MARCH 7, 2012

# DRAINAGE REPORT

FOR

# BROADSTONE SANTA MONICA
## San Pedro Blvd. and Santa Monica Ave. NE

BY


***ISAACSON & ARFMAN, P.A.***

***Consulting Engineering Associates***

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


*I&A Project No. 1900*

MARCH 7, 2012

# DRAINAGE REPORT

FOR

# BROADSTONE SANTA MONICA PLACE
## San Pedro Blvd. and Santa Monica Ave. NE

BY


***ISAACSON & ARFMAN, P.A.***

***Consulting Engineering Associates***

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


*I&A Project No. 1900*

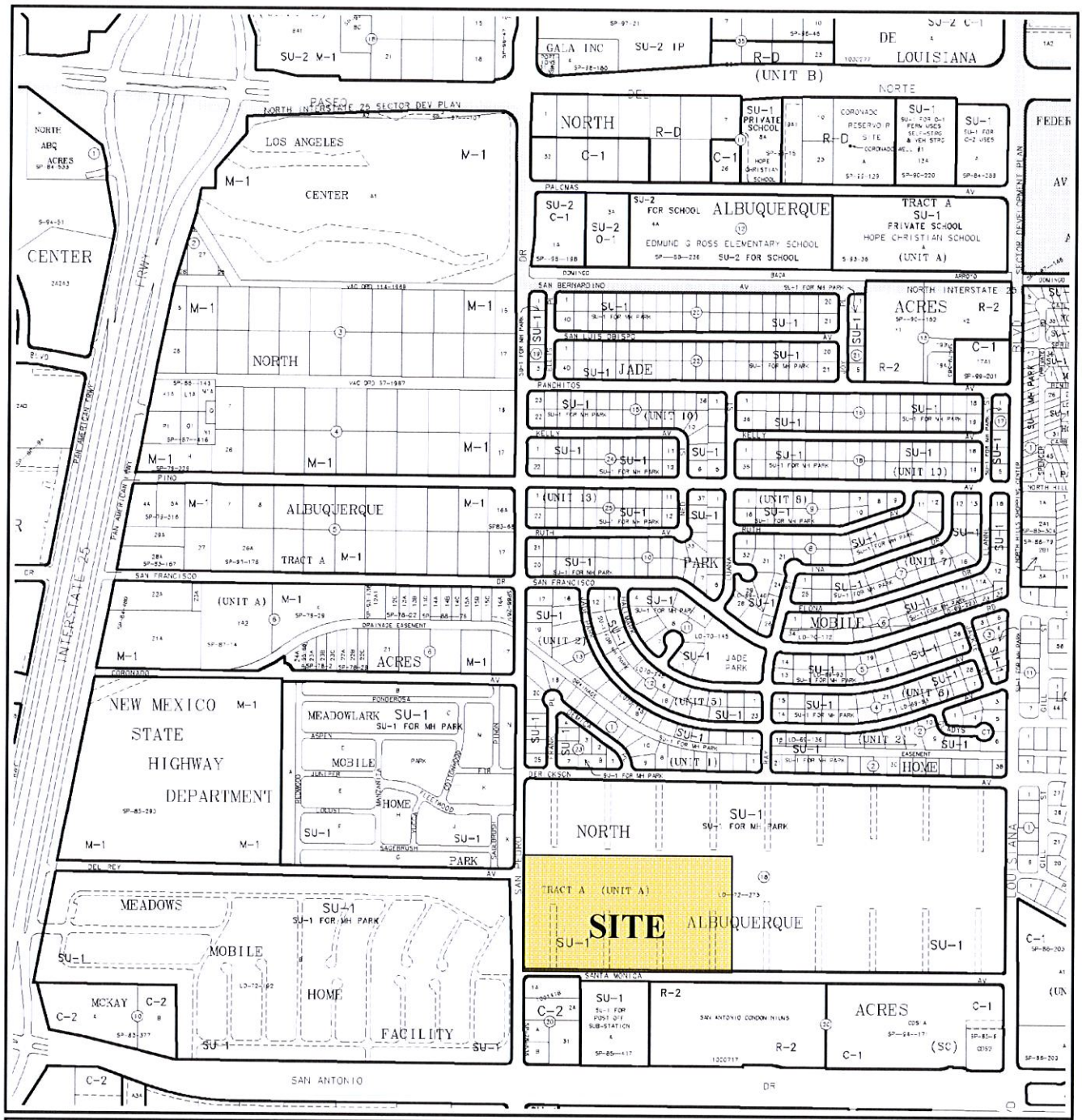
ÅSA M. NILSSON-WEBER
NEW MEXICO
17631
LICENSED PROFESSIONAL ENGINEER

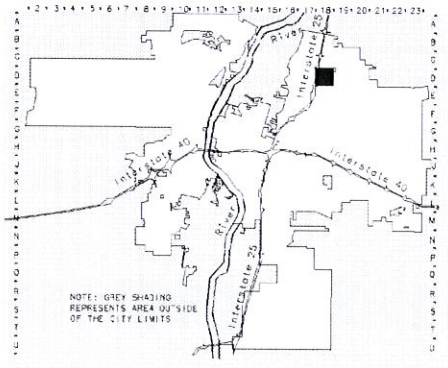
Prepared by:

Åsa Nilsson-Weber, PE

3-7-12
Date

# TABLE OF CONTENTS




CITY OF ALBUQUERQUE NEW MEXICO 1706

A buquerque G eographic I nformation S ystem
PLANNING DEPARTMENT

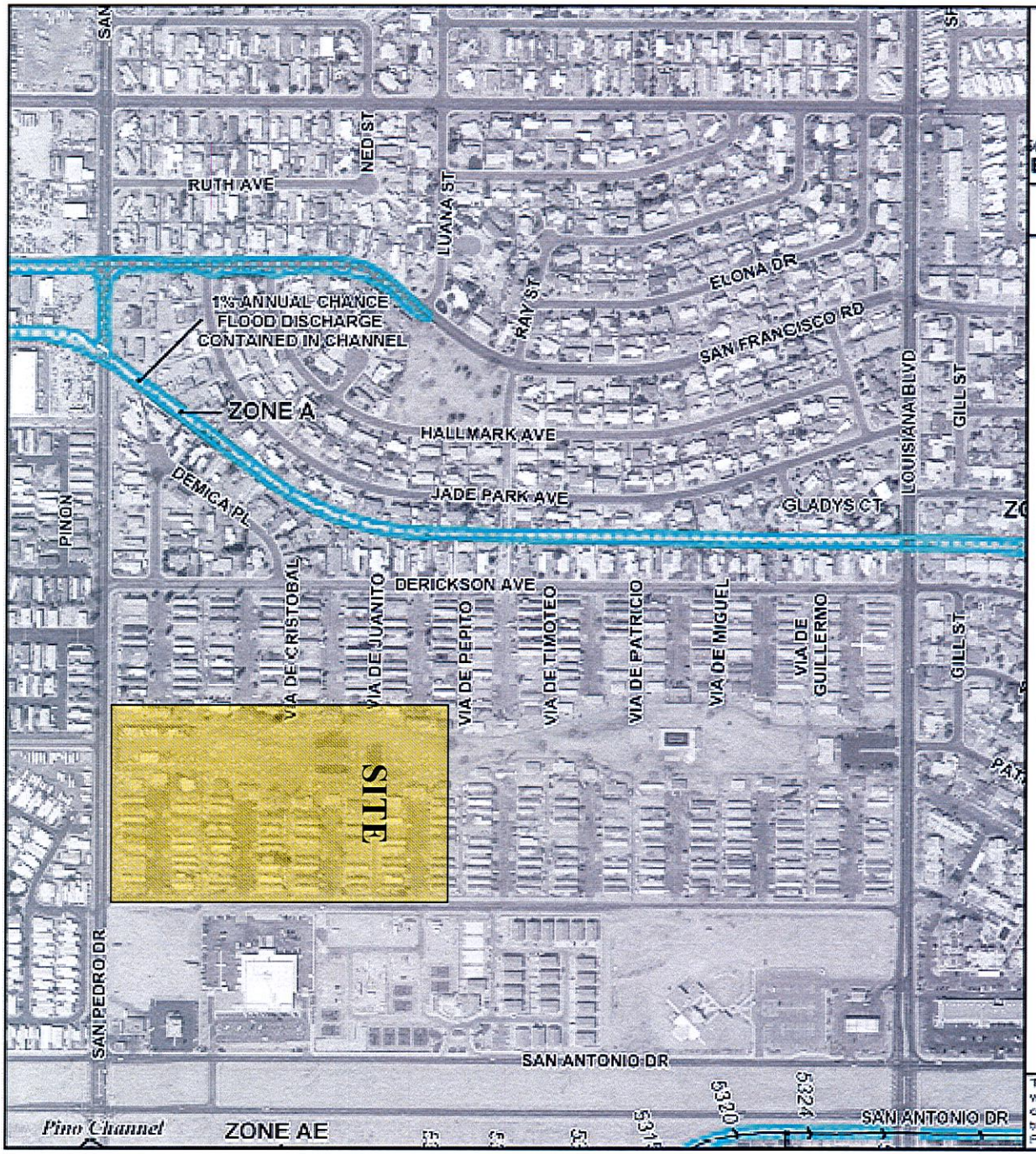


GRAPHIC SCALE IN FEET
250 0 750 1000

# Zone Atlas Page

# D-18-Z

Map Amended through February 01, 2005




MAP SCALE 1" = 500'

0 500 1000 FEET

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0137G

# FIRM

FLOOD INSURANCE RATE MAP

## BERNALILLO COUNTY, NEW MEXICO

AND INCORPORATED AREAS

PANEL 137 OF 825

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| ALBUQUERQUE, CITY OF | 350002 | 0137 | G |
| BERNALILLO COUNTY | | | |
| UNINCORPORATED AREAS | 350001 | 0137 | 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
35001C0137G

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

# I. PROJECT INFORMATION

LEGAL DESCRIPTION:
Tract 2, Santa Monica Place

TOTAL AREA:
13.98 Acres

FLOOD PLAIN:
Zone X
This site lies outside the 100-year flood based on FIRM Map No. 35001C0137G
Map Revision date: September 26, 2008

ENGINEER:
Isaacson & Arfman, P.A.
128 Monroe Street NE
Albuquerque, NM 87108
(505) 268-8828
Attn: Åsa Nilsson-Weber

SURVEYOR:
Surv-Tek, Inc.
(505) 897-3366
Attn: Russ P. Hugg, NMPLS No. 9750

LAND OWNER:
Broadstone Santa Monica, LLC
c/o Titan Development
6300 Riverside Plaza Lane NW - #200
Albuquerque, NM 87120-2617
Attn: Kurt Browning

# II. INTRODUCTION

Broadstone Santa Monica, Tract 2 Santa Monica Place, will be developed with apartments. The site is bound by Santa Monica Ave. NE to the south and by San Pedro Blvd. NE to the west. A Master Drainage Report for Tracts 1-4, Santa Monica Place was prepared by Isaacson & Arfman, P.A. on February 21, 2012. This master report outlined the required drainage improvements for this site.

