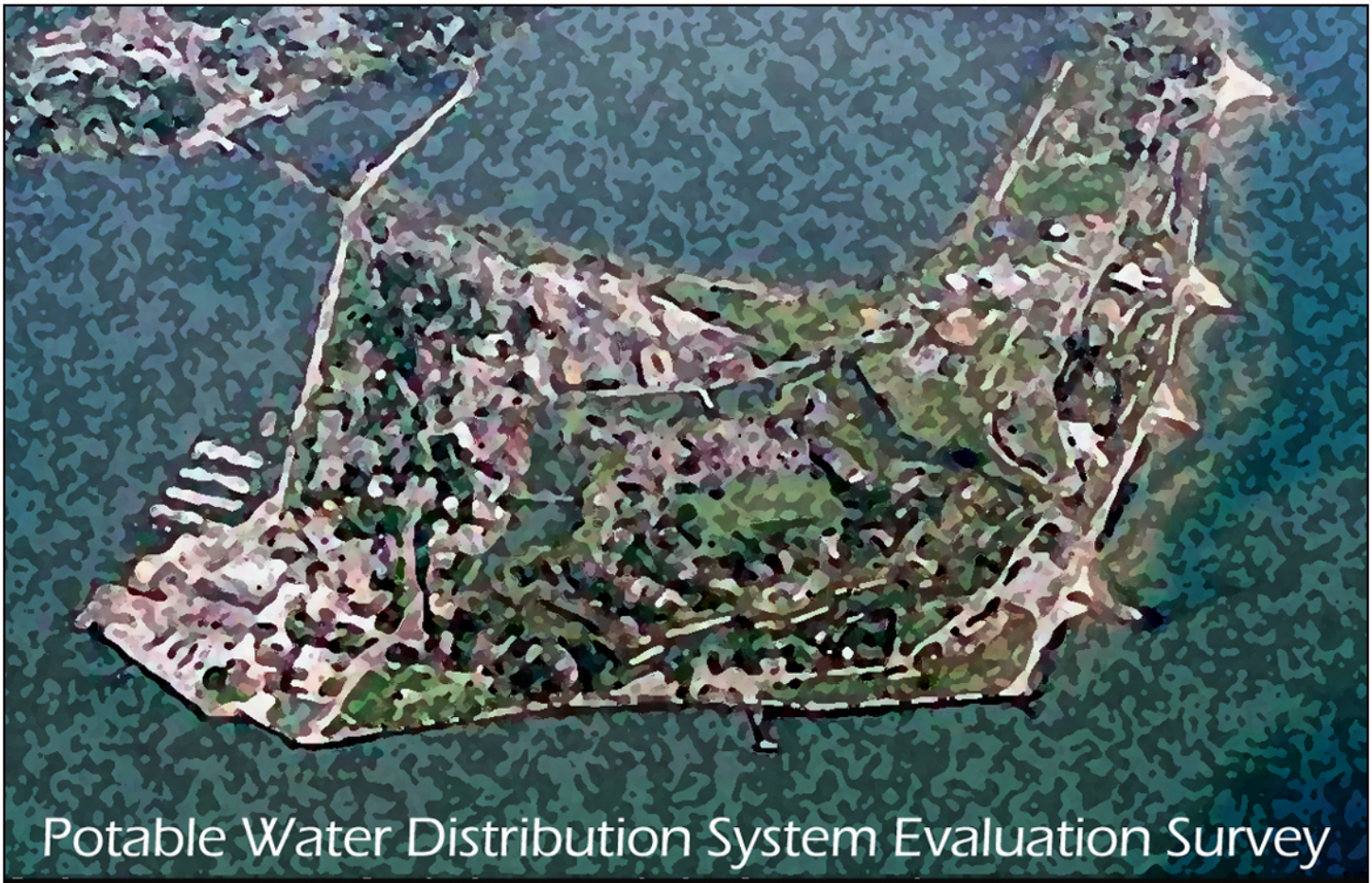

Potable Water Distribution System Evaluation Survey

Fort Monroe, Virginia
May 2004

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Potable Water Distribution System Evaluation Survey
Fort Monroe, Virginia

Final Report
May 2004

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Executive Summary

This report documents a study completed by URS Corporation using the water distribution modeling software, WaterCAD, to evaluate Fort Monroe's water distribution system. The purposes of this study are to model the existing distribution system, evaluate its reliability with particular emphasis on meeting fire flow requirements, study the alternatives to improve the water system based on projected demand and optimize required potential distribution system modifications, and provide a phased, prioritized capital improvement plan including programming level costs for the next five years.

Fort Monroe is a small army base located at the southeastern end of the Virginia Lower Peninsula on sand spit between Hampton Roads and the Chesapeake Bay. It was completed in 1834, and it has since been designated a National Historic Landmark. Its principal occupants include several military organizations, army personnel, and a small population of civilians.

The water distribution system at Fort Monroe, including primary mains and service connections, totals approximately 96000 linear feet of pipe. Most mains are cast iron though some PVC pipe has been laid in recent years. Water storage at Fort Monroe consists of one elevated tank of 300,000-gallon capacity, which is adequate, based on our analysis of the water distribution system with future considerations. The average age of the distribution system is estimated to be about 32 years, however certain portions of the system were installed prior to 1946. The fire protection system at Fort Monroe consists of 37 buildings with sprinkler systems and 78 active fire hydrants located throughout the installation. Generally, preferred fire hydrant pressure is 50 pounds per square inch (psi) or greater with a minimum of 20 psi needed to prevent backflow and collapse of water hoses.

Field research, including leak detection and C-factor testing, was conducted to gather data used to create a model that accurately portrays Fort Monroe's water distribution system. Data was also collected through interviews and available distribution system layout drawings.

Thorough research was conducted in establishing baseline water demand and quantifying projected water demand for future scenarios. In establishing the water demand, detailed information of water consumption was obtained from several sources, including the State Water Regulations, Military Handbooks, and other standard references. The total water demand estimated for existing conditions is in general agreement with the historic water consumption rates. The water demand under existing conditions (summer) is projected at approximately 348,000-gpd. Based on the demolition and construction plans the projected water demand in YR5 is approximately 331,000 gpd. Provision of water for fire fighting was established using Unified Facilities Criteria manual and NFPA Standards. The fire flow requirement on the base at individual hydrants varies from 500-gpm to 2250-gpm with a minimum residual pressure of 20 psi.

As part of this study, the Fort Monroe water distribution system was evaluated using the network analysis program, WaterCAD v6.5. The physical characteristics of the water distribution system included in the computer model are ground topography, the connection to Newport News waterworks, tank characteristics, pipe diameter, length, and interior roughness, active fire hydrants, and most valve locations. Historical and projected water demands are also assigned to the computer model. The model incorporates all looped mains of 4-inch diameter and greater as well as dead end mains of hydraulic significance. Abandoned lines and service connections were not included in the model. The computer model developed for existing conditions simulates 370 pipe elements, 234 pressure junctions, 78 fire hydrants, and 104 valves. The elevated storage tank and the two existing connections to Newport News waterworks were incorporated into the model.

Both steady state and extended-period simulations were performed based on Fort Monroe's existing conditions. Currently, the base is being fed by Newport News Waterworks through a 10-inch cast iron main. The existing system simulation with 2003 winter demands depicts residual water pressures throughout the installation of approximately 50 psi. This is consistent with the average system residual pressure disclosed in the statement of work as well as the static pressures observed in the field during hydrant testing. Fort Monroe's Fire Department has expressed concern that the water supply available for fire protection is inadequate. The results of the steady state fire flow analysis shows that only 19 out of 78 fire hydrants, approximately 25%, satisfy the fire flow requirement under existing conditions with a minimum system residual pressure of 20 psi at the hydrants. Many hydrants cannot deliver 500 gpm, the minimum fire flow required for fire protection as stated in AWWA 31.

Analysis using the existing conditions model (with both the 10- and 14-inch supply lines in operation) and future projected demands were performed. To meet the pressure and flow requirements of the three principal consumers, domestic, recreational, and commercial, no additional modifications were deemed necessary. However, to satisfy the fire flow requirement with a minimum system pressure of 20 psi, several different alternatives were studied to optimize the required distribution system modifications. The improvements have been separated into three phases based on importance and impact on distribution system performance. In prioritizing the capital improvements, the largely developed area, in-and-around the stone fort, was assigned a higher priority. All new pipe segments suggested are PVC pipe based on its ability to withstand corrosion and tuberculation, installation preference, and cost.

The total cost of the improvements for Phase 1 is estimated to be approximately $425,000.00. Upon completion of a total of fifteen (15) projects in Phase 1, available fire flow throughout the installation is much improved. The results of the steady state fire flow analysis shows that 59 out of 78 fire hydrants, approximately 75%, satisfy the fire flow requirement with a minimum system residual pressure of 20 psi at the hydrants. Pressures are improved and hydraulic residence time throughout the system is decreased.

Completion of the five (5) projects in Phase 2 further strengthen the integrity of the distribution and increase the system's ability to meet fire flow requirements. With Phase 2 completion, 100% of the fire hydrants throughout the system fully satisfy the fire flow requirement at a minimum residual pressure of 20 psi. The total cost of the improvements for Phase 2 is estimated to be approximately $275,000.00.

For Phase 3, URS recommends gradual replacement of all remaining cast iron mains on Fort Monroe with PVC pipe of their respective sizes. Phase 3 effectively changes an aging system into one that can provide pressures and flow rates that are adequate for projected demands within the scope of this study. Further, replacing the pipes with newer ones improves the system reliability during times of fire. The total cost of these improvements, for Phase 3, is estimated to be approximately $790,000.00.

Currently, Fort Monroe's water distribution system is incapable of delivering adequate water supply for fire fighting. The 14-inch cast iron supply line that enters the base via Mercury Boulevard was damaged during Hurricane Isabel and was put out of service temporarily; the water tank has also been off-line. Therefore, water is being supplied solely through the 10-inch cast iron main crossing Mill Creek via Mugler Bridge; significant head loss is experienced through this supply line. Larger summer demands will cause pressure problems unless improvements begin immediately.

With the tank on-line and the base fed through both the 10- & 14-inch supply lines, complete satisfaction of fire flow requirements is achieved upon completion of Phase 2 improvements. Although available water supply for fire protection increases as phased improvements are completed, complete satisfaction of fire flow requirements can not be provided with the water tank off-line until completion of Phase 3 improvements. Since this involves gradual replacement of all remaining cast iron mains not addressed in Phase 1 or Phase 2, it is strongly recommended that the water tank remain in constant operation.

Large summer demands, especially irrigation demands, put a strain on the water tank and distribution system. These effects are minimized when the base is being fed through both the 10- & 14-inch supply lines. Under these conditions, the water tank can fill to 93% of its capacity or approximately 280,000 gallons. After phased improvements are completed, the water tank will fill to 93.5% in the summer and fill completely during winter months.

By following the phased, prioritized improvement plan developed by URS, performance of the system and system reliability will improve drastically.

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1.0 Introduction

1.1 Background

Named after former President James Monroe, Ft. Monroe began as a 63-acre stone fort surrounded by a moat. The stone fort is the largest of its kind ever built in the United States. Fort Monroe is a small army base located at the southeastern end of the Virginia Lower Peninsula on a sand spit between Hampton Roads and the Chesapeake Bay. It was completed in 1834, and it has since been designated a National Historic Landmark. Over the years, soil was brought in as fill for the area outside of the stone fort's moat to support expansion, both in terms of occupancy and size. Today, Ft. Monroe encompasses 568-acres of land, 108-acres of which are submerged. The fort is largely developed with a few undeveloped parcels including a large tract of land toward Dog Beach. The topography of the land is shallow and flat; ground level varies from a minimum of 5 feet to a maximum of 10 feet above sea level, with an average elevation of 8 feet above sea level. Land use is primarily administrative in nature, with little industrial processes; however, several buildings on base are dedicated to residential, recreational, and commercial occupancy. Fort Monroe's principal occupants include: HQ TRADOC, Reserve Officers Training Corps Cadet Command, Naval Surface Warfare Center, Joint Task Force Civil Support, Defense Contract Management Agency, United States Army Health Clinic Fort Monroe, Security Assistance Field Activity, TRADOC Combined Operations Field Agency, Army Audit Agency, army personnel, and a small population of civilians.

1.2 Project Objectives

Fort Monroe is experiencing a period of development and expansion, while burdened with an aging water system infrastructure. To ensure that Fort Monroe is able to adequately support the future potable water needs of its residents, URS Corporation has been contracted to conduct a comprehensive study on its water distribution system, with particular emphasis in sustaining acceptable residual pressure and satisfying fire flow requirements. In the past, the fort has experienced problems with low residual pressure and inadequate flow in its distribution system, and with current plans for expansion, both short and long term, these problems with the water distribution system need to be addressed. The purpose of this report is to provide a phased, prioritized capital improvement plan for the next five years that ensures continued system functionality and reliability. Development of the improvement plan is based upon the following: historical water usage; available information of the existing water distribution system; field data collection; interviews with operational personnel; leak detection surveys; hydrant testing; and updated mapping and computer modeling in accordance with established industry standards accounting for future development as per Fort Monroe's Real Property Master Plan.

Per the project Statement of Work, the requirements for this study are as follows:

- Collect and review all available data on the distribution system including pipes, valves, meters, pumps, tanks, and available distribution system layout drawings, permits, etc.
- Conduct field research to develop an inventory of water system facilities and evaluate major system components to determine the structural integrity of the system.
- Conduct representative hydrant testing and field-testing to determine pressure and flow through the system.
- Conduct leak detection surveys.
- Develop, through the use of a commercial off-the-shelf computer program, a water distribution system model to represent Fort Monroe's distribution system.
- Calibrate the model to the data collected during field-testing to create an accurate portrayal of the water distribution system.
- Use the calibrated model to evaluate alternatives based on projected demand and optimize potential distribution system modifications required.
- Prioritize the distribution system modifications required.
- Prepare programming level costs of the projects to support the phased, prioritized capital improvement plan.
- Prepare a report to include an accurate, updated map of the potable water system on Fort Monroe, discuss the methodology involved in the investigation, detail the findings of the study, and provide alternatives for repairing/improving the water system with cost opinions for phased construction. All government comments provided on the draft will be incorporated in the final report.

1.3 Report Organization

This report includes several sections that were developed to fulfill the project purpose and goal in a succinct fashion. The organization of this report is as follows:

- Section 1.0 This section of the report, "Introduction," provides a brief background, overview of the project objectives, and the report contents.
- Section 2.0 "Evaluation of Fort Monroe Water Distribution System" describes the existing conditions as well as future considerations of the potable water system serving Fort Monroe. The process used to develop appropriate design

flows, including both current and predicted demands and fire flow requirements, as well as historic water consumption data are also included here.

- Section 3.0 "Field Work" gives a detailed description of the methodologies, procedures, and results of all field-testing, such as the leak detection study and representative hydrant testing. Information gathered through interviews on the operation of the system is also included.

- Section 4.0 "Computer Modeling of Fort Monroe's Water Distribution System" describes the software package used to develop Fort Monroe's water distribution model. This section presents the data used to construct the model. Assumptions and calibration efforts are also explained here.

- Section 5.0 "Modeling Results and Findings" documents each model run completed under existing and future conditions, its relevance to the project objectives, followed by a brief discussion of the results.

- Section 6.0 "Recommendations and Conclusions" provides a summary of the study's findings as well as recommendations for repair and improvement of the distribution system accounting for Master Plan Short Range component. Supporting construction cost opinions are also included.

The report also includes seven data appendices supporting the content stated in the main report.

- Appendix A: Metered Flow Data

- Appendix B: Estimated Domestic Water Consumption

- Appendix C: Fire Flow Requirements

- Appendix D: Leak Detection Reports

- Appendix E: C-factor Tests

- Appendix F: Newport News Available Pressure

- Appendix G: WaterCAD Results

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2.0 Evaluation of Fort Monroe Water Distribution System

2.1 Existing Conditions

As of September 5, 2003, the City of Newport News Waterworks became the sole supplier of potable water to Fort Monroe. Potable water from the City of Newport News is supplied to Fort Monroe through two lines. A 10-inch cast iron supply line crossing Mill Creek via Mugler Bridge is metered just off base along Water Street. The second supply line, a 14-inch cast iron main, enters the base via Mercury Boulevard and is metered at the intersection of Mercury Boulevard and Old Buckroe Road. Both of these lines are metered using 6-inch meters that cause a significant loss of head, especially through the 10-inch main. The 14-inch cast iron main was damaged during Hurricane Isabel and is put out of service temporarily, forcing the water to be supplied solely by the 10-inch cast iron main. Under existing conditions Fort Monroe's residual water pressure during normal demands is approximately 50 psi throughout the installation.

Water storage facilities at Fort Monroe consist of one elevated tank of 300,000-gallon capacity with a high water elevation of 138.0 feet above mean sea level (MSL). The total head range is 30 feet, from an elevation of 108.0 ft to 138.0 feet above mean sea level. A 12-inch cast iron main currently plays a dual role of filling the tank and then distributing the water from the tank to the rest of the system. The tank is approximately half-full at an elevation of 123.0 feet.

The fire protection system at Fort Monroe consists of 37 buildings with sprinkler systems and 78 active fire hydrants located throughout the installation. A few more hydrants are located on lines that are now abandoned. Generally, preferred fire hydrant pressure is 50 pounds per square inch (psi) or greater with a minimum of 20 psi needed to prevent backflow and collapse of water hoses.

The water distribution system at Fort Monroe, including primary mains and service connections, totals approximately 96000 linear feet of pipe. The existing primary system consists of 14-, 12-, 10-, 8-, and 6-inch mains looped and cross-connected throughout the installation. Most mains are cast iron though some PVC pipe has been laid in recent years. All 4-inch mains have been abandoned with the exception of a 4-inch cast iron main running along Fenwick Road towards Dog Beach. The average age of the distribution system is estimated to be about 32 years, however certain portions of the system were installed prior to 1946.

2.2 Future Considerations

Currently, installed water storage in constrained to the 300,000-gallon capacity of the elevated storage tank. Erecting an additional tank can expand water storage on the installation. However, due to the compact nature of the fort and the historical and architectural status of the installation, the location and design of a new water storage facility must be coordinated in accordance with applicable laws and regulations.

Analysis of the water distribution system with future considerations did not reveal of an imminent requirement of any additional storage facility, refer Section 5.0.

The water distribution system can be expanded in both the developed and underdeveloped areas of Fort Monroe. Dense facilities development suggests that maximum use be made of the existing alignment trenches rather than abandonment of existing lines and installation of all new water lines in developed areas of the fort. In underdeveloped areas of the fort, expansion may proceed with minimal impact.

Based on the Real Property Master Plan prepared for Fort Monroe by R & K Engineering, a total of 11 projects are programmed for Fort Monroe through 2009. Five of these projects require new construction. However, after talking to Fort Monroe Department of Public Works employees, it is apparent that only one of these scheduled projects has a chance of going to completion within the five-year scope of this study.

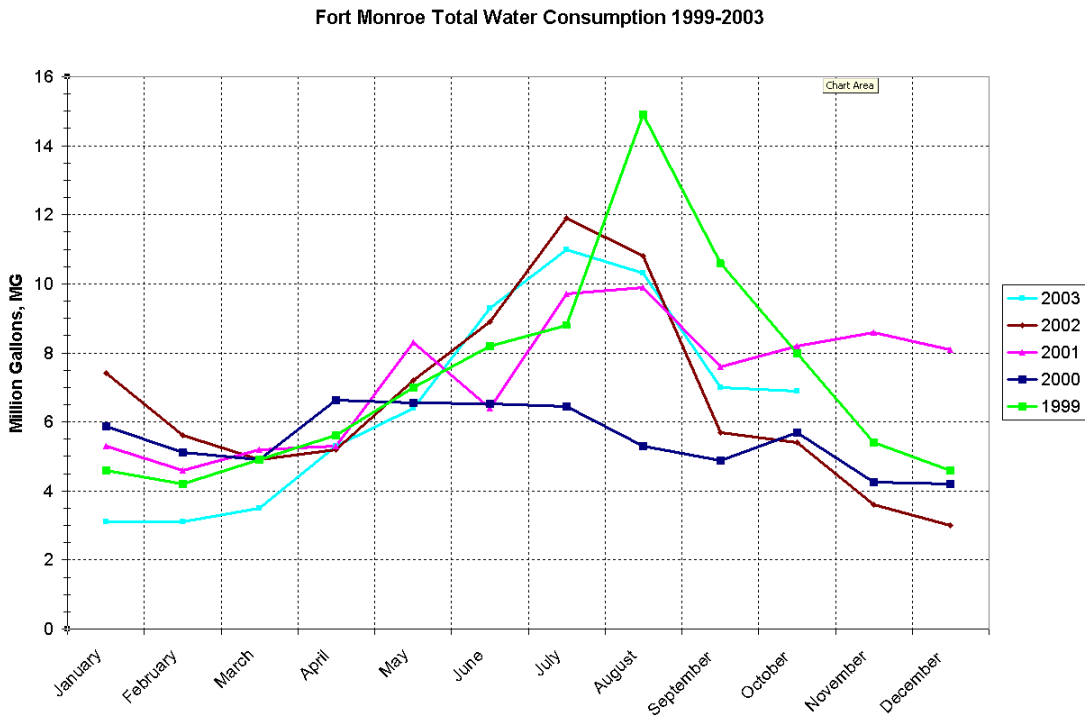
That project will result in a new, modern facility that will allow the Fort Monroe Fire Department, Safety Office, Military Police, Provost Marshal, MP Company HQ and Physical Security operations to collocate. Other building project information was gathered and considered in developing future water trends for the fort.

2.3 Historic Water Consumption

In the past, Fort Monroe was supplied with potable water from two sources. Big Bethel Military Reservoir and Water Treatment Plant Complex was the primary source and the City of Newport News Waterworks acted as a secondary source. Throughout the years, purchases were made from the City of Newport News during periods of repair to the Big Bethel Plant. Big Bethel went idle for repairs on September 5, 2003, and on September 23, 2003, the U.S. army decided not to reactivate the plant. Therefore, the City of Newport News became Fort Monroe's primary potable water supply as of September 5, 2003.

Over the last five years, monthly water usage totals have ranged from 3.0 million gallons per month (December 2002) to 14.9 million gallons per month (August 1999). Figure 2-1 shows Fort Monroe's monthly total water consumption for the periods 1999-2003. Water usage is typically highest during the summer due to irrigation and the use of seasonal facilities. However, water usage is lower when the fort is being supplied by Newport News Waterworks as opposed to the Big Bethel Plant due to lower supplied pressure.

Figure 2-1. Fort Monroe Total Water Consumption 1999-2003



Water consumption data was collected in the form of Newport News Waterworks bills as well as Department of Environmental Quality (DEQ) Annual Reports of Water Withdrawals. As of this report, meter data could not be located for November or December 2003. Metered consumption for the past five years from each potential source can be found in Appendix A: Metered Flow Data.

2.4 Average Daily Flow Projections

The model of Fort Monroe's distribution system addresses projected potable water consumption at various points in time over the five-year scope of the study. A variety of sources, including Virginia Waterworks Regulations and associated military-adopted guidance documents were consulted to determine appropriate unit flow requirements for existing and future facility types and anticipated population. A summary of the domestic water requirements evaluated and selected for estimating future potable water demand is provided in Table 2-1. As Table 2-1 illustrates, an assortment of unit demand factors are recommended by the various sources consulted. The unit demand factors vary both by unit of measure as well as unit flow required for different facility classifications. If Virginia Waterworks Regulations provides daily water consumption rates for a category, then that suggestion was used. Also, if a range of unit flows required is provided, the low end of the range was consistently used. Using the data presented in Table 2-1, the following unit flow consumptions were assumed for the respective facility classifications based on best engineering judgment (BEJ):

- Adult Education Center: A unit flow consumption of 15 gpd/person was selected for the analysis. Water use at an adult education center is thought to be comparable to that of a community college since there is no cafeteria, gym, or showers. According to Virginia Waterworks Regulations, the water consumption rate for a community college is 15 gpd/person.

- Auditorium: A unit flow consumption of 5 gpd/seat was selected for the analysis. Virginia Waterworks Regulations proposes this figure. It is also close to the figures proposed by other references.

- BOQ/BEQ: A unit flow consumption of 65 gpd/person was selected for the analysis. Although higher resident population per capita consumptions are suggested by TM 5-813-1 and MIL-HDBK 1005/16, consumptions provided in these two references are more representative of military family housing. Family housing areas typically include water-consuming features not generally available in a BOQ/BEQ suite, such as full service kitchens and washing machines. Therefore, BOQ/BEQs are more accurately represented as motels as shown in Table 2-1.

- Bowling Alley: A unit flow consumption of 100 gpd/lane was selected for the analysis.

- Clinic: A unit flow consumption of 500 gpd for each doctor's office was selected for the analysis, as recommended by Virginia Waterworks Regulations.

- Day Care Center: A unit flow consumption of 10 gpd/person was selected for the analysis. It is believed that Virginia Waterworks Regulations for the domestic water consumption of elementary schools without showers are adequate to estimate flow consumptions of a day care center.

- Family Housing: A unit flow consumption of 300 gpd/family was selected for the analysis. This estimate is based off of a 3-person household at 100 gpd/person as suggested by Virginia Waterworks Regulations. This estimate also correlates with estimated consumptions for resident population offered by other references.

- Industrial Facility: A unit flow consumption of 15 gpd/person was selected for the analysis. The selected unit consumption is felt to be representative of typical water use activities of employees, which primarily involve the use of restroom facilities over the course of an 8-hr shift.

- Office: A unit flow consumption of 15 gpd/person was selected for the analysis using the same logic as described in the preceding paragraph for industrial facilities. Office facilities for which the required occupancy data could not be located will use a unit flow consumption of 162 gpd/1000 sq. feet of space.

- Picnic Area: A unit flow consumption of 5 gpd/person was selected for the analysis and is in agreement with both references evaluated.

- Restaurant: A unit flow consumption of 50 gpd/seat was selected for the analysis as is suggested by Virginia Waterworks Regulations.

- Self Service Storage: A unit flow consumption of 17 gpd/1000 sq. feet of storage was selected for the analysis. Self-service storage includes family housing garages as well as storage located in a building with another facility code.

- Shopping/Exchange: A unit flow consumption of 200 gpd/1000 sq. feet of area was selected for the analysis as suggested by Virginia Waterworks Regulations.

- Swimming Pool: A unit flow consumption of 10 gpd/person was selected for the analysis and is in agreement with both references evaluated. This category is used for any sort of recreation facility considered.

- Trailer court: A unit flow consumption of 300 gpd/trailer based on 3 people per trailer was selected for the analysis. Trailers contain most amenities found in homes and therefore the unit flow consumption mimics that of family housing.

- Warehouse (mixed use): A unit flow consumption of 94 gpd/1000 sq. feet of storage area was selected for the analysis. Any general-purpose storage building fits this category.

The Average Daily Flow (ADF) projections included in this report are based on the unit flow consumptions described above. Current as well as future facility population and area data were extracted primarily from the following sources:

- Real Property Building List by Category Code, provided by Fort Monroe DPW.

- Fort Monroe Real Property Master Plan Short Range Component, prepared by R & K Engineering, August 2002.

- Ron Pinkoski, Technical Government Point of Contact, Fort Monroe DPW.

While detailed information for most future expansion was extracted from the sources listed above, limited information was obtained for the reconstruction of Wherry housing. For modeling purposes, reconstruction estimates were made and are presented in Appendix B: Estimated Domestic Water Consumption.

Detailed estimates of baseline ADF at various points in time are provided in Appendix B: Estimated Domestic Water Consumption and are summarized in Table 2-3. Known leaks are also included in the baseline ADF and virtually eliminate unaccounted-for-water. Upon comparison, the existing baseline ADF estimate (including leakage) of 230,809 gpd

converted to 6 MG/month was consistent with average monthly-metered water consumption; thus supporting the use of the selected unit flow estimates.

Table 2-1. Domestic Water Contributions Based on Various References

Facility Type	Classification	Unit	Flow (gpd/unit)	Reference
Adult education center	community colleges	person	15	1
	highschools	person	16	1
	schools	person	11	4
	schools without cafeteria, gyms, or showers	person	15	5
Auditorium	theatres, auditorium type	seat	5	1
	movie theatres, auditorium	seat	2	4
	places of worship	1000 sq. feet	133	4
	churches	person	5	5
	movie theatres, auditorium	seat	5	5
BOQ/BEQ	dwellings	person	100	1
	motels	person	65	1
	hotels	person	70	2
	resident population	person	150	2
	resident population	person	100 - 120	3
	condominiums, apartments	each	205	4
	hotels	rental room	65	4
	boarding houses	boarder	50	5
Bowling alley	bowling alley with snackbar	lane	100	5
Clinic	doctor's office in medical center	each	500	1
	hospitals	bed	300	1
	hospital units	bed	600	2
	dentist's office	chair	200	5
		staff member	35	
	doctor's office	patient	10	5
		staff member	35	
	hospitals	bed	250	5
Day care center	elementary schools without showers	person	10	1
	day child care	1000 sq. feet	161	4
	school	person	11	4

Table 2-1. Domestic Water Contributions Based on Various References

Facility Type	Classification	Unit	Flow (gpd/unit)	Reference
Family housing	dwellings	person	100	1
	resident population	person	150	2
	resident population	person	100 - 120	3
	single family residential	each	255	4
Industrial facility	factories, per 8-hr shift	person	15 - 35	1
	depot, industrial, plant and similar projects, per 8-hr shift	person	50	2
	nonresident population	person	30 - 35	3
	office	1000 sq. feet	162	4
	industrial buildings with no showers, per 8-hr shift	employee	15	5
	office buildings with no cafeteria, per 8-hr shift	employee	15	5
Office	factories, per 8-hr shift	person	15 - 35	1
	depot, industrial, plant and similar projects, per 8-hr shift	person	50	2
	nonresident population	person	30 - 35	3
	office	1000 sq. feet	162	4
	industrial buildings with no showers, per 8-hr shift	employee	15	5
	office buildings with no cafeteria, per 8-hr shift	employee	15	5
Picnic area	picnic areas	person	5	1
	picnic parks	person	5	5
Restaurant	restaurants	seat	50	1
	bars, cocktail lounges	1000 sq. feet	315	4
	fast food service	1000 sq. feet	881	4
	restaurants	1000 sq. feet	636	4
	ordinary restaurants	seat	35	5
Self service storage	self service storage	1000 sq. feet	17	5
Shopping/exchange	shopping centers	1000 sq. feet	200 - 300	1
	merchandising	1000 sq. feet	140	4
	stores	public toilet	500	5
		employee	11	

Table 2-1. Domestic Water Contributions Based on Various References

Facility Type	Classification	Unit	Flow (gpd/unit)	Reference
Swimming pool	swimming pool	person	10	1
	swimming pool	person	10	5
Trailer court	trailer courts, three persons per trailer	trailer	300	1
	mobile homes	lot	143	4
Warehouse (mixed use)	warehouse (mixed use)	1000 sq. feet	94	4

References:

1. Commonwealth of Virginia, State Department of Health, Waterworks Regulations, Section 3.1, page 007-1, June 1993.
2. TM 5-813-1 Water Supply, Sources and General Considerations, Departments of the Army, the Navy, and the Air Force, Table 2-1, June 1987.
3. MIL-HDBK 1005/16 Wastewater Treatment System Design Augmenting Handbook, Department of Defense, Section 3.3.2.2, October 1997.
4. Guidelines for Determining Ability to Provide Potable Water and Sanitary Sewer Service, Office of Environmental Services Broward County, Florida, Table 3, July 2001.
5. R309-510-8 Facility Design and Operation: Minimum Sizing Requirements, Utah Administrative Code, Section 203 Table 510-4, October 2003.

Fort Monroe also has twenty-one in-ground irrigation systems. These systems operate from April to November. Table 2-2 is a summary of the flow consumptions for each irrigation system. Detailed information for many of the systems was extracted from the following source:

- Fort Monroe Underground Irrigation System, prepared by Washington Design Group, LTD.

Flow rates for systems not included in the plans cited above were estimated. Irrigation system calculations are provided in Appendix B: Estimated Domestic Water Consumption.

Table 2-2. Seasonal Irrigation System Flow Demands

Building No.	Type	Description	Flow Rate (gpm)
IR1	Permanent	irrigation system, bldg. 87	144.6
IR2	Permanent	irrigation system, bldg. 560	320.9
IR3	Permanent	irrigation system, bldg. 43	432.25
IR4	Permanent	irrigation system, bldg. 80	320.9
IR5	Permanent	irrigation system, bldg. 227	320.9
IR6	Permanent	irrigation system, bldg. 82	320.9
IR7	Permanent	irrigation system, Sherwood Park	320.9
IR8	Permanent	irrigation system, bldg. 133 west end	320.9
IR9	Permanent	irrigation system, bldg. 133 east end	320.9
IR10	Permanent	irrigation system, bldg. 83	107.39
IR11	Permanent	irrigation system, Parade Field	320.9
IR12	Permanent	irrigation system, bldg. 19, casemate	320.9
IR13	Permanent	irrigation system, bldg. 119	431.01
IR14	Permanent	irrigation system, bldg. 57	320.9
IR15	Permanent	irrigation system, bldg. 4	320.9
IR16	Permanent	irrigation system, engineer pier	624.47
IR17	Permanent	irrigation system, bldg. 147	310.9
IR18	Permanent	irrigation system, bldg. 245	320.9
IR19	Permanent	irrigation system, bldg. 96	320.9
IR20	Permanent	irrigation system, bldg. 185	123.73
IR21	Permanent	irrigation system, bldg. 221	455.14

Winter demands are only presented for the existing conditions to compare to historic consumption data and to aid in model calibration. Projected flow rates listed in Table 2-3 include irrigation as well as other seasonal demands.

Table 2-3. Projected Average Daily Baseline Domestic Water Flow Rates

Point in Time	Projected Average Daily Flow Rate (gpd)
Existing Conditions (winter)	230809
Existing Conditions (summer)	347853
YR1	330803
YR2	333611
YR3	330611
YR5	331192

Projected flow rates are based on demolition and construction plans for the next five years. Available information does not indicate any substantial growth between YR3 and YR4, therefore, the projected flow rate for YR4 was not included.

2.5 Fire Flow Requirements

Provision of water for fire fighting is an important consideration for Fort Monroe's water distribution system. The fire flow demand for each hydrant on base was determined according to the following sources:

- UFC 3-600-01 Unified Facilities Criteria, Design: Fire Protection Engineering for Facilities, Department of Defense, April 2003 with changes recorded as of August 2003.
- NFPA 231 Standard for General Storage, 1990.
- NFPA 1231 Standard on Water Supplies for Suburban and Rural Fire Fighting, 1989.
- AWWA M31 Distribution Requirements for Fire Protection, Manual of Water Supply Practices, American Water Works Association, p. 12, 1989.

Detailed estimates of fire flow requirements at various points in time are provided in Appendix C: Fire Flow Requirements. The fire flow requirement for each unsprinklered structure was calculated and allocated to the closest hydrant location. The fire flow requirement assigned to the hydrants in the project area ranged between 500 to 2250 gpm. Some commercial buildings and a few residential buildings located in the project area are equipped with sprinklers to fight fires. Appendix C identifies the buildings equipped with sprinklers and the fire hydrant closest to the building. The sprinkler demand for each of these buildings was determined using the design density corresponding to the appropriate occupancy classification and a maximum design area of 3000 sq.ft. for wet pipe systems and 3900 sq.ft. for dry pipe systems in accordance with UFC 3-600-01. For sprinklered buildings, both a hose and sprinkler demand were assigned. The largest demand required at each hydrant was selected for the analysis. Additional analyses were conducted in the instance that the total flow required for a sprinklered building exceeded the largest demand required at the nearby fire hydrant. Each hydrant was assigned a needed fire flow of at least 500 gpm with a minimum system pressure of 20 psi in accordance with AWWA M31.

3.0 Field Work

3.1 Leak Detection Study

Water leaks are a potential concern for any water distribution system, especially one with Fort Monroe's age and size. Since the fort had been experiencing problems with low pressure and inadequate fire flow, URS investigated whether water leakage was at the root of the problem. Leaks cannot always be found by looking for water rising to the surface, as water does not readily percolate upwards in some types of soil (sand). So, a leak detection survey was recommended to uncover unaccounted-for water in the form of leaks. Officials at Fort Monroe's Department of Public Works agreed with the recommendation, and M.E. Simpson was contracted to conduct the leak detection survey.

The survey was based upon the principle that all leaks make noise, and big leaks make more noise than small ones. To exploit this principle, the latest in state of the art technology was employed. Microprocessor units were used that measured the time it takes sound to travel from the leak to the point where the leak correlator is connected to the water line. By connecting the leak correlator to the water line at two locations, it would compute the distance from the leak to each connection point thus enabling us to determine the exact leak location. Experienced technicians from M.E. Simpson used these devices, along with the S20 electronically enhanced listening device, as listening points to identify leaks. Each hydrant and accessible valve was used as a listening point to identify leaks.

All water mains within the project area were surveyed and five leaks were located. The leaks are listed below by type of leak, leak location, and estimated leakage potential in GPD (Gallons Per Day).

Table 3-1. Leak Detection Results

Type	Location	Size (GPD)
Valve (packing)	Ingalls Rd. & Reeder Circle	720
Hydrant	20 Bernard Rd.	720
Hydrant	Ruckman Rd. & Bernard Rd.	720
Other	McNair Dr. & Family housing	14400
Other	Fenwick Rd. (across from the Heliport)	2880
	Estimated Leakage Total	19440

Both hydrant leaks were fixed during the survey, resulting in a current leakage total of 18,000 GPD. Individual leak location reports may be found in Appendix D: Leak Detection Reports.

3.2 Representative Hydrant Testing

Pipe roughness is an important variable when developing a model to evaluate the effectiveness of a water distribution system. For the purpose of this study, roughness coefficients were calculated using the Hazen-Williams equation that obtained the associated C-factor. This equation is the most widely accepted equation for water-distribution-system analysis. C-factors vary greatly depending on pipe characteristics such as material, age, and diameter.

Though pipe diameters and materials used on Fort Monroe are known, the age of the distribution system varies and is unknown. Therefore, in order to determine appropriate roughness coefficients to use in the model, C-factor tests were performed on a variety of pipe diameters and locations. C-factor testing is also helpful in determining pressures throughout the distribution system.

In order to perform a C-factor test at any given location, valves must be closed to isolate the test section. Each test uses three hydrants, one downstream (or flow) hydrant and two upstream (or residual) hydrants. The residual hydrants must be located on the same water line. After each residual hydrant has been flushed, an outlet-nozzle cap equipped with a pressure gauge is installed. Air is then allowed to escape and the main valve is opened full. The static pressure reading is taken off of each residual hydrant and recorded. At the flow hydrant, the outlet-nozzle coefficient is determined. In this case, a discharge coefficient of 0.9 representing a rounded shoulder between the nozzle and hydrant barrel was employed. A discharge diffuser with attached pressure gauge is connected to the flow hydrant and the hydrant is opened full. The flowing pressure is recorded from the flow hydrant and the residual pressure is recorded from the residual hydrants. After the flow hydrant is closed, the static pressure is confirmed at the residual hydrants. The pressure gauges are then disconnected and all valves reopened. Finally, all test data is recorded.

A summary of the C-factor test data, all C-factor Test Data Worksheets, specific location and calculation data, as well as gauge calibration results are presented in Appendix E: C-factor Tests. Average C-factors based on pipe diameter and location were developed from the test data and are presented in Table 3-2. C-factor tests could not be run on any PVC or copper pipe, or on cast iron pipe of 4- or 14-inch diameter due to the lack of testing locations. Roughness coefficients included in Table 3-2 for the preceding pipes were estimated according to the following source:

- Chase, D.V., Savic, D.A., and T.M. Walski, Water Distribution Modeling, First Edition, Haestad Methods, Inc., Table 2.3, page 37, 2001.

Table 3-2. C-factors Used to Build Distribution Model

Material	Diameter (in)	C-factor
cast iron	6, along Patton Road near Wherry housing	55

Table 3-2. C-factors Used to Build Distribution Model

Material	Diameter (in)	C-factor
cast iron	6, around Reeder Circle and Darby Street	45
cast iron	6, remaining	40
cast iron	8, along Fenwick Road between wharf and Battery Parrott	25
cast iron	8, remaining	45
cast iron	10	45
cast iron	12	50
PVC	6	149
copper	3	147
cast iron	4	40
cast iron	14	50

These values are just a starting point and may be adjusted when calibrating the distribution model. As mentioned in Section 2.1, the average age of the distribution system is estimated to be about 32-years, however certain sections of the system were installed prior to 1946. The C-factors determined by conducting hydrant testing on representative pipe segments is in general agreement with standard references for the age of the pipe, size, and material.

3.3 Interviews

Interviews were conducted with the following persons to gather information regarding Fort Monroe's distribution system and operational practices:

- Ron Pinkoski, Fort Monroe DPW, Government Point of Contact
- Mark Morrison, Water tank operator, Fort Monroe
- Arnold Dorsey, Fort Monroe institutional knowledge
- Richard Westrich, Fort Monroe institutional knowledge

The Chief of Design Services for Newport News Waterworks, Frank Brown, provided information on water pressure available to the fort at each meter location.

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4.0 Computer Modeling of Fort Monroe's Water Distribution System

4.1 WaterCAD Software Overview

As part of this study, the Fort Monroe water distribution system was evaluated using the network analysis program, WaterCAD v6.5. Designed, developed, and programmed by Haestad Methods' staff of Software and Civil Engineers, WaterCAD is intended to represent the latest technology in Windows-based Water Distribution Analysis and Design.

