SARATOGA ASSOCIATES

ENGINEERING REPORT WATER SUPPLY AND SEWAGE TREATMENT

Carriage Hill Estates

Project No. 2004-035.20M

Town of Brunswick
Rensselaer County
New York

September 30, 2005

Prepared for:
United Development Corporation
400 Jordan Road
Troy, NY 12180

Prepared by:
Saratoga Associates
443 Broadway
Saratoga Springs, NY 12866

Carriage Hill Estates

Table of Contents

1.0 INTRODUCTION

The proposed project (hereinafter referred to as the "Project") consists of the construction of both single-family homes and senior apartments in the Town of Brunswick, Rensselaer County, New York. The site is located east of and adjacent to the Troy County Club, and is bounded by Pinewoods Avenue and to the south, and Brunswick Road (NYS Route 2) to the North. Existing residential development bounds the site to the east. A Niagara Mohawk utility line divides the project site on a north to south access. Refer to *Figure 1 – Project Location Map* for additional geographic reference of the project site.

The Project, see *Figure 2 – Project Concept*, consists of the following components:

- A total of 106 single-family homes are proposed:
  - 87 homes are proposed to be located on ¼-acre lots and are referred to as Carriage Homes marketed to starting families and "empty nester"
  - 19 homes are proposed on lots ranging in size from 3 to 4-acres, and are referred to as Estate Homes.
- The proposed senior apartment component will include a total of 204 units.

It is anticipated that full build-out of the project will occur by 2010.

2.0 WATER SUPPLY

Water service to the project site is proposed from the existing 16-inch diameter water main located along Pinewoods Avenue, see *Figure 3A – On-Site Water Distribution.* The project will be served by the Town of Brunswick's Water District No. 3, which purchases its water from the City of Troy. The existing boundary of Water District No. 3 extends 500 feet from the centerline of Pinewoods Avenue. A new water district will be required to serve the project site.

The existing 16-inch main is fed from a 2 million gallon water tank located on Grange Road (Rte. 142). Hydrant flow test information in the vicinity of the project site at Pinewoods Avenue and Colehammer Road shows a static pressure of approximately 115 psi in the main, residual pressure of 32 psi with a flow of 1075 gpm. At this hydrant, it is estimated that the available fire flow, with a minimum residual pressure of 20 psi, is 1,156 gpm. The hydrant flow test information is attached as Appendix A. It should be noted that this hydrant, located at the intersection of Colehammer Road and Pinewoods Avenue, is upstream of an existing pressure reducing valve pit, located along Pinewoods just west of the project site. This testing location is important, as the proposed water line that would serve the development will be tied into the existing main, also on the upstream side of the valve pit.

It is proposed that two new 10-inch water mains to serve the development be tied into the existing 16-inch main. One 10-inch water main will enter the site adjacent to the proposed pressure sewer from Pinewoods Avenue to Site Road "D". The other 10-inch water main will enter the site at the intersection of the Site Road "A" and Pinewoods Avenue. See *Figure 3A – On-Site Water Distribution.* The new 10-inch mains would form a looped system along the access roads through the development, with smaller diameter service lines branching off to serve the proposed lots. The looped system would stabilize the flow and pressure within the system. It would also allow for maintenance on the system with minimal interruption of water service. The cul-de-sacs would be supplied by dead end 8-inch water mains with a hydrant at the end for flushing the lines.

Engineering calculations, attached as Appendix B, were performed to estimate the domestic water and fire flow demands for the proposed development. A hydraulic analysis using the Haestad WaterCAD Model program, attached as Appendix C, was used to determine if the proposed system has the capacity to meet the estimated water demands. Based on per capita usage, the average domestic daily demand is estimated to be 55,600 gpd and the maximum domestic daily demand is estimated at 111,200 gpd (77 gpm). The worst-case fire flow demand would be 750 gpm for the non-sprinklered residential homes. The total demand estimate for use in design and analysis would be the worst-case fire flow demand of 750 gpm plus the maximum domestic daily demand of 77 gpm for a total demand of 827 gpm with a minimum 20 psi maintained at the main.

The hydraulic analysis indicates that the most critical location for evaluation is the high point in the system. The topography indicates that this location would occur approximately halfway along the main roadway through the site. The hydraulic analysis indicates that with the maximum domestic daily demand of 77 gpm applied to the system and the worst-case fire flow demand of 750 gpm applied at this point the resulting pressure in the system is approximately 30 psi.

The water supply facilities also have to provide the required 52 gpm at a minimum 40 psi for the sprinkler systems in the Senior Housing Units designed per NFPA 13R. The hydraulic analysis indicates that with the maximum domestic daily demand of 75 gpm applied to the system and the sprinkler fire flow demand of 52 gpm applied at the Senior Housing Units the resulting pressure in the system is approximately 110 psi.

Based on the above, the existing water supply system would adequately provide water to the proposed development.

The proposed water system will be designed in accordance with the Recommended Standards for Water Works – 2003. Plans and Engineering Reports will be submitted to the Town of Brunswick and the Rensselaer County Health Department for review and approval.

3.0 SEWAGE TREATMENT

The proposed project is located east of the Rensselaer County Sewer District No. 1. Based on initial discussion with officials of the Town of Brunswick, Rensselaer County, Rensselaer County Health Department and prior investigations performed by C.T. Male Associates, P.C., it was determined that the only practical and feasible way to develop this project was to access the Rensselaer County Sewer System. The nearest feasible connection to this system is approximately 11,000 feet west of the project site on Pinewoods Avenue.

Effluent from the development will ultimately be received, treated and discharged to the Hudson River by the existing county-owned wastewater treatment plant located in the City of Troy. Note, however, that the creation of a Town Sewer District will be required. This will require additional discussion with the Town Engineer, the Town Attorney and coordination with the City of Troy and Rensselaer County. The attached calculations estimate the maximum daily flow from the development at approximately 0.08 MGD. There is excess capacity at the wastewater treatment plant, as it has a design capacity of 24 MGD and a current average daily loading of only 19 MGD.

The existing sanitary sewer facility located closest to the project site is a City-owned lift station at the intersection of Pinewoods and Central Avenues that pumps effluent through a 4" force main to a City-owned 12" diameter gravity sewer that begins near the intersection of Pinewoods and Elmgrove Avenues. The City Engineer has indicated that this lift station is already operating above its design capacity and does not have the ability to accommodate the new flows from the proposed development. It will be necessary to bypass this lift station with new sanitary sewer facilities and tie into the existing gravity sewer near the intersection of Pinewoods and Maple Avenues. This is the starting point of the City-owned 26-inch by 40-inch brick sewer that gravity flows west to the County-owned Monroe Street Pump Station, which pumps the effluent to the wastewater treatment plant. City and County personnel have indicated that they believe that these gravity sewers and this pump station, respectively, have the ability to accommodate the new flows from the proposed development.

The proposed sanitary sewer system for the new development, see *Figure 3A – On-Site Sanitary Sewer,* will consist of an on-site network of gravity sewers and secondary pump stations with force mains to ultimately convey the effluent in a southerly direction towards Pinewoods Avenue. Five pumping stations of various sizes will be required for the proposed project and preliminary design information is attached as Appendix E and F.

The first pumping station (PS-1) will direct the total sewage from the project via a 4-inch diameter forced main to the discharge point at the existing gravity sewer at Maple Avenue and Pinewoods Avenue in the City of Troy. The proposed route is shown on *Figures 4A, 4B & 4C – Off-Site Sanitary Sewer.*

The second pumping station (PS-2) will be located on the north side of the project near Route 2 to move the sanitary sewage from the Senior Housing and several estate lots via a forced main back to the gravity sewer system within the project and subsequently to the first pumping station located near Pinewoods Avenue.

The third pumping station (PS-3) will be located on the east side of the proposed project to move the sewage from the carriage lots via a forced main back to the gravity sewer system within the project and subsequently to PS-2.