The purpose of this master drainage report is to analyze flows generated and flow capacity of onsite driving aisles, sidewalk culverts and storm drains.

# III. EXISTING CONDITIONS

The site discharges to the northwest and flows enter the existing public storm sewer system inlets near the intersection of Derickson Ave. and San Pedro Blvd. NE.

The existing public storm drain system at the intersection of Derickson Ave. and San Pedro Blvd. includes a 48" pipe east to an existing cattle guard inlet in Derickson Ave. and a 36" pipe south to collect street flow from four existing curb inlets in San Pedro Blvd. The flows are conveyed north in a 60" storm drain to the North Pino Arroyo. There are also four additional curb inlets in San Pedro Blvd. between Derickson Ave. and the North Pino Arroyo.

# IV. PROPOSED CONDITIONS

The site will be developed with apartments, drives, parking areas and landscaping. There is one entrance from San Pedro Blvd. and two entrances from Santa Monica Ave. Land treatments were calculated based on the impervious and pervious areas shown on the site plan and landscaping plan. See Appendix A for a Basin Map and a Basin Area & Land Treatment table. The 100-year, 6-hour flows were calculated in AHYMO (Appendix B).

The site will discharge 13.0 cfs to Santa Monica Ave. and 48.1 to San Pedro Blvd. for a total of 61.1 cfs, which is less than the 61.4 cfs listed for Tract 2 in the Master Drainage Report for Tracts 1-4.

### PUBLIC STORM DRAIN

Per the Master Drainage Report, a public 48-inch storm drain shall be extended from the existing cattle guard inlet in Derickson Ave. onto Tract 1. A temporary inlet shall be constructed at the terminus of the 48-inch storm drain to capture undeveloped flows from Tract 1. See section on Offsite Drainage Improvements for further discussion.

## PRIVATE STORM DRAIN

There are two onsite private storm drain systems as shown on the Private Storm Drain Detail plan in the back pocket (Sheet CG5.1). The Storm Drain Sub-Basin Map in Appendix C shows the basins contributing flows to each inlet. Flows were calculated based on the master drainage basin cfs/acre.

The west storm drain system collects 21.5 cfs through 5 sump inlets, and the flows are discharged to San Pedro Blvd. via a stilling basin at the entrance. A 4-inch discharge pipe will convey water collected in the 0.5-foot sump in the basin to the 2-foot sidewalk culvert north of the basin. The westerly inlet in the driving aisle will accept 11 cfs at a head of 0.5 feet (see Appendix C for Inlet Capacity Chart), and the remaining flows will overflow toward the San Pedro Blvd. entrance.

The east storm drain system collects 2.8 cfs in 4 sump inlets located in Basin 1. These flows discharge through a headwall to a parking area and then surface flows northwest. Appendix C contains storm drain calculations and inlet capacity charts.

## SIDEWALK CULVERTS

A total of 5 sidewalk culverts will discharge between 1 and 2.2 cfs each to Santa Monica Ave. and San Pedro Blvd. The sidewalk culvert capacity calculations included in Appendix D show that a 2-foot sidewalk culvert has capacity for 2.4 cfs. There are also a series of private onsite sidewalk culverts and drain pipes that will convey minor flows under walks.

## DRIVING AISLE FLOW CAPACITY

The drives have capacity to contain surface flows. Capacity calculations are included in Appendix E for one critical location adjacent to Building Number 16, denoted on the Basin Map as Section A-A.

## OFFSITE DRAINAGE IMPROVEMENTS

Per the Master Drainage Report for Tracts 1-4, Santa Monica Place, the following improvements shall be required.

- A storm water deflection berm shall be constructed to direct the flows to a temporary inlet at the terminus of the new 48" storm drain that shall capture flows from Tract 1. The 48" storm drain and the temporary inlet shall be constructed with the public work order plans for Broadstone Santa Monica Apartments.

- A berm shall be constructed between Tracts 1 & 3 and Tracts 2 & 4, and the offsite flows from the east shall be diverted via a swale to a detention pond with weir overflow to Derickson Ave. The maximum pond storage volume at a maximum outflow of 26.8 cfs is 1.9 ac-ft.

The Offsite Grading Plan in the back pocket shows the offsite grading improvements.

# V. SUMMARY AND CONCLUSIONS

Broadstone Santa Monica, Tract 2 Santa Monica Place, will be developed with apartments. The drainage improvements include the following:

- A public 48" storm drain shall be installed from the existing cattle guard inlet in Derickson Ave. to onsite (by public work order).

- Private storm drain with inlets shall be constructed per the Grading Plan. A stilling basin shall be constructed at the storm drain outfall by the San Pedro Blvd. entrance.

- Five 24-inch sidewalk culverts shall be installed to convey flows to Santa Monica Ave. and San Pedro Blvd. (by public work order).

- Private sidewalk culverts and drain pipes shall be installed per the Grading Plan.

- A storm water deflection berm shall be constructed to direct the flows to a temporary inlet at the terminus of the new 48" storm drain that shall capture flows from Tract 1. The temporary inlet shall be constructed by public work order.

- A berm shall be constructed between Tracts 1 & 3 and Tracts 2 & 4, and a swale shall be constructed to direct offsite flows from the east to a detention pond. The detention pond shall be constructed in accordance with the Offsite Grading Plan with a riprap-lined weir and overflow channel to Derickson Ave.

# APPENDIX A

## Land Treatments & Basin Areas

**BASIN AREA & LAND TREATMENT TABLE**

PROJECT NAME Broadstone Santa Monica

PROJECT # 1900

| BASIN ID | AREA (sf) | AREA (Ac) | AREA (sq. mi.) | Q100 (cfs) | LAND TREATMENTS %A | %B | %C | %D |
|---|---|---|---|---|---|---|---|---|
| 1 | 205,518 | 4.7181 | 0.00737 | 21.7 | 0 | 0 | 20 | 80 |
| 2a | 19,920 | 0.4573 | 0.00071 | 1.9 | 0 | 0 | 52 | 48 |
| 2b | 22,611 | 0.5191 | 0.00081 | 2.2 | 0 | 0 | 50 | 50 |
| 2c | 12,601 | 0.2893 | 0.00045 | 1.1 | 0 | 0 | 50 | 50 |
| 2d | 10,384 | 0.2384 | 0.00037 | 1.0 | 0 | 0 | 40 | 60 |
| 3 | 85,176 | 1.9554 | 0.00306 | 8.9 | 0 | 4 | 16 | 80 |
| 4 | 121,519 | 2.7897 | 0.00436 | 13.1 | 0 | 0 | 15 | 85 |
| 5a | 107,771 | 2.4741 | 0.00387 | 8.8 | 0 | 25 | 45 | 30 |
| 5b | 12,993 | 0.2983 | 0.00047 | 1.3 | 0 | 0 | 50 | 50 |
| 6 | 10,671 | 0.2450 | 0.00038 | 1.1 | 0 | 0 | 20 | 80 |
| TOTAL AREA = | 609,164 | 13.9845 | 0.02185 | 61.1 | | | | |

NOTE: Land treatments were calculated from impervious/pervious areas in site plan, and 100-yr, 6-hr flow was calculated in AHYMO.

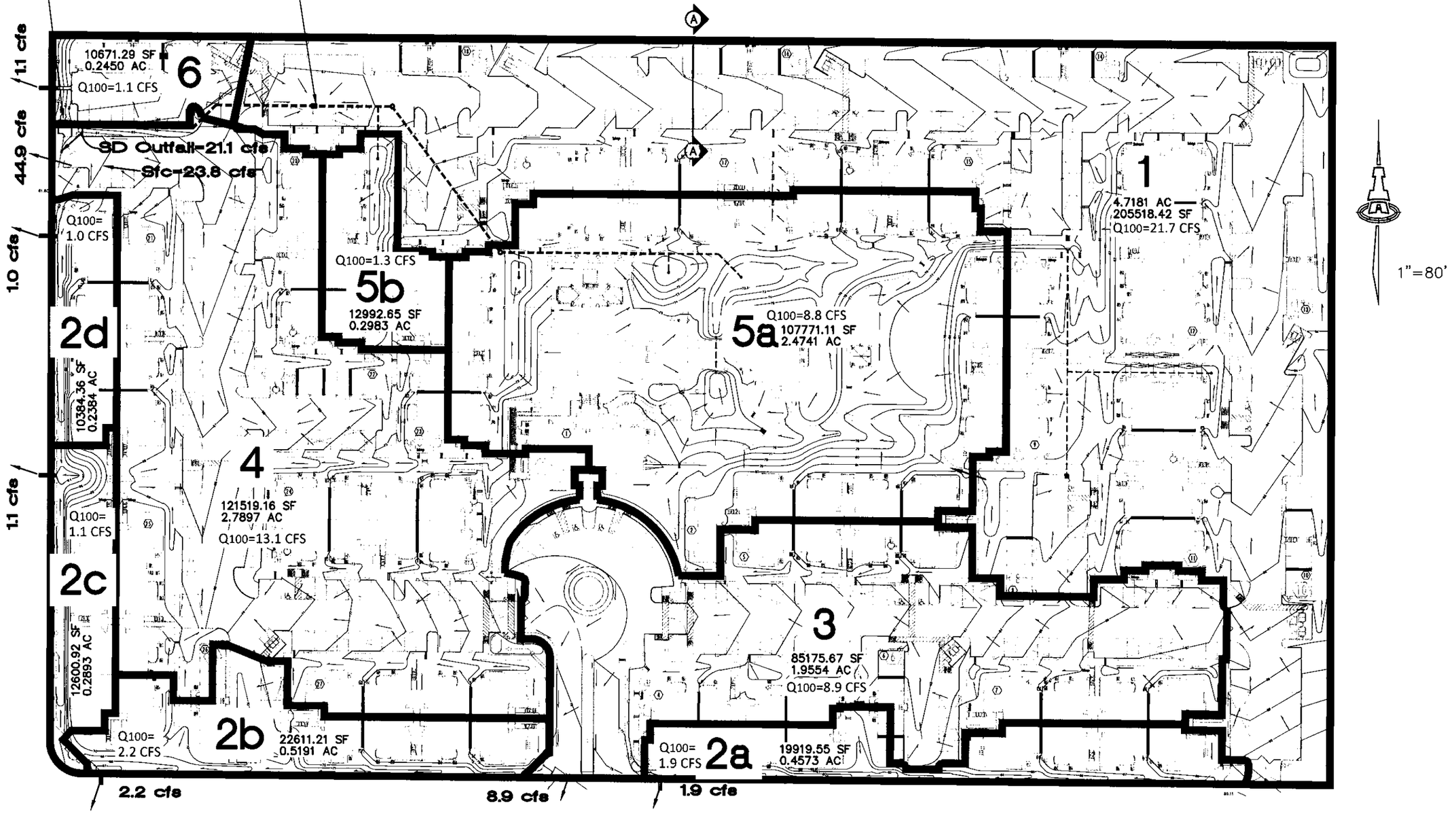
# BROADSTONE SANTA MONICA
# BASIN MAP
## 3-6-12

