

HYDRAULIC ANALYSIS

FINAL REPORT

**UNIFIED STUDY
YONKERS WATER DISTRIBUTION SYSTEM
ANALYSIS ON THE EFFECTS OF NEW
DEVELOPMENTS**

AUGUST 2008

Prepared for:

**CITY OF YONKERS, NEW YORK
DEPARTMENT OF PUBLIC WORKS**

LACKOWITZ ENGINEERING

LACKOWITZ ENGINEERING

August 21, 2008

Mr. John Speight
Superintendent
Yonkers Water Bureau
170 Saw Mill River Road
Yonkers, New York 10703

Re: Final Report
Unified Analysis on the Effect of New Development on Water System Conditions in Both
the High and Low Service Systems

Dear Mr. Speight:

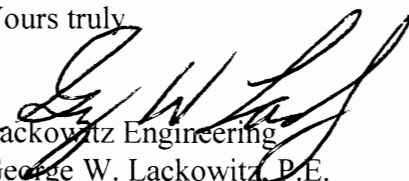
Significant new developments have been proposed in the City of Yonkers which will increase demand upon the existing water system. These developments include:

- The SFC Projects consisting of River Park Center, Palisades Point and the Cacase Center
- Proposed additional developments identified by the Yonkers Department of Planning

The enclosed Unified Analysis identifies the effect these developments will have on the Yonkers Water System and recommends Water System Improvements.

If you have any questions or comments, please do not hesitate to contact me.

Yours truly


Lackowicz Engineering
George W. Lackowicz, P.E.

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UNIFIED STUDY
CITY OF YONKERS**

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CITY OF YONKERS**

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CITY OF YONKERS**

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**EXECUTIVE SUMMARY
UNIFIED STUDY
OF YONKERS WATER DISTRIBUTION SYSTEM
ANALYSIS ON THE EFFECTS OF NEW DEVELOPMENTS
AUGUST 2008**

An analysis has been performed to quantify the effect of the following proposed developments in both the high and low service zones of the Yonkers water distribution system:

The SFC Projects consisting of the River Park Center, Palisades Point and Cacase Center. These developments are referred to in the report as the Phase I Developments.

Proposed additional developments identified by the Yonkers Department of Planning and included in the DEIS for River Park/Cacase/Palisades Point sites. These proposed developments are referred to in the report as the Phase II Developments.

Summary of the Results of the Analyses

To perform the analyses, the Yonkers Hydraulic Model was upgraded and recalibrated. The criteria water demand condition for analyzing the system was at the maximum day demand. At the maximum day water demand condition, the following system vulnerabilities were identified:

- Fire Flow Availability and Water Pressure on Ashburton Avenue
- Fire Flow Availability and Water Pressure in portions of Southwest Yonkers (the area south of Valentine Lane between Riverdale Avenue and South Broadway)
- Water pressure issues along Rumsey Road

Phase I Developments

At maximum day water demand conditions and with the existing water distribution system, the proposed Phase I Developments will reduce domestic pressure in the Downtown Area, and further worsen water system conditions in the areas with the identified vulnerabilities. However, construction of the proposed Phase I Pipeline Project in the vicinity of the River Park Center project

(See Figure 1) will mitigate the effects of the Phase I Developments in the Downtown Area (including in the vicinity of City Hall and Refined Sugar), but construction of the proposed Phase I Pipeline Project will not address the vulnerabilities identified on Ashburton Avenue, Rumsey Road or Southwest Yonkers. Therefore, to address the identified vulnerabilities requires the following:

Project	Phasing	Description	Purpose
Ashburton Avenue Project	Prior to the start of River Park Center construction to prevent construction activities from reducing water pressure in the area.	Clean and cement line pipelines on Ashburton, Locust Hill and Palisades Avenue. Connect portions of water main to high service zone.	Increase fire flow availability and maximum day domestic pressure in area.
Phase I Pipeline Project	As part of River Park Center	Water mains around River Park Center site and on Prospect Street	Mitigate the effect of Phase I development in Downtown Area
Southside Connection to Palisades Point	As part of Palisades Point Development	Installation of water mains from Hawthorne Avenue and across the Metro North railroad tracks to Palisades Point site.	Maintain domestic pressure and fire flow availability at Palisades Point site in the event of a pipeline rupture or shut down.
Southwest Yonkers Improvement Project	Prior to completion of Phase I Developments	Clean and cement line distribution mains and replacement and/or installation of transmission mains in Southwest Yonkers.	Increase fire flow availability and maximum day domestic pressure in area south of Valentine Lane in southwest Yonkers.

Rumsey Road Project	Prior to completion of Phase I Developments	Create an intermediate pressure service zone along Rumsey Road.	Increase domestic pressure along Rumsey Road.
Water Treatment Plant Pump Project	In Progress by City of Yonkers	Installation of additional 8 MGD pump and replacement of an existing pump with 8 MGD pump.	Increase capacity at pump station to maintain normal water system conditions at Phase II plus fire demands. Additionally provides full pump redundancy at Water Treatment Plant.
Low Service Pump Station Project	In Progress by City of Yonkers	Install additional 7 MGD pump at Low Service Station.	Provides pump redundancy at Low Service Station.
North Broadway Transmission Main project	In Progress by City of Yonkers	Installation of transmission main in North Broadway and Ashburton Avenue.	Provide additional source of supply to Mulford Gardens and proposed high service portion of Ashburton Avenue.

Phase II Projects

The Phase II projects consist of 25 new developments (16 in the low service zone, 9 in the high service zone) distributed around the distribution system. Model simulations were performed considering the combined water demands from both the Phase I and Phase II Developments. These simulations indicated adding the water demands from the Phase II Developments has no significant additional impact on the water system.

**UNIFIED STUDY
OF YONKERS WATER DISTRIBUTION SYSTEM
ANALYSIS ON THE EFFECTS OF NEW DEVELOPMENTS
AUGUST 2008**

OVERVIEW

Significant new developments have been proposed in the City of Yonkers which will increase water demands upon the existing system. In order to quantify the effects the new developments will have throughout the Yonkers water distribution system, a unified analysis of the water distribution system incorporating all of the proposed developments throughout the City has been performed. The analysis:

- Estimates the effect that the developments will have on water pressure and fire flow availability in both the high and low service zones.
- Identifies water system improvements to mitigate the identified effects.

In order to perform the analysis, the existing Yonkers Hydraulic Model was upgraded and recalibrated. The model was then utilized to analyze water system conditions at:

- Average day water demands
- Maximum day water demands
- Maximum day water demands plus fire flow

MODEL DEVELOPMENT

The hydraulic model provides a mathematical representation of all major components in the Yonkers water distribution system including:

- Sources of water supply – Connections to the New York City water supply system
- Individual pumps at each of the system's pump stations
- The three existing 1 Million Gallon Storage Tanks
- All pipes 16 inches in diameter and larger as well as major 12 inch, 8 inch and 6 inch diameter pipelines.

Pipelines

The length, diameter and friction factor for major pipelines in the distribution system are incorporated into the model. This procedure produces a “skeleton” of the water system composed of the pipelines connecting the sources of supply, pump stations, water storage tanks and water demands throughout the distribution system.

Water Demands

Utilizing chart records from the sources of supply, pump stations and water storage tanks, the diurnal pattern of water demand conditions were developed. The twenty-four hour average day water demand (rounded to the nearest 0.1 MGD) for each of the development scenarios were prepared as follows:

Average Day Baseline Demand – 28.4 MGD consisting of:

1. 2007 Average Day city-wide demand of 28 MGD
2. Estimated Average Day water demand for the Ridge Hill development of 0.375 MGD

Average Day Phase I Demands – 28.9 MGD consisting of:

1. Baseline demand of 28.4 MGD
2. Estimate of Average Day demands for the River Park Center, Cacase Center and Palisades Point developments as identified in Table 2A prepared by Divney Tung Schwalbe and included in Appendix A – 0.498 MGD

Average Day Phase II Demands – 29.4 MGD consisting of:

1. Phase I demands – 28.9 MGD
2. Phase II demands consisting of 25 new developments distributed around the distribution system as identified in Table 3 prepared by Divney Tung Schwalbe and included in Appendix A.– 0.515 MGD

Maximum Day Demands

The New York State Health Department evaluates water system improvements at the criteria of maximum day water demand conditions. Therefore, the Unified Study will utilize maximum day water demand conditions to evaluate the effect of the Phase I and Phase II Developments on the Yonkers Water System.