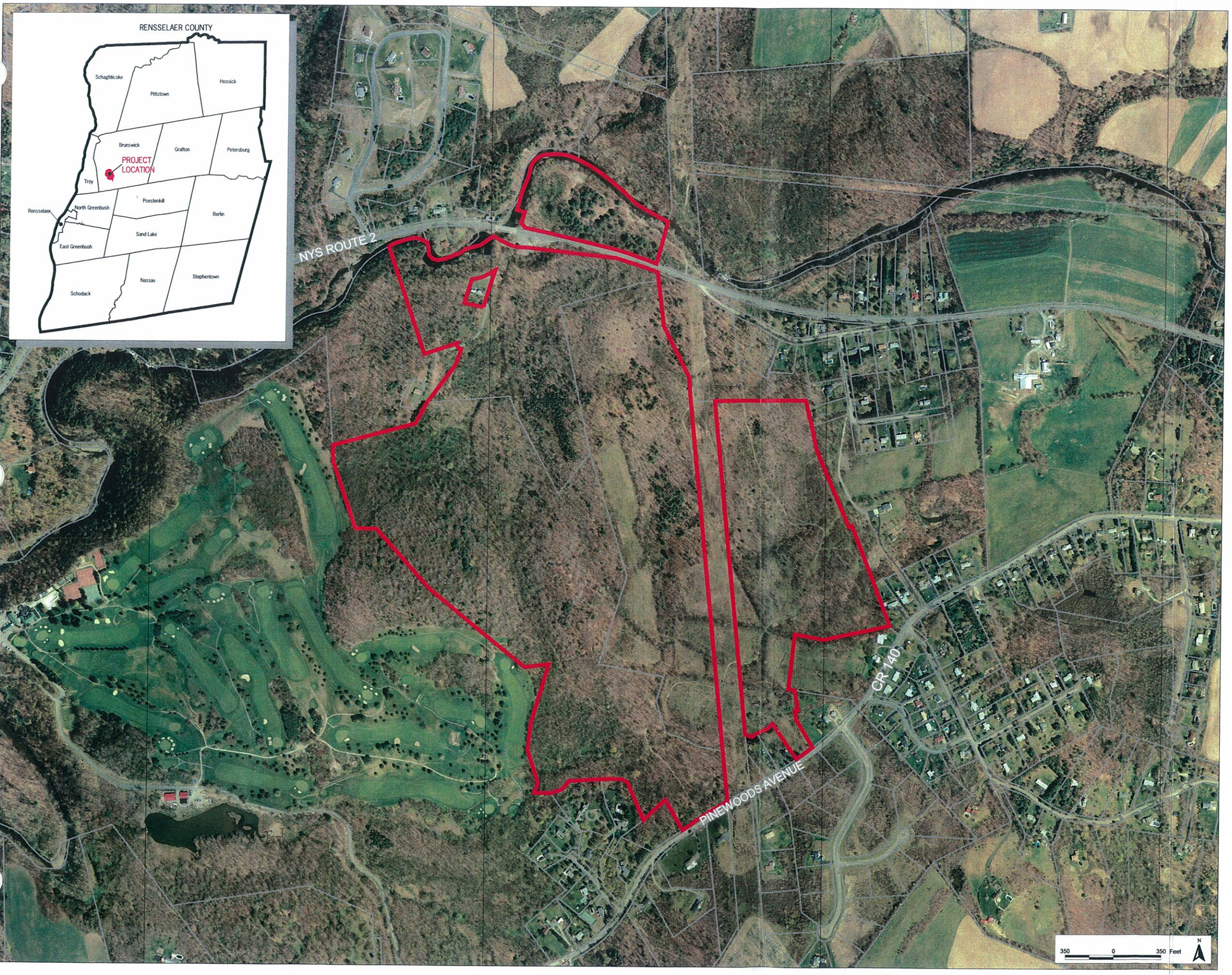
The fourth pumping station (PS-4) will also be located on the east side of the proposed project to move the sewage from the carriage lots via a forced main back to the gravity sewer system within the project and subsequently to PS-3.

The fifth pumping station (PS-5) will be located on the west side of the proposed project to move the sewage from several estate lots via a forced main back to the gravity sewer system within the project and subsequently to PS-2.

The gravity portion of the sewer system will consist of 8-inch diameter, SDR 35, plastic sewer pipe, bell and spigot joints with elastomeric gaskets and appropriate fittings.

The result of the analysis and preliminary calculations indicate that the proposed sewage system can be constructed to serve the project. The sanitary sewer facilities will be designed in accordance with NYSDEC requirements and the Recommended Standards for Wastewater Facilities – 2004. Plans and Engineering Reports will be submitted to NYSDEC, Rensselaer County Health Department and the Town of Brunswick for review and approval.

Figures



PROJECT LOCATION

Figure 1
Carriage Hill Estates
Draft Environmental Impact Statement
September 2005

KEY

- PROPERTY BOUNDARY, PROPOSED PROJECT LOCATION
- TAX PARCEL BOUNDARY

PROJECT # 2004-035.20M

This map is computer generated using data acquired by Saratoga Associates from various sources and is intended only for reference, conceptual planning and presentation purposes. This map is not intended for and should not be used to establish boundaries, property lines, location of objects or to provide any other information typically needed for construction or any other purpose when engineered plans or lnad surveys are required.

File Location: S:\GIS\04035\BRUNSWICK.apr

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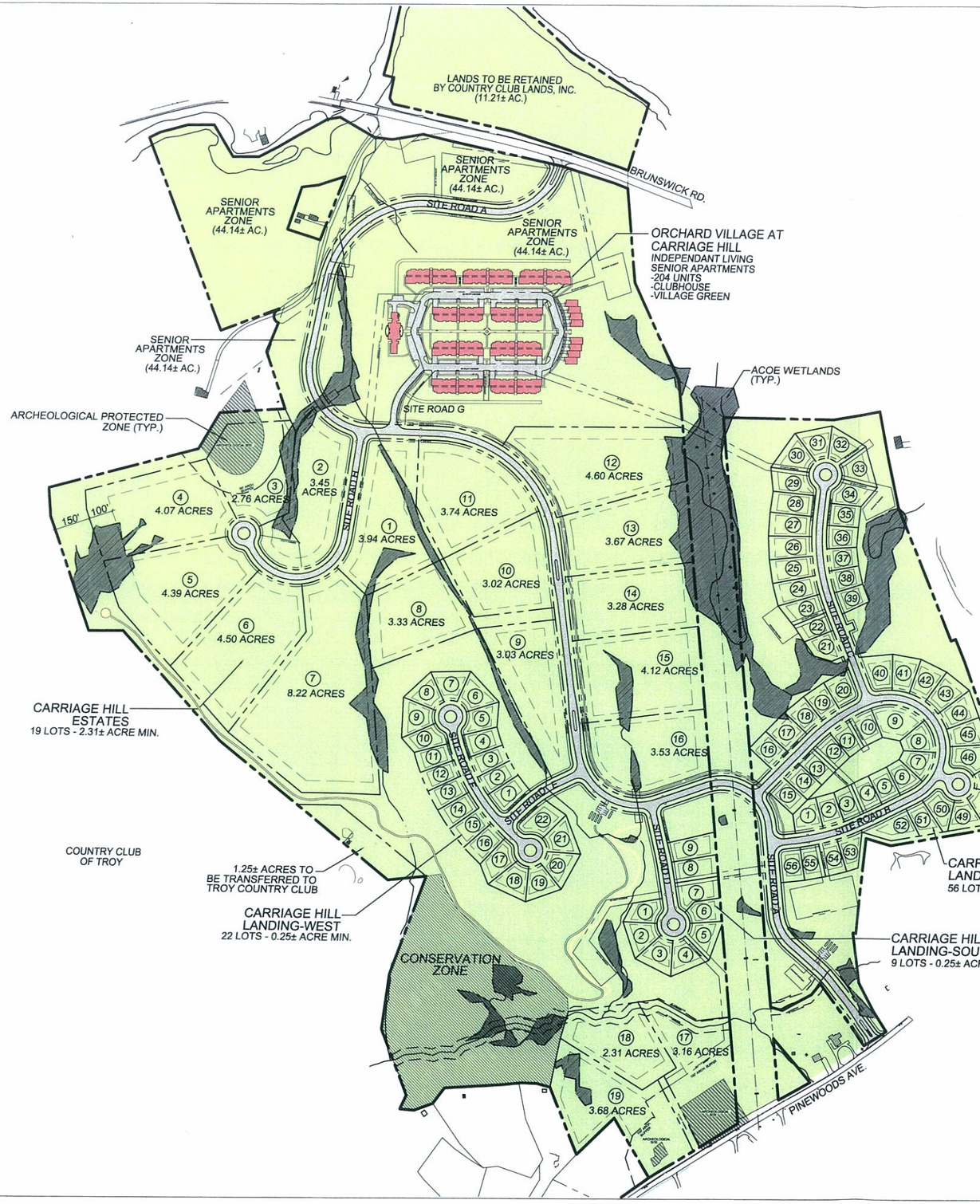
unitedgroup



LOT SCHEDULE

ZONE	UNITS
ESTATE LOTS (2.31 ACRE MIN.)	19
CARRIAGE HILL LANDING (0.25 ACRE MIN.)	87
ORCHARD VILLAGE (SENIOR APARTMENTS)	204
TOTAL UNITS	310

CARRIAGE HILL LANDING-EAST (17.20± AC.)

LOT NO.	SIZE (SF)	SIZE (AC.)	LOT NO.	SIZE (SF)	SIZE (AC.)
1	12,480	.287	29	15,743	.361
2	11,122	.255	30	15,413	.354
3	11,214	.257	31	13,384	.307
4	11,262	.259	32	13,780	.316
5	11,220	.258	33	15,739	.361
6	11,264	.259	34	15,155	.348
7	11,723	.269	35	12,221	.281
8	12,534	.288	36	11,775	.270
9	21,804	.501	37	10,944	.251
10	12,845	.295	38	10,955	.251
11	11,513	.264	39	10,960	.252
12	11,384	.261	40	16,642	.382
13	11,264	.259	41	14,037	.322
14	11,264	.259	42	14,208	.326
15	11,275	.259	43	14,912	.342
16	12,272	.282	44	14,437	.331
17	13,785	.316	45	14,330	.329
18	11,669	.268	46	17,637	.405
19	11,710	.269	47	12,011	.276
20	13,451	.309	48	20,286	.466
21	12,260	.281	49	12,364	.284
22	10,924	.251	50	13,213	.303
23	14,042	.322	51	11,910	.273
24	15,420	.354	52	17,192	.395
25	15,880	.365	53	11,715	.269
26	15,885	.365	54	11,635	.267
27	15,975	.367	55	11,251	.258
28	15,318	.352	56	12,461	.286

CARRIAGE HILL LANDING-WEST (6.92± AC.)

LOT NO.	SIZE (SF)	SIZE (AC.)	LOT NO.	SIZE (SF)	SIZE (AC.)
1	14,483	.332	14	12,789	.294
2	11,626	.267	15	13,417	.308
3	12,073	.277	16	13,632	.313
4	13,140	.302	17	14,872	.341
5	13,671	.314	18	15,406	.354
6	14,520	.333	19	13,368	.307
7	13,777	.316	20	13,773	.316
8	13,369	.307	21	14,264	.327
9	15,407	.354	22	17,987	.413
10	13,607	.312			
11	12,058	.277			
12	11,811	.271			
13	12,331	.283			

CARRIAGE HILL LANDING-SOUTH (3.09± AC.)