STILLING BASIN WITH OVERFLOW TO SAN PEDRO VIA ENTRANCE

2'X3' INLET CAPACITY = 11 CFS @ 0.5' HEAD REMAINDER OVERFLOWS TO SAN PEDRO VIA ENTRANCE

TOTAL FLOWS & DISCHARGE LOCATIONS:

| | |
|---|---|
| SANTA MONICA | 13.0 CFS |
| SAN PEDRO | 48.1 CFS |
| TOTAL: | 61.1 CFS |



# APPENDIX B

## DRAINAGE CALCULATIONS

AHYMO PROGRAM SUMMARY TABLE (AHYMO_97) - - VERSION: 1997.02d RUN DATE (MON/DAY/YR) =02/28/2012
INPUT FILE = 1900P2.DAT USER NO.= AHYMO-S-9702dIsa-Arfman3



| 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********** | | | | | | | | | | | |
| *S | BROADSTONE SANTA MONICA | | | | | | | | | | |
| *S | TRACT 2, SANTA MONICA PLACE | | | | | | | | | | |
| *S | DEVELOPED CONDITIONS | | | | | | | | | | |
| *S | 100-YR, 6-HR STORM | | | | | | | | | | |
| *S | 1900P2.DAT | | | | | | | | | | |
| *S | FEBRUARY 28, 2012 | | | | | | | | | | |
| *S | BY ASA NILSSON-WEBER | | | | | | | | | | |
| *S | ISAACSON & ARFMAN, P.A. | | | | | | | | | | |
| *S********** | | | | | | | | | | | |
| START | | | | | | | | | | TIME= | .00 |
| RAINFALL TYPE= 1 | | | | | | | | | | RAIN6= | 2.450 |
| *S | | | | | | | | | | | |
| *S BASIN 1 | | | | | | | | | | | |
| COMPUTE NM HYD | 100.00 | - | 1 | .00737 | 21.68 | .792 | 2.01525 | 1.500 | 4.597 | PER IMP= | 80.00 |
| *S BASIN 2a | | | | | | | | | | | |
| COMPUTE NM HYD | 200.00 | - | 2 | .00071 | 1.87 | .064 | 1.69538 | 1.500 | 4.122 | PER IMP= | 48.00 |
| *S BASIN 2b | | | | | | | | | | | |
| COMPUTE NM HYD | 300.00 | - | 3 | .00081 | 2.15 | .074 | 1.71538 | 1.500 | 4.151 | PER IMP= | 50.00 |
| *S BASIN 2c | | | | | | | | | | | |
| COMPUTE NM HYD | 400.00 | - | 4 | .00045 | 1.12 | .038 | 1.56363 | 1.500 | 3.891 | PER IMP= | 41.67 |
| *S BASIN 2d | | | | | | | | | | | |
| COMPUTE NM HYD | 500.00 | - | 5 | .00037 | 1.03 | .036 | 1.81533 | 1.500 | 4.353 | PER IMP= | 60.00 |
| *S BASIN 3 | | | | | | | | | | | |
| COMPUTE NM HYD | 600.00 | - | 6 | .00306 | 8.94 | .326 | 1.99861 | 1.500 | 4.565 | PER IMP= | 80.00 |
| *S BASIN 4 | | | | | | | | | | | |
| COMPUTE NM HYD | 700.00 | - | 7 | .00436 | 13.06 | .480 | 2.06522 | 1.500 | 4.680 | PER IMP= | 85.00 |
| *S BASIN 5a | | | | | | | | | | | |
| COMPUTE NM HYD | 800.00 | - | 8 | .00387 | 8.84 | .292 | 1.41397 | 1.500 | 3.568 | PER IMP= | 30.00 |
| *S BASIN 5b | | | | | | | | | | | |
| COMPUTE NM HYD | 900.00 | - | 9 | .00047 | 1.26 | .043 | 1.71538 | 1.500 | 4.179 | PER IMP= | 50.00 |
| *S BASIN 6 | | | | | | | | | | | |
| COMPUTE NM HYD | 110.00 | - | 10 | .00038 | 1.14 | .041 | 2.01525 | 1.500 | 4.674 | PER IMP= | 80.00 |
| FINISH | | | | | | | | | | | |

```
*S*********************************************************************
*S       BROADSTONE SANTA MONICA
*S       TRACT 2, SANTA MONICA PLACE
*S       DEVELOPED CONDITIONS
*S       100-YR, 6-HR STORM
*S       1900P2.DAT
*S       FEBRUARY 28, 2012
*S       BY ASA NILSSON-WEBER
*S       ISAACSON & ARFMAN, P.A.
*S*********************************************************************
START                RAINFALL BEGINS AT 0.0 HRS
RAINFALL             TYPE=1 RAIN QUARTER=0 RAIN ONE=2.1
                     RAIN SIX=2.45 RAIN DAY=2.85 DT=0.03333HR
*S
*S  BASIN 1
COMPUTE NM HYD        ID=1 HYD NO=100 AREA=0.00737 SQ MI
                      PER A=0 PER B=0 PER C=20 PER D=80
                      TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD             ID=1   CODE=1
*S  BASIN 2a
COMPUTE NM HYD        ID=2 HYD NO=200 AREA=0.00071 SQ MI
                      PER A=0 PER B=0 PER C=52 PER D=48
                      TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD             ID=2   CODE=1
*S  BASIN 2b
COMPUTE NM HYD        ID=3 HYD NO=300 AREA=0.00081 SQ MI
                      PER A=0 PER B=0 PER C=50 PER D=50
                      TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD             ID=3   CODE=1
*S  BASIN 2c
COMPUTE NM HYD        ID=4 HYD NO=400 AREA=0.00045 SQ MI
                      PER A=0 PER B=20 PER C=50 PER D=50
                      TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD             ID=4   CODE=1
*S  BASIN 2d
COMPUTE NM HYD        ID=5 HYD NO=500 AREA=0.00037 SQ MI
                      PER A=0 PER B=0 PER C=40 PER D=60
                      TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD             ID=5   CODE=1
*S  BASIN 3
COMPUTE NM HYD        ID=6 HYD NO=600 AREA=0.00306 SQ MI
                      PER A=0 PER B=4 PER C=16 PER D=80
                      TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD             ID=6   CODE=1
*S  BASIN 4
COMPUTE NM HYD        ID=7 HYD NO=700 AREA=0.00436 SQ MI
                      PER A=0 PER B=0 PER C=15 PER D=85
                      TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD             ID=7   CODE=1
*S  BASIN 5a
COMPUTE NM HYD        ID=8 HYD NO=800 AREA=0.00387 SQ MI
                      PER A=0 PER B=25 PER C=45 PER D=30
                      TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD             ID=8   CODE=1
```

```
*S  BASIN 5b
COMPUTE NM HYD       ID=9 HYD NO=900 AREA=0.00047 SQ MI
                     PER A=0 PER B=0 PER C=50 PER D=50
                     TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD            ID=9   CODE=1
*S  BASIN 6
COMPUTE NM HYD       ID=10 HYD NO=110 AREA=0.00038 SQ MI
                     PER A=0 PER B=0 PER C=20 PER D=80
                     TP=-0.1333 HR   MASS RAIN=-1
PRINT HYD            ID=10   CODE=1
FINISH
```

# APPENDIX C

## PRIVATE STORM DRAIN & INLET CALCULATIONS

# BROADSTONE SANTA MONICA
# STORM DRAIN
# SUB-BASIN MAP
## 3-6-12

2'X3' INLET CAPACITY
= 11 CFS @ 0.5' HEAD
REMAINDER OVERFLOWS TO SAN
PEDRO VIA ENTRANCE

NOTE: FLOW RATES FOR SUB-BASINS CALCULATED BASED ON MASTER BASIN CFS/ACRE.

1"=60'

