APPENDIX E

SEWER TECHNICAL STUDY

BY: KIMLEY-HORN AND ASSOCIATES, INC.

Sewer Technical Study

Douglas Park Rezone Application
Long Beach, CA

August 25, 2008

Prepared for:
The Boeing Company
4501 E. Conant Street
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1. Introduction

This document complies with the City of Long Beach Water Department (LBWD) Sewer Design Criteria.

The proposed project involves the rezoning of approximately 100 acres of the Douglas Park project, located at the southwest corner of Carson Street and Lakewood Boulevard in the City of Long Beach. **Exhibit A** contains a vicinity map for the project. The site is vacant and has been mass graded per plans for PacifiCenter @ Long Beach, a redevelopment project of The Boeing Company's C-1 Aircraft Production facility. The area to be rezoned consists of relatively flat, non-graded pads prepared for continued improvements. Portions of this area, under PacifiCenter plans, were designated for residential uses. A rezone application for the property has been filed to change the land use of the area to mixed use, retail, commercial/office, research and development and hotel uses. **Exhibit B** contains the proposed land use by Quadrant. **Exhibit C** contains the aerial photo identifying the current project site and infrastructure built-out under the PacifiCenter @ Long Beach project.

As stated in the December 2003 report, this project is within the County of Los Angeles Sanitation District (CSDLA) Number 3. The existing sewage flows generated on the Douglas Park site are discharged into 1 of 2 pipelines (a 15-inch and a 21-inch) which connect to the CSDLAs Joint Outfall "A" Unit 1A North Long Beach Interceptor Trunk Sewer (NLBITS) at the intersection of Conant Street and Clark Avenue. Both pipes extend to the Douglas Park project at the intersection of Lakewood Boulevard and Conant Street and are maintained and owned by the LBWD. The 15-inch line only serves the Boeing Douglas Park project and the 21-inch line serves both the Douglas Park project and other areas of Long Beach and City of Lakewood. **Exhibit D** contains the local off-site sewer system serving the project.

2. Executive Summary

The Sewer Master Plan Study, dated December 2003, was completed by Kimley-Horn and Associates, Inc., for use as the technical basis for the Final Environmental Impact Report (Final EIR) prepared in accordance with the California Environmental Quality Act (CEQA) requirements for the PacifiCenter Project @ Long Beach. The project's design features completed as part of the site development and will remain within the rezone area include:

- The construction of Phase 1 Sewer Improvements which include Bayer Avenue, Worsham Avenue, Schaufele Avenue, and Cover Street (from Lakewood Boulevard to Schaufele Avenue) and Conant Street (from Lakewood Boulevard to Heinemann Avenue).
- The construction of Segment 3 Sewer Improvements which include Heinemann Avenue.
- The design of Segment 4 Sewer Improvements currently in construction on Cover Street (from Heinemann Avenue to the City of Long Beach/ Lakewood Boundary) and a portion of Conant Street (from the Boeing Enclave Boundary to Cover Street).
- The design of Segment 5 Sewer Improvements in Steinmann Avenue and extending the sewer on Conant Street to Heinemann Avenue.

The approximate 100-acre rezone as proposed will change the land use north of Cover Street from residential to commercial/office/R&D and maintain the previously proposed 400 room hotel. The project design features as part of the rezone area include the following:

- The overall sewer capacity north of Cover will be significantly reduced. The average daily flow generation rate for residential uses is based on 85 gallons per day (GPD) per person and 2.5 persons per Equivalent Dwelling Unit (EDU). The 1,400 residential units from the original December 2003 Sewer Master Plan give a total flow of 0.75 million gallons per day (MGD) maximum daily demand. The generation rate for commercial/office/R&D is 200 gallons per 1,000 square feet per day. With a proposed total of 1.58 million square feet of new development with the new land use, this gives 0.70 MGD, which is less than half of the residential flow. **Table 1** shows the proposed sewer capacity for the rezone area as well as the entire site, before and after the zoning changes.
- The proposed rezone area would include sewer system improvements designed to provide adequate sewer service to all future development on the site. This new infrastructure will not impose significant impacts on the existing municipal system or impacts on the Phase 1 and Segment 3 infrastructure in place or the Segment 4 and Segment 5 infrastructure designed and approved.

Table 1: Summary of the Douglas Park Sewer Capacity

Year	Area	Peak Flow (MGD)
Approved Douglas Park Project	**100-acre Rezone Area[1]**	**.75**
	Total Site	**3.47**
August 25, 2008 Sewer Technical Study for the Rezone Area	**100-Acre Rezone Area[1]**	**.70**
	Total Site	**2.0**

[1]The proposed 400 room hotel capacity is included in the overall site number as it remains the same.

3. Existing Conditions

Kimley-Horn has reviewed documents and files from the City of Long Beach, the City of Lakewood, and the County of Los Angeles Sanitation District (CSDLA) Number 3 for previously written sewer studies for the Douglas Park project area. The documents and files reviewed included basin-wide maps, conceptual plans of the proposed project, and plans of the proposed improvements. Section 5 of this report lists the references used.

Local Off-Site Sewer System

As stated in the December 2003 report, this project is within the County of Los Angeles Sanitation District (CSDLA) Number 3. The existing sewage flows generated on the Douglas Park site are discharged into 1 of 2 pipelines (a 15-inch and a 21-inch) which connect to the CSDLAs Joint Outfall "A" Unit 1A North Long Beach Interceptor Trunk Sewer (NLBITS) at the intersection of Conant Street and Clark Avenue. Both pipes extend to the Douglas Park project at the intersection of Lakewood Boulevard and Conant Street and are maintained and owned by the LBWD.

The 15-inch line only serves the portion of the Phase 1 infrastructure and will serve the rezone area east of Worsham Avenue. The 21-inch line serves both the Douglas Park project and other areas of Long Beach and City of Lakewood. The 21-inch line serves the existing Segment 3, proposed Segments 4 and 5 and the rezone area west of Worsham Avenue. **Exhibit E** contains the local off-site sewer system serving the project.

4. Proposed Improvements

The sewer lines North of Cover Street for the approximate 100-acre rezone will be reconfigured to accommodate the changes to the land use, lot configuration, lot sizes as well as proposed buildings. The sewage expected to be generated from the area north of Cover Street in the Douglas Park rezone area has been estimated using the City of Long Beach's average wastewater generation factors.

As specified in the LBWD Rules and Regulations, the rezone area conceptual sewer alignments and sizes have been designed to meet the following LBWD criteria:

- The smallest size sewer line allowed is 8 inches.
- Main line sewers, up to 15 inches in diameter (no lines have been proposed greater then 15-inches), will be designed to flow one-half full.
- All lines will be designed to provide a minimum velocity of 2-feet per second.
- A minimum cover of 5 feet should also be maintained per City of Long Beach standards.

The calculations for the average and peak sewage flows were based on the proposed land uses for the project site. The proposed rezone area development incorporates a mix of research and development (R&D), retail, hotel, office, and light industrial. For these types of land uses, average wastewater generation factors from the City of Long Beach use a flow of 200 GPD per 1000 square feet of development. The proposed sewer system was analyzed using Manning's equation for pipe flow to determine the capacity of the main sewer network serving the proposed land use areas. The City of Long Beach's criteria, the calculations to determine sewer pipe capacity and size utilizes a depth-to-diameter (D/d) design criteria of 0.75 (assume ¾ full for pipe capacity) for pipe sizes 18 inches in diameter or larger, and a D/d of 0.50 for pipes less than 18 inches in diameter were used. The sizing of sewer pipelines is based on the calculated peak flow. The peak sewage flows were calculated using the following equation:

$$Q_{peak}=2.04 * (Q_{Average})^{0.983}$$

Where,

Q is sewage flow in CFS.

Peak sewage flows are used in the model for sizing the new sewer pipelines in the Douglas Park Rezone Area. The land use types and the square footage were used to determine flow for the areas tributary to the proposed sewer collection system **Table 2** summarizes the calculated peak flows for the proposed sewer system including the rezone area, current installed sewer system south of Cover Street, designed but not installed sewer system south of Cover Street and the off-site contributing flow. A detailed spreadsheet showing the flow calculations is included in the **Appendix A.**

Table 2: Proposed Sewage Flow

Sewer Line			*Tributary Area*	*Peak Flow*		*Total Peak Flow at Connection*	*December 2003 Sewer Master Plan*
Line Location		*MH Location*	*(acres)*	*(MGD)*	*(CFS)*	*(CFS)*	*(CFS)*
Tributary to 15 inch sewer	Conant Street (Bayer Ave. to Lakewood Blvd.)	MH1	45.46	0.41	0.64	0.64	1.21
Tributary to 21 inch sewer	Conant Street (Heineman n Ave. to Lakewood Blvd.)	MH29	320.30	1.94	3.00	3.00	3.01
Offsite Flow from Lakewood						2.16[1]	1.91[1]
Total						5.80	6.13

1-Area was further analyzed in the Approved Sewer Area Study TG 765-H6 for the Lakewood Parcel Map.

Table 3 is a summary of average and peak flows from this site including the rezone area as well as the constructed and designed segments south of Cover Street. The 15-inch existing flow is from the flow currently contributing to the existing 15-inch line. The 8-inch proposed sewer tributary to the existing 15-inch sewer is flow coming from the proposed development via the 8-inch line in Bayer Avenue that will eventually flow into the 15-inch line. The 8-inch proposed flow of 0.15 CFS (cubic feet per second) was calculated using 549,000 square feet of floor area and a flow rate from the City of Long Beach standards of 200 gallons per 1,000 square feet per day. The total proposed peak flow into the existing 15-inch sewer along Conant Street is 0.64 CFS. The total peak flow into the existing 21- inch sewer along Conant Street is 3.00 CFS, with 0.54 CFS coming from the proposed

development. Therefore, the total proposed peak flow calculated for the proposed Douglas Park project at full development was determined to be 3.64 CFS. Proposed Peak Flows including the 2.16 CFS entering from the City of Lakewood is 5.80 CFS.

Table 3: Average & Peak Sewage Flows Summary
(Project Site Only)

Sewer	*Avg Daily Flow (CFS)*	*Avg Daily Flow (MGD)*	*Peak Flow (CFS)*	*Peak Flow (MGD)*	*Notes*
15-inch Existing	.15	0.10	.31	.20	At End of Line
8-inch Proposed tributary to Existing 15-inch	.15	0.10	.33	.21	At MH 9
21-inch Existing	1.21	0.78	2.46	1.59	At End of Line
8 inch Proposed tributary to Existing 21-inch	.26	0.17	0.54	0.25	At MH 41 and MH 58

The remaining capacity of the local sewer system was analyzed to determine if the downstream system could handle the projected sewage volume from the planned development. The capacity of the 15-inch line is 2.04 CFS and of the 21-inch is 5.04 CFS, for a total of 7.04 CFS (based on both pipes being 75 percent full). The estimated sewage peak flow generated from the project into the existing 15-inch and 21-inch sewers at build out is 2.35 MGD or 3.64 CFS. The off-site flow into the CSDLA'S sewer line at the westerly site boundary is 2.16 CFS for a total of 5.80 CFS sewage generation at the site boundary. The total peak discharge from the project plus the off-site area (5.55 CFS) is less than the available capacity (7.04 CFS) of the existing sewer system serving the project area; therefore there is adequate capacity in the downstream system for the project flows.

The sewer system improvements on-site shall be constructed concurrently with the street improvements to accommodate future build-out of the site and not at a specific development increment or threshold. This ensures that the sewer system improvements will be constructed in a logical manner and will reduce the potential for additional trenching and resurfacing of streets for subsequent sewer system improvements. **Exhibit D** depicts the proposed sewer line sizes and locations. **Table 4** on the following page identifies the corresponding size and slopes of the network of sewers that drain to the sewers in Conant Street.