The historic maximum day water demand for the Yonkers distribution system is 45 MGD. The maximum day water demand for the proposed developments was calculated utilizing a “peaking factor” to convert average day demands to maximum day demands. The current city-wide peaking factor of maximum day demands (45 MGD) to average day (28 MGD) is 1.6. This includes the range of water users from low density residential customers (whose demands can increase significantly at the maximum day due to lawn sprinkling) to industrial users (with little or no additional demand at the maximum day). Therefore the city-wide peaking factor of 1.6 would not be appropriate for the proposed new demands.

In order to estimate a peaking factor for the new demands, an analysis was performed of water meter records for five (5) existing office buildings in the SWEP site. This analysis indicated that the average daily demand for the five office buildings in the period March 2005 to September 2005 was 0.128 gallons per day per square foot. This represents an increase of 28 percent over the 0.1 gallons per day per square foot factor used to estimate the average daily water demand for office buildings.

To account for the difference between a six month average (March to September) and the maximum day, a 40 percent increase over average day was utilized resulting in a peaking factor of 1.4. Since the factors that will increase summer period water usage for high density residential developments are similar

to an office building (water cooled air conditioning systems, irrigation of landscaping) a factor of 1.4 was used for both proposed high density residential and office demands.

This results in the following demands for each development scenario:

Maximum Day Baseline Demand – 45.5 MGD

This includes:

1. Historic Maximum Day city-wide demand of 45 MGD
2. Estimated Maximum Day water demand for the Ridge Hill development of 0.52 MGD

Maximum Day Phase I Demand – 46.2 MGD

This includes a combined demand of 0.7 MGD for the Phase I Developments

Maximum Day Phase II Demand – 47 MGD

This includes:

1. Phase I demand 0.7 MGD
2. Demand for the Cintas facility based on all equipment simultaneously operational for the entire 24 hour day - .17 MGD
3. Demand of .63 MGD for all other developments in Phase II

Maximum Day Demand Plus Fire

For each of the development scenarios, an estimate of fire flow availability was calculated at representative locations in the distribution system. These simulations were performed considering a 3,500 gallon per minute (gpm) fire flow. A 3,500 gpm fire flow is based on Insurance Service Organization (ISO) methodology which provides that 3,500 gpm is the maximum fire flow from a public water system. The ISO methodology was utilized to conform to “Recommended Standards for Water Works”, the criteria used by the New York

State Health Department for evaluating public water system improvements. Since a fire could occur at any time, the fire flow availability calculation is performed at system-wide maximum day demand conditions.

SYSTEM IMPROVEMENTS

The hydraulic model incorporates the following system improvements:

Tuckahoe Road Improvement Program

This recently completed program which included the installation of new high capacity transmission mains as well as the cleaning and cement lining of existing transmission mains, increased flow availability to the Downtown Area and the high service pumps in Northwest Yonkers.

North Broadway Transmission Main

This planned project consists of the installation of a new high capacity transmission main from the SWEP Water Storage Tank in Northwest Yonkers to the southern boundary of the high service zone on Ashburton Avenue.

Water Treatment Plant Pump Project

This planned project increases supply to the high service zone in Northwest Yonkers by increasing the capacity of the high service pumps at the Water Treatment Plant.

These projects either already completed or currently planned by the City of Yonkers, have significantly improved water system conditions in both the Downtown Area and Northwest Yonkers.

MODEL CALIBRATION

In the model calibration process, the ability of the model to simulate observed water system conditions is tested. Water system parameters are modified until an acceptable agreement between observed and calculated water system conditions is obtained. For this project the following two calibration procedures were performed:

Extended period calibration over the 24 hour day

Hydrant flow calibration

A discussion of this calibration process follows.

Extended Period Calibration

For this project, the model was tested for its ability to simulate the relationship of the following:

- The water level in two of the three system water tanks (during the calibration period the Concord Water Tank was out of service for maintenance).
- A continuous record of water pressure in the City Hall area.

The calibration analysis was performed for water system conditions observed on Monday, June 9, 2008. Water demands on this 90 degree day was 32.5 MGD. Starting at 8:00 a.m. with a known water level in each of the three water storage tanks, the model simulated the rise and fall of the level in the storage tanks as well as the change in water pressure in the City Hall area. As the figures enclosed in Attachment B indicates, the model simulated the rise and fall over the entire 24 hour day of the levels in the water tanks and the pressure in the downtown area.

Hydrant Flow Calibration

In order to further test the model's ability to simulate water system conditions in the downtown area, model simulations of hydrant flow tests were compared to the results of actual flow tests. As is shown in Table 1, the model simulated the observed pressure drop during the hydrant flow to within 2 psi at each location. These calibrations indicate the model's ability to simulate water system conditions in the Yonkers distribution system.

USE OF THE HYDRAULIC MODEL TO ANALYZE THE EFFECTS OF THE PROPOSED DEVELOPMENTS

Average Day Water Demands

At the average day water demand conditions the Phase I and Phase II developments will have little or no effect upon water system conditions in the Yonkers system. As Table 2 indicates, the hydraulic model calculates a 1 psi drop in water pressure from baseline conditions to Phase I conditions and a 1 psi from Phase I conditions to Phase II conditions. These differences are within the accuracy of the model and therefore are not significant.

Maximum Day Water Demands

At the maximum day water demand condition and without water main improvements, both the Phase I and Phase II Development scenarios will have a negative impact upon water system conditions. As Table 3 indicates the Phase I Developments will result in a reduction of water pressure in both the City Hall area and in the vicinity of Refined Sugar. Additionally, an increase of flow through the Odell Avenue Pressure Reducing Valve (PRV) results in a decrease in the minimum water level of the SWEP tank.

Hydraulic analyses performed in 2007 identified the need for the following projects in the vicinity of the River Park Center development:

- 16 inch diameter water main on Nepperhan Avenue from Elm Street to New Main Street
- 16 inch diameter water main on New Main Street from Nepperhan Avenue to Palisades Avenue
- 16 inch diameter water main on Palisades Avenue from Elm Street to New Main Street
- 16 inch diameter water main on Prospect Street from South Broadway to Riverdale Avenue

As part of this analysis, a 12 inch diameter water main on Elm Street from Nepperhan Avenue to Palisades Avenue has been added. These mains shown on Figure 1, ring the River Park Center site and combined with the Prospect Street pipeline, form the Phase I Pipeline Projects.

As Table 4 indicates, in the vicinity of River Park Center and Refined Sugar, the Phase I Pipeline Projects mitigate the effects upon domestic water pressure of the Phase I Developments. But, the Phase I Pipeline Projects do not improve current low pressure conditions in the following areas:

Ashburton Avenue

This area includes Ashburton Avenue, Locust Hill Avenue (from Palisades Avenue to Ashburton Avenue) and Palisades Avenue (from Elm Street to Ashburton Avenue). The analysis indicates that even with the Phase I Pipeline Projects, fire flow availability on Ashburton Avenue remains at less than 500 gpm during the maximum day water demand condition. Additionally model simulations indicate that during the peak hour of the maximum day, water pressure along Ashburton Avenue would drop to approximately 20 psi. With this area immediately adjacent to the River Park site, water consuming activities during construction will further stress the hydraulically fragile area. To address

this situation will require that either the following work be performed prior to the start of construction on the River Park site (See Figure 2):

- Cleaning and cement lining existing pipelines along Ashburton Avenue, Palisades Avenue and Locust Hill Avenue
- Transferring a portion of the water main on Ashburton Avenue to the high service zone. Initially the Ashburton Avenue line would be supplied from a high service line on Vineyard Avenue through the proposed pipeline installed as part of the Mulford Gardens project. When the North Broadway transmission main is completed, it would connect to the Ashburton Avenue high service line to provide a second source of supply

or

The implementation of an approved Construction Water Remedial Plan.

