CITY OF ALBUQUERQUE

Hydrology Section Planning Department
David S. Campbell, Director

Timothy M. Keller, Mayor

March 5, 2018

Asa Nilsson-Weber
Isaacson & Arfman, P.A.
128 Monroe St NE
Albuquerque, NM 87108

RE: **Stormcloud Units 4A & 4B Supplemental Calculations**
Engineer's Stamp Date: 03/13/2018
Hydrology File: H09D022A

Dear Ms. Donart:

Based on the information provided in the Drainage Report Supplement received on 3/14/2018 the above-referenced application is approved for Work Order and Grading Permit.

Prior to constructing the additional grading in the Unit 4A pond please submit shop drawings with sections showing horizontal and vertical dimensions to the property line and the fence and materials specifications to DRC. Please copy both AMAFCA and Hydrology with the shop drawings and sections.

An Approved Engineer's Certification for release of financial guarantees is required prior to close out of the Work Order and acceptance of the Unit 4A infrastructure.

If you have any questions, please contact me at 924-3986 or e-mail at jhughes@cabq.gov .

Sincerely,

James D. Hughes
Principal Engineer, Planning Dept.
Development Review Services

PO Box 1293
Albuquerque
NM 87103
www.cabq.gov

Orig: Drainage File

City of Albuquerque

Planning Department

Development & Building Services Division

DRAINAGE AND TRANSPORTATION INFORMATION SHEET (REV 09/2015)

Project Title: Stormcloud Subdivision Units 4A & 4B Building Permit #: _____ City Drainage #: H09/D022A

DRB#: 1005029 EPC#: _____ Work Order#: Unit 4A 691585 / Unit 4B 691586

Legal Description: Stormcloud Subdivision, Units 4A & 4B

City Address: _____

Engineering Firm: Isaacson & Arfman, P.A. Contact: Asa Nilsson-Weber

Address: 128 Monroe Street NE - Albuquerque, NM 87108

Phone#: (505) 268-8828 Fax#: _____ E-mail: asaw@iacivil.com

Owner: Pulte Homes Contact: Kevin Patton

Address: 7601 Jefferson Street NE, Suite 320 - Albuquerque, NM 87109

Phone#: (505) 341-8591 Fax#: _____ E-mail: kevin.patton@pultegroup.com

Architect: _____ Contact: _____

Address: _____

Phone#: _____ Fax#: _____ E-mail: _____

Other Contact: _____ Contact: _____

Address: _____

Phone#: _____ Fax#: _____ E-mail: _____

Check all that Apply:

DEPARTMENT:

__X__ HYDROLOGY/ DRAINAGE

_____ TRAFFIC/ TRANSPORTATION

_____ MS4/ EROSION & SEDIMENT CONTROL

TYPE OF SUBMITTAL:

_____ ENGINEER/ ARCHITECT CERTIFICATION

_____ CONCEPTUAL G & D PLAN

_____ GRADING PLAN

_____ DRAINAGE MASTER PLAN

_____ DRAINAGE REPORT

_____ CLOMR/LOMR

_____ TRAFFIC CIRCULATION LAYOUT (TCL)

_____ TRAFFIC IMPACT STUDY (TIS)

_____ EROSION & SEDIMENT CONTROL PLAN (ESC)

__X__ OTHER (SPECIFY) Supplemental Drainage Calculations

CHECK TYPE OF APPROVAL/ACCEPTANCE SOUGHT:

_____ BUILDING PERMIT APPROVAL

_____ CERTIFICATE OF OCCUPANCY

_____ PRELIMINARY PLAT APPROVAL

_____ SITE PLAN FOR SUB'D APPROVAL

_____ SITE PLAN FOR BLDG. PERMIT APPROVAL

_____ FINAL PLAT APPROVAL

__X__ SIA/ RELEASE OF FINANCIAL GUARANTEE

_____ FOUNDATION PERMIT APPROVAL

_____ GRADING PERMIT APPROVAL

_____ SO-19 APPROVAL

_____ PAVING PERMIT APPROVAL

_____ GRADING/ PAD CERTIFICATION

_____ WORK ORDER APPROVAL

_____ CLOMR/LOMR

_____ PRE-DESIGN MEETING

_____ OTHER (SPECIFY) _____

IS THIS A RESUBMITTAL?: __X__ Yes _____ No

DATE SUBMITTED: March 13, 2018 By: Åsa Nilsson-Weber

COA STAFF: ELECTRONIC SUBMITTAL RECEIVED: ___

MARCH 13, 2018

SUPPLEMENTAL DRAINAGE CALCULATIONS

FOR

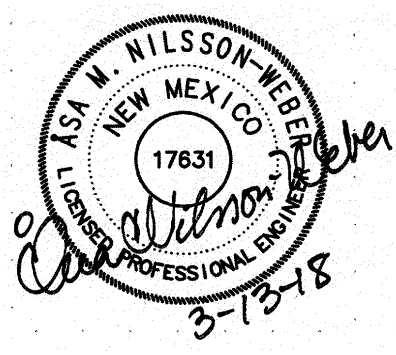
STORMCLOUD SUBDIVISION, UNITS 4A & 4B

A 181-DWELLING UNIT SINGLE-DETACHED RESIDENTIAL SUBDIVISION

ALBUQUERQUE, NEW MEXICO

Revised/supplemental calculations for onsite storm drain and offsite street and storm drain capacities

BY



ISAACSON & ARFMAN, P.A.
Consulting Engineering Associates

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

I&A Project No. 2174/1821

INTRODUCTION

During the final inspection for the Mirehaven Arroyo adjacent to Stormcloud Unit 4A, City of Albuquerque Hydrology Department questioned the capacity of the 24-inch storm drain from the first-flush pond going to the Mirehaven Arroyo. After looking into the storm drain calculations, the losses at the pond inlet were not taken into consideration in the calculations and the storm drain was in fact under-sized. An inlet in the Mirehaven Arroyo tying to the 24-inch storm drain had also been added during construction to capture 2.0 cfs.

SUPPORTING INFORMATION

See Appendix A for the following excerpts from drainage reports:

- Stormcloud Units 4 & 5 drainage report by Advanced Engineering dated September 11, 2006, showing allowable discharge rates.
- The Crossing Subdivision Unit 3 drainage report by Bohannan Huston dated March 16, 2004 showing street and storm drain flows at Roaring Fork Place/Eagle River Road.
- Tierra Oeste Unit 3 drainage report by Bohannan Huston dated February 13, 2001 showing street and storm drain flows at Gunnison Place/Casa Florida.

DRAINAGE ANALYSIS

A new storm drain software was used for the storm drain calculations, Stormwater Studio, which performs EGL calculations based on HEC-22 3rd Edition methodology taking into account momentum energy losses at junctions, per criteria outlined in the DPM and required by City of Albuquerque Hydrology Department. The calculations were performed to analyze how much flow would fit in the onsite storm drain system before it reached capacity at certain starting water surface elevations in the pond. See Appendix B for calculations.

Calculations show that the 24-inch storm drain from the pond to the Mirehaven Arroyo can convey 29.2 cfs of the 42.6 cfs total going into the pond at a water surface elevation of 67.12 in the first flush pond along with 2 cfs from the added inlet in the Mirehaven Arroyo right-of-way for a total of 31.2 cfs. The remaining onsite 13.4 cfs would overflow to three outfall locations in the neighboring streets and storm drain systems. See Appendix B for a revised basin map. The street and storm drain capacities in the neighborhood are not compromised by the additional flows.

Summary of bypass flow to offsite:

A. 5.0 cfs would bypass sump inlets 9 and 10 in Monsoon Road and overflow east of the pond at a street elevation of 68.15 to the east end of Animas Place for a total of 23.9 cfs; allowable discharge=20.5 cfs; net additional flow=3.4 cfs.
B. 3.0 cfs would bypass inlet 7 and flow to the south end of Gunnison Place for a total street flow of 15.5 cfs; allowable discharge=13.0 cfs; net additional flow=2.5 cfs.
C. 5.4 cfs would bypass sump inlets 9 and 10 and overflow at a street elevation of 68.8 to the sump inlets and storm drain at the south end of Summer Breeze Drive. This storm drain has capacity for the added flows as shown in the storm drain calculations in Appendix B.

The northeast corner of the pond tract adjacent to the Mirehaven Arroyo is a couple of tenths lower than the overflow elevation in Monsoon Road, so prior to the final grading certification, this area shall be built up to prevent the water from overflowing into the AMAFCA right-of-way.

Animas Place Additional Street Flow

The below exhibit shows the street flows including the additional 3.4 cfs at Animas Place (formerly named Henry Fork Rd NW). The storm drain has additional capacity to carry the excess flow since the HGL is approximately 3 feet below grade at the downstream inlet and pipe as shown on storm drain summary and profile in the excerpts from the Crossing Unit 3 drainage report in Appendix A. See Appendix B for street capacity calculations.

Gunnison Place Additional Street Flow

The below exhibit shows the street flows including the additional 2.5 cfs at Gunnison Place. As shown in Appendix A, excerpts from Tierra Oeste Unit 3 drainage report, the sump inlet at the knuckle has capacity for 36.4 cfs and the total flow at this point, including the 2.5 cfs is 32.9 cfs. The storm drain was designed for non-pressure flow (see table in Appendix A) and has capacity for the additional flow of 2.5 cfs. Street capacity calculations included in Appendix B shows that the street has capacity for the additional flow.

SUMMARY

The storm drain from the first flush pond into the Mirehaven Arroyo as designed and installed does not have capacity for all of the onsite flows going into the pond. As a result, flows in excess of what was designated as allowable flows on the drainage reports of the neighboring subdivisions (The Crossing Unit 3 and Tierra Oeste Unit 3) will be directed to downstream outfall points as shown below.

- 3.4 cfs will be added to the street/storm drain system at Eagle River Road and Roaring Fork Place.
- 2.5 cfs in Gunnison Place will be added to the street/storm drain system in Gunnison Place/Casa Florida.
- 5.4 cfs will be added to the storm drain system in Summer Breeze Drive.

The offsite streets and storm drain systems have capacity for the additional flows as shown by the street capacity and Summer Breeze storm drain calculations in Appendix B and storm drain information from drainage reports for neighboring subdivisions in Appendix A.

APPENDIX A

Excerpts from Drainage Reports

DRAINAGE REPORT
FOR

STORM CLOUD SUBDIVISION
UNITS 4 & 5

Prepared by:

ADVANCED
ENGINEERING
and CONSULTING, LLC

4416 Anaheim Ave., NE
Albuquerque, New Mexico 87113

September, 2006

SHAHAB BIAZAR
NEW MEXICO
13479
9/5/06
REGISTERED PROFESSIONAL ENGINEER

Shahab Biazar
PE NO. 13479

developed flow rate of 1.25 cfs. The flow of 1.25 cfs is less than 4 cfs as it was indicated in the drainage report for Las Lomitas Subdivision Drainage report.

