

# **City Of Petersburg**

## **WATER DISTRIBUTION SYSTEM OPERATION EVALUATION**

June 2001



## TABLE OF CONTENTS

<b>Section</b>	<b>Title</b>	<b>Page Number</b>
1.	Distribution System Overview	1
2.	Demand	2
3.	Operational Controls	2
4.	Reason for Study	3
5.	Causes of Contamination	3
6.	Analysis	5
7.	Conclusions and Recommendations	5

### Tables

<b>Number</b>	<b>Title</b>	<b>Page Number</b>
1	Water Storage Tanks in the City of Petersburg	1
2	Operational Pump Controls	2
3	Storage and Turnover in Tanks	6
4	Storage Requirements	6

### Graphs of Model Results

<b>Title</b>	<b>Follows Page</b>
Walnut Hill Tank	7
Jamestown Tank	7
Mt. Vernon Tank	7
Mercury Street Tank	7
Industrial Park Tank	7
Halifax Tank	7

### Maps

<b>Title</b>	<b>Follows Page</b>
Water Distribution System Map	1
Age Analysis Map	5

### Appendix

Water Sampling Plan (Approved 1991)

## **1. Distribution System Overview**

The City of Petersburg's water distribution system serves approximately 35,000 customers through pipes ranging in size from 1-inch to 20-inches. The City's current water distribution system map is shown following page 1.

The City's water is supplied through two Pressure Reducing Valves (PRV's) from the Appomattox River Water Authority (ARWA) water treatment plant. Currently, ARWA maintains operational control of water delivered to Petersburg. The ARWA water treatment plant obtains water from the Appomattox River and provides conventional treatment consisting of rapid mix, coagulation, flocculation, sedimentation, filtration and disinfection. Primary disinfection at the plant is provided with chlorination. Secondary disinfection is provided with chloramines (a mixture of free chlorine and ammonia.) The drinking water provided by ARWA meets or exceeds all treatment requirements by the Virginia Department of Health (VDH) and the United States Environmental Protection Agency (USEPA) Surface Water Treatment Rule (SWTR).

The City of Petersburg's water distribution system is divided into low and high-pressure service areas. The City operates two pump stations, both serving the high-pressure service area (the Locks and Mt. Vernon Pump Stations). Two of the City's water storage tanks are located in the low-pressure service area (the Mercury Street Tank and Mt. Vernon Tank). The Jamestown, Walnut Hill, Industrial Park, and Halifax storage tanks are located in the high-pressure service area. The City's storage tanks are summarized in the following table.

**TABLE 1  
WATER STORAGE TANKS IN THE CITY OF PETERSBURG**

<b>Storage Tank Name</b>	<b>Pressure Zone</b>	<b>Diameter (ft)</b>	<b>Max. HGL (ft)</b>	<b>Min. HGL (ft)</b>	<b>Max. Level (ft)</b>	<b>Volume (gal)</b>
Mercury Street Tank	Low	80	180	136	50	1,900,000
Mt. Vernon Tank	Low	165	180	145	35	5,600,000
Halifax Tank	High	50	265	176	89	1,300,000
Industrial Park Tank	High	80	265	225	40	1,000,000
Walnut Hill Tank	High	55	265	240	25	500,000
Jamestown Tank	High	72	265	230	35	1,000,000

The City's distribution system is comprised of varied materials of varied age. Ductile iron, cast iron (both lined and unlined), concrete, PVC and steel pipes are found throughout the system. Many sections of the Petersburg water distribution system are over 50-years old.



LOCKS  
P.S.  
ARWA  
SUPPLY

HALIFAX  
TANK

MT. VERNON  
TANK

FT. LEE PS  
(OUT OF SERVICE)  
MERCURY ST.  
TANK  
MT. VERNON  
TANK  
MT. VERNON  
P.S.

JAMESTOWN  
TANK

WALNUT HILL  
TANK

**COLOR CODING LEGEND**

COLOR	DIAMETER
	4-INCH
	6-INCH
	8-INCH
	12-INCH
	16-INCH
	20-INCH

ANY REUSE OR PROJECT EXTENSION, ANY OTHER PROJECT OR ALTERATIONS OR ADDITIONS TO THIS PROJECT SHALL BE AT THE USER'S SOLE RISK AND WHOLLY LIABILITY TO GARRETT FLEMING, INC.

No.	DESCRIPTION	DATE	BY

DESIGNED J.W.U.	TRACED CADD	SCALE NONE
DRAWN J.W.U.	CHECKED M.P.L.	APPROVED M.P.L.



**Garrett Fleming**

CITY OF PETERSBURG  
WATER DISTRIBUTION SYSTEM  
OPERATION EVALUATION

WATER DISTRIBUTION MAP

JOB NO. 38742	SHEET No. N/A
DATE JUNE 2001	DRAWING NO. N/A

The City of Petersburg follows a written flushing plan. Each area of the City is flushed annually in late spring or early summer. The current program divides the City into four areas. The program requires flushing concentrically away from the storage tank(s) in that area.

The City has a Virginia Department of Health (VDH) approved sampling plan. 45 different locations are sampled monthly. The sampling plan was approved in 1991. The sampling plan and addresses for each location are included in the Appendix.

**2. Demand**

For the year 2000, water demand for the City of Petersburg was as follows:

ARWA Readings	1,729 Mgal
City of Petersburg Meter Readings	1,587 Mgal

The difference of 142 Mgal per year represents unaccounted for water of only 8%. This difference is caused by many reasons including leaks in the system, main breaks, manual draining of storage tanks, fire demand, flushing, and water meter inaccuracies.

Although there is an 8% loss, this is considered an average loss value for most water distribution systems, and is not of immediate concern.

For this report, the ARWA readings were used to represent the amount of water actually in the system while modeling. The 1995 demand data used existing in the previous model is 2% less than the demand data used by the 2000 model.

**3. Operational Controls**

The City of Petersburg Public Utilities Department currently uses the following operational controls for the pump settings:

TABLE 2  
OPERATIONAL PUMP CONTROLS

Pump Station		On Below (HGL)	Off Above (HGL)	Control Tank
<b>LOCKS PUMP STATION</b>	Locks Pump 1	259	263	Industrial Park Tank
	Locks Pump 2	OFF	OFF	NONE
<b>MT VERNON PUMP STATION</b>	Mt. Vernon Pump 1	257	264	Jamestown Tank
	Mt. Vernon Pump 2	OFF	OFF	NONE

#### **4. Reason For Study**

The purpose of this study is to determine the most likely source of recent water quality problems experienced by the City of Petersburg and recommend measures to eliminate those water quality problems.

In the summer of 2000, the City of Petersburg water sampling program results contained six test results in which the presence of coliforms tested. These positive results occurred in samples taken from July 24<sup>th</sup> to the end of September.

VDH requires all municipalities to monitor their distribution system on a monthly basis for the presence of indicator organisms known as coliform bacteria. Total coliform bacteria do not pose a health risk to humans, however their presence may indicate that other (possibly pathogenic) organisms may be present. This monitoring rule is referred to as the Total Coliform Rule (TCR). TCR also mandates that re-sampling be conducted (including one upstream and one downstream sample) if any sample tests positive for total coliform. The TCR requires that second samples be tested for fecal coliform or E. Coli. Bacteria as well.

#### **5. Causes of Contamination**

There are several different typical causes of coliform positive samples in the water distribution system. Discussed below are some of the most common causes.

- **False positives because of sampler error** – The sampler employed by the City is one of the key components to ensuring that all the samples taken are indicators of the water quality in the distribution system. Often times, new or inexperienced samplers can unknowingly contaminate samples while collecting the sample or opening the bottles incorrectly. The same person took all but one of the positive samples.
- **The sampling procedure itself** – During the actual sampling procedure, there are several different ways contamination can occur. The water should be run long enough before taking the sample that the water is clear and cold (a temperature consistent with the distribution system) so that the sample accurately represents water from the system, not water that has been sitting in the pipes in the building. Samples should not be taken after a backflow preventor. Although the samplers for the City are most likely aware of proper sample collection procedures, a re-training or discussion of proper sampling procedures may be helpful.

