145 + 0.59}{2}\right) \times (6.6 - 1.72) \times 3600 = 6456$ CF

APPENDIX B
HYDRAULIC CALCULATIONS

CIRCULAR CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

March 5, 2008 18" CPEP Basin 10 to Low

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	6.5
Channel Bottom Slope (ft/ft)	0.005
Manning's Roughness Coefficient (n-value)	0.013
Channel Diameter (ft)	1.5

COMPUTATION RESULTS

DESCRIPTION	VALUE
Normal Depth (ft)	1.09
Flow Velocity (fps)	4.74
Froude Number	0.826
Velocity Head (ft)	0.35
Energy Head (ft)	1.44
Cross-Sectional Area of Flow (sq ft)	1.37
Top Width of Flow (ft)	1.34

CIRCULAR CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

March 5, 2008 12" CPEP IN BASIN 11

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	2.0
Channel Bottom Slope (ft/ft)	0.0166
Manning's Roughness Coefficient (n-value)	0.013
Channel Diameter (ft)	1.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Normal Depth (ft)	0.46
Flow Velocity (fps)	5.64
Froude Number	1.667
Velocity Head (ft)	0.49
Energy Head (ft)	0.96
Cross-Sectional Area of Flow (sq ft)	0.35
Top Width of Flow (ft)	1.0

CIRCULAR CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

March 5, 2008

18" CPEP Basin 20 to Row

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	5.38
Channel Bottom Slope (ft/ft)	0.005
Manning's Roughness Coefficient (n-value)	0.013
Channel Diameter (ft)	1.5

COMPUTATION RESULTS

DESCRIPTION	VALUE
Normal Depth (ft)	0.95
Flow Velocity (fps)	4.58
Froude Number	0.896
Velocity Head (ft)	0.33
Energy Head (ft)	1.27
Cross-Sectional Area of Flow (sq ft)	1.17
Top Width of Flow (ft)	1.45

CIRCULAR CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION

March 5, 2008 12"CPEP Basin 21 to Basin 20.

PROGRAM INPUT DATA

DESCRIPTION	VALUE
Flow Rate (cfs)	1.72
Channel Bottom Slope (ft/ft)	0.0079
Manning's Roughness Coefficient (n-value)	0.013
Channel Diameter (ft)	1.0

COMPUTATION RESULTS

DESCRIPTION	VALUE
Normal Depth (ft)	0.53
Flow Velocity (fps)	4.11
Froude Number	1.121
Velocity Head (ft)	0.26
Energy Head (ft)	0.79
Cross-Sectional Area of Flow (sq ft)	0.42
Top Width of Flow (ft)	1.0

Check ORIFICE FOR PIPES AT INLETS

Basin 11

Qout = 20CFS

Area of Pipe

12"DIA = 0.779 SF 24"DIA = 3.1416SF

18"DIA = 1.767SF

Depth (h)

12"DIA = (4+0.6) − 0.5 = 4.1 Ft

18"DIA = (4+0.6) − 0.75 = 3.85Ft

$Q = C_A\sqrt{2gh}$

12" PIPE $Q = 0.6(0.779)\sqrt{64.4(4.1)} = 7.59$

Solve for Area Q = 20CFS

$20 = 0.6(A)\sqrt{64.4(4.1)} \Rightarrow A =$ 0.205SF ≈ 4" DIA Pipe

Install Orifice Plate on 12" PIPE leaving 3" opening

Basin 10

Qout = 4.5CFS + 20CFS = 6.5CFS

Depth (h)