The souther portion of the subdivision (south of Mirehaven Arroyo) is analyzed under the sub-basins A1 through A3, B, C, D, & E (Exhibit G). Basins A1 through A3 fall within Basin Off-1A under the Storm Cloud Units 1 and 2 (which was designed for a future developed runoff of 29.76 cfs). Sub-basins A1 through A3 drain to a series of inlets within sub-basin A3 and then discharge to a proposed 24" sd pipe at a total developed flow rate of 26.88 cfs (which is less than allowable flow rate of 29.76 cfs) Sub-basin B with a developed runoff of 3.23 cfs drains to Animas Place NW (The Crossing Subdivision). Sub-basin B fall withing Basins D4 (2.91 cfs developed runoff) and D5 (0.56 developed runoff) under the Crossing Subdivision. Therefore, the discharge from our sub-basin B (3.23 cfs) is slightly lower than the allowed total discharge for Basins D4 and D5 (3.47 cfs). Sub-basin C with developed runoff rate of 12.80 cfs drains to Gunnison Place. Based on the Analysis Point F under the basin map for the Crossing Subdivision 13.00 cfs is designed to enter Gunnison Place. Sub-basins D1 through D5 drain to a series of inlets and then discharges to Mirehaven Arroyo via 30" Storm sewer pipe at a flow rate of 40.88 cfs. Sub-basin E with a developed flow rate of 19.22 cfs discharge into Henry Fork Road. Sub-basin E drains to Discharge Point G under the Crossing Subdivision basin map with allowable discharge rate of 20.50 cfs. Mirahaven Arroyo will be chanalized per Wilson and Company Design (see Section VIII for copies of the construction plans). Box culverts will be placed at the Tierra Pintada Street at the arroyo crossing. Box culvert would be built with a total opening width of 36' by a

Onsite Developed Basins

BASIN	Area (SQ. FT)	Area (AC.)	Land Treatment Percentages A	B	C	D	Q(100) (cfs/ac.)	Q(100) (CFS)
1	68278	1.57	0.0%	27.0%	27.0%	46.0%	3.6032	5.65
2	29747	0.68	0.0%	27.0%	27.0%	46.0%	3.6032	2.46
3	165603	3.80	0.0%	27.0%	27.0%	46.0%	3.6032	13.70
4	53103	1.22	0.0%	27.0%	27.0%	46.0%	3.6032	4.39
5	137454	3.16	0.0%	27.0%	27.0%	46.0%	3.6032	11.37
6	107607	2.47	0.0%	27.0%	27.0%	46.0%	3.6032	8.92
7	40428	0.93	0.0%	27.0%	27.0%	46.0%	3.6032	3.34
8	25554	0.59	0.0%	27.0%	27.0%	46.0%	3.6032	2.11
9	91935	2.11	0.0%	27.0%	27.0%	46.0%	3.6032	7.60
10	161511	3.71	0.0%	27.0%	27.0%	46.0%	3.6032	13.36
11	110202	2.53	0.0%	27.0%	27.0%	46.0%	3.6032	9.12
12	104312	2.39	0.0%	27.0%	27.0%	46.0%	3.6032	8.63
13	50410	1.16	0.0%	27.0%	27.0%	46.0%	3.6032	4.17
14	19166	0.44	0.0%	27.0%	27.0%	46.0%	3.6032	1.59
15	91835	2.11	0.0%	27.0%	27.0%	46.0%	3.6032	7.60
16	27451	0.63	0.0%	27.0%	27.0%	46.0%	3.6032	2.27

Developed off "Site" Basins

BASIN	Area (SQ. FT)	Area (AC.)	Land Treatment Percentages A	B	C	D	Q(100) (cfs/ac.)	Q(100) (CFS)
01	139800	3.18	0.0%	27.0%	27.0%	46.0%	3.6032	11.46
02	54000	1.24	0.0%	27.0%	27.0%	46.0%	3.6032	4.47
03	51300	1.18	0.0%	27.0%	27.0%	46.0%	3.6032	4.24
04	35200	0.81	0.0%	27.0%	27.0%	46.0%	3.6032	2.91
05	6800	0.16	0.0%	27.0%	27.0%	46.0%	3.6032	0.58
06	230300	5.29	0.0%	27.0%	27.0%	46.0%	3.6032	19.05 *
07	91000	2.09	0.0%	27.0%	27.0%	46.0%	3.6032	7.53 *
08	33600	0.77	0.0%	27.0%	27.0%	46.0%	3.6032	2.78
09	90500	2.08	30.0%	30.0%	33.0%	7.0%	2.579	5.38
D10	35100	0.81	0.0%	10.0%	20.0%	70.0%	4.036	3.25
D11	191500	2.33	30.0%	30.0%	33.0%	7.0%	2.579	6.01
D12	66500	1.53	0.0%	10.0%	20.0%	70.0%	4.036	6.16
D13	233500	5.36	0.0%	20.0%	20.0%	60.0%	3.602	20.38
D14	10100	0.23	0.0%	0.0%	25.0%	75.0%	4.245	0.98
D15	122100	2.80	60.0%	10.0%	30.0%	0.0%	2.138	5.99
D16	109700	2.52	60.0%	0.0%	40.0%	0.0%	2.322	5.85
D17	183000	4.18	60.0%	10.0%	30.0%	0.0%	2.138	8.93
D18	28500	0.65	0.0%	10.0%	20.0%	70.0%	4.036	2.64

Analysis Points for Fully Developed Conditions Basin Map

AP	Upstream AP	Q	Contributing Onsite Basins	Q	Contributing Offsite Basins	Q	Total Q
A					40% of D1	4.6	4.6
B					60% of D1,D2	11.3	11.3
C	10% of B	1.1					1.1
D	90% of B	10.2			D3	4.2	14.5
E	10% of D	1.4					1.4
F	90% of D	13.0					13.0
G	E	1.4			D6	19.0	20.5
1			1, 3	19.3	D8, D4, D5	6.3	25.6
2	1	25.6	2,5	13.8			39.4
3	2	39.4	4	4.4			43.8
4	10% of F	1.3	40% of 7	1.3			2.6
5	90% of F	11.7	60% of7	2.0			13.7
6	5	13.7	6,8	16.5			30.2
7	10% of 8	3.0					3.0
8	90% of 6	27.2	8	2.1			29.3
9	G	20.5	13	4.2	D7	7.5	32.2
10	4,9	34.8	10,14	14.0			48.8
11			11,15	16.7			16.7
12	7,11	19.7	12,16	10.9			30.6
H	3	43.8			D9, D10	8.6	52.4
J*	H - 19cfs	33.4					33.4
K	J	33.4			D11, D12, D15	18.2	51.6
L	6	29.3			D13, D14, D16	27.2	56.5
M							0.0
N							0.0

*Note: 2 - Single "A" inlets between AP H and AP J accept 9.5cfs each.

Note: Developed Offsite AP's are labeled with letters, while developed onsite AP's are labeled with numbers. Onsite fully developed AP labels correspond to the onsite AP labels for the Proposed Condition. Developed offsite basins are labeled with numbers preceded by the letter 'D'.

N

SCALE: 1" = 200'

BOHANNAN-HUSTON INC.

THE CROSSING

UNITS I & II

FULLY DEVELOPED CONDITIONS PLAN

EXHIBIT B

DESIGN ANALYSIS REPORT
FOR
TIERRA OESTE UNIT 3 (TRACT E AND A PORTION OF TRACT A OF THE CROSSINGS)

JULY 13, 2001

PREPARED BY:

BOHANNAN HUSTON, INC.
COURTYARD I
7500 JEFFERSON STREET NE
ALBUQUERQUE, NM 87109

PREPARED FOR:

WESTLAND DEVELOPMENT
401 COORS BOULEVARD NW
ALBUQUERQUE, NM 87121

PREPARED BY:

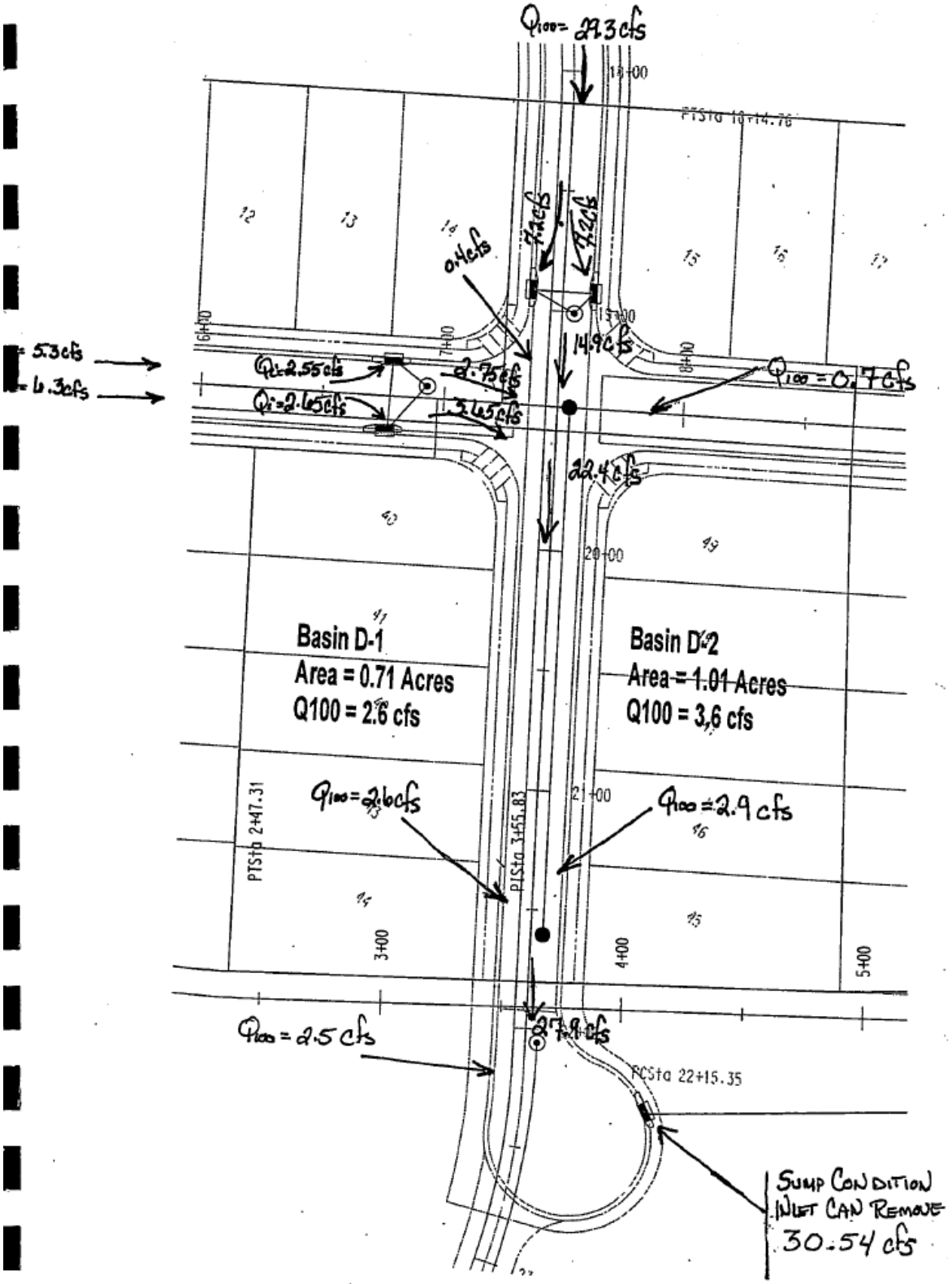
Yolanda Padilla 7/13/01

Yolanda Padilla, E.I. **Date**

UNDER THE SUPERVISION OF:

Kevin Patton, P.E. **Date**

KEVIN G. PATTON
NEW MEXICO
13685
REGISTERED PROFESSIONAL ENGINEER


Q100= 27.3 cfs
PTSta 10+14.76
0.4cfs
7.3cfs
7.2cfs
14.9cfs
Q100 = 0.7cfs
Qi=2.55cfs
2.75cfs
Qi=2.65cfs
3.65cfs
22.4cfs
Basin D-1
Area = 0.71 Acres
Q100 = 2.6 cfs
Basin D-2
Area = 1.01 Acres
Q100 = 3.6 cfs
Q100 = 2.6cfs
Q100 = 2.9 cfs
PTSta 2+47.31
PTSta 3+55.83
27.8 cfs
Q100 = 2.5 cfs
FCSta 22+15.35
SUMP CONDITION
INLET CAN REMOVE
30.54 cfs

GUNNISON CUL-DE-SAC INLET

ANALYSIS OF AN INLET IN A SUMP CONDITION - **At the end of the cul-de-sac low point**

INLET TYPE: Double Grate Type "A" with curb opening wings on both sides on inlet.