- **Sampling locations** – Some sample locations can increase chances for positive coliform results. For example, places which are generally good breeding places for bacteria are bathrooms and locations behind backflow preventors, such as outside spigots of residences. Schools are not good locations because they do not use a constant amount of water throughout the year, and they have large diameter service pipes. During times when school is not in session, the water is not flushed through their system and contamination may occur. Another sampling location to be avoided is a dead end in the system, especially dead ends with low demand. These areas are not necessarily reflective of the water in the system. Sample locations should be a good representation of the water distribution system. After reviewing Petersburg’s VDH approved sampling plan, it is evident that several sampling locations could be a contributing factor to the positive coliform samples.
- **Temperature of the water in the system or outside air is high** – Higher temperature water will increase the likelihood of bacterial growth. All of the positive coliform tests occurring in the summer. It is evident that this could be one of the major contributing factors. No water temperature readings were taken while collecting the water samples. The importance of the temperature reading should be stressed to the sampler because it may help the City determine when tanks or pipelines in the system need to be flushed based on temperature. Temperature can also be an indicator of the quality of the sample. For good sampling, water should be run for an adequate amount of time before the sample is taken as representative of the distribution system. A higher temperature may be an indication that the water was not run long enough before the sample was taken.
- **Through the handling or testing of the sample** – There is a possibility that samples could be contaminated while handling after collection. The ARWA water testing laboratory tests all of the water samples collected for Petersburg. The personnel are very experienced and have quality lab equipment to perform proper testing. The lab did not experience a higher volume of coliform positive samples from other areas during this time. Therefore it is unlikely that improper handling during the lab testing was the cause of positive coliform results.
- **Low daily turnover rates in the water storage tanks** – This is a likely cause of contamination in the system. Of the City’s six water storage tanks, two have little or no turnover, and therefore create potential for bacterial regrowth. The Mercury Street and Halifax storage tanks serve areas with low demand. Both will continue to pose a contamination risk if the water in the tanks is not circulated more frequently or the tanks are not taken out of service.
- **Activities in sample areas (hydrant flushing, large fires, water line breaks, cross connections, construction)** – When water is being flushed or moved at high velocity (such as during a large fire or main break) through a pipe that does not normally experience high velocities, there is a risk that some bacteria or build-up along the side walls of the pipe will slough off and

contaminate the distribution system water. Cross connections and construction can also be culprits because dirt and bacteria can enter the water system in these areas. During this period, there was no pipe flushing or construction affecting water lines reported.

## 6. Analysis

- Trace analysis from the model reveals that with current operational controls for the system, the Mercury Street and Halifax storage tanks do not serve the surrounding area. Both tanks remain full with no incoming or outgoing water.
- Age analysis reveals that many areas, especially on the outskirts of the southern and eastern portion of the town may require additional flushing. The age analysis map is shown following page 5.
- Using the model, it is evident that taking the Mercury Street tank out of service does not affect pressures in the area or fire flow. A similar study of the Halifax tank reveals that while this tank does not serve the surrounding area, it does aid minimally with fireflow capacity. The model also shows that this tank could be taken out of commission without a large effect on the system. (i.e., both tanks may be taken out of service at the same time.)

## 7. Conclusions and Recommendations

The following conclusions and recommendations are based on the modeling analysis and other information provided by the City concerning the operation of the water distribution system:

- **Heterotrophic Plate Count (HPC)** – HPC testing estimates the number of live heterotrophic bacteria in water. These tests provide the concentrations of the general bacterial population, and can alert the City of possible coliform presence in the water. By using these inexpensive tests, the City can flush areas of potential contamination *before* getting a positive coliform sample.
- **More aggressive flushing program in dead end and potential problem areas of the City** – To help minimize water detention times in dead end or low demand areas, additional flushing beyond the annual flushing will help. By looking at the Age Analysis Map following page 5, a plan should be developed to flush the areas with older water on a regular basis, especially during warmer temperature months.
- **Keep water turn-over in tanks daily at a good level** – One of the keys to insuring good water quality is turning over the water in storage tanks. The water in each one of the tanks should turn over by 30% on a daily basis. The following table shows the storage tanks and the desired minimum level to reach a 30% turnover:



LOCKS  
P.S.  
ARWA  
SUPPLY

HALIFAX  
TANK

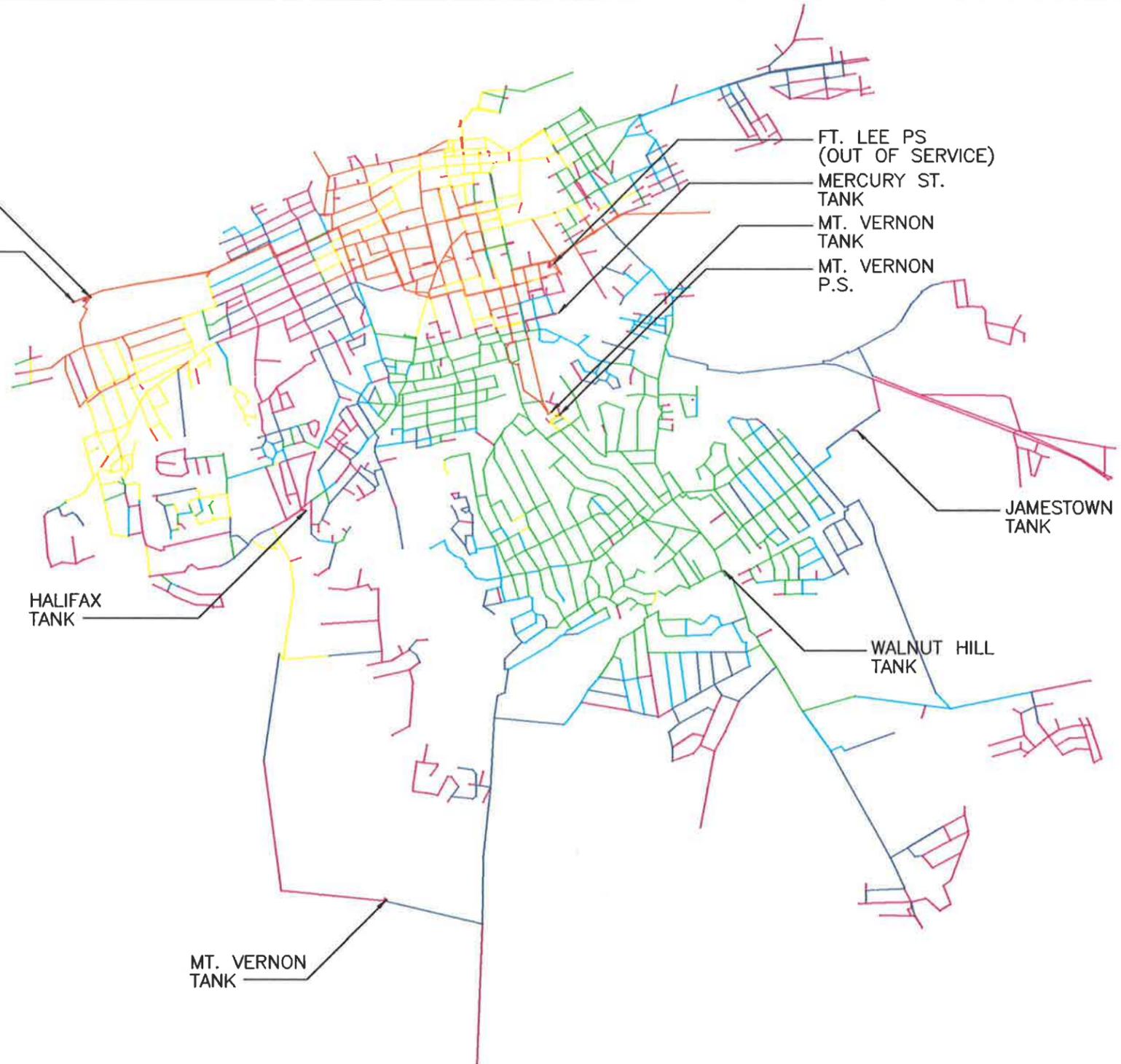
MT. VERNON  
TANK

FT. LEE PS  
(OUT OF SERVICE)  
MERCURY ST.  
TANK  
MT. VERNON  
TANK  
MT. VERNON  
P.S.