18" DIA = (3.75 + 2.8) − 0.75 = 5.8 ft

$6.5 = 0.6(A)\sqrt{64.4(5.8)} \Rightarrow A = 0.5605SF$

Install Orifice Plate on 18" PIPE leaving 6" opening

Basin 21

$Q_{out} = 1.72$ CFS

Area of Pipe 12" DIA = 0.779 SF

Depth = (3 + 2.8) − 0.5 = 5.3 ft

$1.72 = 0.6(A)\sqrt{64.4(5.3)} \Rightarrow A = 0.155$ SF

Install orifice Plate on 12" Pipe leaving 3" opening

Basin 20

$Q_{out} = 3.66$ CFS + 1.72 CFS = 5.38 CFS

Area of Pipe 18" DIA = 1.767 SF

Depth = (5.0 + .6) − 0.75 = 4.85 ft

$5.38 = 0.6(A)\sqrt{64.4(4.85)} \Rightarrow A = 0.507$ SF

Install orifice Plate on 18" PIPE leaving 6" opening

APPENDIX C
SOUTH BROADWAY AREA DRAINAGE REPORT

DRAFT

EXISTING CONDITIONS REPORT

SOUTH BROADWAY SECTOR DEVELOPMENT AREA STUDY AND DESIGN ANALYSIS FOR STORM DRAINAGE MANAGEMENT INFRASTRUCTURE

NOVEMBER, 1989

PREPARED FOR

CITY OF ALBUQUERQUE
P.O. BOX 1293
ALBUQUERQUE, NM 87103

PREPARED BY

BOHANNAN-HUSTON, INC.
COURTYARD I
7500 JEFFERSON ST., N.E.
ALBUQUERQUE, NM 87109

(505) 823-1000

JOB NO. 89208.02

TABLE 1

HYDROLOGY FOR SOUTH BROADWAY

BASIN	AREA (SQ.MI.)	LENGTH OF LONGEST FLOWPATH	ELEV. @ TOP	ELEV. @ BOTTOM	SLOPE	% SOIL TYPE*A	% SOIL TYPE*B	LAND USE	CN	% IMPERV	IMPERV AREA	PERV AREA	Tc MIN	Tp HRS	K HRS	10-YR Qpk CFS	100-YR Qpk CFS
SJ-1	0.0795	3500	4968.0	4950	0.0051	65	35	RANGE-FAIR	60	30	0.02385	0.05564	31.8	0.3532	0.177	26	48
SJ-2	0.0989	2500	4959.0	4948	0.0044	30	70	RANGE-FAIR	65	35	0.0346	0.06426	26.0	0.2894	0.145	45	88
SJ-3	0.0237	1500	4965.0	4946.5	0.0123	35	65	RANGE-FAIR	64	35	0.0083	0.01541	11.8	0.1313	0.066	22	41
SJ-4	0.1881	2375	4964.0	4946.4	0.0074	28	72	RANGE-FAIR	66	35	0.06585	0.12228	20.5	0.2276	0.114	107	209
SJ-5	0.0414	2500	4963.5	4944	0.0078	50	50	RANGE-FAIR	62	40	0.01654	0.02482	20.9	0.2322	0.116	26	48
SJN-6	0.0526	3500	4945.0	4939.8	0.0015	0	100	RANGE-FAIR	70	30	0.01578	0.03682	51.3	0.5697	0.285	12	26