WEIR:	Q=C*L*H^1.5		ORIFICE:	Q=C*A*(2*G*H)**0.5
Wing opening	Grate opeining		Grate opening	Wing opening
C= 3.0	C=3.0		C=0.6	C=0.6
L= 4.0 ft	L(double grate)=[2(2.67')+2(1.8')]=8.		A(double grate)=8.19 sf	A=2.0 sf
Q=3.0(4.0')H**1.5= 12.0H**1.5	Q=3.0(8.94)H^1.5=26.82*H^1.5		Q=4.194*(64.4*H)^0.5	Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.38	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	1.07	2.40	17.64	4.55	
	0.30	0.30	1.97	4.41	21.60	8.35	
	0.40	0.40	3.04	6.78	24.94	12.86	
	0.50	0.50	4.24	9.48	27.88	17.97	
	0.60	0.60	5.58	12.46	30.55	23.62	
TOP OF CURB	0.70	0.70	7.03	15.71	32.99	29.76	
	0.80	0.80	8.59	19.19	35.27	36.36	Q(100 yr) = 30.4 cfs is provided at this depth
	0.90	0.90	10.25	22.90	37.41	43.39	
ROW LIMIT	1.00	1.00	12.00	26.82	39.43	50.82	

NOTE: The total runoff intercepted by the inlet at the low point in the road is:

Qr(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].

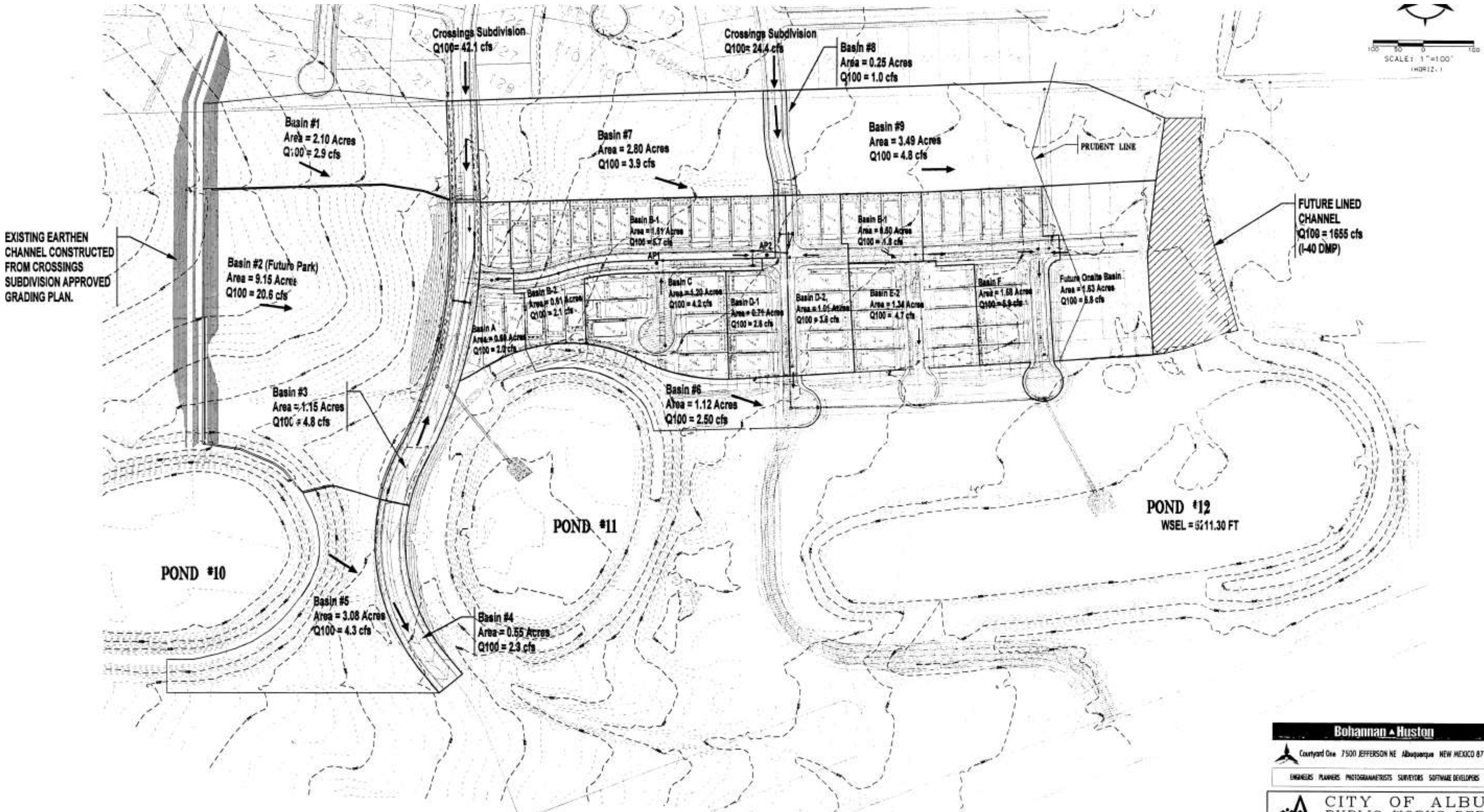
THE 100 YR STORM EVENT =29.12 cfs at the sump condition

THE 2 x 100 YR STORM EVENT =Does not apply to this subdivision

Max RCP flow (non-pressure, full pipe)

Table assumes Manning's n = 0.013

Pipe Size (in)/ Slope (%)	18	24	30	36	42
	Pipe Capacity (cfs)				
0.60%	**8.16**	17.57	31.86	51.80	**78.14**
0.76%	**9.18**	19.77	35.85	58.30	87.95
0.79%	9.36	**20.16**	36.55	**59.44**	89.66
1.41%	12.51	**26.93**	48.84	79.41	119.79
1.43%	12.60	**27.13**	49.18	79.97	120.64
1.51%	12.94	27.87	50.54	**82.18**	123.96
1.57%	13.20	28.42	51.53	**83.80**	126.40
2.25%	15.80	34.02	**61.69**	100.32	151.32
4.11%	**21.35**	45.99	83.38	135.58	204.52
4.19%	21.56	**46.43**	84.19	136.90	206.50
5.73%	**25.21**	54.30	98.45	160.09	241.48
9.17%	**31.89**	68.69	124.54	202.52	305.49



Bohannan ▲ Huston

Courtyard One 7500 JEFFERSON NE Albuquerque NEW MEXICO 87109

ENGINEERS PLANNERS PHOTOGRAMMETRISTS SURVEYORS SOFTWARE DEVELOPERS

AS-BUILT INFORMATION	
CONTRACTOR	
WORK STAKED BY	
INSPECTOR'S ACCEPTANCE BY	
FIELD VERIFICATION BY	
DRAWINGS CORRECTED BY	
MICRO-FILM	
RECORDED BY	
NO.	

BENCH MARKS

ACS BRASS TABLET STAMPED "1-B10"
GEOGRAPHIC POSITION (NAD 1927)
N.M. STATE PLANE COORD. (CENTRAL ZONE)
X=357,526.69 Y=1,525,168.35
GROUND TO GRID FACTOR = 0.9996640
DELTA ALPHA = -00DEG 16 MIN 30 SEC
NGVD 1929 ELEVATION = 5419.522

SURVEY INFORMATION

FIELD NOTES		
NO.	BY	DATE

ENGINEER'S SEAL

KEVIN G. PATTON, NEW MEXICO, 13686, REGISTERED PROFESSIONAL ENGINEER

8-7-01

NO.	DATE	BY	REMARKS
			REVISIONS
			DESIGN

DESIGNED BY	RKL	DATE 07/2001
DRAWN BY	RKL	DATE 07/2001
CHECKED BY	KP	DATE 07/2001

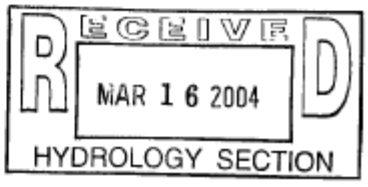
CITY OF ALBUQUERQUE
PUBLIC WORKS DEPARTMENT
ENGINEERING DEVELOPMENT GROUP

TIERRA OESTE UNIT 3
FULLY DEVELOPED DRAINAGE CONDITIONS

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	MO./DAY/YR.	MO./DAY/YR.

THE CROSSING SUBDIVISION UNIT 3

DRAINAGE REPORT REVISIONS
02/11/04



COMP. J. Tapia

CK.

DATE 2/2/04

WILSON & COMPANY

LOC.

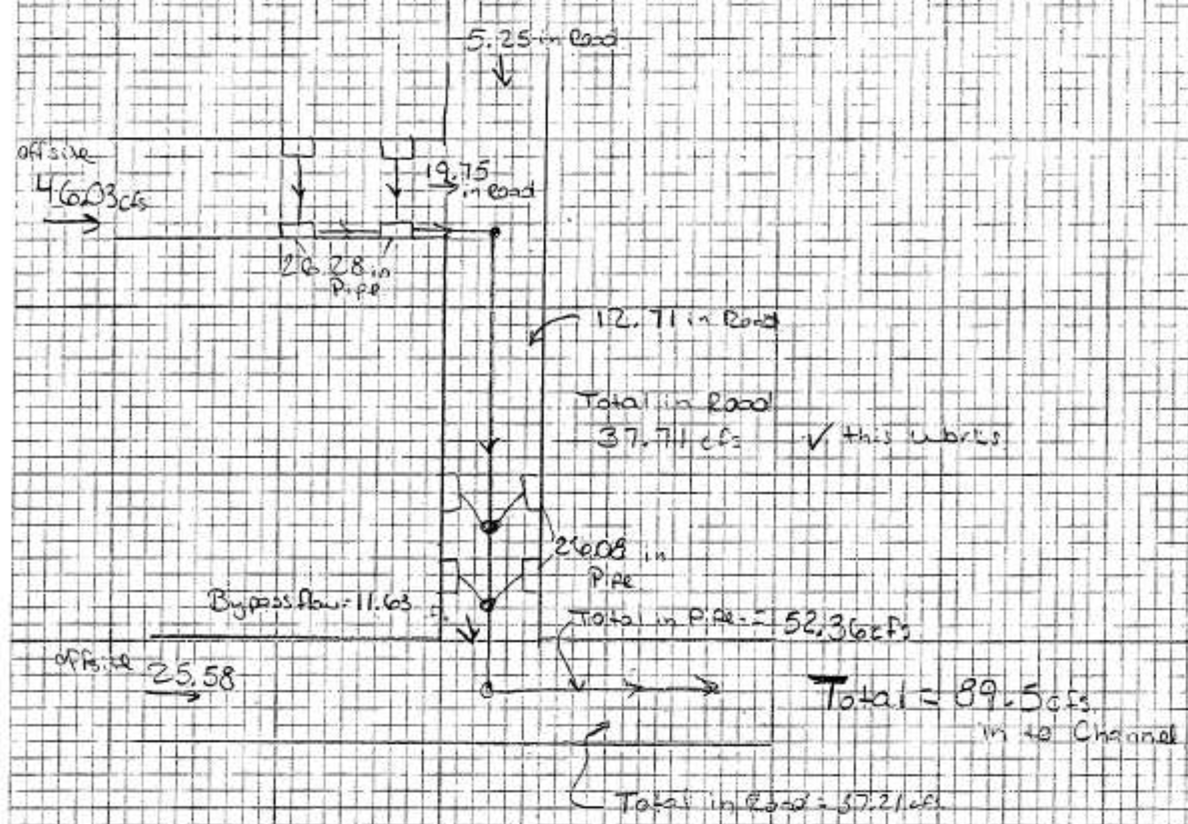
PROJ.