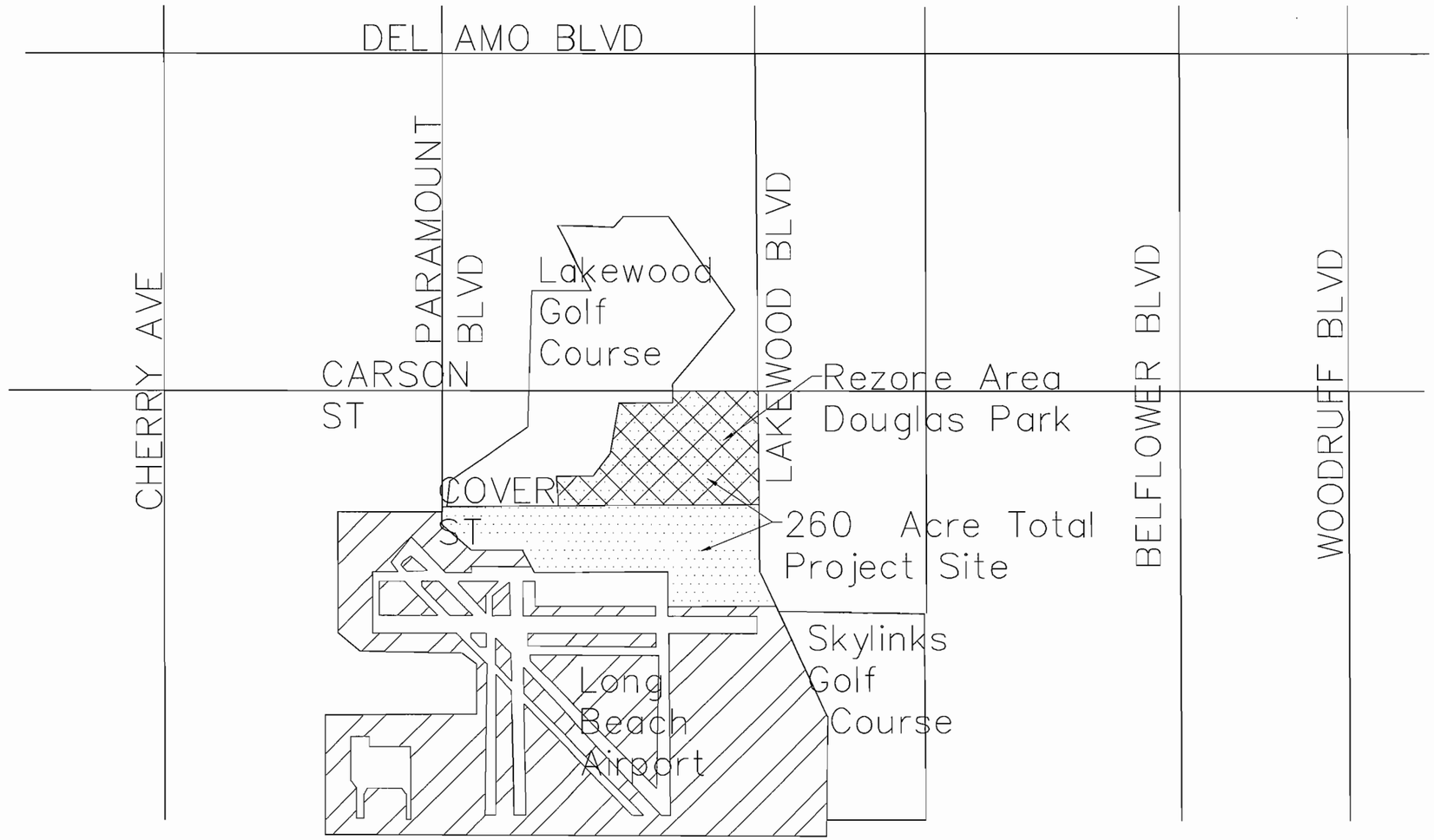
Table 4: Proposed Sewer System Rezone Area

Sewer Location	*Size (IN)*	*Length (FT)*	*Slope (FT/FT)*
Bayer Avenue			
Reach P18	8	60	.0061
Reach P19	8	380	.0050
Reach P20	8	377	.0088
Reach P21	8	265	.0136
Reach P22	8	260	.0050
Reach P23	8	263	.0050
Reach P24	8	530	.0050
Reach P25	8	282	.0050
Reach P26	8	544	.0122
Reach P27	8	345	.0076
Reach P28	8	267	.0070
Schaufele Avenue			
Reach 42	8	189	.0050
Reach 43	8	256	.0059
Reach 44	8	473	.0069
Reach 45	8	300	.0050
Reach 46	8	393	.0050
Reach 47	8	246	.0050
Reach 48	8	119	.0075
Reach 49	8	156	.0135
Reach 50	8	358	.0050
Reach 51	8	235	.0050
Reach 52	8	265	.0083
Heinemann Avenue			
Reach 62	8	399	.0096
Reach 63	8	449	.0050
Reach 64	8	153	.0050

5. References

- City of Long Beach, Department of Public Works, Handbook of Design Standards, June, 1995.
- City of Long Beach, Water Department; Rules, Regulations and Charges Governing Potable Water, Reclaimed Water, Sewer Service, and the Emergency Water Conservation Plan.
- "Long Beach Water Department Sewer Calculations and Improvement Map".
- Los Angeles County Sanitation District Sewage Design Manual.
- Watson, Montgomery, "Long Beach C1 Facility Spill Containment Plan", McDonnell Douglas Corporation, September, 1994.

VICINITY MAP



0' 50' 100' 200'

July 14, 2008

This plan is conceptual in nature and subject to change

DOUGLAS PARK

BOEING

VICINITY MAP - EXHIBIT A

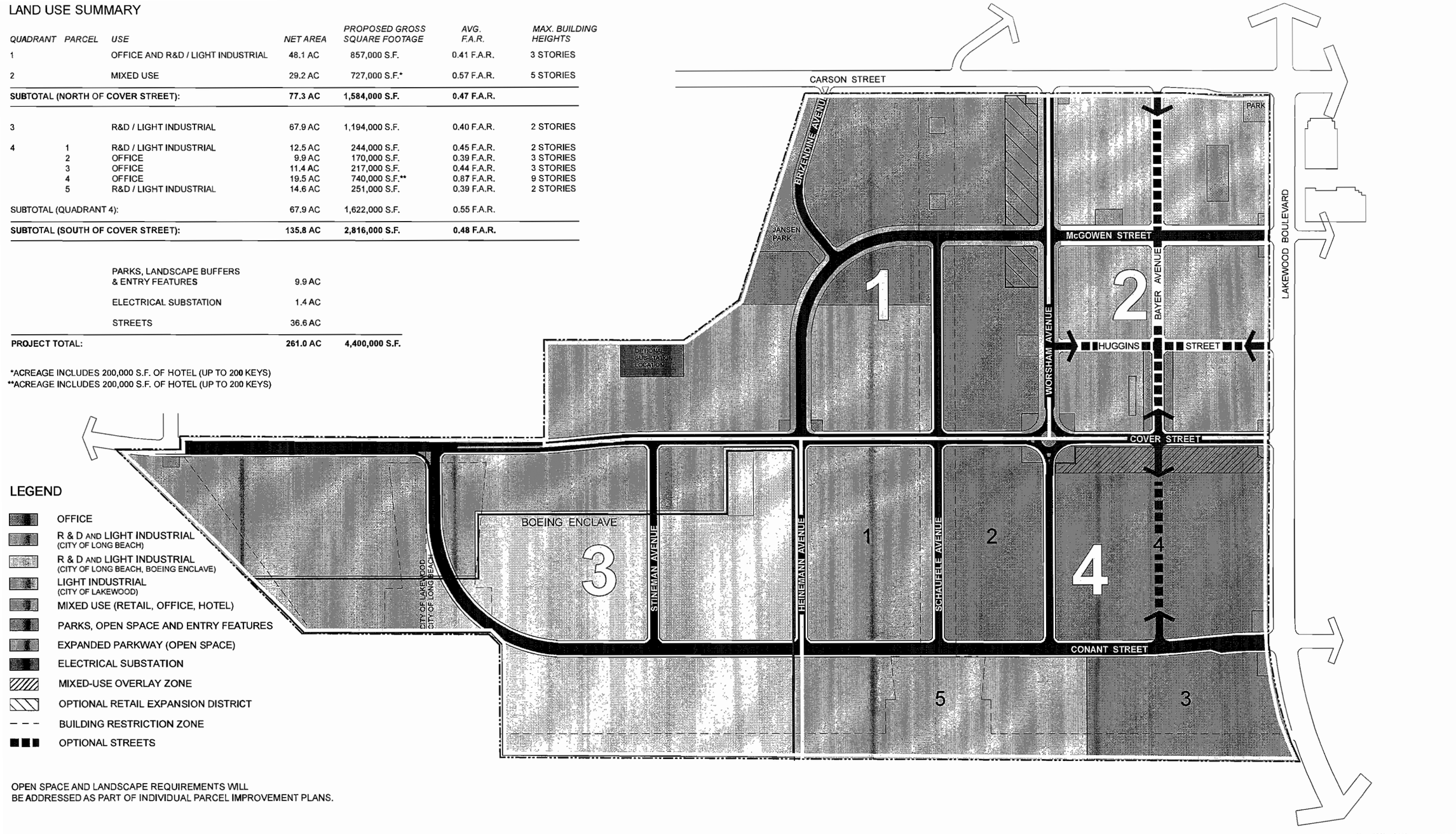
Kimley-Horn and Associates, Inc.

ALTOON + PORTER ARCHITECTS

LAND USE SUMMARY

QUADRANT	PARCEL	USE	NET AREA	PROPOSED GROSS SQUARE FOOTAGE	AVG. F.A.R.	MAX. BUILDING HEIGHTS
1		OFFICE AND R&D / LIGHT INDUSTRIAL	48.1 AC	857,000 S.F.	0.41 F.A.R.	3 STORIES
2		MIXED USE	29.2 AC	727,000 S.F.*	0.57 F.A.R.	5 STORIES
SUBTOTAL (NORTH OF COVER STREET):			**77.3 AC**	**1,584,000 S.F.**	**0.47 F.A.R.**	
3		R&D / LIGHT INDUSTRIAL	67.9 AC	1,194,000 S.F.	0.40 F.A.R.	2 STORIES
4	1	R&D / LIGHT INDUSTRIAL	12.5 AC	244,000 S.F.	0.45 F.A.R.	2 STORIES
	2	OFFICE	9.9 AC	170,000 S.F.	0.39 F.A.R.	3 STORIES
	3	OFFICE	11.4 AC	217,000 S.F.	0.44 F.A.R.	3 STORIES
	4	OFFICE	19.5 AC	740,000 S.F.**	0.87 F.A.R.	9 STORIES
	5	R&D / LIGHT INDUSTRIAL	14.6 AC	251,000 S.F.	0.39 F.A.R.	2 STORIES
SUBTOTAL (QUADRANT 4):			67.9 AC	1,622,000 S.F.	0.55 F.A.R.	
SUBTOTAL (SOUTH OF COVER STREET):			**135.8 AC**	**2,816,000 S.F.**	**0.48 F.A.R.**	
		PARKS, LANDSCAPE BUFFERS & ENTRY FEATURES	9.9 AC			
		ELECTRICAL SUBSTATION	1.4 AC			
		STREETS	36.6 AC			
PROJECT TOTAL:			**261.0 AC**	**4,400,000 S.F.**		

*ACREAGE INCLUDES 200,000 S.F. OF HOTEL (UP TO 200 KEYS)
**ACREAGE INCLUDES 200,000 S.F. OF HOTEL (UP TO 200 KEYS)



OPEN SPACE AND LANDSCAPE REQUIREMENTS WILL BE ADDRESSED AS PART OF INDIVIDUAL PARCEL IMPROVEMENT PLANS.

Land Use Plan

This plan is conceptual in nature and subject to change

DOUGLAS PARK
LONG BEACH
BOEING

EXHIBIT B

0' 100' 200' 400'

Land Use Plan

Kimley-Horn and Associates, Inc.

ALTOON + PORTER ARCHITECTS

0' 50' 100' 200'

July 14, 2008

This plan is conceptual in nature and subject to change

DOUGLAS PARK

BOEING

AERIAL PHOTO- EXHIBIT C

Kimley-Horn and Associates, Inc.