JAMESTOWN  
TANK

WALNUT HILL  
TANK

COLOR CODING LEGEND	
COLOR	AGE
<span style="display:inline-block; width:15px; height:10px; background-color:orange;"></span>	0-6 HOURS
<span style="display:inline-block; width:15px; height:10px; background-color:yellow;"></span>	6-12 HOURS
<span style="display:inline-block; width:15px; height:10px; background-color:green;"></span>	12-18 HOURS
<span style="display:inline-block; width:15px; height:10px; background-color:blue;"></span>	18-24 HOURS
<span style="display:inline-block; width:15px; height:10px; background-color:darkblue;"></span>	24-36 HOURS
<span style="display:inline-block; width:15px; height:10px; background-color:purple;"></span>	36-48 HOURS



ALL RIGHTS ARE RESERVED BY THE CITY OF PETERSBURG. NO PART OF THIS DOCUMENT IS TO BE REPRODUCED OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM.

			DESIGNED J.W.U.	TRACED CADD	SCALE NONE		CITY OF PETERSBURG	AGE ANALYSIS MAP	JOB NO. 38742	SHEET No. N/A														
<table border="1"> <thead> <tr> <th>No.</th> <th>DESCRIPTION</th> <th>DATE</th> <th>BY</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> <td> </td> <td> </td> </tr> </tbody> </table>			No.	DESCRIPTION	DATE		BY														DRAWN J.W.U.	CHECKED M.P.L.	APPROVED M.P.L.	WATER DISTRIBUTION SYSTEM OPERATIONAL ANALYSIS
No.	DESCRIPTION	DATE	BY																					

**TABLE 3**  
**MINIMUM LEVELS TO REACH 30% TURNOVER**

<b>STORAGE TANK</b>	<b>PRESSURE ZONE</b>	<b>MAX LEVEL</b>	<b>MIN LEVEL</b>
<b>Halifax</b>	High	89	62
<b>Industrial Park</b>	High	40	28
<b>Walnut Hill</b>	High	25	18
<b>Jamestown</b>	High	35	25
<b>Mt. Vernon</b>	Low	35	25
<b>Mercury Street</b>	Low	50	35

Given the storage volume available to the City, it will be a difficult turn over every tank 30% each day. An alternative to turning water over in the tanks is to take the Mercury Street or Halifax tank, or both, out of service. This will reduce the volume of dead storage in the water system. The modeling analysis results show minimal negative impacts to the City's fireflow and service capabilities. The following table depicts the amount of storage in Petersburg and the amount that is required by VDH to meet storage standards:

**TABLE 4**  
**STORAGE REQUIREMENTS**

	<b>MGal</b>
<b>Storage available</b>	11.3
<b>Average Day Demand</b>	4.74
<b>Maximum Day Demand</b>	6.87
<b>Storage required by VDH</b>	2.37
<b>Storage in excess of requirement</b>	8.93

The City's Public Utilities Department goal is to keep all the storage tanks in service. Based on model analysis, the following alternatives will help cycle the existing tanks, therefore increasing water quality.

- Turn off ARWA from 10 p.m. to 4 a.m. daily to cycle the tanks in the low pressure system.
- Add a 15 hp pump to the Halifax tank discharge. This will pump water out of the tank and force turnover to occur. The pump should run for two to three hours a day to reach a 25-30% turnover. The cost for this pump station is approximately \$10,500.

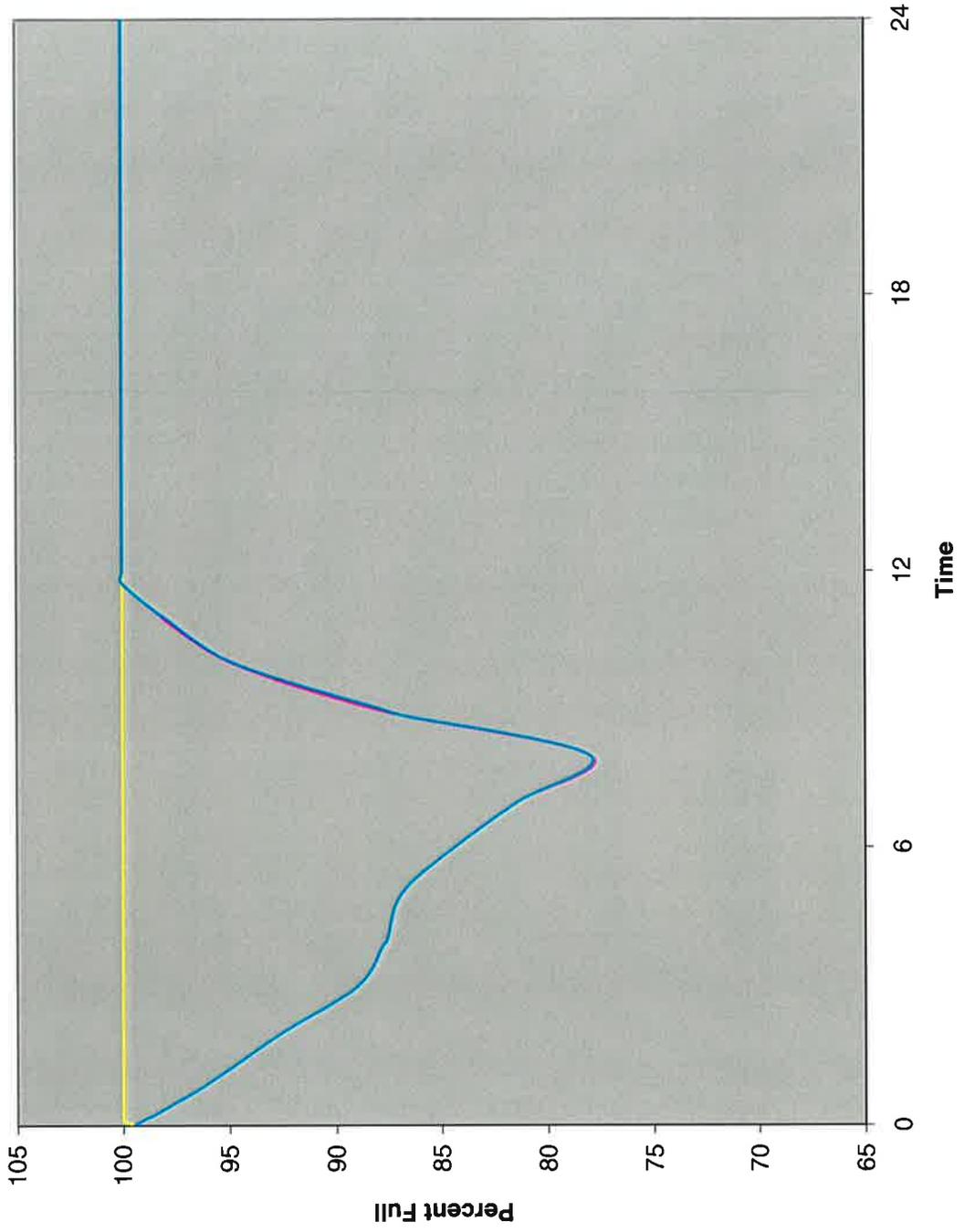
On the following pages are graphs of the storage tank operation created from the modeling results. Each 24-hour graph shows:

- Current average day operation
- ARWA off from 10 p.m. to 4 a.m.
- The 15 hp pump at the Halifax Tank running from 9 to 11 A.M.
- ARWA off for 6 hours and the Halifax Tank pump run for two hours simultaneously

The modeling results show that with ARWA off for 6 hours and the Halifax pump running for two hours, all six of the City's tanks will cycle near the goal level.