WaterCAD's computations are based on research conducted by the U.S. Environmental Protection Agency and are applicable to any fluid system with the following characteristics:

- Steady or gradually-varying turbulent flow.
- Incompressible, Newtonian, single phase fluids.
- Full, closed conduits (pressure systems).

4.2 Model Development

4.2.1 General

The physical characteristics of the water distribution system included in the computer model are ground topography, the connection to Newport News waterworks, tank characteristics, pipe diameter, length, and interior roughness, active fire hydrants, and most valve locations. Historical and projected water demands are also assigned to the computer model. The model incorporates all looped mains of 4-inch diameter and greater as well as dead end mains of hydraulic significance. Abandoned lines and service connections were not included in the model.

The computer model of the Fort Monroe water distribution system was created from a 2002 water system map received in AutoCAD drawing format. Fort Monroe personnel assured system accuracy and configuration.

The computer model developed for existing conditions simulates 370 pipe elements, 234 pressure junctions, 78 fire hydrants, and 104 valves. The elevated storage tank and the two existing connections to Newport News waterworks were also incorporated into the model. An updated map of the potable water system on Fort Monroe is included as Exhibit 1 attached behind the appendices. The labels used to represent pressure junctions, fire hydrants, valves and pipes in the computer model have been annotated in Exhibit 1.

4.2.2 Topography

All elevation data in the model refers to ground elevation using mean sea level (MSL) as the datum. Ground elevations are frequently used for models of municipal water distribution systems and are relatively easy to obtain. However, this method may overlook poor service pressures, since the model could incorrectly calculate acceptable pressures for a customer that is notably higher than the ground. This aspect is not going to pose a significant problem because of the flat topography in the project area.

The elevation at each pressure junction and valve was estimated to the nearest 0.5-foot using a scaled map with 1-foot contour lines prepared by Washington Design Group, LTD. The elevation of the connection points to Newport News waterworks were determined from a U.S. Geological Survey (USGS) topography map.

4.2.3 Connection to City System

The computer model requires the tie-in points with Newport News waterworks to be modeled as a pump and a reservoir. The reservoir simulates the supply of water from the system. The elevation of the reservoir is set to the elevation at the connection point. The pump and pump curve represents the pressure drops and the available flow from the existing system.

Data from a fire flow test is used to generate a pump curve. In this case, Newport News simulated several fire flow tests using their computer model. The model calculations are presented in Appendix F: Newport News Available Pressure and are summarized in Figures 4-1, 4-2, and 4-3.

Figure 4-1. Water St. Pump Curve

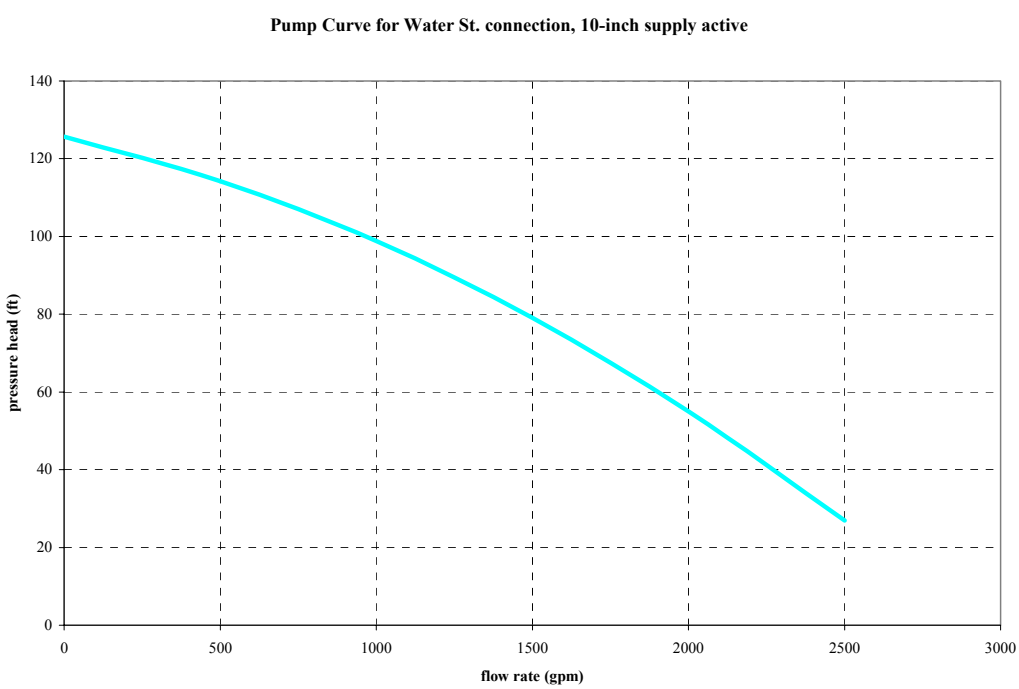


Figure 4-2. Old Buckroe Rd. Pump Curve

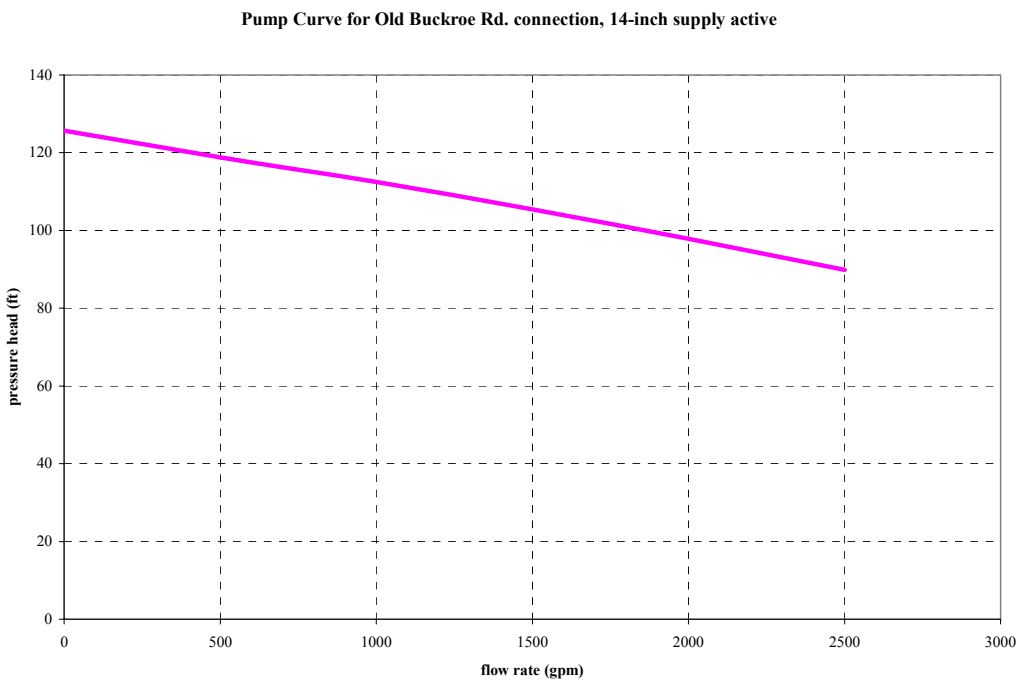
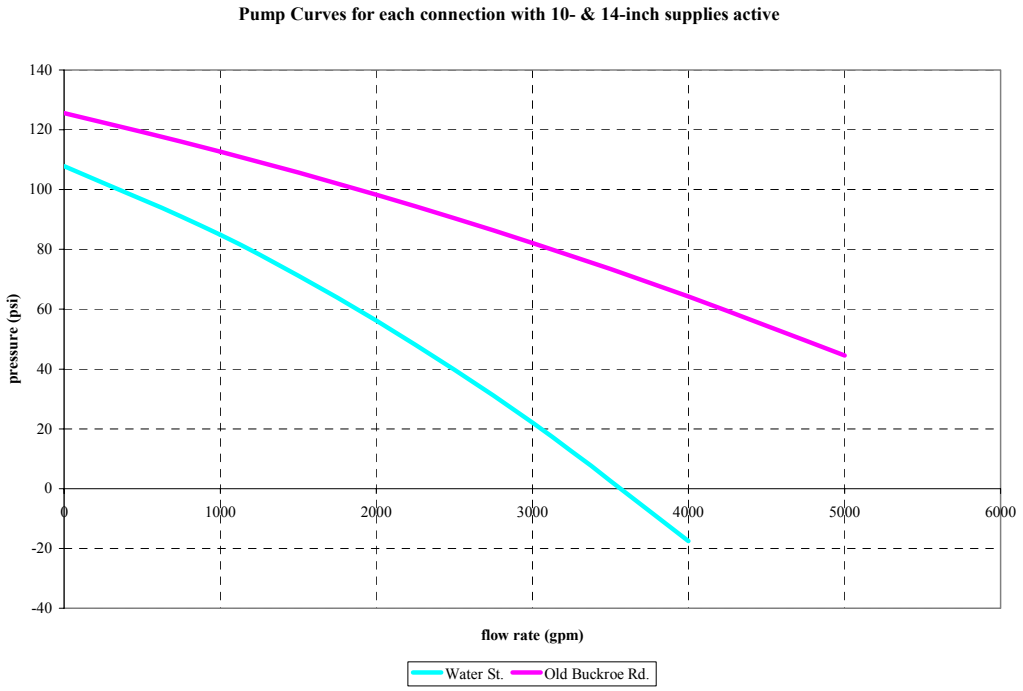


Figure 4-3. Combined Flow Pump Curves



The pipe connecting the reservoir to the pump should be smooth, short, and wide. This was achieved by assigning a pipe length of 1 foot, roughness coefficient of 140, and diameter of 48 inches.

4.2.4 Pipe Friction Coefficient (C-factor)

The pipe friction coefficient, C-factor in the Hazen-Williams empirical equation for pipe flow, is an index of pipe hydraulic capacity. The C-factor is dependent upon a number of factors including pipe material, type of lining, pipe age, cross-sectional area, and amount of tuberculation. High C-factors represent smoother interior surfaces.

The mains in the Fort Monroe water distribution system are mostly unlined cast iron. The C-factors developed through hydrant testing were used in the model and range from 25 to 50. These values are relatively low and account for the age and condition of pipes in the system. As mentioned earlier, the C-factors determined by conducting hydrant testing on representative pipe segments are in general agreement with standard industry references for the age of the pipe, size, and material.

4.2.5 Fire Hydrants

All fire hydrants located on active mains in Fort Monroe's distribution system were included in the model. The model uses a numbering system consistent with the one currently used on the base. Fire hydrants without numbers were assigned descriptive labels based on their locations (i.e., H-near100 is located near building 100).

Fire hydrant flow is modeled by using a short, small diameter pipe with a large minor loss. This was achieved by assigning a pipe length of 0.5 foot and a roughness coefficient of 40. The pipe diameter was chosen as 4.5 inches; this represents the size of the large outlet on each hydrant. In cases where the fire hydrant is not located directly adjacent to the main, an equivalent length of pipe with a 4.5-inch diameter was used.

4.2.6 Skeletonization

Constructing a computer model of a water distribution system usually involves a certain degree of skeletonization. A skeletonized model usually excludes small diameter pipes and other lines that do not have a significant influence on the hydraulics of the system. Although skeletonization can have an effect on the ability of the model to accurately represent the existing distribution system, skeletonization of Fort Monroe's system is very minimal as is required to perform accurate fire flow analyses.

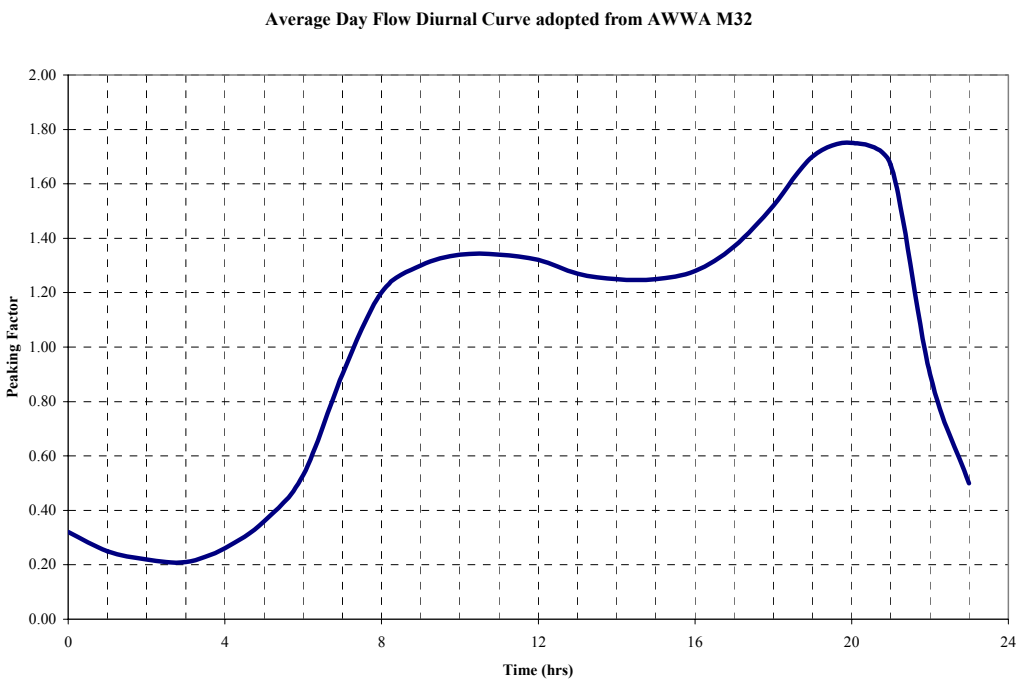
4.2.7 Baseline Demand Allocation

Modeling equations are based on the assumption that water is withdrawn at a pressure junction. In reality, water is withdrawn at many locations along the length of the pipe. For the purposes of this study, the baseline ADF for each structure on Fort Monroe was assigned to the pressure junction in closest proximity to that structure. WaterCAD's ability to support composite demands enables the total junction demand to be easily altered according to future construction and demolition plans.

4.2.8 Time-Varying Demands

Temporal variations in water usage for water systems typically follow a 24-hour cycle called a diurnal demand pattern. No data was available to develop a diurnal curve representative of Fort Monroe's daily water usage pattern. Therefore, the AWWA Average Day Flow Diurnal Curve found in AWWA Manual M32 was used in the model. This curve, shown below as Figure 4-4, represents an average between residential and non-residential users and was applied to all structures included in the model.

Figure 4-4. Average Day Flow Diurnal Curve



4.2.9 Peaking Factors

For some consumption conditions, demands are determine by multiplying the average demands by a peaking factor. The peaking factor is a ratio of demands during peak consumption hour of the day to average hourly consumption or maximum daily consumption to average daily consumption.

A **peak hour** factor of 1.75 was used in the model, determined from the AWWA Average Day Flow Diurnal Curve.

A **maximum day** factor of 2 was used in the model. This is consistent with suggested factors from the following sources:

- Chase, D.V., Savic, D.A., and T.M. Walski, Water Distribution Modeling, First Edition, Haestad Methods, Inc., page 136, 2001.

- State of Washington, State Department of Health, Water System Design Manual, Section 5.2, Equation 5-2, page 5-4, August 2001.

- Engineering Design Guidelines, Yucaipi Valley Water District Engineering Department.

For **minimum day** conditions, a hypothetical day when Fort Monroe is completely shut down possibly due to inclement weather is considered. This is an extreme case in which only residential water usage is included.

4.3 Assumptions

A water model is a representation of an actual system and is only as reliable as the data used in its development. It is cost prohibitive and physically impossible to field verify, measure and test all the model parameters. In view of this, assumptions based on our best engineering judgment were made in the development of the model and have proven successful on similar projects.

4.3.1 Pipe Diameter

The nominal and actual diameters of pipes usually differ. Although the actual diameter of a new pipe is a known value larger than its nominal diameter, corrosion and tuberculation over time make determining the actual diameter of existing pipes difficult. In this case, the nominal diameter is used for model development due to lack of a better value. Since the C-factors used in the model were developed using the nominal diameter of the existing pipes, those factors should account for differences between actual and nominal pipe diameters.

The water distribution system shown on the 2002 Water System Map, received in AutoCAD drawing format, was used in assigning the pipe diameters. No field verification of the system configuration, connectivity details or pipe diameters was performed.

4.3.2 Storage Tank

Very little data on the elevated storage tank was available. No scaled drawings or tank operation data could be gathered. Tank elevation, high and low water elevations, and total capacity were input to the model based on drawings received from Fort Monroe DPW. Although the tank is double ellipsoidal in shape, no stage-storage relationship was available. As a result, in the model, the tank is assumed to have a constant area within the head range. Initial water surface elevation of 123.0 feet, representing half the tank, was assumed.

4.3.3 Valves

All valves located on modeled mains were included in the model. The model uses a numbering system for valves consistent with the one currently used in Fort Monroe water system maps. Since the current status of each valve is unknown, for modeling purposes all valves are assumed to be fully open.

4.3.4 Irrigation Schedule

No information was available regarding the operation of the twenty-one irrigation systems on Fort Monroe. In order to account for the seasonal demands added by irrigation, the following schedule was assumed based on the BEJ after consulting several landscape service recommendations.

Each irrigation system is divided into six zones, each with one-sixth of the total irrigation flow rate for the system. Each zone is watered for 45 minutes (3, 15-minute intervals) twice weekly (Monday and Thursday). The irrigation demand pattern corresponding to this schedule will commence at 0400 hours and continue until 0830 hours using a constant flow rate equal to one-sixth of the total irrigation system demand.

4.4 Model Calibration

4.4.1 General

Calibration involves comparing model results to those observed in the field. Since WaterCAD simply solves the energy and continuity equations based on the data supplied, one cannot assume that that the model is an accurate representation of the system. Calibrating the model is necessary to develop confidence in and understanding of the distribution system.

4.4.2 Types of Error in Modeling

There are two main types of error in data entry, typographic errors and measurement errors. Typographic errors, which involve transferring data into the model incorrectly, are easy to correct but often difficult to locate. Model data checking was initiated in the early stages of the project and found to be correct. Measurement errors, on the other hand, deal with the accuracy of data used to create the model. These errors are more difficult to identify and correct. Measurement errors are assumed to be negligible.

4.4.3 Calibration Efforts

The calibration process often involves adjusting system demands and/or roughness coefficients. In this case, the roughness coefficients used to develop the model are sufficiently low. Any adjustments required to lower these coefficients would render the model unrealistic. Therefore, during our calibration efforts, lowering the C-values was

not attempted. System demands were temporarily adjusted, however the resulting simulations did not prove permanent demand adjustments to be advantageous.

The existing system simulation with 2003 winter demands depicts residual water pressures throughout the installation of approximately 50 psi. This is consistent with the average system residual pressure disclosed in the statement of work as well as the static pressures observed in the field during hydrant testing.

Fort Monroe's Fire Department has expressed concern that the water supply available for fire protection is inadequate. The results of a simulated fire flow analysis are in agreement with their concern.

No attempt was made in conducting an exhaustive field-testing of the water distribution system to simultaneously measure flows and residual pressures throughout the system. Further calibration attempts were not performed due to the lack of available field observations. However, as mentioned before, the model does reflect existing residual pressures during normal day water demand, and results of the fire flow analysis are in agreement with the Fire Department's concern. The computer model of Fort Monroe's water distribution system is a good representation of the actual system, and the calculated system response is in agreement with actual system behavior. Hence, it is considered to be a calibrated model and can be used to simulate future projected demands, and for analysis and optimization of distribution system modifications required.

5.0 Modeling Results and Findings

5.1 Goals

The goal of this project is to develop a phased, prioritized capital improvement plan for Fort Monroe's water distribution system for the next five years to ensure system reliability and adequate pressure and flow, especially for fire protection. Simulations were performed based on current and projected demands and potential distribution system modifications.

5.2 Runs Performed

The runs are listed in sequential order. Relevance to the project objectives and the results obtained are included for each run. Supporting WaterCAD tables for each run can be found in Appendix G: WaterCAD Results. The following scenarios were considered in order to recommend improvements based on existing demand patterns.

Both steady state and extended-period simulations were performed based on Fort Monroe's existing conditions. Currently, the base is being fed by Newport News Waterworks through a 10-inch cast iron main.

5.2.1 Run 1 Base Conditions

A steady state analysis using baseline demands for winter conditions including known leakage was performed to determine the average residual pressures throughout the distribution system. Currently, irrigation systems are dormant and service to the marina is not active. The total junction demand allocation is approximately 230,000 gpd, which is consistent with the billing records reviewed for the winter months. The results of this analysis reveal that under average daily winter conditions, the water pressure on base is between 49 and 51 psi depending on location. This calculated pressure is consistent with the static pressure readings recorded during our hydrant testing exercise in different segments of the project area.

5.2.2 Run 2 Fire Flow Analysis – Existing Conditions

One main goal of this study is to provide adequate pressure and flow during a fire-fighting event. The tank is considered to be half-full for this simulation at an elevation of 123.0 feet. A water demand of double the average summer demands plus leakage was used to represent the "worst case scenario". The results of the steady state fire flow analysis show that only 19 out of 78 fire hydrants, approximately 25%, satisfy the fire flow requirement under existing conditions with a minimum system residual pressure of 20 psi at the hydrants. Many hydrants cannot deliver 500 gpm, the minimum fire flow required for fire protection as stated in AWWA 31. The available fire flow at each hydrant at a minimum residual pressure of 20 psi is included in Appendix G.

5.2.2.1 Runs 2.1 through 2.9 Fire Flow Analysis of Sprinklered Buildings – Existing Conditions

In addition to the fire flow analysis used to determine satisfaction of fire flow requirements for unsprinklered buildings, a series of extended-period analyses were performed to determine whether adequate water supply for fire protection can be provided to sprinklered buildings. The tank is considered to be half-full at the start of the simulation at an elevation of 123.0 feet. As in Run 2, a water demand of double the average summer demands plus leakage was used to represent the "worst case scenario". The time period used for each simulation lies between 1900 hours and 2100 hours depending on the flow duration required; this time period corresponds with the peak of the Average Day Flow Diurnal Curve and also represents the "worst case scenario". The fire flow requirement is satisfied if, for the duration required, the pressure at each point in the distribution system remains at least 20 psi. The results of these analyses indicate that fire flow requirements are satisfied at all but one of the sprinklered buildings on base.

5.2.3 Run 3 Tank Cycling

Customers living west of the stone fort and west of Murray Street in the project area have expressed concern over lack of water pressure while the tank is cycling. During this period, the water supply from Newport News is shut off and water from the tank feeds the distribution system. Most recently, the tank was allowed to cycle from 0900 until 1000 hours when customers on the west end of the base began to complain of low pressures. In the computer model a scenario was setup, with the 10-inch main from Newport News closed which allows supply only from the tank, to investigate the problem. An extended-period analysis was performed beginning at 0900 hours using summer demands including leakage. At the beginning of the simulation period, the tank was assumed to be half-full. The results of this analysis indicate that although pressures throughout the installation drop as the tank cycles, the pressure does not fall below 41 psi anywhere on base until the tank reaches its minimum elevation after about five hours.

This finding is inconsistent with information provided by Fort Monroe personnel. Additional scenarios were explored in order to explain the inconsistencies, including:

- Increasing demands, up to a factor of 4x the baseline demands
- Several alternatives were studied by changing the status of several valves, which may have an impact in the flow distribution to these areas.
- The marina is one of the largest water consumers. For this reason, an alternative was studied by assigning maximum demand at the marina based on an assumption that all 352 slips are full.
- All the above alternatives were also studied when the tank is not cycling and distribution is solely from the 10-inch Newport News supply line to validate the concerns expressed.

However, under no situation were the results consistent with the problem expressed by the customers. Without detailed information pertaining to the tank level, flow through the distribution mains, status of all the valves, and continuous pressure recordings, the expressed concerns cannot be simulated.

5.2.4 Run 4 Water Age Analysis – Existing Conditions

Water age, which is the total residence time of water in the system, can be used as a general indicator of water quality within the distribution system as well as in the storage tank. Long residence times, greater than three days according to the AWWA, can contribute to water quality degradation. This extended-period simulation assumes an extreme case of minimum winter demands including only the residential customers on Fort Monroe. The tank is assumed to be half-full at the beginning of the run and will float on the system for the entirety of the simulation. The run was performed over a period of seven days. The results of the analysis indicate areas of the system, some dead-end mains, with long residence times. These areas are on smaller mains located around the periphery of the distribution system as well as toward Dog Beach where there is very little demand. Residence times of longer than seven days were observed at dead-end locations. Also, when allowed to float on the system, turnover time for water in the storage tank is in excess of seven days. Supporting WaterCAD results are presented in Appendix G.

5.2.5 Run 5 Existing Summer Conditions

An extended period analysis that simulates average summer conditions including irrigation and leakage was conducted to examine water pressures on base over a 3-day period. The average day diurnal curve demand pattern was used to represent the water usage pattern of customers while leakage remained fixed and irrigation followed the assumed schedule, refer to Section 4.3.4. Water was supplied solely from the 10-inch cast iron main and the water tank is half-full at the beginning of the simulation. Although the irrigation schedule used in the model is assumed, irrigation will constitute a large demand during the summer months. The results of this analysis indicate that Fort Monroe's water distribution system will not be able to sustain acceptable water pressures during irrigation period when only the 10-inch main is feeding the installation.

5.2.6 Run 6 Fire Flow Analysis – 10- & 14-inch NN supplies

This simulation is identical to Run 2 with one exception. Instead of the system being fed solely by the 10-inch supply main, the damaged 14-inch line is assumed to be operational in the near future and is also supplying the base. The results of this steady state fire flow analysis indicate that the same 19 fire hydrants satisfy the required fire flow with a minimum system pressure of 20 psi. Although no additional hydrants can meet the required fire flow compared with Run 2 or 7, the available fire flow at each hydrant at a minimum residual pressure of 20 psi has considerably increased throughout the system.

5.2.7 Run 7 Fire Flow Analysis – 14-inch NN supply only

This simulation is identical to Run 2 with one exception. Instead of the system being fed by the 10-inch supply main, the damaged 14-inch line is assumed to be operational in the near future and is solely supplying the base. The results of this steady state fire flow analysis indicate that the same 19 fire hydrants satisfy the required fire flow with a minimum system pressure of 20 psi as in Run 2. Although no additional hydrants can meet the required fire flow, the available fire flow at each hydrant at a minimum residual pressure of 20 psi has increased throughout the system.

5.2.8 Run 8 Tank Performance under Existing Summer Conditions – 10-inch NN supply only

An extended period analysis that simulates average summer conditions including irrigation and leakage was conducted to examine tank performance over a seven-day period. The average day diurnal curve demand pattern was used to represent the water usage pattern of customers while leakage remained fixed and irrigation followed the assumed schedule, refer to Section 4.3.4. Water was supplied solely from the 10-inch cast iron main and the water tank is half-full at the beginning of the simulation. Although the irrigation schedule used in the model is assumed, irrigation will constitute a large demand during the summer months. The results of this analysis indicate that the water tank will fill to approximately 86.5% when only the 10-inch main is feeding the installation. However the effect of irrigation is considerable; the tank empties to below 10% of its capacity.

5.2.9 Run 9 Tank Performance under Existing Summer Conditions – 14-inch NN supply only

This simulation is identical to Run 8 with one exception. Instead of the system being fed by the 10-inch supply main, the damaged 14-inch line is assumed to be operational in the near future and is solely supplying the base. The results of this analysis indicate that the water tank will fill to approximately 91% when only the 14-inch main is feeding the installation. The effect of irrigation is not quite as dramatic is in Run 8; the tank empties to 20% of its capacity.

5.2.10 Run 10 Tank Performance under Existing Summer Conditions- 10- & 14-inch NN supplies

This simulation is identical to Run 8 with the exception that the damaged 14-inch line is assumed to be operational and the base is being fed through both the 10- & 14-inch supply lines. The results of this analysis indicate that the water tank will fill to approximately 93% when both mains are feeding the installation. Tank performance is greatly improved and irrigation demands drain the tank to approximately 40% of its capacity.

6.0 Recommendations and Conclusions

Analysis using the existing conditions model (with both the 10- and 14-inch supply lines in operation) and future projected demands were performed. To meet the pressure and flow requirements of the three principal consumers, domestic, recreational, and commercial, no additional modifications were deemed necessary. However, to satisfy fire flow requirements with a minimum system pressure of 20 psi, several different alternatives were studied to optimize the required distribution system modifications. The alternative scenarios performed are too numerous to describe in this report. Hence, only the final distribution system improvements are prioritized and listed under each phase. The computer results shown in Appendix G: WaterCAD Results are for all the improvements recommended under each phase.

In prioritizing the capital improvements, the largely developed area, in-and-around the moat, was assigned a higher priority.

6.1 Recommended Improvements

The list of improvements to the Fort Monroe water distribution system provided below is recommended for implementation. The improvements have been separated into three phases based on importance and impact on distribution system performance. Projects are listed in order of priority. All new pipe segments suggested are PVC pipe. This recommendation was made based on its ability to withstand corrosion and tuberculation, installation preference, and cost.

6.1.1 Phase 1

The following improvements are vital to improve performance of the system and its ability to provide adequate fire flow. These improvements can be successfully completed without interrupting service to customers. Solid bold lines in Exhibit 2 highlight improvements suggested for completion during this phase. The improvements are color-coded according to pipe diameter and are labeled by phase and project numberwhich correspond to the list below. The following general construction sequence is suggested by URS:

1-1. Repair 14-inch cast iron supply main. We were informed that this work is in progress and would be made operational soon. Hence, there is no cost associated with this work in preparing our cost opinions.

1-2. Install an 8-inch PVC connection (228 feet of 8-inch PVC pipe) between the 14-inch supply line at J-233-B and J-250-B. This connection would help in satisfying the fire demand requirement at hydrant H-57 and significantly improve fire demand at the neighboring hydrants.

1-3. Replace the 10-inch cast iron supply main from the meter to J-302-C with 10-inch PVC pipe (1351 feet of 10-inch PVC pipe). The existing 10-inch cast iron main is experiencing severe head loss even during normal supply. This

improvement is critical to help improve the fire flow requirements throughout the distribution system.

1-4. Replace the existing 6-inch cast iron pipe with 1820 feet of 8-inch PVC pipe along Eustis Lane starting at J-219-B and continuing as shown in Exhibit 2 to J-233-B. This would help improve the available fire flow at several of the hydrants located en route.

1-5. There is an existing connection from the 8-inch cast iron main to the 12-inch cast iron main running parallel near Reeder Circle. It is recommended that an additional connection at J-249-B be installed along the 6-inch parallel line. This connection would help improve the system reliability during the times of fire and improves the fire flow requirement at hydrants along Ingalls Road.

1-6. Install a 121 feet of 10-inch PVC line to run parallel the existing pipe from J-104-A to J-105-A. This improvement is essential to meet the high fire flow requirement at the marina.

1-7. Replace the existing 6-inch cast iron pipe from J-210-B to J-211-B with 215 feet of 10-inch PVC pipe. This improvement is recommended to help improve the fire flow requirements at hydrants located west of Murray Street and west of the stone fort.

1-8. Install a new 1002 feet of 8-inch PVC pipe connecting the 10-in cast iron main at J-251-B to J-509-F. Also replace the 6-inch cast iron main from J-509-F to J-508-F as shown in Exhibit 2. This improvement is recommended to improve fire flow requirements along Fenwick Road.

1-9. Connect the 10-inch cast iron main to the 6-inch main at J-252-B. This connection would improve system reliability.

1-10. Replace all cast iron pipes along Fenwick Road from J-126-A to J-505-F with 10-inch PVC pipe (4617 feet of 10-inch PVC pipe). The existing 6- and 8-inch cast iron pipe has a very low C-value and is not able to meet the fire flow requirements along Fenwick Road. Also replace the 8-inch cast iron main along the East Gate to the stone fort from J-400-E to J-401-E with 10-inch PVC pipe. This improvement satisfies the fire flow requirement at hydrants H-27 and H-65 located at the eastern end of the stone fort.

1-11. All the connections presently located on the existing 6-inch line along Fenwick Road between J-115-A to J-109-A need to be transferred to the recommended 10-inch line along Fenwick Road. This is essential to maintain service connection and improve the fire flow requirement at hydrant H-behind37.

1-12. Replace the 6-inch cast iron main along Patch Road from the 10-inch main at J-208-B to J-221-B with 8-inch PVC pipe and install a new connection to the 6-inch cast iron pipe at J-253-B as shown in Exhibit 2 (2042 feet of 8-inch PVC pipe). This improvement helps satisfy the fire flow requirement along Patch Road. Also replace the existing 6-inch cast iron pipe located along North Gate from J-212-B to J-213-B with 8-inch PVC pipe. This is important to meet fire flow requirement within the stone fort.

1-13. Replace the existing 6-inch line from J-509-F to J-517-F with 8-inch PVC pipe as shown in Exhibit 2 (1119 feet of 8-inch PVC pipe). This would satisfy the fire flow requirement at hydrants H-20 and H-18.

1-14. Replace the 4-inch cast iron segment from J-117-A to J-207-A as shown in Exhibit 2 with 579 feet of 6-inch PVC pipe. Standards recommend that fire hydrants be located on a minimum 6-inch pipe. All 6-inch cast iron pipe within the stone fort should be replaced with 8-inch PVC pipe and a connection between the existing 6-inch PVC pipe and the new pipe should be established at J-143-A (4416 feet of 8-inch PVC pipe). This improvement is recommended to satisfy fire flow requirements within the moat area. The Casemate Museum is of importance. It is important to note that along with meeting fire flow requirement at this location, the museum need to be equipped with other means of fighting fire such as fire suppressants, carbon dioxide, foam, etc. This is only a suggestion because some historical artifacts displayed at the museum could be damaged as easily with water as with fire.

1-15. Repair the leaks located during the leak detection survey. This is recommended to avoid waste as well and lower water bills.

Upon completion of these fifteen projects listed above in Phase 1, available fire flow throughout the installation is much improved. The results of the steady state fire flow analysis shows that 59 out of 78 fire hydrants, approximately 75%, satisfy the fire flow requirement with a minimum residual pressure of 20 psi at the hydrants. With the water tank off-line, approximately 67% of fire hydrants satisfy the fire flow requirements. The water tank is now capable of filling to approximately 93% of its capacity in the summer and can fill completely during winter months. The total cost of the improvements for Phase 1 is estimated to be approximately $425,000.00. A detailed cost break down is given in Table 6-1. We have assumed mobilization cost to be approximately 10% of the total cost excluding contingency costs and rounded to the nearest $10,000. The unit-prices of PVC pipes and other ancillary items were derived by first collecting recent bid tabs and a median price of those bid prices was used for cost opinion purposes. These unit prices include installation costs. Because of the recent increase in prices of crude oil, gasoline, and steel it is difficult to estimate what prices the contractors might actually bid upon. Upon completion of Phase 1, available fire flow throughout the installation is much improved. For modeling purposes, this phase is scheduled for completion between YR1 and YR3. Pressures are improved and hydraulic residence time throughout the system is decreased. Supporting data and fire flow availability for each of these years based on Phase 1 completion is included as part of Appendix G: WaterCAD Results.

6.1.2 Phase 2

The following improvements further strengthen the integrity of the distribution and increase the system's ability to meet fire flow requirements. Dashed bold lines in Exhibit 2 highlight improvements suggested for completion during this phase. The improvements are color-coded according by pipe diameter and are labeled by phase and project number which correspond to the list below.

2-1. Replace the 6-inch cast iron pipe around the Exchange from J-513-F to J-516-F with 1466 feet of 8-inch PVC pipe as shown in Exhibit 2. This would satisfy fire flow requirements at hydrant H-14.

2-2. Replace the line from J-505-F towards Dog Beach to J-800-I as well as the water line serving bldg. 185 from J-703-H to J-702-H with 8-inch PVC pipe. Also connect the new 8-inch PVC line with the existing 6-inch PVC line (5115 feet of 8-inch PVC pipe). This improvement is included in Phase 2 as opposed to Phase 1 since the area is currently undeveloped. However, completion of this project is essential to provide adequate fire flow, especially to the RV park.

2-3. Replace the 6-inch cast iron line along Patton Road from J-518-F to J-402-E with 1331 feet of 8-inch PVC pipe. Once construction of the new family housing replacing Wherry housing is complete, this line must be upgraded in order to provide adequate fire flow.

2-4. Replace the water line connecting to the 10-inch supply main at J-302-C and continuing to J-119-A with 8-inch PVC pipe as shown in Exhibit 2 (3525 feet of 8-inch PVC pipe). This would help improve the available fire flow at several of the hydrants located en route.

2-5. Replace the 6-inch cast iron main along Reeder Circle and hydrant 53 from J-218-B to J-215-B as with 855 feet of 8-inch PVC pipe as shown in Exhibit 2. This would satisfy fire flow requirements at hydrant H-53.

The total cost of these improvements, for Phase 2, is estimated to be approximately $275,000.00. A detailed cost break down is given in Table 6-1.Upon completion of Phase 2, 100% of the fire hydrants throughout the system fully satisfy the fire flow requirement at a minimum residual pressure of 20 psi. With the water tank off-line, approximately 87% of fire hydrants satisfy the fire flow requirements. The water tank is still capable of filling to approximately 93% of its capacity in the summer and can fill completely during winter months. For modeling purposes, this phase is scheduled for completion by YR5. Pressures continue to improve and hydraulic residence time is further decreased. Supporting data and fire flow availability for YR5 based on Phase 2 completion is included as part of Appendix G: WaterCAD Results.

6.1.3 Phase 3

It is important to note that the existing cast iron mains are over 30-years old and evidence suggests that these mains be considered for phased replacement. The low C-values determined from our hydrant testing further validate recommended phased replacement plan.

URS recommends gradual replacement of all remaining cast iron mains on Fort Monroe with PVC pipe of their respective sizes. Phase 3 effectively changes an aging system into one that can provide pressures and flow rates that are adequate for projected demands within the scope of this study. Further, replacing the pipes with newer ones improves the system reliability during times of fire. With the water tank off-line, 100% of fire hydrants satisfy the fire flow requirements. The water tank is capable of filling to 93.5% of its capacity in the summer and can fill completely during winter months. The total cost of these improvements, for Phase 3, is estimated to be approximately $790,000.00. A detailed break-up of the costs is given in Table 6-1. Data for Phase 3 completion based on YR5 demand projections is included in Appendix G: WaterCAD Results.

Table 6-1. Fort Monroe Water Distribution System Improvements - Summary of Construction Cost Options

PHASE 1

Description	Diameter (inch)	Quantity	Unit	Unit Price	Total Cost
Mobilization		1	LS	$ 30,000.00	$ 30,000.00
Repair 14-inch CI Supply Main	14"	0	LF	$ -	$ -
Connection	6"	1	EA	$ 300.00	$ 300.00
Connection	8" & 6"	2	EA	$ 400.00	$ 800.00
Connection	10" & 6"	1	EA	$ 500.00	$ 500.00
Water Line DR25 PVC w/ Appurtenances	6"	579	LF	$ 14.00	$ 8,106.00
Water Line DR25 PVC w/ Appurtenances	8"	11353	LF	$ 16.00	$ 181,648.00
Water Line DR25 PVC w/ Appurtenances	10"	6304	LF	$ 18.00	$ 113,472.00
Leak Repair		3	LS	$ 800.00	$ 2,400.00
Sub Total					$ 337,226.00
Contingencies (assumed 25%)					$ 85,000.00
TOTAL					$ 422,226.00

PHASE 2

Description	Diameter (inch)	Quantity	Unit	Unit Price	Total Cost
Mobilization		1	LS	$ 20,000.00	$ 20,000.00
Connection	8" & 6"	2	EA	$ 400.00	$ 800.00
Water Line DR25 PVC w/ Appurtenances	8"	12292	LF	$ 16.00	$ 196,672.00
Sub Total					$ 217,472.00
Contingencies (assumed 25%)					$ 55,000.00
TOTAL					$ 272,472.00

PHASE 3

Description	Diameter (inch)	Quantity	Unit	Unit Price	Total Cost
Mobilization		1	LS	$ 60,000.00	$ 60,000.00
Water Line DR25 PVC w/ Appurtenances	4"	3343	LF	$ 6.00	$ 20,058.00
Water Line DR25 PVC w/ Appurtenances	6"	7920	LF	$ 14.00	$ 110,880.00

Table 6-1. Fort Monroe Water Distribution System Improvements - Summary of Construction Cost Options

Water Line DR25 PVC w/ Appurtenances	8"	1389	LF	$	16.00	$ 22,224.00
Water Line DR25 PVC w/ Appurtenances	10"	5883	LF	$	18.00	$ 105,894.00
Water Line DR25 PVC w/ Appurtenances	12"	3443	LF	$	22.00	$ 75,746.00
Water Line DR25 PVC w/ Appurtenances	14"	8600	LF	$	27.00	$ 232,200.00
Sub Total						$ 627,002.00
Contingencies (assumed 25%)						$ 160,000.00
TOTAL						$ 787,002.00

6.2 Conclusions

Currently, Fort Monroe's water distribution system is incapable of delivering adequate water supply for fire fighting. The 14-inch cast iron supply line that enters the base via Mercury Boulevard was damaged during Hurricane Isabel and was put out of service temporarily; the water tank has also been off-line. Therefore, water is being supplied solely through the 10-inch cast iron main crossing Mill Creek via Mugler Bridge; significant head loss is experienced through this supply line. Larger summer demands will cause pressure problems unless improvements begin immediately.