SUBJ.

FILE

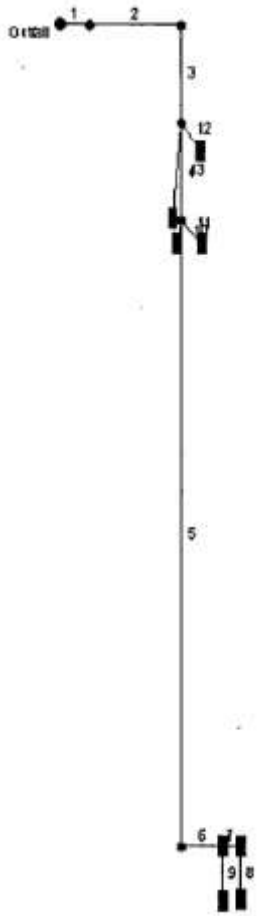
SHEET

OF



File in T:\Projects\X3218003\Eng\SDdesign020204

Hydraflow Plan View



Project file: SDdesign_020204.stm	No. Lines: 13	02-02-2004

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 (%)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	
1	End	36.3	0.00	0.00	0.40	0.00	0.00	0.0	1.9	0.0	89.57	54.25	12.79	36	0.88	5219.80	5219.48	5223.24	5222.33	5226.14	5226.14	OUTFALL
2	1	110.0	0.00	0.00	0.00	0.00	0.00	0.0	1.6	0.0	52.36	55.11	7.41	36	0.91	5221.30	5220.30	5224.52	5223.61	5226.94	5226.14	EAGLE RIVER R
3	2	50.4	0.00	0.00	0.40	0.00	0.00	0.0	1.5	0.0	52.36	51.50	7.41	36	0.79	5221.80	5221.40	5225.78	5225.37	5227.48	5226.94	30 ROARING FO
4	3	50.4	0.00	0.00	0.00	0.00	0.00	0.0	1.4	0.0	42.90	34.69	8.74	30	0.95	5222.38	5221.90	5226.65	5225.91	5228.57	5227.48	30 ROARING FO
5	4	324.0	0.00	0.00	0.40	0.00	0.00	0.0	0.4	0.0	26.28	35.43	5.35	30	0.99	5225.70	5222.48	5228.60	5226.83	5232.90	5228.57	30 ROARING FO
6	5	50.0	0.00	0.00	0.40	0.00	0.00	0.0	0.2	0.0	26.28	60.53	6.12	30	2.90	5227.25	5225.80	5229.07	5229.04	5233.97	5232.90	30 CLARKS FOR
7	6	21.7	0.00	0.00	0.40	0.00	0.00	0.0	0.2	0.0	17.22	13.98	5.48	24	0.51	5227.45	5227.34	5230.34	5230.17	5234.27	5233.97	24 CLARKS FOR
8	7	26.8	0.00	0.00	0.40	0.00	0.00	0.0	0.0	0.0	8.61	14.17	2.74	24	0.52	5227.69	5227.55	5231.09	5231.04	5234.27	5234.27	Connects DI A C
9	6	27.7	0.00	0.00	0.40	0.00	0.00	0.0	0.0	0.0	4.53	7.92	2.56	18	0.76	5227.55	5227.34	5230.24	5230.17	5234.14	5233.97	Connects DI C C
10	4	12.6	0.00	0.00	0.40	0.00	0.00	0.0	0.0	0.0	8.31	17.01	4.70	18	3.49	5222.92	5222.48	5226.93	5226.83	5228.71	5228.57	Roaring DI A
11	4	27.5	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	8.31	29.55	4.70	18	10.55	5225.38	5222.48	5227.05	5226.83	5228.71	5228.57	Roaring DI A
12	3	27.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	4.73	28.99	2.77	18	10.15	5224.64	5221.90	5225.96	5225.91	5228.04	5227.48	Roaring DI C
13	3	50.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	4.73	9.10	2.68	18	1.00	5222.40	5221.90	5226.05	5225.91	5227.97	5227.48	Roaring DI C

Project File: SDdesign_020204.stm

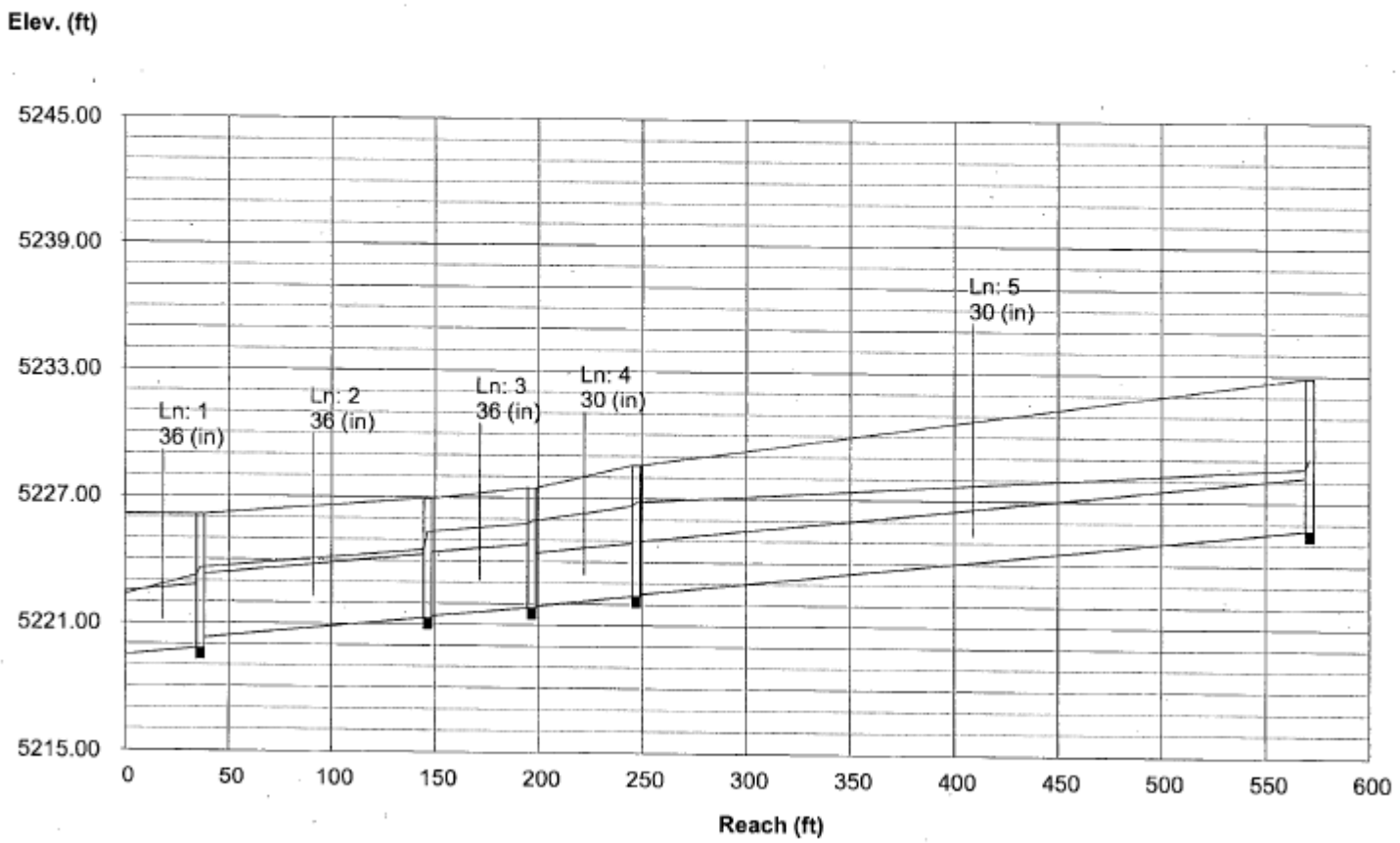
Number of lines: 13

Run Date: 02-11-2004

NOTES: Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82; Return period = 100 Yrs.