Finally, as also shown on Table 4, water system conditions are not significantly different at the Phase II Development scenario as compared to the Phase I Development. Therefore, this indicates that the Phase II Developments have no significant additional impact.

Southwest Yonkers Improvement Project

Simulations indicate with existing system during maximum day water demand conditions, water pressure in the area south of Valentine Lane between Riverdale Avenue and South Broadway drop significantly. Model simulations indicate that at the peak hour of the maximum day, water pressures of approximately 20 psi can be expected. As Table 4 indicates, this situation is not significantly improved by the Phase I Pipeline Projects. To address this situation will require a combination of pipeline cleaning and cement lining as well as the installation of new transmission mains (See Figure 2). Creation of a booster pumping zone combined with pipeline cleaning and cement lining in the area may be a cost effective alternative to address the situation.

Rumsey Road

Rumsey Road is another area in the low service system which is at one of the higher elevations supplied by the low service system. Pipeline cleaning and cement lining in the area has improved pressure conditions, but in order to maintain normal pressure in the area throughout the maximum day, installation of a pressure reducing valve from the high service system to the low service system on Rumsey Road to create a new intermediate pressure zone area would be required.

Maximum Day Plus Fire Flow

As an indication of the effect upon the fire flow availability of the Phase I and Phase II Development projects, simulations were performed to estimate the residual water pressure during a three hour, 3,500 gpm fire flow at the following representative locations:

- City Hall
This is representative of fire flow availability at the River Park Center/Cacase development site.
- Vark Street and Riverdale Avenue
This is representative of the fire flow availability in the downtown area including the volume of fire flow available to the Refined Sugar facility.
- Palisades Point
- South Westchester Executive Park (SWEP)

The model simulations for the locations in downtown Yonkers are summarized in Table 5. As this table indicates, the Phase I pipeline projects will mitigate the effect on fire flow of both the Phase I and Phase II developments in vicinity of City Hall and Refined Sugar.

EFFECT OF THE PHASE I AND PHASE II DEVELOPMENTS ON SOURCES OF SUPPLY

At the maximum day water demand condition, the Phase I and Phase II Developments combined will increase demands by 1.5 MGD from 45.5 MGD (baseline) to 47.0 MGD (combined Phase I and Phase II developments). Model simulations indicate that the additional flow will be provided from the following sources of supply:

Mountaindale Connection
Supplied by the Catskill Aqueduct: Increase of 0.8 MGD

Kensico Line
Supplied by Shaft 22 of the Delaware Aqueduct: Increase of 0.7 MGD

The model simulations also indicate that increases of this magnitude have no impact on the operation of either the Mountaindale or Kensico Line connections. The Kensico Line (operated by County Water District No. 1 and supplied by Shaft 22) also provides supply to the City of Mount Vernon at the Springer Avenue Connection. Model simulations indicate that the additional flow to Yonkers from the Kensico Line will not impact supply pressure to the City of Mount Vernon at Springer Avenue.

OTHER CONSIDERATIONS

Additional issues identified by the study were as follows:

Redundant Supply to Palisades Point Development

Currently the source of all water supply to the Palisades Point development is from two connections to the distribution system north of the development. But, a water main break or shut down within the development could result in a total loss of supply to the Palisades Point site. To address this situation, a southern source of supply from Hawthorne Street is required. Four alternatives have been

identified to supply a second source of supply to the Palisades Point development, all of which achieve the required hydraulic goals.

Additional Pumps

All maximum day simulations were performed with the proposed 8 MGD pump at the Water Treatment Plant operational. As is shown in Table 6, during the maximum day water demand condition, the proposed 8 MGD pump at the Water Treatment Plant is necessary to maintain normal water system conditions with a three hour, 3,500 gpm fire flow in Northwest Yonkers.

In order to provide pump redundancy at both the Water Treatment Plant Pump Station and the Low Service Pump Station the following is required:

- Replacement of an existing pump with an 8 MGD pump at the Water Treatment Plant
- Installation of an additional 7 MGD pump at the Low Service Pump Station

**TABLE 1
UNIFIED STUDY
CITY OF YONKERS
MODEL CALIBRATION
HYDRANT FLOW TEST**

Location	Hydrant Flow	Observed Pressure Drop	Simulated Pressure Drop
Palisades Point	1,470 gpm	15 psi	16 psi
Larkin Plaza	1,450 gpm	11 psi	12 psi
Alexander Street near intersection with Wells Street	1,000 gpm	5 psi	5 psi
Riverdale Avenue near intersection with Ashburton Avenue	1,300 gpm	4 psi	5 psi
Ashburton Avenue between Warburton Avenue and Broadway	600 gpm	3 psi	4 psi
Ashburton Avenue and Vineyard Avenue	400 gpm	6 psi	7 psi
Nepperhan and Ashburton Avenue	1,200 gpm	4 psi	2 psi

**TABLE 2
UNIFIED STUDY
CITY OF YONKERS
AVERAGE DAY WATER DEMAND CONDITION
EXISTING DISTRIBUTION SYSTEM**

Calculated Daily Minimum Water Pressure

	Baseline	Phase I Development	Phase II Development
Location	Existing Distribution System	Existing Distribution System	Existing Distribution System
City Hall	73 psi	72 psi	71 psi
Refined Sugar Facility	102 psi	101 psi	100 psi
Ashburton Avenue and Locust Hill	37 psi	36 psi	35 psi
Riverdale Avenue south of Valentine Lane	40 psi	39 psi	38 psi
Rumsey Road	35 psi	34 psi	34 psi
SWEP site	82 psi	82 psi	80 psi

Water Tank Levels

Note: At average day water demand conditions, the simulations considered one pump operating at the Water Treatment Plant, Hillview Pump station and Crisfield Pump station. With ample capacity at each of these pump stations, any one of the three water storage tanks can be completely filled by turning an additional pump.

**TABLE 3
UNIFIED STUDY
CITY OF YONKERS
MAXIMUM DAY WATER DEMAND CONDITION
EXISTING DISTRIBUTION SYSTEM**

Calculated Daily Minimum Water Pressure

	Baseline	Phase I Development	Phase II Development
Location	Existing Distribution System	Existing Distribution System	Existing Distribution System
City Hall	57 psi	52 psi	49 psi
Refined Sugar Facility	86 psi	81 psi	79 psi
Ashburton Avenue and Locust Hill	20 psi	15 psi	12 psi
Riverdale Avenue south of Valentine Lane	20 psi	16 psi	14 psi
Rumsey Road	25 psi	23 psi	21 psi
SWEP site	75 psi	74 psi	72 psi

Calculated Daily Minimum Water Tank Levels

SWEP Tank (gallons)	510,000	470,000	360,000
% of Capacity	51%	47%	36%

Proposed additional 8 MGD Pump operating at Water Treatment Pump Station
One of one pumps operating at Low Service Pump Station.

Nodine Hill Tank (gallons)	700,000	700,000	690,000
% of Capacity	70%	70%	69%

All pumps operating at Hillview Pump Station

Concord Tank (gallons)	900,000	900,000	880,000
% of Capacity	90%	90%	88%

One of three pumps operating at Crisfield Pump Station

Calculated Daily Maximum Flow

Odell Avenue PRV	1.6 MGD	1.7 MGD	2.0 MGD
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**TABLE 4
UNIFIED STUDY
CITY OF YONKERS
MAXIMUM DAY WATER DEMAND CONDITION
WITH PHASE I PIPELINE PROJECTS**

Calculated Daily Minimum Water Pressure

Location	Baseline Existing Distribution System	Phase I Development Phase I Pipeline Projects	Phase II Development Phase I Pipeline Projects
City Hall	57 psi	60 psi	58 psi
Refined Sugar Facility	86 psi	88 psi	86 psi
Ashburton Avenue and Locust Hill	20 psi	24 psi	21 psi
Riverdale Avenue south of Valentine Lane	20 psi	22 psi	20 psi
Rumsey Road	25 psi	24 psi	23 psi
SWEP site	75 psi	75 psi	73 psi

Calculated Daily Minimum Water Tank Levels

SWEP Tank (gallons)	510,000	510,000	400,000
% of Capacity	51%	51%	40%

Proposed additional 8 MGD Pump operating at Water Treatment Pump Station
One of one pumps operating at Low Service Pump Station.