With the tank on-line and the base fed through both the 10- & 14-inch supply lines, complete satisfaction of fire flow requirements is achieved upon completion of Phase 2 improvements. Although available water supply for fire protection increases as phased improvements are completed, complete satisfaction of fire flow requirements can not be provided with the water tank off-line until completion of Phase 3 improvements. Since this involves gradual replacement of all remaining cast iron mains not addressed in Phase 1 or Phase 2, it is strongly recommended that the water tank remain in constant operation.

Large summer demands, especially irrigation demands, put a strain on the water tank and distribution system. These effects are minimized when the base is being fed through both the 10- & 14-inch supply lines. Under these conditions, the water tank can fill to 93% of its capacity or approximately 280,000 gallons. After phased improvements are completed, the water tank will fill to 93.5% in the summer and fill completely during winter months.

By following the phased, prioritized improvement plan developed by URS, performance of the system and system reliability will improve drastically.

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Appendix A: Metered Flow Data

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Table A-1
Total Water Consumption 1999 – 2003

Month	2003 Water Withdrawals (MG)		
	Big Bethel	Newport News	Combined
January	1.2	1.9	3.1
February	3.1	0.0	3.1
March	3.4	0.1	3.5
April	5.2	0.1	5.3
May	5.9	0.5	6.4
June	1.1	8.2	9.3
July	2.8	8.2	11.0
August	3.8	6.5	10.3
September	0.2	6.8	7.0
October	0.0	6.9	6.9
November	0.0		
December	0.0		
		Total	**65.9**

Month	2002 Water Withdrawals (MG)		
	Big Bethel	Newport News	Combined
January	0.0	7.4	7.4
February	0.0	5.6	5.6
March	0.0	4.9	4.9
April	0.0	5.2	5.2
May	0.0	7.2	7.2
June	0.0	8.9	8.9
July	6.5	5.4	11.9
August	10.8	0.0	10.8
September	5.7	0.0	5.7
October	5.4	0.0	5.4
November	3.6	0.0	3.6
December	3.0	0.0	3.0
		Total	**79.6**

Table A-1
Total Water Consumption 1999 – 2003

Month	2001 Water Withdrawals (MG)		
	Big Bethel	**Newport News**	**Combined**
January	0.0	5.3	5.3
February	0.0	4.6	4.6
March	0.0	5.2	5.2
April	2.8	2.5	5.3
May	8.3	0.0	8.3
June	6.4	0.0	6.4
July	9.5	0.2	9.7
August	8.1	1.8	9.9
September	3.5	4.1	7.6
October	3.9	4.3	8.2
November	8.6	0.0	8.6
December	3.7	4.4	8.1
		Total	**87.2**

Month	2000 Water Withdrawals (MG)		
	Big Bethel	**Newport News**	**Combined**
January	5.9	0	5.9
February	5.1	0	5.1
March	1.4	3.5	4.9
April	3.6	3	6.6
May	6.5	0	6.5
June	6.5	0	6.5
July	6.5	0	6.5
August	5.3	0	5.3
September	4.9	0	4.9
October	5.7	0.0	5.7
November	4.3	0.0	4.3
December	2.0	2.2	4.2
		Total	**66.4**

Table A-1
Total Water Consumption 1999 – 2003

Month	1999 Water Withdrawals (MG)		
	Big Bethel	**Newport News**	**Combined**
January	4.6	0.0	4.6
February	4.2	0.0	4.2
March	4.9	0.0	4.9
April	5.6	0.0	5.6
May	7.0	0.0	7.0
June	8.2	0.0	8.2
July	8.7	0.1	8.8
August	6.6	8.3	14.9
September	4.8	5.8	10.6
October	6.7	1.3	8.0
November	5.4	0.0	5.4
December	4.6	0.0	4.6
		Total	**86.8**

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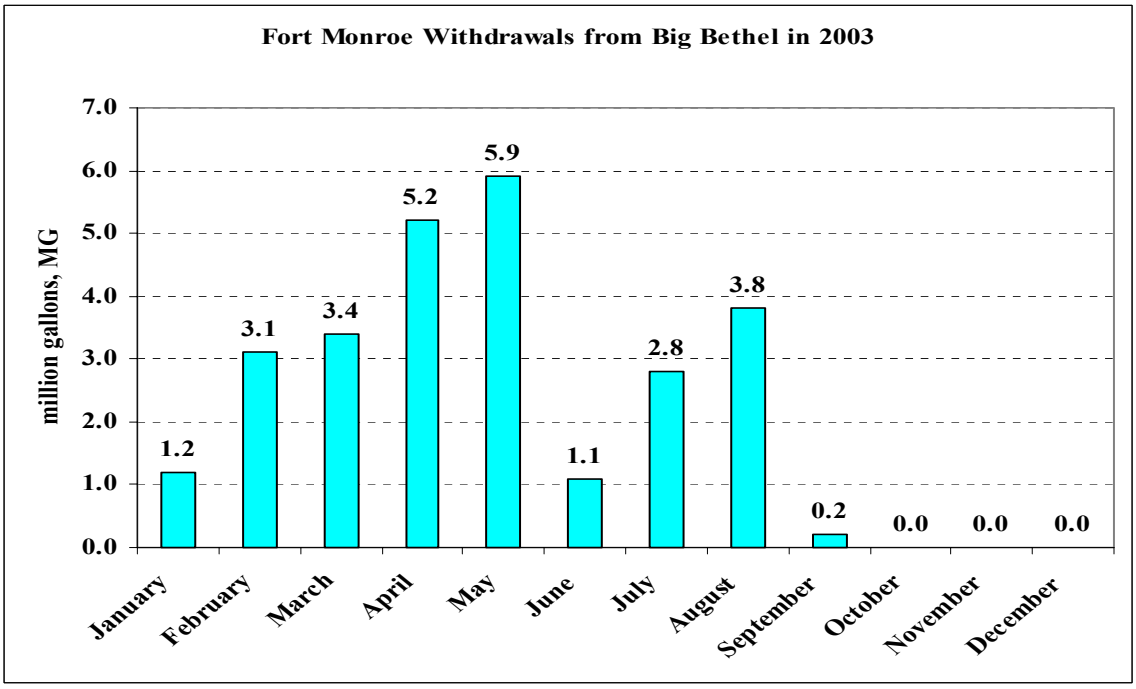
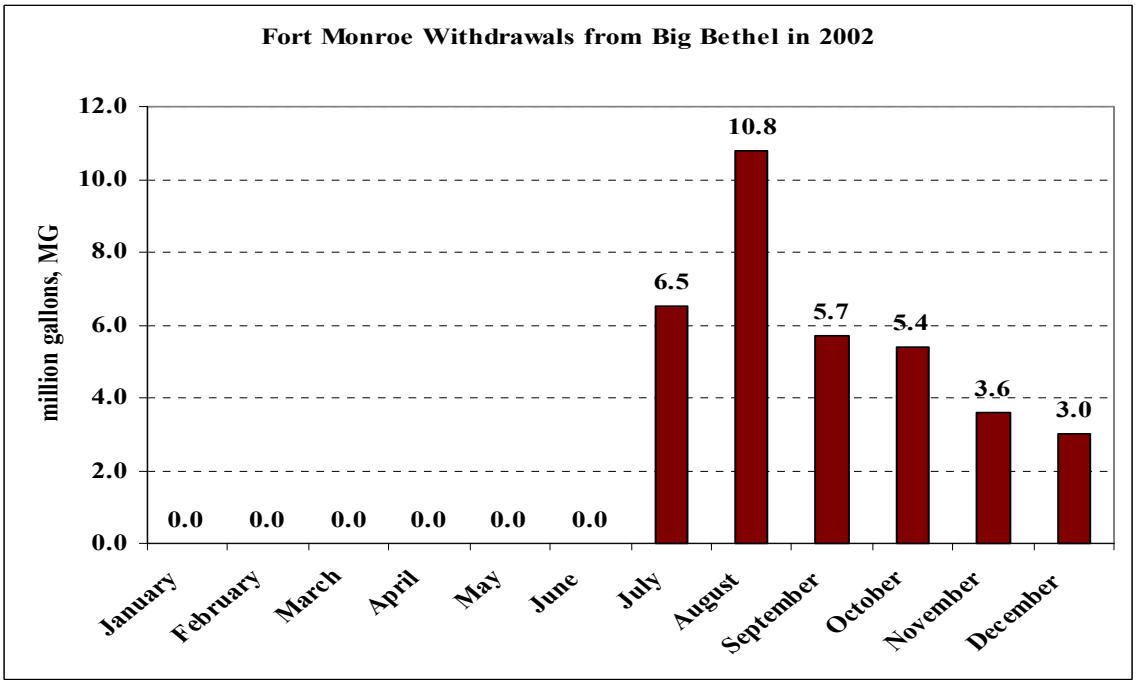
Table A-2
Water Withdrawals from Big Bethel 1999-2003

Month	Water Withdrawals (MG)				
	1999	2000	2001	2002	2003
January	4.6	5.9	0.0	0.0	1.2
February	4.2	5.1	0.0	0.0	3.1
March	4.9	1.4	0.0	0.0	3.4
April	5.6	3.6	2.8	0.0	5.2
May	7.0	6.5	8.3	0.0	5.9
June	8.2	6.5	6.4	0.0	1.1
July	8.7	6.5	9.5	6.5	2.8
August	6.6	5.3	8.1	10.8	3.8
September	4.8	4.9	3.5	5.7	0.2
October	6.7	5.7	3.9	5.4	0.0
November	5.4	4.3	8.6	3.6	0.0
December	4.6	2.0	3.7	3.0	0.0
Total	**71.3**	**57.7**	**54.8**	**35.0**	**26.7**



Big Bethel was the primary water supply to Fort Monroe from March 2003 until September 5, 2003. Big Bethel went idle for repairs at that point and on September 23, 2003, the U.S. army decided not to restart the plant. Therefore, Newport News Waterworks became the sole supply of water to Fort Monroe as of September 5, 2003.

Table A-2
Water Withdrawals from Big Bethel 1999-2003



Big Bethel was shut down for various repair projects from January 2002 through July 1, 2002. However, Fort Monroe did not receive water from Big Bethel until July 17, 2002. The base purchased water solely from Big Bethel for the remainder of the year.

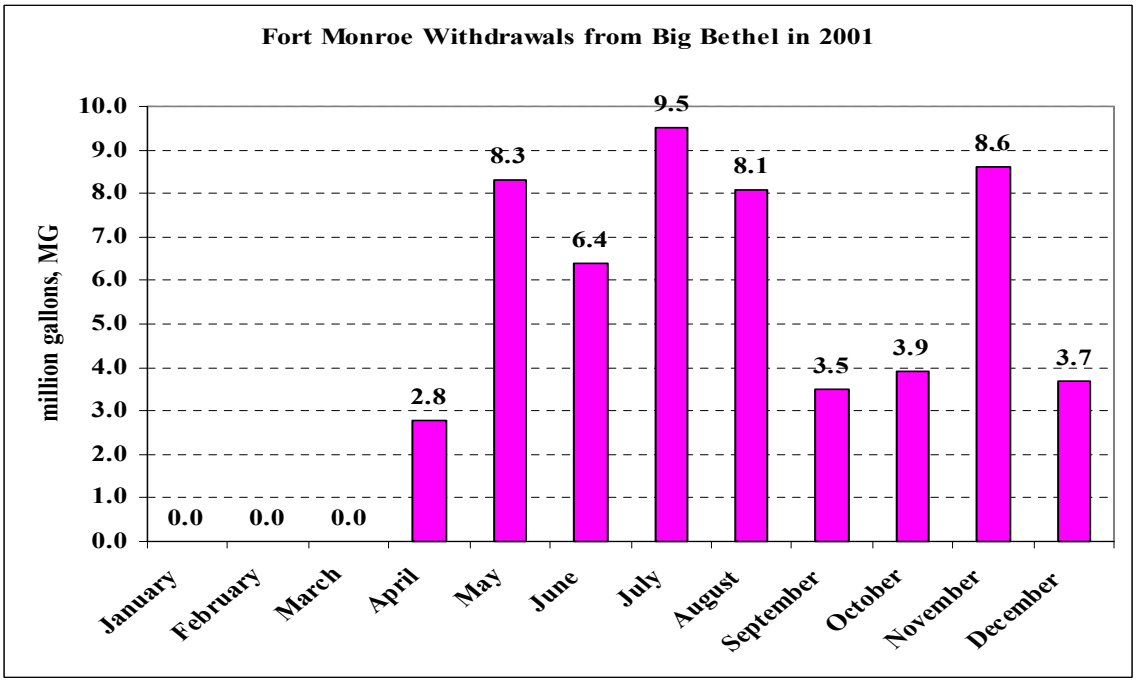
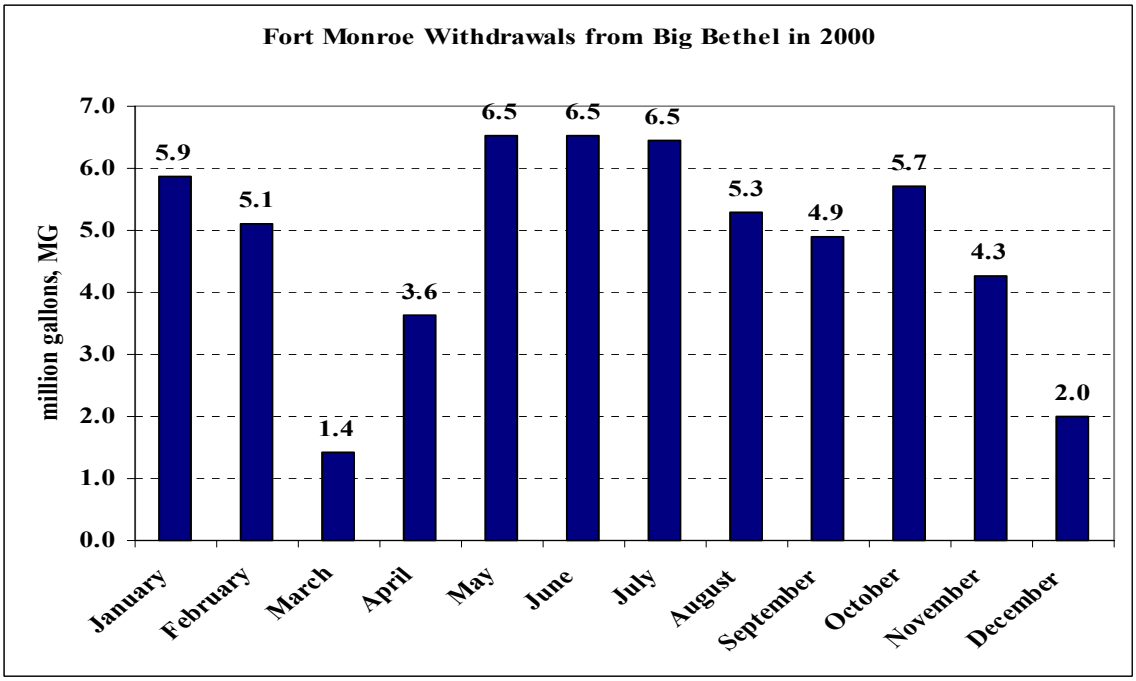


Table A-2
Water Withdrawals from Big Bethel 1999-2003

Due to a water line break between Langley Air Force Base and Fort Monroe, water was not purchased from Big Bethel from September 11, 2001 through October 19, 2001. Repair work at Big Bethel starting on December 13, 2001 forced Fort Monroe to purchase water from Newport News Waterworks for the remainder of the year.



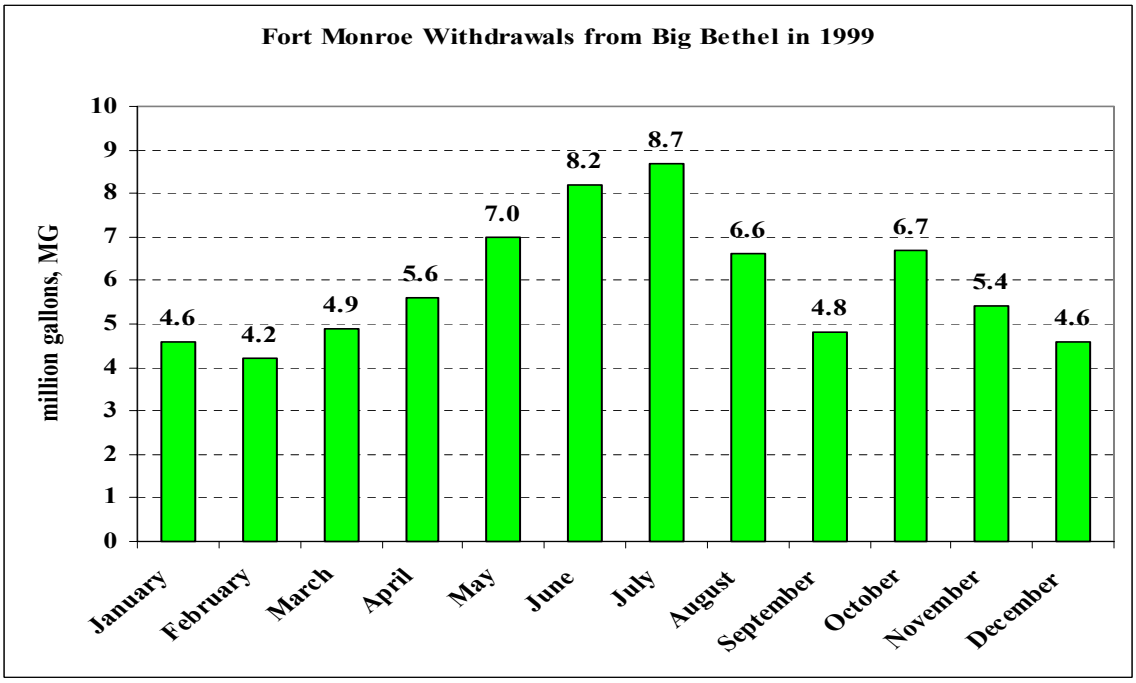
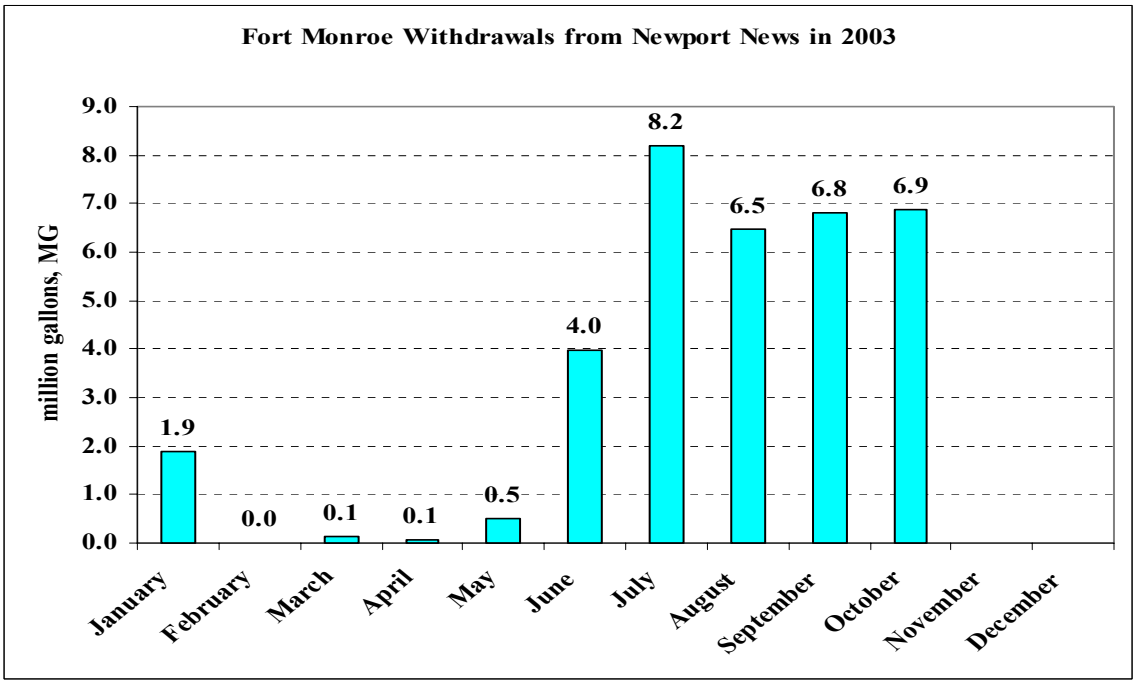


Table A-3
Water Withdrawals from Newport News 1999-2003

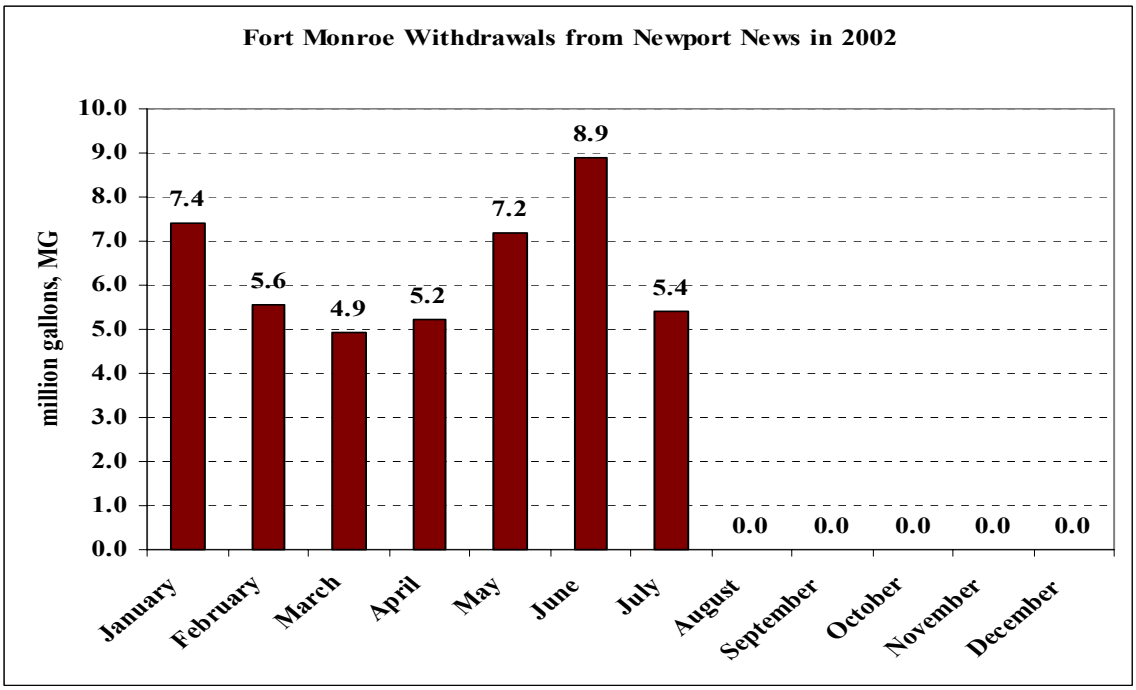
Month	Water Withdrawals (MG)				
	1999	2000	2001	2002	2003
January	0.0	0.0	5.3	7.4	1.9
February	0.0	0.0	4.6	5.6	0.0
March	0.0	3.5	5.2	4.9	0.1
April	0.0	3.0	2.5	5.2	0.1
May	0.0	0.0	0.0	7.2	0.5
June	0.0	0.0	0.0	8.9	4.0
July	0.1	0.0	0.2	5.4	8.2
August	8.3	0.0	1.8	0.0	6.5
September	5.8	0.0	4.1	0.0	6.8
October	1.3	0.0	4.3	0.0	6.9
November	0.0	0.0	0.0	0.0	
December	0.0	2.2	4.4	0.0	
Total	**15.5**	**8.7**	**32.3**	**44.6**	**34.9**



Although Big Bethel had been the sole supply of water to Fort Monroe since July 17, 2002, water was purchased from Newport News Waterworks in January 2003. Newport News was the alternate water supply to Fort Monroe from March 2003 until September 5, 2003. Big Bethel went idle for repairs at that point and on September 23, 2003, the U.S.

Table A-3
Water Withdrawals from Newport News 1999-2003

army decided not to restart the plant. Therefore, Newport News Waterworks became the sole water supply to Fort Monroe as of September 5, 2003.



Fort Monroe purchased water from Newport News Waterworks from January 2002 through July 17, 2002 since Big Bethel was shut down for various repair projects. The base purchased water solely from Big Bethel for the rest of the year.

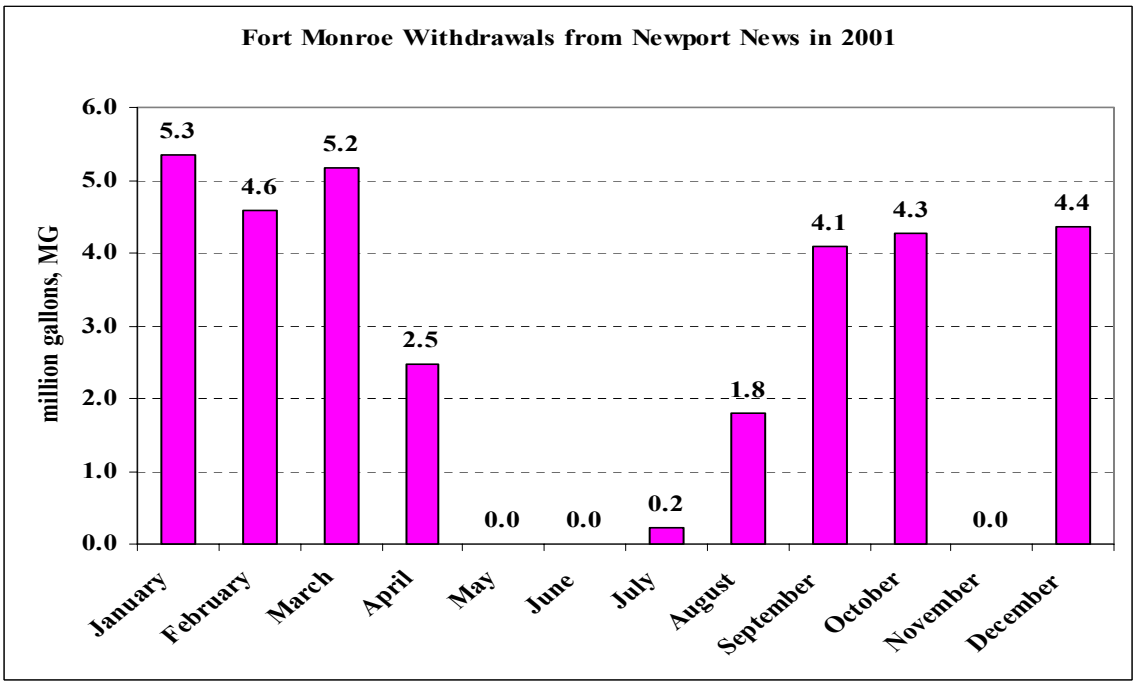
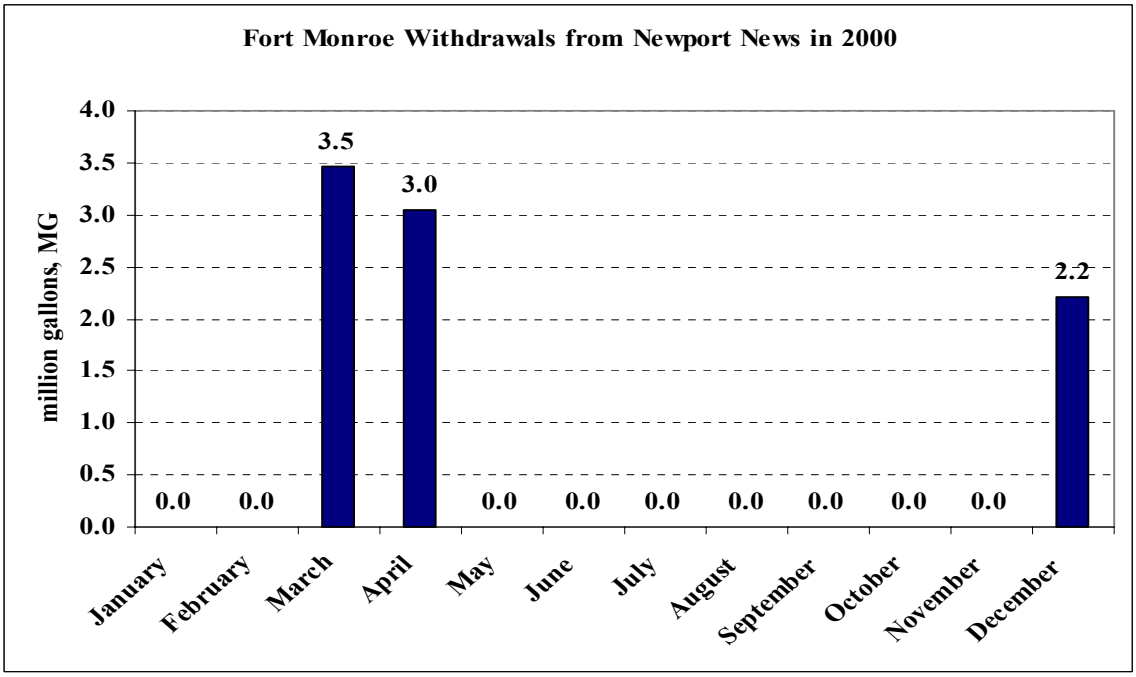


Table A-3
Water Withdrawals from Newport News 1999-2003

Water was purchased from Newport News Waterworks for use on base between January 1, 2001 and April 13, 2001 as well as between July 18, 2001 and August 16, 2001. Due to a water line break between Langley Air Force Base and Fort Monroe, water was purchased from Newport News from September 11, 2001 to October 19, 2001. Repair work at Big Bethel starting on December 13, 2001 forced Fort Monroe to purchase water from Newport News for the remainder of the year.



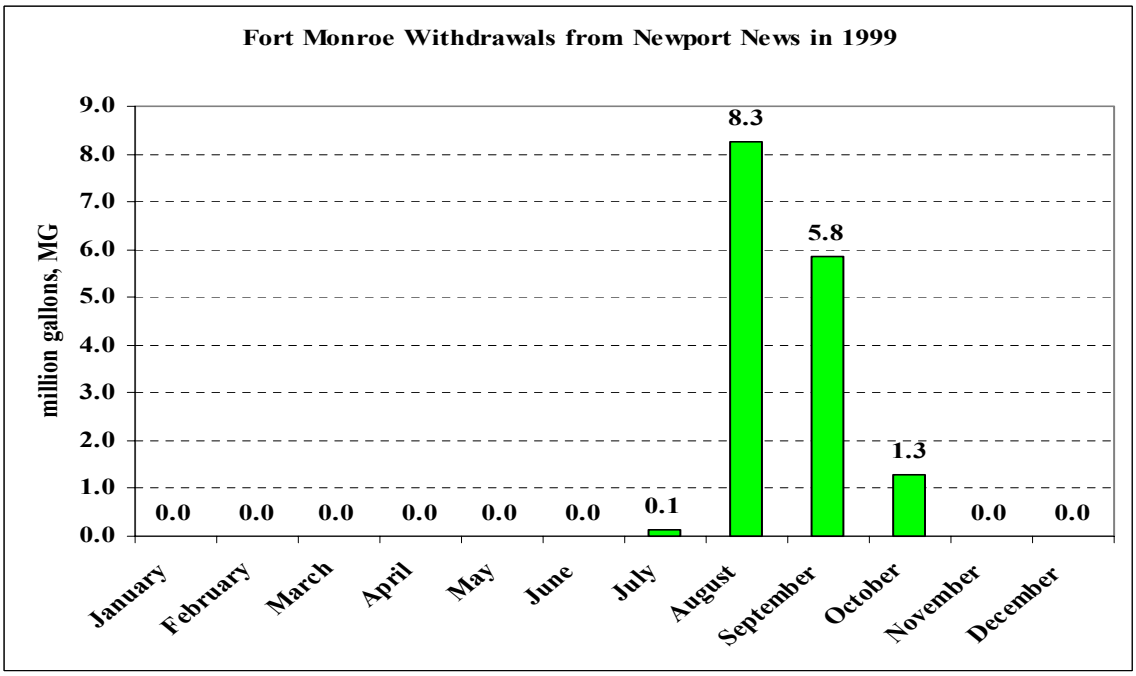


Table A-3
Water Withdrawals from Newport News 1999-2003

Water purchase data was taken from Newport News Waterworks bills. The dates were adjusted to reflect the dates Newport News water was used on base. Water purchased each month was calculated by proportionally allocating water from each statement to the months represented in that statement. The water purchased for each month was then determined by adding the water from each meter allocated to a particular month.

	Meter Reading Dates			Percent Allocation		Water Purchased (gal)		
Meter	Beginning	End	Total days	1st month	2nd month	Total	1st month	2nd month
B	12/14/2000	1/10/2001	27	data below		4121480	2213596	1907884
W	12/14/2000	1/10/2001	27	data below				0
B	1/10/2001	2/8/2001	29	72.4	27.6	4744564	3435064.34	1309499.66
W	1/10/2001	2/8/2001	29	72.4	27.6	0	0	0
W	2/8/2001	3/12/2001	32	62.5	37.5	378488	236555	141933
B	2/8/2001	3/12/2001	32	62.5	37.5	4856764	3035477.5	1821286.5
B	3/12/2001	4/11/2001	30	63.3	36.7	5069944	3210964.53	1858979.47
W	3/12/2001	4/10/2001	29	65.5	34.5	0	0	0
W	4/10/2001	4/13/2001	4	100	0	33660	33660	0
B	4/11/2001	4/13/2001	3	100	0	580448	580448	0
W	7/18/2001	8/13/2001	26	50	50	435336	217668	217668
B	7/18/2001	8/13/2001	26	50	50	5984	2992	2992
W	8/13/2001	8/16/2001	4	100	0	1567808	1567808	0
B	8/13/2001	8/16/2001	4	100	0	0	0	0
W	9/11/2001	10/10/2001	29	65.5	34.5	6254028	4097466.62	2156561.38
B	9/11/2001	10/10/2001	29	65.5	34.5	0	0	0
B	10/10/2001	10/19/2001	10	100	0	1890196	1890196	0
W	10/10/2001	10/19/2001	10	100	0	229636	229636	0
B	12/1/2001	12/11/2001	12	100	0	53108	53108	0
B	12/13/2001	1/11/2002	29	62.1	37.9	7025964	4360943.17	2665020.83
W	12/13/2001	1/11/2002	29	62.1	37.9	0	0	0
B	1/11/2002	2/11/2002	31	64.5	35.5	7371540	4755832.26	2615707.74
W	1/11/2002	2/11/2000	31	64.5	35.5	0	0	0
B	2/11/2002	3/13/2002	30	56.7	43.3	5183640	2937396	2246244
W	2/11/2002	3/12/2002	29	58.6	41.4	0	0	0
B	3/13/2002	4/12/2002	30	60	40	4482016	2689209.6	1792806.4
W	3/12/2002	4/12/2002	31	61.3	38.7	0	0	0
B	4/12/2002	5/10/2002	28	64.3	35.7	5317532	3418413.43	1899118.57
W	4/12/2002	5/13/2002	31	58.1	41.9	0	0	0
B	5/10/2002	6/12/2002	33	63.6	36.4	8302800	5283600	3019200

	Meter Reading Dates			Percent Allocation		Water Purchased (gal)		
Meter	Beginning	End	Total days	1st month	2nd month	Total	1st month	2nd month
W	5/13/2002	6/11/2002	29	62.1	37.9	14960	9285.51724	5674.48276
B	6/12/2002	7/11/2002	29	62.1	37.9	5975024	3708635.59	2266388.41
W	6/11/2002	7/11/2002	30	63.3	36.7	3392928	2148854.4	1244073.6
B	7/11/2002	7/17/2002	8	100	0	0	0	0
W	7/11/2002	7/17/2002	8	100	0	1902912	1902912	0
B	1/9/2003	1/31/2003	23	100	0	0	0	0
W	1/9/2003	1/31/2003	23	100	0	1878228	1878228	0
B	3/11/2003	4/11/2003	31	64.5	35.5	0	0	0
W	3/11/2003	4/10/2003	30	66.7	33.3	205700	137133.333	68566.6667
B	4/11/2003	5/12/2003	31	61.3	38.7	0	0	0
W	4/10/2003	5/12/2003	32	62.5	37.5	2244	1402.5	841.5
B	5/12/2003	6/11/2003	30	63.3	36.7	62084	39319.8667	22764.1333
W	5/12/2003	6/11/2003	30	63.3	36.7	739024	468048.533	270975.467
B	6/11/2003	7/9/2003	28	67.9	32.1	0	0	0
W	6/11/2003	7/10/2003	29	65.5	34.5	5632440	3690219.31	1942220.69
B	7/9/2003	8/12/2003	34	64.7	35.3	4286040	2773320	1512720
W	7/10/2003	8/11/2003	32	65.6	34.4	5310052	3484721.63	1825330.38
B	8/12/2003	9/11/2003	30	63.3	36.7	3137112	1986837.6	1150274.4
W	8/11/2003	9/11/2003	31	64.5	35.5	1774256	1144681.29	629574.71
B	9/11/2003	10/13/2003	32	59.4	40.6	2580600	1532231.25	1048368.75
W	9/11/2003	10/13/2003	32	59.4	40.6	5874044	3487713.63	2386330.38
B	10/13/2003	11/10/2003	28	64.3	35.7	0	0	0
W	10/13/2003	11/10/2003	28	64.3	35.7	5344460	3436487.78	1907972.22
B	11/10/2003	?	?	?	#VALUE!	?	#VALUE!	#VALUE!
W	11/?	?	?	?	#VALUE!	?	#VALUE!	#VALUE!
NN	3/21/2000	4/6/2000	16	62.5	37.5	5531460	3457162.5	2074297.5
NN	4/13/2000	4/18/2000	5	100	0	965328	965328	0
NN	12/15/2000	12/31/2000	16	100	0	2213596	2213596	0
W	7/12/1999	8/10/1999	29	65.5	34.5	130900	85762.069	45137.931
B	7/22/1999	7/23/1999	1	100	0	53108	53108	0
B	8/6/1999	8/12/1999	6	100	0	1546116	1546116	0
B	8/12/1999	9/10/1999	29	65.5	34.5	10258072	6720805.79	3537266.21
B	9/10/1999	10/11/1999	31	64.5	35.5	3580676	2310113.55	1270562.45

Above eight lines were supplied by Ron Pinkoski via email.