INLET=11.0 CFS

3.70 AC
17.0 CFS

INLET=1.3 CFS

0.06 AC
0.2 CFS

0.10 AC
0.4 CFS

0.11 AC
0.4 CFS

0.08 AC
0.3 CFS

Q100=21.7 CFS

Q100=13 CFS

1.3 CFS
0.36 AC

0.8 CFS

INLET=1.7 CFS

0.43 AC
1.5 CFS

INLET=1.0 CFS

0.17 AC
0.6 CFS

INLET=6.5 CFS

0.23 AC

Q100=8.8 CFS

12"SD=3.1 CFS

0.07 AC
0.2 CFS

0.04 AC
0.1 CFS

0.18 AC
0.6 CFS

INLET=0.6 CFS

INLET=1.1 CFS

INLET=0.4 CFS

0.08 AC
0.4 CFS

1.1 CFS
0.31 AC

0.14 AC
0.6 CFS

0.12 AC
0.6 CFS

1.7 CFS

0.35 AC

0.09 AC
0.4 CFS

INLET=0.7 CFS

0.15 AC
0.7 CFS

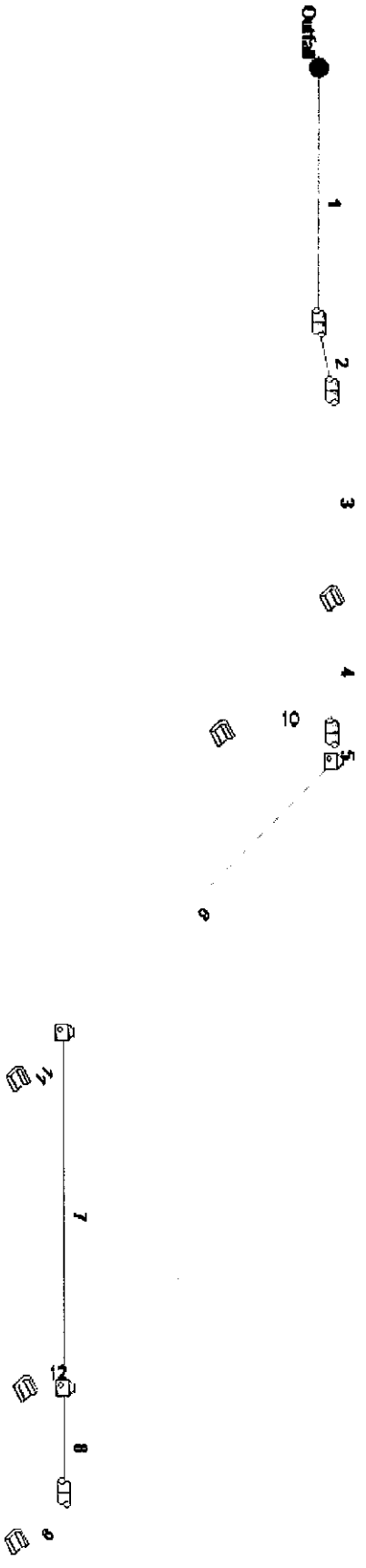
0.11 AC
0.5 CFS

Q100=15.1 CFS

M:\CAD FILES\1900-1999\1900\dwg\1900 C-701-BASIN TRACT 2.dwg, 3/6/2012 3:55:52 PM, ANW

**BROADSTONE SANTA MONICA**

**WEST STORM DRAIN**



# Storm Sewer Inventory Report



| Line No. | Alignment | | | | Flow Data | | | | Physical Data | | | | | | | | Line ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dnstr Line No. | Line Length (ft) | Defl angle (deg) | Junc Type | Known Q (cfs) | Drng Area (ac) | Runoff Coeff (C) | Inlet Time (min) | Invert El Dn (ft) | Line Slope (%) | Invert El Up (ft) | Line Size (in) | Line Shape | N Value (n) | J-Loss Coeff (K) | Inlet/ Rim El (ft) | |
| 1 | End | 98.000 | 0.000 | None | 0.00 | 0.00 | 0.00 | 0.0 | 61.50 | 0.56 | 62.05 | 24 | Cir | 0.012 | 0.23 | 66.20 | |
| 2 | 1 | 26.200 | -11.250 | None | 0.00 | 0.00 | 0.00 | 0.0 | 62.05 | 0.57 | 62.20 | 24 | Cir | 0.012 | 0.23 | 66.90 | |
| 3 | 2 | 78.600 | 11.250 | Genr | 11.00 | 0.00 | 0.00 | 0.0 | 62.20 | 0.57 | 62.65 | 24 | Cir | 0.012 | 0.50 | 66.50 | |
| 4 | 3 | 51.400 | 0.000 | None | 0.00 | 0.00 | 0.00 | 0.0 | 62.65 | 0.91 | 63.12 | 24 | Cir | 0.012 | 1.00 | 67.10 | |
| 5 | 4 | 11.200 | 0.000 | MH | 0.00 | 0.00 | 0.00 | 0.0 | 63.12 | 0.98 | 63.23 | 18 | Cir | 0.012 | 0.75 | 67.20 | |
| 6 | 5 | 145.400 | 45.000 | MH | 0.00 | 0.00 | 0.00 | 0.0 | 63.23 | 1.60 | 65.56 | 18 | Cir | 0.012 | 0.75 | 71.10 | |
| 7 | 6 | 135.100 | -45.000 | MH | 0.00 | 0.00 | 0.00 | 0.0 | 65.56 | 1.60 | 67.72 | 18 | Cir | 0.012 | 1.00 | 71.50 | |
| 8 | 7 | 40.000 | 0.000 | None | 0.00 | 0.00 | 0.00 | 0.0 | 67.72 | 1.60 | 68.36 | 12 | Cir | 0.012 | 0.75 | 73.20 | |
| 9 | 8 | 26.000 | 45.000 | Genr | 6.50 | 0.00 | 0.00 | 0.0 | 68.36 | 1.62 | 68.78 | 12 | Cir | 0.012 | 1.00 | 72.00 | |
| 10 | 4 | 42.000 | 90.000 | Genr | 1.30 | 0.00 | 0.00 | 0.0 | 63.12 | 0.90 | 63.50 | 12 | Cir | 0.012 | 1.00 | 66.50 | |
| 11 | 6 | 25.000 | 0.000 | Genr | 1.70 | 0.00 | 0.00 | 0.0 | 65.56 | 1.76 | 66.00 | 8 | Cir | 0.012 | 1.00 | 69.50 | |
| 12 | 7 | 15.000 | 90.000 | Genr | 1.00 | 0.00 | 0.00 | 0.0 | 67.72 | 1.87 | 68.00 | 8 | Cir | 0.012 | 1.00 | 70.50 | |

**1900 PRVT SD WEST** | Number of lines: 12 | Date: 3/6/2012

# Storm Sewer Summary Report



| Line No. | Line ID | Flow rate (cfs) | Line Size (in) | Line shape | Line length (ft) | Invert EL Dn (ft) | Invert EL Up (ft) | Line Slope (%) | HGL Down (ft) | HGL Up (ft) | Minor loss (ft) | HGL Junct (ft) | Dns Line No. | Junction Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 21.50 | 24 | Cir | 98.000 | 61.50 | 62.05 | 0.561 | 64.20* | 64.95* | 0.17 | 65.12 | End | None |
| 2 | | 21.50 | 24 | Cir | 26.200 | 62.05 | 62.20 | 0.573 | 65.12* | 65.32* | 0.17 | 65.49 | 1 | None |
| 3 | | 21.50 | 24 | Cir | 78.600 | 62.20 | 62.65 | 0.573 | 65.49* | 66.10* | 0.36 | 66.46 | 2 | Generic |
| 4 | | 10.50 | 24 | Cir | 51.400 | 62.65 | 63.12 | 0.914 | 66.46* | 66.56* | 0.17 | 66.73 | 3 | None |
| 5 | | 9.20 | 18 | Cir | 11.200 | 63.12 | 63.23 | 0.982 | 66.73* | 66.80* | 0.32 | 67.12 | 4 | Manhole |
| 6 | | 9.20 | 18 | Cir | 145.400 | 63.23 | 65.56 | 1.602 | 67.12* | 68.07* | 0.32 | 68.39 | 5 | Manhole |
| 7 | | 7.50 | 18 | Cir | 135.100 | 65.56 | 67.72 | 1.599 | 68.39 | 68.88 | 0.40 | 69.29 | 6 | Manhole |
| 8 | | 6.50 | 12 | Cir | 40.000 | 67.72 | 68.36 | 1.600 | 69.29* | 70.42* | 0.80 | 71.22 | 7 | None |
| 9 | | 6.50 | 12 | Cir | 26.000 | 68.36 | 68.78 | 1.615 | 71.22* | 71.96* | 1.06 | 73.03 | 8 | Generic |
| 10 | | 1.30 | 12 | Cir | 42.000 | 63.12 | 63.50 | 0.905 | 66.73* | 66.78* | 0.04 | 66.82 | 4 | Generic |
| 11 | | 1.70 | 8 | Cir | 25.000 | 65.56 | 66.00 | 1.760 | 68.39* | 68.81* | 0.37 | 69.18 | 6 | Generic |
| 12 | | 1.00 | 8 | Cir | 15.000 | 67.72 | 68.00 | 1.867 | 69.29* | 69.38* | 0.13 | 69.50 | 7 | Generic |

**1900 PRVT SD WEST** | Number of lines: 12 | Run Date: 3/6/2012

NOTES: Return period = 2 Yrs. ; *Surcharged (HGL above crown).

# Storm Sewer Tabulation



| Station | | Len | Drng Area | | Rnoff coeff | Area x C | | Tc | | Rain (I) | Total flow | Cap full | Vel | Pipe | | Invert Elev | | HGL Elev | | Grnd / Rim Elev | | Line ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Line | To Line | (ft) | Incr (ac) | Total (ac) | (C) | Incr | Total | Inlet (min) | Syst (min) | (in/hr) | (cfs) | (cfs) | (ft/s) | Size (in) | Slope (%) | Dn (ft) | Up (ft) | Dn (ft) | Up (ft) | Dn (ft) | Up (ft) | |
| 1 | End | 98.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 1.7 | 0.0 | 21.50 | 18.36 | 6.84 | 24 | 0.56 | 61.50 | 62.05 | 64.20 | 64.95 | 65.50 | 66.20 | |
| 2 | 1 | 26.200 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 1.6 | 0.0 | 21.50 | 18.54 | 6.84 | 24 | 0.57 | 62.05 | 62.20 | 65.12 | 65.32 | 66.20 | 66.90 | |
| 3 | 2 | 78.600 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 1.4 | 0.0 | 21.50 | 18.54 | 6.84 | 24 | 0.57 | 62.20 | 62.65 | 65.49 | 66.10 | 66.90 | 66.50 | |
| 4 | 3 | 51.400 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 1.2 | 0.0 | 10.50 | 23.43 | 3.34 | 24 | 0.91 | 62.65 | 63.12 | 66.46 | 66.56 | 66.50 | 67.10 | |
| 5 | 4 | 11.200 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 1.1 | 0.0 | 9.20 | 11.27 | 5.21 | 18 | 0.98 | 63.12 | 63.23 | 66.73 | 66.80 | 67.10 | 67.20 | |
| 6 | 5 | 145.400 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.7 | 0.0 | 9.20 | 14.40 | 5.21 | 18 | 1.60 | 63.23 | 65.56 | 67.12 | 68.07 | 67.20 | 71.10 | |
| 7 | 6 | 135.100 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.1 | 0.0 | 7.50 | 14.38 | 4.67 | 18 | 1.60 | 65.56 | 67.72 | 68.39 | 68.88 | 71.10 | 71.50 | |
| 8 | 7 | 40.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.1 | 0.0 | 6.50 | 4.88 | 8.28 | 12 | 1.60 | 67.72 | 68.36 | 69.29 | 70.42 | 71.50 | 73.20 | |
| 9 | 8 | 26.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 | 6.50 | 4.90 | 8.28 | 12 | 1.62 | 68.36 | 68.78 | 71.22 | 71.96 | 73.20 | 72.00 | |
| 10 | 4 | 42.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 | 1.30 | 3.67 | 1.66 | 12 | 0.90 | 63.12 | 63.50 | 66.73 | 66.78 | 67.10 | 66.50 | |
| 11 | 6 | 25.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 | 1.70 | 1.74 | 4.87 | 8 | 1.76 | 65.56 | 66.00 | 68.39 | 68.81 | 71.10 | 69.50 | |
| 12 | 7 | 15.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 | 1.00 | 1.79 | 2.87 | 8 | 1.87 | 67.72 | 68.00 | 69.29 | 69.38 | 71.50 | 70.50 | |