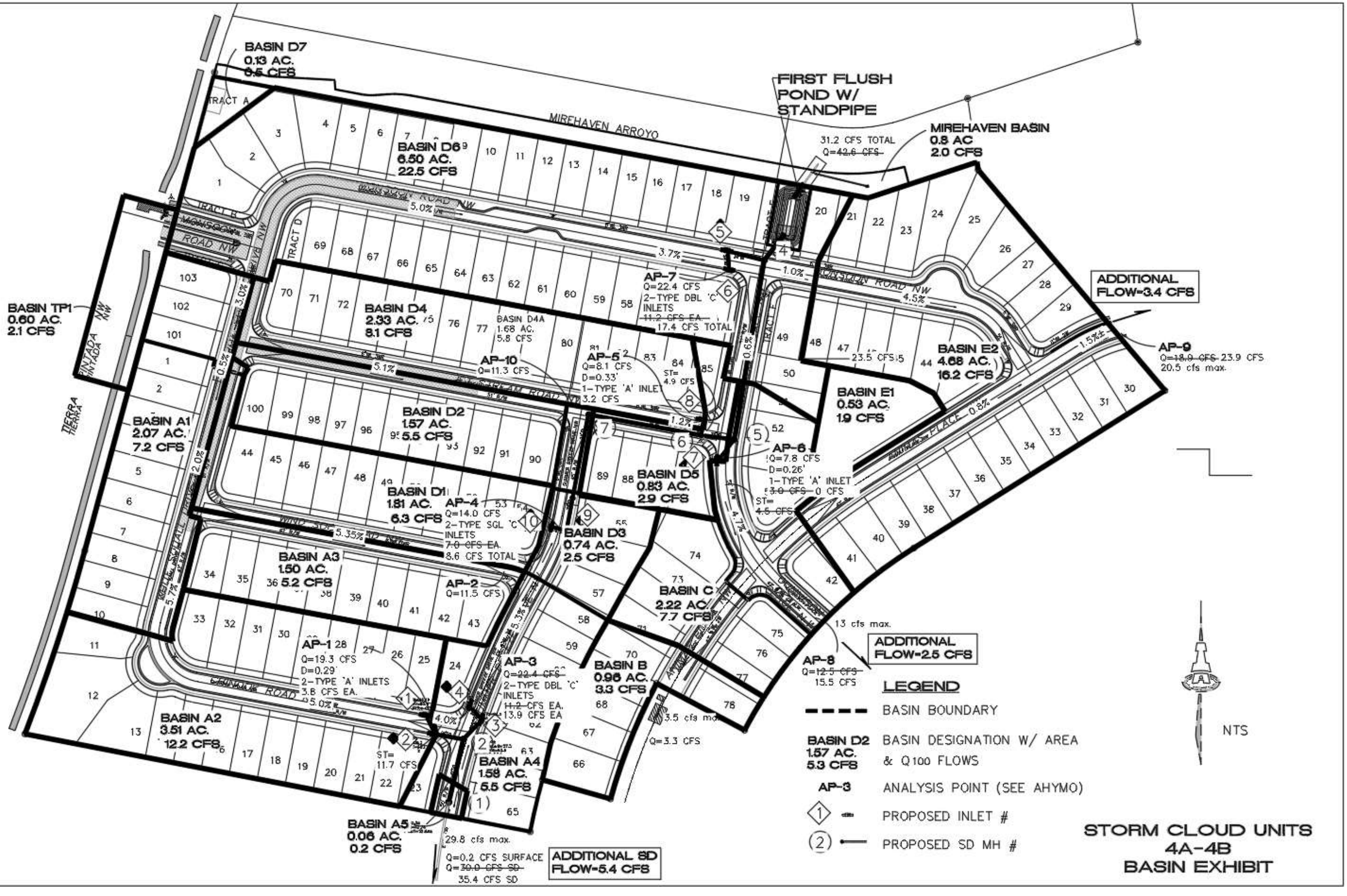
Storm Sewer Profile

Proj. file: SDdesign_020204.stm



APPENDIX B

Revised Basin Exhibit
Storm Drain Calculations
Street Capacity Calculations

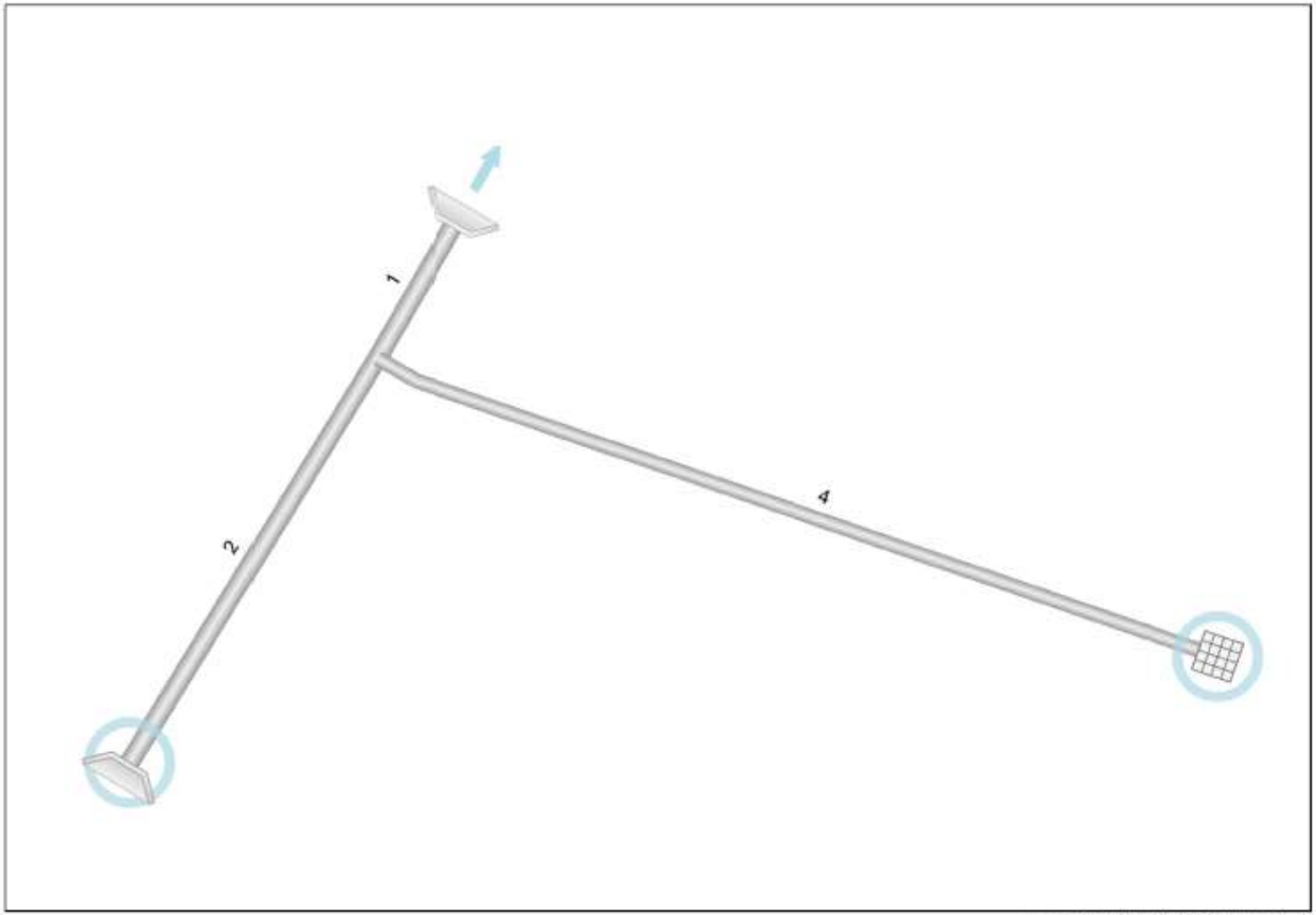

BASIN D7
0.13 AC.
0.5 CFS
TRACT A
MIREHAVEN ARROYO
FIRST FLUSH
POND W/
STANDPIPE
31.2 CFS TOTAL
Q=42.6 CFS
MIREHAVEN BASIN
0.8 AC
2.0 CFS
BASIN D6
6.50 AC.
22.5 CFS
ADDITIONAL
FLOW=3.4 CFS
AP-9
Q=18.9 CFS 23.9 CFS
20.5 cfs max.
BASIN TP1
0.60 AC.
2.1 CFS
AP-7
Q=22.4 CFS
2-TYPE DBL 'C'
INLETS
11.2 CFS EA.
17.4 CFS TOTAL
BASIN D4
2.33 AC.
8.1 CFS
BASIN D4A
1.68 AC.
5.8 CFS
AP-10
Q=11.3 CFS
AP-5
Q=8.1 CFS
D=0.33'
1-TYPE 'A' INLET
3.2 CFS
ST=
4.9 CFS
BASIN E2
4.68 AC.
16.2 CFS
23.5 CFS
BASIN E1
0.53 AC.
1.9 CFS
BASIN A1
2.07 AC.
7.2 CFS
BASIN D2
1.57 AC.
5.5 CFS
AP-6
Q=7.8 CFS
D=0.26'
1-TYPE 'A' INLET
3.0 CFS 0 CFS
ST=
4.5 CFS
BASIN D5
0.83 AC.
2.9 CFS
BASIN D1
1.81 AC.
6.3 CFS
AP-4
Q=14.0 CFS
2-TYPE SGL 'C'
INLETS
7.0 CFS EA.
8.6 CFS TOTAL
BASIN D3
0.74 AC.
2.5 CFS
BASIN A3
1.50 AC.
5.2 CFS
AP-2
Q=11.5 CFS
BASIN C
2.22 AC.
7.7 CFS
13 cfs max.
ADDITIONAL
FLOW=2.5 CFS
AP-8
Q=12.5 CFS
15.5 CFS
AP-1
Q=19.3 CFS
D=0.29'
2-TYPE 'A' INLETS
3.8 CFS EA.
AP-3
Q=22.4 CFS
2-TYPE DBL 'C'
INLETS
11.2 CFS EA.
13.9 CFS EA
BASIN B
0.96 AC.
3.3 CFS
3.5 cfs max.
Q=3.3 CFS
BASIN A2
3.51 AC.
12.2 CFS
ST=
11.7 CFS
BASIN A4
1.58 AC.
5.5 CFS
BASIN A5
0.06 AC.
0.2 CFS
29.8 cfs max.
Q=0.2 CFS SURFACE
Q=30.0 CFS SD
35.4 CFS SD
ADDITIONAL SD
FLOW=5.4 CFS
LEGEND
BASIN BOUNDARY
BASIN D2 BASIN DESIGNATION W/ AREA
1.57 AC. & Q100 FLOWS
5.3 CFS
AP-3 ANALYSIS POINT (SEE AHYMO)
PROPOSED INLET #
PROPOSED SD MH #
NTS
STORM CLOUD UNITS
4A-4B
BASIN EXHIBIT

Plan View

Stormwater Studio 2017 v 1.0.0.0

Project Name: 1821 MIREHAVEN PIPE

03-01-2018



Project File: 1821 MIREHAVEN PIPE-REV3 2017-12-15.swm

Energy Grade Line Calculations

Project Name: 1821 MIREHAVEN PIPE

Stormwater Studio 2017 v 1.0.0.0

03-01-2018

Line No	Line Size	Q	Downstream							Length	Upstream							Pipe		Junction		
			Invert Elev	Depth	Area	HGL Elev	Vel	Vel Head	EGL Elev		Invert Elev	Depth	Area	HGL Elev	Vel	Vel Head	EGL Elev	n Value	Enrgy Loss	HGLa Elev	EGLa Elev	Enrgy Loss
	(in)	(cfs)	(ft)	(ft)	(sqft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft)	(ft/s)	(ft)	(ft)		(ft)	(ft)	(ft)	(ft)
1	24	31.20	60.30	1.60‡	2.69	61.90	11.60	2.09	63.79	15.00	60.90	1.88³	3.07	62.78	10.18	1.61	64.39	0.013	0.247	62.78	64.39	0.00
2	24	29.20	60.90	2.00	3.04	62.98	9.30	1.34	64.33	47.00	62.30	1.85³	3.04	64.15	9.62	1.44	65.59	0.013	0.731	67.12ic	67.12	1.53
3	18	2.00	60.90	1.50	1.77	64.37	1.13	0.02	64.39	4.50	61.00	1.50	1.77	64.37	1.13	0.02	64.39	0.013	0.002	64.38	64.40	0.01
4	18	2.00	61.00	1.50	1.77	64.38	1.13	0.02	64.40	84.00	61.90	1.50	1.77	64.41	1.13	0.02	64.43	0.013	0.030	64.42	64.44	0.01

Notes: Return Period = 2-yrs. ³ Critical depth. ‡ Supercritical.