Appendix B: Estimated Domestic Water Consumption

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Table B-1
Estimated Domestic Water Flow Rates

Existing Conditions (winter)

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
1	Permanent	family housing	family housing	family	300	1	6689	300
2	Permanent	private/organizational club building	shopping/exchange	1000 sq. feet	200	7.488	7488	1497.6
3	Permanent	family housing	family housing	family	300	2	5643	600
5	Permanent	exchange cafeteria	restaurant	seat	50	20	756	1000
5	Permanent	administrative building	office	person	15	507	94454	7605
7	Permanent	library branch	office	person	15	8	4856	120
8	Permanent	organizational storage building	warehouse (mixed use)	1000 sq. feet	94	0.659	659	61.946
9	Permanent	band training building	auditorium	seat	5	30	12965	150
10	Permanent	administrative building	self service storage	1000 sq. feet	17	2.112	2112	35.904
10	Permanent	controlled humidity warehouse, installation	warehouse (mixed use)	1000 sq. feet	94	0.906	906	85.164
10	Permanent	information systems facility	office	person	15	3	906	45
10	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.32	7320	688.08
10	Permanent	administrative building	office	person	15	135	28528	2025
11	Permanent	administrative building	office	person	15	45	7734	675
13	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.16	1160	19.72
14	Permanent	museum	shopping/exchange	1000 sq. feet	200	3.694	3694	738.8
15	Permanent	family housing	family housing	family	300	2	6965	600
16	Permanent	family housing	family housing	family	300	2	5220	600
17	Permanent	family housing	family housing	family	300	4	10234	1200
18	Permanent	family housing	family housing	family	300	4	10234	1200
19	Permanent	family housing	family housing	family	300	1	3204	300
20	Permanent	museum	shopping/exchange	1000 sq. feet	200	34.704	34704	6940.8
21	Permanent	chapel	self service storage	1000 sq. feet	17	29.122	29122	495.074
22	Permanent	museum	shopping/exchange	1000 sq. feet	200	26.52	26520	5304
23	Permanent	museum	shopping/exchange	1000 sq. feet	200	7.8	7800	1560
24	Permanent	fire/rescue station	self service storage	1000 sq. feet	17	3.751	3751	63.767
25	Permanent	family housing	family housing	family	300	2	4370	600
26	Permanent	family housing	family housing	family	300	2	4370	600
27	Permanent	information systems facility	office	person	15	3	3400	45
27	Permanent	training aids center	office	person	15	8	7413	120
27	Permanent	administrative building	office	person	15	29	5825	435
28	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.12	8120	763.28
28	Permanent	installation, maintenance, and repair building	industrial facility	person	15	27	18696	405
28	Permanent	administrative building	office	person	15	69	12418	1035
30	Permanent	family housing	family housing	family	300	2	4370	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
31	Permanent	family housing	family housing	family	300	2	4370	600
32	Permanent	recreational equipment checkout	industrial facility	person	15	3	3167	45
32	Permanent	indoor morale, welfare, and recreation facility	office	person	15	3	365	45
33	Permanent	family housing	family housing	family	300	4	10837	1200
34	Permanent	family housing	family housing	family	300	4	10837	1200
35	Permanent	family housing	family housing	family	300	4	10837	1200
36	Permanent	drug and alcohol abuse counseling center	office	person	15	0	1457	0
36	Permanent	post office	office	person	15	0	2381	0
36	Permanent	army community services center	swimming pool	person	10	0	7557	0
37	Permanent	administrative building	office	person	15	41	9570	615
38	Permanent	fire/rescue station	office	person	15	1	2171	15
39	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.528	528	8.976
40	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.552	552	9.384
42	Permanent	auditorium, general purpose	auditorium	seat	5	898	10450	4490
43	Permanent	family housing	family housing	family	300	4	10837	1200
44	Permanent	family housing	family housing	family	300	4	10837	1200
45	Permanent	family housing	family housing	family	300	4	10837	1200
46	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.86	860	80.84
47	Permanent	administrative building	office	person	15	6	1186	90
48	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.736	2736	257.184
49	Permanent	administrative building	office	person	15	3	561	45
50	Permanent	family housing	family housing	family	300	3	10882	900
51	Permanent	family housing	family housing	family	300	4	11194	1200
52	Permanent	family housing	family housing	family	300	4	11194	1200
53	Permanent	administrative building	office	person	15	10	3091	150
54	Permanent	family housing	family housing	family	300	4	11194	1200
55	Permanent	family housing	family housing	family	300	1	3387	300
56	Permanent	administrative building	office	person	15	91	19402	1365
57	Permanent	access control building	industrial facility	person	15	4	625	60
57	Permanent	information systems facility	office	person	15	4	4029	60
57	Permanent	installation, maintenance, and repair building	industrial facility	person	15	7	18758	105
57	Permanent	general instruction building	office	person	15	8	1987	120
57	Permanent	administrative building	office	person	15	9	2084	135
57	Permanent	vehicle storage building, installation	warehouse (mixed use)	1000 sq. feet	94	21.195	21195	1992.33
59	Permanent	information systems facility	office	person	15	31	20161	465
60	Permanent	family housing	family housing	family	300	1	2143	300
61	Permanent	transient UPH	BOQ/BEQ	person	65	2	3044	130
62	Permanent	family housing	family housing	family	300	2	7370	600
63	Permanent	family housing	family housing	family	300	2	7370	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
64	Permanent	family housing	family housing	family	300	1	2351	300
70	Permanent	family housing	family housing	family	300	0	7880	0
71	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.979	1979	33.643
73	Permanent	administrative building	office	person	15	9	1736	135
76	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.868	868	14.756
77	Permanent	administrative building	office	person	15	34	8032	510
78	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.287	2287	38.879
79	Permanent	family housing	family housing	family	300	0	7854	0
80	Permanent	transient officers UPH	BOQ/BEQ	person	65	6	9634	390
81	Permanent	plant/utilities building	industrial facility	person	15	3	3004	45
81	Permanent	installation, maintenance, and repair building	industrial facility	person	15	2	4704	30
82	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	1.078	1078	101.332
82	Permanent	automation-aided instructional building	office	person	15	4	1032	60
82	Permanent	army continuing education system facility	adult education center	person	15	12	2809	180
82	Permanent	company headquarters building	office	person	15	10	2240	150
82	Permanent	general instruction building	office	person	15	13	3341	195
82	Permanent	dental clinic	clinic	each	500	1	4452	500
82	Permanent	administrative building	office	person	15	95	21379	1425
82	Permanent	troop dispensary/health clinic	clinic	each	500	1	31569	500
83	Permanent	administrative building	office	person	15	30	8202	450
84	Permanent	administrative building	office	person	15	20	3927	300
85	Permanent	community support facility	office	person	15	3	897	45
86	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.668	668	62.792
87	Permanent	police/mp station	office	person	15	8	3150	120
87	Permanent	company headquarters building	office	person	15	11	4138	165
87	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.264	4264	400.816
87	Permanent	UPH mess facilities	restaurant	person	50	100	7300	5000
87	Permanent	enlisted unaccompanied personnel housing	BOQ/BEQ	person	65	80	20550	5200
88	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	9.624	9624	904.656
89	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.575	2575	242.05
90	Permanent	family housing	family housing	family	300	1	1399	300
91	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.21	210	19.74
93	Permanent	family housing	family housing	family	300	1	5958	300
94	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
95	Permanent	child development center	day care center	person	10	0	4247	0
96	Permanent	simulator building	office	person	15	260	7497	3900
96	Permanent	administrative building	office	person	15	97	20190	1455
98	Permanent	private/organizational club building	swimming pool	person	10	0	1703	0
99	Permanent	private/organizational club building	swimming pool	person	10	0	1703	0

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
100	Permanent	information systems facility	office	person	15	1	494	15
100	Permanent	administrative building	office	person	15	119	24747	1785
101	Permanent	family housing	family housing	family	300	2	11742	600
102	Permanent	family housing	family housing	family	300	2	11742	600
103	Permanent	family housing	family housing	family	300	1	5871	300
105	Permanent	general instruction building	office	person	15	10	2562	150
105	Permanent	administrative building	office	person	15	91	15965	1365
107	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25
108	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
109	Permanent	family housing	family housing	family	300	2	3071	600
110	Permanent	family housing	family housing	family	300	2	3071	600
111	Permanent	family housing	family housing	family	300	2	3071	600
112	Permanent	family housing	family housing	family	300	2	3071	600
113	Permanent	family housing	family housing	family	300	2	3071	600
114	Permanent	family housing	family housing	family	300	2	3071	600
115	Permanent	family housing	family housing	family	300	2	3071	600
116	Permanent	administrative building	office	person	15	27	5246	405
117	Permanent	administrative building	office	person	15	55	10337	825
118	Permanent	family housing	family housing	family	300	1	7273	300
119	Permanent	family housing	family housing	family	300	1	12173	300
120	Permanent	family housing	family housing	family	300	1	7584	300
121	Permanent	family housing	family housing	family	300	1	5275	300
121	Permanent	family housing	family housing	family	300	1	5275	300
122	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.302	302	5.134
123	Permanent	family housing	family housing	family	300	2	10548	600
124	Permanent	family housing	family housing	family	300	2	10548	600
125	Permanent	family housing	family housing	family	300	1	7720	300
126	Permanent	family housing	family housing	family	300	2	10549	600
127	Permanent	family housing	family housing	family	300	2	10226	600
128	Permanent	family housing	family housing	family	300	2	10228	600
129	Permanent	family housing	family housing	family	300	2	10816	600
130	Permanent	family housing	family housing	family	300	2	3071	600
131	Permanent	family housing	family housing	family	300	2	3071	600
132	Permanent	family housing	family housing	family	300	2	3071	600
133	Permanent	administrative building	self service storage	1000 sq. feet	17	3.206	3206	54.502
133	Permanent	information systems facility	office	person	15	26	7225	390
133	Permanent	auditorium, general purpose	auditorium	seat	5	186	5020	930
133	Permanent	administrative building	office	person	15	112	26558	1680
134	Permanent	administrative building	office	person	15	67	21296	1005

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
135	Permanent	information systems facility	office	person	15	6	2462	90
135	Permanent	information systems facility	office	person	15	19	8680	285
135	Permanent	administrative building	office	person	15	35	5868	525
136	Permanent	transient UPH	BOQ/BEQ	person	65	2	1693	130
137	Permanent	transient officers UPH	BOQ/BEQ	person	65	2	1693	130
138	Permanent	administrative building	office	person	15	56	13833	840
139	Permanent	administrative building	office	person	15	181	37019	2715
140	Permanent	family housing	family housing	family	300	2	3578	600
141	Permanent	family housing	family housing	family	300	1	4928	300
142	Permanent	family housing	family housing	family	300	1	4928	300
143	Permanent	family housing	family housing	family	300	4	16430	1200
144	Permanent	family housing	family housing	family	300	4	16430	1200
145	Permanent	CIDC field operations building	office	person	15	4	1366	60
146	Permanent	family housing	family housing	family	300	1	4212	300
147	Permanent	transient officers UPH	BOQ/BEQ	person	65	1	1270	65
148	Permanent	family housing	family housing	family	300	2	3578	600
149	Permanent	family housing	family housing	family	300	2	3578	600
150	Permanent	family housing	family housing	family	300	2	3578	600
151	Permanent	family housing	family housing	family	300	2	3930	600
152	Permanent	family housing	family housing	family	300	2	3579	600
153	Permanent	family housing	family housing	family	300	2	3578	600
154	Permanent	family housing	family housing	family	300	2	3578	600
155	Permanent	family housing	family housing	family	300	2	3578	600
156	Permanent	family housing	family housing	family	300	2	3578	600
157	Permanent	family housing	family housing	family	300	1	7021	300
158	Permanent	family housing	family housing	family	300	1	7021	300
159	Permanent	administrative building	office	person	15	21	4794	315
161	Permanent	information systems facility	office	person	15	8	1344	120
161	Permanent	administrative building	office	person	15	163	38564	2445
163	Permanent	administrative building	office	person	15	83	14865	1245
164	Permanent	exchange maintenance shop	warehouse (mixed use)	1000 sq. feet	94	3.249	3249	305.406
165	Permanent	simulator building	warehouse (mixed use)	1000 sq. feet	94	9.542	9542	896.948
166	Permanent	chapel	auditorium	seat	5	225	3678	1125
167	Permanent	family housing	family housing	family	300	2	3883	600
168	Permanent	administrative building	office	person	15	16	2202	240
168	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	9.998	9998	939.812
170	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
171	Permanent	physical fitness center	swimming pool	person	10	15	34020	150
173	Permanent	administrative building	office	person	15	0	2400	0

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
174	Permanent	administrative building	office	person	15	0	1658	0
175	Permanent	administrative building	office	person	15	0	1755	0
176	Permanent	administrative building	office	person	15	0	3002	0
177	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
178	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	1.47	1470	138.18
181	Permanent	commissary	shopping/exchange	1000 sq. feet	200	0	20080	0
182	Permanent	information systems facility	office	person	15	12	3106	180
183	Permanent	private/organizational club building	swimming pool	person	10	12	808	120
183	Permanent	information systems facility	office	person	15	4	4562	60
185	Permanent	open dining facility	picnic area	seat	5	500	21929	2500
186	Permanent	family housing	family housing	family	300	2	4464	600
187	Permanent	family housing	family housing	family	300	2	4464	600
188	Permanent	family housing	family housing	family	300	2	4464	600
191	Permanent	family housing	family housing	family	300	2	4370	600
192	Permanent	family housing	family housing	family	300	2	4370	600
193	Permanent	family housing	family housing	family	300	2	4370	600
194	Permanent	family housing	family housing	family	300	2	4370	600
195	Permanent	family housing	family housing	family	300	2	4370	600
196	Permanent	family housing	family housing	family	300	2	4370	600
198	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.079	79	1.343
201	Permanent	bowling center	bowling alley	lane	100	14	11569	1400
204	Permanent	electronic and communications equipment RTD&E building	office	person	15	4	9410	60
207	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	4	9776	40
207	Permanent	cafeteria	restaurant	seat	50	50	3000	2500
208	Permanent	exchange cafeteria	restaurant	seat	50	1	192	50
209	Permanent	administrative building	office	person	15	9	1872	135
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	0.828	828	165.6
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	1.778	1778	355.6
210	Permanent	exchange automotive service station	office	person	15	23	468	345
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	30.992	30992	6198.4
211	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.303	303	28.482
215	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.094	94	8.836
217	Permanent	administrative building	office	person	15	7	1221	105
220	Permanent	garage, family housing	self service storage	1000 sq. feet	17	3.364	3364	57.188
221	Permanent	recreational equipment checkout	industrial facility	person	15	8	23329	120
222	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.415	1415	24.055
223	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.348	2348	39.916
224	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
226	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0	1137	0

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
227	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
228	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
234	Permanent	information systems facility	office	person	15	4	272	60
234	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	30.271	30271	2845.474
235	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	15	681	150
238	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.344	344	5.848
240	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.342	2342	39.814
243	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.293	293	27.542
243	Permanent	information systems facility	office	person	15	2	392	30
243	Permanent	administrative building	office	person	15	74	12080	1110
245	Permanent	child development center	day care center	person	10	97	8190	970
247	Permanent	administrative building	office	person	15	10	2704	150
248	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.182	2182	205.108
250	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.088	88	8.272
478	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25
479	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
556	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
557	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
558	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
559	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
560	Permanent	access control building	industrial facility	person	15	4	135	60
1093	Temporary	trailer park near Dog Beach	trailer court	3 persons per trailer, per trailer	300	6		1800
1093	Permanent	trailer park near Dog Beach	trailer court	3 persons per trailer, per trailer	300	13		3900
A0027	Permanent	training aids center	office	person	15	6	2222	90
Bank	Permanent	Old Point National Bank	office	person	15	6	1400	90
Hotel	Permanent	Chamberlin Hotel	BOQ/BEQ	person	65	372	185788	0
LEAK1	Temporary	Ingalls Rd. & Reeder Circle	leak					720
LEAK2	Temporary	McNair Dr. & family housing	leak					14400
LEAK3	Temporary	Fenwick Rd. across from the heliport	leak					2880
NEW1	Permanent	new building along Darby Street	office	person	15	60	7500	900
NEW2	Permanent	new building along Fenwick Rd. @ Griffith St.	office	person	15	60	7500	900
NEW3	Permanent	new building along Fenwick Rd. next to NEW2	office	person	15	60	7500	900
NEW4	Permanent	new building along Fenwick Rd. at old T-249	office	person	15	60	7500	900
NEW5	Permanent	new building at old T-264	office	person	15	60	7500	900
T0024	Temporary	company headquarters building	office	person	15	0	2006	0
T0028	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.498	498	8.466
T0058	Temporary	transient UPH	BOQ/BEQ	person	65	18	7875	1170
T0086	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0	6262	0

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
T0099	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.744	7744	727.936
T0100	Temporary	information systems facility	office	person	15	5	1104	75
T0100	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.27	8270	777.38
T0101	Temporary	installation, maintenance, and repair building	industrial facility	person	15	5	3424	75
T0101	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	5.94	5940	558.36
T0104	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	10.076	10076	947.144
T0181	Temporary	administrative building	office	person	15	28	4826	420
T0182	Temporary	administrative building	office	person	15	30	4826	450
T0183	Temporary	administrative building	office	person	15	27	4826	405
T0184	Temporary	general instruction building	office	person	15	27	4825	405
T0191	Temporary	veterinary facility	clinic	each	500	1	2178	500
T0194	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.83	4830	454.02
T0195	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.83	4830	454.02
T0196	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.83	4830	454.02
T0216	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.705	705	11.985
T0246	Temporary	private/organizational club building	swimming pool	person	10	3	1019	30
T0247	Temporary	administrative building	office	person	15	30	4800	450
T0258	Temporary	administrative building	office	person	15	31	4830	465
T0260	Temporary	thrift shop	shopping/exchange	1000 sq. feet	200	0	4830	0
T0261	Temporary	indoor morale, welfare, and recreation facility	swimming pool	person	10	0	2239	0
T0457	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
T0468	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
W300	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W301	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W302	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W303	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W304	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W305	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W306	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W307	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W309	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W311	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W312	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W313	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W314	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W316	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W318	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W320	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W322	Permanent	Wherry family housing	family housing	family	300	4	4400	1200

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
W324	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W342	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W344	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W346	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W348	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W350	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W352	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W354	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W356	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W358	Permanent	Wherry family housing	family housing	family	300	0		0
W360	Permanent	Wherry family housing	family housing	family	300	0		0
W424	Permanent	Wherry family housing	family housing	family	300	0		0
W426	Permanent	Wherry family housing	family housing	family	300	0		0
W428	Permanent	Wherry family housing	family housing	family	300	0		0
W430	Permanent	Wherry family housing	family housing	family	300	0		0
W432	Permanent	Wherry family housing	family housing	family	300	0		0
W434	Permanent	Wherry family housing	family housing	family	300	0		0
W436	Permanent	Wherry family housing	family housing	family	300	0		0
W440	Permanent	Wherry family housing	family housing	family	300	0		0
W442	Permanent	Wherry family housing	family housing	family	300	0		0
W444	Permanent	Wherry family housing	family housing	family	300	0		0
W452	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W454	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W456	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W458	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W460	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W462	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W464	Permanent	Wherry family housing	family housing	family	300	0		0
W466	Permanent	Wherry family housing	family housing	family	300	0		0
W468	Permanent	Wherry family housing	family housing	family	300	0		0
W470	Permanent	Wherry family housing	family housing	family	300	0		0
W472	Permanent	Wherry family housing	family housing	family	300	0		0
W474	Permanent	Wherry family housing	family housing	family	300	0		0
W476	Permanent	Wherry family housing	family housing	family	300	0		0
W482	Permanent	Wherry family housing	family housing	family	300	0		0
W484	Permanent	Wherry family housing	family housing	family	300	0		0
							Total	**230810 gpd**

Table B-2
Estimated Domestic Water Flow Rates

Existing Conditions (summer)

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
1	Permanent	family housing	family housing	family	300	1	6689	300
2	Permanent	private/organizational club building	shopping/exchange	1000 sq. feet	200	7.488	7488	1497.6
3	Permanent	family housing	family housing	family	300	2	5643	600
5	Permanent	exchange cafeteria	restaurant	seat	50	20	756	1000
5	Permanent	administrative building	office	person	15	507	94454	7605
7	Permanent	library branch	office	person	15	8	4856	120
8	Permanent	organizational storage building	warehouse (mixed use)	1000 sq. feet	94	0.659	659	61.946
9	Permanent	band training building	auditorium	seat	5	30	12965	150
10	Permanent	administrative building	self service storage	1000 sq. feet	17	2.112	2112	35.904
10	Permanent	controlled humidity warehouse, installation	warehouse (mixed use)	1000 sq. feet	94	0.906	906	85.164
10	Permanent	information systems facility	office	person	15	3	906	45
10	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.32	7320	688.08
10	Permanent	administrative building	office	person	15	135	28528	2025
11	Permanent	administrative building	office	person	15	45	7734	675
13	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.16	1160	19.72
14	Permanent	museum	shopping/exchange	1000 sq. feet	200	3.694	3694	738.8
15	Permanent	family housing	family housing	family	300	2	6965	600
16	Permanent	family housing	family housing	family	300	2	5220	600
17	Permanent	family housing	family housing	family	300	4	10234	1200
18	Permanent	family housing	family housing	family	300	4	10234	1200
19	Permanent	family housing	family housing	family	300	1	3204	300
20	Permanent	museum	shopping/exchange	1000 sq. feet	200	34.704	34704	6940.8
21	Permanent	chapel	self service storage	1000 sq. feet	17	29.122	29122	495.074
22	Permanent	museum	shopping/exchange	1000 sq. feet	200	26.52	26520	5304
23	Permanent	museum	shopping/exchange	1000 sq. feet	200	7.8	7800	1560
24	Permanent	fire/rescue station	self service storage	1000 sq. feet	17	3.751	3751	63.767
25	Permanent	family housing	family housing	family	300	2	4370	600
26	Permanent	family housing	family housing	family	300	2	4370	600
27	Permanent	information systems facility	office	person	15	3	3400	45
27	Permanent	training aids center	office	person	15	8	7413	120
27	Permanent	administrative building	office	person	15	29	5825	435
28	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.12	8120	763.28
28	Permanent	installation, maintenance, and repair building	industrial facility	person	15	27	18696	405
28	Permanent	administrative building	office	person	15	69	12418	1035
30	Permanent	family housing	family housing	family	300	2	4370	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
31	Permanent	family housing	family housing	family	300	2	4370	600
32	Permanent	recreational equipment checkout	industrial facility	person	15	3	3167	45
32	Permanent	indoor morale, welfare, and recreation facility	office	person	15	3	365	45
33	Permanent	family housing	family housing	family	300	4	10837	1200
34	Permanent	family housing	family housing	family	300	4	10837	1200
35	Permanent	family housing	family housing	family	300	4	10837	1200
36	Permanent	drug and alcohol abuse counseling center	office	person	15	0	1457	0
36	Permanent	post office	office	person	15	0	2381	0
36	Permanent	army community services center	swimming pool	person	10	0	7557	0
37	Permanent	administrative building	office	person	15	41	9570	615
38	Permanent	fire/rescue station	office	person	15	1	2171	15
39	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.528	528	8.976
40	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.552	552	9.384
42	Permanent	auditorium, general purpose	auditorium	seat	5	898	10450	4490
43	Permanent	family housing	family housing	family	300	4	10837	1200
44	Permanent	family housing	family housing	family	300	4	10837	1200
45	Permanent	family housing	family housing	family	300	4	10837	1200
46	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.86	860	80.84
47	Permanent	administrative building	office	person	15	6	1186	90
48	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.736	2736	257.184
49	Permanent	administrative building	office	person	15	3	561	45
50	Permanent	family housing	family housing	family	300	3	10882	900
51	Permanent	family housing	family housing	family	300	4	11194	1200
52	Permanent	family housing	family housing	family	300	4	11194	1200
53	Permanent	administrative building	office	person	15	10	3091	150
54	Permanent	family housing	family housing	family	300	4	11194	1200
55	Permanent	family housing	family housing	family	300	1	3387	300
56	Permanent	administrative building	office	person	15	91	19402	1365
57	Permanent	access control building	industrial facility	person	15	4	625	60
57	Permanent	information systems facility	office	person	15	4	4029	60
57	Permanent	installation, maintenance, and repair building	industrial facility	person	15	7	18758	105
57	Permanent	general instruction building	office	person	15	8	1987	120
57	Permanent	administrative building	office	person	15	9	2084	135
57	Permanent	vehicle storage building, installation	warehouse (mixed use)	1000 sq. feet	94	21.195	21195	1992.33
59	Permanent	information systems facility	office	person	15	31	20161	465
60	Permanent	family housing	family housing	family	300	1	2143	300
61	Permanent	transient UPH	BOQ/BEQ	person	65	2	3044	130
62	Permanent	family housing	family housing	family	300	2	7370	600
63	Permanent	family housing	family housing	family	300	2	7370	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
64	Permanent	family housing	family housing	family	300	1	2351	300
70	Permanent	family housing	family housing	family	300	0	7880	0
71	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.979	1979	33.643
73	Permanent	administrative building	office	person	15	9	1736	135
76	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.868	868	14.756
77	Permanent	administrative building	office	person	15	34	8032	510
78	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.287	2287	38.879
79	Permanent	family housing	family housing	family	300	0	7854	0
80	Permanent	transient officers UPH	BOQ/BEQ	person	65	6	9634	390
81	Permanent	plant/utilities building	industrial facility	person	15	3	3004	45
81	Permanent	installation, maintenance, and repair building	industrial facility	person	15	2	4704	30
82	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	1.078	1078	101.332
82	Permanent	automation-aided instructional building	office	person	15	4	1032	60
82	Permanent	army continuing education system facility	adult education center	person	15	12	2809	180
82	Permanent	company headquarters building	office	person	15	10	2240	150
82	Permanent	general instruction building	office	person	15	13	3341	195
82	Permanent	dental clinic	clinic	each	500	1	4452	500
82	Permanent	administrative building	office	person	15	95	21379	1425
82	Permanent	troop dispensary/health clinic	clinic	each	500	1	31569	500
83	Permanent	administrative building	office	person	15	30	8202	450
84	Permanent	administrative building	office	person	15	20	3927	300
85	Permanent	community support facility	office	person	15	3	897	45
86	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.668	668	62.792
87	Permanent	police/mp station	office	person	15	8	3150	120
87	Permanent	company headquarters building	office	person	15	11	4138	165
87	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.264	4264	400.816
87	Permanent	UPH mess facilities	restaurant	person	50	100	7300	5000
87	Permanent	enlisted unaccompanied personnel housing	BOQ/BEQ	person	65	80	20550	5200
88	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	9.624	9624	904.656
89	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.575	2575	242.05
90	Permanent	family housing	family housing	family	300	1	1399	300
91	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.21	210	19.74
93	Permanent	family housing	family housing	family	300	1	5958	300
94	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
95	Permanent	child development center	day care center	person	10	0	4247	0
96	Permanent	simulator building	office	person	15	260	7497	3900
96	Permanent	administrative building	office	person	15	97	20190	1455
98	Permanent	private/organizational club building	swimming pool	person	10	0	1703	0
99	Permanent	private/organizational club building	swimming pool	person	10	0	1703	0

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
100	Permanent	information systems facility	office	person	15	1	494	15
100	Permanent	administrative building	office	person	15	119	24747	1785
101	Permanent	family housing	family housing	family	300	2	11742	600
102	Permanent	family housing	family housing	family	300	2	11742	600
103	Permanent	family housing	family housing	family	300	1	5871	300
105	Permanent	general instruction building	office	person	15	10	2562	150
105	Permanent	administrative building	office	person	15	91	15965	1365
107	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25
108	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
109	Permanent	family housing	family housing	family	300	2	3071	600
110	Permanent	family housing	family housing	family	300	2	3071	600
111	Permanent	family housing	family housing	family	300	2	3071	600
112	Permanent	family housing	family housing	family	300	2	3071	600
113	Permanent	family housing	family housing	family	300	2	3071	600
114	Permanent	family housing	family housing	family	300	2	3071	600
115	Permanent	family housing	family housing	family	300	2	3071	600
116	Permanent	administrative building	office	person	15	27	5246	405
117	Permanent	administrative building	office	person	15	55	10337	825
118	Permanent	family housing	family housing	family	300	1	7273	300
119	Permanent	family housing	family housing	family	300	1	12173	300
120	Permanent	family housing	family housing	family	300	1	7584	300
121	Permanent	family housing	family housing	family	300	1	5275	300
121	Permanent	family housing	family housing	family	300	1	5275	300
122	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.302	302	5.134
123	Permanent	family housing	family housing	family	300	2	10548	600
124	Permanent	family housing	family housing	family	300	2	10548	600
125	Permanent	family housing	family housing	family	300	1	7720	300
126	Permanent	family housing	family housing	family	300	2	10549	600
127	Permanent	family housing	family housing	family	300	2	10226	600
128	Permanent	family housing	family housing	family	300	2	10228	600
129	Permanent	family housing	family housing	family	300	2	10816	600
130	Permanent	family housing	family housing	family	300	2	3071	600
131	Permanent	family housing	family housing	family	300	2	3071	600
132	Permanent	family housing	family housing	family	300	2	3071	600
133	Permanent	administrative building	self service storage	1000 sq. feet	17	3.206	3206	54.502
133	Permanent	information systems facility	office	person	15	26	7225	390
133	Permanent	auditorium, general purpose	auditorium	seat	5	186	5020	930
133	Permanent	administrative building	office	person	15	112	26558	1680
134	Permanent	administrative building	office	person	15	67	21296	1005

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
135	Permanent	information systems facility	office	person	15	6	2462	90
135	Permanent	information systems facility	office	person	15	19	8680	285
135	Permanent	administrative building	office	person	15	35	5868	525
136	Permanent	transient UPH	BOQ/BEQ	person	65	2	1693	130
137	Permanent	transient officers UPH	BOQ/BEQ	person	65	2	1693	130
138	Permanent	administrative building	office	person	15	56	13833	840
139	Permanent	administrative building	office	person	15	181	37019	2715
140	Permanent	family housing	family housing	family	300	2	3578	600
141	Permanent	family housing	family housing	family	300	1	4928	300
142	Permanent	family housing	family housing	family	300	1	4928	300
143	Permanent	family housing	family housing	family	300	4	16430	1200
144	Permanent	family housing	family housing	family	300	4	16430	1200
145	Permanent	CIDC field operations building	office	person	15	4	1366	60
146	Permanent	family housing	family housing	family	300	1	4212	300
147	Permanent	transient officers UPH	BOQ/BEQ	person	65	1	1270	65
148	Permanent	family housing	family housing	family	300	2	3578	600
149	Permanent	family housing	family housing	family	300	2	3578	600
150	Permanent	family housing	family housing	family	300	2	3578	600
151	Permanent	family housing	family housing	family	300	2	3930	600
152	Permanent	family housing	family housing	family	300	2	3579	600
153	Permanent	family housing	family housing	family	300	2	3578	600
154	Permanent	family housing	family housing	family	300	2	3578	600
155	Permanent	family housing	family housing	family	300	2	3578	600
156	Permanent	family housing	family housing	family	300	2	3578	600
157	Permanent	family housing	family housing	family	300	1	7021	300
158	Permanent	family housing	family housing	family	300	1	7021	300
159	Permanent	administrative building	office	person	15	21	4794	315
161	Permanent	information systems facility	office	person	15	8	1344	120
161	Permanent	administrative building	office	person	15	163	38564	2445
163	Permanent	administrative building	office	person	15	83	14865	1245
164	Permanent	exchange maintenance shop	warehouse (mixed use)	1000 sq. feet	94	3.249	3249	305.406
165	Permanent	simulator building	warehouse (mixed use)	1000 sq. feet	94	9.542	9542	896.948
166	Permanent	chapel	auditorium	seat	5	225	3678	1125
167	Permanent	family housing	family housing	family	300	2	3883	600
168	Permanent	administrative building	office	person	15	16	2202	240
168	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	9.998	9998	939.812
170	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
171	Permanent	physical fitness center	swimming pool	person	10	15	34020	150
173	Permanent	administrative building	office	person	15	0	2400	0

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
174	Permanent	administrative building	office	person	15	0	1658	0
175	Permanent	administrative building	office	person	15	0	1755	0
176	Permanent	administrative building	office	person	15	0	3002	0
177	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
178	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	1.47	1470	138.18
181	Permanent	commissary	shopping/exchange	1000 sq. feet	200	0	20080	0
182	Permanent	information systems facility	office	person	15	12	3106	180
183	Permanent	private/organizational club building	swimming pool	person	10	12	808	120
183	Permanent	information systems facility	office	person	15	4	4562	60
185	Permanent	open dining facility	picnic area	seat	5	500	21929	2500
186	Permanent	family housing	family housing	family	300	2	4464	600
187	Permanent	family housing	family housing	family	300	2	4464	600
188	Permanent	family housing	family housing	family	300	2	4464	600
191	Permanent	family housing	family housing	family	300	2	4370	600
192	Permanent	family housing	family housing	family	300	2	4370	600
193	Permanent	family housing	family housing	family	300	2	4370	600
194	Permanent	family housing	family housing	family	300	2	4370	600
195	Permanent	family housing	family housing	family	300	2	4370	600
196	Permanent	family housing	family housing	family	300	2	4370	600
198	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.079	79	1.343
201	Permanent	bowling center	bowling alley	lane	100	14	11569	1400
204	Permanent	electronic and communications equipment RTD&E building	office	person	15	4	9410	60
207	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	4	9776	40
207	Permanent	cafeteria	restaurant	seat	50	50	3000	2500
208	Permanent	exchange cafeteria	restaurant	seat	50	1	192	50
209	Permanent	administrative building	office	person	15	9	1872	135
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	0.828	828	165.6
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	1.778	1778	355.6
210	Permanent	exchange automotive service station	office	person	15	23	468	345
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	30.992	30992	6198.4
211	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.303	303	28.482
215	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.094	94	8.836
217	Permanent	administrative building	office	person	15	7	1221	105
220	Permanent	garage, family housing	self service storage	1000 sq. feet	17	3.364	3364	57.188
221	Permanent	recreational equipment checkout	industrial facility	person	15	8	23329	120
222	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.415	1415	24.055
223	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.348	2348	39.916
224	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
226	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0	1137	0

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
227	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
228	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
234	Permanent	information systems facility	office	person	15	4	272	60
234	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	30.271	30271	2845.474
235	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	15	681	150
238	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.344	344	5.848
240	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.342	2342	39.814
243	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.293	293	27.542
243	Permanent	information systems facility	office	person	15	2	392	30
243	Permanent	administrative building	office	person	15	74	12080	1110
245	Permanent	child development center	day care center	person	10	97	8190	970
247	Permanent	administrative building	office	person	15	10	2704	150
248	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.182	2182	205.108
250	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.088	88	8.272
478	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25
479	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
556	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
557	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
558	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
559	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
560	Permanent	access control building	industrial facility	person	15	4	135	60
1093	Temporary	trailer park near Dog Beach	trailer court	3 persons per trailer, per trailer	300	6		1800
1093	Permanent	trailer park near Dog Beach	trailer court	3 persons per trailer, per trailer	300	13		3900
A0027	Permanent	training aids center	office	person	15	6	2222	90
Bank	Permanent	Old Point National Bank	office	person	15	6	1400	90
C2	**Permanent**	**picnic area with water at the gazebo at the club**	**picnic area**	**person**	**5**	**40**		200
DB1	**Permanent**	**picnic area with water**	**picnic area**	**person**	**5**	**100**		500
DB2	**Permanent**	**picnic area with water**	**picnic area**	**person**	**5**	**500**		2500
Hotel	Permanent	Chamberlin Hotel	BOQ/BEQ	person	65	372	185788	0
IR1	**Permanent**	**irrigation system, bldg. 87**						6507
IR10	**Permanent**	**irrigation system, bldg. 83**						4832.55
IR11	**Permanent**	**irrigation system, Parade Field**						14440.5
IR12	**Permanent**	**irrigation system, bldg. 19, casemate**						14440.5
IR13	**Permanent**	**irrigation system, bldg. 119**						19395.45
IR14	**Permanent**	**irrigation system, bldg. 57**						14440.5
IR15	**Permanent**	**irrigation system, bldg. 4**						14440.5
IR16	**Permanent**	**irrigation system, engineer pier**						28101.15
IR17	**Permanent**	**irrigation system, bldg. 147**						13990.5
IR18	**Permanent**	**irrigation system, bldg. 245**						14440.5

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
IR19	**Permanent**	**irrigation system, bldg. 96**						14440.5
IR2	**Permanent**	**irrigation system, bldg. 560**						14440.5
IR20	**Permanent**	**irrigation system, bldg. 185**						5567.85
IR21	**Permanent**	**irrigation system, bldg. 221**						20481.3
IR3	**Permanent**	**irrigation system, bldg. 43**						19451.25
IR4	**Permanent**	**irrigation system, bldg. 80**						14440.5
IR5	**Permanent**	**irrigation system, bldg. 227**						14440.5
IR6	**Permanent**	**irrigation system, bldg. 82**						14440.5
IR7	**Permanent**	**irrigation system, Sherwood Park**						14440.5
IR8	**Permanent**	**irrigation system, bldg. 133 west end**						14440.5
IR9	**Permanent**	**irrigation system, bldg. 133 east end**						14440.5
LEAK1	Temporary	Ingalls Rd. & Reeder Circle	leak					720
LEAK2	Temporary	McNair Dr. & family housing	leak					14400
LEAK3	Temporary	Fenwick Rd. across from the heliport	leak					2880
Marina	**Permanent**	**pier/wharf (1031, 1032, 1033, 1034), assuming 1/4 full total 352 slips)**	**trailer court**	**3 persons per trailer, per trailer**	**300**	**88**		26400
NEW1	Permanent	new building along Darby Street	office	person	15	60	7500	900
NEW2	Permanent	new building along Fenwick Rd. @ Griffith St.	office	person	15	60	7500	900
NEW3	Permanent	new building along Fenwick Rd. next to NEW2	office	person	15	60	7500	900
NEW4	Permanent	new building along Fenwick Rd. at old T-249	office	person	15	60	7500	900
NEW5	Permanent	new building at old T-264	office	person	15	60	7500	900
T0024	Temporary	company headquarters building	office	person	15	0	2006	0
T0028	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.498	498	8.466
T0058	Temporary	transient UPH	BOQ/BEQ	person	65	18	7875	1170
T0086	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0	6262	0
T0099	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.744	7744	727.936
T0100	Temporary	information systems facility	office	person	15	5	1104	75
T0100	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.27	8270	777.38
T0101	Temporary	installation, maintenance, and repair building	industrial facility	person	15	5	3424	75
T0101	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	5.94	5940	558.36
T0104	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	10.076	10076	947.144
T0181	Temporary	administrative building	office	person	15	28	4826	420
T0182	Temporary	administrative building	office	person	15	30	4826	450
T0183	Temporary	administrative building	office	person	15	27	4826	405
T0184	Temporary	general instruction building	office	person	15	27	4825	405
T0191	Temporary	veterinary facility	clinic	each	500	1	2178	500
T0194	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.83	4830	454.02
T0195	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.83	4830	454.02
T0196	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.83	4830	454.02

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
T0216	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.705	705	11.985
T0246	Temporary	private/organizational club building	swimming pool	person	10	3	1019	30
T0247	Temporary	administrative building	office	person	15	30	4800	450
T0258	Temporary	administrative building	office	person	15	31	4830	465
T0260	Temporary	thrift shop	shopping/exchange	1000 sq. feet	200	0	4830	0
T0261	Temporary	indoor morale, welfare, and recreation facility	swimming pool	person	10	0	2239	0
T0457	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
T0468	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
W300	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W301	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W302	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W303	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W304	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W305	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W306	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W307	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W309	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W311	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W312	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W313	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W314	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W316	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W318	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W320	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W322	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W324	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W342	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W344	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W346	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W348	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W350	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W352	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W354	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W356	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W358	Permanent	Wherry family housing	family housing	family	300	0		0
W360	Permanent	Wherry family housing	family housing	family	300	0		0
W424	Permanent	Wherry family housing	family housing	family	300	0		0
W426	Permanent	Wherry family housing	family housing	family	300	0		0
W428	Permanent	Wherry family housing	family housing	family	300	0		0

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
W430	Permanent	Wherry family housing	family housing	family	300	0		0
W432	Permanent	Wherry family housing	family housing	family	300	0		0
W434	Permanent	Wherry family housing	family housing	family	300	0		0
W436	Permanent	Wherry family housing	family housing	family	300	0		0
W440	Permanent	Wherry family housing	family housing	family	300	0		0
W442	Permanent	Wherry family housing	family housing	family	300	0		0
W444	Permanent	Wherry family housing	family housing	family	300	0		0
W452	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W454	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W456	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W458	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W460	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W462	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W464	Permanent	Wherry family housing	family housing	family	300	0		0
W466	Permanent	Wherry family housing	family housing	family	300	0		0
W468	Permanent	Wherry family housing	family housing	family	300	0		0
W470	Permanent	Wherry family housing	family housing	family	300	0		0
W472	Permanent	Wherry family housing	family housing	family	300	0		0
W474	Permanent	Wherry family housing	family housing	family	300	0		0
W476	Permanent	Wherry family housing	family housing	family	300	0		0
W482	Permanent	Wherry family housing	family housing	family	300	0		0
W484	Permanent	Wherry family housing	family housing	family	300	0		0
					Total	**Avg.**	**Flow**	**347853 gpd**

Table B-3
Estimated Domestic Water Flow Rates

YR1

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
1	Permanent	family housing	family housing	family	300	1	6689	300
2	Permanent	private/organizational club building	shopping/exchange	1000 sq. feet	200	7.488	7488	1497.6
3	Permanent	family housing	family housing	family	300	2	5643	600
5	Permanent	exchange cafeteria	restaurant	seat	50	20	756	1000
5	Permanent	administrative building	office	person	15	507	94454	7605
7	Permanent	library branch	office	person	15	8	4856	120
8	Permanent	organizational storage building	warehouse (mixed use)	1000 sq. feet	94	0.659	659	61.946
9	Permanent	band training building	auditorium	seat	5	30	12965	150
10	Permanent	administrative building	self service storage	1000 sq. feet	17	2.112	2112	35.904
10	Permanent	controlled humidity warehouse, installation	warehouse (mixed use)	1000 sq. feet	94	0.906	906	85.164
10	Permanent	information systems facility	office	person	15	3	906	45
10	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.32	7320	688.08
10	Permanent	administrative building	office	person	15	135	28528	2025
11	Permanent	administrative building	office	person	15	45	7734	675
13	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.16	1160	19.72
14	Permanent	museum	shopping/exchange	1000 sq. feet	200	3.694	3694	738.8
15	Permanent	family housing	family housing	family	300	2	6965	600
16	Permanent	family housing	family housing	family	300	2	5220	600
17	Permanent	family housing	family housing	family	300	4	10234	1200
18	Permanent	family housing	family housing	family	300	4	10234	1200
19	Permanent	family housing	family housing	family	300	1	3204	300
20	Permanent	museum	shopping/exchange	1000 sq. feet	200	34.704	34704	6940.8
21	Permanent	chapel	self service storage	1000 sq. feet	17	29.122	29122	495.074
22	Permanent	museum	shopping/exchange	1000 sq. feet	200	26.52	26520	5304
23	Permanent	museum	shopping/exchange	1000 sq. feet	200	7.8	7800	1560
24	Permanent	fire/rescue station	self service storage	1000 sq. feet	17	3.751	3751	63.767
25	Permanent	family housing	family housing	family	300	2	4370	600
26	Permanent	family housing	family housing	family	300	2	4370	600
27	Permanent	information systems facility	office	person	15	3	3400	45
27	Permanent	training aids center	office	person	15	8	7413	120
27	Permanent	administrative building	office	person	15	29	5825	435
28	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.12	8120	763.28
28	Permanent	installation, maintenance, and repair building	industrial facility	person	15	27	18696	405
28	Permanent	administrative building	office	person	15	69	12418	1035
30	Permanent	family housing	family housing	family	300	2	4370	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
31	Permanent	family housing	family housing	family	300	2	4370	600
32	Permanent	recreational equipment checkout	industrial facility	person	15	3	3167	45
32	Permanent	indoor morale, welfare, and recreation facility	office	person	15	3	365	45
33	Permanent	family housing	family housing	family	300	4	10837	1200
34	Permanent	family housing	family housing	family	300	4	10837	1200
35	Permanent	family housing	family housing	family	300	4	10837	1200
37	Permanent	administrative building	office	person	15	41	9570	615
38	Permanent	fire/rescue station	office	person	15	1	2171	15
39	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.528	528	8.976
40	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.552	552	9.384
42	Permanent	auditorium, general purpose	auditorium	seat	5	898	10450	4490
43	Permanent	family housing	family housing	family	300	4	10837	1200
44	Permanent	family housing	family housing	family	300	4	10837	1200
45	Permanent	family housing	family housing	family	300	4	10837	1200
46	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.86	860	80.84
47	Permanent	administrative building	office	person	15	6	1186	90
48	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.736	2736	257.184
49	Permanent	administrative building	office	person	15	3	561	45
50	Permanent	family housing	family housing	family	300	3	10882	900
51	Permanent	family housing	family housing	family	300	4	11194	1200
52	Permanent	family housing	family housing	family	300	4	11194	1200
53	Permanent	administrative building	office	person	15	10	3091	150
54	Permanent	family housing	family housing	family	300	4	11194	1200
55	Permanent	family housing	family housing	family	300	1	3387	300
56	Permanent	administrative building	office	person	15	91	19402	1365
57	Permanent	access control building	industrial facility	person	15	4	625	60
57	Permanent	information systems facility	office	person	15	4	4029	60
57	Permanent	installation, maintenance, and repair building	industrial facility	person	15	7	18758	105
57	Permanent	general instruction building	office	person	15	8	1987	120
57	Permanent	administrative building	office	person	15	9	2084	135
57	Permanent	vehicle storage building, installation	warehouse (mixed use)	1000 sq. feet	94	21.195	21195	1992.33
59	Permanent	information systems facility	office	person	15	31	20161	465
60	Permanent	family housing	family housing	family	300	1	2143	300
61	Permanent	transient UPH	BOQ/BEQ	person	65	2	3044	130
62	Permanent	family housing	family housing	family	300	2	7370	600
63	Permanent	family housing	family housing	family	300	2	7370	600
64	Permanent	family housing	family housing	family	300	1	2351	300
71	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.979	1979	33.643
73	Permanent	administrative building	office	person	15	9	1736	135