**1900 PRVT SD WEST**

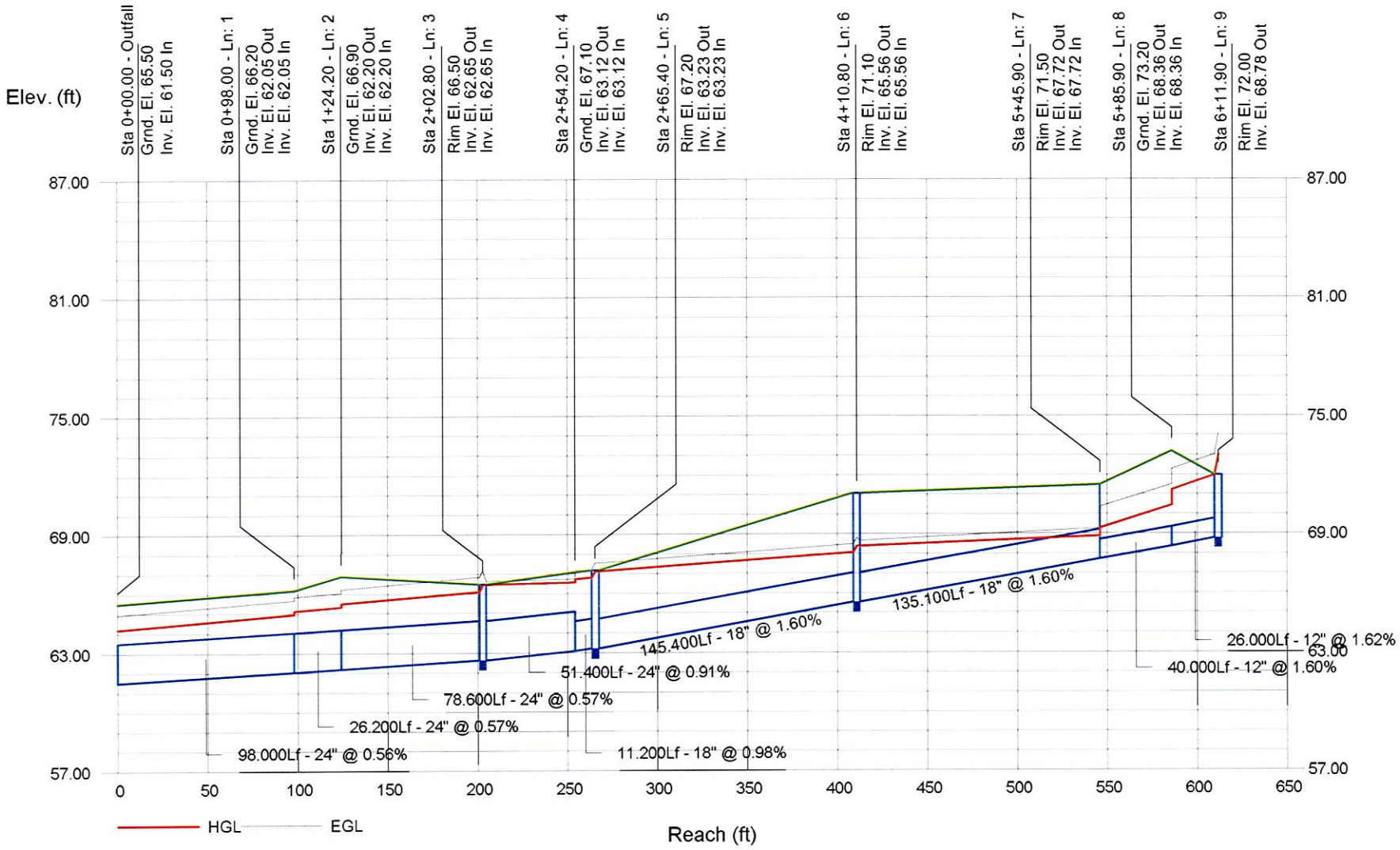
Number of lines: 12

Run Date: 3/6/2012

NOTES:Intensity = 69.87 / (Inlet time + 13.10) ^ 0.87; Return period =Yrs. 2 ; c = cir e = ellip b = box