Nodine Hill Tank (gallons)	700,000	700,000	690,000
% of Capacity	70%	70%	69%

All pumps operating at Hillview Pump Station

Concord Tank (gallons)	900,000	900,000	880,000
% of Capacity	90%	90%	88%

One of three pumps operating at Crisfield Pump station

Calculated Daily Maximum Flow

Odell Avenue PRV	1.6 MGD	1.4 MGD	1.7 MGD
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**TABLE 5
UNIFIED STUDY
CITY OF YONKERS
THREE HOUR, 3,500 GPM FIRE FLOW IN DOWNTOWN YONKERS
WITH PHASE I PIPELINE PROJECTS**

Calculated Residual Water Pressure

	Baseline	Phase I Development	Phase II Development
Fire Flow Location	Existing Distribution System	Phase I Pipeline Projects	Phase I Pipeline Projects
City Hall	43 psi	53 psi	52 psi
Vark and Riverdale Avenue	56 psi	63 psi	62 psi
Palisades Point	20 psi	26 psi	24 psi

**TABLE 6
UNIFIED STUDY
CITY OF YONKERS
THREE HOUR, 3,500 GPM FIRE FLOW ON SWEP SITE IN NORTHWEST
YONKERS
(HIGH SERVICE ZONE)**

**WITH PHASE I PIPELINE PROJECTS
WITHOUT PROPOSED 8 MGD PUMP AT WATER TREATMENT PLANT**

Calculated Residual Water Pressure

Location	Baseline Existing Distribution System	Phase I Development Phase I Pipeline Projects	Phase II Development Phase I Pipeline Projects
Fire Flow Location SWEP	70 psi	69 psi	62 psi
Adjacent Area Roberts Avenue	36 psi	36 psi	27 psi

Calculated Daily Minimum Water Tank Level

SWEP Tank (gallons)			
	26,000	19,000	Empty
% of Capacity	3%	2%	0%

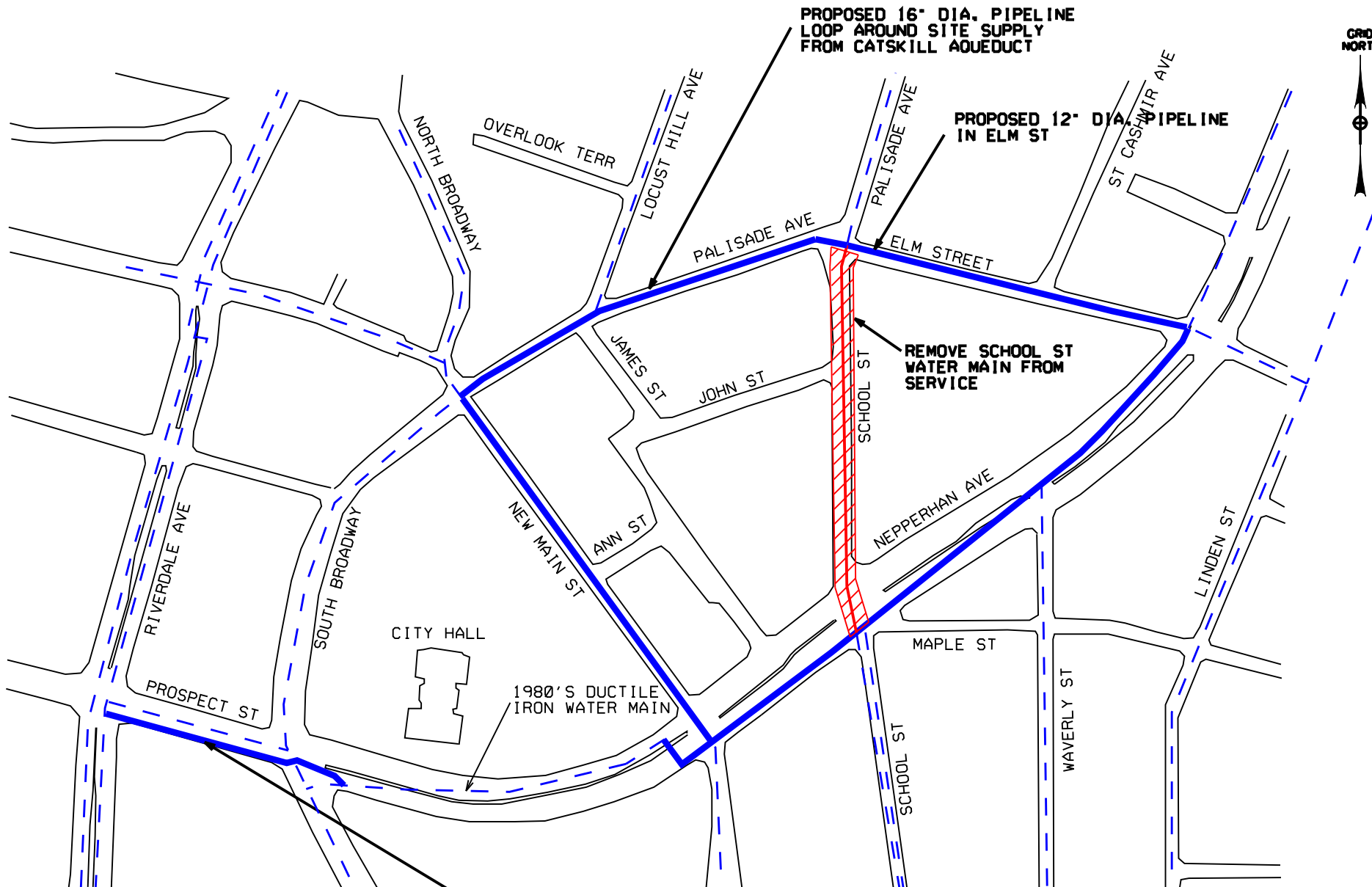
**WITH PHASE I PIPELINE PROJECTS
WITH PROPOSED 8 MGD PUMP AT WATER TREATMENT PLANT**

Calculated Residual Water Pressure

Location	Phase I Development Phase I Pipeline Projects And Proposed Pump	Phase II Development Phase I Pipeline Projects And Proposed Pump
SWEP	72 psi	70 psi
Roberts Avenue	38 psi	37 psi

Calculated Daily Minimum Water Tank Level

SWEP Tank (gallons)		
	228,000	125,800
% of Capacity	23 %	12 %



**PROPOSED 16" DIA. PIPELINE
LOOP AROUND SITE SUPPLY
FROM CATSKILL AQUEDUCT**

**PROPOSED 12" DIA. PIPELINE
IN ELM ST**

**REMOVE SCHOOL ST
WATER MAIN FROM
SERVICE**

**PROPOSED NEW 16" DIA. PIPELINE
TO RIVERDALE AVE TRANSMISSION MAIN
SUPPLY FROM HILLVIEW RESERVOIR**

**FIGURE 1
PROPOSED PHASE I PIPELINES
IN THE VICINITY OF
RIVER PARK CENTER PROJECT
UNIFIED STUDY
JULY 2008**

- EXISTING PIPE - - - -
- PROPOSED PIPE ————
- EXISTING PIPE TO BE REMOVED ▨▨▨▨

ASHBURTON AVENUE PROJECT
 CLEAN & CEMENT LINE
 EXISTING WATER MAINS
 ASHBURTON AVE
 LOCUST HILL AVE
 PALISADES AVE

ASHBURTON AVENUE PROJECT
 INSTALL NEW PIPELINE TO
 CONNECT MULFORD GARDENS
 TO NEW HIGH SERVICE ZONE
 MAIN FROM NORTH BROADWAY