SJH-701	0.0788	2250	4968.0	4944	0.0107	91	9	RANGE-FAIR	69	30	0.02364	0.05516	17.1	0.1898	0.095	46	96
SJ-7	0.0684	2550	4966.0	4943.9	0.0087	30	70	RANGE-FAIR	65	32	0.02188	0.0465	20.4	0.2264	0.113	36	70
SJ-8	0.0460	1125	4960.0	4939	0.0187	10	90	RANGE-POOR	78	20	0.00921	0.03682	8.1	0.0897	0.045	49	118
SJ-9SS	0.0419	1600	4942.0	4938.2	0.0024	0	100	RANGE-POOR	79	35	0.01467	0.02724	23.4	0.2603	0.130	27	58
SJ-9OL	0.0504	2300	4942.0	4936.8	0.0023	0	100	RANGE-POOR	79	35	0.01764	0.03276	31.6	0.3508	0.175	26	54
SJN-10	0.0167	1900	4942.5	4941	0.0008	0	100	RANGE-POOR	79	20	0.00333	0.01332	40.9	0.4540	0.227	5	12
SJN-710	0.0321	1700	5002.5	4938	0.0379	87	13	RANGE-POOR	69	4	0.00128	0.03083	8.4	0.0938	0.047	5	23
SJN-720	0.0409	2225	4996.0	4936.5	0.0267	90	10	RANGE-POOR	69	2	0.00082	0.04008	11.9	0.1321	0.066	3	20
SJN-730	0.0423	1750	4994.0	4945	0.028	70	30	RANGE-POOR	71	50	0.02117	0.02117	9.7	0.1079	0.054	67	130
SJN-740	0.1302	2100	4941.0	4936	0.0024	0	100	RANGE-POOR	79	50	0.06512	0.06512	28.9	0.3206	0.160	91	179
SJN-750	0.1110	1250	5040.2	4995	0.0362	70	30	RANGE-POOR	71	0	0	0.111	6.8	0.0754	0.038	11	87
SJH-109	0.1042	3200	5017.0	4938.5	0.0245	85	15	RANGE-POOR	70	8	0.00834	0.09587	16.3	0.1806	0.090	20	65
SJH-100*	0.0970									60	0.0582	0.0388		0.1755	0.088	118	210
SJH-102*	0.1750									40	0.07	0.105		0.2112	0.106	121	215
SJH-105*	0.0530									35	0.01855	0.03445		0.1494	0.075	43	77
SJH-106*	0.0950									35	0.03325	0.06175		0.1799	0.090	66	117
SJH-150*	0.0750									35	0.02625	0.04875		0.1259	0.063	71	126
SJH-152*	0.1320									35	0.0462	0.0858		0.1476	0.074	109	194
SJH-153*	0.0620									40	0.0248	0.0372		0.1412	0.071	60	108
SJH-200*	0.0550									40	0.022	0.033		0.1453	0.073	53	94
SJH-202*	0.0820									10	0.0082	0.0738		0.1872	0.094	16	28
SJH-700*	0.0565									0	0	0.0565		0.1186	0.059	5	33
BH-134*	0.0330									65	0.02145	0.01155		0.0971	0.049	74	133