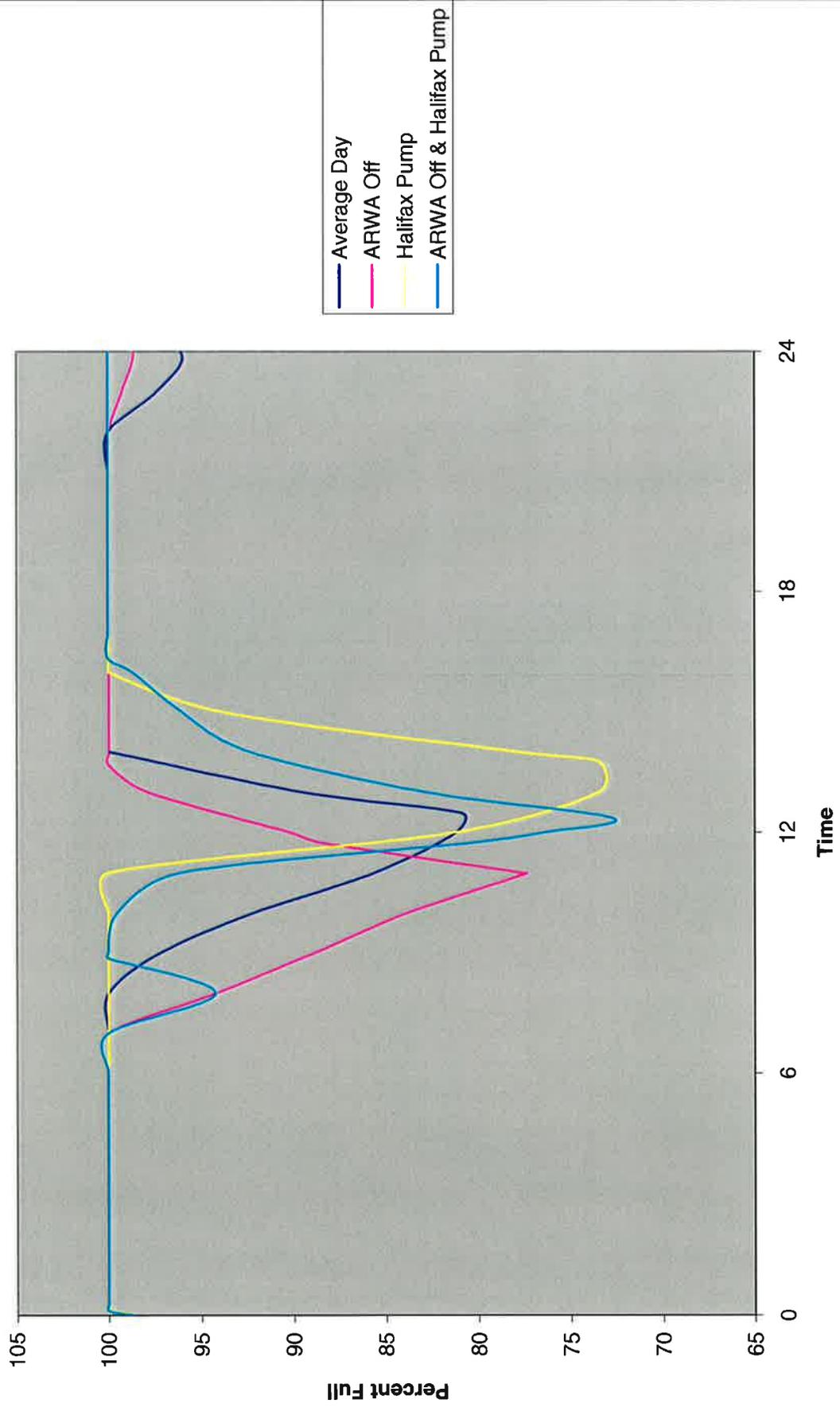
- **Move some of the Sampling Locations** – The best solution for changing sampling locations, is to install sampling stations, at least for several of the primary points. For commercial locations, sampling in kitchens rather than bathrooms will reduce the number of positive coliform tests. Locations with general cleanliness and short service lines are preferred. Do not sample at locations with swivel faucets as they can be breeding places for bacteria. Sampling at schools should be done at schools that can show no appreciable decrease in usage over the summer.
- **Ensure that the sampling forms are completely filled out** – This will monitor changes in the water quality during hot weather periods specifically.
- **System flushing** – Continue flushing the system annually using the developed flushing plan, and running water from fresh to dirty, outward concentrically from the storage tanks, and from larger diameter to smaller diameter pipe. Run the hydrants five to ten minutes or until the water is clear.
- **Systematic flushing of the area with free chlorine** – It may be helpful to have ARWA, with the cooperation of other localities, do a systematic flushing with free chlorine to rid the system of organisms resistant to chloramines periodically during the warmer months of the year.
- **Ensure adequate disinfectant residual** - This can be maintained by booster disinfection at strategic points in the water distribution system.

# MERCURY STREET TANK



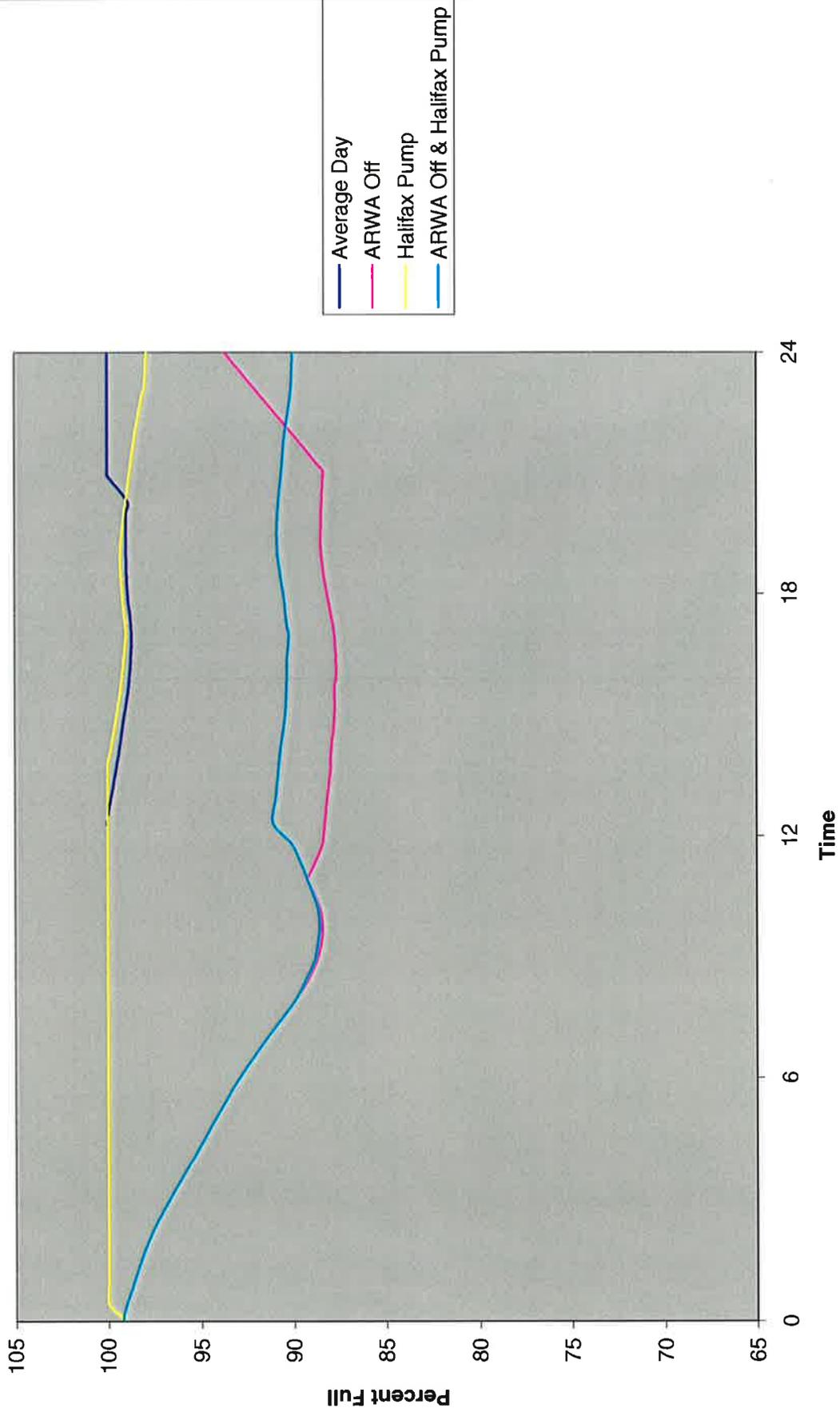
- Average Day
- ARWA Off
- Halifax Pump
- ARWA Off & Halifax Pump