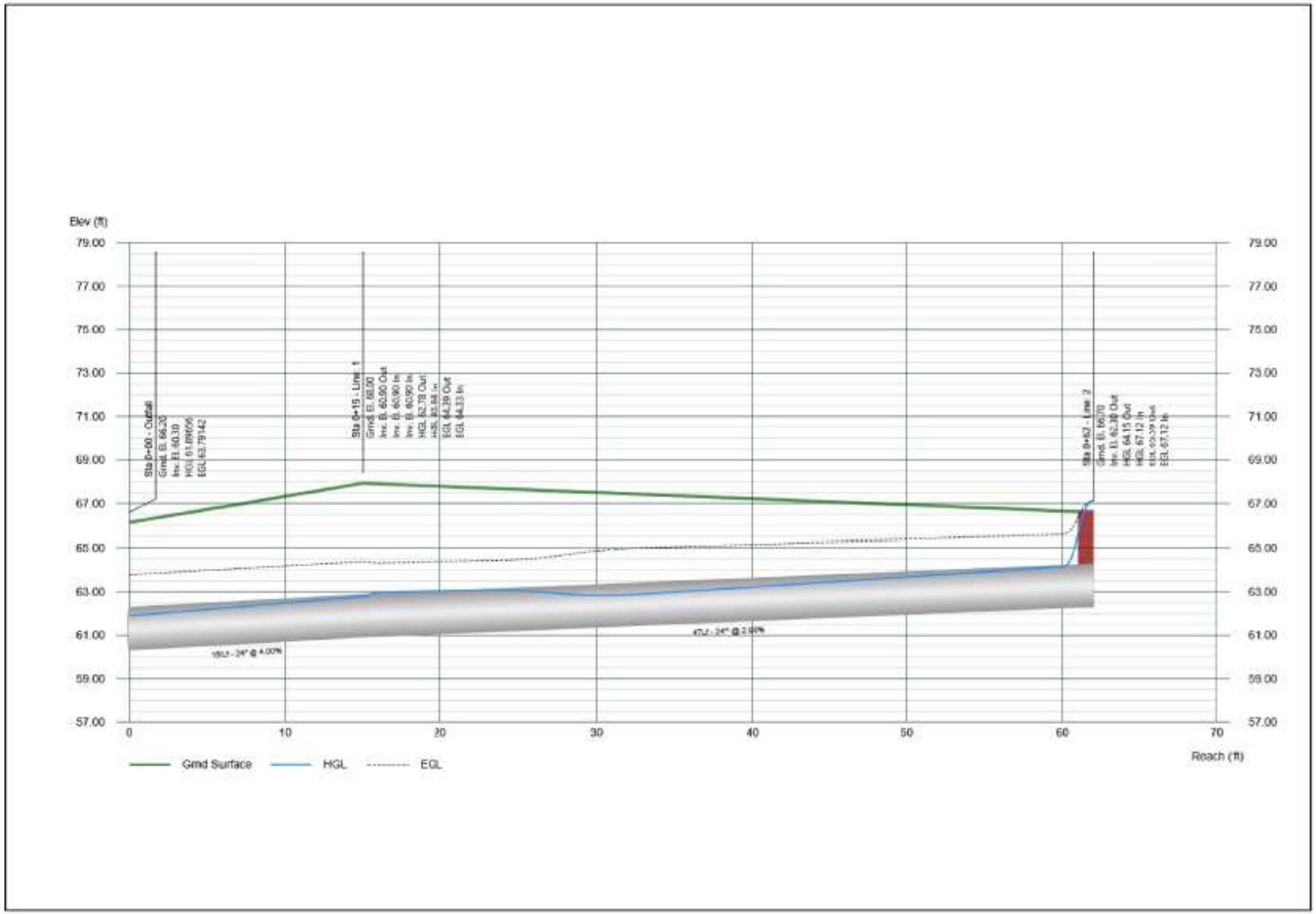
Project File: 1821 MIREHAVEN PIPE-REV5 2017-12-15.sws

Profile View

Stormwater Studio 2017 v 1.0.0.0

Project Name: 1821 MIREHAVEN PIPE

03-01-2018

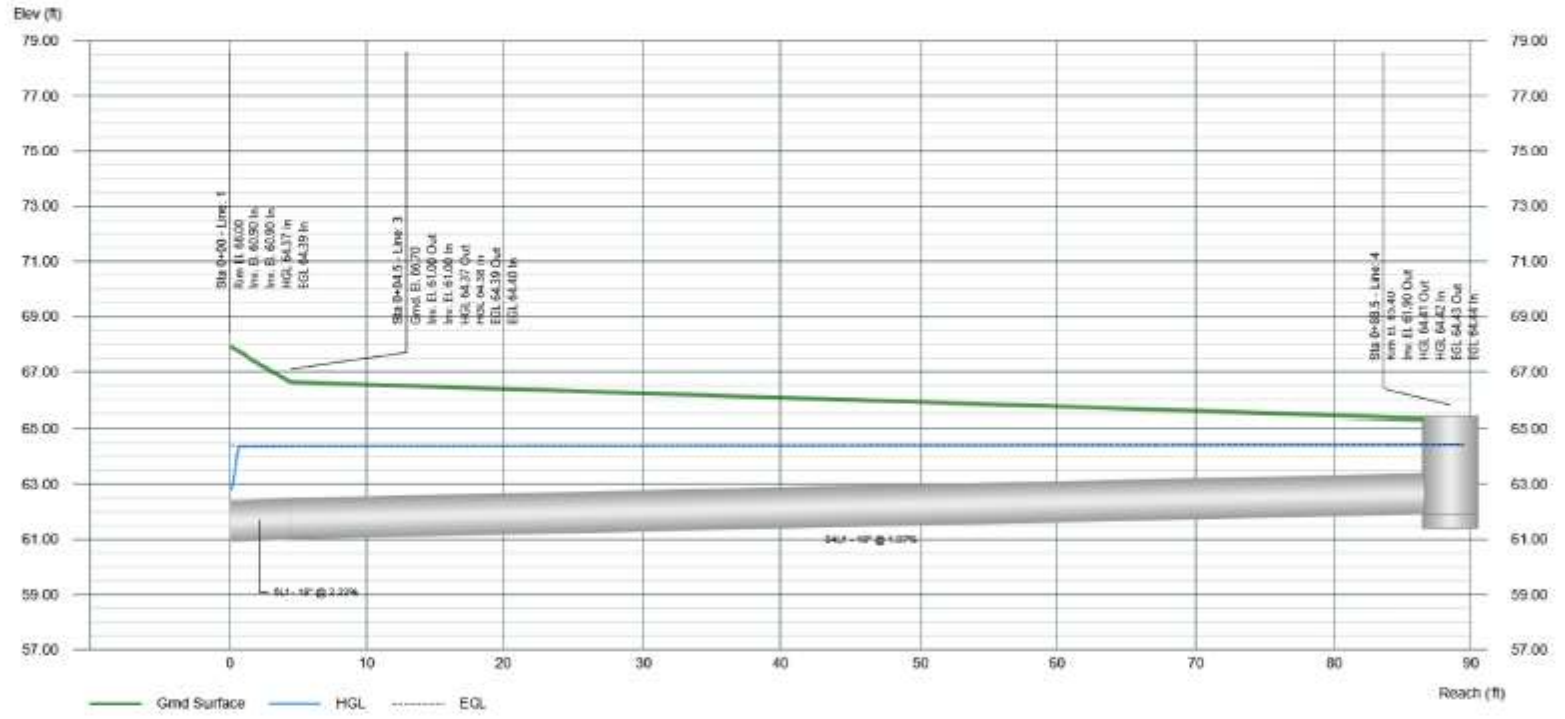


Profile View

Stormwater Studio 2017 v 1.0.0.0

Project Name: 1821 MIREHAVEN PIPE

03-01-2018



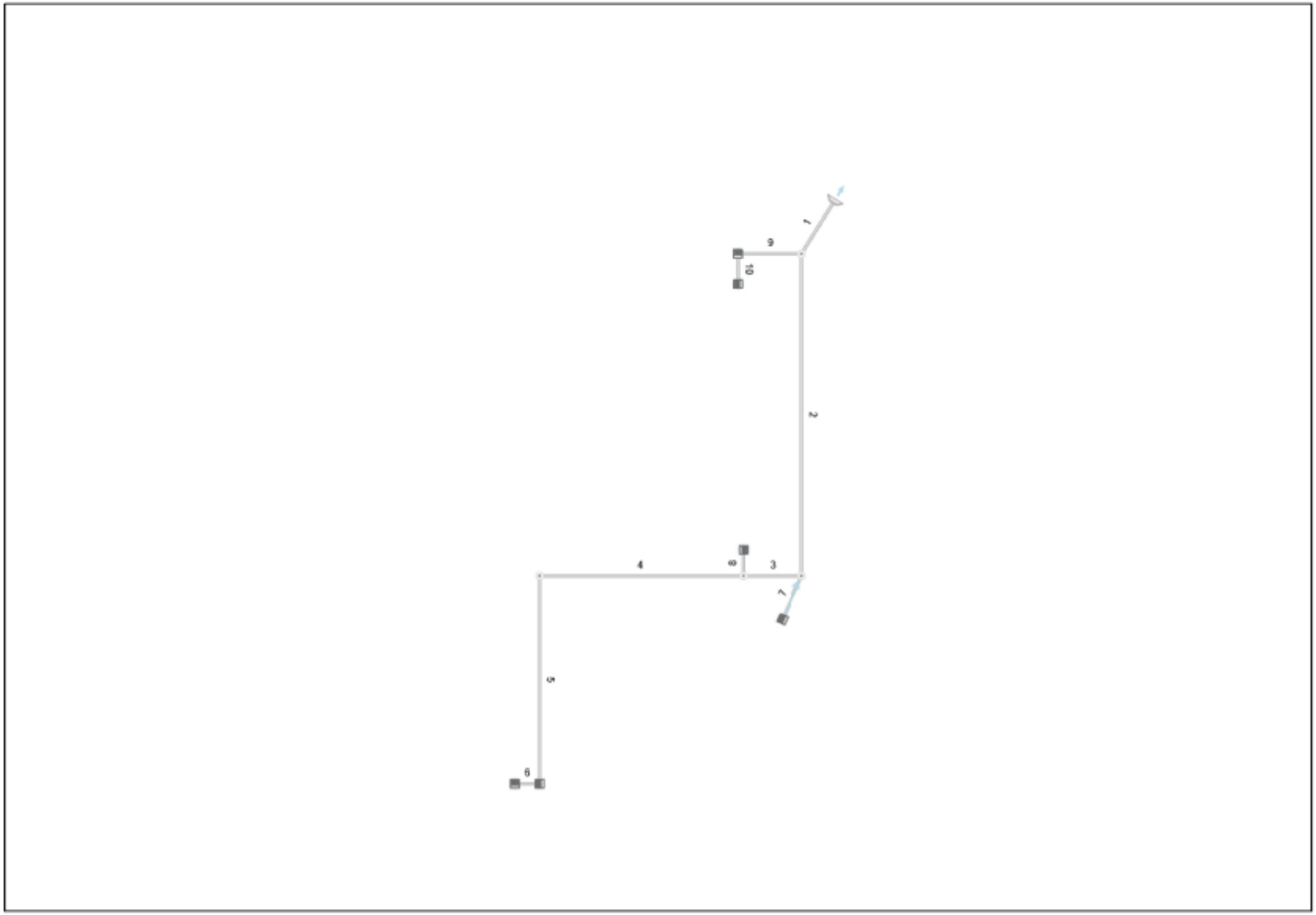
Project File: 1821 MIREHAVEN PIPE-REVS 2018-12-18.swe

Plan View

Stormwater Studio 2017 v 1.0.0.0

Project Name: Enter Project Name...

03-01-2018



Project File: 1821 GUNNISON SD-REV.sws

Energy Grade Line Calculations

Project Name: Enter Project Name...