LOT NO.	SIZE (SF)	SIZE (AC.)
1	12,380	.284
2	14,023	.322
3	14,601	.335
4	14,841	.341
5	14,522	.333
6	12,416	.285
7	17,739	.407
8	16,760	.385
9	17,318	.398

ESTATE LOTS (72.80± AC.)

LOT NO.	SIZE (AC.)	LOT NO.	SIZE (AC.)
1	3.94	11	3.74
2	3.45	12	4.60
3	2.76	13	3.67
4	4.07	14	3.28
5	4.39	15	4.12
6	4.50	16	3.53
7	8.22	17	3.16
8	3.33	18	2.31
9	3.03	19	3.68
10	3.02		

PROJECT CONCEPT

Figure 2
Carriage Hill Estates
Draft Environmental Impact Statement

September, 2005

PROJECT # 2004-035.20M

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ON-SITE WATER DISTRIBUTION

Figure 3A
Carriage Hill Estates
Draft Environmental Impact Statement

September, 2005

KEY

PROPOSED WATER MAIN

W W EXISTING 16" WATER MAIN

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ON-SITE SANITARY SEWER

Figure 3B
Carriage Hill Estates
Draft Environmental Impact Statement

September, 2005

KEY

PROPOSED GRAVITY SEWER

FM — PROPOSED FORCE MAIN

PS-1 — PUMP STATION

PROJECT # 2004-035.20M

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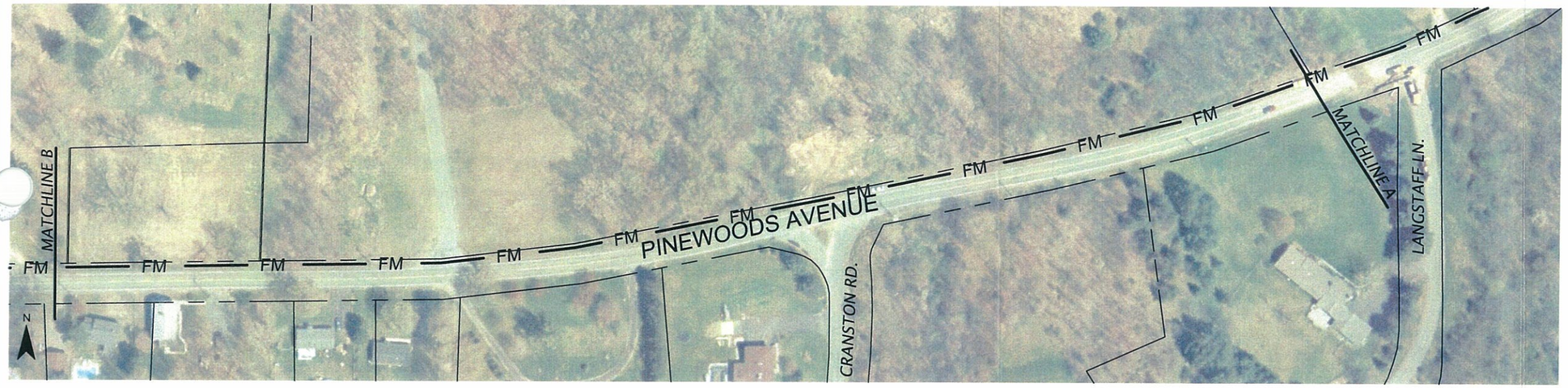

0 75 150 225 300 Feet

OFF-SITE SANITARY SEWER

Figure 4A
Carriage Hill Estates
Draft Environmental Impact Statement

September, 2005

KEY

FM PROPOSED FORCE MAIN

NOTE:
AERIAL PHOTOGRAPHY TAKEN FROM NYSGIS CLEARINGHOUSE, DATED APRIL 2000.

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OFF-SITE SANITARY SEWER

Figure 4B
Carriage Hill Estates
Draft Environmental Impact Statement

September, 2005

KEY

FM PROPOSED FORCE MAIN

NOTE:
AERIAL PHOTOGRAPHY TAKEN FROM NYSGIS CLEARINGHOUSE, DATED APRIL 2000.

PROJECT # 2004-035.20M

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OFF-SITE SANITARY SEWER

Figure 4C
Carriage Hill Estates
Draft Environmental Impact Statement

September, 2005

KEY

——FM—— PROPOSED FORCE MAIN

NOTE:
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Appendices

Appendix A – Water Supply Hydrant Flow Tests

R B M GUARDIAN FIRE PROTECTION, INC.

8 Enterprise Drive
Albany, New York 12204
Telephone (518) 463-4340 Fax (518) 463-4378

TSA Proj. Name: CHE
TSA Proj. #: 04-035.10M
Sub-File #:
Originator: GEI
Cc: PCM

November 17th, 2004

To: United Development
80 State Street
Albany, New York 12207

assume el. 456

Attn: Kim Williams
Fax # 434-6427

From: Matt G. Wilms

Re: Flow Test Summary For Hydrants

Please find the results of the hydrant flow test that was conducted for the above referenced project:

1. Date of Flow: 11/17/2004
2. Time: 9:00 am
3. ~~Performed by:~~ RBM Guardian Fire Protection, Inc. & Brunswick Water Department
4. Street Name: Pinewoods & Colehammer Road
5. Size of Main: 16"
6. (Circulating) or ~~Dead-End Main~~

STATIC	115	PSI					
1 1/8 Playpipe		pitot		GPM @		PSI	
1 3/4 Playpipe		pitot		GPM @		PSI	
2 1/2 Hydrant		pitot		GPM @		PSI	
2 1/2 Hosemonster	35	pitot	1075	GPM @	32	PSI	

REMARKS:

$$Q_{20psi} = Q_F \frac{H_R^{.54}}{H_F^{.54}} = 1075 \frac{(95)^{.54}}{(83)^{.54}} = 1156 \text{ gpm}$$

If you have any questions, please do not hesitate to call me.

cc: The Saratoga Associates - Gregg E. Ursprung (Faxed Only 587-2564)
Kestner Engineers, PC - Mark L. Kestner (Faxed Only 273-7583

C.T. MALE ASSOCIATES, P.C.
50 Century Hill Drive
P.O. Box 727
LATHAM, NEW YORK 12110
(518) 785-0976 FAX (518) 785-3264

JOB 87.4050 COUNTRY CLUB PROP.
SHEET NO. _____ OF _____
CALCULATED BY J. NG DATE 4-3-90
CHECKED BY _____ DATE _____
SCALE _____

HYDRANT FLOW TEST RESULTS

LOCATION: COLEHAMMER AVE - PINEWOODS AVE. INTERSECTION

DATE: MARCH, 29, 1990

TIME: 11:00

C. ST. MARTIN
BY: J. NG

RESIDUAL HYDRANT - NOZZLE SIZE (IN.): 2½"

STATIC (PSI):	115	115
RESIDUAL (PSI):	40	32
H_F =	75	83 PSI
H_R =	95	95 PSI

FLOW HYDRANT - NOZZLE SIZE (IN.): 2½"

PITOT (PSI):	40	32
FLOW (GPM) (Q_F):	1060	1015

10.69 12.96
95 115
83
10.87

$$Q_{20\,PSI} = Q_F \frac{H_R^{0.54}}{H_F^{0.54}} = 1015 \frac{(95)^{0.54}}{(75)^{0.54}} = 1060 \frac{(95)^{0.54}}{(83)^{0.54}} = 1156 \text{ GPM}$$

$$= 1204 \text{ GPM}$$

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P.O. Box 727
LATHAM, NEW YORK 12110
(518) 785-0976 FAX (518) 785-3264

JOB 87.4050 COUNTRY CLUB PRO

SHEET NO. _____ OF _____

CALCULATED BY J. NG DATE 4-3-90

CHECKED BY _____ DATE _____

SCALE _____

COUNTRY CLUB PROPERTIES. C/O BRUNSWICK

PRESSURE READINGS DURING FIRE FLOW TEST CONDUCTED ON MARCH 29, 1990

LOCATION OF FLOW TEST:

COLEHAMMER AVE. - PINEWOODS AVE INTERSECTION

LOCATION OF PRESSURE READINGS:

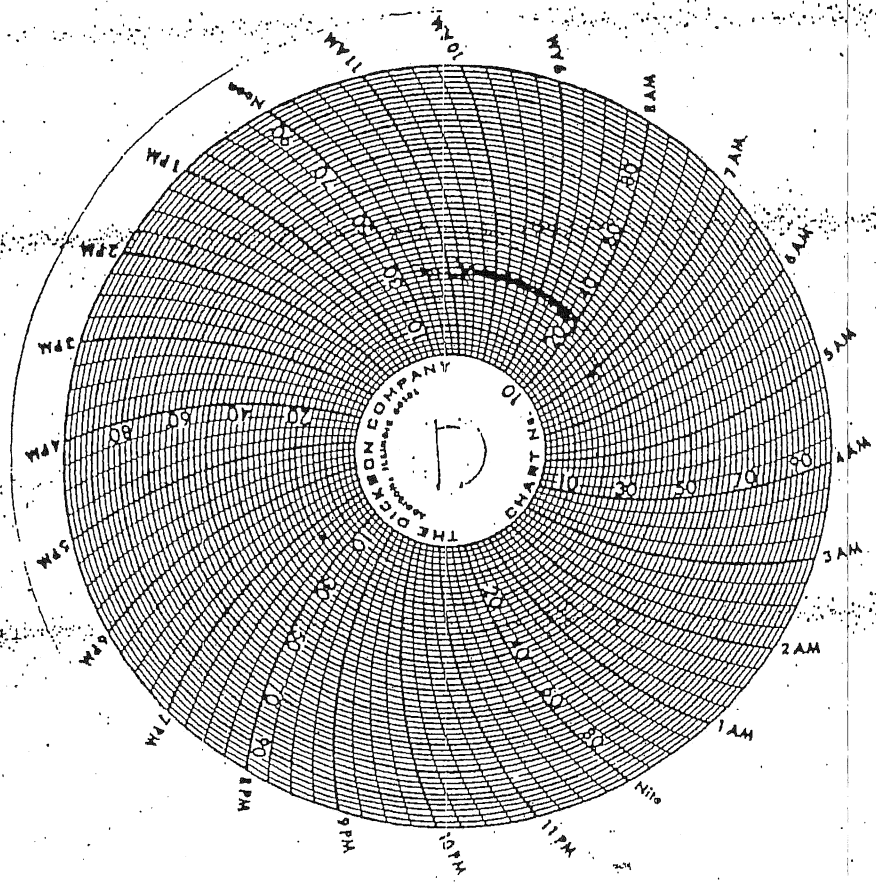
SHAFTER AVE.