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
76	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.868	868	14.756
77	Permanent	administrative building	office	person	15	34	8032	510
78	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.287	2287	38.879
80	Permanent	transient officers UPH	BOQ/BEQ	person	65	6	9634	390
81	Permanent	plant/utilities building	industrial facility	person	15	3	3004	45
81	Permanent	installation, maintenance, and repair building	industrial facility	person	15	2	4704	30
82	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	1.078	1078	101.332
82	Permanent	automation-aided instructional building	office	person	15	4	1032	60
82	Permanent	army continuing education system facility	adult education center	person	15	12	2809	180
82	Permanent	company headquarters building	office	person	15	10	2240	150
82	Permanent	general instruction building	office	person	15	13	3341	195
82	Permanent	dental clinic	clinic	each	500	1	4452	500
82	Permanent	administrative building	office	person	15	95	21379	1425
82	Permanent	troop dispensary/health clinic	clinic	each	500	1	31569	500
83	Permanent	administrative building	office	person	15	30	8202	450
84	Permanent	administrative building	office	person	15	20	3927	300
85	Permanent	community support facility	office	person	15	3	897	45
86	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.668	668	62.792
87	Permanent	police/mp station	office	person	15	8	3150	120
87	Permanent	company headquarters building	office	person	15	11	4138	165
87	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.264	4264	400.816
87	Permanent	UPH mess facilities	restaurant	person	50	100	7300	5000
87	Permanent	enlisted unaccompanied personnel housing	BOQ/BEQ	person	65	80	20550	5200
89	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.575	2575	242.05
90	Permanent	family housing	family housing	family	300	1	1399	300
91	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.21	210	19.74
93	Permanent	family housing	family housing	family	300	1	5958	300
94	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
95	Permanent	child development center	day care center	person	10	0	4247	0
96	Permanent	simulator building	office	person	15	260	7497	3900
96	Permanent	administrative building	office	person	15	97	20190	1455
98	Permanent	private/organizational club building	swimming pool	person	10	0	1703	0
99	Permanent	private/organizational club building	swimming pool	person	10	0	1703	0
100	Permanent	information systems facility	office	person	15	1	494	15
100	Permanent	administrative building	office	person	15	119	24747	1785
101	Permanent	family housing	family housing	family	300	2	11742	600
102	Permanent	family housing	family housing	family	300	2	11742	600
103	Permanent	family housing	family housing	family	300	1	5871	300
105	Permanent	general instruction building	office	person	15	10	2562	150

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
105	Permanent	administrative building	office	person	15	91	15965	1365
107	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25
108	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
109	Permanent	family housing	family housing	family	300	2	3071	600
110	Permanent	family housing	family housing	family	300	2	3071	600
111	Permanent	family housing	family housing	family	300	2	3071	600
112	Permanent	family housing	family housing	family	300	2	3071	600
113	Permanent	family housing	family housing	family	300	2	3071	600
114	Permanent	family housing	family housing	family	300	2	3071	600
115	Permanent	family housing	family housing	family	300	2	3071	600
116	Permanent	administrative building	office	person	15	27	5246	405
117	Permanent	administrative building	office	person	15	55	10337	825
118	Permanent	family housing	family housing	family	300	1	7273	300
119	Permanent	family housing	family housing	family	300	1	12173	300
120	Permanent	family housing	family housing	family	300	1	7584	300
121	Permanent	family housing	family housing	family	300	1	5275	300
121	Permanent	family housing	family housing	family	300	1	5275	300
122	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.302	302	5.134
123	Permanent	family housing	family housing	family	300	2	10548	600
124	Permanent	family housing	family housing	family	300	2	10548	600
125	Permanent	family housing	family housing	family	300	1	7720	300
126	Permanent	family housing	family housing	family	300	2	10549	600
127	Permanent	family housing	family housing	family	300	2	10226	600
128	Permanent	family housing	family housing	family	300	2	10228	600
129	Permanent	family housing	family housing	family	300	2	10816	600
130	Permanent	family housing	family housing	family	300	2	3071	600
131	Permanent	family housing	family housing	family	300	2	3071	600
132	Permanent	family housing	family housing	family	300	2	3071	600
133	Permanent	administrative building	self service storage	1000 sq. feet	17	3.206	3206	54.502
133	Permanent	information systems facility	office	person	15	26	7225	390
133	Permanent	auditorium, general purpose	auditorium	seat	5	186	5020	930
133	Permanent	administrative building	office	person	15	112	26558	1680
134	Permanent	administrative building	office	person	15	67	21296	1005
135	Permanent	information systems facility	office	person	15	6	2462	90
135	Permanent	information systems facility	office	person	15	19	8680	285
135	Permanent	administrative building	office	person	15	35	5868	525
136	Permanent	transient UPH	BOQ/BEQ	person	65	2	1693	130
137	Permanent	transient officers UPH	BOQ/BEQ	person	65	2	1693	130
138	Permanent	administrative building	office	person	15	56	13833	840

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
139	Permanent	administrative building	office	person	15	181	37019	2715
140	Permanent	family housing	family housing	family	300	2	3578	600
141	Permanent	family housing	family housing	family	300	1	4928	300
142	Permanent	family housing	family housing	family	300	1	4928	300
143	Permanent	family housing	family housing	family	300	4	16430	1200
144	Permanent	family housing	family housing	family	300	4	16430	1200
145	Permanent	CIDC field operations building	office	person	15	4	1366	60
146	Permanent	family housing	family housing	family	300	1	4212	300
147	Permanent	transient officers UPH	BOQ/BEQ	person	65	1	1270	65
148	Permanent	family housing	family housing	family	300	2	3578	600
149	Permanent	family housing	family housing	family	300	2	3578	600
150	Permanent	family housing	family housing	family	300	2	3578	600
151	Permanent	family housing	family housing	family	300	2	3930	600
152	Permanent	family housing	family housing	family	300	2	3579	600
153	Permanent	family housing	family housing	family	300	2	3578	600
154	Permanent	family housing	family housing	family	300	2	3578	600
155	Permanent	family housing	family housing	family	300	2	3578	600
156	Permanent	family housing	family housing	family	300	2	3578	600
157	Permanent	family housing	family housing	family	300	1	7021	300
158	Permanent	family housing	family housing	family	300	1	7021	300
159	Permanent	administrative building	office	person	15	21	4794	315
161	Permanent	information systems facility	office	person	15	8	1344	120
161	Permanent	administrative building	office	person	15	163	38564	2445
163	Permanent	administrative building	office	person	15	83	14865	1245
164	Permanent	exchange maintenance shop	warehouse (mixed use)	1000 sq. feet	94	3.249	3249	305.406
165	Permanent	simulator building	warehouse (mixed use)	1000 sq. feet	94	9.542	9542	896.948
166	Permanent	chapel	auditorium	seat	5	225	3678	1125
167	Permanent	family housing	family housing	family	300	2	3883	600
168	Permanent	administrative building	office	person	15	16	2202	240
168	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	9.998	9998	939.812
170	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
171	Permanent	physical fitness center	swimming pool	person	10	15	34020	150
176	Permanent	administrative building	office	person	15	0	3002	0
177	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
178	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	1.47	1470	138.18
181	Permanent	commissary	shopping/exchange	1000 sq. feet	200	0	20080	0
182	Permanent	information systems facility	office	person	15	12	3106	180
183	Permanent	private/organizational club building	swimming pool	person	10	12	808	120
183	Permanent	information systems facility	office	person	15	4	4562	60

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
185	Permanent	open dining facility	picnic area	seat	5	500	21929	2500
186	Permanent	family housing	family housing	family	300	2	4464	600
187	Permanent	family housing	family housing	family	300	2	4464	600
188	Permanent	family housing	family housing	family	300	2	4464	600
191	Permanent	family housing	family housing	family	300	2	4370	600
192	Permanent	family housing	family housing	family	300	2	4370	600
193	Permanent	family housing	family housing	family	300	2	4370	600
194	Permanent	family housing	family housing	family	300	2	4370	600
195	Permanent	family housing	family housing	family	300	2	4370	600
196	Permanent	family housing	family housing	family	300	2	4370	600
198	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.079	79	1.343
201	Permanent	bowling center	bowling alley	lane	100	14	11569	1400
204	Permanent	electronic and communications equipment RTD&E building	office	person	15	4	9410	60
207	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	4	9776	40
207	Permanent	cafeteria	restaurant	seat	50	50	3000	2500
208	Permanent	exchange cafeteria	restaurant	seat	50	1	192	50
209	Permanent	administrative building	office	person	15	9	1872	135
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	0.828	828	165.6
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	1.778	1778	355.6
210	Permanent	exchange automotive service station	office	person	15	23	468	345
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	30.992	30992	6198.4
211	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.303	303	28.482
215	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.094	94	8.836
217	Permanent	administrative building	office	person	15	7	1221	105
220	Permanent	garage, family housing	self service storage	1000 sq. feet	17	3.364	3364	57.188
221	Permanent	recreational equipment checkout	industrial facility	person	15	8	23329	120
222	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.415	1415	24.055
223	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.348	2348	39.916
224	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
226	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0	1137	0
227	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
228	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
234	Permanent	information systems facility	office	person	15	4	272	60
234	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	30.271	30271	2845.474
235	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	15	681	150
238	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.344	344	5.848
240	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.342	2342	39.814
243	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.293	293	27.542
243	Permanent	information systems facility	office	person	15	2	392	30

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
243	Permanent	administrative building	office	person	15	74	12080	1110
245	Permanent	child development center	day care center	person	10	97	8190	970
247	Permanent	administrative building	office	person	15	10	2704	150
250	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.088	88	8.272
478	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25
479	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
556	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
557	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
558	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
559	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
560	Permanent	access control building	industrial facility	person	15	4	135	60
1093	Permanent	trailer park near Dog Beach	trailer court	3 persons per trailer, per trailer	300	53		15900
A0027	Permanent	training aids center	office	person	15	6	2222	90
Bank	Permanent	Old Point National Bank	office	person	15	6	1400	90
C2	Permanent	picnic area with water at the gazebo at the club	picnic area	person	5	40		200
DB1	Permanent	picnic area with water	picnic area	person	5	100		500
DB2	Permanent	picnic area with water	picnic area	person	5	500		2500
Hotel	Permanent	Chamberlin Hotel	BOQ/BEQ	person	65	372	185788	0
IR1	Permanent	irrigation system, bldg. 87						6507
IR10	Permanent	irrigation system, bldg. 83						4832.55
IR11	Permanent	irrigation system, Parade Field						14440.5
IR12	Permanent	irrigation system, bldg. 19, casemate						14440.5
IR13	Permanent	irrigation system, bldg. 119						19395.45
IR14	Permanent	irrigation system, bldg. 57						14440.5
IR15	Permanent	irrigation system, bldg. 4						14440.5
IR16	Permanent	irrigation system, engineer pier						28101.15
IR17	Permanent	irrigation system, bldg. 147						13990.5
IR18	Permanent	irrigation system, bldg. 245						14440.5
IR19	Permanent	irrigation system, bldg. 96						14440.5
IR2	Permanent	irrigation system, bldg. 560						14440.5
IR20	Permanent	irrigation system, bldg. 185						5567.85
IR21	Permanent	irrigation system, bldg. 221						20481.3
IR3	Permanent	irrigation system, bldg. 43						19451.25
IR4	Permanent	irrigation system, bldg. 80						14440.5
IR5	Permanent	irrigation system, bldg. 227						14440.5
IR6	Permanent	irrigation system, bldg. 82						14440.5
IR7	Permanent	irrigation system, Sherwood Park						14440.5
IR8	Permanent	irrigation system, bldg. 133 west end						14440.5
IR9	Permanent	irrigation system, bldg. 133 east end						14440.5

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
Marina	Permanent	pier/wharf (1031, 1032, 1033, 1034), assuming 1/4 full total 352 slips)	trailer court	3 persons per trailer, per trailer	300	88		26400
NEW, Admin1	Permanent	administrative building replacing T-247	office	person	15	60	7500	900
NEW, Admin2	Permanent	administrative building replacing T-181, T-182	office	person	15	60	7500	900
NEW, Admin3	Permanent	administrative building replacing T-194 - T-196	office	person	15	60	7500	900
NEW, Storage	Permanent	storage building, general purpose, installation, replacing T-24	warehouse (mixed use)	1000 sq. feet	94	2	2000	188
NEW, YS1	Permanent	youth services building behind 221	office	1000 sq. feet	162	3.2	3200	518.4
NEW1	Permanent	new building along Darby Street	office	person	15	60	7500	900
NEW2	Permanent	new building along Fenwick Rd. @ Griffith St.	office	person	15	60	7500	900
NEW3	Permanent	new building along Fenwick Rd. next to NEW2	office	person	15	60	7500	900
NEW4	Permanent	new building along Fenwick Rd. at old T-249	office	person	15	60	7500	900
NEW5	Permanent	new building at old T-264	office	person	15	60	7500	900
T0028	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.498	498	8.466
T0099	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.744	7744	727.936
T0100	Temporary	information systems facility	office	person	15	5	1104	75
T0100	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.27	8270	777.38
T0101	Temporary	installation, maintenance, and repair building	industrial facility	person	15	5	3424	75
T0101	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	5.94	5940	558.36
T0104	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	10.076	10076	947.144
T0183	Temporary	administrative building	office	person	15	27	4826	405
T0184	Temporary	general instruction building	office	person	15	27	4825	405
T0191	Temporary	veterinary facility	clinic	each	500	1	2178	500
T0216	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.705	705	11.985
T0260	Temporary	thrift shop	shopping/exchange	1000 sq. feet	200	0	4830	0
T0261	Temporary	indoor morale, welfare, and recreation facility	swimming pool	person	10	0	2239	0
T0457	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
T0468	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
W300	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W301	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W302	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W303	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W304	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W305	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W306	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W307	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W309	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W311	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W312	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W313	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W314	Permanent	Wherry family housing	family housing	family	300	4	4400	1200

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
W316	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W318	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W320	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W322	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W324	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W342	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W344	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W346	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W348	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W350	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W352	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W354	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W356	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W440	Permanent	Wherry family housing	family housing	family	300	0		0
W442	Permanent	Wherry family housing	family housing	family	300	0		0
W444	Permanent	Wherry family housing	family housing	family	300	0		0
W482	Permanent	Wherry family housing	family housing	family	300	0		0
W484	Permanent	Wherry family housing	family housing	family	300	0		0

Projected Avg. Flow 330803 gpd

Table B-4
Estimated Domestic Water Flow Rates

YR2

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
1	Permanent	family housing	family housing	family	300	1	6689	300
2	Permanent	private/organizational club building	shopping/exchange	1000 sq. feet	200	7.488	7488	1497.6
3	Permanent	family housing	family housing	family	300	2	5643	600
5	Permanent	exchange cafeteria	restaurant	seat	50	20	756	1000
5	Permanent	administrative building	office	person	15	507	94454	7605
7	Permanent	library branch	office	person	15	8	4856	120
8	Permanent	organizational storage building	warehouse (mixed use)	1000 sq. feet	94	0.659	659	61.946
9	Permanent	band training building	auditorium	seat	5	30	12965	150
10	Permanent	administrative building	self service storage	1000 sq. feet	17	2.112	2112	35.904
10	Permanent	controlled humidity warehouse, installation	warehouse (mixed use)	1000 sq. feet	94	0.906	906	85.164
10	Permanent	information systems facility	office	person	15	3	906	45
10	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.32	7320	688.08
10	Permanent	administrative building	office	person	15	135	28528	2025
11	Permanent	administrative building	office	person	15	45	7734	675
13	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.16	1160	19.72
14	Permanent	museum	shopping/exchange	1000 sq. feet	200	3.694	3694	738.8
15	Permanent	family housing	family housing	family	300	2	6965	600
16	Permanent	family housing	family housing	family	300	2	5220	600
17	Permanent	family housing	family housing	family	300	4	10234	1200
18	Permanent	family housing	family housing	family	300	4	10234	1200
19	Permanent	family housing	family housing	family	300	1	3204	300
20	Permanent	museum	shopping/exchange	1000 sq. feet	200	34.704	34704	6940.8
21	Permanent	chapel	self service storage	1000 sq. feet	17	29.122	29122	495.074
22	Permanent	museum	shopping/exchange	1000 sq. feet	200	26.52	26520	5304
23	Permanent	museum	shopping/exchange	1000 sq. feet	200	7.8	7800	1560
24	Permanent	fire/rescue station	self service storage	1000 sq. feet	17	3.751	3751	63.767
25	Permanent	family housing	family housing	family	300	2	4370	600
26	Permanent	family housing	family housing	family	300	2	4370	600
27	Permanent	information systems facility	office	person	15	3	3400	45
27	Permanent	training aids center	office	person	15	8	7413	120
27	Permanent	administrative building	office	person	15	29	5825	435
28	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.12	8120	763.28
28	Permanent	installation, maintenance, and repair building	industrial facility	person	15	27	18696	405
28	Permanent	administrative building	office	person	15	69	12418	1035
30	Permanent	family housing	family housing	family	300	2	4370	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
31	Permanent	family housing	family housing	family	300	2	4370	600
32	Permanent	recreational equipment checkout	industrial facility	person	15	3	3167	45
32	Permanent	indoor morale, welfare, and recreation facility	office	person	15	3	365	45
33	Permanent	family housing	family housing	family	300	4	10837	1200
34	Permanent	family housing	family housing	family	300	4	10837	1200
35	Permanent	family housing	family housing	family	300	4	10837	1200
37	Permanent	administrative building	office	person	15	41	9570	615
38	Permanent	fire/rescue station	office	person	15	1	2171	15
39	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.528	528	8.976
40	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.552	552	9.384
42	Permanent	auditorium, general purpose	auditorium	seat	5	898	10450	4490
43	Permanent	family housing	family housing	family	300	4	10837	1200
44	Permanent	family housing	family housing	family	300	4	10837	1200
45	Permanent	family housing	family housing	family	300	4	10837	1200
46	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.86	860	80.84
47	Permanent	administrative building	office	person	15	6	1186	90
48	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.736	2736	257.184
49	Permanent	administrative building	office	person	15	3	561	45
50	Permanent	family housing	family housing	family	300	3	10882	900
51	Permanent	family housing	family housing	family	300	4	11194	1200
52	Permanent	family housing	family housing	family	300	4	11194	1200
53	Permanent	administrative building	office	person	15	10	3091	150
54	Permanent	family housing	family housing	family	300	4	11194	1200
55	Permanent	family housing	family housing	family	300	1	3387	300
56	Permanent	administrative building	office	person	15	91	19402	1365
57	Permanent	access control building	industrial facility	person	15	4	625	60
57	Permanent	information systems facility	office	person	15	4	4029	60
57	Permanent	installation, maintenance, and repair building	industrial facility	person	15	7	18758	105
57	Permanent	general instruction building	office	person	15	8	1987	120
57	Permanent	administrative building	office	person	15	9	2084	135
57	Permanent	vehicle storage building, installation	warehouse (mixed use)	1000 sq. feet	94	21.195	21195	1992.33
59	Permanent	information systems facility	office	person	15	31	20161	465
60	Permanent	family housing	family housing	family	300	1	2143	300
61	Permanent	transient UPH	BOQ/BEQ	person	65	2	3044	130
62	Permanent	family housing	family housing	family	300	2	7370	600
63	Permanent	family housing	family housing	family	300	2	7370	600
64	Permanent	family housing	family housing	family	300	1	2351	300
71	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.979	1979	33.643
73	Permanent	administrative building	office	person	15	9	1736	135

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
76	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.868	868	14.756
77	Permanent	administrative building	office	person	15	34	8032	510
78	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.287	2287	38.879
80	Permanent	transient officers UPH	BOQ/BEQ	person	65	6	9634	390
81	Permanent	plant/utilities building	industrial facility	person	15	3	3004	45
81	Permanent	installation, maintenance, and repair building	industrial facility	person	15	2	4704	30
82	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	1.078	1078	101.332
82	Permanent	automation-aided instructional building	office	person	15	4	1032	60
82	Permanent	army continuing education system facility	adult education center	person	15	12	2809	180
82	Permanent	company headquarters building	office	person	15	10	2240	150
82	Permanent	general instruction building	office	person	15	13	3341	195
82	Permanent	dental clinic	clinic	each	500	1	4452	500
82	Permanent	administrative building	office	person	15	95	21379	1425
82	Permanent	troop dispensary/health clinic	clinic	each	500	1	31569	500
83	Permanent	administrative building	office	person	15	30	8202	450
84	Permanent	administrative building	office	person	15	20	3927	300
85	Permanent	community support facility	office	person	15	3	897	45
86	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.668	668	62.792
87	Permanent	police/mp station	office	person	15	8	3150	120
87	Permanent	company headquarters building	office	person	15	11	4138	165
87	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.264	4264	400.816
87	Permanent	UPH mess facilities	restaurant	person	50	100	7300	5000
87	Permanent	enlisted unaccompanied personnel housing	BOQ/BEQ	person	65	80	20550	5200
89	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.575	2575	242.05
90	Permanent	family housing	family housing	family	300	1	1399	300
91	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.21	210	19.74
93	Permanent	family housing	family housing	family	300	1	5958	300
94	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
96	Permanent	simulator building	office	person	15	260	7497	3900
96	Permanent	administrative building	office	person	15	97	20190	1455
99	Permanent	private/organizational club building	swimming pool	person	10	0	1703	0
100	Permanent	information systems facility	office	person	15	1	494	15
100	Permanent	administrative building	office	person	15	119	24747	1785
101	Permanent	family housing	family housing	family	300	2	11742	600
102	Permanent	family housing	family housing	family	300	2	11742	600
103	Permanent	family housing	family housing	family	300	1	5871	300
105	Permanent	general instruction building	office	person	15	10	2562	150
105	Permanent	administrative building	office	person	15	91	15965	1365
107	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
108	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
109	Permanent	family housing	family housing	family	300	2	3071	600
110	Permanent	family housing	family housing	family	300	2	3071	600
111	Permanent	family housing	family housing	family	300	2	3071	600
112	Permanent	family housing	family housing	family	300	2	3071	600
113	Permanent	family housing	family housing	family	300	2	3071	600
114	Permanent	family housing	family housing	family	300	2	3071	600
115	Permanent	family housing	family housing	family	300	2	3071	600
116	Permanent	administrative building	office	person	15	27	5246	405
117	Permanent	administrative building	office	person	15	55	10337	825
118	Permanent	family housing	family housing	family	300	1	7273	300
119	Permanent	family housing	family housing	family	300	1	12173	300
120	Permanent	family housing	family housing	family	300	1	7584	300
121	Permanent	family housing	family housing	family	300	1	5275	300
121	Permanent	family housing	family housing	family	300	1	5275	300
122	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.302	302	5.134
123	Permanent	family housing	family housing	family	300	2	10548	600
124	Permanent	family housing	family housing	family	300	2	10548	600
125	Permanent	family housing	family housing	family	300	1	7720	300
126	Permanent	family housing	family housing	family	300	2	10549	600
127	Permanent	family housing	family housing	family	300	2	10226	600
128	Permanent	family housing	family housing	family	300	2	10228	600
129	Permanent	family housing	family housing	family	300	2	10816	600
130	Permanent	family housing	family housing	family	300	2	3071	600
131	Permanent	family housing	family housing	family	300	2	3071	600
132	Permanent	family housing	family housing	family	300	2	3071	600
133	Permanent	administrative building	self service storage	1000 sq. feet	17	3.206	3206	54.502
133	Permanent	information systems facility	office	person	15	26	7225	390
133	Permanent	auditorium, general purpose	auditorium	seat	5	186	5020	930
133	Permanent	administrative building	office	person	15	112	26558	1680
134	Permanent	administrative building	office	person	15	67	21296	1005
135	Permanent	information systems facility	office	person	15	6	2462	90
135	Permanent	information systems facility	office	person	15	19	8680	285
135	Permanent	administrative building	office	person	15	35	5868	525
136	Permanent	transient UPH	BOQ/BEQ	person	65	2	1693	130
137	Permanent	transient officers UPH	BOQ/BEQ	person	65	2	1693	130
138	Permanent	administrative building	office	person	15	56	13833	840
139	Permanent	administrative building	office	person	15	181	37019	2715
140	Permanent	family housing	family housing	family	300	2	3578	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
141	Permanent	family housing	family housing	family	300	1	4928	300
142	Permanent	family housing	family housing	family	300	1	4928	300
143	Permanent	family housing	family housing	family	300	4	16430	1200
144	Permanent	family housing	family housing	family	300	4	16430	1200
145	Permanent	CIDC field operations building	office	person	15	4	1366	60
146	Permanent	family housing	family housing	family	300	1	4212	300
147	Permanent	transient officers UPH	BOQ/BEQ	person	65	1	1270	65
148	Permanent	family housing	family housing	family	300	2	3578	600
149	Permanent	family housing	family housing	family	300	2	3578	600
150	Permanent	family housing	family housing	family	300	2	3578	600
151	Permanent	family housing	family housing	family	300	2	3930	600
152	Permanent	family housing	family housing	family	300	2	3579	600
153	Permanent	family housing	family housing	family	300	2	3578	600
154	Permanent	family housing	family housing	family	300	2	3578	600
155	Permanent	family housing	family housing	family	300	2	3578	600
156	Permanent	family housing	family housing	family	300	2	3578	600
157	Permanent	family housing	family housing	family	300	1	7021	300
158	Permanent	family housing	family housing	family	300	1	7021	300
159	Permanent	administrative building	office	person	15	21	4794	315
161	Permanent	information systems facility	office	person	15	8	1344	120
161	Permanent	administrative building	office	person	15	163	38564	2445
163	Permanent	administrative building	office	person	15	83	14865	1245
164	Permanent	exchange maintenance shop	warehouse (mixed use)	1000 sq. feet	94	3.249	3249	305.406
165	Permanent	simulator building	warehouse (mixed use)	1000 sq. feet	94	9.542	9542	896.948
166	Permanent	chapel	auditorium	seat	5	225	3678	1125
167	Permanent	family housing	family housing	family	300	2	3883	600
168	Permanent	administrative building	office	person	15	16	2202	240
168	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	9.998	9998	939.812
170	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
171	Permanent	physical fitness center	swimming pool	person	10	15	34020	150
177	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
178	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	1.47	1470	138.18
182	Permanent	information systems facility	office	person	15	12	3106	180
183	Permanent	private/organizational club building	swimming pool	person	10	12	808	120
183	Permanent	information systems facility	office	person	15	4	4562	60
185	Permanent	open dining facility	picnic area	seat	5	500	21929	2500
186	Permanent	family housing	family housing	family	300	2	4464	600
187	Permanent	family housing	family housing	family	300	2	4464	600
188	Permanent	family housing	family housing	family	300	2	4464	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
191	Permanent	family housing	family housing	family	300	2	4370	600
192	Permanent	family housing	family housing	family	300	2	4370	600
193	Permanent	family housing	family housing	family	300	2	4370	600
194	Permanent	family housing	family housing	family	300	2	4370	600
195	Permanent	family housing	family housing	family	300	2	4370	600
196	Permanent	family housing	family housing	family	300	2	4370	600
198	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.079	79	1.343
201	Permanent	bowling center	bowling alley	lane	100	14	11569	1400
204	Permanent	electronic and communications equipment RTD&E building	office	person	15	4	9410	60
207	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	4	9776	40
207	Permanent	cafeteria	restaurant	seat	50	50	3000	2500
208	Permanent	exchange cafeteria	restaurant	seat	50	1	192	50
209	Permanent	administrative building	office	person	15	9	1872	135
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	0.828	828	165.6
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	1.778	1778	355.6
210	Permanent	exchange automotive service station	office	person	15	23	468	345
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	30.992	30992	6198.4
211	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.303	303	28.482
215	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.094	94	8.836
217	Permanent	administrative building	office	person	15	7	1221	105
220	Permanent	garage, family housing	self service storage	1000 sq. feet	17	3.364	3364	57.188
221	Permanent	recreational equipment checkout	industrial facility	person	15	8	23329	120
222	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.415	1415	24.055
223	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.348	2348	39.916
224	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
226	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0	1137	0
227	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
228	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
234	Permanent	information systems facility	office	person	15	4	272	60
234	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	30.271	30271	2845.474
235	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	15	681	150
238	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.344	344	5.848
240	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.342	2342	39.814
243	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.293	293	27.542
243	Permanent	information systems facility	office	person	15	2	392	30
243	Permanent	administrative building	office	person	15	74	12080	1110
245	Permanent	child development center	day care center	person	10	97	8190	970
247	Permanent	administrative building	office	person	15	10	2704	150
250	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.088	88	8.272

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
478	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25
479	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
556	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
557	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
558	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
559	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
560	Permanent	access control building	industrial facility	person	15	4	135	60
1093	Permanent	trailer park near Dog Beach	trailer court	3 persons per trailer, per trailer	300	53		15900
A0027	Permanent	training aids center	office	person	15	6	2222	90
Bank	Permanent	Old Point National Bank	office	person	15	6	1400	90
C2	Permanent	picnic area with water at the gazebo at the club	picnic area	person	5	40		200
DB1	Permanent	picnic area with water	picnic area	person	5	100		500
DB2	Permanent	picnic area with water	picnic area	person	5	500		2500
Hotel	Permanent	Chamberlin Hotel	BOQ/BEQ	person	65	372	185788	0
IR1	Permanent	irrigation system, bldg. 87						6507
IR10	Permanent	irrigation system, bldg. 83						4832.55
IR11	Permanent	irrigation system, Parade Field						14440.5
IR12	Permanent	irrigation system, bldg. 19, casemate						14440.5
IR13	Permanent	irrigation system, bldg. 119						19395.45
IR14	Permanent	irrigation system, bldg. 57						14440.5
IR15	Permanent	irrigation system, bldg. 4						14440.5
IR16	Permanent	irrigation system, engineer pier						28101.15
IR17	Permanent	irrigation system, bldg. 147						13990.5
IR18	Permanent	irrigation system, bldg. 245						14440.5
IR19	Permanent	irrigation system, bldg. 96						14440.5
IR2	Permanent	irrigation system, bldg. 560						14440.5
IR20	Permanent	irrigation system, bldg. 185						5567.85
IR21	Permanent	irrigation system, bldg. 221						20481.3
IR3	Permanent	irrigation system, bldg. 43						19451.25
IR4	Permanent	irrigation system, bldg. 80						14440.5
IR5	Permanent	irrigation system, bldg. 227						14440.5
IR6	Permanent	irrigation system, bldg. 82						14440.5
IR7	Permanent	irrigation system, Sherwood Park						14440.5
IR8	Permanent	irrigation system, bldg. 133 west end						14440.5
IR9	Permanent	irrigation system, bldg. 133 east end						14440.5
Marina	Permanent	pier/wharf (1031, 1032, 1033, 1034), assuming 1/4 full total 352 slips)	trailer court	3 persons per trailer, per trailer	300	88		26400
NEW, Admin1	Permanent	administrative building replacing T-247	office	person	15	60	7500	900
NEW, Admin2	Permanent	administrative building replacing T-181, T-182	office	person	15	60	7500	900
NEW, Admin3	Permanent	administrative building replacing T-194 - T-196	office	person	15	60	7500	900

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
NEW, Admin4	Permanent	administrative building replacing 176	office	person	15	60	7500	900
NEW, Admin5	Permanent	administrative building replacing T-260, T-261	office	person	15	60	7500	900
NEW, Admin6	Permanent	administrative building replacing T-183, T-184, T-191, & T-192	office	person	15	60	7500	900
NEW, Storage	Permanent	storage building, general purpose, installation, replacing T-24	warehouse (mixed use)	1000 sq. feet	94	2	2000	188
NEW, VTC	Permanent	video teleconference center	office	person	15	60	7500	900
NEW, YS1	Permanent	youth services building behind 221	office	1000 sq. feet	162	3.2	3200	518.4
NEW, YS2	Permanent	youth services building behind 245	office	1000 sq. feet	162	3.2	3200	518.4
NEW1	Permanent	new building along Darby Street	office	person	15	60	7500	900
NEW2	Permanent	new building along Fenwick Rd. @ Griffith St.	office	person	15	60	7500	900
NEW3	Permanent	new building along Fenwick Rd. next to NEW2	office	person	15	60	7500	900
NEW4	Permanent	new building along Fenwick Rd. at old T-249	office	person	15	60	7500	900
NEW5	Permanent	new building at old T-264	office	person	15	60	7500	900
T0028	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.498	498	8.466
T0099	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.744	7744	727.936
T0100	Temporary	information systems facility	office	person	15	5	1104	75
T0100	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.27	8270	777.38
T0101	Temporary	installation, maintenance, and repair building	industrial facility	person	15	5	3424	75
T0101	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	5.94	5940	558.36
T0104	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	10.076	10076	947.144
T0216	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.705	705	11.985
T0457	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
T0468	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
W300	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W301	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W302	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W303	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W304	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W305	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W306	Permanent	Wherry family housing	family housing	family	300	2	1250	600
W307	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W309	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W311	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W312	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W313	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W314	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W316	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W318	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W320	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W322	Permanent	Wherry family housing	family housing	family	300	4	4400	1200

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
W324	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W342	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W344	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W346	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W348	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W350	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W352	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W354	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W356	Permanent	Wherry family housing	family housing	family	300	4	4400	1200
W440	Permanent	Wherry family housing	family housing	family	300	0		0
W442	Permanent	Wherry family housing	family housing	family	300	0		0
W444	Permanent	Wherry family housing	family housing	family	300	0		0
W482	Permanent	Wherry family housing	family housing	family	300	0		0
W484	Permanent	Wherry family housing	family housing	family	300	0		0

Projected Avg. Flow 333611 gpd

Table B-5
Estimated Domestic Water Flow Rates

YR3

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
1	Permanent	family housing	family housing	family	300	1	6689	300
2	Permanent	private/organizational club building	shopping/exchange	1000 sq. feet	200	7.488	7488	1497.6
3	Permanent	family housing	family housing	family	300	2	5643	600
5	Permanent	exchange cafeteria	restaurant	seat	50	20	756	1000
5	Permanent	administrative building	office	person	15	507	94454	7605
7	Permanent	library branch	office	person	15	8	4856	120
8	Permanent	organizational storage building	warehouse (mixed use)	1000 sq. feet	94	0.659	659	61.946
9	Permanent	band training building	auditorium	seat	5	30	12965	150
10	Permanent	administrative building	self service storage	1000 sq. feet	17	2.112	2112	35.904
10	Permanent	controlled humidity warehouse, installation	warehouse (mixed use)	1000 sq. feet	94	0.906	906	85.164
10	Permanent	information systems facility	office	person	15	3	906	45
10	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.32	7320	688.08
10	Permanent	administrative building	office	person	15	135	28528	2025
11	Permanent	administrative building	office	person	15	45	7734	675
13	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.16	1160	19.72
14	Permanent	museum	shopping/exchange	1000 sq. feet	200	3.694	3694	738.8
15	Permanent	family housing	family housing	family	300	2	6965	600
16	Permanent	family housing	family housing	family	300	2	5220	600
17	Permanent	family housing	family housing	family	300	4	10234	1200
18	Permanent	family housing	family housing	family	300	4	10234	1200
19	Permanent	family housing	family housing	family	300	1	3204	300
20	Permanent	museum	shopping/exchange	1000 sq. feet	200	34.704	34704	6940.8
21	Permanent	chapel	self service storage	1000 sq. feet	17	29.122	29122	495.074
22	Permanent	museum	shopping/exchange	1000 sq. feet	200	26.52	26520	5304
23	Permanent	museum	shopping/exchange	1000 sq. feet	200	7.8	7800	1560
24	Permanent	fire/rescue station	self service storage	1000 sq. feet	17	3.751	3751	63.767
25	Permanent	family housing	family housing	family	300	2	4370	600
26	Permanent	family housing	family housing	family	300	2	4370	600
27	Permanent	information systems facility	office	person	15	3	3400	45
27	Permanent	training aids center	office	person	15	8	7413	120
27	Permanent	administrative building	office	person	15	29	5825	435
28	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.12	8120	763.28
28	Permanent	installation, maintenance, and repair building	industrial facility	person	15	27	18696	405
28	Permanent	administrative building	office	person	15	69	12418	1035
30	Permanent	family housing	family housing	family	300	2	4370	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
31	Permanent	family housing	family housing	family	300	2	4370	600
32	Permanent	recreational equipment checkout	industrial facility	person	15	3	3167	45
32	Permanent	indoor morale, welfare, and recreation facility	office	person	15	3	365	45
33	Permanent	family housing	family housing	family	300	4	10837	1200
34	Permanent	family housing	family housing	family	300	4	10837	1200
35	Permanent	family housing	family housing	family	300	4	10837	1200
37	Permanent	administrative building	office	person	15	41	9570	615
38	Permanent	fire/rescue station	office	person	15	1	2171	15
39	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.528	528	8.976
40	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.552	552	9.384
42	Permanent	auditorium, general purpose	auditorium	seat	5	898	10450	4490
43	Permanent	family housing	family housing	family	300	4	10837	1200
44	Permanent	family housing	family housing	family	300	4	10837	1200
45	Permanent	family housing	family housing	family	300	4	10837	1200
46	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.86	860	80.84
47	Permanent	administrative building	office	person	15	6	1186	90
48	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.736	2736	257.184
49	Permanent	administrative building	office	person	15	3	561	45
50	Permanent	family housing	family housing	family	300	3	10882	900
51	Permanent	family housing	family housing	family	300	4	11194	1200
52	Permanent	family housing	family housing	family	300	4	11194	1200
53	Permanent	administrative building	office	person	15	10	3091	150
54	Permanent	family housing	family housing	family	300	4	11194	1200
55	Permanent	family housing	family housing	family	300	1	3387	300
56	Permanent	administrative building	office	person	15	91	19402	1365
57	Permanent	access control building	industrial facility	person	15	4	625	60
57	Permanent	information systems facility	office	person	15	4	4029	60
57	Permanent	installation, maintenance, and repair building	industrial facility	person	15	7	18758	105
57	Permanent	general instruction building	office	person	15	8	1987	120
57	Permanent	administrative building	office	person	15	9	2084	135
57	Permanent	vehicle storage building, installation	warehouse (mixed use)	1000 sq. feet	94	21.195	21195	1992.33
59	Permanent	information systems facility	office	person	15	31	20161	465
60	Permanent	family housing	family housing	family	300	1	2143	300
61	Permanent	transient UPH	BOQ/BEQ	person	65	2	3044	130
62	Permanent	family housing	family housing	family	300	2	7370	600
63	Permanent	family housing	family housing	family	300	2	7370	600
64	Permanent	family housing	family housing	family	300	1	2351	300
71	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.979	1979	33.643
73	Permanent	administrative building	office	person	15	9	1736	135