Stormwater Studio 2017 v 1.0.0.0

03-01-2018

Line No	Line Size	Q	Downstream							Length	Upstream							Pipe		Junction		
			Invert Elev	Depth	Area	HGL Elev	Vel	Vel Head	EGL Elev		Invert Elev	Depth	Area	HGL Elev	Vel	Vel Head	EGL Elev	n Value	Enrgy Loss	HGLa Elev	EGLa Elev	Enrgy Loss
	(in)	(cfs)	(ft)	(ft)	(sqft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft)	(ft/s)	(ft)	(ft)		(ft)	(ft)	(ft)	(ft)
1	36	29.21	60.50	3.00	7.07	67.12	4.13	0.27	67.39	53.20	61.09	3.00	7.07	67.22	4.13	0.27	67.49	0.013	0.102	67.32	67.59	0.10
2	36	11.81	61.19	3.00	7.07	67.56	1.67	0.04	67.61	288.00	62.34	3.00	7.07	67.65	1.67	0.04	67.70	0.013	0.090	67.68	67.72	0.03
3	24	11.80	62.44	2.00	3.14	67.59	3.76	0.22	67.81	52.97	62.65	2.00	3.14	67.74	3.76	0.22	67.96	0.013	0.144	67.78	68.00	0.04
4	24	8.60	62.75	2.00	3.14	67.93	2.74	0.12	68.05	182.00	63.48	2.00	3.14	68.19	2.74	0.12	68.31	0.013	0.263	68.27	68.39	0.08
5	24	8.60	63.58	2.00	3.14	68.32	2.74	0.12	68.43	186.00	64.13	2.00	3.14	68.59	2.74	0.12	68.70	0.013	0.269	68.59	68.70	0.00
6	18	4.30	64.23	1.50	1.77	68.65	2.43	0.09	68.74	22.00	64.30	1.50	1.77	68.68	2.43	0.09	68.78	0.013	0.037	68.69	68.79	0.01
7	18	0.01	62.44	1.50	1.77	67.72	0.01	0.00	67.72	42.80	62.77	1.50	1.77	67.72	0.01	0.00	67.72	0.013	0.000	67.72	67.72	0.00
8	18	3.20	62.97	1.50	1.77	67.97	1.81	0.05	68.02	23.00	64.40	1.50	1.77	67.99	1.81	0.05	68.04	0.013	0.021	68.00	68.05	0.01
9	24	17.40	61.19	2.00	3.14	67.30	5.54	0.48	67.78	57.80	62.40	2.00	3.14	67.64	5.54	0.48	68.12	0.013	0.342	67.70	68.18	0.06
10	24	8.70	62.60	2.00	3.14	68.11	2.77	0.12	68.23	27.10	62.75	2.00	3.14	68.15	2.77	0.12	68.27	0.013	0.040	68.16	68.27	0.01

Notes: Return Period = 2-yrs.

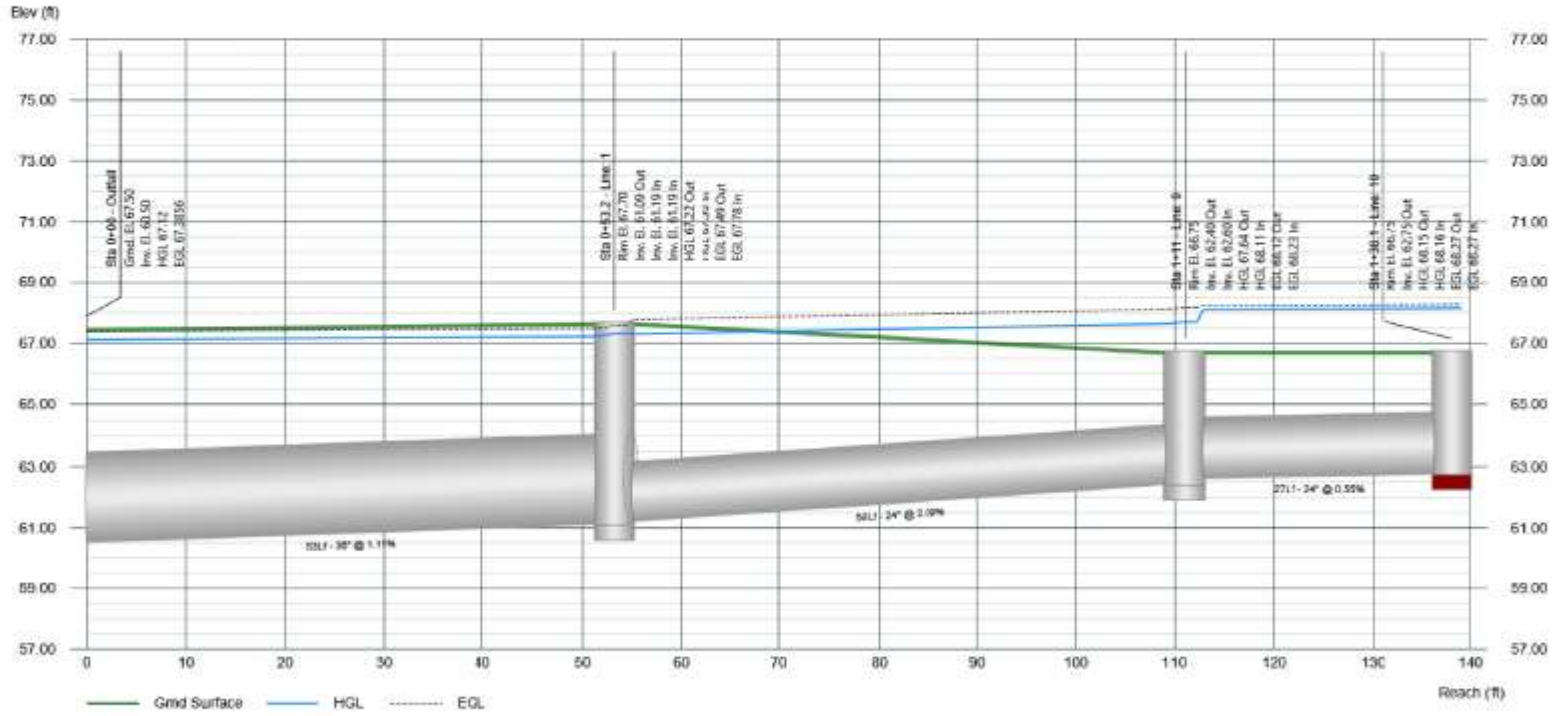
Project File: 1821 GUNNISON SD-REV.sws

Profile View

Stormwater Studio 2017 v 1.0.0.0

Project Name: Enter Project Name...

03-01-2018



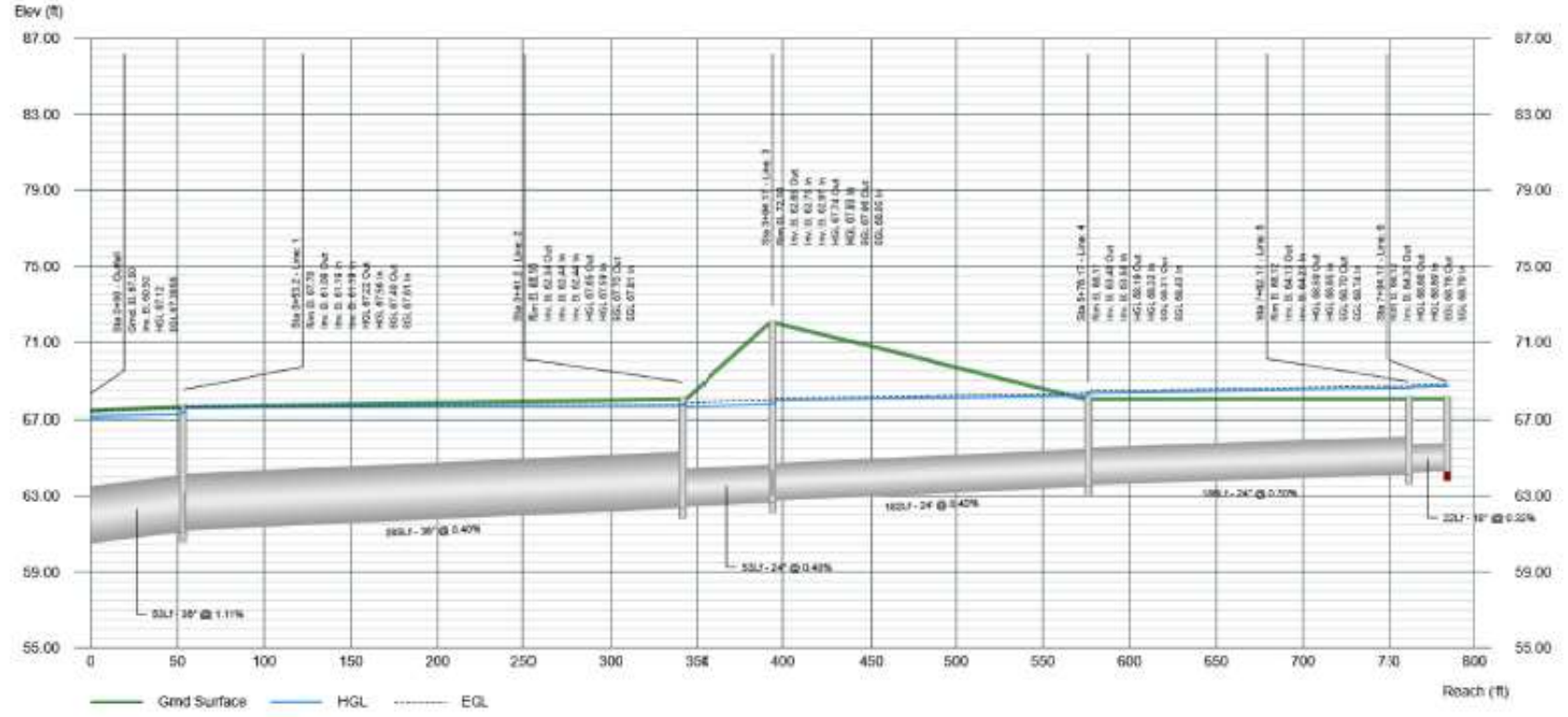
Project File: 1821 GUNNISON SD-REV.sws

Profile View

Stormwater Studio 2017 v 1.0.0.0

Project Name: Enter Project Name...

03-01-2018



Plan View

Stormwater Studio 2017 v 1.0.0.0

Project Name: SUMMER BREEZE

03-01-2018

Project File: SUMMER BREEZE.sws

Energy Grade Line Calculations

Project Name: SUMMER BREEZE

Stormwater Studio 2017 v 1.0.0.0

03-01-2018

Line No	Line Size	Q	Downstream							Length	Upstream							Pipe		Junction		
			Invert Elev	Depth	Area	HGL Elev	Vel	Vel Head	EGL Elev		Invert Elev	Depth	Area	HGL Elev	Vel	Vel Head	EGL Elev	n Value	Enrgy Loss	HGLa Elev	EGLa Elev	Enrgy Loss
	(in)	(cfs)	(ft)	(ft)	(sqft)	(ft)	(ft/s)	(ft)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft)	(ft/s)	(ft)	(ft)		(ft)	(ft)	(ft)	(ft)
1	36	35.40	48.36	3.00	7.07	59.70	5.01	0.39	60.09	144.00	52.68	3.00	7.07	60.11	5.01	0.39	60.50	0.013	0.406	60.11	60.50	0.01
2	42	35.40	52.78	3.50	9.62	60.38	3.68	0.21	60.59	102.37	55.85	3.50	9.62	60.50	3.68	0.21	60.71	0.013	0.127	60.60	60.81	0.10
3	24	7.60	56.85	2.00	3.14	60.75	2.42	0.09	60.84	44.12	59.80	0.98[2]	1.52	60.78	4.99	0.39	61.16	0.013	0.133	60.78	61.16	0.00
4	18	3.80	60.00	1.10	1.39	61.10	2.73	0.12	61.22	30.20	61.10	0.74[2]	0.87	61.85	4.34	0.29	62.14	0.013	0.106	61.85	62.14	0.00
5	24	27.80	56.85	2.00	3.14	60.08	8.85	1.22	61.30	39.00	57.65	2.00	3.14	60.67	8.85	1.22	61.89	0.013	0.589	60.92	62.14	0.26
6	24	13.90	57.85	2.00	3.14	61.96	4.43	0.30	62.26	24.80	58.10	2.00	3.14	62.05	4.42	0.30	62.36	0.013	0.094	62.11	62.41	0.06

Notes: Return Period = 2-yrs. [2] Critical depth.