STATIC PRESS: 85 P.S.I.

RESIDUAL PRESS: 70 P.S.I.

* READINGS BY BRIAN TOLLISEN

3/29/90
Hudson Drive
During Flow Test with C.T. Male
ON Pinewoods Ave
10:52 AM
STATIC Pressure
AT MT View Fire House
85 PSI
Dropped 16 pounds During Flw test.



Appendix B – Water Supply Calculations

Domestic Demand Estimates

The estimated domestic water demand is based on the number of persons living in the development with an average daily design demand of 100 gallons per day per person. Peaking factors of 2.0 and 5.0 are utilized for the maximum daily and peak hourly demands, respectively. The estimated domestic demands are:

Senior Housing

204 living units – assume 1.3 people per unit
(204 x 1.3) = 265 residents

Average Daily Demand	100 gpd/person x 265 =	26,500 gpd
Maximum Daily Demand	2.0 x 26,500 gpd =	53,000 gpd
Peak Hourly Demand	(5.0 x 26,500) / (18 hrs/day)(60 min/hr) =	123 gpm

Residential Estate Lots (4 Bedroom)

19 lots with homes – assume 3.6 people per home
(19 x 3.6) = 68 residents

Average Daily Demand	100 gpd/person x 68 =	6,800 gpd
Maximum Daily Demand	2.0 x 6,800 gpd =	13,600 gpd
Peak Hourly Demand	(5.0 x 6,800) / (18 hrs/day)(60 min/hr) =	32 gpm

Carriage Lots (3 Bedroom)

87 lots with homes – assume 2.56 people per home
(87 x 2.56) = 223 residents

Average Daily Demand	100 gpd/person x 223 =	22,300 gpd
Maximum Daily Demand	2.0 x 22,300 gpd =	44,600 gpd
Peak Hourly Demand	(5.0 x 22,300) / (18 hrs/day)(60 min/hr) =	103 gpm

Total Domestic Demand

Average Daily Demand	26,500 + 6,800 + 22,300 =	55,600 gpd
Maximum Daily Demand	53,000 + 13,600 + 44,600 gpd =	111,200 gpd
Peak Hourly Demand	123 + 32 + 102 =	257 gpm

Fire Demand Estimates

Senior Housing

The Needed Fire Flow (NFF) shall be determined per NFPA 13R for sprinklered residential buildings up to four stories in height.
Assume 4 design sprinkers @ 13 gpm per sprinker = 52 gpm with 40 psi @ main
Add the inside and outside hose demand per NFPA 13 Table 7-2.3.1.1
Ordinary hazard = 250 gpm with 20 psi @ main
250 gpm + 52 GPM = 302 gpm
However, per AWWA M-31 the minimum NFF is 500 gpm with 20 psi @ main

Residential Estate and Carriage Lot Homes

Per AWWA M-31 Table 1-5, the minimum NFF is 750 gpm with 20 psi @ main

Total Design Demand

The design demand, as defined by AWWA, is either the peak hourly domestic demand or the fire demand plus the maximum daily domestic demand, whichever is greater.

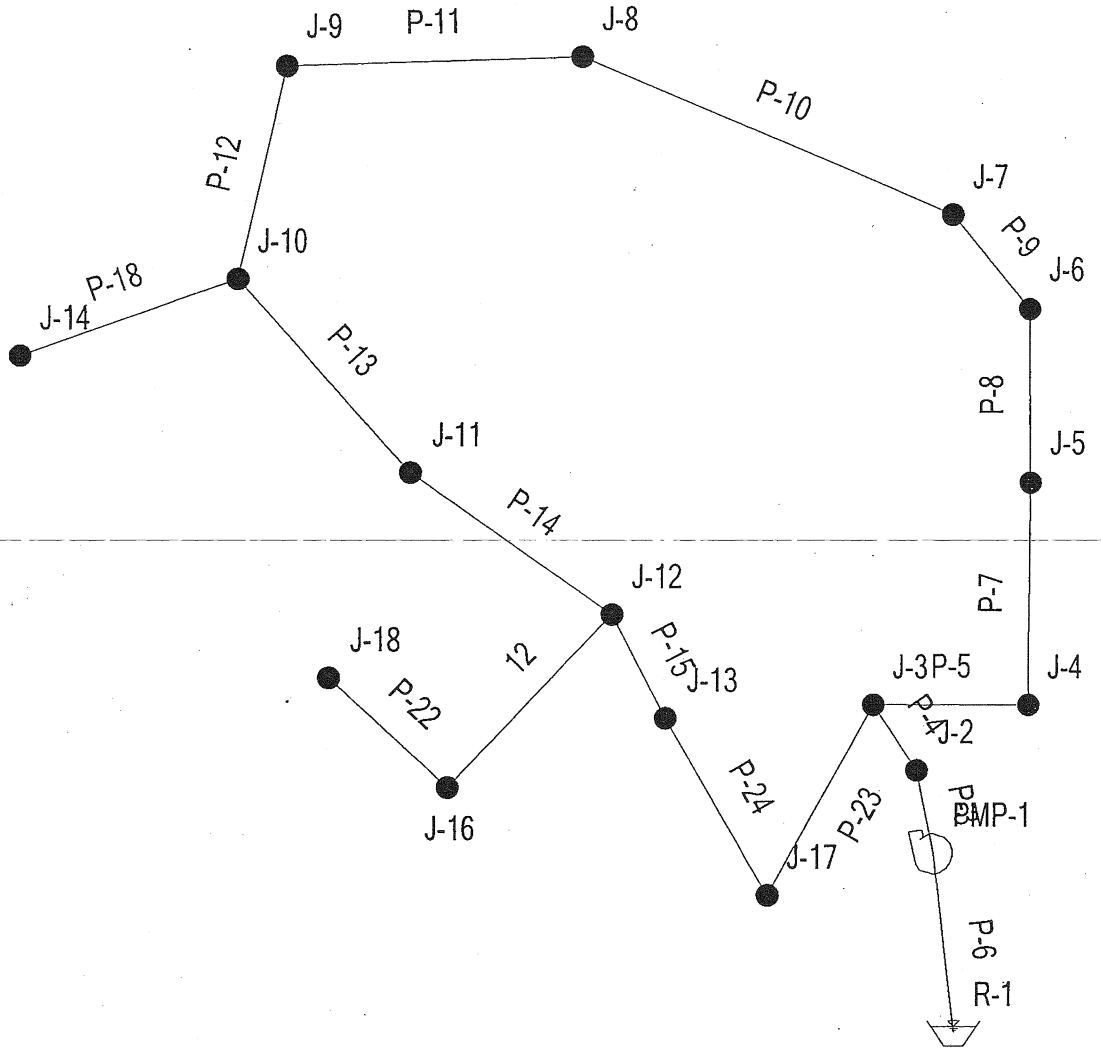
Peak Hourly Domestic Demand = 287 GPM

Fire Demand + Maximum Daily Demand = 750 GPM + 77 GPM = 827 GPM

Therefore, the design demand is 827 GPM with 20 psi @ main.

Appendix C – Water Supply Model

Scenario: Maximum Daily Demand



Scenario: Peak Hourly Demand
Steady State Analysis
Junction Report

Label	Elevation (ft)	Zone	Type	Base Flow (gpm)	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-2	456.00	Zone	Demand	0.00	Fixed	0.00	706.84	108.53
J-3	456.00	Zone	Demand	0.00	Fixed	0.00	706.84	108.53
J-4	456.00	Zone	Demand	0.00	Fixed	0.00	706.84	108.53
J-5	475.00	Zone	Demand	22.69	Fixed	22.69	706.69	100.24
J-6	455.00	Zone	Demand	25.93	Fixed	25.93	706.55	108.83
J-7	445.00	Zone	Demand	17.59	Fixed	17.59	706.48	113.13
J-8	476.00	Zone	Demand	62.00	Fixed	62.00	706.42	99.69
J-9	482.00	Zone	Demand	62.00	Fixed	62.00	706.42	97.10
J-10	472.00	Zone	Demand	3.33	Fixed	3.33	706.43	101.43
J-11	523.00	Zone	Demand	10.00	Fixed	10.00	706.46	79.37
J-12	480.00	Zone	Demand	8.33	Fixed	8.33	706.53	98.01
J-13	462.00	Zone	Demand	4.63	Fixed	4.63	706.57	105.81
J-14	456.00	Zone	Demand	8.33	Fixed	8.33	706.43	108.35
J-16	500.00	Zone	Demand	12.96	Fixed	12.96	706.52	89.35
J-17	439.00	Zone	Demand	26.60	Fixed	26.60	706.64	115.79
J-18	530.00	Zone	Demand	12.96	Fixed	12.96	706.51	76.37

WaterCAD Model Flows
Revised 9/30/05

J-5

Carriage Lots (3 Bedroom)