ALTOON + PORTER ARCHITECTS

LEGEND	SYMBOL
260 ACRE BOEING SITE	
SERVICE AREA BOUNDARY	
LONG BEACH WATER DEPARTMENT TRUNK SEWER SYSTEM	
L.A. COUNTY SANITATION DISTRICT TRUNK SEWER SYSTEM	
PRIVATE SEWER SYSTEM	
EXISTING MANHOLE + IDENTIFICATION NUMBER	•254
L.A. COUNTY DEPARTMENT OF PUBLIC WORKS SEWER	

0' 50' 100' 200'

July 14, 2008

This plan is conceptual in nature and subject to change

DOUGLAS PARK
LONG BEACH

BOEING

EXISTING TRUNK SYSTEM
OVERALL SEWER SERVICE AREA - EXHIBIT D

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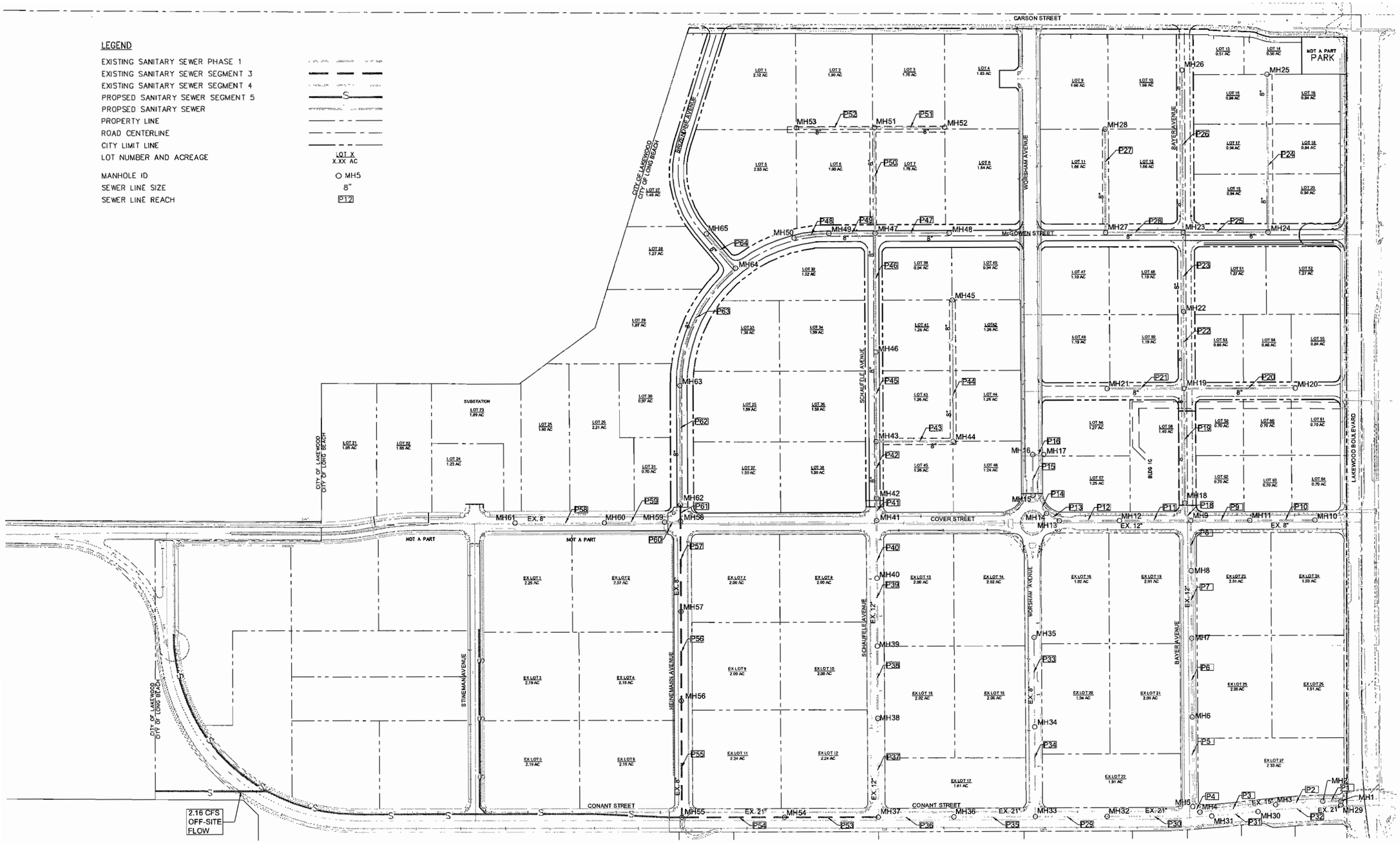
ALTOON + PORTER ARCHITECTS

LEGEND

EXISTING SANITARY SEWER PHASE 1	
EXISTING SANITARY SEWER SEGMENT 3	
EXISTING SANITARY SEWER SEGMENT 4	
PROPSED SANITARY SEWER SEGMENT 5	S
PROPSED SANITARY SEWER	
PROPERTY LINE	
ROAD CENTERLINE	
CITY LIMIT LINE	
LOT NUMBER AND ACREAGE	LOT X X.XX AC
MANHOLE ID	○ MH5
SEWER LINE SIZE	8"
SEWER LINE REACH	P12



0' 50' 100' 200'

July 14, 2008

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DOUGLAS PARK

BOEING

PROPOSED ONSITE SEWER SYSTEM
EXHIBIT E

Kimley-Horn and Associates, Inc.

ALTOON + PORTER ARCHITECTS

APPENDICES

APPENDIX A

PROPOSED
SEWER SYSTEM

FLOW CALCULATIONS

Proposed Sewer System Flow Generation Calculations							
Lot Number	Lot Acreage	Lot Sq Feet	Building (sq. ft)	Lot flow rate (gal/day)	Flow Rate (ft^3/sec)	Peak Flow (cfs)	Peak Flow (gal/day)
1	2.12	92,347.20	39,607.71	7,921.54	0.012	0.027	17,415.57
2	1.90	82,764.00	35,497.48	7,099.50	0.011	0.024	15,637.39
3	1.76	76,665.60	32,881.88	6,576.38	0.010	0.022	14,504.03
4	1.83	79,714.80	34,189.68	6,837.94	0.011	0.023	15,070.89
5	2.93	127,630.80	54,740.85	10,948.17	0.017	0.037	23,937.59
6	1.90	82,764.00	35,497.48	7,099.50	0.011	0.024	15,637.39
7	1.76	76,665.60	32,881.88	6,576.38	0.010	0.022	14,504.03
8	1.84	80,150.40	34,376.51	6,875.30	0.011	0.023	15,151.84
9	1.66	72,309.60	31,013.59	6,202.72	0.010	0.021	13,693.54
10	1.66	72,309.60	31,013.59	6,202.72	0.010	0.021	13,693.54
11	1.66	72,309.60	31,013.59	6,202.72	0.010	0.021	13,693.54
12	1.66	72,309.60	31,013.59	6,202.72	0.010	0.021	13,693.54
13	0.51	22,215.60	9,528.27	1,905.65	0.003	0.007	4,292.31
14	0.50	21,780.00	9,341.44	1,868.29	0.003	0.007	4,209.56
15	0.94	40,946.40	17,561.91	3,512.38	0.005	0.012	7,829.50
16	0.94	40,946.40	17,561.91	3,512.38	0.005	0.012	7,829.50
17	0.94	40,946.40	17,561.91	3,512.38	0.005	0.012	7,829.50
18	0.94	40,946.40	17,561.91	3,512.38	0.005	0.012	7,829.50
19	0.94	40,946.40	17,561.91	3,512.38	0.005	0.012	7,829.50
20	0.94	40,946.40	17,561.91	3,512.38	0.005	0.012	7,829.50
21	1.66	72,309.60	31,013.59	6,202.72	0.010	0.021	13,693.54
22	2.09	91,040.40	39,047.23	7,809.45	0.012	0.027	17,173.29
23	1.38	60,112.80	25,782.38	5,156.48	0.008	0.018	11,419.60
24	1.54	67,082.40	28,771.64	5,754.33	0.009	0.020	12,719.86
25	1.86	81,021.60	34,750.16	6,950.03	0.011	0.024	15,313.72
26	1.94	84,506.40	36,244.79	7,248.96	0.011	0.025	15,960.95
27	1.46	63,597.60	27,277.01	5,455.40	0.008	0.019	12,070.03
28	1.27	55,321.20	23,727.26	4,745.45	0.007	0.016	10,524.19
29	1.87	81,457.20	34,936.99	6,987.40	0.011	0.024	15,394.65
30	0.97	42,253.20	18,122.40	3,624.48	0.006	0.012	8,075.07
31	0.97	42,253.20	18,122.40	3,624.48	0.006	0.012	8,075.07
32	1.52	66,211.20	28,397.98	5,679.60	0.009	0.019	12,557.46
33	1.38	60,112.80	25,782.38	5,156.48	0.008	0.018	11,419.60
34	1.59	69,260.40	29,705.79	5,941.16	0.009	0.020	13,125.72
35	1.59	69,260.40	29,705.79	5,941.16	0.009	0.020	13,125.72
36	1.59	69,260.40	29,705.79	5,941.16	0.009	0.020	13,125.72
37	1.59	69,260.40	29,705.79	5,941.16	0.009	0.020	13,125.72
38	1.59	69,260.40	29,705.79	5,941.16	0.009	0.020	13,125.72
39	0.94	40,946.40	17,561.91	3,512.38	0.005	0.012	7,829.50
40	0.94	40,946.40	17,561.91	3,512.38	0.005	0.012	7,829.50
41	1.26	54,885.60	23,540.43	4,708.09	0.007	0.016	10,442.73
42	1.26	54,885.60	23,540.43	4,708.09	0.007	0.016	10,442.73

43	1.26	54,885.60	23,540.43	4,708.09	0.007	0.016	10,442.73
44	1.26	54,885.60	23,540.43	4,708.09	0.007	0.016	10,442.73
45	1.26	54,885.60	23,540.43	4,708.09	0.007	0.016	10,442.73
46	1.24	54,014.40	23,166.78	4,633.36	0.007	0.016	10,279.76
47	1.19	51,836.40	22,232.63	4,446.53	0.007	0.015	9,872.16
48	1.19	51,836.40	22,232.63	4,446.53	0.007	0.015	9,872.16
49	1.19	51,836.40	22,232.63	4,446.53	0.007	0.015	9,872.16
50	1.19	51,836.40	22,232.63	4,446.53	0.007	0.015	9,872.16
51	1.27	55,321.20	23,727.26	4,745.45	0.007	0.016	10,524.19
52	1.27	55,321.20	23,727.26	4,745.45	0.007	0.016	10,524.19
53	0.86	37,461.60	16,067.28	3,213.46	0.005	0.011	7,174.00
54	0.86	37,461.60	16,067.28	3,213.46	0.005	0.011	7,174.00
55	0.84	36,590.40	15,693.62	3,138.72	0.005	0.011	7,009.97
56	1.27	55,321.20	23,727.26	4,745.45	0.007	0.016	10,524.19
57	1.25	54,450.00	23,353.61	4,670.72	0.007	0.016	10,361.25
58	1.40	60,984.00	26,156.04	5,231.21	0.008	0.018	11,582.26
59	0.70	30,492.00	13,078.02	2,615.60	0.004	0.009	5,859.78
60	0.70	30,492.00	13,078.02	2,615.60	0.004	0.009	5,859.78
61	0.70	30,492.00	13,078.02	2,615.60	0.004	0.009	5,859.78
62	0.70	30,492.00	13,078.02	2,615.60	0.004	0.009	5,859.78
63	0.70	30,492.00	13,078.02	2,615.60	0.004	0.009	5,859.78
64	0.70	30,492.00	13,078.02	2,615.60	0.004	0.009	5,859.78
Sub-totals	84.59		1,580,385.16	316,077.03			699,811.18
A1	2.25	98,010.00	56,030.36	11,206.07	0.017	0.038	24,491.78
A2	2.57	111,949.20	63,999.12	12,799.82	0.020	0.043	27,911.89
A3	2.19	95,396.40	54,536.21	10,907.24	0.017	0.037	23,849.63
A4	2.19	95,396.40	54,536.21	10,907.24	0.017	0.037	23,849.63
A5	2.19	95,396.40	54,536.21	10,907.24	0.017	0.037	23,849.63
A6	2.19	95,396.40	54,536.21	10,907.24	0.017	0.037	23,849.63
A7	2.00	87,120.00	49,804.76	9,960.95	0.015	0.034	21,814.11
A8	2.00	87,120.00	49,804.76	9,960.95	0.015	0.034	21,814.11
A9	2.00	87,120.00	49,804.76	9,960.95	0.015	0.034	21,814.11
A10	2.00	87,120.00	49,804.76	9,960.95	0.015	0.034	21,814.11
A11	2.24	97,574.40	55,781.33	11,156.27	0.017	0.038	24,384.78
A12	2.24	97,574.40	55,781.33	11,156.27	0.017	0.038	24,384.78
A13	2.00	87,120.00	49,804.76	9,960.95	0.015	0.034	21,814.11
A14	2.02	87,991.20	50,302.81	10,060.56	0.016	0.034	22,028.52
A15	2.02	87,991.20	50,302.81	10,060.56	0.016	0.034	22,028.52
A16	2.06	89,733.60	51,298.90	10,259.78	0.016	0.035	22,457.25
A17	1.81	78,843.60	45,073.31	9,014.66	0.014	0.031	19,775.30
A18	1.92	83,635.20	47,812.57	9,562.51	0.015	0.032	20,956.08
A19	2.01	87,555.60	50,053.79	10,010.76	0.015	0.034	21,921.32
A20	1.94	84,506.40	48,310.62	9,662.12	0.015	0.033	21,170.65
A21	2.00	87,120.00	49,804.76	9,960.95	0.015	0.034	21,814.11
A22	1.91	83,199.60	47,563.55	9,512.71	0.015	0.032	20,848.79
A23	2.01	87,555.60	50,053.79	10,010.76	0.015	0.034	21,921.32