# WALNUT HILL TANK

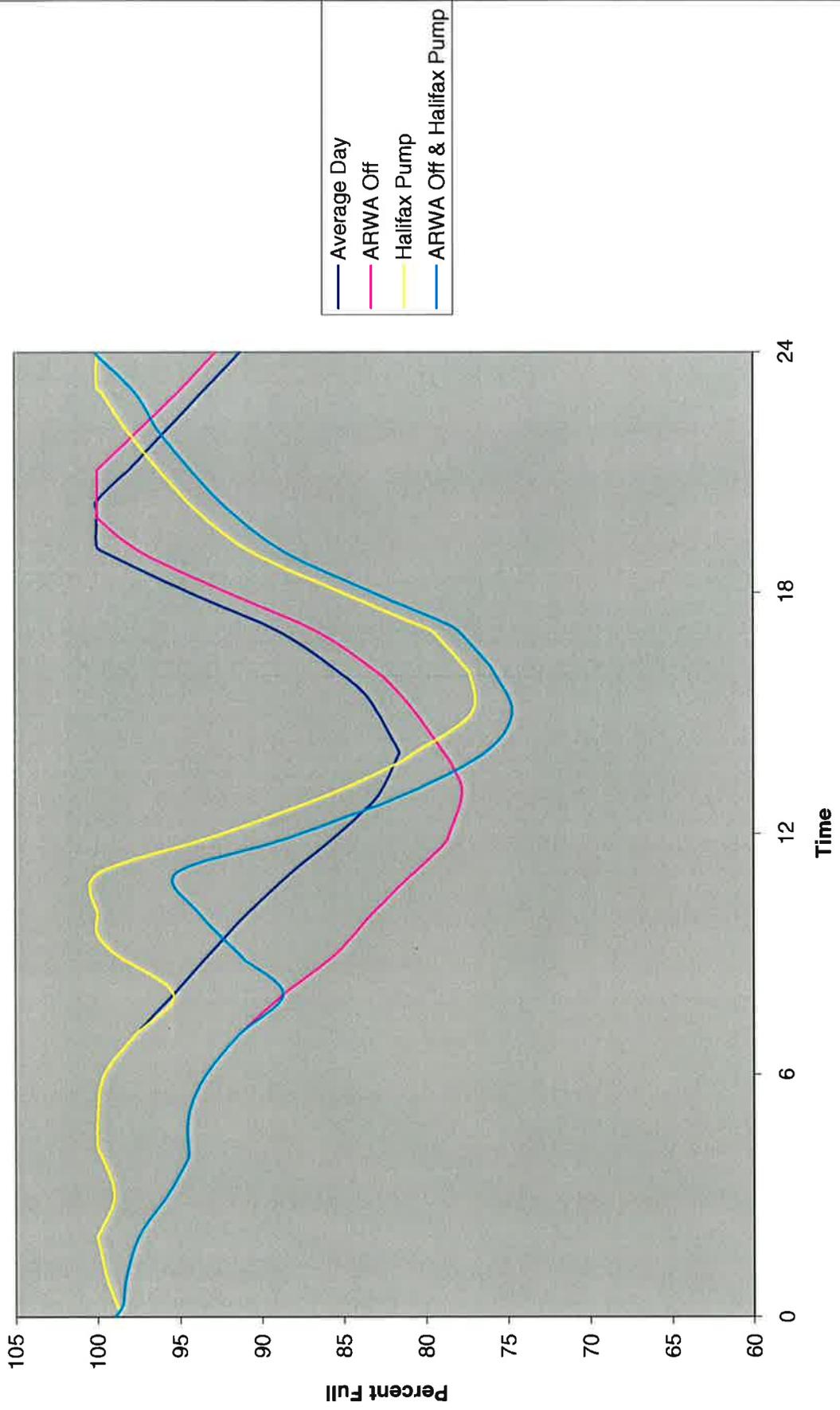


- Average Day
- ARWA Off
- Halifax Pump
- ARWA Off & Halifax Pump

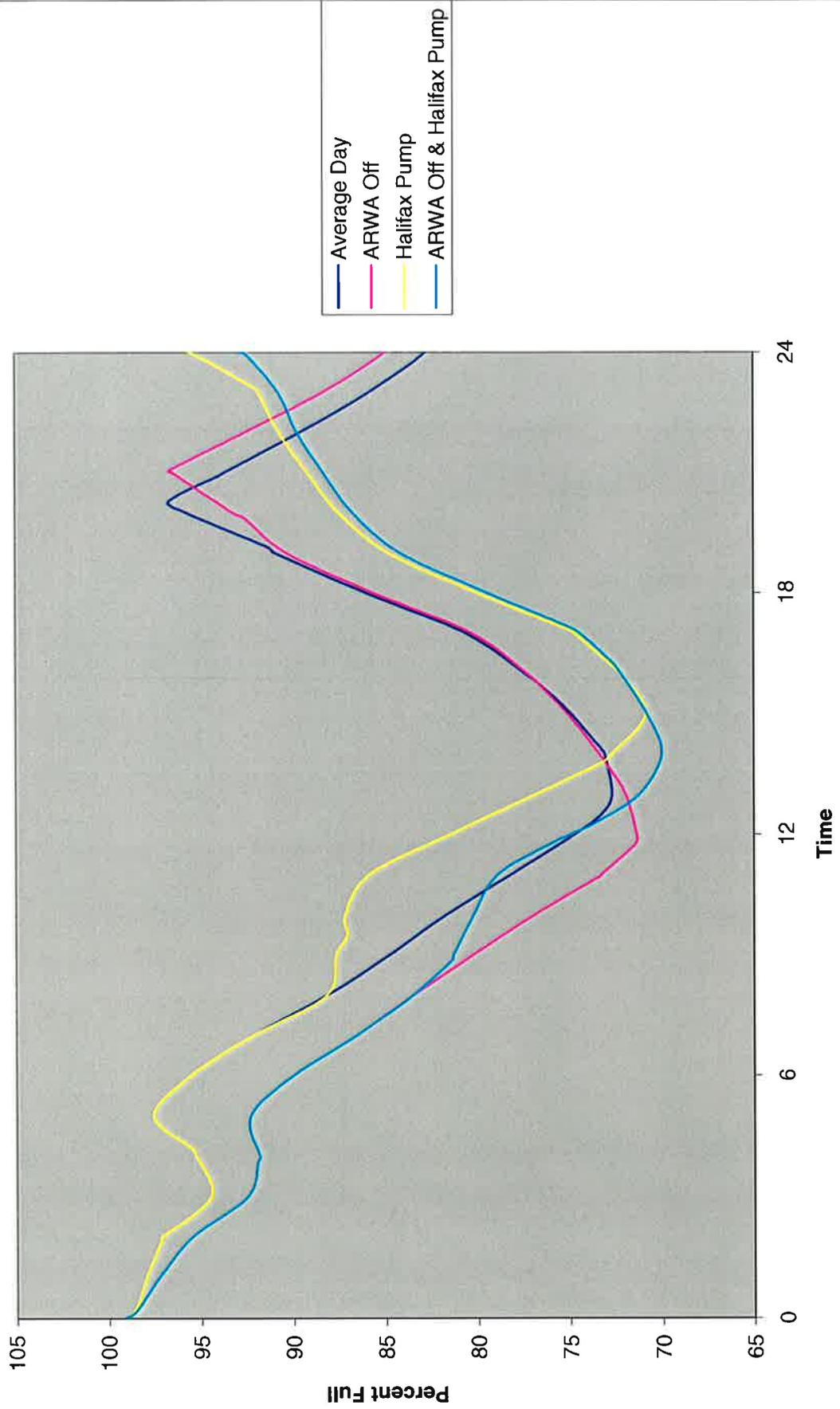
# MT. VERNON TANK



# INDUSTRIAL PARK TANK

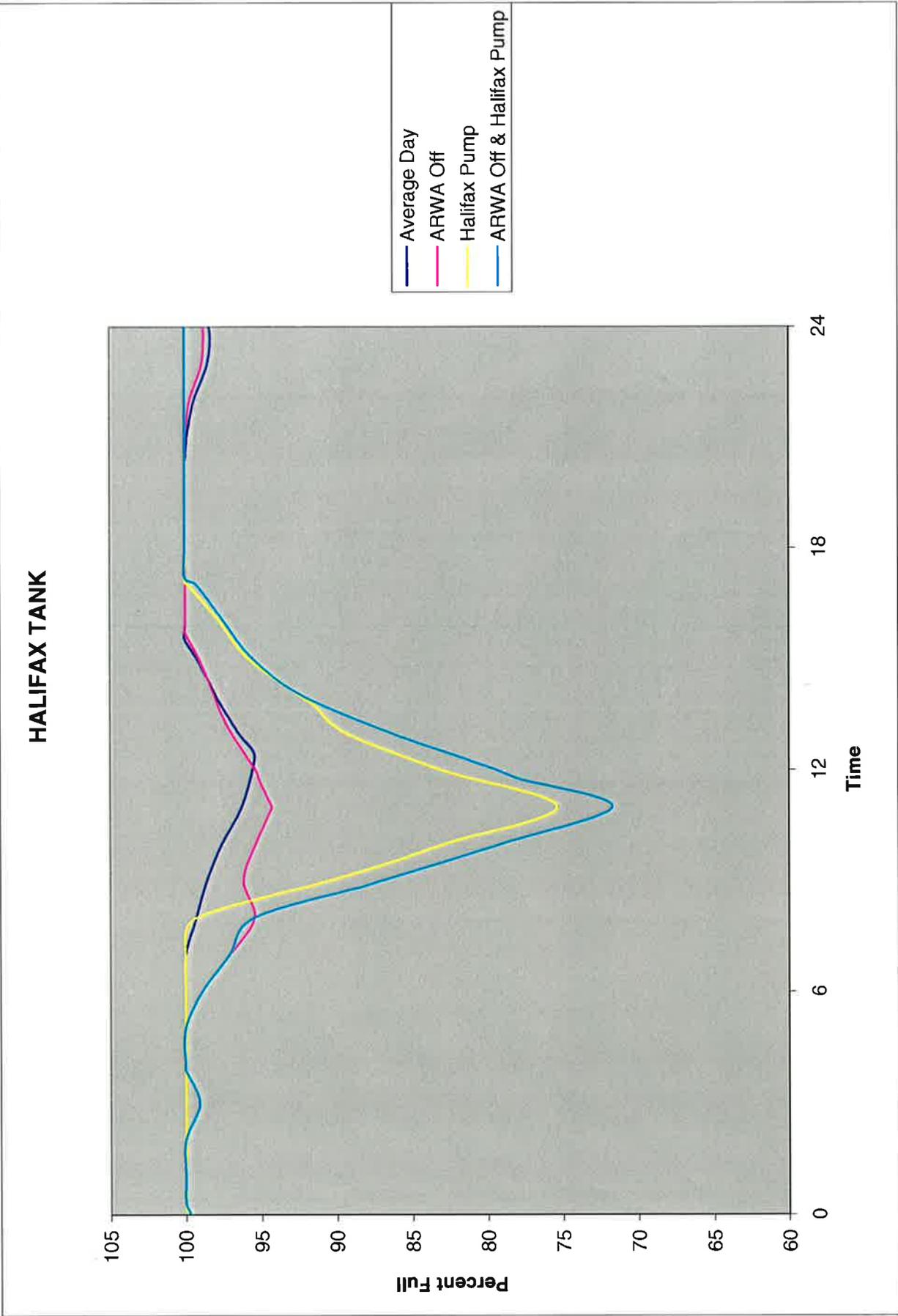


# JAMESTOWN TANK



- Average Day
- ARWA Off
- Halifax Pump
- ARWA Off & Halifax Pump

Graphs (2) Chart 1



**CITY OF PETERSBURG**  
**WATER DISTRIBUTION SYSTEM**  
**OPERATION EVALUATION**

**APPENDIX**  
**WATER SAMPLING PLAN**  
**(APPROVED 1991)**

**JUNE 2001**

BACTERIOLOGICAL MONITORING PLAN

WATERWORKS NAME: City of Petersburg

PWSID NUMBER: 3730750

I. Purpose

It is the purpose of this document to establish a bacteriological monitoring program which will identify specific sampling locations which will provide samples representative of the water quality throughout the distribution system for this waterworks.

II. Responsible Charge

The following person will normally be responsible for collecting samples under this program (name, title and address);

Robert L. Vest - Service Technician II

424 St. Andrew Street

Petersburg, Virginia 23803

Phone: 804-733-2407

SEVFO  
Copy

III. Program Elements

1. The Petersburg waterworks is current  
45 water samples for coliform analysis.  
Three different sampling locations are identified for every required routine sample for a total of 207 locations.
2. Attachment No. 1 consists of a system piping map, with each sample site location identified.
3. Routine Samples
  - a. Routine samples shall be collected from the designated locations listed in Attachment 2.
  - b. Routine bacteriological samples will be collected from each of the above routine locations on a rotating basis. Attachment 3 discusses how sample collection is to be rotated between the sample locations.
  - c. When more than one (1) routine sample per month is required, the samples will be collected at evenly spaced timed intervals throughout the month. Allowances will be made for holidays, vacations, etc., to make sure that all of the required samples will be analyzed each month. Normally, routine samples will be collected so that no more than 15 are collected in any one week.

- d. These routine sample locations are chosen to allow for the collection of required upstream and downstream repeat samples when necessary.
- e. No routine samples shall be collected at the water source(s) or at entry point(s) to the system.
- f. For the month following any month in which there is a positive sample, five routine samples will be collected. These routine samples will be collected from the designated locations, and will be distributed evenly throughout the system and the month.