* All basin data except percent impervious taken from original AMDS computer input files.

S766
S851
GIBSON
S862
S864
S852
S881
S885
S882
S883
ADD
AVE
BLVD
SJH-200
S962
ROBT
SAN JOSE
CEMETERY
JANE
LEWIS
EL ROSARIO
CEMETERY
BRUSH RD
GIBSON
LINDI
TR
S61
AVE
SAN JOSE CHURCH
& SCHOOL
SJH-202
EXTENSION SAN JOSE ADD
S161
ARNO
WALTER
AVE
HIGH
S261
BROADWAY PLACE ADD
S271
S281
S282
S101
BROADWAY HILLS ADD
S201
AVE
S263
S264
SJH-700
LEROY B MILLS
SJH-109
CEMETERY
Basin Limits
DR
S15
SJN-710
S601
RD
ST.
SJN
OIL
COMPAN
GERALD
AVE
WHEELER
AMOKIR
SAN JOSE
MULBERRY
CEDAR
BETHEL
UNIT
KIRTLAND
PARK
FLIGHTW
TRANSPORT
ST.
EISENMAN
SUNPORT
PHASE
PARK
WOODWARD

L14S	S645	4935.50	S747		550	72	8.97364	10996.0	
L14S	S747	surv.	S748			72		0.0	
L14S	S748	surv.	S936			72		0.0	
L14S	S936	surv.	S937			72		0.0	
L14S	S937	surv.	M14N/S33a			72		0.0	
L14S	S852	NA	S851	NA	250	24	NA	NA	
L14S	S851	NA	S761	NA	249	24	NA	NA	
L14S	S766/JB	4948.51	S762	4948.29	49	66	0.00440	193.1	
L14S	S762	4948.29	S761	4946.77	346	66	0.00440	193.1	
L14S	S761	4946.77	S18	4936.42	341	66	0.03035	507.1	
L14S	S18	4936.42	S742	4936.02	265	66	0.00151	113.1	
L14S	S742	4936.02	S746	4935.74	190	66	0.00147	111.7	
L14S	S746	4935.74	S745b	4935.53	140	66	0.00154	114.1	
L14S	S745b	4935.53	S744b	4935.48	30	66	0.00150	112.7	
L14S	S662	NA	S661	4949.54	50	18	NA	NA	
L14S	S646	NA	S547	NA	125	15	NA	NA	
L14S	S547	NA	S546	NA	210	15	NA	NA	
L14S	S546	surv.	S544		30	15			
L14S	S763	NA	S764	4949.04	70	24	NA	NA	
L14S	S862	NA	S864	4947.16	70	24	NA	NA	
L14S	S663	4949.58	S661	4949.54	45	48	0.00098	39.0	08-541-54
L14S	S661	4949.54	S764	4949.04	510	48	0.00098	39.0	08-541-54
L14S	S764	4949.04	S765	4948.59	300	60	0.00150	87.4	08-541-54
L14S	S765	4948.59	JB/S766	4948.51	50	60	0.00150	87.4	08-541-54
L14S	JB/S766	4947.82	S861	4947.49	163	72	0.00202	165.2	08-561-56
L14S	S861	4947.49	S864	4947.16	167	72	0.00198	163.2	08-561-56
L14S	S864	4947.16	S962	4946.40	380	72	0.00200	164.2	08-561-56
L14S	S962	4946.40	S961	4946.24	70	72	0.00229	175.5	08-561-56
L14S	S961	4946.24	M14N/S61	4945.23	505	72	0.00200	164.2	08-561-56