A24	1.93	84,070.80	48,061.59	9,612.32	0.015	0.033	21,063.37
A25	2.00	87,120.00	49,804.76	9,960.95	0.015	0.034	21,814.11
A26	1.91	83,199.60	47,563.55	9,512.71	0.015	0.032	20,848.79
A27	2.33	101,494.80	58,022.55	11,604.51	0.018	0.039	25,347.54
Sub-totals	55.93		1,392,790.16	278,558.03			609,637.95
Area 3	67.90	29,580,635.00	1,194,000.00	238,800.00	0.369	0.767	495,467.85
Area 4_3	11.40	4,966,410.00	217,000.00	43,400.00	0.067	0.143	92,695.82
Area 4_5	14.60	6,360,490.00	251,000.00	50,200.00	0.078	0.165	106,954.61
Totals	234.42		4,635,175.32	927,035.06			2,004,567.40

APPENDIX B

LONG BEACH SEWER

RULES AND REGULATIONS

Long Beach Water Department
The Standard in Water Conservation &
Environmental Stewardship

RULES, REGULATIONS AND CHARGES

GOVERNING

POTABLE WATER, RECLAIMED WATER, SEWER SERVICE,

AND THE WATER CONSERVATION AND WATER SUPPLY SHORTAGE PLAN

PART 14

SEWER USE

SECTION 1401. DISCHARGES PROHIBITED

Except as provided in Parts 10 through 18, no person shall discharge or cause to be discharged into any Public Sewer or into any opening of any Public Sewer in the City the following:

A. Earth, sand, rocks, ashes, gravel, plaster, concrete, glass, metal filings, metal objects, other materials which will not be carried by the Sewer stream, anything which may obstruct the flow of Sewage in the Sewer, or any object which will cause clogging of a Sewage pump or a Sewage sludge pump;

B. Any garbage which has not been first shredded so that each particle is not more than 3/8-inch in any dimension or any garbage containing broken glass;

C. Any solid or semisolid material such as garbage, trimmings, cuttings, offal or other waste produced in the processing of meats, fruits, vegetables, foodstuffs or similar materials except garbage produced which meets the requirements of Parts 10 through 18;

D. Any volatile liquids or substances which can produce toxic or flammable atmospheres in the Sewer;

E. Any compounds which may produce strong odors in the Sewer or Sewage Treatment Plant;

F. Any storm water or runoff from any roof, yard, driveway, street or pump station, except where prior approval has been given by the Chief Engineer;

G. Any materials which will cause damage to any part of the Sewer System, abnormal sulfide generation, abnormal maintenance or operation costs of any part of the Sewer System, or which may cause any part of the Sewer System to become a nuisance or a menace to public health or a hazard to workers or which will cause objectionable conditions at the final point of disposal of the Sewage;

H. Any liquid having a temperature in excess of one hundred twenty degrees Fahrenheit;

I. Unpolluted water from refrigeration systems, air conditioning systems, industrial cooling systems, swimming pools or other unpolluted water from any origin except as authorized by the Department;

J. Any radioactive waste which constitutes, or may constitute, a public health hazard or endanger workmen charged with the maintenance of Public Sewers.

The owner is liable for any uncontrolled discharge into the City Sewer System or public property. When the Department finds that the owner is unable to prevent an uncontrolled discharge into the City Sewer System or public property within one (1) hour, the potable water service will be disconnected and the Health Department will be notified.

SECTION 1402. APPROVAL REQUIRED PRIOR TO OCCUPANCY

No person shall use or occupy any building or Structure in the City for which any Sewer has been constructed unless the Sewer has been inspected and Approved by an authorized Inspector.

SECTION 1403. CONNECTIONS IN UNDEDICATED STREETS

No person shall connect or cause to be connected any Sewer which has been or may hereafter be constructed in any proposed street, highway, alley, right-of-way, or other place which is intended to be dedicated to public use, with the Sewer System unless the Sewer has been constructed to the satisfaction of the Department and, if located within the City at the time construction is started, pursuant to a permit issued by the Department.

SECTION 1404. SEVERAL STRUCTURES ON ONE LOT

When a Lot or parcel of land is of sufficient size that the zoning requirements do not prohibit its division into smaller parcels, each of such possible parcels upon which one or more buildings containing Plumbing fixtures are, or may be, located and used separate and apart from other buildings or other Structures shall be considered as a separate parcel of land and separate connections shall be made to the Main Line Sewer from each such possible parcel. If a Main Line Sewer is adjacent to a portion of the parcel of land but is not immediately adjacent to the smaller portion thereof on which the building is located, then the property owner shall construct a Main Line Sewer so that the building may be adequately served by the Public Sewer. Every building or Structure which contains any Plumbing fixtures shall be separately and independently connected to a Main Line Sewer with a Sewer Lateral, except when more than one building or other Structure is situated upon the same Lot or parcel and all of the buildings and Structures are owned by the same person, then the buildings may be connected to a Main Line Sewer by a single Sewer Lateral.

SECTION 1405. BUILDING SEWER CONNECTION ACROSS ANOTHER LOT

No Building Sewer shall hereafter be joined to the Sewer System unless the building or Structure is entirely located upon the Lot upon which the building or Structure is located unless it is impossible or impractical to make such a connection. If a Lot or parcel of land requiring a Building Sewer is so situated that access to the Sewer System is not possible except across some other Lot or parcel of land, a Building Sewer may be constructed if an easement can be obtained from the owner of the land. The application for the permit shall be accompanied by a recorded easement executed by the owner of the parcel of land. The issuance of a permit to construct a Building Sewer across another Lot shall not in any manner constitute an approval of the easement. The Department will not be a party in the negotiation of any private easement for Sewer Service.

SECTION 1406 MAINTENANCE

The property owner shall maintain and repair all Building Sewers, House Connections, Industrial Sewers, Private Sewage Disposal Systems and appurtenances thereto in a safe and sanitary condition and, further shall maintain in good working order all devices or safeguards which are required by Parts 10 through 18 of these Rules.

The property owner is responsible for maintaining sewage flow to the Main Line Sewer. This includes, but not limited to, inspection, clearing, cleaning and repairing of the Sewer Lateral.

A Force Main which discharges Sewage from a lift station or an ejector vacuum system to a public manhole in a Main Line Sewer shall be considered private and shall be operated and maintained by the private property owner.

SECTION 1418. DISCONNECTION COSTS

If an industrial connection Sewer or a House Connection through which Wastewater is disposed has been disconnected from the Public Sewer by the Department for failure to comply with the provisions of Parts 10 through 18. Non-compliant Customers shall pay disconnection costs. Any Applicant requesting permission to reconnect to the Sewer System shall pay to the Department the reasonable cost of making the reconnection. The Department shall determine the cost, and may require the installation of a manhole for the purpose of measuring the flow or making periodical tests of the waste passing through the connection.

PART 15

SEWER INSTALLATION

SECTION 1501. LOWERING WATER LEVEL

Where groundwater conditions are found to exist which will require the lowering of the water level in the installation area, the method to be used in lowering the water level shall be Approved by the Department.

SECTION 1502. EXCAVATIONS

If a permit issued pursuant to Parts 10 through 18 authorizes the making of an excavation in a public street or alley, the person to whom the permit is issued shall comply with the provisions of Sections 14.08.230, 14.08.340, 14.08.350 and 14.08.360 of the Long Beach Municipal Code in making the excavation.

SECTION 1503. NOTICE OF NONCOMPLIANCE

If work performed on Sewers in a public street pursuant to a permit issued under Parts 10 through 18 does not comply with the provisions of Parts 10 through 18, the Department shall notify the person to whom the permit was issued and specify the defect of the work. The person shall, without delay, take such steps as may be necessary to protect the public and within a period of five days after service of notice shall proceed with reasonable diligence to remedy the defect. If the person does not comply with the requirements of the notice, the Department shall not grant to the person a permit authorizing the installation of Sewers until the person has complied in full with the terms of the notice.

SECTION 1504. MATERIALS AND SPECIFICATIONS STANDARDS

All materials used in any work done under Parts 10 through 18 shall be new, first-class materials and shall conform to and the manner of construction shall meet all the requirements of Parts 10 through 18.

The Department at the expense of the permittee may order tests of any material to determine whether such material meets the specifications as defined in Section 1507.

SECTION 1505. MAIN LINE SEWER SIZE

Main line Sewer pipe shall have an inside diameter of not less than eight inches and shall have sufficient capacity to carry Sewage from the area tributary when computed upon the basis developed in the Sewer master plan.

SECTION 1506. MAIN LINE SEWER GRADIENT

A Main Line Sewer shall be designed so as to provide a minimum velocity of two feet per second for pipes up to a 15-inch diameter flowing one-half (1/2) full, and pipes with an 18-inch diameter flowing three-quarters (3/4) full except that the Department may approve a gradient that will develop a lower velocity if it finds that the gradient required to develop the above-stated velocity of two feet per second is unfeasible.

SECTION 1507. PIPE SPECIFICATIONS

A. The pipe used shall be either vitrified clay pipe (VCP) or ductile iron pipe with fusion bond epoxy coating. All vitrified clay pipe six inches or more in diameter shall

conform to the "Standard Specifications for Public Works Construction", latest edition, and the Long Beach, California Amendments thereto. All vitrified clay pipe four inches in diameter shall be first-class vitrified clay pipe, ceramic glazed on the inside.

B. That portion of the pipe extending from the Public Sewer Main to the Property Line shall be not less than six inches in internal diameter. That portion extending from the Property Line to the house or building shall be not less than four inches in internal diameter provided, however, that the size of the pipe shall meet all of the requirements of the Uniform Plumbing Code.

SECTION 1508. VITRIFIED CLAY PIPE STRENGTH

Vitrified clay pipe used for Sewers shall be as follows:

A. Standard strength for Sewers not more than ten feet in depth from the surface to invert;

B. Extra strength for Sewers more than ten feet and not more than twenty feet in depth;

C. Extra strength reinforced with concrete cradle or concrete encasement, for Sewers more than twenty feet in depth;

D. Extra strength encased in concrete or placed inside of steel pipe back filled with sand for Sewers under railways, freeways, major highways and such other streets as may be designated by the Department;

E. Reinforced as required by the Department for Sewers under large conduits or other Structures.

SECTION 1509. PIPE LAYING METHOD

All pipe shall be laid upgrade on an unyielding Foundation true to line and grade and with a uniform bearing under the full length of the barrel of the pipe. Bell and spigot pipe shall be laid with sockets upgrade. Suitable excavations shall be made to receive the bells or collars of the pipe. All adjustments to bring the pipe to line and grade shall be made by scraping away or filling in under the body of the pipe, and not by wedging or blocking.

SECTION 1510. MAIN LINE SEWER SLOPE

The grade or slope of Main Line Sewers shall be shown on the plans in feet of fall per foot of horizontal distance expressed as a decimal. Slopes shall be calculated to four (4) decimal places.

SECTION 1511. PIPE JOINT MATERIALS

All joints in vitrified clay pipe or ductile iron pipe shall be made with Approved joint materials to the satisfaction of the Department.

SECTION 1512. PIPE DISTURBANCE AFTER JOINTS MADE

No person shall walk upon or disturb the pipe in any manner after the joints have been made.