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
76	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.868	868	14.756
77	Permanent	administrative building	office	person	15	34	8032	510
78	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.287	2287	38.879
80	Permanent	transient officers UPH	BOQ/BEQ	person	65	6	9634	390
81	Permanent	plant/utilities building	industrial facility	person	15	3	3004	45
81	Permanent	installation, maintenance, and repair building	industrial facility	person	15	2	4704	30
82	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	1.078	1078	101.332
82	Permanent	automation-aided instructional building	office	person	15	4	1032	60
82	Permanent	army continuing education system facility	adult education center	person	15	12	2809	180
82	Permanent	company headquarters building	office	person	15	10	2240	150
82	Permanent	general instruction building	office	person	15	13	3341	195
82	Permanent	dental clinic	clinic	each	500	1	4452	500
82	Permanent	administrative building	office	person	15	95	21379	1425
82	Permanent	troop dispensary/health clinic	clinic	each	500	1	31569	500
83	Permanent	administrative building	office	person	15	30	8202	450
84	Permanent	administrative building	office	person	15	20	3927	300
85	Permanent	community support facility	office	person	15	3	897	45
86	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.668	668	62.792
87	Permanent	police/mp station	office	person	15	8	3150	120
87	Permanent	company headquarters building	office	person	15	11	4138	165
87	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.264	4264	400.816
87	Permanent	UPH mess facilities	restaurant	person	50	100	7300	5000
87	Permanent	enlisted unaccompanied personnel housing	BOQ/BEQ	person	65	80	20550	5200
89	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.575	2575	242.05
90	Permanent	family housing	family housing	family	300	1	1399	300
91	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.21	210	19.74
93	Permanent	family housing	family housing	family	300	1	5958	300
94	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
96	Permanent	simulator building	office	person	15	260	7497	3900
96	Permanent	administrative building	office	person	15	97	20190	1455
99	Permanent	private/organizational club building	swimming pool	person	10	0	1703	0
100	Permanent	information systems facility	office	person	15	1	494	15
100	Permanent	administrative building	office	person	15	119	24747	1785
101	Permanent	family housing	family housing	family	300	2	11742	600
102	Permanent	family housing	family housing	family	300	2	11742	600
103	Permanent	family housing	family housing	family	300	1	5871	300
105	Permanent	general instruction building	office	person	15	10	2562	150
105	Permanent	administrative building	office	person	15	91	15965	1365
107	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
108	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
109	Permanent	family housing	family housing	family	300	2	3071	600
110	Permanent	family housing	family housing	family	300	2	3071	600
111	Permanent	family housing	family housing	family	300	2	3071	600
112	Permanent	family housing	family housing	family	300	2	3071	600
113	Permanent	family housing	family housing	family	300	2	3071	600
114	Permanent	family housing	family housing	family	300	2	3071	600
115	Permanent	family housing	family housing	family	300	2	3071	600
116	Permanent	administrative building	office	person	15	27	5246	405
117	Permanent	administrative building	office	person	15	55	10337	825
118	Permanent	family housing	family housing	family	300	1	7273	300
119	Permanent	family housing	family housing	family	300	1	12173	300
120	Permanent	family housing	family housing	family	300	1	7584	300
121	Permanent	family housing	family housing	family	300	1	5275	300
121	Permanent	family housing	family housing	family	300	1	5275	300
122	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.302	302	5.134
123	Permanent	family housing	family housing	family	300	2	10548	600
124	Permanent	family housing	family housing	family	300	2	10548	600
125	Permanent	family housing	family housing	family	300	1	7720	300
126	Permanent	family housing	family housing	family	300	2	10549	600
127	Permanent	family housing	family housing	family	300	2	10226	600
128	Permanent	family housing	family housing	family	300	2	10228	600
129	Permanent	family housing	family housing	family	300	2	10816	600
130	Permanent	family housing	family housing	family	300	2	3071	600
131	Permanent	family housing	family housing	family	300	2	3071	600
132	Permanent	family housing	family housing	family	300	2	3071	600
133	Permanent	administrative building	self service storage	1000 sq. feet	17	3.206	3206	54.502
133	Permanent	information systems facility	office	person	15	26	7225	390
133	Permanent	auditorium, general purpose	auditorium	seat	5	186	5020	930
133	Permanent	administrative building	office	person	15	112	26558	1680
134	Permanent	administrative building	office	person	15	67	21296	1005
135	Permanent	information systems facility	office	person	15	6	2462	90
135	Permanent	information systems facility	office	person	15	19	8680	285
135	Permanent	administrative building	office	person	15	35	5868	525
136	Permanent	transient UPH	BOQ/BEQ	person	65	2	1693	130
137	Permanent	transient officers UPH	BOQ/BEQ	person	65	2	1693	130
138	Permanent	administrative building	office	person	15	56	13833	840
139	Permanent	administrative building	office	person	15	181	37019	2715
140	Permanent	family housing	family housing	family	300	2	3578	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
141	Permanent	family housing	family housing	family	300	1	4928	300
142	Permanent	family housing	family housing	family	300	1	4928	300
143	Permanent	family housing	family housing	family	300	4	16430	1200
144	Permanent	family housing	family housing	family	300	4	16430	1200
145	Permanent	CIDC field operations building	office	person	15	4	1366	60
146	Permanent	family housing	family housing	family	300	1	4212	300
147	Permanent	transient officers UPH	BOQ/BEQ	person	65	1	1270	65
148	Permanent	family housing	family housing	family	300	2	3578	600
149	Permanent	family housing	family housing	family	300	2	3578	600
150	Permanent	family housing	family housing	family	300	2	3578	600
151	Permanent	family housing	family housing	family	300	2	3930	600
152	Permanent	family housing	family housing	family	300	2	3579	600
153	Permanent	family housing	family housing	family	300	2	3578	600
154	Permanent	family housing	family housing	family	300	2	3578	600
155	Permanent	family housing	family housing	family	300	2	3578	600
156	Permanent	family housing	family housing	family	300	2	3578	600
157	Permanent	family housing	family housing	family	300	1	7021	300
158	Permanent	family housing	family housing	family	300	1	7021	300
159	Permanent	administrative building	office	person	15	21	4794	315
161	Permanent	information systems facility	office	person	15	8	1344	120
161	Permanent	administrative building	office	person	15	163	38564	2445
163	Permanent	administrative building	office	person	15	83	14865	1245
164	Permanent	exchange maintenance shop	warehouse (mixed use)	1000 sq. feet	94	3.249	3249	305.406
165	Permanent	simulator building	warehouse (mixed use)	1000 sq. feet	94	9.542	9542	896.948
166	Permanent	chapel	auditorium	seat	5	225	3678	1125
167	Permanent	family housing	family housing	family	300	2	3883	600
168	Permanent	administrative building	office	person	15	16	2202	240
168	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	9.998	9998	939.812
170	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
171	Permanent	physical fitness center	swimming pool	person	10	15	34020	150
177	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
178	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	1.47	1470	138.18
182	Permanent	information systems facility	office	person	15	12	3106	180
183	Permanent	private/organizational club building	swimming pool	person	10	12	808	120
183	Permanent	information systems facility	office	person	15	4	4562	60
185	Permanent	open dining facility	picnic area	seat	5	500	21929	2500
186	Permanent	family housing	family housing	family	300	2	4464	600
187	Permanent	family housing	family housing	family	300	2	4464	600
188	Permanent	family housing	family housing	family	300	2	4464	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
191	Permanent	family housing	family housing	family	300	2	4370	600
192	Permanent	family housing	family housing	family	300	2	4370	600
193	Permanent	family housing	family housing	family	300	2	4370	600
194	Permanent	family housing	family housing	family	300	2	4370	600
195	Permanent	family housing	family housing	family	300	2	4370	600
196	Permanent	family housing	family housing	family	300	2	4370	600
198	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.079	79	1.343
201	Permanent	bowling center	bowling alley	lane	100	14	11569	1400
204	Permanent	electronic and communications equipment RTD&E building	office	person	15	4	9410	60
207	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	4	9776	40
207	Permanent	cafeteria	restaurant	seat	50	50	3000	2500
208	Permanent	exchange cafeteria	restaurant	seat	50	1	192	50
209	Permanent	administrative building	office	person	15	9	1872	135
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	0.828	828	165.6
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	1.778	1778	355.6
210	Permanent	exchange automotive service station	office	person	15	23	468	345
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	30.992	30992	6198.4
211	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.303	303	28.482
215	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.094	94	8.836
217	Permanent	administrative building	office	person	15	7	1221	105
220	Permanent	garage, family housing	self service storage	1000 sq. feet	17	3.364	3364	57.188
221	Permanent	recreational equipment checkout	industrial facility	person	15	8	23329	120
222	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.415	1415	24.055
223	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.348	2348	39.916
224	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
226	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0	1137	0
227	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
228	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
234	Permanent	information systems facility	office	person	15	4	272	60
234	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	30.271	30271	2845.474
235	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	15	681	150
238	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.344	344	5.848
240	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.342	2342	39.814
243	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.293	293	27.542
243	Permanent	information systems facility	office	person	15	2	392	30
243	Permanent	administrative building	office	person	15	74	12080	1110
245	Permanent	child development center	day care center	person	10	97	8190	970
247	Permanent	administrative building	office	person	15	10	2704	150
250	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.088	88	8.272

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
478	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25
479	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
556	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
557	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
558	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
559	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
560	Permanent	access control building	industrial facility	person	15	4	135	60
1093	Permanent	trailer park near Dog Beach	trailer court	3 persons per trailer, per trailer	300	53		15900
A0027	Permanent	training aids center	office	person	15	6	2222	90
Bank	Permanent	Old Point National Bank	office	person	15	6	1400	90
C2	Permanent	picnic area with water at the gazebo at the club	picnic area	person	5	40		200
DB1	Permanent	picnic area with water	picnic area	person	5	100		500
DB2	Permanent	picnic area with water	picnic area	person	5	500		2500
Hotel	Permanent	Chamberlin Hotel	BOQ/BEQ	person	65	372	185788	0
IR1	Permanent	irrigation system, bldg. 87						6507
IR10	Permanent	irrigation system, bldg. 83						4832.55
IR11	Permanent	irrigation system, Parade Field						14440.5
IR12	Permanent	irrigation system, bldg. 19, casemate						14440.5
IR13	Permanent	irrigation system, bldg. 119						19395.45
IR14	Permanent	irrigation system, bldg. 57						14440.5
IR15	Permanent	irrigation system, bldg. 4						14440.5
IR16	Permanent	irrigation system, engineer pier						28101.15
IR17	Permanent	irrigation system, bldg. 147						13990.5
IR18	Permanent	irrigation system, bldg. 245						14440.5
IR19	Permanent	irrigation system, bldg. 96						14440.5
IR2	Permanent	irrigation system, bldg. 560						14440.5
IR20	Permanent	irrigation system, bldg. 185						5567.85
IR21	Permanent	irrigation system, bldg. 221						20481.3
IR3	Permanent	irrigation system, bldg. 43						19451.25
IR4	Permanent	irrigation system, bldg. 80						14440.5
IR5	Permanent	irrigation system, bldg. 227						14440.5
IR6	Permanent	irrigation system, bldg. 82						14440.5
IR7	Permanent	irrigation system, Sherwood Park						14440.5
IR8	Permanent	irrigation system, bldg. 133 west end						14440.5
IR9	Permanent	irrigation system, bldg. 133 east end						14440.5
Marina	Permanent	pier/wharf (1031, 1032, 1033, 1034), assuming 1/4 full total 352 slips)	trailer court	3 persons per trailer, per trailer	300	88		26400
NEW, Admin1	Permanent	administrative building replacing T-247	office	person	15	60	7500	900
NEW, Admin2	Permanent	administrative building replacing T-181, T-182	office	person	15	60	7500	900
NEW, Admin3	Permanent	administrative building replacing T-194 - T-196	office	person	15	60	7500	900

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
NEW, Admin4	Permanent	administrative building replacing 176	office	person	15	60	7500	900
NEW, Admin5	Permanent	administrative building replacing T-260, T-261	office	person	15	60	7500	900
NEW, Admin6	Permanent	administrative building replacing T-183, T-184, T-191, & T-192	office	person	15	60	7500	900
NEW, FH1	Permanent	family housing replacing Wherry	family housing	family	300	2	?	600
NEW, FH2	Permanent	family housing replacing Wherry	family housing	family	300	11	?	3300
NEW, FH3	Permanent	family housing replacing Wherry	family housing	family	300	7	?	2100
NEW, FH4	Permanent	family housing replacing Wherry	family housing	family	300	10	?	3000
NEW, FH5	Permanent	family housing replacing Wherry	family housing	family	300	10	?	3000
NEW, FH6	Permanent	family housing replacing Wherry	family housing	family	300	7	?	2100
NEW, FH7	Permanent	family housing replacing Wherry	family housing	family	300	8	?	2400
NEW, FH8	Permanent	family housing replacing Wherry	family housing	family	300	33	?	9900
NEW, Storage	Permanent	storage building, general purpose, installation, replacing T-24	warehouse (mixed use)	1000 sq. feet	94	2	2000	188
NEW, VTC	Permanent	video teleconference center	office	person	15	60	7500	900
NEW, YS1	Permanent	youth services building behind 221	office	1000 sq. feet	162	3.2	3200	518.4
NEW, YS2	Permanent	youth services building behind 245	office	1000 sq. feet	162	3.2	3200	518.4
NEW1	Permanent	new building along Darby Street	office	person	15	60	7500	900
NEW2	Permanent	new building along Fenwick Rd. @ Griffith St.	office	person	15	60	7500	900
NEW3	Permanent	new building along Fenwick Rd. next to NEW2	office	person	15	60	7500	900
NEW4	Permanent	new building along Fenwick Rd. at old T-249	office	person	15	60	7500	900
NEW5	Permanent	new building at old T-264	office	person	15	60	7500	900
T0028	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.498	498	8.466
T0099	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.744	7744	727.936
T0100	Temporary	information systems facility	office	person	15	5	1104	75
T0100	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.27	8270	777.38
T0101	Temporary	installation, maintenance, and repair building	industrial facility	person	15	5	3424	75
T0101	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	5.94	5940	558.36
T0104	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	10.076	10076	947.144
T0216	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.705	705	11.985
T0457	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
T0468	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
					Projected	**Avg.**	**Flow**	**330611 gpd**

Table B-6
Estimated Domestic Water Flow Rates

YR5

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
1	Permanent	family housing	family housing	family	300	1	6689	300
2	Permanent	private/organizational club building	shopping/exchange	1000 sq. feet	200	7.488	7488	1497.6
3	Permanent	family housing	family housing	family	300	2	5643	600
5	Permanent	exchange cafeteria	restaurant	seat	50	20	756	1000
5	Permanent	administrative building	office	person	15	507	94454	7605
7	Permanent	library branch	office	person	15	8	4856	120
8	Permanent	organizational storage building	warehouse (mixed use)	1000 sq. feet	94	0.659	659	61.946
9	Permanent	band training building	auditorium	seat	5	30	12965	150
10	Permanent	administrative building	self service storage	1000 sq. feet	17	2.112	2112	35.904
10	Permanent	controlled humidity warehouse, installation	warehouse (mixed use)	1000 sq. feet	94	0.906	906	85.164
10	Permanent	information systems facility	office	person	15	3	906	45
10	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.32	7320	688.08
10	Permanent	administrative building	office	person	15	135	28528	2025
11	Permanent	administrative building	office	person	15	45	7734	675
13	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.16	1160	19.72
14	Permanent	museum	shopping/exchange	1000 sq. feet	200	3.694	3694	738.8
15	Permanent	family housing	family housing	family	300	2	6965	600
16	Permanent	family housing	family housing	family	300	2	5220	600
17	Permanent	family housing	family housing	family	300	4	10234	1200
18	Permanent	family housing	family housing	family	300	4	10234	1200
19	Permanent	family housing	family housing	family	300	1	3204	300
20	Permanent	museum	shopping/exchange	1000 sq. feet	200	34.704	34704	6940.8
21	Permanent	chapel	self service storage	1000 sq. feet	17	29.122	29122	495.074
22	Permanent	museum	shopping/exchange	1000 sq. feet	200	26.52	26520	5304
23	Permanent	museum	shopping/exchange	1000 sq. feet	200	7.8	7800	1560
24	Permanent	fire/rescue station	self service storage	1000 sq. feet	17	3.751	3751	63.767
25	Permanent	family housing	family housing	family	300	2	4370	600
26	Permanent	family housing	family housing	family	300	2	4370	600
27	Permanent	information systems facility	office	person	15	3	3400	45
27	Permanent	training aids center	office	person	15	8	7413	120
27	Permanent	administrative building	office	person	15	29	5825	435
28	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.12	8120	763.28
28	Permanent	installation, maintenance, and repair building	industrial facility	person	15	27	18696	405
28	Permanent	administrative building	office	person	15	69	12418	1035
30	Permanent	family housing	family housing	family	300	2	4370	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
31	Permanent	family housing	family housing	family	300	2	4370	600
32	Permanent	recreational equipment checkout	industrial facility	person	15	3	3167	45
32	Permanent	indoor morale, welfare, and recreation facility	office	person	15	3	365	45
33	Permanent	family housing	family housing	family	300	4	10837	1200
34	Permanent	family housing	family housing	family	300	4	10837	1200
35	Permanent	family housing	family housing	family	300	4	10837	1200
37	Permanent	administrative building	office	person	15	41	9570	615
38	Permanent	fire/rescue station	office	person	15	1	2171	15
39	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.528	528	8.976
40	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.552	552	9.384
42	Permanent	auditorium, general purpose	auditorium	seat	5	898	10450	4490
43	Permanent	family housing	family housing	family	300	4	10837	1200
44	Permanent	family housing	family housing	family	300	4	10837	1200
45	Permanent	family housing	family housing	family	300	4	10837	1200
46	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.86	860	80.84
47	Permanent	administrative building	office	person	15	6	1186	90
48	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.736	2736	257.184
49	Permanent	administrative building	office	person	15	3	561	45
50	Permanent	family housing	family housing	family	300	3	10882	900
51	Permanent	family housing	family housing	family	300	4	11194	1200
52	Permanent	family housing	family housing	family	300	4	11194	1200
53	Permanent	administrative building	office	person	15	10	3091	150
54	Permanent	family housing	family housing	family	300	4	11194	1200
55	Permanent	family housing	family housing	family	300	1	3387	300
56	Permanent	administrative building	office	person	15	91	19402	1365
57	Permanent	access control building	industrial facility	person	15	4	625	60
57	Permanent	information systems facility	office	person	15	4	4029	60
57	Permanent	installation, maintenance, and repair building	industrial facility	person	15	7	18758	105
57	Permanent	general instruction building	office	person	15	8	1987	120
57	Permanent	administrative building	office	person	15	9	2084	135
57	Permanent	vehicle storage building, installation	warehouse (mixed use)	1000 sq. feet	94	21.195	21195	1992.33
59	Permanent	information systems facility	office	person	15	31	20161	465
60	Permanent	family housing	family housing	family	300	1	2143	300
61	Permanent	transient UPH	BOQ/BEQ	person	65	2	3044	130
62	Permanent	family housing	family housing	family	300	2	7370	600
63	Permanent	family housing	family housing	family	300	2	7370	600
64	Permanent	family housing	family housing	family	300	1	2351	300
71	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.979	1979	33.643
73	Permanent	administrative building	office	person	15	9	1736	135

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
76	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.868	868	14.756
77	Permanent	administrative building	office	person	15	34	8032	510
78	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.287	2287	38.879
80	Permanent	transient officers UPH	BOQ/BEQ	person	65	6	9634	390
81	Permanent	plant/utilities building	industrial facility	person	15	3	3004	45
81	Permanent	installation, maintenance, and repair building	industrial facility	person	15	2	4704	30
82	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	1.078	1078	101.332
82	Permanent	automation-aided instructional building	office	person	15	4	1032	60
82	Permanent	army continuing education system facility	adult education center	person	15	12	2809	180
82	Permanent	company headquarters building	office	person	15	10	2240	150
82	Permanent	general instruction building	office	person	15	13	3341	195
82	Permanent	dental clinic	clinic	each	500	1	4452	500
82	Permanent	administrative building	office	person	15	95	21379	1425
82	Permanent	troop dispensary/health clinic	clinic	each	500	1	31569	500
83	Permanent	administrative building	office	person	15	30	8202	450
84	Permanent	administrative building	office	person	15	20	3927	300
85	Permanent	community support facility	office	person	15	3	897	45
86	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.668	668	62.792
87	Permanent	police/mp station	office	person	15	8	3150	120
87	Permanent	company headquarters building	office	person	15	11	4138	165
87	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	4.264	4264	400.816
87	Permanent	UPH mess facilities	restaurant	person	50	100	7300	5000
87	Permanent	enlisted unaccompanied personnel housing	BOQ/BEQ	person	65	80	20550	5200
89	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	2.575	2575	242.05
90	Permanent	family housing	family housing	family	300	1	1399	300
91	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.21	210	19.74
93	Permanent	family housing	family housing	family	300	1	5958	300
94	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
96	Permanent	simulator building	office	person	15	260	7497	3900
96	Permanent	administrative building	office	person	15	97	20190	1455
99	Permanent	private/organizational club building	swimming pool	person	10	0	1703	0
100	Permanent	information systems facility	office	person	15	1	494	15
100	Permanent	administrative building	office	person	15	119	24747	1785
101	Permanent	family housing	family housing	family	300	2	11742	600
102	Permanent	family housing	family housing	family	300	2	11742	600
103	Permanent	family housing	family housing	family	300	1	5871	300
105	Permanent	general instruction building	office	person	15	10	2562	150
105	Permanent	administrative building	office	person	15	91	15965	1365
107	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
108	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
109	Permanent	family housing	family housing	family	300	2	3071	600
110	Permanent	family housing	family housing	family	300	2	3071	600
111	Permanent	family housing	family housing	family	300	2	3071	600
112	Permanent	family housing	family housing	family	300	2	3071	600
113	Permanent	family housing	family housing	family	300	2	3071	600
114	Permanent	family housing	family housing	family	300	2	3071	600
115	Permanent	family housing	family housing	family	300	2	3071	600
116	Permanent	administrative building	office	person	15	27	5246	405
117	Permanent	administrative building	office	person	15	55	10337	825
118	Permanent	family housing	family housing	family	300	1	7273	300
119	Permanent	family housing	family housing	family	300	1	12173	300
120	Permanent	family housing	family housing	family	300	1	7584	300
121	Permanent	family housing	family housing	family	300	1	5275	300
121	Permanent	family housing	family housing	family	300	1	5275	300
122	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.302	302	5.134
123	Permanent	family housing	family housing	family	300	2	10548	600
124	Permanent	family housing	family housing	family	300	2	10548	600
125	Permanent	family housing	family housing	family	300	1	7720	300
126	Permanent	family housing	family housing	family	300	2	10549	600
127	Permanent	family housing	family housing	family	300	2	10226	600
128	Permanent	family housing	family housing	family	300	2	10228	600
129	Permanent	family housing	family housing	family	300	2	10816	600
130	Permanent	family housing	family housing	family	300	2	3071	600
131	Permanent	family housing	family housing	family	300	2	3071	600
132	Permanent	family housing	family housing	family	300	2	3071	600
133	Permanent	administrative building	self service storage	1000 sq. feet	17	3.206	3206	54.502
133	Permanent	information systems facility	office	person	15	26	7225	390
133	Permanent	auditorium, general purpose	auditorium	seat	5	186	5020	930
133	Permanent	administrative building	office	person	15	112	26558	1680
134	Permanent	administrative building	office	person	15	67	21296	1005
135	Permanent	information systems facility	office	person	15	6	2462	90
135	Permanent	information systems facility	office	person	15	19	8680	285
135	Permanent	administrative building	office	person	15	35	5868	525
136	Permanent	transient UPH	BOQ/BEQ	person	65	2	1693	130
137	Permanent	transient officers UPH	BOQ/BEQ	person	65	2	1693	130
138	Permanent	administrative building	office	person	15	56	13833	840
139	Permanent	administrative building	office	person	15	181	37019	2715
140	Permanent	family housing	family housing	family	300	2	3578	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
141	Permanent	family housing	family housing	family	300	1	4928	300
142	Permanent	family housing	family housing	family	300	1	4928	300
143	Permanent	family housing	family housing	family	300	4	16430	1200
144	Permanent	family housing	family housing	family	300	4	16430	1200
145	Permanent	CIDC field operations building	office	person	15	4	1366	60
146	Permanent	family housing	family housing	family	300	1	4212	300
147	Permanent	transient officers UPH	BOQ/BEQ	person	65	1	1270	65
148	Permanent	family housing	family housing	family	300	2	3578	600
149	Permanent	family housing	family housing	family	300	2	3578	600
150	Permanent	family housing	family housing	family	300	2	3578	600
151	Permanent	family housing	family housing	family	300	2	3930	600
152	Permanent	family housing	family housing	family	300	2	3579	600
153	Permanent	family housing	family housing	family	300	2	3578	600
154	Permanent	family housing	family housing	family	300	2	3578	600
155	Permanent	family housing	family housing	family	300	2	3578	600
156	Permanent	family housing	family housing	family	300	2	3578	600
157	Permanent	family housing	family housing	family	300	1	7021	300
158	Permanent	family housing	family housing	family	300	1	7021	300
159	Permanent	administrative building	office	person	15	21	4794	315
161	Permanent	information systems facility	office	person	15	8	1344	120
161	Permanent	administrative building	office	person	15	163	38564	2445
163	Permanent	administrative building	office	person	15	83	14865	1245
166	Permanent	chapel	auditorium	seat	5	225	3678	1125
167	Permanent	family housing	family housing	family	300	2	3883	600
168	Permanent	administrative building	office	person	15	16	2202	240
168	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	9.998	9998	939.812
170	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798
171	Permanent	physical fitness center	swimming pool	person	10	15	34020	150
177	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
178	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	1.47	1470	138.18
182	Permanent	information systems facility	office	person	15	12	3106	180
183	Permanent	private/organizational club building	swimming pool	person	10	12	808	120
183	Permanent	information systems facility	office	person	15	4	4562	60
185	Permanent	open dining facility	picnic area	seat	5	500	21929	2500
186	Permanent	family housing	family housing	family	300	2	4464	600
187	Permanent	family housing	family housing	family	300	2	4464	600
188	Permanent	family housing	family housing	family	300	2	4464	600
191	Permanent	family housing	family housing	family	300	2	4370	600
192	Permanent	family housing	family housing	family	300	2	4370	600

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
193	Permanent	family housing	family housing	family	300	2	4370	600
194	Permanent	family housing	family housing	family	300	2	4370	600
195	Permanent	family housing	family housing	family	300	2	4370	600
196	Permanent	family housing	family housing	family	300	2	4370	600
198	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.079	79	1.343
201	Permanent	bowling center	bowling alley	lane	100	14	11569	1400
204	Permanent	electronic and communications equipment RTD&E building	office	person	15	4	9410	60
207	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	4	9776	40
207	Permanent	cafeteria	restaurant	seat	50	50	3000	2500
208	Permanent	exchange cafeteria	restaurant	seat	50	1	192	50
209	Permanent	administrative building	office	person	15	9	1872	135
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	0.828	828	165.6
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	1.778	1778	355.6
210	Permanent	exchange automotive service station	office	person	15	23	468	345
210	Permanent	exchange main retail store	shopping/exchange	1000 sq. feet	200	30.992	30992	6198.4
211	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.303	303	28.482
215	Permanent	hazardous material storage building, installation	warehouse (mixed use)	1000 sq. feet	94	0.094	94	8.836
217	Permanent	administrative building	office	person	15	7	1221	105
220	Permanent	garage, family housing	self service storage	1000 sq. feet	17	3.364	3364	57.188
221	Permanent	recreational equipment checkout	industrial facility	person	15	8	23329	120
222	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.415	1415	24.055
223	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.348	2348	39.916
224	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
226	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0	1137	0
227	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.325	325	5.525
228	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.137	1137	19.329
234	Permanent	information systems facility	office	person	15	4	272	60
234	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	30.271	30271	2845.474
235	Permanent	indoor morale, welfare, and recreation facility	swimming pool	person	10	15	681	150
238	Permanent	garage, family housing	self service storage	1000 sq. feet	17	0.344	344	5.848
240	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.342	2342	39.814
243	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.293	293	27.542
243	Permanent	information systems facility	office	person	15	2	392	30
243	Permanent	administrative building	office	person	15	74	12080	1110
245	Permanent	child development center	day care center	person	10	97	8190	970
247	Permanent	administrative building	office	person	15	10	2704	150
250	Permanent	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	0.088	88	8.272
478	Permanent	garage, family housing	self service storage	1000 sq. feet	17	2.25	2250	38.25
479	Permanent	garage, family housing	self service storage	1000 sq. feet	17	1.694	1694	28.798

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
556	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
557	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
558	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
559	Permanent	installation and ready-issue ammunition storage	warehouse (mixed use)	1000 sq. feet	94	0.114	114	10.716
560	Permanent	access control building	industrial facility	person	15	4	135	60
1093	Permanent	trailer park near Dog Beach	trailer court	3 persons per trailer, per trailer	300	53		15900
A0027	Permanent	training aids center	office	person	15	6	2222	90
Bank	Permanent	Old Point National Bank	office	person	15	6	1400	90
C2	Permanent	picnic area with water at the gazebo at the club	picnic area	person	5	40		200
DB1	Permanent	picnic area with water	picnic area	person	5	100		500
DB2	Permanent	picnic area with water	picnic area	person	5	500		2500
Hotel	Permanent	Chamberlin Hotel	BOQ/BEQ	person	65	372	185788	0
IR1	Permanent	irrigation system, bldg. 87						6507
IR10	Permanent	irrigation system, bldg. 83						4832.55
IR11	Permanent	irrigation system, Parade Field						14440.5
IR12	Permanent	irrigation system, bldg. 19, casemate						14440.5
IR13	Permanent	irrigation system, bldg. 119						19395.45
IR14	Permanent	irrigation system, bldg. 57						14440.5
IR15	Permanent	irrigation system, bldg. 4						14440.5
IR16	Permanent	irrigation system, engineer pier						28101.15
IR17	Permanent	irrigation system, bldg. 147						13990.5
IR18	Permanent	irrigation system, bldg. 245						14440.5
IR19	Permanent	irrigation system, bldg. 96						14440.5
IR2	Permanent	irrigation system, bldg. 560						14440.5
IR20	Permanent	irrigation system, bldg. 185						5567.85
IR21	Permanent	irrigation system, bldg. 221						20481.3
IR3	Permanent	irrigation system, bldg. 43						19451.25
IR4	Permanent	irrigation system, bldg. 80						14440.5
IR5	Permanent	irrigation system, bldg. 227						14440.5
IR6	Permanent	irrigation system, bldg. 82						14440.5
IR7	Permanent	irrigation system, Sherwood Park						14440.5
IR8	Permanent	irrigation system, bldg. 133 west end						14440.5
IR9	Permanent	irrigation system, bldg. 133 east end						14440.5
Marina	Permanent	pier/wharf (1031, 1032, 1033, 1034), assuming 1/4 full total 352 slips)	trailer court	3 persons per trailer, per trailer	300	88		26400
NEW, 52052	Permanent	emergency services building, fire/rescue station	office	1000 sq. feet	162	3	3000	486
NEW, 52052	Permanent	emergency services building, police/mp station	office	1000 sq. feet	162	3	3000	486
NEW, 52052	Permanent	emergency services building, storage	self service storage	1000 sq. feet	17	9.5	9500	161.5
NEW, 52052	Permanent	emergency services building, BOQ/BEQ	BOQ/BEQ	person	65	10	2500	650
NEW, Admin1	Permanent	administrative building replacing T-247	office	person	15	60	7500	900

Building No.	Type	Description	Facility Type	Unit of Measure	Estimated Unit Flow (gpd)	No. of Units	Area (ft^2)	Total Estimated Flow (gpd)
NEW, Admin2	Permanent	administrative building replacing T-181, T-182	office	person	15	60	7500	900
NEW, Admin3	Permanent	administrative building replacing T-194 - T-196	office	person	15	60	7500	900
NEW, Admin4	Permanent	administrative building replacing 176	office	person	15	60	7500	900
NEW, Admin5	Permanent	administrative building replacing T-260, T-261	office	person	15	60	7500	900
NEW, Admin6	Permanent	administrative building replacing T-183, T-184, T-191, & T-192	office	person	15	60	7500	900
NEW, FH1	Permanent	family housing replacing Wherry	family housing	family	300	2	?	600
NEW, FH2	Permanent	family housing replacing Wherry	family housing	family	300	11	?	3300
NEW, FH3	Permanent	family housing replacing Wherry	family housing	family	300	7	?	2100
NEW, FH4	Permanent	family housing replacing Wherry	family housing	family	300	10	?	3000
NEW, FH5	Permanent	family housing replacing Wherry	family housing	family	300	10	?	3000
NEW, FH6	Permanent	family housing replacing Wherry	family housing	family	300	7	?	2100
NEW, FH7	Permanent	family housing replacing Wherry	family housing	family	300	8	?	2400
NEW, FH8	Permanent	family housing replacing Wherry	family housing	family	300	33	?	9900
NEW, Storage	Permanent	storage building, general purpose, installation, replacing T-24	warehouse (mixed use)	1000 sq. feet	94	2	2000	188
NEW, VTC	Permanent	video teleconference center	office	person	15	60	7500	900
NEW, YS1	Permanent	youth services building behind 221	office	1000 sq. feet	162	3.2	3200	518.4
NEW, YS2	Permanent	youth services building behind 245	office	1000 sq. feet	162	3.2	3200	518.4
NEW1	Permanent	new building along Darby Street	office	person	15	60	7500	900
NEW2	Permanent	new building along Fenwick Rd. @ Griffith St.	office	person	15	60	7500	900
NEW3	Permanent	new building along Fenwick Rd. next to NEW2	office	person	15	60	7500	900
NEW4	Permanent	new building along Fenwick Rd. at old T-249	office	person	15	60	7500	900
NEW5	Permanent	new building at old T-264	office	person	15	60	7500	900
T0028	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.498	498	8.466
T0099	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	7.744	7744	727.936
T0100	Temporary	information systems facility	office	person	15	5	1104	75
T0100	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	8.27	8270	777.38
T0101	Temporary	installation, maintenance, and repair building	industrial facility	person	15	5	3424	75
T0101	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	5.94	5940	558.36
T0104	Temporary	storage building, general purpose, installation	warehouse (mixed use)	1000 sq. feet	94	10.076	10076	947.144
T0216	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.705	705	11.985
T0457	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
T0468	Temporary	garage, family housing	self service storage	1000 sq. feet	17	0.531	531	9.027
					Projected	**Avg.**	**Flow**	**331192.1 gpd**

Table B-7
Irrigation System Calculations

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
1	**87**	5	0.72	3.6	
		3	1.44	4.32	
		0	1.61	0	
		1	2.42	2.42	
		7	3.23	22.61	
		2	0.85	1.7	
		1	1.71	1.71	
		7	1.1	7.7	
		3	1.4	4.2	
		8	2	16	
		2	2	4	
		1	2.6	2.6	
		2	0.85	1.7	
		1	1.28	1.28	
		2	1.71	3.42	
		2	1.61	3.22	
		6	3.23	19.38	
		1	4.84	4.84	
		2	6.45	12.9	
		4	0.8	3.2	
		12	1.7	20.4	
		4	0.85	3.4	144.6
2	**560**				estimated
3	**43**	5	1	5	
		1	1.4	1.4	
		8	2	16	
		2	2	4	
		2	3	6	
		4	0.88	3.52	
		2	1.57	3.14	
		6	1.61	9.66	
		8	3.23	25.84	
		1	3.63	3.63	
		1	6.45	6.45	
		3	1.61	4.83	
		1	2.42	2.42	

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
		1	2.82	2.82	
		4	3.23	12.92	
		2	0.85	1.7	
		3	1.28	3.84	
		1	1.71	1.71	
		3	1	3	
		7	2	14	
		1	2.6	2.6	
		1	3	3	
		1	4	4	
		6	0.88	5.28	
		5	1.57	7.85	
		3	0.72	2.16	
		2	1.61	3.22	
		5	3.23	16.15	
		3	6.45	19.35	
		1	1.61	1.61	
		1	2.82	2.82	
		5	3.23	16.15	
		3	6.45	19.35	
		1	1.61	1.61	
		1	2.82	2.82	
		2	3.23	6.46	
		1	3.63	3.63	
		1	4.84	4.84	
		1	6.45	6.45	
		3	1	3	
		4	2	8	
		2	3	6	
		7	0.88	6.16	
		12	1.57	18.84	
		2	1.61	3.22	
		1	2.42	2.42	
		1	2.82	2.82	
		4	3.23	12.92	
		2	4.84	9.68	
		3	6.45	19.35	
		2	1.61	3.22	
		3	3.23	9.69	

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
		1	3.23	3.23	
		1	4.84	4.84	
		2	6.45	12.9	
		2	1	2	
		1	1.4	1.4	
		5	2	10	
		1	3	3	
		9	0.88	7.92	
		13	1.57	20.41	432.25
4	**80**				estimated
5	**227**				estimated
6	**82**				estimated
7	**Sherwood Park**				estimated
8	**133 W end**				estimated
9	**133 E end**				estimated
10	**83**	8	0.85	6.8	
		2	1.49	2.98	
		10	1.71	17.1	
		2	2.13	4.26	
		1	2.56	2.56	
		21	0	0	
		9	0.4	3.6	
		26	1.3	33.8	
		2	0.8	1.6	
		2	0.8	1.6	
		4	1.7	6.8	
		6	1.7	10.2	
		2	2.5	5	
		2	0.85	1.7	
		2	1.71	3.42	
		1	2.56	2.56	
		1	3.41	3.41	107.39
11	**Parade Field**				estimated
12	**19, Casemate**				estimated
13	**119**	37	0.25	9.25	
		41	0.25	10.25	
		8	0.4	3.2	
		27	1.3	35.1	
		2	0.72	1.44	
		1	1.44	1.44	

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
		1	2.16	2.16	
		4	0.85	3.4	
		1	1.49	1.49	
		6	1.71	10.26	
		1	2.13	2.13	
		1	2.56	2.56	
		1	3.41	3.41	
		2	0.72	1.44	
		1	1.44	1.44	
		4	0.85	3.4	
		3	1.71	5.13	
		3	1.61	4.83	
		1	2.42	2.42	
		1	2.82	2.82	
		1	3.23	3.23	
		1	4.03	4.03	
		22	0	0	
		12	0.72	8.64	
		6	1.44	8.64	
		1	2.88	2.88	
		6	0.85	5.1	
		5	1.77	8.85	
		1	2.56	2.56	
		1	3.41	3.41	
		9	0.4	3.6	
		29	1.3	37.7	
		6	0.4	2.4	
		24	1.3	31.2	
		4	0.72	2.88	
		2	1.44	2.88	
		2	1.61	3.22	
		1	2.82	2.82	
		5	3.23	16.15	
		2	6.45	12.9	
		3	1.61	4.83	
		1	2.42	2.42	
		1	2.82	2.82	
		6	3.23	19.38	
		1	4.03	4.03	

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
		1	6.45	6.45	
		1	1.61	1.61	
		2	3.23	6.46	
		1	4.84	4.84	
		2	6.45	12.9	
		5	0.4	2	
		16	1.3	20.8	
		3	0.72	2.16	
		6	1.44	8.64	
		1	1.8	1.8	
		1	2.16	2.16	
		3	2.88	8.64	
		1	1.61	1.61	
		4	3.23	12.92	
		1	6.45	6.45	
		3	1.61	4.83	
		5	3.23	16.15	
		1	6.45	6.45	431.01
14	**57**				estimated
15	**4**				estimated
16	**Engineer Pier**	2	0.72	1.44	
		6	1.44	8.64	
		1	2.16	2.16	
		6	0.85	5.1	
		3	1.71	5.13	
		1	2.56	2.56	
		1	1.61	1.61	
		1	2.42	2.42	
		6	3.23	19.38	
		20	0	0	
		3	0.6	1.8	
		18	1.09	19.62	
		8	1	8	
		10	2	20	
		4	1	4	
		1	1.4	1.4	
		10	2	20	
		1	2.6	2.6	
		1	3	3	

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
		2	4	8	
		9	0.72	6.48	
		2	1.44	2.88	
		2	2.16	4.32	
		3	1.61	4.83	
		1	1.61	1.61	
		1	2.42	2.42	
		5	3.23	16.15	
		1	4.84	4.84	
		1	6.45	6.45	
		8	0.88	7.04	
		27	1.57	42.39	
		3	1.61	4.83	
		6	3.23	19.38	
		1	4.84	4.84	
		1	6.45	6.45	
		1	2.42	2.42	
		5	3.23	16.15	
		1	4.84	4.84	
		2	6.45	12.9	
		6	1	6	
		12	2	24	
		1	3	3	
		2	0.88	1.76	
		3	0.88	2.64	
		7	1.57	10.99	
		15	1.57	23.55	
		3	0.72	2.16	
		2	0.72	1.44	
		4	1.44	5.76	
		2	1.44	2.88	
		1	1.8	1.8	
		1	2.88	2.88	
		3	16.1	48.3	
		1	3.23	3.23	
		3	6.45	19.35	
		9	0.88	7.92	
		17	1.57	26.69	
		2	2.89	5.78	

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
		3	0.8	2.4	
		7	1.7	11.9	
		4	2.2	8.8	
		4	3.23	12.92	
		2	4.03	8.06	
		3	4.84	14.52	
		1	6.45	6.45	
		1	1.61	1.61	
		1	2.42	2.42	
		3	3.23	9.69	
		1	4.84	4.84	
		3	6.45	19.35	
		4	0.6	2.4	
		10	1.09	10.9	
		4	0.85	3.4	
		2	1.71	3.42	
		2	2.13	4.26	
		1	2.56	2.56	
		2	1.61	3.22	
		1	2.01	2.01	
		3	3.23	9.69	
		1	4.03	4.03	
		1	6.45	6.45	
		1	3.63	3.63	
		5	6.45	32.25	
		6	0.8	4.8	
		10	1.7	17	
		1	2.5	2.5	
		1	3.4	3.4	727.09
17	**147**	3	3.23	9.69	
		1	2.42	2.42	
		1	4.84	4.84	
		3	6.45	19.35	
		6	0.72	4.32	
		5	0.9	4.5	
		15	1.44	21.6	
		1	1.8	1.8	
		1	2.16	2.16	
		2	2.88	5.76	

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
		3	0.88	2.64	
		1	0.88	0.88	
		10	1.57	15.7	
		10	1.57	15.7	
		3	0.88	2.64	
		9	1.57	14.13	
		2	1.57	3.14	
		1	2.89	2.89	
		3	1.61	4.83	
		6	3.23	19.38	
		3	4.03	12.09	
		1	6.45	6.45	
		4	1.61	6.44	
		4	3.23	12.92	
		2	4.84	9.68	
		1	6.45	6.45	
		12	0.4	4.8	
		2	0.6	1.2	
		9	0.9	8.1	
		1	1.3	1.3	
		1	1.7	1.7	
		1	2.42	2.42	
		6	3.23	19.38	
		2	6.45	12.9	
		4	1	4	
		4	1.3	5.2	
		4	0.81	3.24	
		8	1.62	12.96	
		2	1	2	
		1	1.1	1.1	
		8	1.3	10.4	
		3	2.6	7.8	310.9
18	**245**	2	0.5	1	
		4	1.4	5.6	
		4	0.7	2.8	
		4	1.71	6.84	
		4	3.43	13.72	
		1	6.85	6.85	
		4	2.32	9.28	

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
		6	4.63	27.78	
		11	0.7	7.7	
		2	1.4	2.8	
		5	0.85	4.25	
		1	1.06	1.06	
		2	1.28	2.56	
		11	1.71	18.81	
		4	3.41	13.64	
		4	0.88	3.52	
		4	1.57	6.28	
		1	2.89	2.89	
		9	1	9	
		8	2	16	
		39	0.5	19.5	
		4	1.61	6.44	
		7	3.23	22.61	
		2	3.63	7.26	
		1	6.45	6.45	
		1	2.19	2.19	
		2	2.67	5.34	
		4	3.43	13.72	
		39	0.5	19.5	
		33	0.5	16.5	
		3	0.88	2.64	
		3	1.57	4.71	
		1	2.89	2.89	
		4	0.85	3.4	
		3	1.06	3.18	
		1	1.28	1.28	
		4	1.71	6.84	
		2	1.92	3.84	
		3	3.41	10.23	320.9
19	**96**				estimated
20	**185**	1	1.61	1.61	
		7	3.23	22.61	
		1	3.15	3.15	
		1	1.61	1.61	
		8	3.23	25.84	
		5	1.71	8.55	

System No.	Building No.	Qty. of Sprinkler Heads	Flow Rate (gpm)	Total Flow (gpm)	Total Flow for System (gpm)
		2	2.19	4.38	
		2	2.67	5.34	
		2	3.15	6.3	
		3	3.43	10.29	
		2	6.85	13.7	
		4	1	4	
		8	1.3	10.4	
		35	0.17	5.95	123.73
21	**221**	4	11	44	
		4	11	44	
		4	11	44	
		4	11	44	
		3	11	33	
		3	11	33	
		4	11	44	
		4	11	44	
		4	11	44	
		3	11	33	
		3	11	33	
		4	1.71	6.84	
		3	1.06	3.18	
		2	1.92	3.84	
		1	1.28	1.28	455.14

The systems for which no information was found were estimated by the following procedure:

- A hypothetical box plot was constructed to determine whether outliers were present in the data set.