PHASE I PIPELINE PROJECT
 NEW WATER MAIN TO
 STRENGTHEN SUPPLY
 TO RIVER PARK CENTER

PHASE I PIPELINE PROJECT
 NEW WATER MAIN AROUND
 RIVER PARK CENTER

SOUTHSIDE CONNECTION
 TO PALISADES POINT
 NEW WATER MAIN TO
 PROVIDE SECOND SOURCE
 OF SUPPLY TO PALISADES POINT

SOUTHWEST YONKERS
 IMPROVEMENT PROJECT

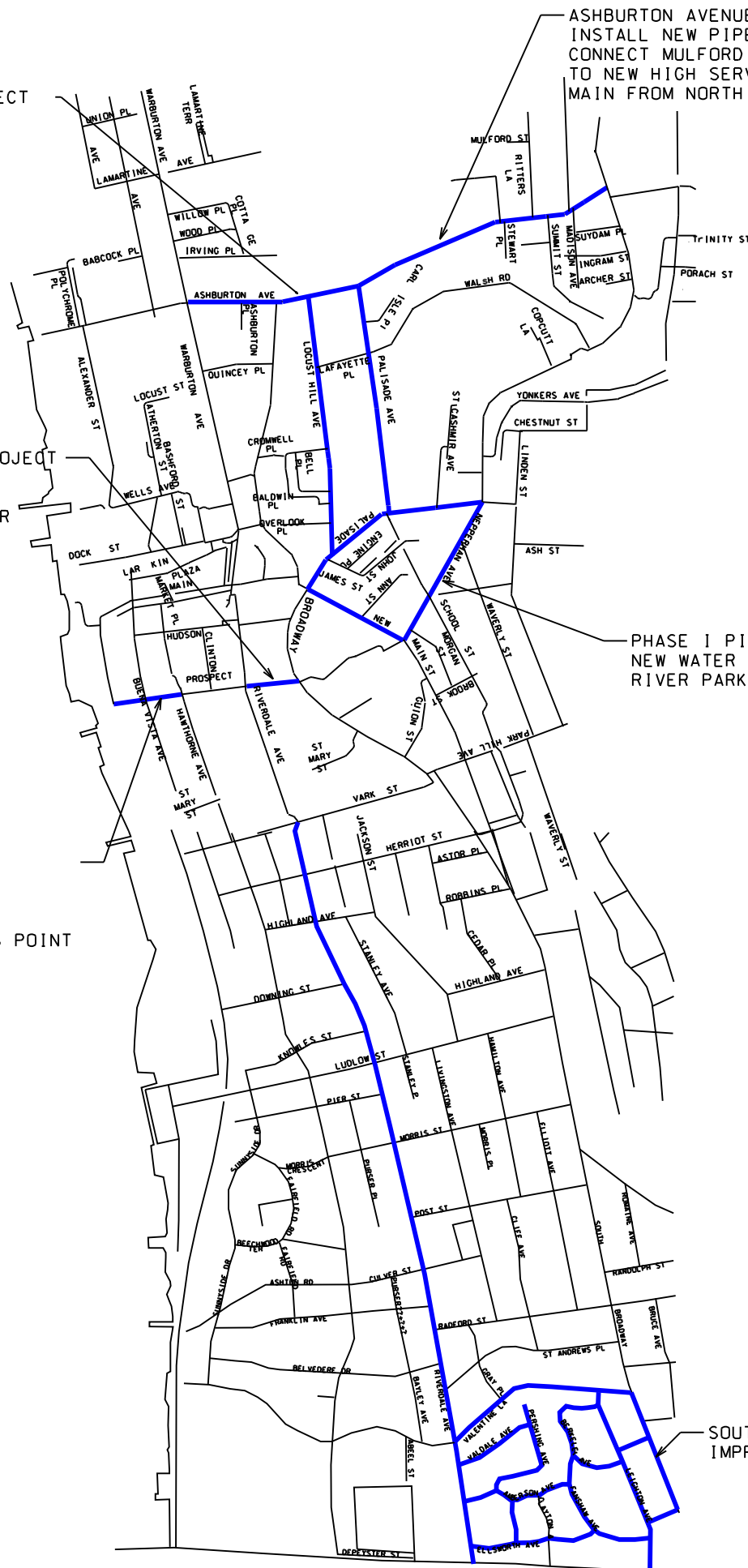


FIGURE 2
 SUMMARY OF PIPELINE PROJECTS
 UNIFIED STUDY
 JULY 2008

ATTACHMENT A

**Average Day Water Demands
Phase I & Phase II Projects
As prepared by Divney Tung Schwalbe**

**UNIFIED STUDY
YONKERS WATER DISTRIBUTION SYSTEM
ANALYSIS ON THE EFFECTS OF NEW DEVELOPMENTS
AUGUST 2008**

LACKOWITZ ENGINEERING

TABLE NO. 2A

SFC - PHASE I PROJECTS
 STRUEVER FIDELCO CAPPELLI, LLC
 YONKERS, NEW YORK

SUMMARY OF AVERAGE DAILY SANITARY FLOW AND WATER DEMAND

Proposed Program Components		Floor Area (GSF)	Sanitary Demand (GPD)	Water Demand (GPD)
<u>River Park Area</u>				
River Park Center:	Residential	1,150,200	218,520	240,372
	Retail, Office, Cinema, Ballpark, Restaurant	747,000	116,800	128,480
Palisade Office:	Office, College	225,000	18,000	19,800
Government Center:	Retail, Restaurant	30,000	9,600	10,560
Cacace Center:	Firehouse, Hotel, Office	<u>265,000</u>	<u>30,400</u>	<u>33,440</u>
River Park Area Total		2,417,200	393,320	432,652
	Peak Flow Rate (gpm)		819	901
Palisades Point:	Residential, Retail, Office	1,143,200	100,920	111,012
	Peak Flow Rate (gpm)		210	231
Project Totals (River Park Area & Palisades Point)		3,560,400	494,240	543,664
	Peak Flow Rate (gpm)		1,030	1,133
Existing Parcels:	Various existing parcels to be razed		41,490	45,639
	Peak Flow Rate (gpm)		86	95
Net Increase (gpd)			452,750	498,025
Peak Flow Rate (gpm)			943	1038
Seasonal Irrigation Demand ⁽⁵⁾			0	24,955

Notes

1. Flow Rates based on NYSDEC Design Standards for Wastewater Treatment Works (1988) pp. 10-13.
2. Water Demand estimated at 110% of Sanitary flows.
3. Peak Rate calculated at three (3) times the average daily rate due to mixed use of development.
4. Proposed Sanitary Flow figures calculated using water saving fixtures adjustment factor.
5. The seasonal irrigation demand for the ballfield is calculated using historic evapotranspiration data for the New York area and a preliminary estimate of the play field area at approximately 121,000 square feet. Based on an average demand for the peak season of 66.88 gallons per minute and a watering cycle of 4 hours per day, the seasonal irrigation demand for the ballfield is estimated at approximately 16,050 gallons per day. An additional 100,000 square feet was used to account for other green areas within the proposed project based on 1 inch of irrigation per week. The seasonal irrigation demand for these other green areas is estimated at approximately 8,900 gallons per day.