ZONE ATLAS	MANHOLE# UP STRM.	INVERT	MANHOLE # DN. STRM.	INVERT	LENGTH (FT.)	DIA. (IN.)	SLOPE (FT/FT)	CAPACITY (CFS)	CITY JOB NUMBER
M14N									
M14N	Inlet	4935.30	S34	4934.70	100	15	0.00600	4.3	
M14N	S34	4934.70	S33b	4934.53	28	15	0.00600	4.3	
M14N	S32	4934.64	S33b	4934.53	132	36	0.00083	16.7	08-591-59
M14N	S33b	4934.53	S35	4934.40	166	36	0.00078	16.2	08-591-59
M14N	S35	4934.40	S131	4934.16	289	36	0.00083	16.7	08-591-59
M14N	S131	4934.16	S132	4933.90	321	36	0.00081	16.5	08-591-59
M14N	S132	4933.90	S3	4933.66	285	36	0.00084	16.8	08-591-59
M14N	S3	4933.66	S232	4933.54	149	36	0.00081	16.4	08-591-59
M14N	S232	4933.54	S331b/JB	4932.50	200	36	0.00520	41.7	08-591-59
M14N	S331b/JB	4932.50	S243	4932.16	218	72	0.00156	145.0	
M14N	S243	4932.16	S342/JB	4931.74	269	72	0.00156	145.0	
M14N	S342/JB	4931.74	S351/JB	4930.92	325	72	0.00252	184.4	
M14N	S351/JB	4930.92	Outlet	4929.37	320	*	0.00484		
M14N	S224	4934.65	S223	4934.00	203	24	0.00320	11.1	
M14N	S33a	survey	S331b/JB	4932.50		72			
M14N	S331b/JB	4932.50	S342	4931.74	487	72	0.00156	145.0	
M14N	S342	4931.71	S351/JB	4931.19	333	72	0.00156	145.1	
M14N	S61	4946.54	S161	4945.97	368	72	0.00155	144.5	
M14N	S161	4944.22	S261/JB	4943.20	510	72	0.00200	164.2	08-561-56
M14N	S261/JB	4943.20	S252	4938.95	345	54	0.01232	189.2	08-561-56
M14N	S252	4938.95	S251/JB	4934.40	370	54	0.01230	189.0	08-561-56
M14N	S251/JB	4932.90	S241/JB	4932.50	370	72	0.00108	120.7	08-561-56
M14N	S241/JB	4932.16	S341/JB	4931.95	490	72	0.00043	76.0	08-561-56
M14N	S341/JB	4931.95	S342/JB	4931.74	42	72	0.00500	259.6	
M14N	S21	4935.30	S22	4935.20	100	36	0.00100	18.3	08-704-70
M14N	S22	4935.20	S121	4934.90	300	36	0.00100	18.3	08-704-70
M14N	S121	4934.90	S122	4934.60	300	36	0.00100	18.3	08-704-70
M14N	S122	4934.60	S221	4934.30	200	36	0.00150	22.4	08-704-70
M14N	S221	4934.30	S222	4934.10	100	36	0.00200	25.9	08-704-70
M14N	S222	4934.10	S223	4934.00	62	36	0.00161	23.2	08-704-70
M14N	S223	4934.00	S321	4933.70	239	36	0.00126	20.5	08-704-70
M14N	S321	4933.70	S332a	4933.67	24	36	0.00125	20.4	08-704-70
M14N	S332a	4933.67	S333	4933.52	156	36	0.00096	17.9	08-704-70
M14N	S333	4933.52	S331a	4933.30	218	36	0.00101	18.4	08-704-70
M14N	S331a	4933.30	S332b	4933.02	201	36	0.00139	21.6	08-704-70
M14N	S332b	4933.02	S331b	4932.50	47	36	0.01106	60.8	08-704-70
M14N	S6	5011.45	S201	5003.07	387	48	0.02165	183.2	08-621-62
M14N	S201	5002.17	S282	4987.58	590	48	0.02473	195.8	08-621-62
M14N	S282	4986.45	S281	4978.38	400	48	0.02018	176.8	08-621-62
M14N	S281	4975.43	S271	4965.58	400	48	0.02463	195.4	08-621-62
M14N	S271	4964.32	S262	4954.74	386	48	0.02482	196.1	08-621-62
M14N	S262	4951.11	S263	4948.05	210	54	0.01457	205.8	08-621-62
M14N	S263	4946.77	S264	4943.05	254	54	0.01465	206.3	08-621-62
M14N	S264	4941.97	S253	4939.17	280	54	0.01000	170.4	08-621-62
M14N	S253	4939.17	S254	4938.03	120	54	0.00950	166.1	08-621-62
M14N	S254	4937.05	S242	4933.53	358	54	0.00983	169.0	08-621-62
M14N	S242	4932.85	S342	4931.40	126	54	0.01151	182.8	08-621-62
M14N	S333	4933.12	S343	4932.02	370	24	0.00297	10.7	10-001-70
M14N	S343	4932.02	S344	4931.18	280	30	0.00300	19.5	10-001-70
M14N	S344	4931.18	S353	4930.50	225	30	0.00302	19.5	10-001-70