4. Repeat Sampling

- a. At least one repeat sample will be collected at the same tap as the original sample. At least one repeat sample will be collected from within 5 service connections downstream of the original sample. At least one repeat sample will be collected from within 5 service connections upstream of the original sample. Additional repeat samples may be collected from anywhere in the system.
- b. Repeat samples shall be collected from the designated locations listed in Attachment 4.

IV. Attachments

- A. No. 1 - System Piping Map
- B. No. 2 - Routine Sample Locations
- C. No. 3 - Discussion of Sample Rotation
- D. No. 4 - Repeat Sample Locations

V. This bacteriological monitoring plan is established this date:

Albert E. Andrews, III

Name

*Albert E. Andrews, III*  
Signature

Superintendent - Utility Lines Div.

Title

September 19, 1991

Date

VIRGINIA DEPARTMENT OF HEALTH  
DIVISION OF WATER SUPPLY ENGINEERING

APPROVED BY: *Daniel B. Boye*  
REGIONAL DIRECTOR

SOUTHEAST VA. REGIONAL OFFICE

DATE 29 Oct 91



# City of Petersburg

DEPARTMENT OF PUBLIC UTILITIES  
Utility Lines Division  
(804) 733-2407

424 St. Andrew Street  
Petersburg, Virginia 23803

## WATER SAMPLING SCHEDULE Bacteriological

SAMPLE LOCATION (Take samples according to their numerical listing)

- 1. 010 Locks
- 01D Ramsey's Iron & Metal Inc. - 30 Mill Rd.
- 01U Stackhouse - 33 Rawlings La.
  
- 2. 020 Pepsi Cola Plant - 1501 W. Washington St.
- 02D Wyatt Sign Co. - 1311 Hinton St.
- 02U Southern State - 1609 W. Washington St.
  
- 3. 030 Seven Eleven (460 E.) - 2210 County Dr.
- 03D California Inn (bathroom - office) - 2214 County Dr.
- 03U Jamestown Tank (in pit)
  
- 4. 040 Modern Radiator - 1001 E. Bank St.
- 04D Barksdale Oil Co. (bathroom - office) - 1041 E. Bank St.
- 04U B.P. Short & So. (office) - 1006 E. Bank St.
  
- 5. 050 Virginia State College (boiler house)
- 05D Simm Hall
- 05U Jones Dining Hall
  
- 6. 060 Wastewater Treatment Plant (kitchen office) - 900 Magazine Rd.
- 06D Wastewater Treatment Plant (shop) - 900 Magazine Rd.
- 06U Wastewater Treatment Plant (new lab building) - 900 Magazine Rd.
  
- 7. 070 Wastewater Treatment Plant (mens bathroom - control room) - Magazine Rd.
- 07D Wastewater Treatment Plant (new lab building) - Magazine Rd.
- 07U Wastewater Treatment Plant (shop) - 900 Magazine Rd.
  
- 8. 080 Seven Eleven (South Crater Rd.) - 3829 S. Crater Rd.
- 08D Beckey's Florist & Gift Shop (bathroom) - 3847 A S. Crater Rd.
- 08U J.L. Thacker (bathroom) - 3671 S. Crater Rd.