TABLE NO. 2B

**SFC - PHASE I PROJECTS
STRUEVER FIDELCO CAPPELLI, LLC
YONKERS, NEW YORK**

Date: 9/6/2006
By: DTS
Issue No. 11
Rev. 5/30/2007

Estimate of Sanitary Flow and Water Demand - Phase I Sites

Existing Conditions

Description	Address	Tax Designation			Site Area (sf)	Bldg Area ⁽¹⁾ (sf)	Sanitary Demand Generators				Use	DEC Unit Flowrate ⁽²⁾ (gals.)	Sanitary Demand Avg Daily Flow	Water Demand Avg Daily Flow ⁽⁴⁾	
		Section	Block	Lot			Residential Units			Other (Seats/keys/sq.ft.)					
							1 BR	2 BR	3 BR						
RIVER PARK CENTER															
1	12 Palisade Ave				4,358	8,716									
		Two story commerical building	1	484	3					4,300	Clinic (Office)	0.1	430	473	
										4,300	Office	0.1	430	473	
2	8 Palisade Ave; 109, 113, 177 New Main Street, and 2 & 8 James Street	One Story three tenant retail building.	1	484	1,5,8,59,6,1,62,63	36,954	35,649			35,000	Retail	0.1	3,500	3,850	
3	119 New Main Street	One Story single tenant retail building	1	484	57	1,530	1,530			1,500	Retail	0.1	150	165	
4	123-125 New Main Street	One Story three tenant retail building	1	484	55,56	6,840	5,782			5,700	Retail	0.1	570	627	
5	127, 129,131 New Main St	One Story commercial building (131 New Main Street). Five Story residential/commercial building (127/129 New Main Street) with 2 retail establishments and 16 apartments. 8 apartments with 3 rooms and 8 with 5 rooms	1	484	15,51,53	38,700	35,900			9,800	Retail	0.1	980	1,078	
6	135-145 New Main St	Two Story seven tenant retail building	1	483	12,13,16	17,150	12,424	8	8	12,000	Residential Retail	Varies by BR (2) 0.1	3,600 1,200	3,960 1,320	
7	147,149,151A New Main St	One Story single tenant retail building.	1	483	10	9,540	5,688			5,600	Retail	0.1	560	616	
8	151B New Main St	One Story single tenant retail building	1	483	9	2,325	992			900	Retail	0.1	90	99	
9	153 New Main St	One Story single tenant retail building	1	483	7	2,370	1,659			32	Restaurant	35	1,120	1,232	
10	155 New Main Street	One Story Restaurant.	1	483	5	1,774	1,680			32	Restaurant	35	1,120	1,232	
11	58-70 Elm Street	One Story and Two story slab, single tenant, gas and service station.	1	475	1	17,280	5,032			2	Service Station	400	800	880	
12	33 John St & 7 New School Street	One Story, over full basement, which includes office space, shop area for a A/C installer, and a separate coffee shop building	1	475	64,65,66	4,585	4,827			3,000	Office	0.1	300	330	
13	37 John Street	Two Story commercial building	1	475	67	5,775	6,675			30 2 3,300 100	Restaurant Service Station Retail Car Wash	35 400 0.1 40	1,050 800 330 4,000	1,155 880 363 4,400	
14	78 Elm St, 92 Elm St, 193 Nepperhan Ave, 195 Nepperhan Ave, 45 John Street	Four story eight family apartment building with one retail tenant on the first floor and a small garage structure (23 x 18) at the rear (193 Nepperhan Ave). And a Vacant four story eight family apartment building that is severly fire damaged (195 Nepperhan Ave).	1	475	9,19,25,2,6,70	52,155	5,500	8	8		Residential	Varies by BR (2)	3,600	3,960	
15	46 John Street	Two story Commercial Building	1	475	53	14,425	8,280			1,400 8,200	Retail Commercial	0.1 0.1	140 820	154 902	
16	197 Nepperhan Ave	One story three tenant Retail Building	1	475	22	4,590	4,489			1,500	Retail	0.1	150	165	
17	5-7 School Street	Fire House	1	475	50,51,55,59		25,000			30	Institution	125	3,750	4,125	
River Park Center Subtotal												29,490	32,439		

PALISADE OFFICE/COLLEGE

18	45 Palisade Avenue	unknown	1	2027	48						0	0
19	43 Palisade Avenue	unknown	1	2027	50						0	0
20	41 Palisade Avenue	unknown	1	2027	51						0	0
21	39 Palisade Avenue	unknown	1	2027	52						0	0
22	33 Palisade Avenue	unknown	1	2027	54						0	0
	Palisade Office Subtotal										0	0

GOVERNMENT CENTER GARAGE

23	110 New Main Street	Salvation Army Headquarters	1	487	13,15	10,454	20,908	20,000	Retail/Office	0.1	2,000	2,200
24	87 Nepperhan Avenue	Yonkers Building Dept, Parking Athy, etc.	1	488	1 (partial)			100,000	Office	0.1	<u>10,000</u>	<u>11,000</u>
	Government Center Subtotal										12,000	13,200

TOTAL (Gallons per Day)

41,490 45,639

DEC FLOWRATE STANDARDS⁽²⁾:

	Daily Flow	
Residential		
Bedrooms		
1	150	gal
2	300	gal
3	400	gal
Office	0.1	gal/day/sf
Hotel	120	gal/day/key
Retail	0.1	gal/day/sf
Restaurant	35	gal/day/seat (assume 50 sf/seat)
Movies	3	gal/day/seat
Sports Stadium	5	gal/day/seat
Church	3	gal/day/seat
Service Station	400	gal/day/toilet
Car Wash (rollover type)	40	gal/car/day

1. Existing parcel & building information based on Bill Fonte Inventory Table (8/16/06)
2. Unit flow values based on NYSDEC Design Standards for Wastewater Treatment Works (1988), pp.10-13
3. Domestic Water Demand = Sanitary Demand x 110%
4. Assumed values based on Inventory Table descriptions; actual numbers to be field-verified if needed
5. Larkin Plaza, Cacace, and Palisades Point sites currently have no sewer or water demand

SFC PHASE I PROJECTS
Yonkers, New York

Estimate of Sanitary Flow and Water Demand - Phase I Sites

Proposed Conditions

Key Map	Description	Address	Tax Designation			Site Area (sf)	Bldg Area ⁽¹⁾ (sf)	Sanitary Demand Generators				Use	DEC Unit Flowrate ⁽²⁾ (gals.)	Sanitary Demand		Water Demand
			Section	Block	Lot			Residential Units			Other (Seats/keys/sq.ft.)			Avg Daily Flow	Adj Daily Flow ⁽³⁾	Avg Daily Flow ⁽⁴⁾
								1 BR	2 BR	3 BR						
<u>RIVER PARK CENTER</u>																
	Tower West ⁽¹⁾⁽⁶⁾					575,100	119	238	118		Apts	*see below	136,450	109,160	120,076	
	Tower East ⁽¹⁾⁽⁶⁾					575,100	118	238	119		Apts	*see below	136,700	109,360	120,296	
	Residential Subtotal					1,150,200	237	476	237				273,150	218,520	240,372	
	Office					100,000					Office Space	0.1	10,000	8,000	8,800	
	Retail					450,000					Retail space	0.1	45,000	36,000	39,600	
	Restaurant ⁽⁵⁾					75,000				1,500	Restaurant	35	52,500	42,000	46,200	
	Movie Theater					80,000				2,000	Movies	3	6,000	4,800	5,280	
	Ballpark					42,000				6,500	Sports	5	32,500	26,000	28,600	
	River Park Center Subtotal					1,897,200							419,150	335,320	368,852	
<u>PALISADE OFFICE/COLLEGE</u>																
	Office					225,000					Office Space	0.1	22,500	18,000	19,800	
<u>GOVERNMENT CENTER</u>																
	Retail					15,000					Retail space	0.1	1,500	1,200	1,320	
	Restaurant					15,000				300	Restaurant	35	10,500	8,400	9,240	
	Govt Ctr Garage Subtotal					30,000							12,000	9,600	10,560	
<u>CACACE</u>																
	Office					150,000					Office Space	0.1	15,000	12,000	13,200	
	Hotel ⁽⁵⁾					75,000				150	Hotel	120	18,000	14,400	15,840	
	Fire House					40,000				40	Institution	125	5,000	4,000	4,400	
	Cacace Subtotal					265,000							38,000	30,400	33,440	
RIVER PARK AREA TOTAL												Average Daily Flow (gpd)	491,650	393,320	432,652	
												Peak Flow Rate⁽⁷⁾ (gpm)	1,024	819	901	
<u>PALISADES POINT</u>																
	North Tower ⁽⁶⁾					265,000	55	109	54		Apts/Condos	*see below	62,550	50,040	55,044	
	South Tower ⁽⁶⁾					302,600	54	109	55		Apts/Condos	*see below	62,800	50,240	55,264	
	Residential Subtotal					567,600	109	218	109				125,350	100,280	110,308	
	Retail/Office					8,000					Retail	0.1	800	640	704	
	Palisades Point Subtotal					1,143,200							126,150	100,920	111,012	
GRAND TOTAL												Average Daily Flow (gpd)	617,800	494,240	543,664	
												Peak Flow Rate⁽⁷⁾ (gpm)	1,287	1,030	1,133	
SEASONAL IRRIGATION DEMAND																
	Green Areas ⁽⁸⁾					100,000										8,900
	Ballpark ⁽⁹⁾					120,000										16,055

DEC FLOWRATE STANDARDS⁽²⁾:

Residential	Daily Flow	
Bedrooms		
1	150	gal
2	300	gal
3	400	gal
Office	0.1	gal/day/sf
Hotel	120	gal/day/key
Retail	0.1	gal/day/sf
Restaurant	35	gal/day/seat
Movies	3	gal/day/seat
Sports Stadium	5	gal/day/seat
Institution (non-hosp)	125	gal/day/person

(1) Proposed building area and program information based on Design Development Listing (8/30/06)

(2) Unit flow values based on NYSDEC Design Standards for Wastewater Treatment Works (1988), pp.10-13

(3) 20% subtracted from daily flow for use of water savings plumbing per NYSDEC Design Standards for Wastewater Treatment Works (1988) p.10.