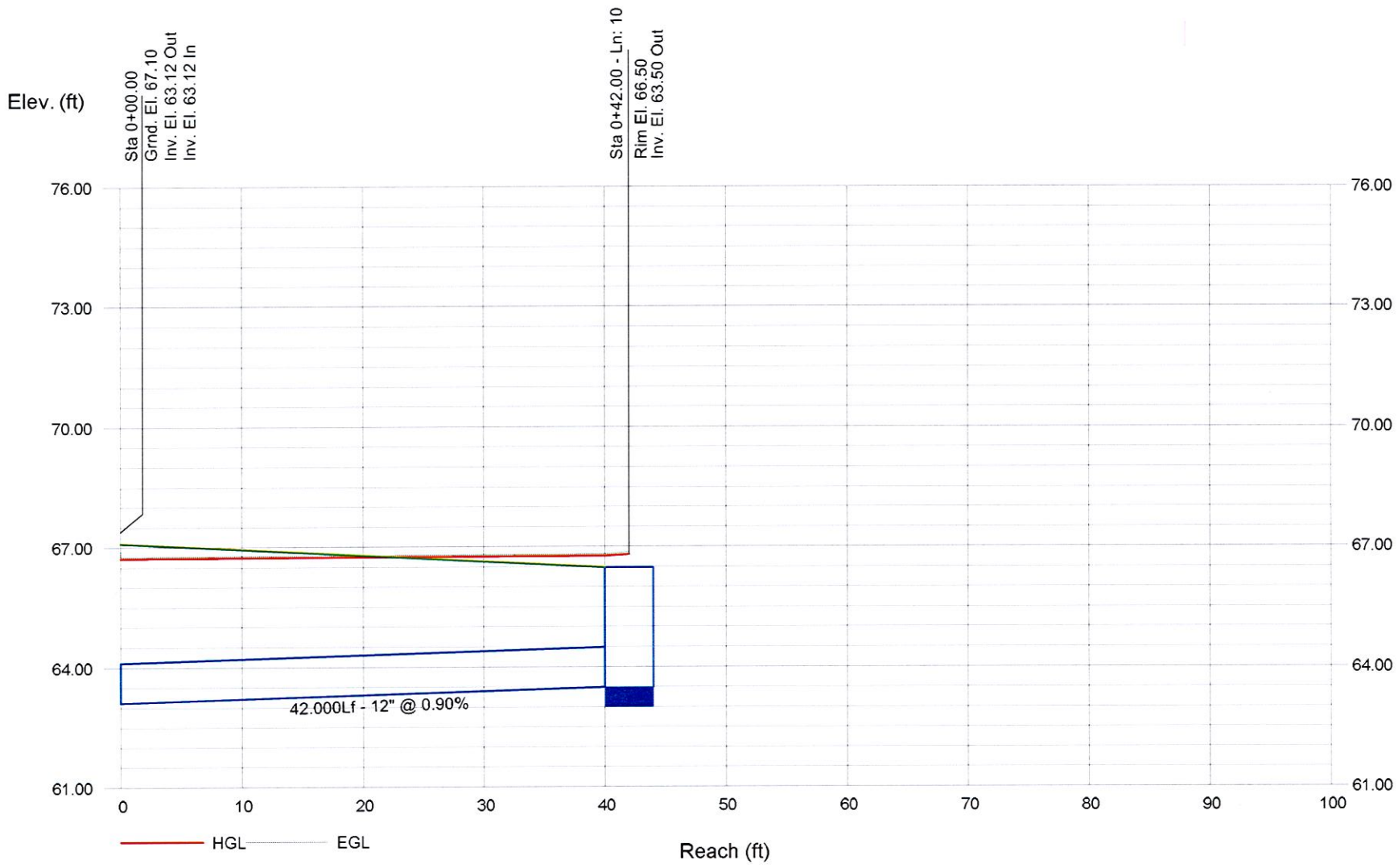
# Storm Sewer Profile

Proj. file: 1900-PRVT SD WEST.stm



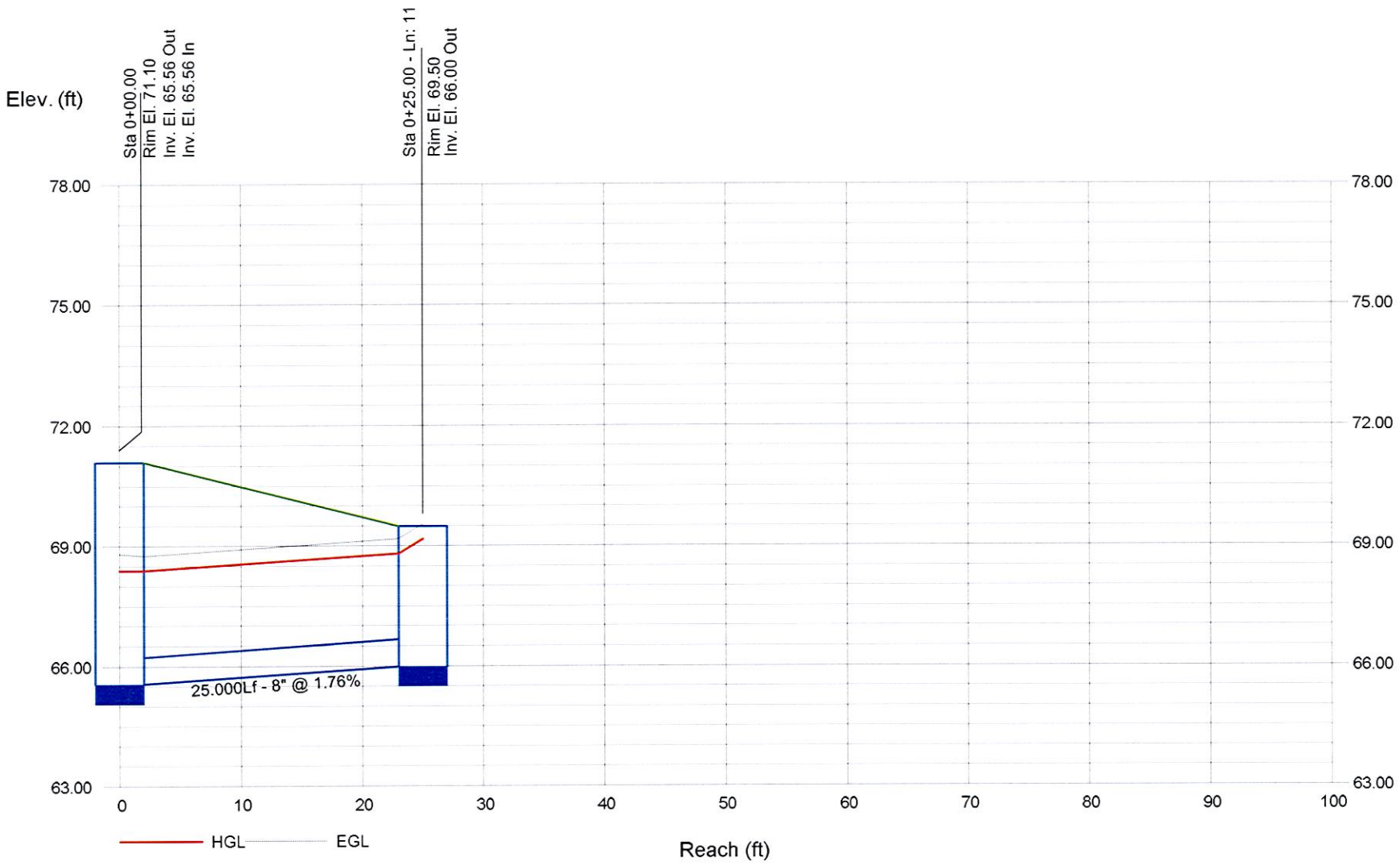
# Storm Sewer Profile

Proj. file: 1900-PRVT SD WEST.stm



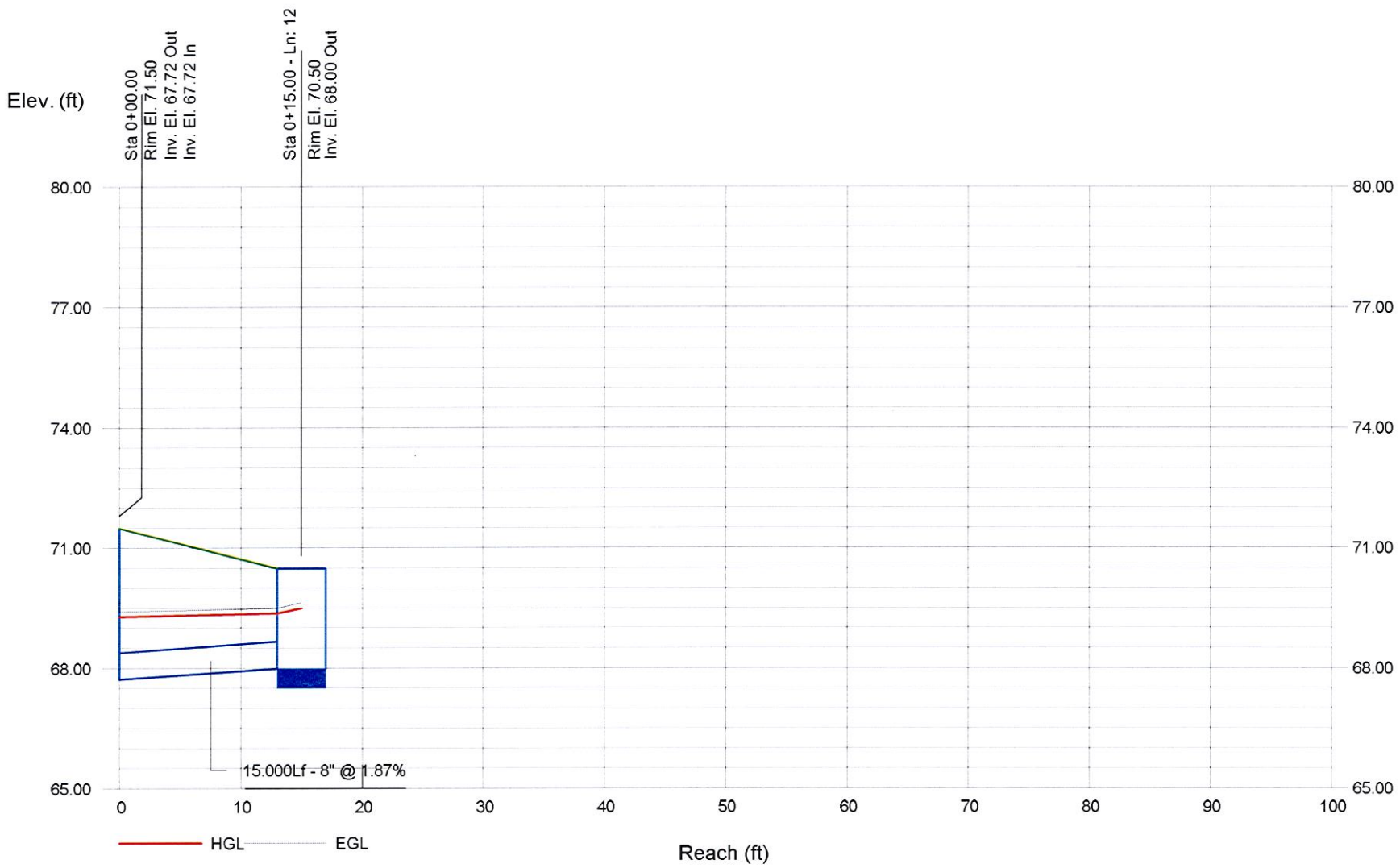
# Storm Sewer Profile

Proj. file: 1900-PRVT SD WEST.stm



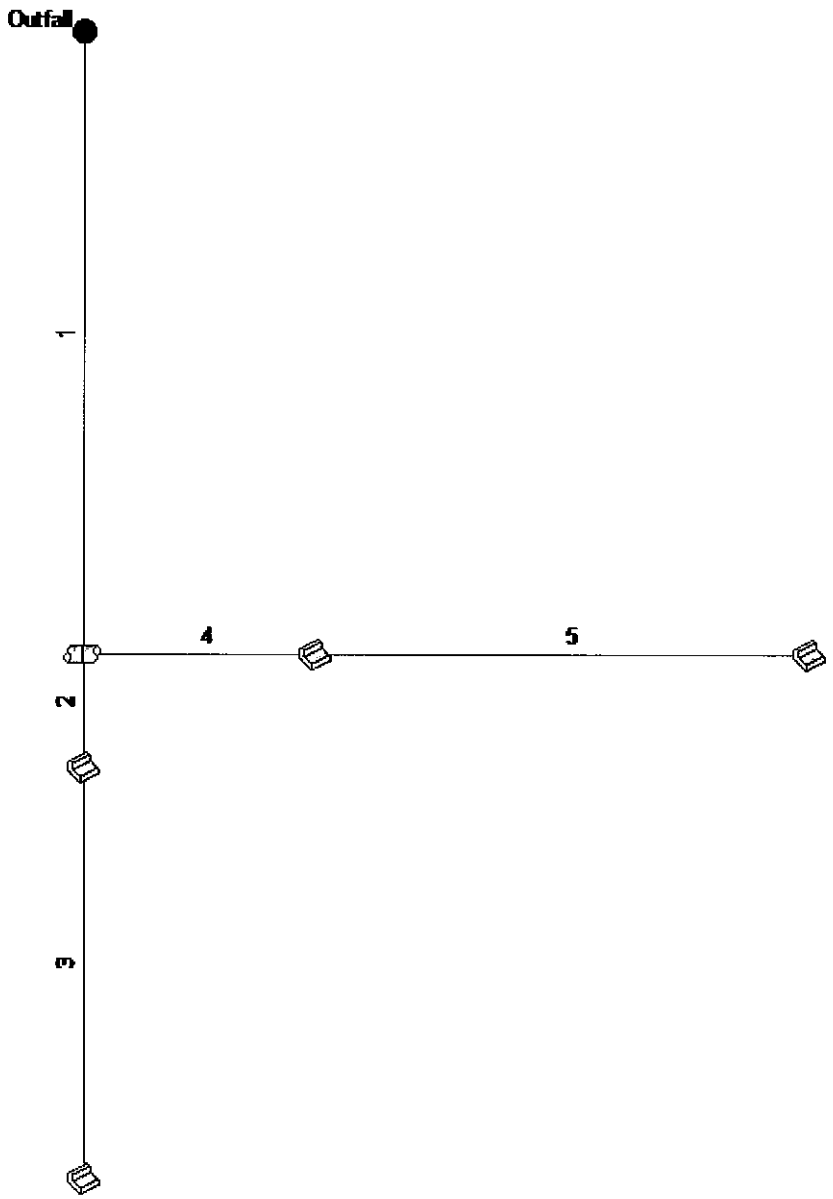
# Storm Sewer Profile

Proj. file: 1900-PRVT SD WEST.stm



**BROADSTONE SANTA MONICA**

**EAST STORM DRAIN**



# Storm Sewer Inventory Report



| Line No. | Alignment | | | | Flow Data | | | | Physical Data | | | | | | | | Line ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dnstr Line No. | Line Length (ft) | Defl angle (deg) | Junc Type | Known Q (cfs) | Drng Area (ac) | Runoff Coeff (C) | Inlet Time (min) | Invert El Dn (ft) | Line Slope (%) | Invert El Up (ft) | Line Size (in) | Line Shape | N Value (n) | J-Loss Coeff (K) | Inlet/ Rim El (ft) | |
| 1 | End | 99.300 | 90.000 | None | 0.00 | 0.00 | 0.00 | 0.0 | 78.20 | 0.70 | 78.90 | 12 | Cir | 0.012 | 1.00 | 82.50 | |
| 2 | 1 | 18.000 | 0.000 | Genr | 0.60 | 0.00 | 0.00 | 0.0 | 78.90 | 0.56 | 79.00 | 8 | Cir | 0.012 | 0.50 | 82.00 | |
| 3 | 2 | 65.500 | 0.000 | Genr | 0.70 | 0.00 | 0.00 | 0.0 | 79.00 | 1.53 | 80.00 | 8 | Cir | 0.012 | 1.00 | 83.00 | |
| 4 | 1 | 36.800 | -90.000 | Genr | 1.10 | 0.00 | 0.00 | 0.0 | 78.90 | 0.68 | 79.15 | 8 | Cir | 0.012 | 0.50 | 82.00 | |
| 5 | 4 | 79.100 | 0.000 | Genr | 0.40 | 0.00 | 0.00 | 0.0 | 79.15 | 0.70 | 79.70 | 8 | Cir | 0.012 | 1.00 | 82.70 | |

# Storm Sewer Summary Report



| Line No. | Line ID | Flow rate (cfs) | Line Size (in) | Line shape | Line length (ft) | Invert EL Dn (ft) | Invert EL Up (ft) | Line Slope (%) | HGL Down (ft) | HGL Up (ft) | Minor loss (ft) | HGL Junct (ft) | Dns Line No. | Junction Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 2.80 | 12 | Cir | 99.300 | 78.20 | 78.90 | 0.705 | 79.00 | 79.61 | n/a | 79.61 j | End | None |
| 2 | | 1.30 | 8 | Cir | 18.000 | 78.90 | 79.00 | 0.556 | 79.61* | 79.79* | 0.11 | 79.90 | 1 | Generic |
| 3 | | 0.70 | 8 | Cir | 65.500 | 79.00 | 80.00 | 1.527 | 79.90 | 80.39 | n/a | 80.39 j | 2 | Generic |
| 4 | | 1.50 | 8 | Cir | 36.800 | 78.90 | 79.15 | 0.679 | 79.61* | 80.09* | 0.14 | 80.24 | 1 | Generic |
| 5 | | 0.40 | 8 | Cir | 79.100 | 79.15 | 79.70 | 0.695 | 80.24 | 80.30 | 0.02 | 80.33 | 4 | Generic |

**1900 PRVT SD EAST** | Number of lines: 5 | Run Date: 3/6/2012

NOTES: Return period = 2 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

# Storm Sewer Tabulation



| Station | | Len | Drng Area | | Rnoff coeff | Area x C | | Tc | | Rain (I) | Total flow | Cap full | Vel | Pipe | | Invert Elev | | HGL Elev | | Grnd / Rim Elev | | Line ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Line | To Line | (ft) | Incr (ac) | Total (ac) | (C) | Incr | Total | Inlet (min) | Syst (min) | (in/hr) | (cfs) | (cfs) | (ft/s) | Size (in) | Slope (%) | Dn (ft) | Up (ft) | Dn (ft) | Up (ft) | Dn (ft) | Up (ft) | |
| 1 | End | 99.300 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 1.3 | 0.0 | 2.80 | 3.24 | 4.43 | 12 | 0.70 | 78.20 | 78.90 | 79.00 | 79.61 | 80.00 | 82.50 | |
| 2 | 1 | 18.000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.5 | 0.0 | 1.30 | 0.98 | 3.72 | 8 | 0.56 | 78.90 | 79.00 | 79.61 | 79.79 | 82.50 | 82.00 | |
| 3 | 2 | 65.500 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 | 0.70 | 1.62 | 2.63 | 8 | 1.53 | 79.00 | 80.00 | 79.90 | 80.39 | 82.00 | 83.00 | |
| 4 | 1 | 36.800 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 1.2 | 0.0 | 1.50 | 1.08 | 4.30 | 8 | 0.68 | 78.90 | 79.15 | 79.61 | 80.09 | 82.50 | 82.00 | |
| 5 | 4 | 79.100 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 | 0.40 | 1.09 | 1.17 | 8 | 0.70 | 79.15 | 79.70 | 80.24 | 80.30 | 82.00 | 82.70 | |