19 lots with homes – assume 2.56 people per home
(19 x 2.56) = 49 residents

Average Daily Demand	100 gpd/person x 49 =	4,900gpd – 3.40 gpm
Maximum Daily Demand	2.0 x 4,900 gpd =	9,600 gpd – 6.80 gpm
Peak Hourly Demand	(5.0 x 4,900) / (18 hrs/day)(60 min/hr) =	22.69 gpm

J-6

Carriage Lots (3 Bedroom)

22 lots with homes – assume 2.56 people per home
(22 x 2.56) = 56 residents

Average Daily Demand	100 gpd/person x 56 =	5,600 gpd – 3.89 gpm
Maximum Daily Demand	2.0 x 5,600 gpd =	11,200 gpd – 7.78 gpm
Peak Hourly Demand	(5.0 x 5,600) / (18 hrs/day)(60 min/hr) =	25.93 gpm

J-7

Carriage Lots (3 Bedroom)

15 lots with homes – assume 2.56 people per home
(15 x 2.56) = 38 residents

Average Daily Demand	100 gpd/person x 38 =	3,800 gpd – 2.64 gpm
Maximum Daily Demand	2.0 x 3,800 gpd =	7,600 gpd – 5.28 gpm
Peak Hourly Demand	(5.0 x 3,800) / (18 hrs/day)(60 min/hr) =	17.59 gpm

J-8

Senior Housing

102 living units – assume 70% with 1 person and 30% with 2 people
(102 x 0.70)(1) + (102 x 0.30)(2) = 132.6 residents

Average Daily Demand	100 gpd/person x 132.6 =	13,260 gpd – 9.21 gpm
Maximum Daily Demand	2.0 x 13,260 gpd =	26,520 gpd – 18.42 gpm
Peak Hourly Demand	(5.0 x 13,260) / (18 hrs/day)(60 min/hr) =	62 gpm

J-9

Senior Housing

102 living units – assume 70% with 1 person and 30% with 2 people
(102 x 0.70)(1) + (102 x 0.30)(2) = 132.6 residents

Average Daily Demand	100 gpd/person x 132.6 =	13,260 gpd – 9.21 gpm
Maximum Daily Demand	2.0 x 13,260 gpd =	26,520 gpd – 18.42 gpm
Peak Hourly Demand	(5.0 x 13,260) / (18 hrs/day)(60 min/hr) =	62 gpm

J-10

Residential Estate Lots (4 Bedroom)

2 lots with homes – assume 3.6 people per home
(2 x 3.6) = 7.2 residents

Average Daily Demand	100 gpd/person x 7.2 =	720 gpd – 0.5 gpm
Maximum Daily Demand	2.0 x 720 gpd =	1,440 gpd – 1.0 gpm
Peak Hourly Demand	(5.0 x 720) / (18 hrs/day)(60 min/hr) =	3.33 gpm

J-11

Residential Estate Lots (4 Bedroom)

6 lots with homes – assume 3.6 people per home
(6 x 3.6) = 21.6 residents

Average Daily Demand	100 gpd/person x 21.6 =	2,160 gpd – 1.5 gpm
Maximum Daily Demand	2.0 x 2,160 gpd =	4,320 gpd – 3.0 gpm
Peak Hourly Demand	(5.0 x 2,160) / (18 hrs/day)(60 min/hr) =	10.0 gpm

J-12

Residential Estate Lots (4 Bedroom)

5 lots with homes – assume 3.6 people per home
(5 x 3.6) = 18 residents

Average Daily Demand	100 gpd/person x 18 =	1,800 gpd – 1.25 gpm
Maximum Daily Demand	2.0 x 1,800 gpd =	3,600 gpd – 2.5 gpm
Peak Hourly Demand	(5.0 x 1,800) / (18 hrs/day)(60 min/hr) =	8.33 gpm

J-13

Residential Estate Lots (4 Bedroom)

1 lots with home – assume 3.6 people per home
(1 x 3.6) = 3.6 residents

Average Daily Demand	100 gpd/person x 4 =	400 gpd – 0.28 gpm
Maximum Daily Demand	2.0 x 400 gpd =	800 gpd – 0.56 gpm
Peak Hourly Demand	(5.0 x 400) / (18 hrs/day)(60 min/hr) =	4.63 gpm

J-17

Carriage Lots (3 Bedroom)

9 lots with homes – assume 2.56 people per home
(9 x 2.56) = 23 residents

Average Daily Demand	100 gpd/person x 23 =	2,300 gpd – 1.60 gpm
Maximum Daily Demand	2.0 x 2,300 gpd =	4,600 gpd – 3.2 gpm
Peak Hourly Demand	(5.0 x 2,300) / (18 hrs/day)(60 min/hr) =	26.6 gpm

J-18

Carriage Lots (3 Bedroom)

11 lots with homes – assume 2.56 people per home
(11 x 2.56) = 28 residents

Average Daily Demand	100 gpd/person x 28 =	2,800 gpd – 1.94 gpm
Maximum Daily Demand	2.0 x 2,800 gpd =	5,600 gpd – 3.88 gpm
Peak Hourly Demand	(5.0 x 2,800) / (18 hrs/day)(60 min/hr) =	12.96 gpm

J-16

Carriage Lots (3 Bedroom)

11 lots with homes – assume 2.56 people per home
(11 x 2.56) = 28 residents

Average Daily Demand	100 gpd/person x 28 =	2,800 gpd – 1.94 gpm
Maximum Daily Demand	2.0 x 2,800 gpd =	5,600 gpd – 3.88 gpm
Peak Hourly Demand	(5.0 x 2,800) / (18 hrs/day)(60 min/hr) =	12.96 gpm

J-14

Residential Estate Lots (4 Bedroom)

5 lots with homes – assume 3.6 people per home
(5 x 3.6) = 18 residents

Average Daily Demand	100 gpd/person x 18 =	1,800 gpd – 1.25 gpm
Maximum Daily Demand	2.0 x 1,800 gpd =	3,600 gpd – 2.5 gpm
Peak Hourly Demand	(5.0 x 1,800) / (18 hrs/day)(60 min/hr) =	8.33 gpm

DESIGN OF PUMPING STATIONS

INTRODUCTION

Five pumping stations of various sizes will be required for the proposed project.

The first pumping station (PS-1) will direct the total sewage from the project via a forced main to the discharge point at the existing gravity sewer at Maple Avenue and Pinewoods Avenue in the City of Troy.

The second pumping station (PS-2) will be located on the north side of the project near Route 2 to move the sanitary sewage from the Senior Housing and several residential lots via a forced main back to the gravity sewer system within the project and subsequently to PS-1 located near Pinewoods Avenue.

The third pumping station (PS-3) will be located on the east side of the proposed project to move the sewage from the carriage lots via a forced main back to the gravity sewer system within the project and subsequently to PS-1.

The fourth pumping station (PS-4) will also be located on the east side of the proposed project to move the sewage from the carriage lots via a forced main back to the gravity sewer system within the project and subsequently to PS-3.

The fifth pumping station (PS-5) will be located on the west side of the proposed project to move the sewage from several residential lots via a forced main back to the gravity sewer system within the project and subsequently to PS-2.

PRELIMINARY DESIGN PUMPING STATION NO. 1

Calculate Sanitary Flows and Pump Rate

Sanitary flow consists of the flow from ten Residential Estate lots and 82 Carriage Lots.

14 – Residential Estates
14 lots with homes – assume 3.6 people per home
14 lots x 3.6 people x 75 gpd/person = 3,780 gpd

31 – Carriage Lots
31 lots with homes – assume 2.56 people per home
31 lots x 2.56 people x 75 gpd/person = 5,952 gpd

Flow from Pump Station No. 2
Flow = 19,880 gpd

Flow from Pump Station No. 3
Flow = 10,752 gpd

Total Flow = 40,364 gpd

Peak Flow = 4 x 40,364 gpd / 18 hours x 60 min/hour = 150gpm

It is 900 linear feet from the pump station to the highest point (ground elevation of 456 feet) in the force main. Overall length of the force main is approximately 12,000 linear feet with a low point of ground elevation of 316 feet and discharging into a manhole with rim elevation of 343 ft.

PRELIMINARY DESIGN PUMPING STATION NO. 2

Calculate Sanitary Flows and Pump Rate

Sanitary flow consists of the flow from the Senior Housing and seven Residential Estate lots.

Senior Housing Average Daily Flow = 19,875 gpd

Flow from Pump Station No. 5
Flow = 5 gpd

Total Flow = 19,880 gpd

Peak Flow = 4 x 19,880 gpd / 18 hours x 60 min/hour = 74 gpm

It is 700 linear feet from the pump station (ground elevation of 430 feet) to the highest point in the force main (ground elevation of 523 feet) which coincides with the discharge point into the gravity sewer in the project.

PRELIMINARY DESIGN PUMPING STATION NO. 3

Calculate Sanitary Flows and Pump Rate

Sanitary flow consists of the flow from the Carriage lots.

56 – Carriage Lots
56 lots with homes – assume 2.56 people per home
56 lots x 2.56 people x 75 gpd/person = 10,752 gpd

Total Flow = 10,752 gpd

Peak Flow = 4 x 10,752 gpd / 18 hours x 60 min/hour = 40 gpm

It is 900 linear feet from the pump station (ground elevation of 450 feet) to the highest point in the force main (ground elevation of 475 feet) which coincides with the discharge point into the gravity sewer in the project.

PRELIMINARY DESIGN PUMPING STATION NO. 4

Calculate Sanitary Flows and Pump Rate
Sanitary flow consists of the flow from the Carriage lots.

13 – Carriage Lots
13 lots with homes – assume 2.56 people per home
13 lots x 2.56people x 75 gpd/person = 2,496 gpd

Total Flow = 2,496 gpd

Peak Flow = 4 x 2,496 gpd / 18 hours x 60 min/hour = 9 gpm.