9. 090 Chang's Food Mart (bathroom) - 2328 E. Washington St.  
 09D Youngs Foreign Car Repair (bathroom) - 2327 E. Washington St.  
 09U Food Lion (bathroom) - 2400 E. Washington St.
10. 100 Petersburg High School - 3101 Johnson Rd.  
 10D Johnson Rd. Fire Station (bathroom) - Johnson Rd.  
 10U Anderson Education Center (Room #110) - 3101 Homestead Dr.
11. 110 School Board Maintenance Office - W. Wythe St.  
 11D Recreation Office (kitchen sink) - W. Wythe St.  
 11U School Board Maintenance Shop (bathroom) - W. Wythe St.
12. 120 Market Street Fire Station (bathroom) - S. Market St.  
 12D Merit Bakery Discount Store (bathroom) - 42 S. Market St.  
 12U Market Street Fire Station (maintenance shop) - S. Market St.
13. 130 Health Center (men's bathroom 1<sup>st</sup> floor) - 301 Halifax St.  
 13D Crockett's Food Center (kitchen sink) - 400 Halifax St.  
 13U Petersburg Dept. of Social Services (men's bathroom 1<sup>st</sup> floor) -  
 Farmer St.
14. 140 City Garage Office (bathroom) - 800 Arlington St.  
 14D Traffic Maintenance Shop (sink) - 800 Arlington St.  
 14U City Garage (brake room sink) - 800 Arlington St.
15. 150 Pecan Acres (Housing Area Office) - 433 Pecan St.  
 15D Pecan Acres Child Care Center (bathroom) - 432 Pecan St.  
 15U Petersburg Area Transit Office (utility room) - 309 Fairgrounds Rd.
16. 160 Utility Lines Division Office (bathroom) - 424 St. Andrew St.  
 16D Utility Lines Division Yard (bathroom) - 424 St. Andrew St.  
 16U Utility Lines Division Shop (sink) - 424 St. Andrew St.
17. 170 CECO Inc. (bathroom) - 2929 N. Normandy Dr.  
 17D Virginia Abrasives (outside faucet) - 2851 Service Rd.  
 17U Brenco Bearing Inc. (office sink) - Petersburg Industrial Park
18. 180 Seven Eleven (bathroom) - 900 S. Sycamore St.  
 18D Canton Restaurant (bathroom) - 950 S. Sycamore St.  
 18U Gene's Transmission (bathroom sink) - 812 S. Sycamore St.
19. 190 Mount Vernon Water Pumping Station - Mount Vernon St.  
 19D Mount Vernon Tank (pit) - Mount Vernon St.  
 19U Resident R.L. Emory (outside faucet) - 1583 Mount Vernon St.

20. 200 Halifax St. Tank - Halifax St.  
 20D Cesco Roofing (bathroom) - 1600 Halifax St.  
 20U Try Me Supermarket - 1614 Halifax St.
21. 210 Seven Eleven (bathroom) - 225 S. Boulevard  
 21D McDonalds (bathroom) - 2128 S. Crater Rd.  
 21U Hardee's (bathroom) - 1865 S. Crater Rd.
22. 220 Mercury St. Tank - Mercury St.  
 22D Webster St. Apartment Building 1 Apt. A (kitchen sink) - Webster St.  
 22U George Coleman's Residence (outside faucet) - 336 Glenwood Ct.
23. 230 Zip Mart (kitchen) - 2744 S. Crater Rd.  
 23D Triangle Dodge (showroom - men's bathroom) - 2833 S. Crater Rd.  
 23U Burger King - 2910 S. Crater Rd.
24. 240 4<sup>th</sup> Street Fire Station - 4<sup>th</sup> Street  
 24D Decorating Outlet (bathroom) - 327 Bollingbrook St.  
 24U Midas Muffler Shop (bathroom) 214 Bollingbrook St.
25. 250 Willie Pope's Residence (outside faucet) - 1342 Steele St.  
 25D Colonel A. Pelliford's Residence (outside faucet) - 1314 Beazley St.  
 25U Deborah Westbrook's Residence (outside faucet) - 1346 Steele St.
26. 260 Walnut Hill Tank (in pit)  
 26D Moore's Building Supplies (bathroom) - 2520 S. Crater Rd.  
 26U Firestone Mastercare Service (bathroom) - 2140 S. Crater Rd.
27. 270 Walnut Hill Fire Station (bathroom) - 1907 S. Sycamore St.  
 27D Palmore Decorating Center (bathroom) - 1927 S. Sycamore St.  
 27U Parham's Texaco (bathroom) - 1901 S. Sycamore St.
28. 280 Fire Administration Building (bathroom) - 400 E. Washington St.  
 28D Aunt Sarah's (bathroom) - 403 E. Washington St.  
 28U Regency Inn Motel (bathroom) - 380 E. Washington St.
29. 290 City Hall Annex (bathroom 1<sup>st</sup> floor) - 103 W. Tabb St.  
 29D City Hall (bathroom downstairs) - 22 W. Tabb St.  
 29U City Registrar Office (bathroom) - 142 N. Union St.
30. 300 A.P. Hill Community Center (bathroom 1<sup>st</sup> floor) - 1237 Halifax St.  
 30D Roper Stith's Residence (kitchen sink) - 1232 Halifax St.  
 30U Grace Archer's Residence (kitchen sink) - 1310 Halifax St.
31. 310 Petersburg Public Library (outside faucet) - 1865 S. Sycamore St.  
 31D James Wright's Residence (outside faucet) - 1875 S. Sycamore St.  
 31U Robert Buckley's Residence (outside faucet) - 1858 S. Sycamore St.

32. 320 School Board Office (bathroom) - 141 E. Wythe St.  
32D Alrod Inc. (bathroom) - 142 E. Wythe St.  
32U Southern Autotronics (bathroom) - 101 E. Wythe St.
33. 330 Buildings & Grounds Office (bathroom) - 1898 Midway St.  
33D Pennington Seed (bathroom) 1711 Midway St.  
33U Buildings & Grounds Shop (bathroom) - 1981 Midway St.
34. 340 Jerry's Electric (bathroom) - 2803 A County Dr.  
34D Stop Shop Brake Shop (bathroom) - 2791 County Dr.  
34U ABE's Auto (bathroom) - 2817 County Dr.
35. 350 Fire Department (bathroom) - 1320 Farmer St.  
35D Shirley Eance's Residence (outside faucet) - 1327 Farmer St.  
35U Gladys Stith's Residence (outside faucet) - 1309 Farmer St.
36. 360 Walnut Hill School (kitchen) - 300 S. Boulevard  
36D Walnut Hill Launderette - 1923 Wakefield Ave.  
36U Dr. Richard Dunn's Office - 1888 S. Sycamore St.
37. 370 Robert E. Lee School (kitchen) - 51 Gibbons Ave.  
37D Alice Wood's Residence (outside faucet) - 60 Gibbons Ave.  
37U Willie Collins' Residence (outside faucet) - 44 Gibbons Ave.
38. 380 Stuart School (kitchen) - 100 Pleasant La.  
38D Kenneth White's Residence (outside faucet) - 411 Pleasant La.  
38U David Edmonds (outside faucet) - 320 Pleasants La.
39. 390 Westview School (kitchen) - 1100 Patterson St.  
39D Carl Wyatt's Residence (outside faucet) - 1105 Patterson St.  
39U Alvin Graves' Residence (outside faucet) - 1039 Patterson St.
40. 400 A.P. Hill School (kitchen) - 1450 Talley Ave.  
40D Charles Lewis' Residence (outside faucet) - 1449 Talley Ave.  
40U Lathurs Mann's Residence (outside faucet) - 1635 Talley Ave.
41. 410 Hardee's (men's bathroom) - 2135 County Dr.  
41D Jim Whelan's Service Center (men's bathroom) - 2156 County Dr.  
41U Sloan's Texaco (men's bathroom) - 2129 County Dr.
42. 420 Hardee's (men's bathroom) - 100 W. Washington St.  
42D Market Place - 110 W. Washington St.  
42U Heilig-Meyers Furniture (bathroom) - 22 W. Washington St.