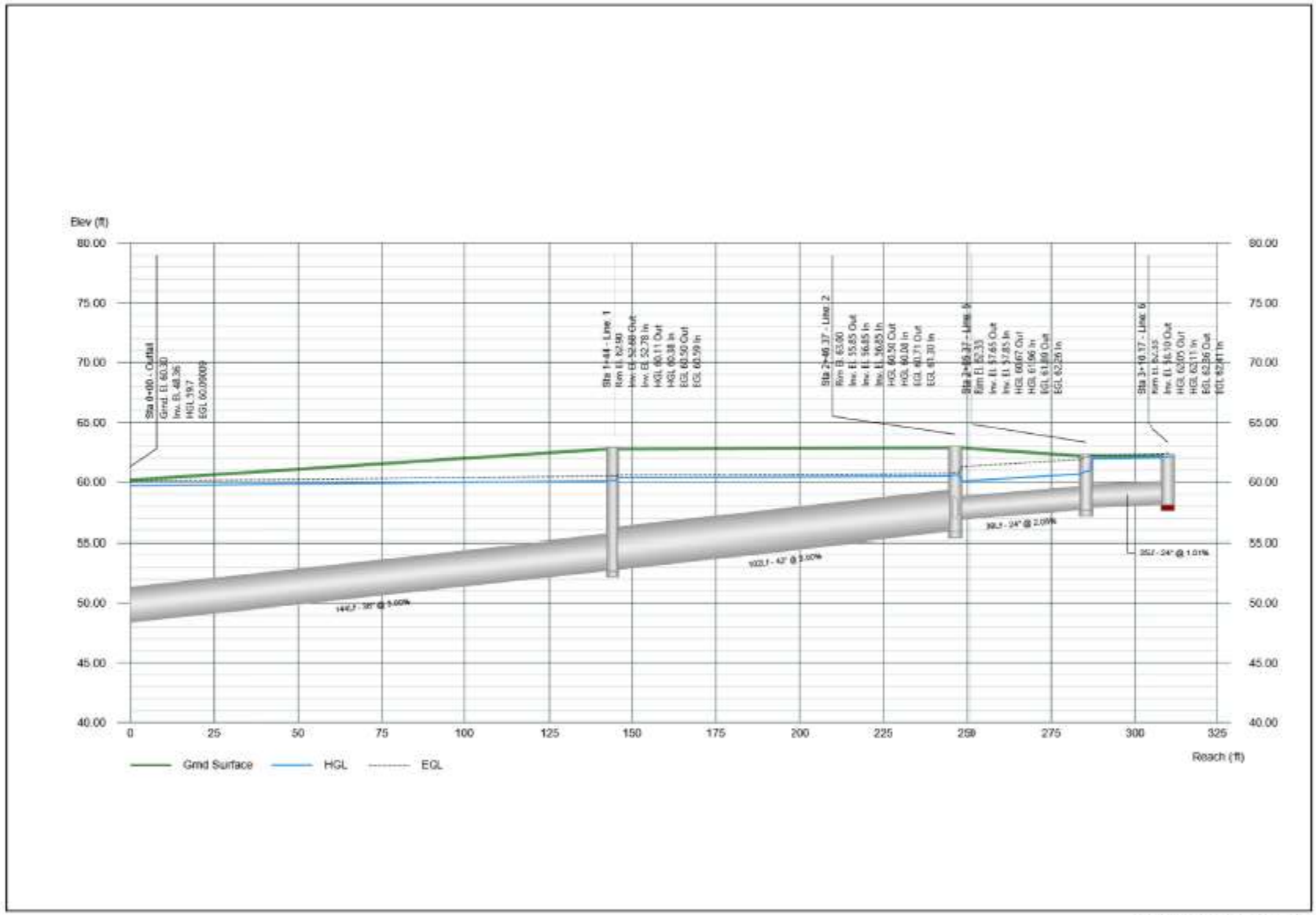
Project File: SUMMER BREEZE.sws

Profile View

Project Name: SUMMER BREEZE

Stormwater Studio 2017 v 1.0.0.0

03-01-2018



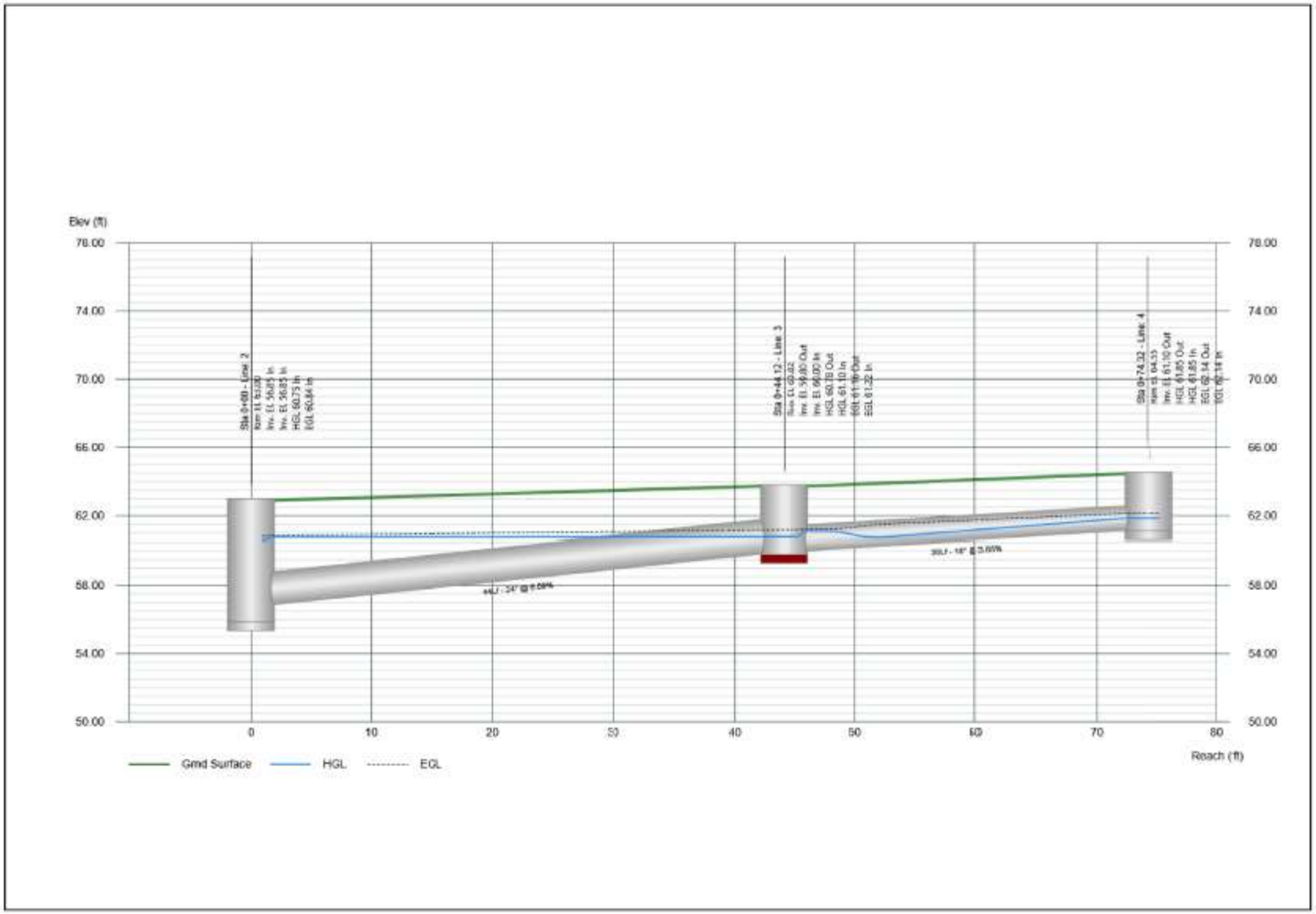
Project File: SUMMER BREEZE.sws

Profile View

Stormwater Studio 2017 v 1.0.0.0

Project Name: SUMMER BREEZE

03-01-2018



Project File: SUMMER BREEZE.sws

STREET FLOW CAPACITY CALCULATIONS

STREET NAME:	**Roaring Fork**		1
LOCATION:	**Before 4 inlets in Clarks Fork**		

STREET INFORMATION		**HALF STREET CALCULATIONS**	
Slope	0.005	Road Width/2	16
Q_{100}	49.4	Curb Height	0.67
Right-of-way Width	50	1/2 Wetted Perimeter (P)	16.602
Road Width	32	1/2 Area(STD)	7.078
Curb Type	std	1/2 Area(MDN)	----
Road Cross Slope	0.02	1/2 Area(MTBL)	----
Manning's N	0.017	Discharge (1/2 Q)	24.713
Depth	0.602		

RESULTS

HGL

Q_{100} FLOW CAPACITY =	**49.43 cfs**	**OK**		
at an HGL Depth=	**0.60 ft**	<	Curb height =	0.67
		OK		

EGL

Velocity	3.49 fps			
$V^2/2g$	0.19 ft			
EGL Depth =	**0.79 ft**	<	Right-of-way height =	0.84
		OK		

~~~~~~

STREET NAME:	**Gunnison**		2
LOCATION:	**Before 4 inlets @ Casa Florida Pl NW**		

STREET INFORMATION		**HALF STREET CALCULATIONS**	
Slope	0.015	Road Width/2	15
Q_{100}	31.8	Curb Height	0.67
Right-of-way Width	51	1/2 Wetted Perimeter (P)	15.403
Road Width	30	1/2 Area(STD)	3.797
Curb Type	std	1/2 Area(MDN)	----
Road Cross Slope	0.02	1/2 Area(MTBL)	----
Manning's N	0.017	Discharge (1/2 Q)	15.903
Depth	0.403		

RESULTS

HGL

Q_{100} FLOW CAPACITY =	**31.81 cfs**	**OK**		
at an HGL Depth=	**0.40 ft**	<	Curb height =	0.67
		OK		

EGL

Velocity	4.19 fps			
$V^2/2g$	0.27 ft			
EGL Depth =	**0.68 ft**	<	Right-of-way height =	0.87
		OK		
~~~~~~

ISAACSON & ARFMAN, P.A. *Consulting Engineering Associates*

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

March 13, 2018

Mr. Doug Hughes, PE
Principal Engineer, Planning Dept.
City of Albuquerque
600 2nd Street NW
Albuquerque, NM 87103

RE: H09D022A – Stormcloud Unit 4
Drainage Calculations for Unit 4 Storm Drain

Dear Mr. Hughes:

Please see attached for a drainage report addressing your concern regarding the insufficient capacity of the existing 24-inch storm drain that is installed from the first flush pond to the Mirehaven Arroyo. The storm drain was indeed undersized because the calculations did not include the inlet losses. The report includes revised storm drain calculations to determine the actual capacity of the existing 24-inch pipe and also the capacity of the on-site storm drain systems based on the elevated pond water surface elevation. The report also includes quantifying the bypass flow rates and analyzing the impact to existing street and storm drain capacity in the adjacent neighborhoods.

The storm drain software used for the calculations in this report is Stormwater Studio. This software performs EGL calculations in the same fashion as StormCAD, taking into account the momentum energy losses at junctions (per DPM). Stormwater Studio costs ~500/seat or ~$1,000 for unlimited seats and is, in my opinion, much more user friendly than StormCAD that costs around $5,700/seat. For your use, below is a link explaining how the calculations are performed.

https://www.hydrologystudio.com/stormwater-studio-help/index.html?losses_in_junctions.htm

The report shows that the downstream street and storm drain capacities are sufficient to accept the additional bypass flows.

If you have questions regarding this submittal, please call me at 266-1688 or email me at asaw@iacivil.com. Please let me know if you and Shahab would like to meet with me to go over the report.

Thank you.

Sincerely,
ISAACSON & ARFMAN

Åsa Nilsson-Weber

Attachment