It is 700 linear feet from the pump station (ground elevation of 440 feet) to the highest point in the force main (ground elevation of 455 feet) which coincides with the discharge point into the gravity sewer in the project.

PRELIMINARY DESIGN PUMPING STATION NO. 5

Calculate Sanitary Flows and Pump Rate
Sanitary flow consists of the flow from seven Residential Estate lots.

5 – Residential Estates
5 lots with homes – assume 3.6 people per home
5 lots x 3.6 people x 75 gpd/person = 1,350 gpd

Total Flow = 1,350 gpd

Peak Flow = 4 x 1,350 gpd / 18 hours x 60 min/hour = 5 gpm

It is 700 linear feet from the pump station (ground elevation of 451 feet) to the highest point in the force main (ground elevation of 489 feet) which coincides with the discharge point into the gravity sewer in the project.

"Peter Radosta" <peter@koesterassociates .com>
07/13/2005 05:31 PM
Please respond to <peter@koesterassociates.com>

To <RMiller@saratogaassociates.com>
cc
bcc
Subject Carriage Hill Estates - Pump Data

Rich,

For the referenced project, please review the attached information, as well as the pump curve data that I will fax you this afternoon.

Each of the pump stations #1, 2, and 3 would be configured as a packaged wet well mounted design. Specifically, the station installation would appear similar to that shown in the attached photos. This style pump station is used in many nearby locations, including within the Town of Brunswick. Closer to your office, you may have seen a similar station as you drive around, as there are over 90 of such stations within Saratoga County. The design considers the flows and force main data you provided me. From a hydraulic perspective, each pump station appears to be straightforward. Although for pump station #1, I have modeled the force main from the station to the high point. Beyond the high point, the model considers the force main will behave as a gravity sewer, thus no friction head loss is considered. Oftentimes, there are varying modeling methods for such piping profiles, so as final design unfolds perhaps we can discuss this in more detail to ensure a proper hydraulic model.

As for the design flow rates, for PS#2 and 3, I've considered a pump flow rate of 100 gpm. This provides for adequate force main scouring velocity, and also allows the pump to operate more to the right within the curve, which offers a better operating point.

For PS#4, I've proposed a duplex grinder submersible pump station, as depicted in the attached CAD file. Initially, I chose a 3 inch diameter force main, but a different size could be utilized, for example 2.5 inches, depending on suitability and availability of your proposed force main materials, soil conditions, etc.

When we are in agreement with the above design approach, I can prepare detailed specifications or any other info you may need for your design. I can also assist with ancillary design elements like site layout, emergency power requirements, alarm systems, etc.

Upon your review, please give me a call if you have any questions or require additional information. As mentioned, I am in the area each week and would be pleased to meet with you to discuss any specific design issues. I will be passing through the Saratoga area tomorrow afternoon and this Friday morning, so give me a call if I should aside some time.

Regards,

- Peter

Peter J. Radosta, P.E.
Koester Associates, Inc.
315.697.3800 phone
315.697.3888 fax
315.727.2534 cell
peter@koesterassociates.com
www.koesterassociates.com


Farm to Market PS (1).jpg


DSC00348.JPG


Carlton by the Lake [4] LP.jpg


Circular Style 4 inch RWWMPS.dwg


Grinder Pump Station.dwg

SYSTEM HEAD CURVE CALCULATIONS

Project Name: Carriage Hill Estates - PS #1
Date: 11 July 2005

Design Point Summary

Design Flow	150	gallons per minute
Force Main Diameter	4	inches
Station Piping Diameter	4	inches
Design C Factor	**120**	
Static Lift	140	feet
Force Main Length	10.5	hundreds of feet
Station Piping	1	hundreds of feet (station pipe equivalent length of same size force main)
Total Eq. Length	11.5	hundreds of feet (includes station loss)
TDH (at C=120)	**161.35**	**feet (calculated)**

System Curve Summary

Flow (gpm)	C FACTOR 100	**C FACTOR 120**	C FACTOR 130	C FACTOR 140	C FACTOR 150	Actual Pump Curve
0	140.00	140.00	140.00	140.00	140.00	
100	154.13	150.08	148.69	147.58	146.67	
150	169.91	**161.35**	158.41	156.05	154.13	
180	181.91	169.91	165.79	162.49	159.79	
200	190.93	176.35	171.35	167.33	164.05	
300	247.83	216.96	206.37	197.86	190.93	
400	323.60	271.04	253.00	238.52	226.72	
500	417.43	338.00	310.75	288.88	271.04	
600	528.73	417.43	379.25	348.60	323.60	
900	963.02	727.39	646.54	581.65	528.73	
1000	1140.15	853.80	755.56	676.69	612.38	
1100	1333.00	991.44	874.25	780.18	703.47	
1200	1541.36	1140.15	1002.49	891.99	801.88	
1300	1765.02	1299.78	1140.15	1012.01	907.52	

Application Summary

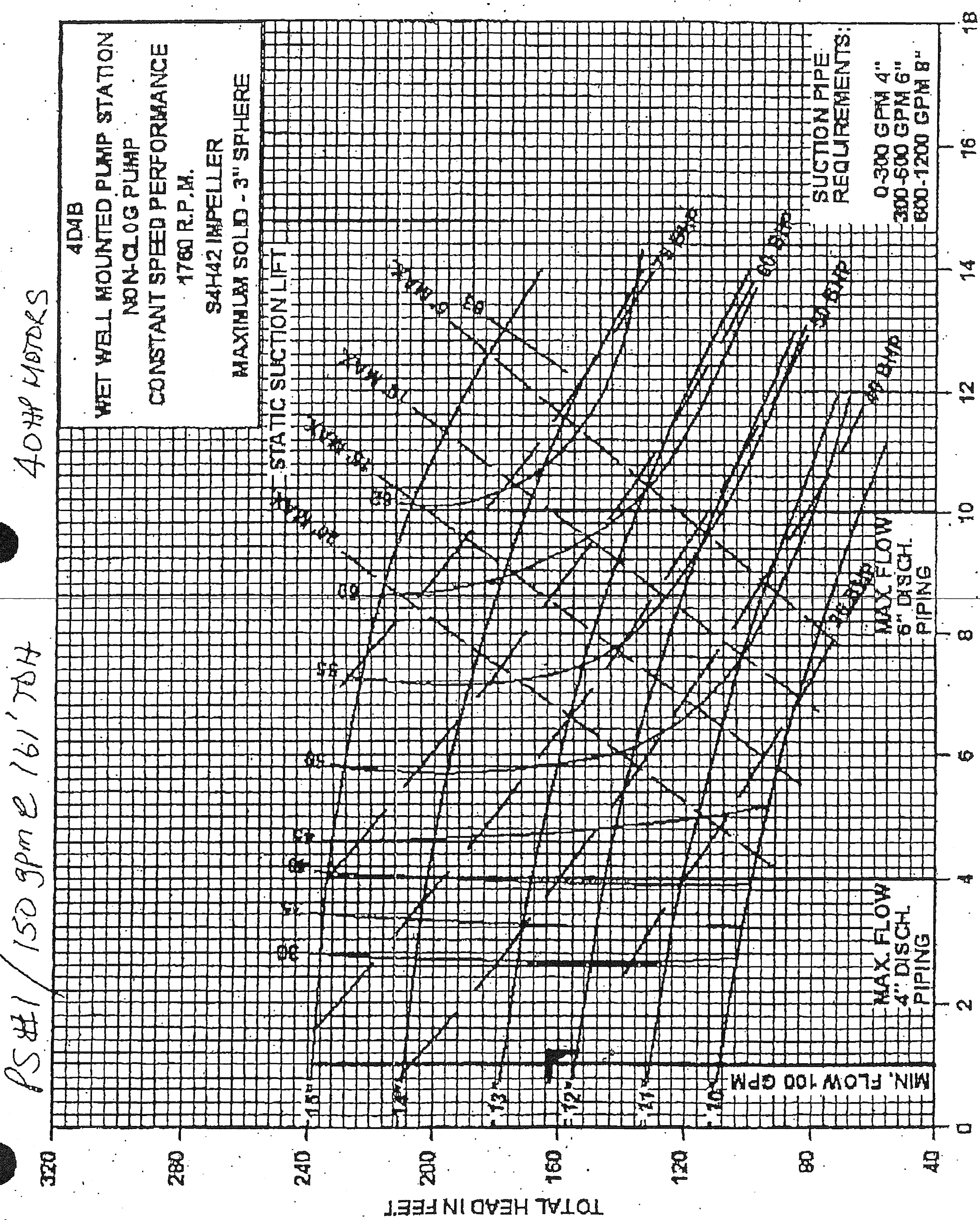
Design Flow	150	gpm
TDH (from above calculations)	161.35	feet
Round to:	161	feet

Please note the System Curve Summary is provided to show system head curves at different possible conditions.
Pipe C Factors change over time, so it is important to consider pump performance at different system curves.