(4) Domestic Water Demand = Sanitary Demand x 110%

(5) Assumed values based on preliminary program: Hotel = 500 sf/key; Restaurant = 50 sf/seat

(6) Bedroom mix estimate based on info from Saccardi and Schiff 5/24/2007

(7) Peaking Factor assumed to be 3.0 due to mixed use development

(8) Irrigation demand calculated using and estimate of 1 inch (depth) of irrigation applied to green areas per week. (1 in/week/sf = 0.089 gal/week/sf)

"Green area" estimates provided by IQ Landscape Architecture and W Architecture

(9) Irrigation demand for the ballpark estimated (using 66.88 gpm @ 4hrs/day = 16,052 gpd) by Chad Brown at IQ Landscape Architecture

TABLE NO. 3

SFC - PHASE I PROJECTS
 STRUEVER FIDELCO CAPPELLI, LLC
 YONKERS, NEW YORK

Date: 03/05/07
 By: DTS
 Issue No. 7
 Rev. 04/26/07

SUMMARY OF OTHER PLANNED DEVELOPMENTS
PRELIMINARY ESTIMATE OF AVERAGE DAILY SANITARY FLOW AND WATER DEMAND

Map ID	Project Name	Address	Development Program	Unit Flow (gpd) ⁽¹⁾	Sanitary Flow (gpd)	Sanitary Flow (w/ Water Saving Fixtures) ⁽²⁾ (gpd)	Water Demand (w/ Water Saving Fixtures) ⁽³⁾ (gpd)
Residential Projects							
19	Buena Vista Phase 2 ⁽⁴⁾	45 Buena Vista Avenue	60 Apts				
			1 BR 24	150	3,600	2,880	3,168
			2 BR 36	300	10,800	8,640	9,504
12	Stan-Lou Building ⁽⁴⁾	27 North Broadway	15 Apts				
			1 BR 6	150	900	720	792
			2 BR 9	300	2,700	2,160	2,376
15	Old Furniture Storage/Cooks ⁽⁴⁾	14 Warburton Avenue	12 Apts				
			1 BR 5	150	750	600	660
			2 BR 7	300	2,100	1,680	1,848
16	Main Street Lofts ⁽⁴⁾	66 Main Street	171 Apts				
			1 BR 68	150	10,200	8,160	8,976
			2 BR 103	300	30,900	24,720	27,192
8	Collins Phase 2 ⁽⁴⁾	75 Dock Street	312 Apts				
			1 BR 125	150	18,750	15,000	16,500
			2 BR 187	300	56,100	44,880	49,368
11	Greystone/North Broadway Lofts	49 N. Broadway	100 Apts				
			1 BR 40	150	6,000	4,800	5,280
			2 BR 60	300	18,000	14,400	15,840
1	Ginsburg	1105-1135 Warburton Avenue	353 Apts				
			1 BR 141	150	21,150	16,920	18,612
			2 BR 212	300	63,600	50,880	55,968
3	Yonkers Green ⁽⁴⁾	Ashburton Avenue & Nepperhan Avenue	124 Townhouse				
			2 BR 50	300	15,000	12,000	13,200
			3 BR 74	400	29,600	23,680	26,048
26	179 Riverdale Avenue	179 Riverdale Avenue	83 Apts				
			1 BR 33	150	4,950	3,960	4,356
			2 BR 50	300	15,000	12,000	13,200
20	1077 Warburton Avenue	1077 Warburton Avenue	71 Apts				
			1 BR 28	150	4,200	3,360	3,696
			2 BR 43	300	12,900	10,320	11,352
4	Ashburton Ave Redvlp. (Mulford Gardens) (Replaces existing 552 units of public housing)	Ashburton Avenue Net Increase Between St. Joseph & Vineland Avenues	245 Apts				
			1 BR 100	150	15,000	12,000	13,200
			2 BR 120	300	36,000	28,800	31,680
			3 BR 100	400	40,000	32,000	35,200
Total Residential					418,200	334,560	368,016

TABLE NO. 3

SFC - PHASE I PROJECTS
 STRUEVER FIDELCO CAPPELLI, LLC
 YONKERS, NEW YORK

Date: 03/05/07
 By: DTS
 Issue No. 7
 Rev. 04/26/07

SUMMARY OF OTHER PLANNED DEVELOPMENTS
PRELIMINARY ESTIMATE OF AVERAGE DAILY SANITARY FLOW AND WATER DEMAND

Map ID	Project Name	Address	Development Program	Unit Flow ⁽¹⁾ (gpd)	Sanitary Flow (gpd)	Sanitary Flow (w/ Water Saving Fixtures) ⁽²⁾ (gpd)	Water Demand (w/ Water Saving Fixtures) ⁽³⁾ (gpd)
Retail Projects							
19	Buena Vista Phase 2 ⁽⁴⁾	45 Buena Vista Avenue	7,500 SF	0.1	750	600	660
17	Homes for America ⁽⁴⁾	86 Main Street	12,000 SF	0.1	1,200	960	1,056
15	Old Furniture Storage/Cooks ⁽⁴⁾	14 Warburton Avenue	4,400 SF	0.1	440	352	387
16	Main Street Lofts ⁽⁴⁾	66 Main Street	12,000 SF	0.1	1,200	960	1,056
5	I-Park Phase 2 (Replaces existing Alexander St. facilities)	Warburton Avenue	Net Increase 20,000 SF	0.1	2,000	1,600	1,760
Total Retail					5,590	4,472	4,919
Office Projects							
5	I-Park Phase 2	Warburton Avenue	(see 20,000 sf net increase above)	0.1	0	0	0
2	900 North Broadway (Medical Office)	900 North Broadway	25,000 SF	0.304	7,600	6,080	6,688
17	Homes for America ⁽⁴⁾	86 Main Street	58,000 SF	0.1	5,800	4,640	5,104
Total Office					13,400	10,720	11,792
Other Projects							
21	Veterinary Office	9 Odell Plaza	25,000 SF	0.14	3,410	2,728	3,001
24	Proctor Theatre ⁽⁴⁾	53 South Broadway	1,200 Seats	3	3,600	2,880	3,168
7	Hudson Park Phase II	Dock Street	153 Berths	2	306	245	269
9	Verizon Switching Station (20 Employees)	140 Corporate Blvd.	20 25,000 SF	22.5	450	360	396
23	Marriott Hotel	160 Executive Blvd.	150 Rooms	137	20,550	16,440	18,084
22	Hampton Inn Hotel	7 Executive Blvd.	114 Rooms	137	15,618	12,494	13,744
10	Restaurant	31 Dock St	Est. @ 80 Seats	35	2,800	2,240	2,464
18	Peter X Kelly's Xavier's Restaurant	Yonkers Pier (end of Main St.)	240 Seats	35	8,400	6,720	7,392
29	Cintas Laundry Facility	325 Executive Blvd.	-	-	87,500	70,000	80,000
30	Flex Building: 225 Corporate Blvd. S.	225 Corporate Blvd. S.	50,000 SF	-	2,841	2,273	2,500
Total Other Projects					145,475	116,380	131,018
Grand Total for All Projects (gpd) Peak Flow (gpm)					582,665	466,132	515,745

⁽¹⁾ Unit flow rates based on NYSDEC Design Standards for Wastewater Treatment Works (1988) pages 10- 13.

⁽²⁾ Use of water saving fixtures assumed to reduce the sanitary demand by 20%.

⁽³⁾ Water demand estimated at 110% of Sanitary flows.