M14N	Inlet	4935.30	S34	4934.70	100	15	0.00600	4.3	
M14N	S34	4934.70	S33b	4934.53	28	15	0.00600	4.3	
M14N	S32	4934.64	S33b	4934.53	132	36	0.00083	16.7	08-591-59
M14N	S33b	4934.53	S35	4934.40	166	36	0.00078	16.2	08-591-59
M14N	S35	4934.40	S131	4934.16	289	36	0.00083	16.7	08-591-59
M14N	S131	4934.16	S132	4933.90	321	36	0.00081	16.5	08-591-59
M14N	S132	4933.90	S3	4933.66	285	36	0.00084	16.8	08-591-59
M14N	S3	4933.66	S232	4933.54	149	36	0.00081	16.4	08-591-59
M14N	S232	4933.54	S331b/JB	4932.50	200	36	0.00520	41.7	08-591-59
M14N	S331b/JB	4932.50	S243	4932.16	218	72	0.00156	145.0	
M14N	S243	4932.16	S342/JB	4931.74	269	72	0.00156	145.0	
M14N	S342/JB	4931.74	S351/JB	4930.92	325	72	0.00252	184.4	
M14N	S351/JB	4930.92	Outlet	4929.37	320	*	0.00484		
M14N	S224	4934.65	S223	4934.00	203	24	0.00320	11.1	
M14N	S33a	survey	S331b/JB	4932.50		72			
M14N	S331b/JB	4932.50	S342	4931.74	487	72	0.00156	145.0	
M14N	S342	4931.71	S351/JB	4931.19	333	72	0.00156	145.1	
M14N	S61	4946.54	S161	4945.97	368	72	0.00155	144.5	
M14N	S161	4944.22	S261/JB	4943.20	510	72	0.00200	164.2	08-561-56
M14N	S261/JB	4943.20	S252	4938.95	345	54	0.01232	189.2	08-561-56
M14N	S252	4938.95	S251/JB	4934.40	370	54	0.01230	189.0	08-561-56
M14N	S251/JB	4932.90	S241/JB	4932.50	370	72	0.00108	120.7	08-561-56
M14N	S241/JB	4932.16	S341/JB	4931.95	490	72	0.00043	76.0	08-561-56
M14N	S341/JB	4931.95	S342/JB	4931.74	42	72	0.00500	259.6	
M14N	S21	4935.30	S22	4935.20	100	36	0.00100	18.3	08-704-70
M14N	S22	4935.20	S121	4934.90	300	36	0.00100	18.3	08-704-70
M14N	S121	4934.90	S122	4934.60	300	36	0.00100	18.3	08-704-70
M14N	S122	4934.60	S221	4934.30	200	36	0.00150	22.4	08-704-70
M14N	S221	4934.30	S222	4934.10	100	36	0.00200	25.9	08-704-70
M14N	S222	4934.10	S223	4934.00	62	36	0.00161	23.2	08-704-70
M14N	S223	4934.00	S321	4933.70	239	36	0.00126	20.5	08-704-70
M14N	S321	4933.70	S332a	4933.67	24	36	0.00125	20.4	08-704-70
M14N	S332a	4933.67	S333	4933.52	156	36	0.00096	17.9	08-704-70
M14N	S333	4933.52	S331a	4933.30	218	36	0.00101	18.4	08-704-70
M14N	S331a	4933.30	S332b	4933.02	201	36	0.00139	21.6	08-704-70
M14N	S332b	4933.02	S331b	4932.50	47	36	0.01106	60.8	08-704-70
M14N	S6	5011.45	S201	5003.07	387	48	0.02165	183.2	08-621-62
M14N	S201	5002.17	S282	4987.58	590	48	0.02473	195.8	08-621-62
M14N	S282	4986.45	S281	4978.38	400	48	0.02018	176.8	08-621-62
M14N	S281	4975.43	S271	4965.58	400	48	0.02463	195.4	08-621-62
M14N	S271	4964.32	S262	4954.74	386	48	0.02482	196.1	08-621-62
M14N	S262	4951.11	S263	4948.05	210	54	0.01457	205.8	08-621-62
M14N	S263	4946.77	S264	4943.05	254	54	0.01465	206.3	08-621-62
M14N	S264	4941.97	S253	4939.17	280	54	0.01000	170.4	08-621-62