SECTION 1513. DEPTH OF LINES TO TOP OF PIPE

A. The minimum depth of Main Line Sewers to top of pipe in residential districts shall be five feet and in business districts shall be sufficient to provide a House

APPENDIX C

SEWER-CAD

MODEL RESULTS

Scenario: Base

Gravity Pipe Report

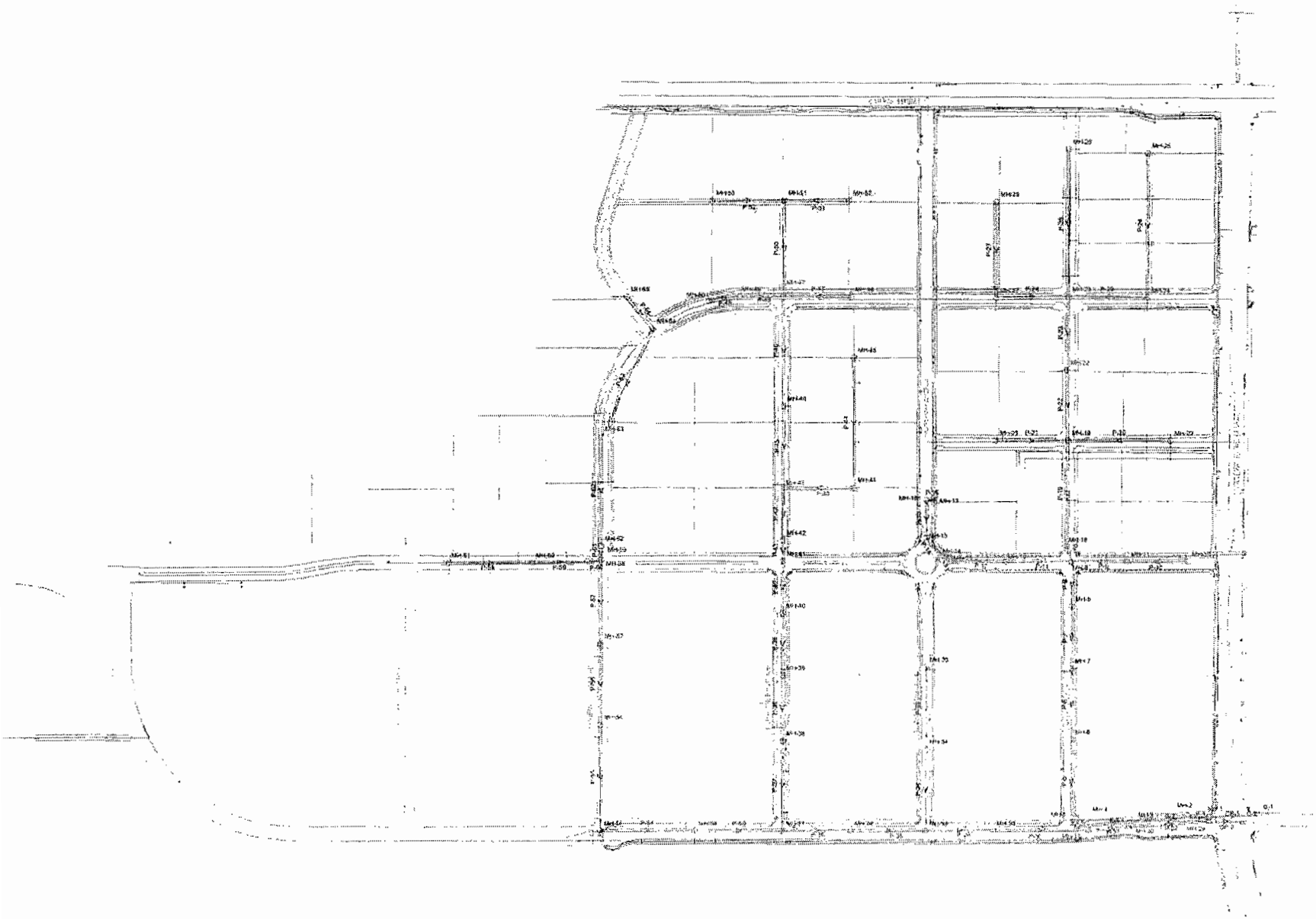
Label	Upstream Node	Downstream Node	Section Size	Mannings n	Constructed Slope (ft/ft)	Length (ft)	Average Velocity (ft/s)	Total Flow (gpd)	Normal Depth / Rise (d/D) (%)	Avg End Depth / Rise (d/D) (%)	Flow / Full Capacity (%)	Upstream Invert Elevation (ft)	Bend Angle (degrees)	Downstream Invert Elevation (ft)	Section Shape	Material	Full Capacity (gpd)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)
OP-1	MH-1	O-1	15 inch	0.013	0.001749	183.00	1.80	414,504.96	33.2	29.1	23.7	27.54	0.00	27.22	Circular	Vitrified Clay Pipe	1,745,781.86	27.95	27.53	0.42
OP-2	MH-29	O-2	21 inch	0.013	0.001230	122.00	2.54	2,707,315.08	64.9	50.6	75.4	28.11	0.00	27.96	Circular	Vitrified Clay Pipe	3,590,715.60	29.13	28.71	0.43
P-1	MH-2	MH-1	15 inch	0.013	0.001250	56.00	1.60	414,504.96	36.2	34.1	28.1	27.61	3.62	27.54	Circular	Vitrified Clay Pipe	1,476,031.20	28.05	27.95	0.09
P-2	MH-3	MH-2	15 inch	0.013	0.001154	156.00	1.55	414,504.96	37.0	31.8	29.2	27.89	3.71	27.71	Circular	Vitrified Clay Pipe	1,418,124.91	28.35	28.05	0.30
P-3	MH-4	MH-3	15 inch	0.013	0.001211	256.00	1.55	389,157.42	35.3	31.9	26.8	28.30	1.81	27.99	Circular	Vitrified Clay Pipe	1,452,785.17	28.74	28.35	0.40
P-4	MH-5	MH-4	15 inch	0.013	0.001154	26.00	1.53	389,157.42	35.8	27.9	27.4	28.53	44.92	28.50	Circular	Vitrified Clay Pipe	1,418,124.91	28.92	28.80	0.12
P-5	MH-6	MH-5	12 inch	0.013	0.001520	296.00	1.68	367,343.31	44.5	37.9	40.9	29.18	50.60	28.73	Circular	Vitrified Clay Pipe	897,788.90	29.63	29.04	0.58
P-6	MH-7	MH-6	12 inch	0.013	0.001499	260.26	1.59	302,759.09	40.2	37.4	34.0	29.67	0.00	29.28	Circular	Vitrified Clay Pipe	891,338.00	30.07	29.63	0.45
P-7	MH-8	MH-7	12 inch	0.013	0.001488	221.74	1.58	302,759.09	40.3	35.2	34.1	30.10	0.00	29.77	Circular	Vitrified Clay Pipe	888,277.74	30.50	30.07	0.43
P-8	MH-9	MH-8	12 inch	0.013	0.001523	164.11	1.53	259,774.40	36.8	33.5	28.9	30.45	0.00	30.20	Circular	Vitrified Clay Pipe	898,703.25	30.82	30.50	0.32
P-9	MH-11	MH-9	12 inch	0.013	0.003980	196.00	0.86	11,719.56	6.4	16.6	0.8	31.33	90.00	30.55	Circular	Vitrified Clay Pipe	1,452,556.71	31.39	30.82	0.58
P-10	MH-10	MH-11	12 inch	0.013	0.004028	216.00	0.00	0.00	0.0	0.0	0.0	32.30	0.00	31.43	Circular	Vitrified Clay Pipe	1,461,324.22	32.30	31.43	0.87
P-11	MH-12	MH-9	12 inch	0.013	0.001483	236.00	0.73	20,885.44	10.6	18.7	2.4	30.90	90.00	30.55	Circular	Vitrified Clay Pipe	886,730.92	31.01	30.82	0.19
P-12	MH-13	MH-12	12 inch	0.013	0.001515	198.00	0.60	10,524.19	7.6	6.4	1.2	31.30	0.00	31.00	Circular	Vitrified Clay Pipe	896,276.20	31.38	31.05	0.32
P-13	MH-14	MH-13	12 inch	0.013	0.001522	46.00	0.60	10,524.19	7.6	6.4	1.2	31.57	30.70	31.50	Circular	Vitrified Clay Pipe	898,222.51	31.65	31.55	0.09
P-14	MH-15	MH-14	12 inch	0.013	0.001538	71.50	0.60	10,524.19	7.6	6.4	1.2	31.88	22.22	31.77	Circular	Vitrified Clay Pipe	903,144.32	31.96	31.82	0.13
P-15	MH-16	MH-15	12 inch	0.013	0.001508	132.64	0.59	10,524.19	7.6	6.4	1.2	32.28	36.67	32.08	Circular	Vitrified Clay Pipe	894,111.28	32.36	32.13	0.22
P-16	MH-17	MH-16	12 inch	0.013	0.001389	36.00	0.58	10,524.19	7.8	6.5	1.2	32.53	89.53	32.48	Circular	Vitrified Clay Pipe	858,119.13	32.61	32.53	0.08
P-18	MH-18	MH-9	8 inch	0.013	0.006123	60.43	2.46	209,727.36	40.4	40.0	34.3	31.02	18.33	30.65	Circular	Vitrified Clay Pipe	611,099.19	31.29	30.91	0.38
P-19	MH-19	MH-18	8 inch	0.013	0.005000	380.00	2.26	203,867.58	42.1	40.5	36.9	33.12	18.28	31.22	Circular	Vitrified Clay Pipe	552,232.73	33.40	31.48	1.92
P-20	MH-20	MH-19	8 inch	0.013	0.008843	376.95	1.24	12,869.75	9.2	10.8	1.8	36.65	89.78	33.32	Circular	Vitrified Clay Pipe	734,403.33	36.72	33.40	3.32
P-21	MH-21	MH-19	8 inch	0.013	0.013635	265.00	1.33	9,872.16	7.3	10.2	1.1	36.93	90.29	33.32	Circular	Vitrified Clay Pipe	911,944.10	36.99	33.40	3.59
P-22	MH-22	MH-19	8 inch	0.013	0.005038	260.00	2.09	151,045.73	35.7	34.5	27.2	34.63	0.20	33.32	Circular	Vitrified Clay Pipe	554,352.63	34.87	33.54	1.33
P-23	MH-23	MH-22	8 inch	0.013	0.005020	262.97	2.01	130,649.38	33.1	32.0	23.6	36.15	0.49	34.83	Circular	Vitrified Clay Pipe	553,313.16	36.37	35.04	1.33
P-24	MH-25	MH-24	8 inch	0.013	0.005017	530.22	0.72	4,209.56	6.2	5.8	0.8	40.61	90.76	37.95	Circular	Vitrified Clay Pipe	553,158.90	40.65	37.99	2.67
P-25	MH-24	MH-23	8 inch	0.013	0.005007	281.62	1.41	38,222.25	17.8	17.2	6.9	37.75	90.45	36.34	Circular	Vitrified Clay Pipe	552,605.18	37.87	36.45	1.42
P-26	MH-26	MH-23	8 inch	0.013	0.012194	544.00	1.00	4,292.31	5.1	5.3	0.5	42.97	0.05	36.34	Circular	Vitrified Clay Pipe	862,389.78	43.01	36.37	6.64
P-27	MH-28	MH-27	8 inch	0.013	0.007633	345.00	1.20	13,693.54	9.8	9.8	2.0	41.04	90.81	38.41	Circular	Vitrified Clay Pipe	682,308.07	41.11	38.48	2.63
P-28	MH-27	MH-23	8 inch	0.013	0.007016	267.00	1.57	37,259.24	16.2	16.3	5.7	38.21	91.15	36.34	Circular	Vitrified Clay Pipe	654,167.61	38.32	36.45	1.87
P-29	MH-33	MH-32	21 inch	0.013	0.001207	240.32	2.50	2,593,770.47	63.4	59.0	72.9	29.63	0.00	29.34	Circular	Vitrified Clay Pipe	3,557,290.52	30.70	30.33	0.37
P-30	MH-32	MH-31	21 inch	0.013	0.001185	346.00	2.48	2,593,770.47	63.8	58.8	73.6	29.24	5.23	28.83	Circular	Vitrified Clay Pipe	3,525,081.59	30.33	29.80	0.53
P-31	MH-31	MH-30	21 inch	0.013	0.001218	156.00	2.51	2,614,619.26	63.5	59.4	73.2	28.73	1.08	28.54	Circular	Vitrified Clay Pipe	3,573,796.30	29.80	29.55	0.24
P-32	MH-30	MH-29	21 inch	0.013	0.001196	276.00	2.51	2,707,315.08	65.5	61.1	76.5	28.44	3.85	28.11	Circular	Vitrified Clay Pipe	3,540,933.11	29.55	29.13	0.42
P-33	MH-35	MH-34	8 inch	0.013	0.004020	296.00	0.00	0.00	0.0	4.8	0.0	32.69	0.08	31.50	Circular	Vitrified Clay Pipe	495,181.90	32.69	31.56	1.13
P-34	MH-34	MH-33	8 inch	0.013	0.003986	296.00	1.52	65,441.85	24.6	48.6	13.3	31.40	90.00	30.22	Circular	Vitrified Clay Pipe	493,096.92	31.56	30.70	0.86
P-35	MH-36	MH-33	21 inch	0.013	0.001214	271.84	2.46	2,400,203.36	60.1	57.3	67.3	30.06	0.08	29.73	Circular	Vitrified Clay Pipe	3,567,923.90	31.09	30.70	0.39
P-36	MH-37	MH-36	21 inch	0.013	0.001869	246.16	2.91	2,400,203.36	52.5	52.9	54.2	30.62	0.27	30.16	Circular	Vitrified Clay Pipe	4,426,754.81	31.54	31.09	0.45
P-37	MH-38	MH-37	12 inch	0.013	0.001196	326.00	1.49	327,388.09	44.7	60.2	41.1	31.21	90.13	30.82	Circular	Vitrified Clay Pipe	796,411.15	31.70	31.54	0.16
P-38	MH-39	MH-38	12 inch	0.013	0.001216	238.53	1.47	305,573.98	42.8	40.7	38.1	31.60	0.05	31.31	Circular	Vitrified Clay Pipe	802,862.78	32.03	31.70	0.33
P-39	MH-40	MH-39	12 inch	0.013	0.001477	223.47	1.52	261,945.76	37.3	35.0	29.6	32.03	0.00	31.70	Circular	Vitrified Clay Pipe	884,832.75	32.40	32.03	0.38
P-40	MH-41	MH-40	12 inch	0.013	0.001534	189.05	1.54	261,945.76	36.9	32.1	29.0	32.42	0.00	32.13	Circular	Vitrified Clay Pipe	901,829.61	32.79	32.40	0.39
P-41	MH-42	MH-41	12 inch	0.013	0.002400	75.00	1.81	261,945.76	32.8	34.9	23.2	32.60	0.27	32.42	Circular	Vitrified Clay Pipe	1,128,026.89	32.93	32.79	0.14
P-42	MH-43	MH-42	8 inch	0.013	0.005026	189.00	2.36	238,377.31	45.9	44.1	43.1	33.75	1.01	32.80	Circular	Vitrified Clay Pipe	553,691.73	34.06	33.08	0.97
P-43	MH-44	MH-43	8 inch	0.013	0.005898	256.00	1.50	38,994.72	17.3	17.3	6.5	35.45	89.26	33.94	Circular	Vitrified Clay Pipe	599,798.85	35.57	34.06	1.51
P-44	MH-45	MH-44	8 inch	0.013	0.006913	473.00	0.98	7,829.50	7.7	7.6	1.2	38.92	90.21	35.65	Circular	Vitrified Clay Pipe	649,352.39	38.97	35.70	3.27
P-45	MH-46	MH-43	8 inch	0.013	0.005033	300.00	2.13	162,688.42	37.1	35.9	29.4	35.45	1.07	33.94	Circular	Vitrified Clay Pipe	554,070.45	35.70	34.17	1.53
P-46	MH-47	MH-46	8 inch	0.013	0.005013	393.00	2.01	131,858.73	33.2	32.2	23.8	37.62	0.38	35.65	Circular	Vitrified Clay Pipe	552,934.87	37.84	35.86	1.98
P-47	MH-48	MH-47	8 inch	0.013	0.005041	246.00	1.07	15,151.84	11.3	10.8	2.7	39.06	90.03	37.82	Circular	Vitrified Clay Pipe	554,473.03	39.14	37.89	1.25
P-48	MH-50	MH-49	8 inch	0.013	0.007526	118.70	1.41	23,937.59	12.9	13.0	3.5	41.01	7.79	40.12	Circular	Vitrified Clay Pipe	677,514.43	41.10	40.21	0.89
P-49	MH-49	MH-47	8 inch	0.013	0.013458	156.29	1.73	23,937.59	11.2	12.1	2.6	39.92	90.16	37.82	Circular	Vitrified Clay Pipe	905,994.57	40.01	37.89	2.12
P-50	MH-51	MH-47	8 inch	0.013	0.005026	357.84	1.63	62,627.88	22.7	22.0	11.3	39.62	0.28	37.82	Circular	Vitrified Clay Pipe	553,640.43	39.77	37.96	1.81
P-51	MH-52	MH-51	8 inch	0.013	0.005021	235.00	1.07	15,070.89	11.3	10.8	2.7	41.00	90.23	39.82	Circular	Vitrified Clay Pipe	553,406.44	41.08	39.89	1.19