System No.	Building No.	Total Flow for System (gpm)
10	83	107.39
20	185	123.73
1	87	144.6
17	147	310.9
18	245	320.9
13	119	431.01
3	43	432.25
21	221	455.14

16	eng. Pier	727.09

L = ¼ (n+1) where n = 9

L = 2.5 rounded to 3

Therefore, Q_L = 144.6

U = ¾ (n+1) where n = 9

U = 7.5 rounded to 7

Therefore, Q_U = 432.25

IQR = Q_U - Q_L

IQR = 432.25 – 144.6

IQR = 287.65

(1.5)IQR = 421.48

Inner fences are located a distance of (1.5)IQR below Q_L and above Q_U. If all observations fall between Q_L – (1.5)IQR and Q_U + (1.5)IQR, there are no outliers and all observations will be taken into account when determining the flow to be used for the estimated irrigation systems.

Q_L – (1.5)IQR = 144.6 – 421.28 = -276.68

Q_U + (1.5)IQR = 432.25 + 421.28 = 853.53

- Since all observations fall between –276.68 and 852.53, the median of the set will become the estimate used. The median is a robust measure of central tendency since it is resistant to the influence of extreme observations.

Therefore, the estimated irrigation systems will use a flow rate of 320.9 gpm for the analysis.

Table B-8
Wherry housing Rebuild Estimation

There are currently 206 Wherry housing units, some of which are unoccupied, totaling 53 buildings. Although there is no firm design for the rebuild, 88 units will replace the current 206 units. Currently, the water demands for Wherry housing are allocated to 8 junctions in the model. The number of units allocated to each junction for the rebuild is proportional to the number of buildings currently allocated to that junction.

Junction	No. of Buildings Currently Allocated	Percentage of Total Current Buildings	Corresponding Number of Units for Rebuild
A	7	13	11
B	1	2	2
C	4	8	7
D	6	11	10
E	6	11	10
F	4	8	7
G	5	9	8
H	20	38	33
Totals	53	100	88

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Appendix C: Fire Flow Requirements

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Table C-1
Fire Flow Requirements

Existing Conditions

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
1	family housing	family housing	6689	N	light hazard	750	90			64
2	private/organizational club building	shopping/exchange	7488	N	ordinary-hazard group 2	1500	90			64
3	family housing	family housing	5643	N	light hazard	750	90			64
5	exchange cafeteria	restaurant	97408	Y	ordinary-hazard group 1	500	60	0.15	450	62 or moat
7	library branch	office	4856	N	ordinary-hazard group 2	1500	90			70
8	organizational storage building	warehouse (mixed use)	659	N	ordinary-hazard group 2	1500	90			70
9	band training building	auditorium	12965	Y	ordinary-hazard group 1	500	60	0.15	585	70
10	administrative building	office	33548	Y	light hazard	250	45	0.1	300	69
10	storage building, general purpose, installation	warehouse (mixed use)	7315	Y	class IV commodities	500	120	0.09	270	69
11	administrative building	office	7974	N	light hazard	750	60			33
13	garage, family housing	self service storage	1160	N	ordinary-hazard group 1	1000	90			53A
14	museum	shopping/exchange	3694	N	ordinary-hazard group 2	1500	90			68
15	family housing	family housing	6965	N	light hazard	750	90			66
16	family housing	family housing	5220	N	light hazard	750	90			66
17	family housing	family housing	10234	N	light hazard	750	90			67
18	family housing	family housing	10234	N	light hazard	750	90			67 or 68
19	family housing	family housing	3204	N	light hazard	750	90			68
20	museum	shopping/exchange	34704	N	ordinary-hazard group 2	2250	120			67
21	chapel	self service storage	29122	N	ordinary-hazard group 2	2250	120			66
22	museum	shopping/exchange	26520	N	ordinary-hazard group 2	2250	120			65
23	museum	shopping/exchange	7800	N	ordinary-hazard group 2	2250	120			61
24	fire/rescue station	self service storage	3751	N	ordinary-hazard group 2	1500	90			40
25	family housing	family housing	4370	N	light hazard	750	90			38
26	family housing	family housing	4370	N	light hazard	750	90			38
27	administrative building	office	16836	Y	light hazard	250	45	0.1	390	41
28	installation, maintenance, and repair building	industrial facility	39521	N (should)	ordinary-hazard group 2	2250	120			53
30	family housing	family housing	4370	N	light hazard	750	90			38
31	family housing	family housing	4370	N	light hazard	750	90			38
32	recreational equipment checkout	industrial facility	3532	N	light hazard	750	60			2
33	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	30
34	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	near100
35	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
36	army community services center	swimming pool	11395	Y	ordinary-hazard group 1	500	60	0.15	585	27
37	administrative building	office	10235	N	light hazard	1125	90			32 or behind37
38	fire/rescue station	office	2171	N	light hazard	750	60			1
39	garage, family housing	self service storage	528	N	ordinary-hazard group 1	1000	90			42 or 43
40	garage, family housing	self service storage	552	N	ordinary-hazard group 1	1000	90			31
42	auditorium, general purpose	auditorium	10450	N	ordinary-hazard group 1	1000	90			38
43	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
44	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
45	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	49
46	storage building, general purpose, installation	warehouse (mixed use)	860	N	ordinary-hazard group 2	1500	90			62
47	administrative building	office	1186	N	light hazard	750	60			moat
48	storage building,	warehouse (mixed	2736	N	ordinary-hazard	1500	90			69

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
	general purpose, installation	use)			group 2					
49	administrative building	office	561	N	light hazard	750	60			61
50	family housing	family housing	10882	N	light hazard	750	90			65
51	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	48 or 49
52	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
53	administrative building	office	3091	N	light hazard	750	60			61
54	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
55	family housing	family housing	3387	N	light hazard	750	90			35
56	administrative building	office	19878	N	light hazard	1125	90			60
57	installation, maintenance, and repair building	industrial facility	48178	Y	ordinary-hazard group 2	500	75	0.2	600	60
59	information systems facility	office	20161	Y	light hazard	250	45	0.1	390	59
60	family housing	family housing	2143	N	light hazard	750	90			29
61	transient UPH	BOQ/BEQ	3044	N	light hazard	750	60			35
62	family housing	family housing	7370	N	light hazard	750	90			69
63	family housing	family housing	7370	N	light hazard	750	90			69
64	family housing	family housing	2351	N	light hazard	750	90			29
70	family housing	family housing	7880	N	light hazard	750	90			43
71	garage, family housing	self service storage	1979	N	ordinary-hazard group 1	1000	90			35
73	administrative building	office	1736	N	light hazard	750	60			37A
76	garage, family housing	self service storage	868	N	ordinary-hazard group 1	1000	90			35
77	administrative building	office	8392	N	light hazard	750	60			40
78	garage, family housing	self service storage	2287	N	ordinary-hazard group 1	1000	90			64
79	family housing	family housing	7854	N	light hazard	750	90			43
80	transient officers UPH	BOQ/BEQ	9634	N	light hazard	750	60			50
82	army continuing education system facility	adult education center	2809	Y	ordinary-hazard group 1	500	60	0.15	421.35	40
82	dental clinic	clinic	4452	Y	light hazard	250	45	0.1	300	40
82	troop dispensary/health clinic	clinic	31569	Y	light hazard	250	45	0.1	300	40
82	administrative building	office	21379	Y	light hazard	250	45	0.1	300	40
82	automation-aided instructional building	office	1032	Y	light hazard	250	45	0.1	103.2	40
82	company headquarters building	office	2240	Y	light hazard	250	45	0.1	224	40
82	general instruction building	office	3341	Y	light hazard	250	45	0.1	300	40
83	administrative building	office	8540	N	light hazard	1125	90			32
84	administrative building	office	3927	N	light hazard	750	60			moat
85	community support facility	office	897	N	light hazard	750	60			62 or moat
86	storage building, general purpose, installation	warehouse (mixed use)	668	N	ordinary-hazard group 2	1500	90			moat
87	enlisted unaccompanied personnel housing	BOQ/BEQ	35138	Y	light hazard	250	45	0.1	300	46
87	storage building, general purpose, installation	warehouse (mixed use)	4264	Y	class IV commodities	500	120	0.1	300	46
88	storage building, general purpose, installation	warehouse (mixed use)	9624	N (should)	ordinary-hazard group 2	1500	90			24 or 26
89	storage building, general purpose, installation	warehouse (mixed use)	2575	N	ordinary-hazard group 2	1500	90			47
90	family housing	family housing	1399	N	light hazard	750	90			51
91	hazardous material storage building, installation	warehouse (mixed use)	210	N	ordinary-hazard group 2	1500	90			18
93	family housing	family housing	5958	N	light hazard	750	90			42

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
94	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			near158
95	child development center	day care center	4247	Y	light hazard	250	45	0.1	390	15
96	administrative building	office	27687	N	light hazard	1125	90			15
98	private/organizational club building	swimming pool	1703	N	ordinary-hazard group 1	1000	90			11
99	private/organizational club building	swimming pool	1703	N	ordinary-hazard group 1	1000	90			11
100	administrative building	office	25911	Y	light hazard	250	45	0.1	300	near100
101	family housing	family housing	11742	N	light hazard	750	90			38
102	family housing	family housing	11742	N	light hazard	750	90			38
103	family housing	family housing	5871	N	light hazard	750	90			41
105	administrative building	office	18527	N	light hazard	1125	90			70
107	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			48
108	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
109	family housing	family housing	3071	N	light hazard	750	90			39
110	family housing	family housing	3071	N	light hazard	750	90			37
111	family housing	family housing	3071	N	light hazard	750	90			37
112	family housing	family housing	3071	N	light hazard	750	90			37
113	family housing	family housing	3071	N	light hazard	750	90			37
114	family housing	family housing	3071	N	light hazard	750	90			34
115	family housing	family housing	3071	N	light hazard	750	90			34
116	administrative building	office	5246	Y	light hazard	250	45	0.1	390	34
117	administrative building	office	10962	N	light hazard	1125	90			61
118	family housing	family housing	7273	N	light hazard	750	90			32
119	family housing	family housing	12173	N	light hazard	750	90			31
120	family housing	family housing	7584	N	light hazard	750	90			31
121	family housing	family housing	10550	N	light hazard	750	90			31
122	garage, family housing	self service storage	302	N	ordinary-hazard group 1	1000	90			32
123	family housing	family housing	10548	N	light hazard	750	90			39
124	family housing	family housing	10548	N	light hazard	750	90			41
125	family housing	family housing	7720	N	light hazard	750	90			41
126	family housing	family housing	10549	N	light hazard	750	90			63
127	family housing	family housing	10226	N	light hazard	750	90			65
128	family housing	family housing	10228	N	light hazard	750	90			66
129	family housing	family housing	10816	N	light hazard	750	90			44
130	family housing	family housing	3071	N	light hazard	750	90			37
131	family housing	family housing	3071	N	light hazard	750	90			37
132	family housing	family housing	3071	N	light hazard	750	90			36
133	auditorium, general purpose	auditorium	42558	N	ordinary-hazard group 1	1500	120			behind37
134	administrative building	office	22696	N	light hazard	1125	90			behind37
135	administrative building	office	17010	Y	light hazard	250	45	0.1	390	59
136	transient UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
137	transient officers UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
138	administrative building	office	14468	N	light hazard	750	60			near158
139	administrative building	office	37970	Y	light hazard	250	45	0.1	390	63
140	family housing	family housing	3578	N	light hazard	750	90			51
141	family housing	family housing	4928	N	light hazard	750	90			30
142	family housing	family housing	4928	N	light hazard	750	90			30
143	family housing	family housing	16430	N	light hazard	750	90			35
144	family housing	family housing	16430	N	light hazard	750	90			35
145	CIDC field operations building	office	1366	N	light hazard	750	60			46
146	family housing	family housing	4212	N	light hazard	750	90			28
147	transient officers UPH	BOQ/BEQ	1270	N	light hazard	750	60			28
148	family housing	family housing	3578	N	light hazard	750	90			40
149	family housing	family housing	3578	N	light hazard	750	90			40
150	family housing	family housing	3578	N	light hazard	750	90			40
151	family housing	family housing	3930	N	light hazard	750	90			50
152	family housing	family housing	3579	N	light hazard	750	90			50

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
153	family housing	family housing	3578	N	light hazard	750	90			51
154	family housing	family housing	3578	N	light hazard	750	90			51
155	family housing	family housing	3578	N	light hazard	750	90			62
156	family housing	family housing	3578	N	light hazard	750	90			62
157	family housing	family housing	7021	N	light hazard	750	90			66
158	family housing	family housing	7021	N	light hazard	750	90			near158
159	administrative building	office	4994	N	light hazard	750	60			moat
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	34
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	near161
163	administrative building	office	15103	N	light hazard	1125	90			34
164	exchange maintenance shop	industrial facility	3249	N	ordinary-hazard group 2	1500	90			14
165	simulator building	office	9542	Y	light hazard	250	45	0.1	390	13
166	chapel	auditorium	3678	N	light hazard	750	60			66
167	family housing	family housing	3883	N	light hazard	750	90			50
168	storage building, general purpose, installation	warehouse (mixed use)	12200	Y	class IV commodities	500	120	0.11	429	52
170	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
171	physical fitness center	swimming pool	34020	Y	light hazard	250	45	0.1	390	40
173	administrative building	office	2400	N	light hazard	750	60			11
174	administrative building	office	1658	N	light hazard	750	60			11
175	administrative building	office	1755	N	light hazard	750	60			11
176	administrative building	office	3002	N	light hazard	750	60			15
177	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			near100
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			20
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			22
181	commissary	shopping/exchange	20080	Y	ordinary-hazard group 2	500	75	0.2	780	36 or 37A
182	information systems facility	office	3106	N	light hazard	750	60			40
183	private/organizational club building	swimming pool	5370	N	ordinary-hazard group 1	1000	90			33 or 37A
185	open dining facility	restaurant	21929	Y	light hazard	250	45	0.1	390	4
186	family housing	family housing	4464	N	light hazard	750	90			52
187	family housing	family housing	4464	N	light hazard	750	90			53
188	family housing	family housing	4464	N	light hazard	750	90			53
191	family housing	family housing	4370	N	light hazard	750	90			53
192	family housing	family housing	4370	N	light hazard	750	90			53
193	family housing	family housing	4370	N	light hazard	750	90			53
194	family housing	family housing	4370	N	light hazard	750	90			53
195	family housing	family housing	4370	N	light hazard	750	90			53
196	family housing	family housing	4370	N	light hazard	750	90			53
198	garage, family housing	self service storage	79	N	ordinary-hazard group 1	1000	90			65
201	bowling center	bowling alley	11569	Y	ordinary-hazard group 1	500	60	0.15	450	11
204	electronic and communications equipment RTD&E building	office	9410	N	ordinary-hazard group 1	1500	120			33
207	cafeteria	restaurant	12776	Y	ordinary-hazard group 1	500	60	0.15	585	37A
208	exchange cafeteria	restaurant	499	N	ordinary-hazard group 1	1500	120			11
209	administrative building	office	1872	N	light hazard	1125	90			65
210	exchange automotive service station	service station	34066	Y	ordinary-hazard group 2	500	75	0.2	600	18, 18A, 19, 19A, or 20
211	storage building, general purpose,	warehouse (mixed use)	303	N	ordinary-hazard group 2	1500	90			8

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
215	installation hazardous material storage building, installation	warehouse (mixed use)	94	N	ordinary-hazard group 2	1500	90			37 or 37A
217	administrative building	office	1221	N	light hazard	750	60			65
220	garage, family housing	self service storage	3364	N	ordinary-hazard group 1	1000	90			53A
221	recreational equipment checkout	industrial facility	23329	Y	light hazard	250	45	0.1	300	56
222	garage, family housing	self service storage	1415	N	ordinary-hazard group 1	1000	90			53A
223	garage, family housing	self service storage	2348	N	ordinary-hazard group 1	1000	90			29 or 30
224	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1500	90			38
226	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
227	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			42
228	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
234	storage building, general purpose, installation	warehouse (mixed use)	30543	N (should)	ordinary-hazard group 2	2250	120			28
235	indoor morale, welfare, and recreation facility	swimming pool	681	N	light hazard	750	60			4
238	garage, family housing	self service storage	344	N	ordinary-hazard group 1	1000	90			29
240	garage, family housing	self service storage	2342	N	ordinary-hazard group 1	1000	90			66
243	administrative building	office	13125	Y	light hazard	250	45	0.1	300	51 or 52
245	child development center	day care center	8190	Y	light hazard	250	45	0.1	300	16
247	administrative building	office	2704	N	light hazard	750	60			9A
248	storage building, general purpose, installation	warehouse (mixed use)	2182	N	ordinary-hazard group 2	1500	90			28
250	storage building, general purpose, installation	warehouse (mixed use)	88	N	ordinary-hazard group 2	1500	90			19A
478	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			66
479	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			68
556	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
557	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
558	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
559	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
560	access control building	industrial facility	135	N	light hazard	750	60			46
1093	trailer park near Dog Beach (permanent)	trailer court		N	light hazard	1125	90			2 or 3
1093	trailer park near Dog Beach (temporary)	trailer court		N	light hazard	1125	90			2 or 3
A0027	training aids center	office	2222	N	light hazard	750	60			41
Bank	Old Point National Bank	bank	1400	Y	light hazard	250	45	0.1	140	19A or 23
Hotel	Chamberlin Hotel	hotel	185788	N	light hazard	1500	120			32
Marina	Permanent	pier/wharf (1031, 1032, 1033, 1034)		N	ordinary-hazard group 2	2250	120			37A
Park1	parking area,	parking		N	vehicle parking area	500	120			2

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
	near bldgs. 32 & 1104									
Park2	parking area, near bldg. 185	parking		N	vehicle parking area	500	120			4
Park3	parking area, near abandoned airfield and football field	parking		N	vehicle parking area	500	120			9 or 9A
Park4	parking area, near bldg. 201	parking		N	vehicle parking area	500	120			11
Park5	parking area, behind bldgs. 96 & 175	parking		N	vehicle parking area	500	120			12
Park6	parking area, around bldg. 245	parking		N	vehicle parking area	500	120			16
Park7	parking area, around bldgs. 164 & 165	parking		N	vehicle parking area	500	120			13 or 14
Park8	parking area, around bldgs. 12 & 249	parking		N	vehicle parking area	500	120			14 or 19
Park9	parking area, near bldg. 210	parking		N	vehicle parking area	500	120			18, 18A, 19, or 19A
Park10	parking area, near Old Point National Bank	parking		N	vehicle parking area	500	120			19A or 23
Park11	parking area, near bldg. 36	parking		N	vehicle parking area	500	120			27
Park12	parking area, next to Chamberlin Hotel	parking		N	vehicle parking area	500	120			32 or 33
Park13	parking area, behind bldg. 11	parking		N	vehicle parking area	500	120			33
Park14	parking area, around bldg. 181	parking		N	vehicle parking area	500	120			36 or 37A
Park15	parking area, between bldgs. 110-113 & 114, 115	parking		N	vehicle parking area	500	120			36 or 37A
Park16	parking area, near bldgs. 25, 30, 31, & 42	parking		N	vehicle parking area	500	120			38
Park17	parking area, near bldgs. 56, 57, & 243	parking		N	vehicle parking area	500	120			52 or 60
Park18	parking area, near bldgs. 59 & 252	parking		N	vehicle parking area	500	120			59
Park19	parking area, near bldgs. T-100 & T-101	parking		N	vehicle parking area	500	120			57
Park20	parking area, behind bldgs. 81 & T-99	parking		N	vehicle parking area	500	120			56
Park21	parking area, near bldgs. T-58 & T-59	parking		N	vehicle parking area	500	120			46 or 47
Park22	parking area, between bldgs. 87 & 89	parking		N	vehicle parking area	500	120			46
Park23	parking area, between bldg. 197 & basketball court	parking		N	vehicle parking area	500	120			46
Park24	parking area, in moat near bldgs. 8 & 9	parking		N	vehicle parking area	500	120			70
Park25	parking area, in moat behind bldg. 5	parking		N	vehicle parking area	500	120			62 or moat
Park26	parking area, in moat near bldg. 117	parking		N	vehicle parking area	500	120			61
Park27	parking area, in moat near bldg. 78	parking		N	vehicle parking area	500	120			64
T0024	company headquarters building	office	2006	N	light hazard	750	60			70
T0028	garage, family housing	self service storage	498	N	ordinary-hazard group 1	1000	90			68
T0058	transient UPH	BOQ/BEQ	7875	N	light hazard	750	60			47
T0086	storage building, general purpose,	warehouse (mixed use)	6262	N (should)	ordinary-hazard group 2	1500	90			3

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
	installation									
T0099	storage building, general purpose, installation	warehouse (mixed use)	7744	N (should)	ordinary-hazard group 2	1500	90			56
T0100	storage building, general purpose, installation	warehouse (mixed use)	9374	N (should)	ordinary-hazard group 2	1500	90			52
T0101	installation, maintenance, and repair building	industrial facility	9364	N (should)	ordinary-hazard group 2	1500	90			57 or 58
T0104	storage building, general purpose, installation	warehouse (mixed use)	10076	Y	class IV commodities	500	120	0.11	330	57
T0181	administrative building	office	4826	N	light hazard	750	60			54
T0182	administrative building	office	4826	N	light hazard	750	60			54
T0183	administrative building	office	4826	N	light hazard	750	60			54
T0184	general instruction building	office	4825	N	light hazard	750	60			54
T0191	veterinary facility	clinic	2178	N	light hazard	750	60			55
T0194	storage building, general purpose, installation	warehouse (mixed use)	4830	N	ordinary-hazard group 2	1500	90			55
T0195	storage building, general purpose, installation	warehouse (mixed use)	4830	N	ordinary-hazard group 2	1500	90			55
T0196	storage building, general purpose, installation	warehouse (mixed use)	4830	N	ordinary-hazard group 2	1500	90			55
T0216	garage, family housing	self service storage	705	N	ordinary-hazard group 1	1000	90			31
T0246	private/organizational club building	swimming pool	1019	N	ordinary-hazard group 1	1000	90			18
T0247	administrative building	office	4800	N	light hazard	750	60			18
T0258	administrative building	office	4830	N	light hazard	750	60			18 or 18A
T0260	thrift shop	shopping/exchange	4830	N	ordinary-hazard group 1	1000	90			14
T0261	indoor morale, welfare, and recreation facility	swimming pool	2239	N	light hazard	750	60			14
T0457	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
T0468	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
NEW1	new building along Darby Street	office	7500	N	light hazard	750	60			55
NEW2	new building along Fenwick Rd. @ Griffith St.	office	7500	N	light hazard	750	60			22
NEW3	new building along Fenwick Rd. next to NEW2	office	7500	N	light hazard	750	60			22
NEW4	new building along Fenwick Rd. at old T-249	office	7500	N	light hazard	750	60			18
NEW5	new building at old T-264	office	7500	N	light hazard	750	60			19
W300	Wherry family housing	family housing	1250	N	light hazard	500	90			26
W301	Wherry family housing	family housing	1250	N	light hazard	500	90			26
W302	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W303	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W304	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W305	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W306	Wherry family housing	family housing	1250	N	light hazard	500	90			26
W307	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W309	Wherry family	family housing	4400	N	light hazard	750	90			25

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
	housing									
W311	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W312	Wherry family housing	family housing	4400	N	light hazard	750	90			24
W313	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W314	Wherry family housing	family housing	4400	N	light hazard	750	90			24
W316	Wherry family housing	family housing	4400	N	light hazard	750	90			24
W318	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W320	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W322	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W324	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W342	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W344	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W346	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W348	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W350	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W352	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W354	Wherry family housing	family housing	4400	N	light hazard	750	90			16
W356	Wherry family housing	family housing	4400	N	light hazard	750	90			16
W358	Wherry family housing	family housing	4400	N	light hazard	750	90			16
W360	Wherry family housing	family housing	4400	N	light hazard	750	90			15
W424	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W426	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W428	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W430	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W432	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W434	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W436	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W440	Wherry family housing	family housing	4400	N	light hazard	750	90			8
W442	Wherry family housing	family housing	4400	N	light hazard	750	90			8
W444	Wherry family housing	family housing	4400	N	light hazard	750	90			7
W452	Wherry family housing	family housing	4400	N	light hazard	750	90			11
W454	Wherry family housing	family housing	4400	N	light hazard	750	90			11
W456	Wherry family housing	family housing	4400	N	light hazard	750	90			11
W458	Wherry family housing	family housing	4400	N	light hazard	750	90			11
W460	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W462	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W464	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W466	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W468	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W470	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W472	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W474	Wherry family housing	family housing	4400	N	light hazard	750	90			9
W476	Wherry family housing	family housing	4400	N	light hazard	750	90			9

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
W482	Wherry family housing	family housing	4400	N	light hazard	750	90			8
W484	Wherry family housing	family housing	4400	N	light hazard	750	90			8

Table C-2
Fire Flow Requirements

YR1

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Sprinkler Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
1	family housing	family housing	6689	N	light hazard	750	90			64
2	private/organizational club building	shopping/exchange	7488	N	ordinary-hazard group 2	1500	90			64
3	family housing	family housing	5643	N	light hazard	750	90			64
5	exchange cafeteria	restaurant	97408	Y	ordinary-hazard group 1	500	60	0.15	450	62 or moat
7	library branch	office	4856	N	ordinary-hazard group 2	1500	90			70
8	organizational storage building	warehouse (mixed use)	659	N	ordinary-hazard group 2	1500	90			70
9	band training building	auditorium	12965	Y	ordinary-hazard group 1	500	60	0.15	585	70
10	administrative building	office	33548	Y	light hazard	250	45	0.1	300	69
10	storage building, general purpose, installation	warehouse (mixed use)	7315	Y	class IV commodities	500	120	0.09	270	69
11	administrative building	office	7974	N	light hazard	750	60			33
13	garage, family housing	self service storage	1160	N	ordinary-hazard group 1	1000	90			53A
14	museum	shopping/exchange	3694	N	ordinary-hazard group 2	1500	90			68
15	family housing	family housing	6965	N	light hazard	750	90			66
16	family housing	family housing	5220	N	light hazard	750	90			66
17	family housing	family housing	10234	N	light hazard	750	90			67
18	family housing	family housing	10234	N	light hazard	750	90			67 or 68
19	family housing	family housing	3204	N	light hazard	750	90			68
20	museum	shopping/exchange	34704	N	ordinary-hazard group 2	2250	120			67
21	chapel	self service storage	29122	N	ordinary-hazard group 2	2250	120			66
22	museum	shopping/exchange	26520	N	ordinary-hazard group 2	2250	120			65
23	museum	shopping/exchange	7800	N	ordinary-hazard group 2	2250	120			61
24	fire/rescue station	self service storage	3751	N	ordinary-hazard group 2	1500	90			40
25	family housing	family housing	4370	N	light hazard	750	90			38
26	family housing	family housing	4370	N	light hazard	750	90			38
27	administrative building	office	16836	Y	light hazard	250	45	0.1	390	41
28	installation, maintenance, and repair building	industrial facility	39521	N (should)	ordinary-hazard group 2	2250	120			53
30	family housing	family housing	4370	N	light hazard	750	90			38
31	family housing	family housing	4370	N	light hazard	750	90			38
32	recreational equipment checkout	industrial facility	3532	N	light hazard	750	60			2
33	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	30
34	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	near100
35	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
37	administrative building	office	10235	N	light hazard	1125	90			32 or behind37
38	fire/rescue station	office	2171	N	light hazard	750	60			1
39	garage, family housing	self service storage	528	N	ordinary-hazard group 1	1000	90			42 or 43
40	garage, family housing	self service storage	552	N	ordinary-hazard group 1	1000	90			31
42	auditorium, general purpose	auditorium	10450	N	ordinary-hazard group 1	1000	90			38
43	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Sprinkler Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
44	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
45	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	49
46	storage building, general purpose, installation	warehouse (mixed use)	860	N	ordinary-hazard group 2	1500	90			62
47	administrative building	office	1186	N	light hazard	750	60			moat
48	storage building, general purpose, installation	warehouse (mixed use)	2736	N	ordinary-hazard group 2	1500	90			69
49	administrative building	office	561	N	light hazard	750	60			61
50	family housing	family housing	10882	N	light hazard	750	90			65
51	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	48 or 49
52	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
53	administrative building	office	3091	N	light hazard	750	60			61
54	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
55	family housing	family housing	3387	N	light hazard	750	90			35
56	administrative building	office	19878	N	light hazard	1125	90			60
57	installation, maintenance, and repair building	industrial facility	48178	Y	ordinary-hazard group 2	500	75	0.2	600	60
59	information systems facility	office	20161	Y	light hazard	250	45	0.1	390	59
60	family housing	family housing	2143	N	light hazard	750	90			29
61	transient UPH	BOQ/BEQ	3044	N	light hazard	750	60			35
62	family housing	family housing	7370	N	light hazard	750	90			69
63	family housing	family housing	7370	N	light hazard	750	90			69
64	family housing	family housing	2351	N	light hazard	750	90			29
71	garage, family housing	self service storage	1979	N	ordinary-hazard group 1	1000	90			35
73	administrative building	office	1736	N	light hazard	750	60			37A
76	garage, family housing	self service storage	868	N	ordinary-hazard group 1	1000	90			35
77	administrative building	office	8392	N	light hazard	750	60			40
78	garage, family housing	self service storage	2287	N	ordinary-hazard group 1	1000	90			64
80	transient officers UPH	BOQ/BEQ	9634	N	light hazard	750	60			50
82	army continuing education system facility	adult education center	2809	Y	ordinary-hazard group 1	500	60	0.15	421.35	40
82	dental clinic	clinic	4452	Y	light hazard	250	45	0.1	300	40
82	troop dispensary/health clinic	clinic	31569	Y	light hazard	250	45	0.1	300	40
82	administrative building	office	21379	Y	light hazard	250	45	0.1	300	40
82	automation-aided instructional building	office	1032	Y	light hazard	250	45	0.1	103.2	40
82	company headquarters building	office	2240	Y	light hazard	250	45	0.1	224	40
82	general instruction building	office	3341	Y	light hazard	250	45	0.1	300	40
83	administrative building	office	8540	N	light hazard	1125	90			32
84	administrative building	office	3927	N	light hazard	750	60			moat
85	community support facility	office	897	N	light hazard	750	60			62 or moat
86	storage building, general purpose, installation	warehouse (mixed use)	668	N	ordinary-hazard group 2	1500	90			moat
87	enlisted unaccompanied personnel housing	BOQ/BEQ	35138	Y	light hazard	250	45	0.1	300	46

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Sprinkler Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
87	storage building, general purpose, installation	warehouse (mixed use)	4264	Y	class IV commodities	500	120	0.1	300	46
89	storage building, general purpose, installation	warehouse (mixed use)	2575	N	ordinary-hazard group 2	1500	90			47
90	family housing	family housing	1399	N	light hazard	750	90			51
91	hazardous material storage building, installation	warehouse (mixed use)	210	N	ordinary-hazard group 2	1500	90			18
93	family housing	family housing	5958	N	light hazard	750	90			42
94	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			near158
95	child development center	day care center	4247	Y	light hazard	250	45	0.1	390	15
96	administrative building	office	27687	N	light hazard	1125	90			15
98	private/organizational club building	swimming pool	1703	N	ordinary-hazard group 1	1000	90			11
99	private/organizational club building	swimming pool	1703	N	ordinary-hazard group 1	1000	90			11
100	administrative building	office	25911	Y	light hazard	250	45	0.1	300	near100
101	family housing	family housing	11742	N	light hazard	750	90			38
102	family housing	family housing	11742	N	light hazard	750	90			38
103	family housing	family housing	5871	N	light hazard	750	90			41
105	administrative building	office	18527	N	light hazard	1125	90			70
107	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			48
108	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
109	family housing	family housing	3071	N	light hazard	750	90			39
110	family housing	family housing	3071	N	light hazard	750	90			37
111	family housing	family housing	3071	N	light hazard	750	90			37
112	family housing	family housing	3071	N	light hazard	750	90			37
113	family housing	family housing	3071	N	light hazard	750	90			37
114	family housing	family housing	3071	N	light hazard	750	90			34
115	family housing	family housing	3071	N	light hazard	750	90			34
116	administrative building	office	5246	Y	light hazard	250	45	0.1	390	34
117	administrative building	office	10962	N	light hazard	1125	90			61
118	family housing	family housing	7273	N	light hazard	750	90			32
119	family housing	family housing	12173	N	light hazard	750	90			31
120	family housing	family housing	7584	N	light hazard	750	90			31
121	family housing	family housing	10550	N	light hazard	750	90			31
122	garage, family housing	self service storage	302	N	ordinary-hazard group 1	1000	90			32
123	family housing	family housing	10548	N	light hazard	750	90			39
124	family housing	family housing	10548	N	light hazard	750	90			41
125	family housing	family housing	7720	N	light hazard	750	90			41
126	family housing	family housing	10549	N	light hazard	750	90			63
127	family housing	family housing	10226	N	light hazard	750	90			65
128	family housing	family housing	10228	N	light hazard	750	90			66
129	family housing	family housing	10816	N	light hazard	750	90			44
130	family housing	family housing	3071	N	light hazard	750	90			37
131	family housing	family housing	3071	N	light hazard	750	90			37
132	family housing	family housing	3071	N	light hazard	750	90			36

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Sprinkler Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
133	auditorium, general purpose	auditorium	42558	N	ordinary-hazard group 1	1500	120			behind37
134	administrative building	office	22696	N	light hazard	1125	90			behind37
135	administrative building	office	17010	Y	light hazard	250	45	0.1	390	59
136	transient UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
137	transient officers UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
138	administrative building	office	14468	N	light hazard	750	60			near158
139	administrative building	office	37970	Y	light hazard	250	45	0.1	390	63
140	family housing	family housing	3578	N	light hazard	750	90			51
141	family housing	family housing	4928	N	light hazard	750	90			30
142	family housing	family housing	4928	N	light hazard	750	90			30
143	family housing	family housing	16430	N	light hazard	750	90			35
144	family housing	family housing	16430	N	light hazard	750	90			35
145	CIDC field operations building	office	1366	N	light hazard	750	60			46
146	family housing	family housing	4212	N	light hazard	750	90			28
147	transient officers UPH	BOQ/BEQ	1270	N	light hazard	750	60			28
148	family housing	family housing	3578	N	light hazard	750	90			40
149	family housing	family housing	3578	N	light hazard	750	90			40
150	family housing	family housing	3578	N	light hazard	750	90			40
151	family housing	family housing	3930	N	light hazard	750	90			50
152	family housing	family housing	3579	N	light hazard	750	90			50
153	family housing	family housing	3578	N	light hazard	750	90			51
154	family housing	family housing	3578	N	light hazard	750	90			51
155	family housing	family housing	3578	N	light hazard	750	90			62
156	family housing	family housing	3578	N	light hazard	750	90			62
157	family housing	family housing	7021	N	light hazard	750	90			66
158	family housing	family housing	7021	N	light hazard	750	90			near158
159	administrative building	office	4994	N	light hazard	750	60			moat
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	34
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	near161
163	administrative building	office	15103	N	light hazard	1125	90			34
164	exchange maintenance shop	industrial facility	3249	N	ordinary-hazard group 2	1500	90			14
165	simulator building	office	9542	Y	light hazard	250	45	0.1	390	13
166	chapel	auditorium	3678	N	light hazard	750	60			66
167	family housing	family housing	3883	N	light hazard	750	90			50
168	storage building, general purpose, installation	warehouse (mixed use)	12200	Y	class IV commodities	500	120	0.11	429	52
170	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
171	physical fitness center	swimming pool	34020	Y	light hazard	250	45	0.1	390	40
176	administrative building	office	3002	N	light hazard	750	60			15
177	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			near100
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			20
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			22

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Sprinkler Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
181	commissary	shopping/exchange	20080	Y	ordinary-hazard group 2	500	75	0.2	780	36 or 37A
182	information systems facility	office	3106	N	light hazard	750	60			40
183	private/organizational club building	swimming pool	5370	N	ordinary-hazard group 1	1000	90			33 or 37A
185	open dining facility	restaurant	21929	Y	light hazard	250	45	0.1	390	4
186	family housing	family housing	4464	N	light hazard	750	90			52
187	family housing	family housing	4464	N	light hazard	750	90			53
188	family housing	family housing	4464	N	light hazard	750	90			53
191	family housing	family housing	4370	N	light hazard	750	90			53
192	family housing	family housing	4370	N	light hazard	750	90			53
193	family housing	family housing	4370	N	light hazard	750	90			53
194	family housing	family housing	4370	N	light hazard	750	90			53
195	family housing	family housing	4370	N	light hazard	750	90			53
196	family housing	family housing	4370	N	light hazard	750	90			53
198	garage, family housing	self service storage	79	N	ordinary-hazard group 1	1000	90			65
201	bowling center	bowling alley	11569	Y	ordinary-hazard group 1	500	60	0.15	450	11
204	electronic and communications equipment RTD&E building	office	9410	N	ordinary-hazard group 1	1500	120			33
207	cafeteria	restaurant	12776	Y	ordinary-hazard group 1	500	60	0.15	585	37A
208	exchange cafeteria	restaurant	499	N	ordinary-hazard group 1	1500	120			11
209	administrative building	office	1872	N	light hazard	1125	90			65
210	exchange automotive service station	service station	34066	Y	ordinary-hazard group 2	500	75	0.2	600	18, 18A, 19, 19A, or 20
211	storage building, general purpose, installation	warehouse (mixed use)	303	N	ordinary-hazard group 2	1500	90			8
215	hazardous material storage building, installation	warehouse (mixed use)	94	N	ordinary-hazard group 2	1500	90			37 or 37A
217	administrative building	office	1221	N	light hazard	750	60			65
220	garage, family housing	self service storage	3364	N	ordinary-hazard group 1	1000	90			53A
221	recreational equipment checkout	industrial facility	23329	Y	light hazard	250	45	0.1	300	56
222	garage, family housing	self service storage	1415	N	ordinary-hazard group 1	1000	90			53A
223	garage, family housing	self service storage	2348	N	ordinary-hazard group 1	1000	90			29 or 30
224	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1500	90			38
226	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
227	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			42
228	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
234	storage building, general purpose, installation	warehouse (mixed use)	30543	N (should)	ordinary-hazard group 2	2250	120			28
235	indoor morale, welfare, and recreation facility	swimming pool	681	N	light hazard	750	60			4
238	garage, family housing	self service storage	344	N	ordinary-hazard group 1	1000	90			29
240	garage, family housing	self service storage	2342	N	ordinary-hazard group 1	1000	90			66
243	administrative building	office	13125	Y	light hazard	250	45	0.1	300	51 or 52
245	child development center	day care center	8190	Y	light hazard	250	45	0.1	300	16