43. 430 Albert Andrews' Residence (outside faucet) - 1753 Pender Ave.  
43D James Barksdale's Residence (outside faucet) - 1745 Pender Ave.  
43U N.H. Andrews' Residence (outside faucet) - 1820 Pender Ave.
44. 440 Harding St. Recreation Center (bathroom) - 453 Harding St.  
44D Banzella Stith's Residence (outside faucet) - 445 Harding St.  
44U Robert Hunt's Residence (outside faucet) - 450 Harding St.
45. 450 Elmore Buffkin's Residence (outside faucet) - 421 Hoke Dr.  
45D George Mason's Residence (outside faucet) - 403 Hoke Dr.  
45U John Pope's Residence (outside faucet) - 427 Hoke Dr.
46. 460 Fred Tucker's Residence (outside faucet) - 1804 Randolph Ave.  
46D Bernice Spatig's Residence (outside faucet) - 1807 Randolph Ave.  
46U Stanley Tipton's Residence (outside faucet) - 1800 Randolph Ave.
47. 470 George Pegram's Residence (outside faucet) - 3372 Francis St.  
47D Willie Young's Residence (outside faucet) - 3364 Francis St.  
47U Oscar Green's Residence (outside faucet) - 3427 Francis St.
48. 480 Leonard Brent's Residence (outside faucet) - 3376 Oakwood Circle  
48D Howard Barnett's Residence (outside faucet) - 3382 Oakwood Circle  
48U Lawrence Robinson's Residence (outside faucet) - 3368 Oakwood Circle
49. 490 Michael Stuart (outside faucet) - 3341 E. Princeton Rd.  
49D Ray Chariton's Residence (outside faucet) - 3333 E. Princeton Rd.  
49U Durrel Angell's Residence (outside faucet) - 3324 E. Princeton Rd.
50. 500 Robert Allen's Residence (outside faucet) - 3356 Lancelot Rd.  
50D Walter Flaunders' Residence (outside faucet) - 1765 W. Princeton Rd.  
50U Carl Keller's Residence (outside faucet) - 3348 Lancelot Rd.
51. 510 Joseph Dyson's Residence (outside faucet) - 426 Walnut St.  
51D Madeline Mason's Residence (outside faucet) - 432 Walnut St.  
51U Carrie Dodson's Residence (outside faucet) - 425 Walnut St.
52. 520 Charles Hester's Residence (outside faucet) - 1045 Elliott Ave.  
52D R.H. Pritchett's Residence (outside faucet) - 1048 Elliott Ave.  
52U Laura Baird's Residence (outside faucet) - 1040 Elliott Ave.
53. 530 Preston Emory's Residence (outside faucet) - 1820 Stuart Ave.  
53D Roy Richardson's Residence (outside faucet) - 1830 Stuart Ave.  
53U M.E. Whitchurch's Residence (outside faucet) - 1816 Stuart Ave.
54. 540 Bobby Goodwin's Residence (outside faucet) - 1603 Circle Dr.  
54D Harry Stallings' Residence (outside faucet) - 1608 Circle Dr.  
54U Louise Lewis' Residence (outside faucet) - 1600 Circle Dr.

55. 550 Joseph Harris' Residence (outside faucet) - 2923 Brierwood Rd.  
55D K. Muromoto's Residence (outside faucet) - 2930 Brierwood Rd.  
55U Thomas Pegram's Residence (outside faucet) - 2917 Brierwood Rd.
56. 560 Joe East's Residence (outside faucet) - 1905 Bogese Dr.  
56D Sylvester Williams' Residence (outside faucet) - 1910 Bogese Dr.  
56U Willie Balthrop's Residence (outside faucet) - 1862 Bogese Dr.
57. 570 Peabody Jr. High School (kitchen) - 725 Wesley St.  
57D Charles Fitzgerald's Residence (outside faucet) - 726 Wesley St.  
57U Oscar Crump's Residence (outside faucet) - 722 Wesley St.
58. 580 Southside Reginal Hospital (men's bathroom 1<sup>st</sup> Floor) - 137 Appollo St.  
58D Cancer Center (bathroom) - Adams St.  
58U Purchasing Office (bathroom) - Appollo St.
59. 590 Citgo (ballroom) - 701 S. Crater Rd.  
59D Auto World (bathroom) - 660 S. Crater Rd.  
59U Flagstop Inn (bathroom) - 815 S. Crater Rd.
60. 600 Golden Skillet (bathroom) - 1228 W. Washington St.  
60D Central Cleaner's (bathroom) - 1234 W. Washington St.  
60U Tri-City Lumber (bathroom) - 1202 W. Washington St.
61. 610 L. Henshaw (outside faucet) - 615 Confederate Ave.  
61D L. Epps (Outside faucet) - 622 Confederate Ave.  
61U R. Warren (outside faucet) - 614 Confederate Ave.
62. 620 S. Gustinis (outside faucet) - 14 Seaboard St.  
62D R. Price (outside faucet) - 17 Seaboard St.  
62U K. Mayes (outside faucet) - 10 Seaboard St.
63. 630 Mary Parsons (outside faucet) - 1655 Berkeley Ave.  
63D M. Gill (outside faucet) - 1658 Berkeley Ave.  
63U J. Tyler (outside faucet) - 1654 Berkeley Ave.
64. 640 R. Hartman (outside faucet) - 2037 Woodland Rd.  
64D J. Williamson (outside faucet) - 2042 Woodland Rd.  
64U L. Turner (outside faucet) - 2031 Woodland Rd.
65. 650 C. Leonard (outside faucet) - 1980 Coggin St.  
65D I. Lynch (outside faucet) - 1987 Coggin St.  
65U E. Felts (outside faucet) - 1977 Coggin St.
66. 660 J. Mann (outside faucet) - 2204 Walton St.  
66D M. Young (outside faucet) - 2205 Walton St.  
66U J. Clarke (outside faucet) - 2147 Walton St.
67. 670 P. Taylor (outside faucet) - 2551 Pinehurst Ave.  
67D L. Chambliss (outside faucet) - 2554 Pinehurst Ave.  
67U G. Mayes (outside faucet) - 2548 Pinehurst Ave.

68. 680 R. Brooks (outside faucet) - 2711 Rollingwood Rd.  
68D E. Ruffin (outside faucet) - 2716 Rollingwood Rd.  
68U G. Hill (outside faucet) - 2706 Rollingwood Rd.
69. 690 D. Hollister (outside faucet) - 218 Seyler Dr.  
69D J. Morgan (outside faucet) - 223 Seyler Dr.  
69U S. Wells (outside faucet) - 211 Seyler Dr.

## WATER SAMPLES TAKEN IN THE FOLLOWING ORDER

### FIRST WEEK OF EACH MONTH

- I Utility Lines Division
- I Mount Vernon Tank
- O Petersburg Library 1865 South Sycamore Street
- P,+ Walnut Hill Water Tank
- I Petersburg High School - Johnson Road
- I ~~Seven Eleven~~ - south Crater Road Thacker Hardware
- I Seven Eleven Rt. 460 East - County Drive
- I Modern Radiator - East Bank Street
- I Fire Administration Building \_ 400 East Washington Street
- I Fourth Street Fire Station 4th Street
- I Virginia State University
- I School Board Maintenance Office - West Wythe Street
- I Health Center -301 Halifax Street
- I Locks Water Pumping Station

### SECOND WEEK OF EACH MONTH

- I Seven Eleven 900 South Sycamore Street
- I Walnut Hill Fire Station - South Sycamore Street
- I Zip Mart South Crater Road
- I Ceco Inc. North Normandy Drive
- I Hardee's - County Drive
- I Chang's Food Mart - East Washington Street laundry
- I Wastewater Treatment Plant (Kitchen Office)
- I Hardee's West Washington Street
- I City Garage
- I A.P. Hill Community Center - Halifax Street
- O Pope House - 1343 Steele Street
- P,+ Halifax Street Tank
- I Stuart School - Pleasants Lane
- I Pecan Acres - Pecan Street
- I Pepsi Cola Company - West Washington Street

Third WEEK OF EACH MONTH

- P: + Mercury Street Tank
- I Walnut Hill School - South Boulevard
- o Buffkin's Residence - 421 Hoke Drive
- I Seven Eleven - South Boulevard
- I Jerry's Electric - County Drive
- o Andy Andrew's Residence - 1753 Pender Avenue
- I Robert E Lee School - Gibbons Avenue
- I School Board Office - 141 East Wythe Street
- I Wastewater Treatment Plant (Bathroom)
- I City Hall Annex - First Floor (Bathroom)
- I Market Street Fire Station - South Market Street
- I Harding Street recreation Center - Harding Street
- I A.P.Hill School - Tally Avenue
- I Westview School - Patterson Avenue
- I City of Petersburg Building and Grounds

I - Inside Top  
o - Outside Top