Scenario: Base

Gravity Pipe Report

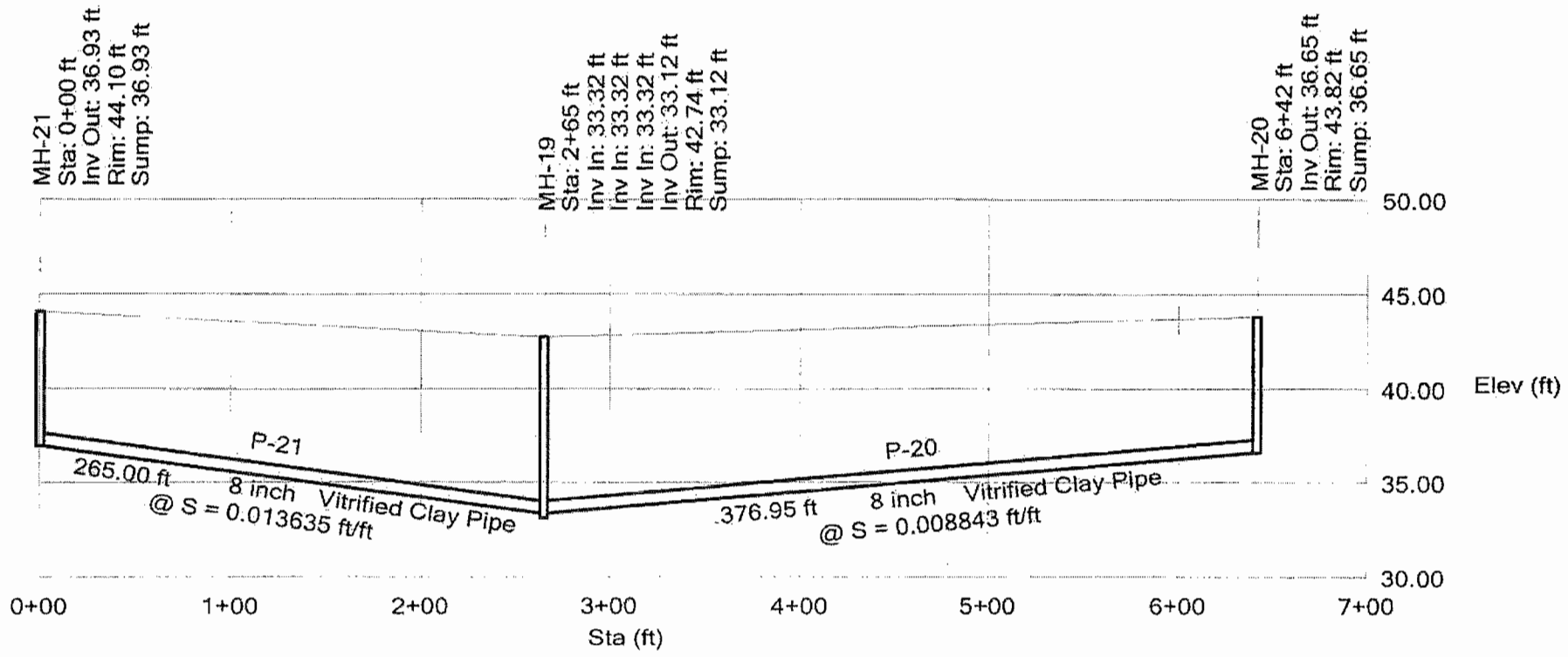
Label	Upstream Node	Downstream Node	Section Size	Mannings n	Constructed Slope (ft/ft)	Length (ft)	Average Velocity (ft/s)	Total Flow (gpd)	Normal Depth / Rise (d/D) (%)	Avg End Depth / Rise (d/D) (%)	Flow / Full Capacity (%)	Upstream Invert Elevation (ft)	Bend Angle (degrees)	Downstream Invert Elevation (ft)	Section Shape	Material	Full Capacity (gpd)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Gravity Element Headloss (ft)
P-52	MH-53	MH-51	8 inch	0.013	0.008314	265.00	1.33	17,415.57	10.8	10.9	2.4	42.02	89.77	39.82	Circular	Vitrified Clay Pipe	712,121.84	42.10	39.89	2.21
P-53	MH-54	MH-37	21 inch	0.013	0.001203	315.84	2.35	2,006,626.67	53.8	49.9	56.5	31.10	0.24	30.72	Circular	Vitrified Clay Pipe	3,552,004.66	32.03	31.54	0.49
P-54	MH-55	MH-54	21 inch	0.013	0.001182	338.28	2.33	1,982,241.89	53.7	50.1	56.3	31.60	0.05	31.20	Circular	Vitrified Clay Pipe	3,521,333.26	32.53	32.03	0.50
P-55	MH-56	MH-55	12 inch	0.013	0.002558	391.00	1.83	252,308.79	31.6	52.2	21.7	32.80	89.73	31.80	Circular	Vitrified Clay Pipe	1,164,462.35	33.12	32.53	0.59
P-56	MH-57	MH-56	12 inch	0.013	0.001171	299.00	1.30	202,582.79	34.6	28.8	25.7	33.35	0.17	33.00	Circular	Vitrified Clay Pipe	787,793.26	33.70	33.23	0.47
P-57	MH-58	MH-57	12 inch	0.013	0.001151	304.00	1.29	202,582.79	34.7	28.9	25.9	33.90	0.00	33.55	Circular	Vitrified Clay Pipe	781,287.83	34.25	33.78	0.47
P-58	MH-61	MH-60	8 inch	0.013	0.001513	304.00	1.13	79,498.07	34.9	29.9	26.2	34.90	0.39	34.44	Circular	Vitrified Clay Pipe	303,794.05	35.13	34.61	0.53
P-59	MH-60	MH-59	8 inch	0.013	0.001782	202.00	1.32	110,772.74	39.9	44.0	33.6	34.34	4.64	33.98	Circular	Vitrified Clay Pipe	329,695.26	34.61	34.30	0.31
P-60	MH-59	MH-58	8 inch	0.013	0.001316	60.80	1.20	118,847.81	45.2	50.1	42.0	33.98	95.14	33.90	Circular	Vitrified Clay Pipe	283,289.41	34.30	34.25	0.05
P-61	MH-62	MH-58	8 inch	0.013	0.001609	55.95	1.18	83,734.98	35.3	36.3	26.7	34.09	0.63	34.00	Circular	Vitrified Clay Pipe	313,226.39	34.33	34.25	0.08
P-62	MH-63	MH-62	8 inch	0.013	0.009663	399.13	1.91	49,408.47	17.2	18.0	6.4	38.15	0.63	34.29	Circular	Vitrified Clay Pipe	767,716.76	38.27	34.40	3.87
P-63	MH-64	MH-63	8 inch	0.013	0.005016	448.60	1.00	12,070.03	10.2	9.7	2.2	40.60	500.00	38.35	Circular	Vitrified Clay Pipe	553,093.77	40.67	38.41	2.26
P-64	MH-65	MH-64	8 inch	0.013	0.005043	152.68	1.00	12,070.03	10.2	9.7	2.2	41.57	65.15	40.80	Circular	Vitrified Clay Pipe	554,614.76	41.64	40.86	0.78