**1900 PRVT SD EAST**

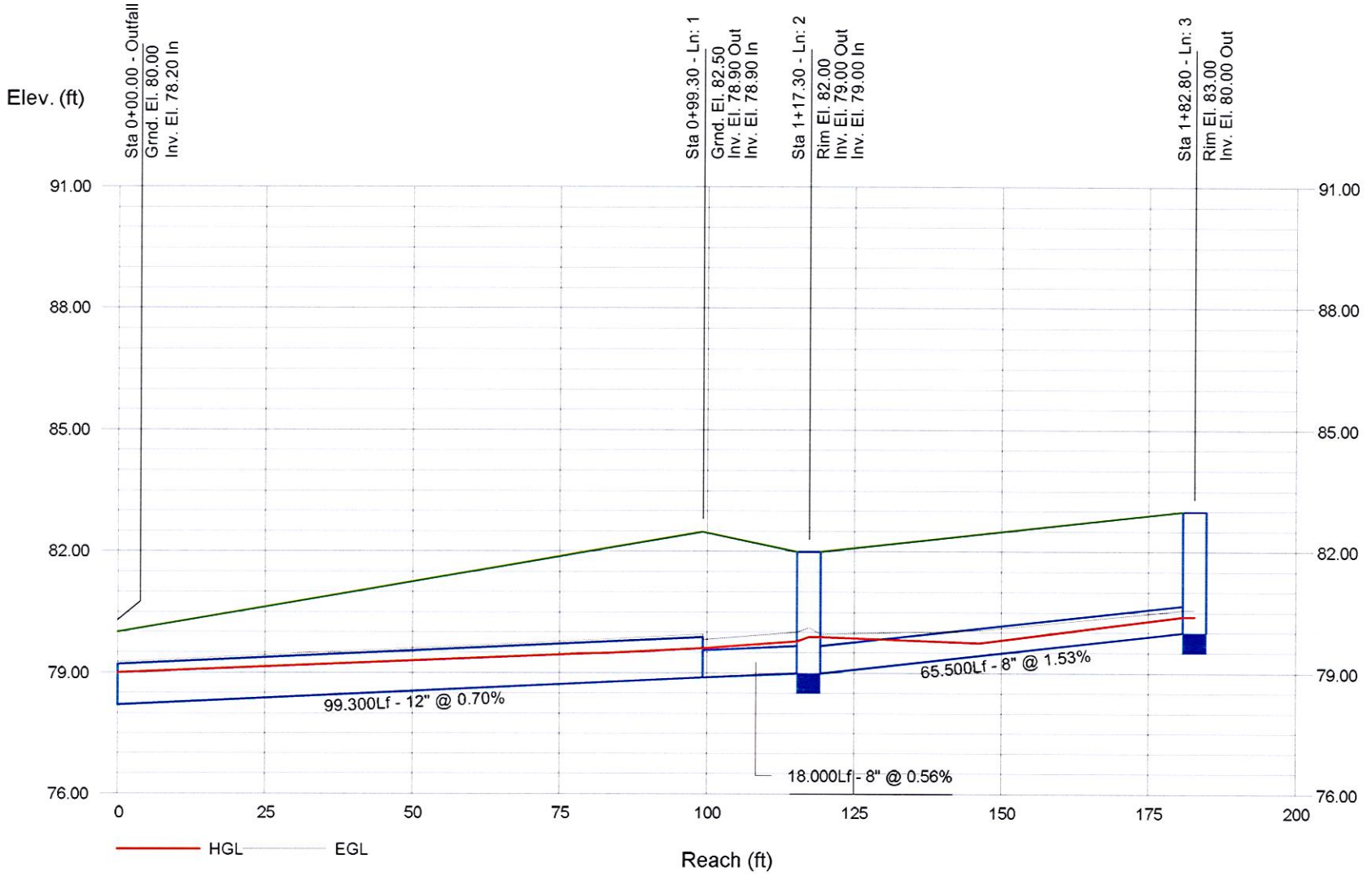
Number of lines: 5

Run Date: 3/6/2012

NOTES:Intensity = 69.87 / (Inlet time + 13.10) ^ 0.87; Return period =Yrs. 2 ; c = cir e = ellip b = box