ENGINEERING DATA

Smith & Loveless, Inc.®
14040 West Santa Fe Trail Drive
Lenexa, Kansas 66215-1284

Vacuum Primed Pump Performance Curves
Constant Speed
4D4B Non-Clog Pump
1760 RPM



SYSTEM HEAD CURVE CALCULATIONS

Project Name: Carriage Hill Estates - PS #2
Date: 11 July 2005

Design Point Summary

Design Flow	100	gallons per minute
Force Main Diameter	4	inches
Station Piping Diameter	4	inches
Design C Factor	**120**	
Static Lift	83	feet
Force Main Length	9.9	hundreds of feet
Station Piping	1	hundreds of feet (station pipe equivalent length of same size force main)
Total Eq. Length	10.9	hundreds of feet (includes station loss)
TDH (at C=120)	**92.56**	**feet (calculated)**

System Curve Summary

Flow (gpm)	C FACTOR 100	**C FACTOR 120**	C FACTOR 130	C FACTOR 140	C FACTOR 150	Actual Pump Curve
0	83.00	83.00	83.00	83.00	83.00	
100	96.39	**92.56**	91.24	90.19	89.32	
150	111.35	103.23	100.45	98.21	96.39	
180	122.72	111.35	107.45	104.32	101.76	
200	131.27	117.45	112.71	108.90	105.80	
300	185.20	155.94	145.90	137.84	131.27	
400	257.02	207.20	190.10	176.38	165.19	
500	345.96	270.67	244.84	224.11	207.20	
600	451.45	345.96	309.77	280.71	257.02	
900	863.08	639.74	563.12	501.61	451.45	
1000	1030.97	759.56	666.44	591.69	530.74	
1100	1213.76	890.02	778.94	689.78	617.07	
1200	1411.24	1030.97	900.49	795.76	710.35	
1300	1623.24	1182.27	1030.97	909.52	810.48	

Application Summary

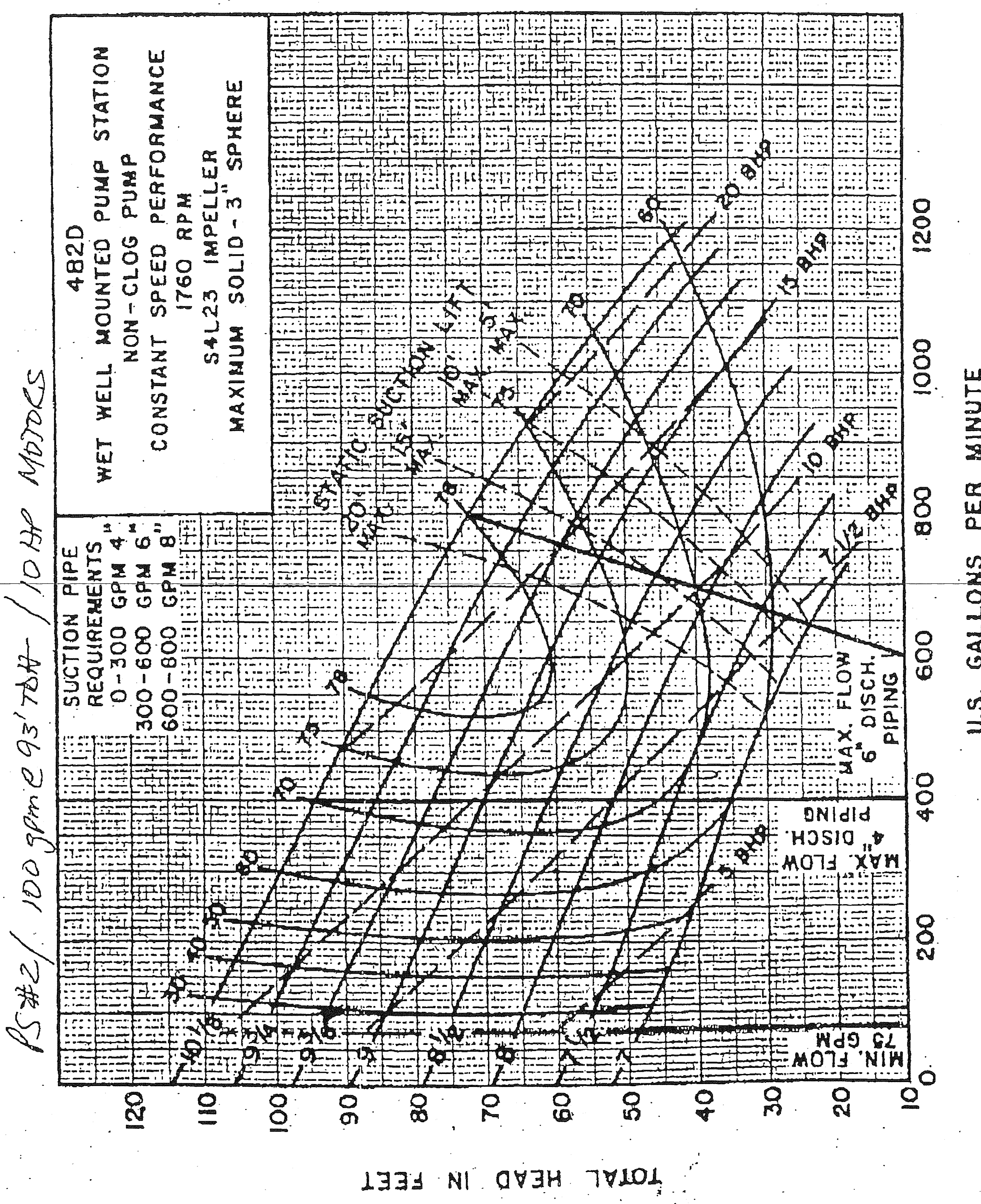
Design Flow	100	gpm
TDH (from above calculations)	92.56	feet
Round to:	93	feet

Please note the System Curve Summary is provided to show system head curves at different possible conditions.
Pipe C Factors change over time, so it is important to consider pump performance at different system curves.

ENGINEERING DATA

Smith & Loveless, Inc.
14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215

Vacuum Primed
Pump Performance Curves
Constant Speed
4B2D
1760 RPM
Page 1
January, 1988



SYSTEM HEAD CURVE CALCULATIONS

Project Name: Carriage Hill Estates - PS #3
Date: 11 July 2005

Design Point Summary

Design Flow	100	gallons per minute
Force Main Diameter	4	inches
Station Piping Diameter	4	inches
Design C Factor	**120**	
Static Lift	25	feet
Force Main Length	9	hundreds of feet
Station Piping	1	hundreds of feet (station pipe equivalent length of same size force main)
Total Eq. Length	10	hundreds of feet (includes station loss)
TDH (at C=120)	**33.77**	**feet (calculated)**

System Curve Summary

Flow (gpm)	C FACTOR 100	**C FACTOR 120**	C FACTOR 130	C FACTOR 140	C FACTOR 150	Actual Pump Curve
0	25.00	25.00	25.00	25.00	25.00	
100	37.28	**33.77**	32.56	31.59	30.80	
150	51.01	43.56	41.01	38.96	37.28	
180	61.44	51.01	47.43	44.56	42.21	
200	69.29	56.61	52.26	48.76	45.92	
300	118.76	91.92	82.71	75.32	69.29	
400	184.65	138.94	123.26	110.67	100.41	
500	266.25	197.18	173.48	154.46	138.94	
600	363.02	266.25	233.04	206.39	184.65	
900	740.67	535.78	465.47	409.04	363.02	
1000	894.69	645.70	560.27	491.69	435.77	
1100	1062.39	765.38	663.48	581.68	514.98	
1200	1243.57	894.69	774.99	678.91	600.55	
1300	1438.06	1033.50	894.69	783.27	692.41	

Application Summary

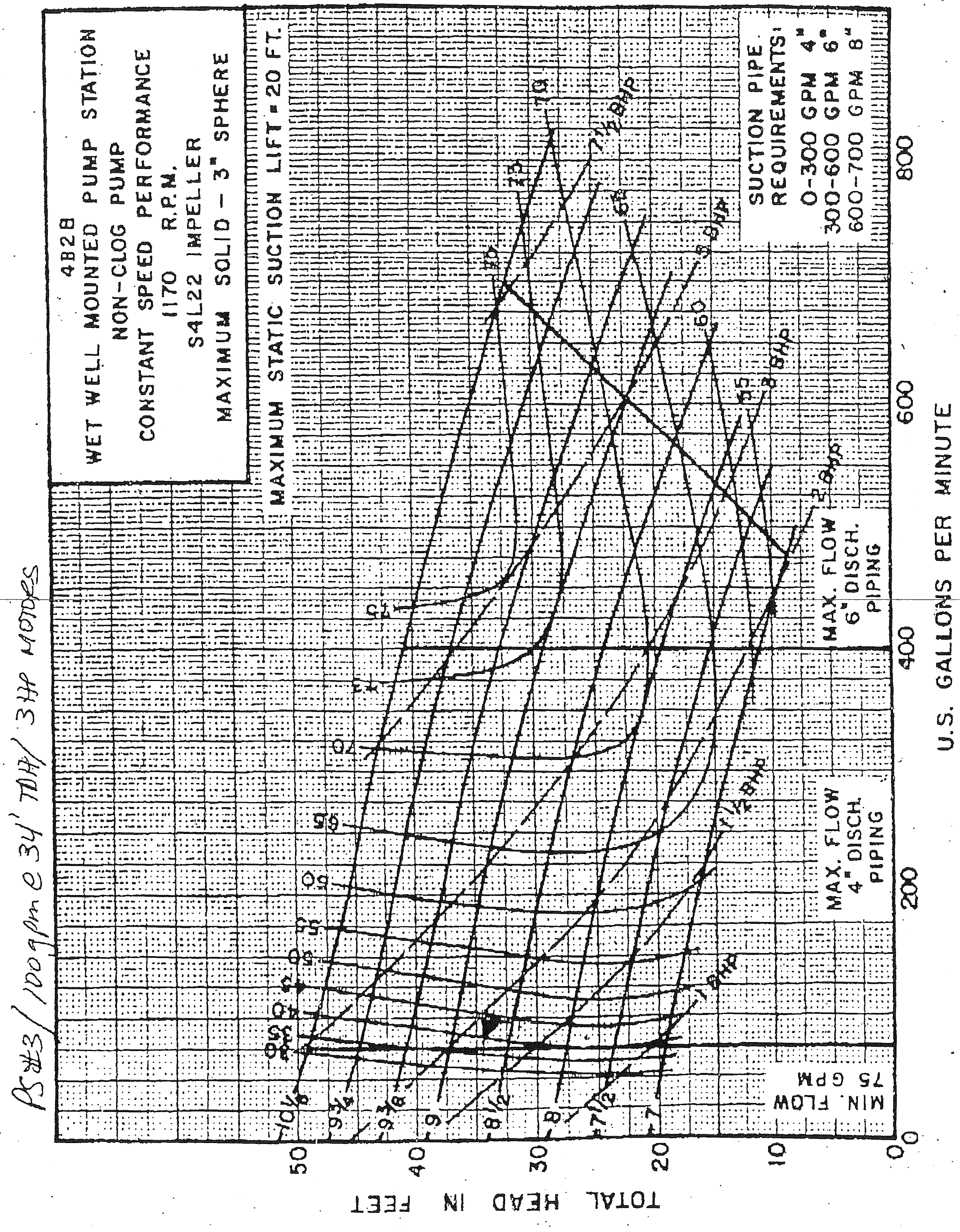
Design Flow	100	gpm
TDH (from above calculations)	33.77	feet
Round to:	34	feet

Please note the System Curve Summary is provided to show system head curves at different possible conditions.
Pipe C Factors change over time, so it is important to consider pump performance at different system curves.