Scenario: Base



Profile - 20_21

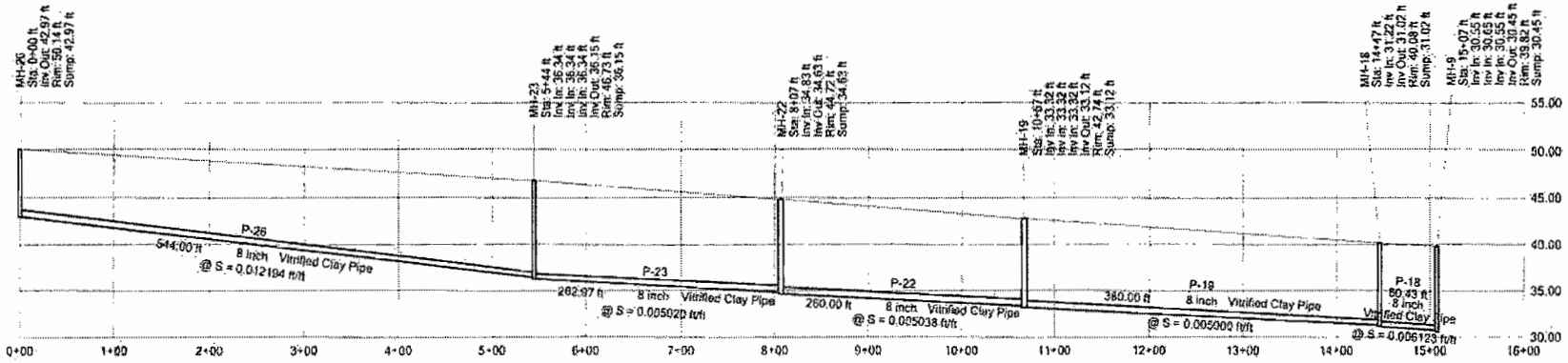
Base @ 0.00 hr



Profile
Scenario: Base

Profile - 18_26

Base @ 0.00 hr



Profile - 24_25

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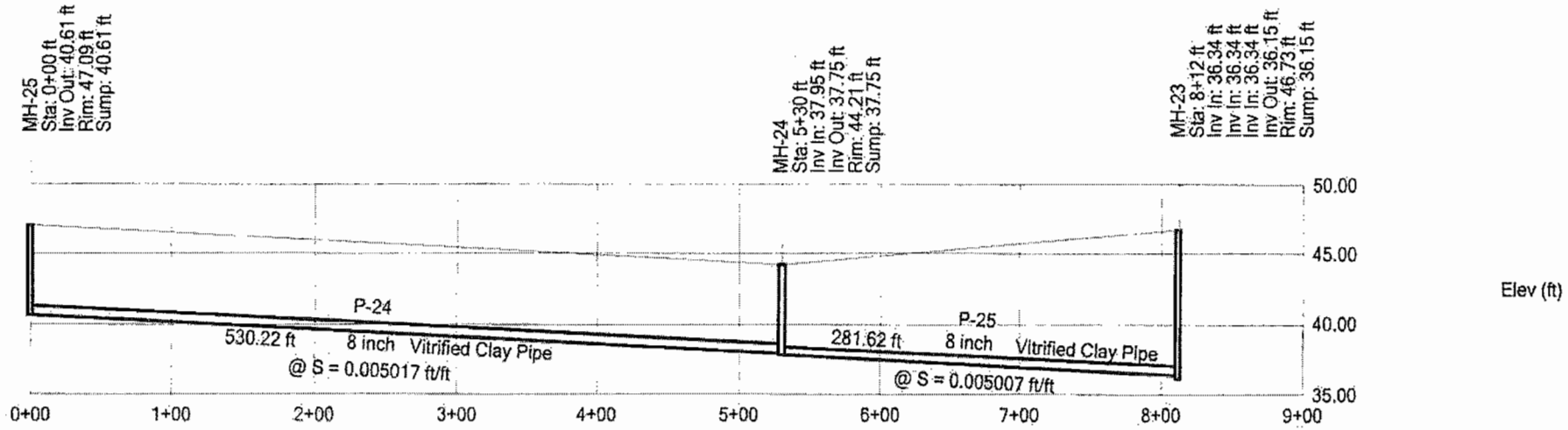

Profile - 27_28

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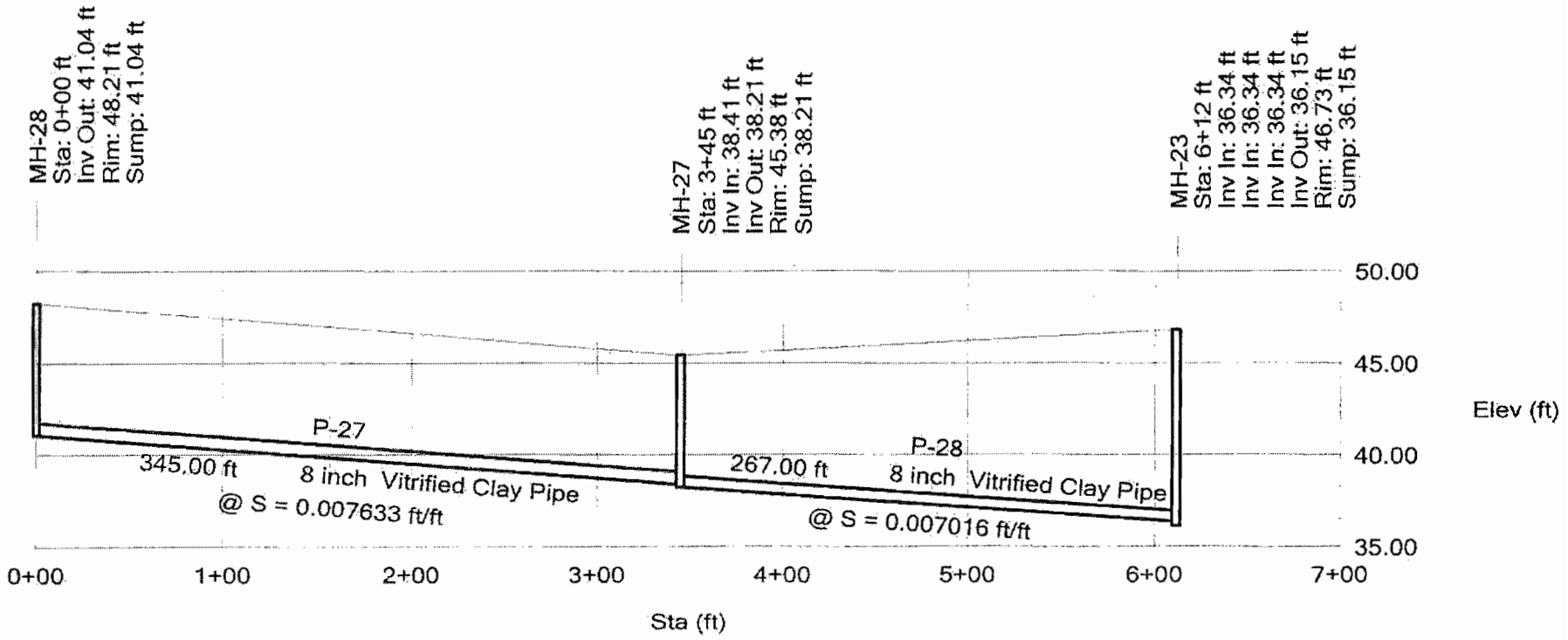
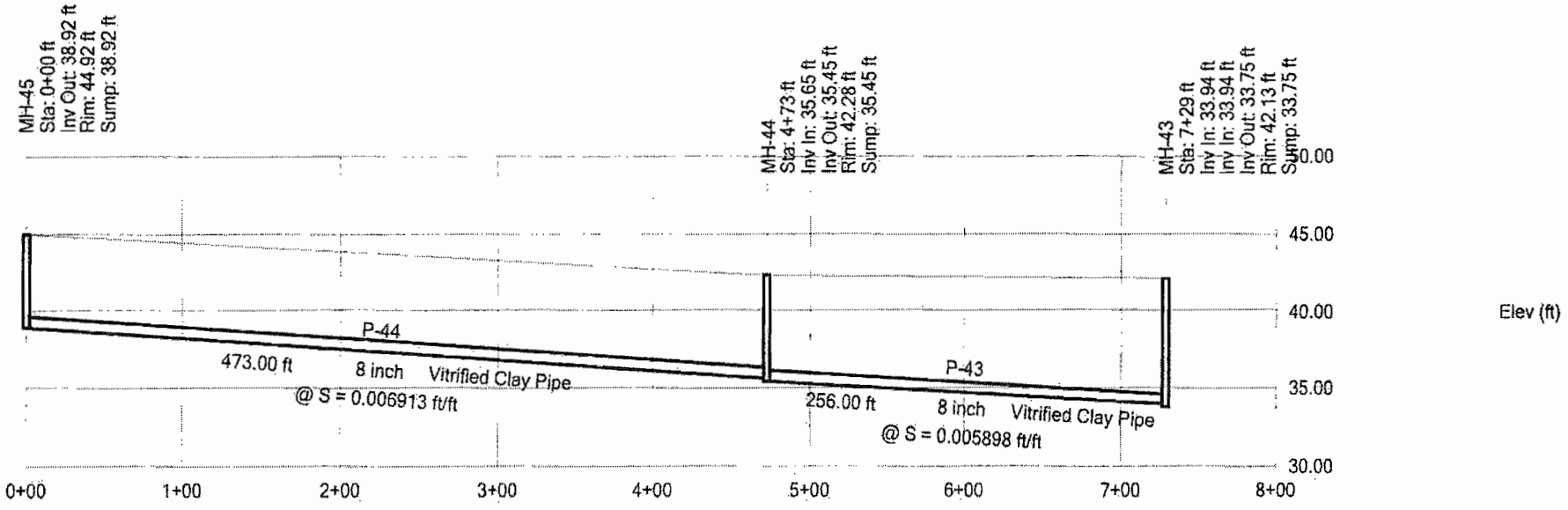