M14N	S253	4939.17	S254	4938.03	120	54	0.00950	166.1	08-621-62
M14N	S254	4937.05	S242	4933.53	358	54	0.00983	169.0	08-621-62
M14N	S242	4932.85	S342	4931.40	126	54	0.01151	182.8	08-621-62
M14N	S333	4933.12	S343	4932.02	370	24	0.00297	10.7	10-001-70
M14N	S343	4932.02	S344	4931.18	280	30	0.00300	19.5	10-001-70
M14N	S344	4931.18	S353	4930.50	225	30	0.00302	19.5	10-001-70
M14N	S353	4930.50	S350	4930.14	120	42	0.00300	47.8	10-001-70
M14N	S350	4930.14	Outlet	4929.77	32	42	0.01156	93.8	
M14N	S431	4932.07	S432a	4931.37	360	30	0.00194	15.7	10-001-70
M14N	S432a	4931.37	S441	4930.79	319	30	0.00182	15.2	10-001-70
M14N	S441	4930.79	S451	4929.89	391	36	0.00230	27.7	10-001-70
M14N	S451	4929.89	Flap Gate	4929.85	17	36	0.00235	28.0	
M14N	S432b	4932.50	S443	4931.28	600	30	0.00203	16.0	22-338-69
M14N	S443	4931.20	S444	4931.12	79	30	0.00101	11.3	22-338-69
M14N	S444	4931.28	S452	4930.56	276	30	0.00261	18.2	22-338-69
M14N	S452	4930.56	Flap Gate	4930.50	24	30	0.00250	17.8	22-338-69
M14N	S433	4932.36	S435	4932.10	130	24	0.00200	8.8	10-001-70
M14N	S435	4932.10	S442	4931.29	270	30	0.00300	19.5	10-001-70
M14N	S442	4931.29	S445	4930.66	210	30	0.00300	19.5	10-001-70
M14N	S445	4930.66	S453	4929.84	273	36	0.00300	31.7	10-001-70
M14N	S453	4929.84	Outlet	4929.71	17	36	0.00765	50.6	
M14N	S551	4931.28	S456	4930.53	250	24	0.00300	10.7	10-001-70
M14N	S456	4930.53	S455	4930.36	58	36	0.00293	31.3	10-001-70
M14N	S455	4930.36	S454	4930.33	8	36	0.00375	35.4	10-001-70
M14N	S454	4930.33	Flap Gate	4927.46	179	36	0.01603	73.2	10-001-70
M14N	S224	4934.45	S223	4933.80	203	24	0.00320	11.1	10-005-83
S									
M14N	S334	4931.20	S421	4930.90	300	36	0.00100	18.3	10-005-83
M14N	S421	4930.90	S522	4930.50	401	36	0.00100	18.3	10-005-83
M14N	S522	4930.50	S521	4930.10	400	36	0.00100	18.3	10-005-83
M14N	S521	4930.10	S621	4929.69	416	36	0.00099	18.1	10-005-83
M14N	S621	4929.69	S622	4929.31	346	36	0.00110	19.2	10-005-83
M14S	S622	4929.31	S631	4928.95	360	36	0.00100	18.3	10-005-83
M14S	S631	4928.95	S641	4928.57	378	36	0.00101	18.3	10-005-83
M14S	S641	4928.57	S642	4928.19	379	36	0.00100	18.3	10-005-83
M14S	S642	4928.19	Drain. Ch.	4927.89	66	36	0.00455	39.0	10-005-83
M14S	S601		S600		495	30		0.0	
M14S	S600		Drain. Ch.	4929.40	85	30		0.0	
M14S	S15		S16		53	30		0.0	
M14S	S16		S17		490	30		0.0	
M14S	S17		Drain. Ch.		70	30		0.0	

MODELING MAP

SOUTH BROADWAY MASTER DRAINAGE STUDY

LEGEND

STUDY AREA BOUNDARY	EXISTING STORM SEWER
SUBBASIN BOUNDARY	S345 MANHOLE IDENTIFICATION NUMBER
SJ-2 BASIN IDENTIFICATION	
OVERLAND FLOW	SWMM MODEL - SHADED AREA

BHI JOB NO.
89208.02

DECEMBER 1989

0 500 1000 1500 2000

SCALE IN FEET
1" = 500'

BOHANNAN HUSTON INC.