⁽⁴⁾ Projects that will discharge into the same sewerage infrastructure as the SFC Phase I Project

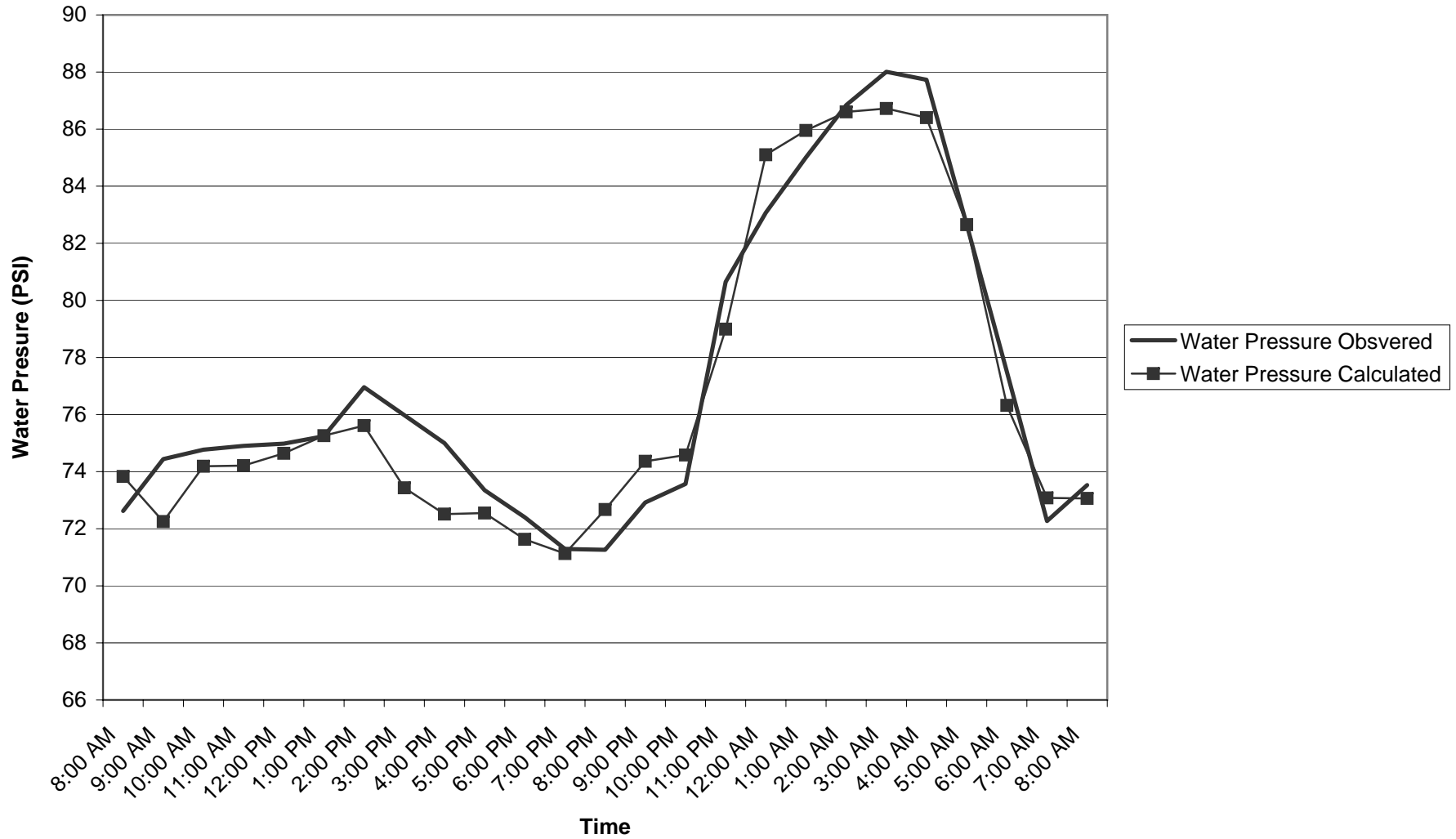
ATTACHMENT B

Hydraulic Model Calibration Figures

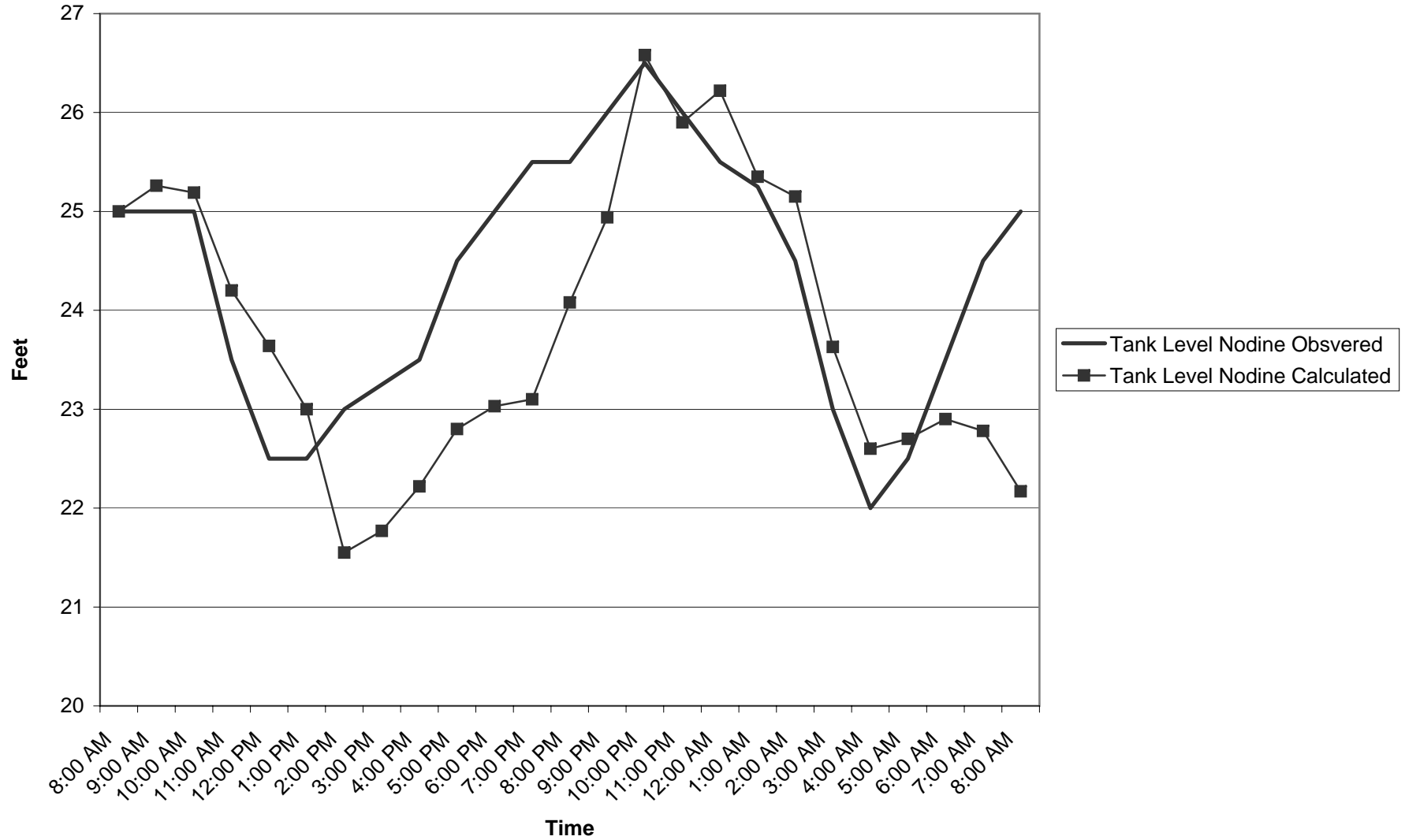
**UNIFIED STUDY
YONKERS WATER DISTRIBUTION SYSTEM
ANALYSIS ON THE EFFECTS OF NEW DEVELOPMENTS
AUGUST 2008**

LACKOWITZ ENGINEERING

Downtown Yonkers Calibration Data - June 9, 2008



Nodine Tank - Calibration Data June 9, 2008



SWEP Tank Calibration Data June 9, 2008