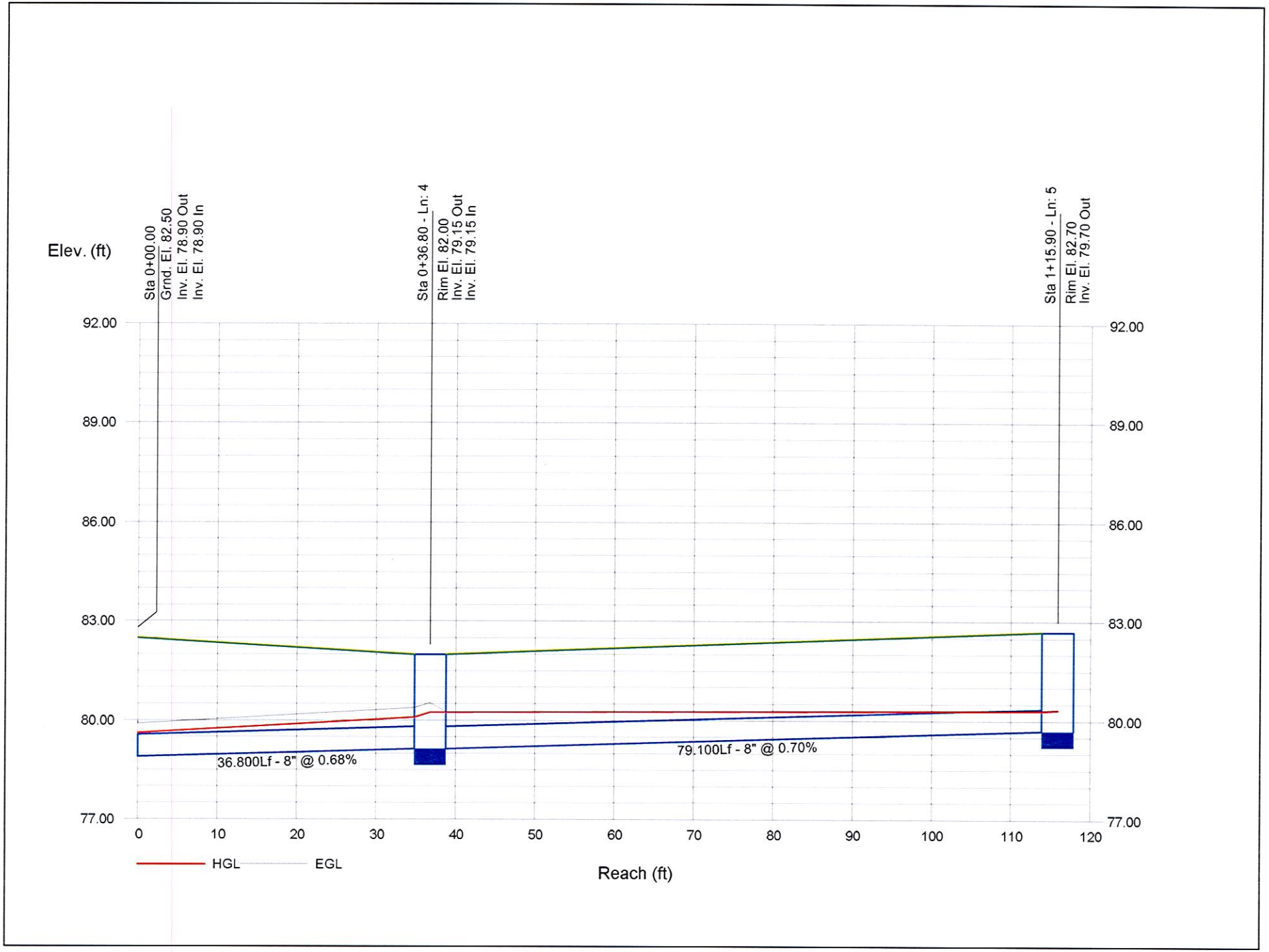
# Storm Sewer Profile

Proj. file: 1900-PRVT SD EAST.stm

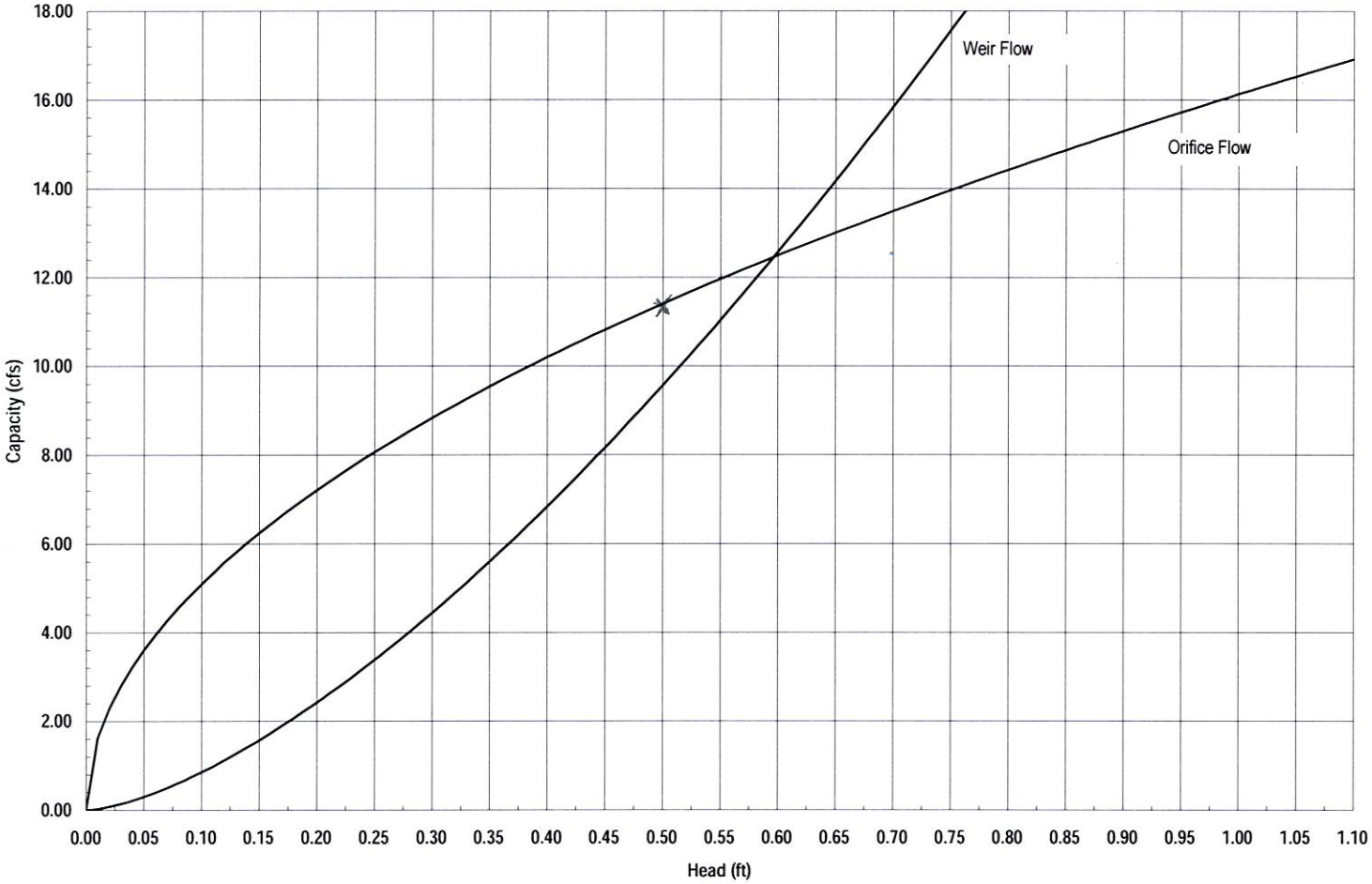


# Storm Sewer Profile

Proj. file: 1900-PRVT SD EAST.stm

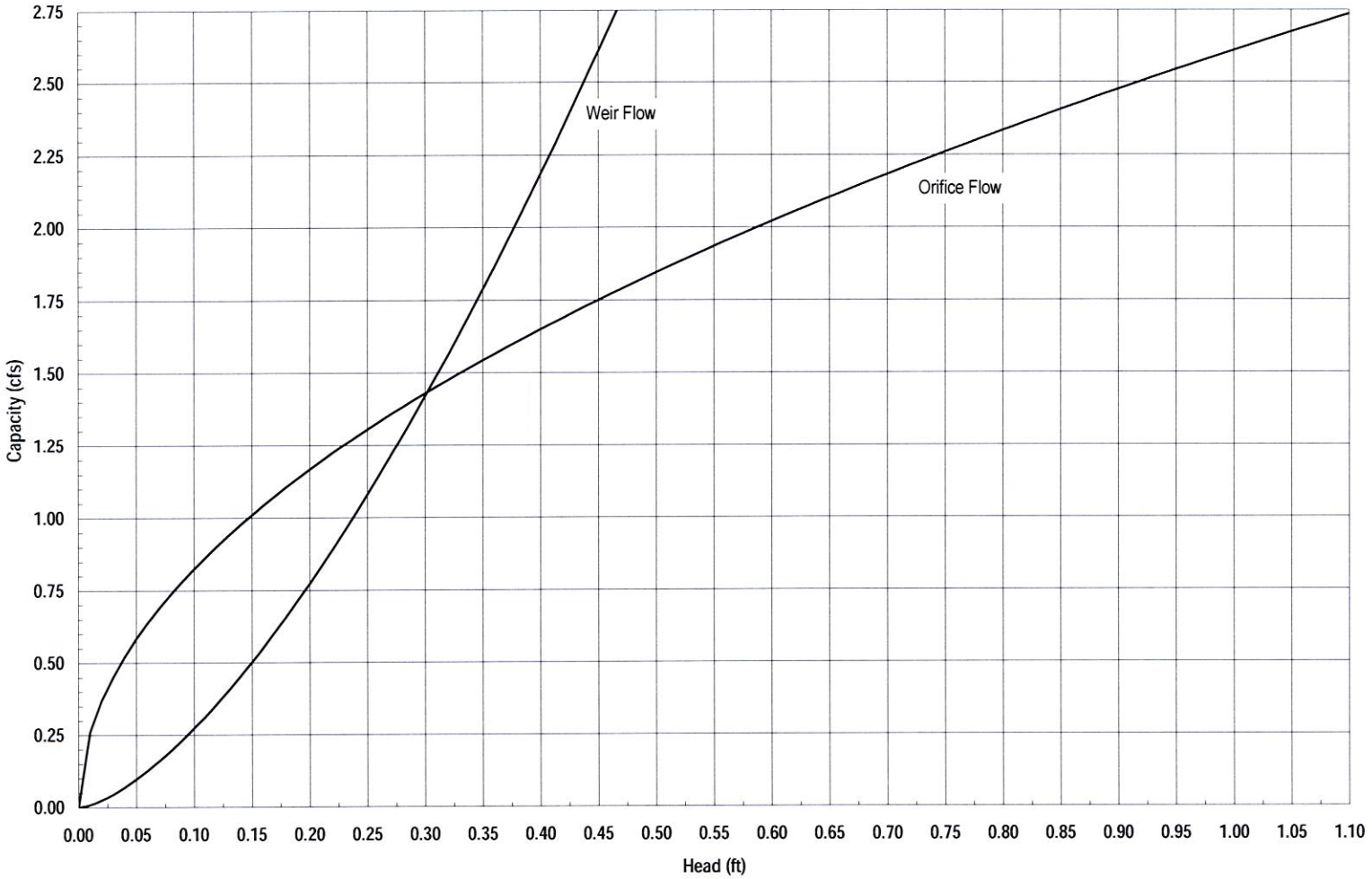


## Nyloplast 2' x 3' Road & Highway Grate Inlet Capacity Chart



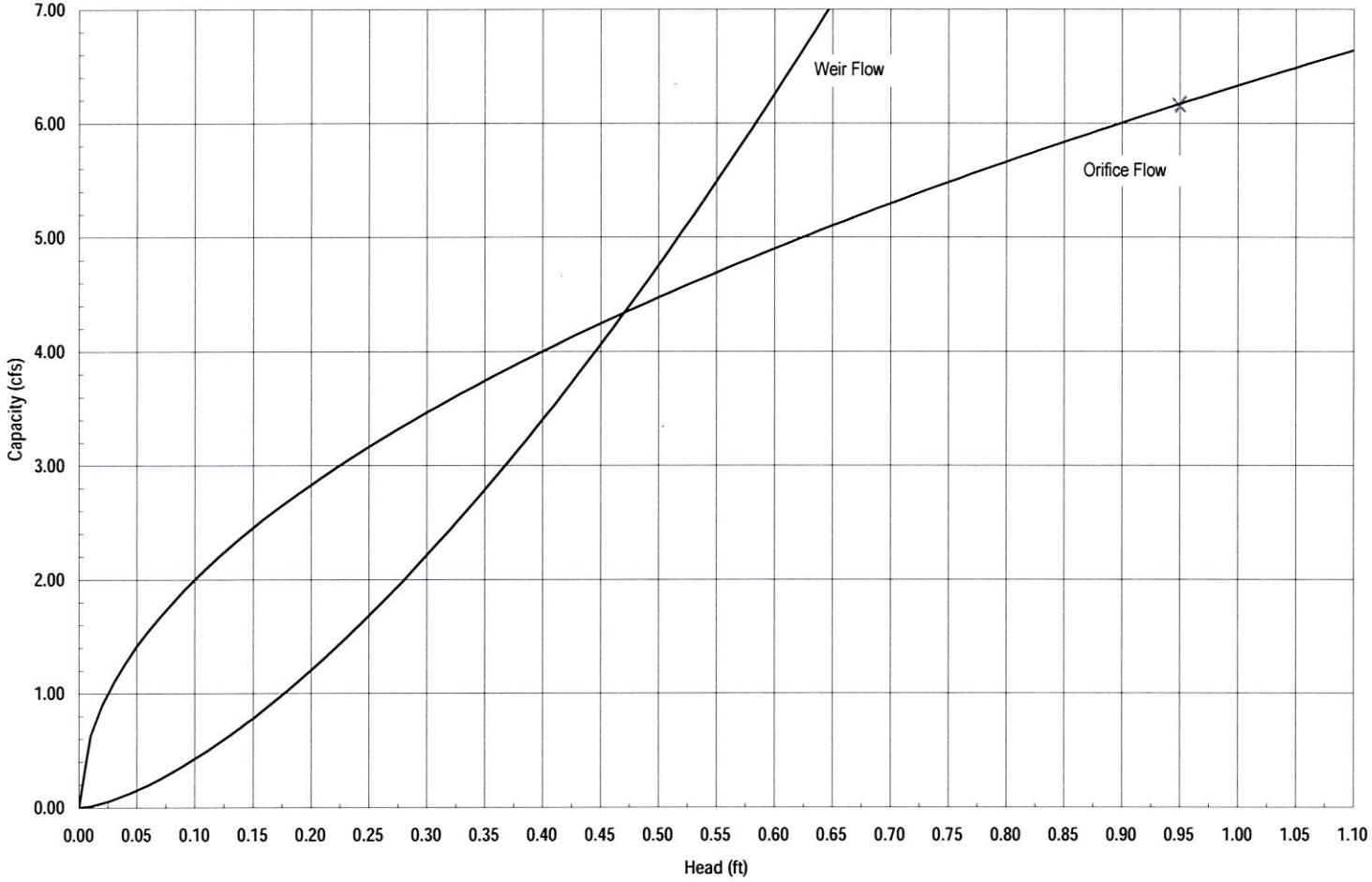

Nyloplast®
3130 Verona Avenue • Buford, Georgia 30518 • (866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490

## Nyloplast 12" Dome Grate Inlet Capacity Chart




Nyloplast®
3130 Verona Avenue • Buford, Georgia 30518 • (866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490

## Nyloplast 18" Dome Grate Inlet Capacity Chart




Nyloplast®
3130 Verona Avenue • Buford, Georgia 30518 • (866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490

# APPENDIX D

## SIDEWALK CULVERT CALCULATIONS

**BROADSTONE SANTA MONICA**

**SIDEWALK CULVERT CAPACITY CALCULATION**

Weir equation: $Q=CLH^{3/2}$

| | | | |
|---|---|---|---|
| Constant | C = | 3.33 | |
| Curb height | H = | 0.5 | feet |
| Opening Length | L = | 1.00 | feet |
| | **Q=** | **1.2** | **cfs** |
| Opening Length | L = | 1.50 | feet |
| | **Q=** | **1.8** | **cfs** |
| Opening Length | L = | 2.00 | feet |
| | **Q=** | **2.4** | **cfs** |

# APPENDIX E

## Driving Aisle Capacity Calculation

# Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2012 by Autodesk, Inc. Friday, Mar 2 2012

## SECTION A-A -- DRIVE AT WEST END OF BUILDING 16

**User-defined**

| | |
|---|---|
| Invert Elev (ft) | = 71.60 |
| Slope (%) | = 1.40 |
| N-Value | = 0.017 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 17.00 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.30 |
| Q (cfs) | = 17.00 |
| Area (sqft) | = 5.56 |
| Velocity (ft/s) | = 3.06 |
| Wetted Perim (ft) | = 30.84 |
| Crit Depth, Yc (ft) | = 0.34 |
| Top Width (ft) | = 30.83 |
| EGL (ft) | = 0.45 |

**(Sta, El, n)-(Sta, El, n)...** (-5.00, 73.35, 0.017)-(0.10, 72.30, 0.017)-(3.00, 72.20, 0.017)-(6.00, 72.00, 0.017)-(15.50, 71.70, 0.017)-(28.00, 71.60, 0.017)-(44.00, 72.00, 0.017)-(44.10, 72.50, 0.017)