ENGINEERING DATA

Vacuum Primed
Pump Performance Curves
Constant Speed
4B2B
1170 RPM

Smith & Loveless, Inc.
14040 W. Santa Fe Trail Dr.
Lenexa, Kansas 66215



SYSTEM HEAD CURVE CALCULATIONS

Project Name: Carriage Hill Estates - PS #4 & #5
Date: 11 July 2005

Design Point Summary

Design Flow	35	gallons per minute
Force Main Diameter	2.5	inches
Station Piping Diameter	3	inches
Design C Factor	**120**	
Static Lift	15	feet
Force Main Length	7	hundreds of feet
Station Piping	1	hundreds of feet (station pipe equivalent length of same size force main)
Total Eq. Length	8	hundreds of feet (includes station loss)
TDH (at C=120)	**24.90**	**feet (calculated)**

System Curve Summary

Flow (gpm)	C FACTOR 100	**C FACTOR 120**	C FACTOR 130	C FACTOR 140	C FACTOR 150	Actual Pump Curve
0	15.00	15.00	15.00	15.00	15.00	
35	28.87	**24.90**	23.54	22.44	21.55	
40	32.76	27.67	25.93	24.53	23.39	
60	52.60	41.83	38.14	35.18	32.76	
80	79.02	60.69	54.40	49.35	45.24	
100	111.74	84.04	74.54	66.91	60.69	
120	150.55	111.74	98.42	87.74	79.02	
140	195.28	143.66	125.95	111.74	100.15	
600	2676.84	1914.75	1653.27	1443.38	1272.23	
900	5650.74	4037.22	3483.61	3039.22	2676.84	
1000	6863.61	4902.84	4230.09	3690.07	3249.69	
1100	8184.18	5845.33	5042.86	4398.71	3873.42	
1200	9610.94	6863.61	5920.98	5164.33	4547.30	
1300	11142.49	7956.67	6863.61	5986.18	5270.68	

Application Summary

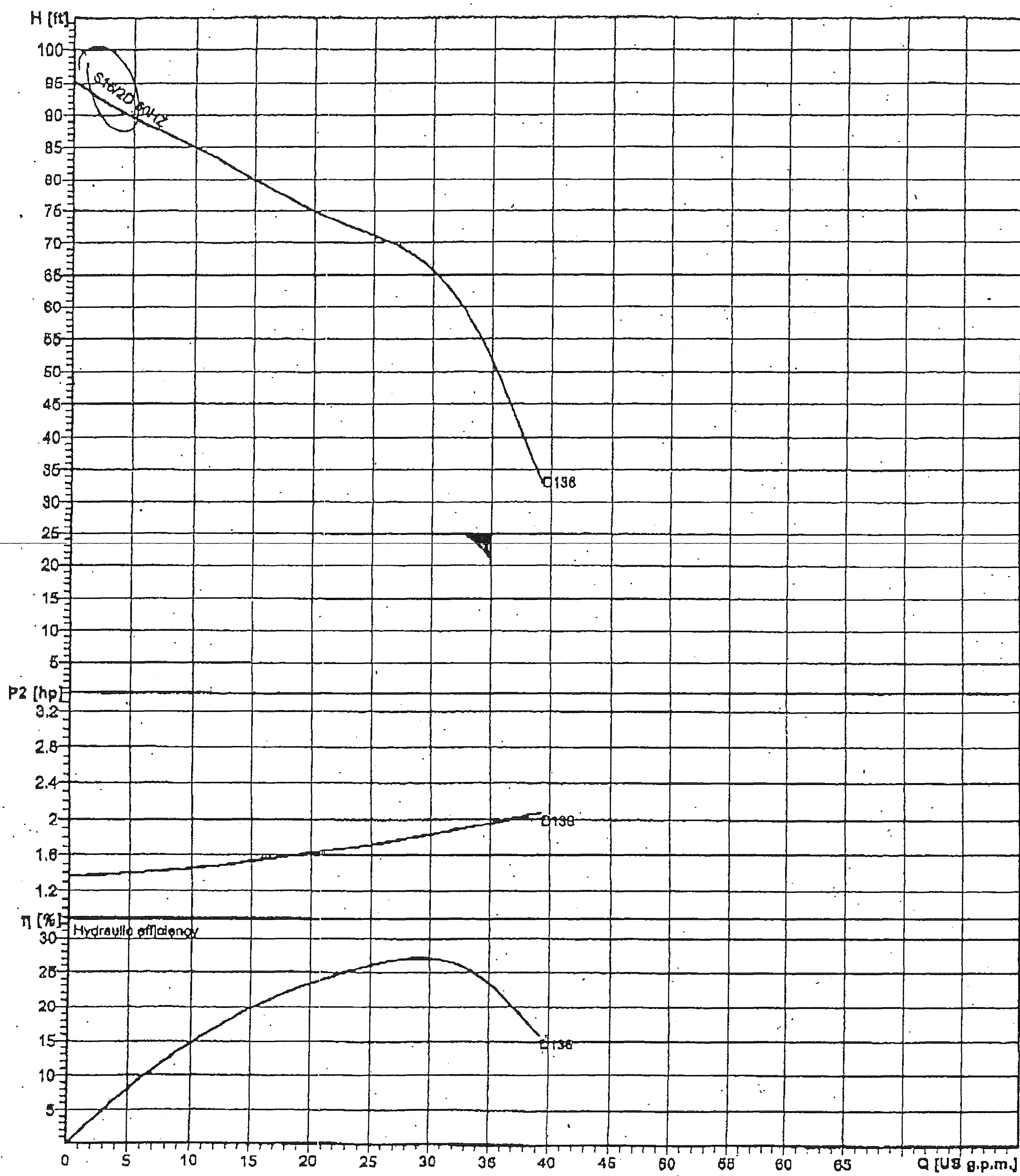
Design Flow	35	gpm
TDH (from above calculations)	24.90	feet
Round to:	25	feet

Please note the System Curve Summary is provided to show system head curves at different possible conditions.
Pipe C Factors change over time, so it is important to consider pump performance at different system curves.

ABS COST-EFFECTIVE PUMPING

Pump performance curves
PIRANHA S16 D 60 HZ

PS#4 / 35 gpm @ 25' TDH / 2HP MOTORS			Discharge 1.25 Inch	Curve number
				Reference curve PIRANHA S D
				Frequency 60 Hz
Density 1 kg/dm³	Viscosity 1.562 cSt	Testnorm Hydraulic Institute	Rated speed 3395..3420 rpm	Date 2004-05-20
Flow	Head	Rated power	Hydraulic efficiency	NPSH



Impeller size 136mm	N° of vanes 4	Impeller Macerator	Solid size	Revision 2003-06-10

ABSELPRO 1.7.1 / 2004-01-30

Sanitary Sewer Flow Estimates

The sanitary sewer flow estimates are based on the number of persons living in the development with an average daily flow of 75 gallons per day per person. Peaking factors of 2.0 and 4.0 are utilized for the maximum daily and peak hourly flows, respectively. The estimated sanitary sewer flows are:

Senior Housing

204 living units – assume 1.3 people per unit
(204 x 1.3) = 265 residents

Average Daily Flow	75 gpd/person x 265 =	19,875 gpd
Maximum Daily Flow	2.0 x 19,875 gpd =	39,750 gpd
Peak Hourly Flow	(4.0 x 19,875) / (18 hrs/day)(60 min/hr) =	74 gpm

Residential Estate Lots (4 Bedroom)

19 lots with homes – assume 3.6 people per home
(19 x 3.6) = 68 residents

Average Daily Flow	75 gpd/person x 68 =	5,100 gpd
Maximum Daily Flow	2.0 x 5,100 gpd =	10,200 gpd
Peak Hourly Flow	(4.0 x 5,100) / (18 hrs/day)(60 min/hr) =	19 gpm

Carriage Lots (3 Bedroom)

87 lots with homes – assume 2.56 people per home
(87 x 2.56) = 223 residents

Average Daily Flow	75 gpd/person x 223 =	16,725 gpd
Maximum Daily Flow	2.0 x 16,725 gpd =	33,450 gpd
Peak Hourly Flow	(4.0 x 16,725) / (18 hrs/day)(60 min/hr) =	62 gpm

Total Sanitary Sewer Flows

Average Daily Flow	19,875 + 5,100 + 16,725 =	41,700 gpd
Maximum Daily Flow	39,750 + 10,200 + 33,450gpd =	83,400 gpd
Peak Hourly Flow	74 + 19 + 62 =	155 gpm