Profile - 43_44

Base @ 0.00 hr



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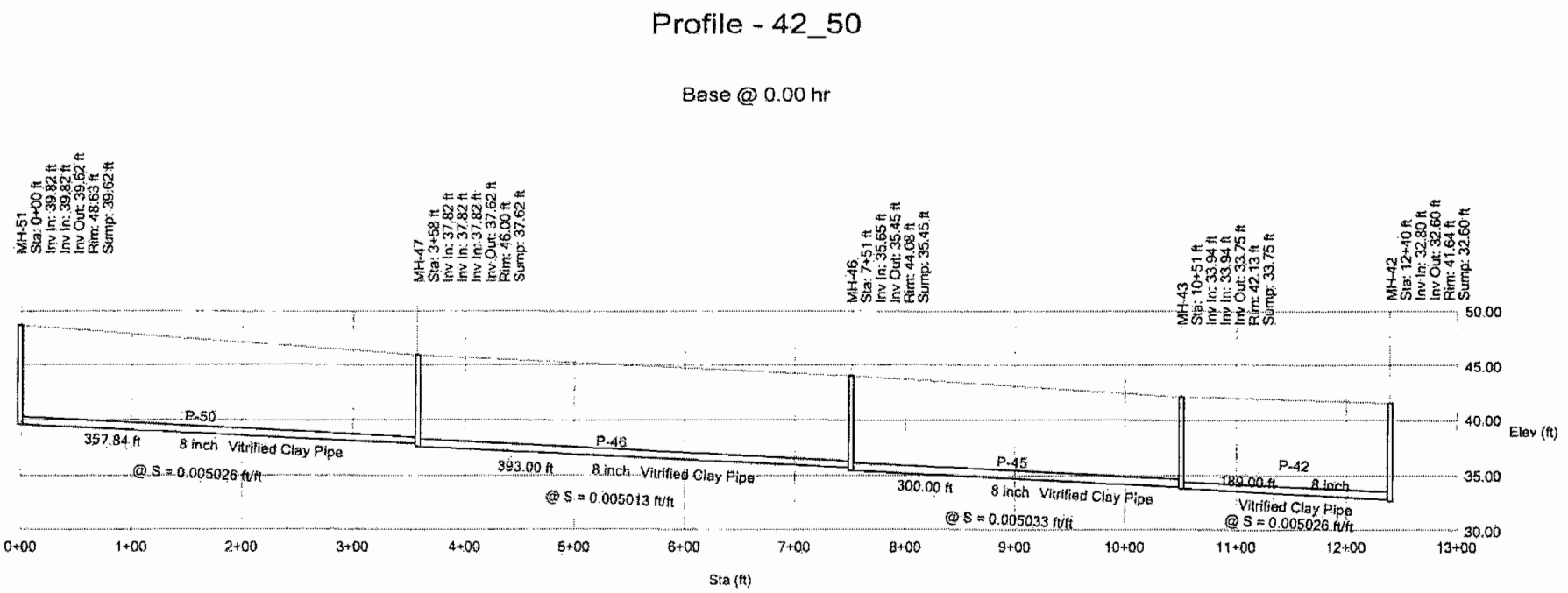
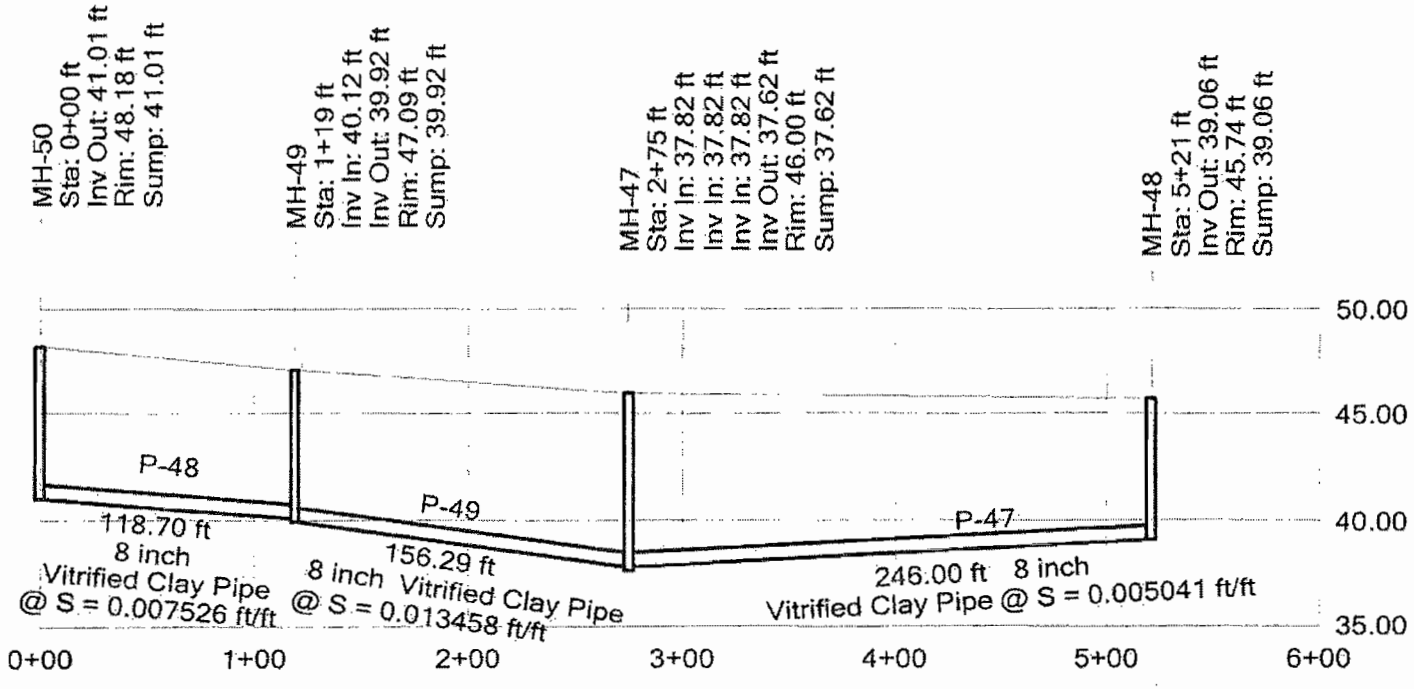
Scenario: Base



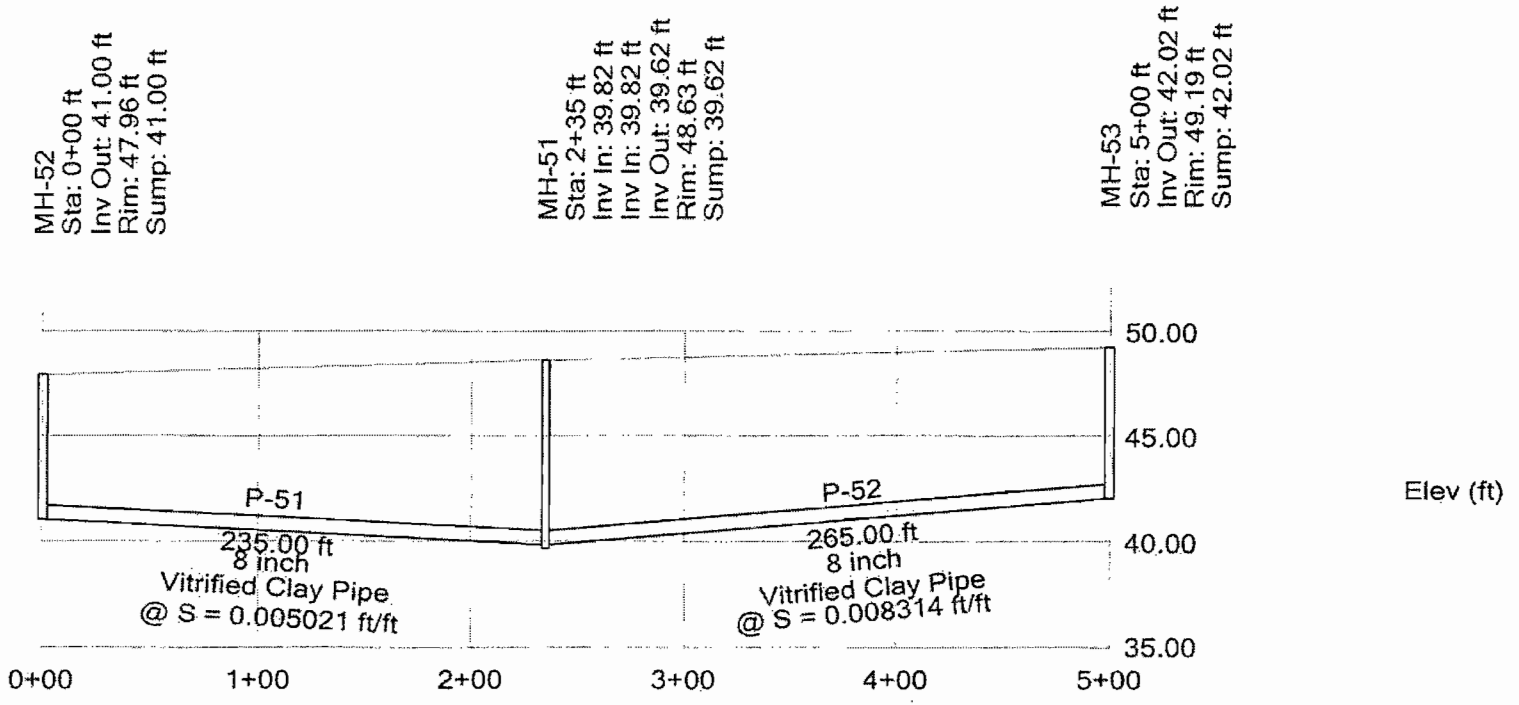
Profile - 47_49

Base @ 0.00 hr



Profile - 51_52

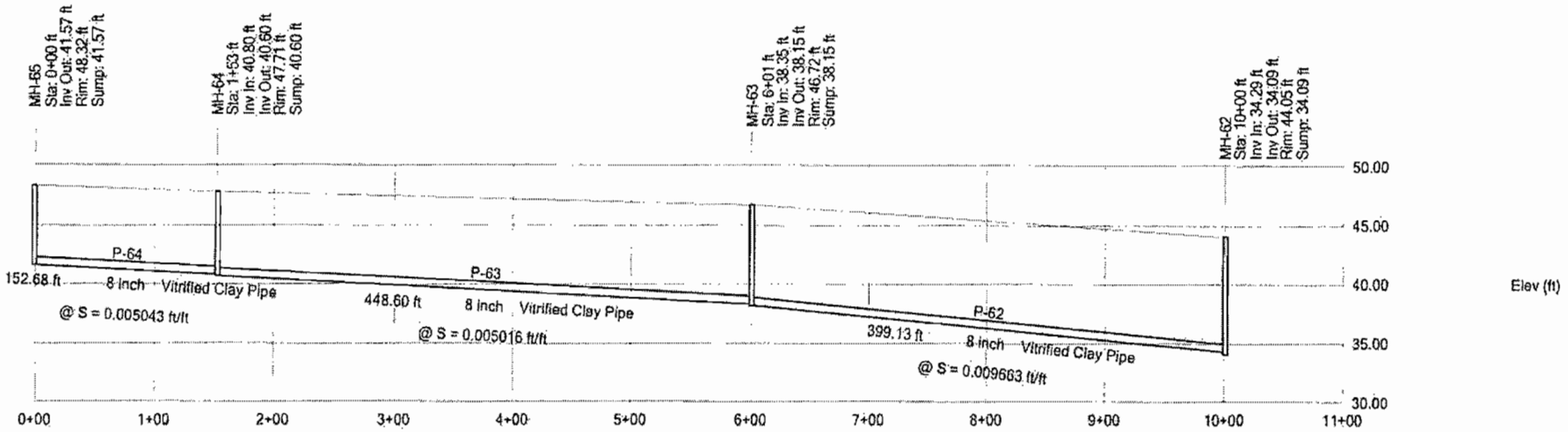
Base @ 0.00 hr



Profile
Scenario: Base

Profile - 62_64

Base @ 0.00 hr



APPENDIX D

FLOW MASTER

TYPICAL PIPE REPORTS

Worksheet for Circular Pipe - 1

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00200	ft/ft
Normal Depth	0.50	ft
Diameter	1.00	ft

Results

Discharge	608484.47	gal/day
Flow Area	0.39	ft^2
Wetted Perimeter	1.57	ft
Top Width	1.00	ft
Critical Depth	0.41	ft
Percent Full	50.0	%
Critical Slope	0.00413	ft/ft
Velocity	2.40	ft/s
Velocity Head	0.09	ft
Specific Energy	0.59	ft
Froude Number	0.67	
Maximum Discharge	2.03	ft^3/s
Discharge Full	1.88	ft^3/s
Slope Full	0.00050	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	50.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s

Worksheet for Circular Pipe - 1

GVF Output Data

Normal Depth	0.50	ft
Critical Depth	0.41	ft
Channel Slope	0.00200	ft/ft
Critical Slope	0.00413	ft/ft

Worksheet for Circular Pipe - 2

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00250	ft/ft
Normal Depth	0.42	ft
Diameter	0.83	ft

Results

Discharge	417066.52	gal/day
Flow Area	0.27	ft^2
Wetted Perimeter	1.31	ft
Top Width	0.83	ft
Critical Depth	0.35	ft
Percent Full	49.9	%
Critical Slope	0.00443	ft/ft
Velocity	2.37	ft/s
Velocity Head	0.09	ft
Specific Energy	0.50	ft
Froude Number	0.73	
Maximum Discharge	1.39	ft^3/s
Discharge Full	1.29	ft^3/s
Slope Full	0.00062	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	49.94	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s

Worksheet for Circular Pipe - 2

GVF Output Data

Normal Depth	0.42	ft
Critical Depth	0.35	ft
Channel Slope	0.00250	ft/ft
Critical Slope	0.00443	ft/ft

Worksheet for Circular Pipe - 3

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.011	
Channel Slope	0.00350	ft/ft
Normal Depth	0.34	ft
Diameter	0.67	ft

Results

Discharge	275471.20	gal/day
Flow Area	0.18	ft^2
Wetted Perimeter	1.05	ft
Top Width	0.67	ft
Critical Depth	0.30	ft
Percent Full	50.2	%
Critical Slope	0.00487	ft/ft
Velocity	2.43	ft/s
Velocity Head	0.09	ft
Specific Energy	0.43	ft
Froude Number	0.83	
Maximum Discharge	0.91	ft^3/s
Discharge Full	0.85	ft^3/s
Slope Full	0.00089	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	50.22	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s

Worksheet for Circular Pipe - 3

GVF Output Data

Normal Depth	0.34	ft
Critical Depth	0.30	ft
Channel Slope	0.00350	ft/ft
Critical Slope	0.00487	ft/ft