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Sprinkler Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
247	administrative building	office	2704	N	light hazard	750	60			9A
250	storage building, general purpose, installation	warehouse (mixed use)	88	N	ordinary-hazard group 2	1500	90			19A
478	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			66
479	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			68
556	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
557	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
558	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
559	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
560	access control building	industrial facility	135	N	light hazard	750	60			46
1093	trailer park near Dog Beach (permanent)	trailer court		N	light hazard	1125	90			2 or 3
A0027	training aids center	office	2222	N	light hazard	750	60			41
Bank	Old Point National Bank	bank	1400	Y	light hazard	250	45	0.1	140	19A or 23
Hotel	Chamberlin Hotel	hotel	185788	N	light hazard	1500	120			32
Marina	Permanent	pier/wharf (1031, 1032, 1033, 1034)		N	ordinary-hazard group 2	2250	120			37A
Park1	parking area, near bldgs. 32 & 1104	parking		N	vehicle parking area	500	120			2
Park2	parking area, near bldg. 185	parking		N	vehicle parking area	500	120			4
Park3	parking area, near abandoned airfield and football field	parking		N	vehicle parking area	500	120			9 or 9A
Park4	parking area, near bldg. 201	parking		N	vehicle parking area	500	120			11
Park5	parking area, behind bldgs. 96 & 175	parking		N	vehicle parking area	500	120			12
Park6	parking area, around bldg. 245	parking		N	vehicle parking area	500	120			16
Park7	parking area, around bldgs. 164 & 165	parking		N	vehicle parking area	500	120			13 or 14
Park8	parking area, around bldgs. 12 & 249	parking		N	vehicle parking area	500	120			14 or 19
Park9	parking area, near bldg. 210	parking		N	vehicle parking area	500	120			18, 18A, 19, or 19A
Park10	parking area, near Old Point National Bank	parking		N	vehicle parking area	500	120			19A or 23
Park11	parking area, near bldg. 36	parking		N	vehicle parking area	500	120			27
Park12	parking area, next to Chamberlin Hotel	parking		N	vehicle parking area	500	120			32 or 33
Park13	parking area, behind bldg. 11	parking		N	vehicle parking area	500	120			33
Park14	parking area, around bldg. 181	parking		N	vehicle parking area	500	120			36 or 37A
Park15	parking area, between bldgs. 110-113 & 114, 115	parking		N	vehicle parking area	500	120			36 or 37A
Park16	parking area, near bldgs. 25, 30, 31, & 42	parking		N	vehicle parking area	500	120			38
Park17	parking area, near bldgs. 56, 57, & 243	parking		N	vehicle parking area	500	120			52 or 60

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Sprinkler Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
Park18	parking area, near bldgs. 59 & 252	parking		N	vehicle parking area	500	120			59
Park19	parking area, near bldgs. T-100 & T-101	parking		N	vehicle parking area	500	120			57
Park20	parking area, behind bldgs. 81 & T-99	parking		N	vehicle parking area	500	120			56
Park21	parking area, near bldgs. T-58 & T-59	parking		N	vehicle parking area	500	120			46 or 47
Park22	parking area, between bldgs. 87 & 89	parking		N	vehicle parking area	500	120			46
Park23	parking area, between bldg. 197 & basketball court	parking		N	vehicle parking area	500	120			46
Park24	parking area, in moat near bldgs. 8 & 9	parking		N	vehicle parking area	500	120			70
Park25	parking area, in moat behind bldg. 5	parking		N	vehicle parking area	500	120			62 or moat
Park26	parking area, in moat near bldg. 117	parking		N	vehicle parking area	500	120			61
Park27	parking area, in moat near bldg. 78	parking		N	vehicle parking area	500	120			64
T0028	garage, family housing	self service storage	498	N	ordinary-hazard group 1	1000	90			68
T0099	storage building, general purpose, installation	warehouse (mixed use)	7744	N (should)	ordinary-hazard group 2	1500	90			56
T0100	storage building, general purpose, installation	warehouse (mixed use)	9374	N (should)	ordinary-hazard group 2	1500	90			52
T0101	installation, maintenance, and repair building	industrial facility	9364	N (should)	ordinary-hazard group 2	1500	90			57 or 58
T0104	storage building, general purpose, installation	warehouse (mixed use)	10076	Y	class IV commodities	500	120	0.11	330	57
T0183	administrative building	office	4826	N	light hazard	750	60			54
T0184	general instruction building	office	4825	N	light hazard	750	60			54
T0191	veterinary facility	clinic	2178	N	light hazard	750	60			55
T0216	garage, family housing	self service storage	705	N	ordinary-hazard group 1	1000	90			31
T0260	thrift shop	shopping/exchange	4830	N	ordinary-hazard group 1	1000	90			14
T0261	indoor morale, welfare, and recreation facility	swimming pool	2239	N	light hazard	750	60			14
T0457	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
T0468	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
NEW1	new building along Darby Street	office	7500	N	light hazard	750	60			55
NEW2	new building along Fenwick Rd. @ Griffith St.	office	7500	N	light hazard	750	60			22
NEW3	new building along Fenwick Rd. next to NEW2	office	7500	N	light hazard	750	60			22
NEW4	new building along Fenwick Rd. at old T-249	office	7500	N	light hazard	750	60			18
NEW5	new building at old T-264	office	7500	N	light hazard	750	60			19
NEW, Admin1	administrative building replacing T-247	office	7500	N	light hazard	750	60			18
NEW, Storage	storage building, general purpose,	warehouse (mixed use)	2000	N	ordinary-hazard group 2	1500	90			70

Building No.	Description	Facility Type	Area (ft^2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Sprinkler Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)	Hydrant No.
NEW, Admin2	installation, replacing T-24 administrative building	office	7500	N	light hazard	750	60			54
NEW, Admin3	replacing T-181, T-182 administrative building	office	7500	N	light hazard	750	60			55
NEW, YS1	replacing T-194 - T-196 youth services building behind 221	office	3200	Y	light hazard	250	45	0.1	390	56
W300	Wherry family housing	family housing	1250	N	light hazard	500	90			26
W301	Wherry family housing	family housing	1250	N	light hazard	500	90			26
W302	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W303	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W304	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W305	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W306	Wherry family housing	family housing	1250	N	light hazard	500	90			26
W307	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W309	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W311	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W312	Wherry family housing	family housing	4400	N	light hazard	750	90			24
W313	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W314	Wherry family housing	family housing	4400	N	light hazard	750	90			24
W316	Wherry family housing	family housing	4400	N	light hazard	750	90			24
W318	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W320	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W322	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W324	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W342	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W344	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W346	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W348	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W350	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W352	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W354	Wherry family housing	family housing	4400	N	light hazard	750	90			16
W356	Wherry family housing	family housing	4400	N	light hazard	750	90			16
W440	Wherry family housing	family housing	4400	N	light hazard	750	90			8
W442	Wherry family housing	family housing	4400	N	light hazard	750	90			8
W444	Wherry family housing	family housing	4400	N	light hazard	750	90			7
W482	Wherry family housing	family housing	4400	N	light hazard	750	90			8
W484	Wherry family housing	family housing	4400	N	light hazard	750	90			8

Note: New construction in bold typeface.

Table C-3
Fire Flow Requirements

YR2

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
1	family housing	family housing	6689	N	light hazard	750	90			64
2	private/organizational club building	shopping/exchange	7488	N	ordinary-hazard group 2	1500	90			64
3	family housing	family housing	5643	N	light hazard	750	90			64
5	exchange cafeteria	restaurant	97408	Y	ordinary-hazard group 1	500	60	0.15	450	62 or moat
7	library branch	office	4856	N	ordinary-hazard group 2	1500	90			70
8	organizational storage building	warehouse (mixed use)	659	N	ordinary-hazard group 2	1500	90			70
9	band training building	auditorium	12965	Y	ordinary-hazard group 1	500	60	0.15	585	70
10	administrative building	office	33548	Y	light hazard	250	45	0.1	300	69
10	storage building, general purpose, installation	warehouse (mixed use)	7315	Y	class IV commodities	500	120	0.09	270	69
11	administrative building	office	7974	N	light hazard	750	60			33
13	garage, family housing	self service storage	1160	N	ordinary-hazard group 1	1000	90			53A
14	museum	shopping/exchange	3694	N	ordinary-hazard group 2	1500	90			68
15	family housing	family housing	6965	N	light hazard	750	90			66
16	family housing	family housing	5220	N	light hazard	750	90			66
17	family housing	family housing	10234	N	light hazard	750	90			67
18	family housing	family housing	10234	N	light hazard	750	90			67 or 68
19	family housing	family housing	3204	N	light hazard	750	90			68
20	museum	shopping/exchange	34704	N	ordinary-hazard group 2	2250	120			67
21	chapel	self service storage	29122	N	ordinary-hazard group 2	2250	120			66
22	museum	shopping/exchange	26520	N	ordinary-hazard group 2	2250	120			65
23	museum	shopping/exchange	7800	N	ordinary-hazard group 2	2250	120			61
24	fire/rescue station	self service storage	3751	N	ordinary-hazard group 2	1500	90			40
25	family housing	family housing	4370	N	light hazard	750	90			38
26	family housing	family housing	4370	N	light hazard	750	90			38
27	administrative building	office	16836	Y	light hazard	250	45	0.1	390	41
28	installation, maintenance, and repair building	industrial facility	39521	N (should)	ordinary-hazard group 2	2250	120			53
30	family housing	family housing	4370	N	light hazard	750	90			38
31	family housing	family housing	4370	N	light hazard	750	90			38
32	recreational equipment checkout	industrial facility	3532	N	light hazard	750	60			2
33	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	30
34	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	near100
35	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
37	administrative building	office	10235	N	light hazard	1125	90			32 or behind37
38	fire/rescue station	office	2171	N	light hazard	750	60			1
39	garage, family housing	self service storage	528	N	ordinary-hazard group 1	1000	90			42 or 43
40	garage, family housing	self service storage	552	N	ordinary-hazard group 1	1000	90			31
42	auditorium, general purpose	auditorium	10450	N	ordinary-hazard group 1	1000	90			38

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
43	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
44	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
45	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	49
46	storage building, general purpose, installation	warehouse (mixed use)	860	N	ordinary-hazard group 2	1500	90			62
47	administrative building	office	1186	N	light hazard	750	60			moat
48	storage building, general purpose, installation	warehouse (mixed use)	2736	N	ordinary-hazard group 2	1500	90			69
49	administrative building	office	561	N	light hazard	750	60			61
50	family housing	family housing	10882	N	light hazard	750	90			65
51	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	48 or 49
52	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
53	administrative building	office	3091	N	light hazard	750	60			61
54	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
55	family housing	family housing	3387	N	light hazard	750	90			35
56	administrative building	office	19878	N	light hazard	1125	90			60
57	installation, maintenance, and repair building	industrial facility	48178	Y	ordinary-hazard group 2	500	75	0.2	600	60
59	information systems facility	office	20161	Y	light hazard	250	45	0.1	390	59
60	family housing	family housing	2143	N	light hazard	750	90			29
61	transient UPH	BOQ/BEQ	3044	N	light hazard	750	60			35
62	family housing	family housing	7370	N	light hazard	750	90			69
63	family housing	family housing	7370	N	light hazard	750	90			69
64	family housing	family housing	2351	N	light hazard	750	90			29
71	garage, family housing	self service storage	1979	N	ordinary-hazard group 1	1000	90			35
73	administrative building	office	1736	N	light hazard	750	60			37A
76	garage, family housing	self service storage	868	N	ordinary-hazard group 1	1000	90			35
77	administrative building	office	8392	N	light hazard	750	60			40
78	garage, family housing	self service storage	2287	N	ordinary-hazard group 1	1000	90			64
80	transient officers UPH	BOQ/BEQ	9634	N	light hazard	750	60			50
82	army continuing education system facility	adult education center	2809	Y	ordinary-hazard group 1	500	60	0.15	421.35	40
82	dental clinic	clinic	4452	Y	light hazard	250	45	0.1	300	40
82	troop dispensary/health clinic	clinic	31569	Y	light hazard	250	45	0.1	300	40
82	administrative building	office	21379	Y	light hazard	250	45	0.1	300	40
82	automation-aided instructional building	office	1032	Y	light hazard	250	45	0.1	103.2	40
82	company headquarters building	office	2240	Y	light hazard	250	45	0.1	224	40
82	general instruction building	office	3341	Y	light hazard	250	45	0.1	300	40
83	administrative building	office	8540	N	light hazard	1125	90			32
84	administrative building	office	3927	N	light hazard	750	60			moat
85	community support facility	office	897	N	light hazard	750	60			62 or moat
86	storage building, general purpose, installation	warehouse (mixed use)	668	N	ordinary-hazard group 2	1500	90			moat
87	enlisted unaccompanied	BOQ/BEQ	35138	Y	light hazard	250	45	0.1	300	46

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
	personnel housing									
87	storage building, general purpose, installation	warehouse (mixed use)	4264	Y	class IV commodities	500	120	0.1	300	46
89	storage building, general purpose, installation	warehouse (mixed use)	2575	N	ordinary-hazard group 2	1500	90			47
90	family housing	family housing	1399	N	light hazard	750	90			51
91	hazardous material storage building, installation	warehouse (mixed use)	210	N	ordinary-hazard group 2	1500	90			18
93	family housing	family housing	5958	N	light hazard	750	90			42
94	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			near158
96	administrative building	office	27687	N	light hazard	1125	90			15
99	private/organizational club building	swimming pool	1703	N	ordinary-hazard group 1	1000	90			11
100	administrative building	office	25911	Y	light hazard	250	45	0.1	300	near100
101	family housing	family housing	11742	N	light hazard	750	90			38
102	family housing	family housing	11742	N	light hazard	750	90			38
103	family housing	family housing	5871	N	light hazard	750	90			41
105	administrative building	office	18527	N	light hazard	1125	90			70
107	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			48
108	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
109	family housing	family housing	3071	N	light hazard	750	90			39
110	family housing	family housing	3071	N	light hazard	750	90			37
111	family housing	family housing	3071	N	light hazard	750	90			37
112	family housing	family housing	3071	N	light hazard	750	90			37
113	family housing	family housing	3071	N	light hazard	750	90			37
114	family housing	family housing	3071	N	light hazard	750	90			34
115	family housing	family housing	3071	N	light hazard	750	90			34
116	administrative building	office	5246	Y	light hazard	250	45	0.1	390	34
117	administrative building	office	10962	N	light hazard	1125	90			61
118	family housing	family housing	7273	N	light hazard	750	90			32
119	family housing	family housing	12173	N	light hazard	750	90			31
120	family housing	family housing	7584	N	light hazard	750	90			31
121	family housing	family housing	10550	N	light hazard	750	90			31
122	garage, family housing	self service storage	302	N	ordinary-hazard group 1	1000	90			32
123	family housing	family housing	10548	N	light hazard	750	90			39
124	family housing	family housing	10548	N	light hazard	750	90			41
125	family housing	family housing	7720	N	light hazard	750	90			41
126	family housing	family housing	10549	N	light hazard	750	90			63
127	family housing	family housing	10226	N	light hazard	750	90			65
128	family housing	family housing	10228	N	light hazard	750	90			66
129	family housing	family housing	10816	N	light hazard	750	90			44
130	family housing	family housing	3071	N	light hazard	750	90			37
131	family housing	family housing	3071	N	light hazard	750	90			37
132	family housing	family housing	3071	N	light hazard	750	90			36
133	auditorium, general purpose	auditorium	42558	N	ordinary-hazard group 1	1500	120			behind37
134	administrative building	office	22696	N	light hazard	1125	90			behind37

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
135	administrative building	office	17010	Y	light hazard	250	45	0.1	390	59
136	transient UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
137	transient officers UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
138	administrative building	office	14468	N	light hazard	750	60			near158
139	administrative building	office	37970	Y	light hazard	250	45	0.1	390	63
140	family housing	family housing	3578	N	light hazard	750	90			51
141	family housing	family housing	4928	N	light hazard	750	90			30
142	family housing	family housing	4928	N	light hazard	750	90			30
143	family housing	family housing	16430	N	light hazard	750	90			35
144	family housing	family housing	16430	N	light hazard	750	90			35
145	CIDC field operations building	office	1366	N	light hazard	750	60			46
146	family housing	family housing	4212	N	light hazard	750	90			28
147	transient officers UPH	BOQ/BEQ	1270	N	light hazard	750	60			28
148	family housing	family housing	3578	N	light hazard	750	90			40
149	family housing	family housing	3578	N	light hazard	750	90			40
150	family housing	family housing	3578	N	light hazard	750	90			40
151	family housing	family housing	3930	N	light hazard	750	90			50
152	family housing	family housing	3579	N	light hazard	750	90			50
153	family housing	family housing	3578	N	light hazard	750	90			51
154	family housing	family housing	3578	N	light hazard	750	90			51
155	family housing	family housing	3578	N	light hazard	750	90			62
156	family housing	family housing	3578	N	light hazard	750	90			62
157	family housing	family housing	7021	N	light hazard	750	90			66
158	family housing	family housing	7021	N	light hazard	750	90			near158
159	administrative building	office	4994	N	light hazard	750	60			moat
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	34
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	near161
163	administrative building	office	15103	N	light hazard	1125	90			34
164	exchange maintenance shop	industrial facility	3249	N	ordinary-hazard group 2	1500	90			14
165	simulator building	office	9542	Y	light hazard	250	45	0.1	390	13
166	chapel	auditorium	3678	N	light hazard	750	60			66
167	family housing	family housing	3883	N	light hazard	750	90			50
168	storage building, general purpose, installation	warehouse (mixed use)	12200	Y	class IV commodities	500	120	0.11	429	52
170	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
171	physical fitness center	swimming pool	34020	Y	light hazard	250	45	0.1	390	40
177	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			near100
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			20
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			22
182	information systems facility	office	3106	N	light hazard	750	60			40
183	private/organizational club building	swimming pool	5370	N	ordinary-hazard group 1	1000	90			33 or 37A

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
185	open dining facility	restaurant	21929	Y	light hazard	250	45	0.1	390	4
186	family housing	family housing	4464	N	light hazard	750	90			52
187	family housing	family housing	4464	N	light hazard	750	90			53
188	family housing	family housing	4464	N	light hazard	750	90			53
191	family housing	family housing	4370	N	light hazard	750	90			53
192	family housing	family housing	4370	N	light hazard	750	90			53
193	family housing	family housing	4370	N	light hazard	750	90			53
194	family housing	family housing	4370	N	light hazard	750	90			53
195	family housing	family housing	4370	N	light hazard	750	90			53
196	family housing	family housing	4370	N	light hazard	750	90			53
198	garage, family housing	self service storage	79	N	ordinary-hazard group 1	1000	90			65
201	bowling center	bowling alley	11569	Y	ordinary-hazard group 1	500	60	0.15	450	11
204	electronic and communications equipment RTD&E building	office	9410	N	ordinary-hazard group 1	1500	120			33
207	cafeteria	restaurant	12776	Y	ordinary-hazard group 1	500	60	0.15	585	37A
208	exchange cafeteria	restaurant	499	N	ordinary-hazard group 1	1500	120			11
209	administrative building	office	1872	N	light hazard	1125	90			65
210	exchange automotive service station	service station	34066	Y	ordinary-hazard group 2	500	75	0.2	600	18, 18A, 19, 19A, or 20
211	storage building, general purpose, installation	warehouse (mixed use)	303	N	ordinary-hazard group 2	1500	90			8
215	hazardous material storage building, installation	warehouse (mixed use)	94	N	ordinary-hazard group 2	1500	90			37 or 37A
217	administrative building	office	1221	N	light hazard	750	60			65
220	garage, family housing	self service storage	3364	N	ordinary-hazard group 1	1000	90			53A
221	recreational equipment checkout	industrial facility	23329	Y	light hazard	250	45	0.1	300	56
222	garage, family housing	self service storage	1415	N	ordinary-hazard group 1	1000	90			53A
223	garage, family housing	self service storage	2348	N	ordinary-hazard group 1	1000	90			29 or 30
224	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1500	90			38
226	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
227	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			42
228	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
234	storage building, general purpose, installation	warehouse (mixed use)	30543	N (should)	ordinary-hazard group 2	2250	120			28
235	indoor morale, welfare, and recreation facility	swimming pool	681	N	light hazard	750	60			4
238	garage, family housing	self service storage	344	N	ordinary-hazard group 1	1000	90			29
240	garage, family housing	self service storage	2342	N	ordinary-hazard group 1	1000	90			66
243	administrative building	office	13125	Y	light hazard	250	45	0.1	300	51 or 52
245	child development center	day care center	8190	Y	light hazard	250	45	0.1	300	16
247	administrative building	office	2704	N	light hazard	750	60			9A
250	storage building, general purpose, installation	warehouse (mixed use)	88	N	ordinary-hazard group 2	1500	90			19A
478	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			66

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
479	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			68
556	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
557	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
558	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
559	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
560	access control building	industrial facility	135	N	light hazard	750	60			46
1093	trailer park near Dog Beach (permanent)	trailer court		N	light hazard	1125	90			2 or 3
A0027	training aids center	office	2222	N	light hazard	750	60			41
Bank	Old Point National Bank	bank	1400	Y	light hazard	250	45	0.1	140	19A or 23
Hotel	Chamberlin Hotel	hotel	185788	N	light hazard	1500	120			32
Marina	Permanent	pier/wharf (1031, 1032, 1033, 1034)		N	ordinary-hazard group 2	2250	120			37A
Park1	parking area, near bldgs. 32 & 1104	parking		N	vehicle parking area	500	120			2
Park2	parking area, near bldg. 185	parking		N	vehicle parking area	500	120			4
Park3	parking area, near abandoned airfield and football field	parking		N	vehicle parking area	500	120			9 or 9A
Park4	parking area, near bldg. 201	parking		N	vehicle parking area	500	120			11
Park5	parking area, behind bldgs. 96 & 175	parking		N	vehicle parking area	500	120			12
Park6	parking area, around bldg. 245	parking		N	vehicle parking area	500	120			16
Park7	parking area, around bldgs. 164 & 165	parking		N	vehicle parking area	500	120			13 or 14
Park8	parking area, around bldgs. 12 & 249	parking		N	vehicle parking area	500	120			14 or 19
Park9	parking area, near bldg. 210	parking		N	vehicle parking area	500	120			18, 18A, 19, or 19A
Park10	parking area, near Old Point National Bank	parking		N	vehicle parking area	500	120			19A or 23
Park11	parking area, near bldg. 36	parking		N	vehicle parking area	500	120			27
Park12	parking area, next to Chamberlin Hotel	parking		N	vehicle parking area	500	120			32 or 33
Park13	parking area, behind bldg. 11	parking		N	vehicle parking area	500	120			33
Park14	parking area, around bldg. 181	parking		N	vehicle parking area	500	120			36 or 37A
Park15	parking area, between bldgs. 110-113 & 114, 115	parking		N	vehicle parking area	500	120			36 or 37A
Park16	parking area, near bldgs. 25, 30, 31, & 42	parking		N	vehicle parking area	500	120			38
Park17	parking area, near bldgs. 56, 57, & 243	parking		N	vehicle parking area	500	120			52 or 60
Park18	parking area, near bldgs. 59 & 252	parking		N	vehicle parking area	500	120			59
Park19	parking area, near bldgs. T-100 & T-101	parking		N	vehicle parking area	500	120			57

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
Park20	parking area, behind bldgs. 81 & T-99	parking		N	vehicle parking area	500	120			56
Park21	parking area, near bldgs. T-58 & T-59	parking		N	vehicle parking area	500	120			46 or 47
Park22	parking area, between bldgs. 87 & 89	parking		N	vehicle parking area	500	120			46
Park23	parking area, between bldg. 197 & basketball court	parking		N	vehicle parking area	500	120			46
Park24	parking area, in moat near bldgs. 8 & 9	parking		N	vehicle parking area	500	120			70
Park25	parking area, in moat behind bldg. 5	parking		N	vehicle parking area	500	120			62 or moat
Park26	parking area, in moat near bldg. 117	parking		N	vehicle parking area	500	120			61
Park27	parking area, in moat near bldg. 78	parking		N	vehicle parking area	500	120			64
T0028	garage, family housing	self service storage	498	N	ordinary-hazard group 1	1000	90			68
T0099	storage building, general purpose, installation	warehouse (mixed use)	7744	N (should)	ordinary-hazard group 2	1500	90			56
T0100	storage building, general purpose, installation	warehouse (mixed use)	9374	N (should)	ordinary-hazard group 2	1500	90			52
T0101	installation, maintenance, and repair building	industrial facility	9364	N (should)	ordinary-hazard group 2	1500	90			57 or 58
T0104	storage building, general purpose, installation	warehouse (mixed use)	10076	Y	class IV commodities	500	120	0.11	330	57
T0216	garage, family housing	self service storage	705	N	ordinary-hazard group 1	1000	90			31
T0457	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
T0468	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
NEW1	new building along Darby Street	office	7500	N	light hazard	750	60			55
NEW2	new building along Fenwick Rd. @ Griffith St.	office	7500	N	light hazard	750	60			22
NEW3	new building along Fenwick Rd. next to NEW2	office	7500	N	light hazard	750	60			22
NEW4	new building along Fenwick Rd. at old T-249	office	7500	N	light hazard	750	60			18
NEW5	new building at old T-264	office	7500	N	light hazard	750	60			19
NEW, Admin1	administrative building replacing T-247	office	7500	N	light hazard	750	60			18
NEW, Storage	storage building, general purpose, installation, replacing T-24	warehouse (mixed use)	2000	N	ordinary-hazard group 2	1500	90			70
NEW, Admin2	administrative building replacing T-181, T-182	office	7500	N	light hazard	750	60			54
NEW, Admin3	administrative building replacing T-194 - T-196	office	7500	N	light hazard	750	60			55
NEW, YS1	youth services building behind 221	office	3200	Y	light hazard	250	45	0.1	390	56
NEW, YS2	**youth services building behind 245**	**office**	**5000**	**Y**	**light hazard**	**250**	**45**	**0.1**	390	**15**
NEW, Admin4	**administrative building**	**office**	**7500**	**N**	**light hazard**	**750**	**60**			**15**

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
	replacing 176									
NEW, VTC	**video teleconference center**	**office**	**7500**	**N**	**light hazard**	**750**	**60**			**36 or 37A**
NEW, Admin5	**administrative building replacing T-260, T-261**	**office**	**7500**	**N**	**light hazard**	**750**	**60**			**14**
NEW, Admin6	**administrative building replacing T-183, T-184, T-191, & T-192**	**office**	**7500**	**N**	**light hazard**	**750**	**60**			**54 or 55**
W300	Wherry family housing	family housing	1250	N	light hazard	500	90			26
W301	Wherry family housing	family housing	1250	N	light hazard	500	90			26
W302	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W303	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W304	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W305	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W306	Wherry family housing	family housing	1250	N	light hazard	500	90			26
W307	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W309	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W311	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W312	Wherry family housing	family housing	4400	N	light hazard	750	90			24
W313	Wherry family housing	family housing	4400	N	light hazard	750	90			25
W314	Wherry family housing	family housing	4400	N	light hazard	750	90			24
W316	Wherry family housing	family housing	4400	N	light hazard	750	90			24
W318	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W320	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W322	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W324	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W342	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W344	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W346	Wherry family housing	family housing	4400	N	light hazard	750	90			26
W348	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W350	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W352	Wherry family housing	family housing	4400	N	light hazard	750	90			21
W354	Wherry family housing	family housing	4400	N	light hazard	750	90			16
W356	Wherry family housing	family housing	4400	N	light hazard	750	90			16
W440	Wherry family housing	family housing	4400	N	light hazard	750	90			8
W442	Wherry family housing	family housing	4400	N	light hazard	750	90			8
W444	Wherry family housing	family housing	4400	N	light hazard	750	90			7
W482	Wherry family housing	family housing	4400	N	light hazard	750	90			8
W484	Wherry family housing	family housing	4400	N	light hazard	750	90			8

Note: New construction in bold typeface.

Table C-4
Fire Flow Requirements

YR3

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
1	family housing	family housing	6689	N	light hazard	750	90			64
2	private/organizational club building	shopping/exchange	7488	N	ordinary-hazard group 2	1500	90			64
3	family housing	family housing	5643	N	light hazard	750	90			64
5	exchange cafeteria	restaurant	97408	Y	ordinary-hazard group 1	500	60	0.15	450	62 or moat
7	library branch	office	4856	N	ordinary-hazard group 2	1500	90			70
8	organizational storage building	warehouse (mixed use)	659	N	ordinary-hazard group 2	1500	90			70
9	band training building	auditorium	12965	Y	ordinary-hazard group 1	500	60	0.15	585	70
10	administrative building	office	33548	Y	light hazard	250	45	0.1	300	69
10	storage building, general purpose, installation	warehouse (mixed use)	7315	Y	class IV commodities	500	120	0.09	270	69
11	administrative building	office	7974	N	light hazard	750	60			33
13	garage, family housing	self service storage	1160	N	ordinary-hazard group 1	1000	90			53A
14	museum	shopping/exchange	3694	N	ordinary-hazard group 2	1500	90			68
15	family housing	family housing	6965	N	light hazard	750	90			66
16	family housing	family housing	5220	N	light hazard	750	90			66
17	family housing	family housing	10234	N	light hazard	750	90			67
18	family housing	family housing	10234	N	light hazard	750	90			67 or 68
19	family housing	family housing	3204	N	light hazard	750	90			68
20	museum	shopping/exchange	34704	N	ordinary-hazard group 2	2250	120			67
21	chapel	self service storage	29122	N	ordinary-hazard group 2	2250	120			66
22	museum	shopping/exchange	26520	N	ordinary-hazard group 2	2250	120			65
23	museum	shopping/exchange	7800	N	ordinary-hazard group 2	2250	120			61
24	fire/rescue station	self service storage	3751	N	ordinary-hazard group 2	1500	90			40
25	family housing	family housing	4370	N	light hazard	750	90			38
26	family housing	family housing	4370	N	light hazard	750	90			38
27	administrative building	office	16836	Y	light hazard	250	45	0.1	390	41
28	installation, maintenance, and repair building	industrial facility	39521	N (should)	ordinary-hazard group 2	2250	120			53
30	family housing	family housing	4370	N	light hazard	750	90			38
31	family housing	family housing	4370	N	light hazard	750	90			38
32	recreational equipment checkout	industrial facility	3532	N	light hazard	750	60			2
33	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	30
34	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	near100
35	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
37	administrative building	office	10235	N	light hazard	1125	90			32 or behind37
38	fire/rescue station	office	2171	N	light hazard	750	60			1
39	garage, family housing	self service storage	528	N	ordinary-hazard group 1	1000	90			42 or 43
40	garage, family housing	self service storage	552	N	ordinary-hazard group 1	1000	90			31
42	auditorium, general purpose	auditorium	10450	N	ordinary-hazard group 1	1000	90			38

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
43	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
44	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
45	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	49
46	storage building, general purpose, installation	warehouse (mixed use)	860	N	ordinary-hazard group 2	1500	90			62
47	administrative building	office	1186	N	light hazard	750	60			moat
48	storage building, general purpose, installation	warehouse (mixed use)	2736	N	ordinary-hazard group 2	1500	90			69
49	administrative building	office	561	N	light hazard	750	60			61
50	family housing	family housing	10882	N	light hazard	750	90			65
51	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	48 or 49
52	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
53	administrative building	office	3091	N	light hazard	750	60			61
54	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
55	family housing	family housing	3387	N	light hazard	750	90			35
56	administrative building	office	19878	N	light hazard	1125	90			60
57	installation, maintenance, and repair building	industrial facility	48178	Y	ordinary-hazard group 2	500	75	0.2	600	60
59	information systems facility	office	20161	Y	light hazard	250	45	0.1	390	59
60	family housing	family housing	2143	N	light hazard	750	90			29
61	transient UPH	BOQ/BEQ	3044	N	light hazard	750	60			35
62	family housing	family housing	7370	N	light hazard	750	90			69
63	family housing	family housing	7370	N	light hazard	750	90			69
64	family housing	family housing	2351	N	light hazard	750	90			29
71	garage, family housing	self service storage	1979	N	ordinary-hazard group 1	1000	90			35
73	administrative building	office	1736	N	light hazard	750	60			37A
76	garage, family housing	self service storage	868	N	ordinary-hazard group 1	1000	90			35
77	administrative building	office	8392	N	light hazard	750	60			40
78	garage, family housing	self service storage	2287	N	ordinary-hazard group 1	1000	90			64
80	transient officers UPH	BOQ/BEQ	9634	N	light hazard	750	60			50
82	army continuing education system facility	adult education center	2809	Y	ordinary-hazard group 1	500	60	0.15	421.35	40
82	dental clinic	clinic	4452	Y	light hazard	250	45	0.1	300	40
82	troop dispensary/health clinic	clinic	31569	Y	light hazard	250	45	0.1	300	40
82	administrative building	office	21379	Y	light hazard	250	45	0.1	300	40
82	automation-aided instructional building	office	1032	Y	light hazard	250	45	0.1	103.2	40
82	company headquarters building	office	2240	Y	light hazard	250	45	0.1	224	40
82	general instruction building	office	3341	Y	light hazard	250	45	0.1	300	40
83	administrative building	office	8540	N	light hazard	1125	90			32
84	administrative building	office	3927	N	light hazard	750	60			moat
85	community support facility	office	897	N	light hazard	750	60			62 or moat
86	storage building, general purpose, installation	warehouse (mixed use)	668	N	ordinary-hazard group 2	1500	90			moat
87	enlisted unaccompanied	BOQ/BEQ	35138	Y	light hazard	250	45	0.1	300	46

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
	personnel housing									
87	storage building, general purpose, installation	warehouse (mixed use)	4264	Y	class IV commodities	500	120	0.1	300	46
89	storage building, general purpose, installation	warehouse (mixed use)	2575	N	ordinary-hazard group 2	1500	90			47
90	family housing	family housing	1399	N	light hazard	750	90			51
91	hazardous material storage building, installation	warehouse (mixed use)	210	N	ordinary-hazard group 2	1500	90			18
93	family housing	family housing	5958	N	light hazard	750	90			42
94	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			near158
96	administrative building	office	27687	N	light hazard	1125	90			15
99	private/organizational club building	swimming pool	1703	N	ordinary-hazard group 1	1000	90			11
100	administrative building	office	25911	Y	light hazard	250	45	0.1	300	near100
101	family housing	family housing	11742	N	light hazard	750	90			38
102	family housing	family housing	11742	N	light hazard	750	90			38
103	family housing	family housing	5871	N	light hazard	750	90			41
105	administrative building	office	18527	N	light hazard	1125	90			70
107	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			48
108	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
109	family housing	family housing	3071	N	light hazard	750	90			39
110	family housing	family housing	3071	N	light hazard	750	90			37
111	family housing	family housing	3071	N	light hazard	750	90			37
112	family housing	family housing	3071	N	light hazard	750	90			37
113	family housing	family housing	3071	N	light hazard	750	90			37
114	family housing	family housing	3071	N	light hazard	750	90			34
115	family housing	family housing	3071	N	light hazard	750	90			34
116	administrative building	office	5246	Y	light hazard	250	45	0.1	390	34
117	administrative building	office	10962	N	light hazard	1125	90			61
118	family housing	family housing	7273	N	light hazard	750	90			32
119	family housing	family housing	12173	N	light hazard	750	90			31
120	family housing	family housing	7584	N	light hazard	750	90			31
121	family housing	family housing	10550	N	light hazard	750	90			31
122	garage, family housing	self service storage	302	N	ordinary-hazard group 1	1000	90			32
123	family housing	family housing	10548	N	light hazard	750	90			39
124	family housing	family housing	10548	N	light hazard	750	90			41
125	family housing	family housing	7720	N	light hazard	750	90			41
126	family housing	family housing	10549	N	light hazard	750	90			63
127	family housing	family housing	10226	N	light hazard	750	90			65
128	family housing	family housing	10228	N	light hazard	750	90			66
129	family housing	family housing	10816	N	light hazard	750	90			44
130	family housing	family housing	3071	N	light hazard	750	90			37
131	family housing	family housing	3071	N	light hazard	750	90			37
132	family housing	family housing	3071	N	light hazard	750	90			36
133	auditorium, general purpose	auditorium	42558	N	ordinary-hazard group 1	1500	120			behind37
134	administrative building	office	22696	N	light hazard	1125	90			behind37

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
135	administrative building	office	17010	Y	light hazard	250	45	0.1	390	59
136	transient UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
137	transient officers UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
138	administrative building	office	14468	N	light hazard	750	60			near158
139	administrative building	office	37970	Y	light hazard	250	45	0.1	390	63
140	family housing	family housing	3578	N	light hazard	750	90			51
141	family housing	family housing	4928	N	light hazard	750	90			30
142	family housing	family housing	4928	N	light hazard	750	90			30
143	family housing	family housing	16430	N	light hazard	750	90			35
144	family housing	family housing	16430	N	light hazard	750	90			35
145	CIDC field operations building	office	1366	N	light hazard	750	60			46
146	family housing	family housing	4212	N	light hazard	750	90			28
147	transient officers UPH	BOQ/BEQ	1270	N	light hazard	750	60			28
148	family housing	family housing	3578	N	light hazard	750	90			40
149	family housing	family housing	3578	N	light hazard	750	90			40
150	family housing	family housing	3578	N	light hazard	750	90			40
151	family housing	family housing	3930	N	light hazard	750	90			50
152	family housing	family housing	3579	N	light hazard	750	90			50
153	family housing	family housing	3578	N	light hazard	750	90			51
154	family housing	family housing	3578	N	light hazard	750	90			51
155	family housing	family housing	3578	N	light hazard	750	90			62
156	family housing	family housing	3578	N	light hazard	750	90			62
157	family housing	family housing	7021	N	light hazard	750	90			66
158	family housing	family housing	7021	N	light hazard	750	90			near158
159	administrative building	office	4994	N	light hazard	750	60			moat
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	34
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	near161
163	administrative building	office	15103	N	light hazard	1125	90			34
164	exchange maintenance shop	industrial facility	3249	N	ordinary-hazard group 2	1500	90			14
165	simulator building	office	9542	Y	light hazard	250	45	0.1	390	13
166	chapel	auditorium	3678	N	light hazard	750	60			66
167	family housing	family housing	3883	N	light hazard	750	90			50
168	storage building, general purpose, installation	warehouse (mixed use)	12200	Y	class IV commodities	500	120	0.11	429	52
170	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
171	physical fitness center	swimming pool	34020	Y	light hazard	250	45	0.1	390	40
177	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			near100
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			20
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			22
182	information systems facility	office	3106	N	light hazard	750	60			40
183	private/organizational club building	swimming pool	5370	N	ordinary-hazard group 1	1000	90			33 or 37A

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
185	open dining facility	restaurant	21929	Y	light hazard	250	45	0.1	390	4
186	family housing	family housing	4464	N	light hazard	750	90			52
187	family housing	family housing	4464	N	light hazard	750	90			53
188	family housing	family housing	4464	N	light hazard	750	90			53
191	family housing	family housing	4370	N	light hazard	750	90			53
192	family housing	family housing	4370	N	light hazard	750	90			53
193	family housing	family housing	4370	N	light hazard	750	90			53
194	family housing	family housing	4370	N	light hazard	750	90			53
195	family housing	family housing	4370	N	light hazard	750	90			53
196	family housing	family housing	4370	N	light hazard	750	90			53
198	garage, family housing	self service storage	79	N	ordinary-hazard group 1	1000	90			65
201	bowling center	bowling alley	11569	Y	ordinary-hazard group 1	500	60	0.15	450	11
204	electronic and communications equipment RTD&E building	office	9410	N	ordinary-hazard group 1	1500	120			33
207	cafeteria	restaurant	12776	Y	ordinary-hazard group 1	500	60	0.15	585	37A
208	exchange cafeteria	restaurant	499	N	ordinary-hazard group 1	1500	120			11
209	administrative building	office	1872	N	light hazard	1125	90			65
210	exchange automotive service station	service station	34066	Y	ordinary-hazard group 2	500	75	0.2	600	18, 18A, 19, 19A, or 20
211	storage building, general purpose, installation	warehouse (mixed use)	303	N	ordinary-hazard group 2	1500	90			8
215	hazardous material storage building, installation	warehouse (mixed use)	94	N	ordinary-hazard group 2	1500	90			37 or 37A
217	administrative building	office	1221	N	light hazard	750	60			65
220	garage, family housing	self service storage	3364	N	ordinary-hazard group 1	1000	90			53A
221	recreational equipment checkout	industrial facility	23329	Y	light hazard	250	45	0.1	300	56
222	garage, family housing	self service storage	1415	N	ordinary-hazard group 1	1000	90			53A
223	garage, family housing	self service storage	2348	N	ordinary-hazard group 1	1000	90			29 or 30
224	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1500	90			38
226	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
227	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			42
228	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
234	storage building, general purpose, installation	warehouse (mixed use)	30543	N (should)	ordinary-hazard group 2	2250	120			28
235	indoor morale, welfare, and recreation facility	swimming pool	681	N	light hazard	750	60			4
238	garage, family housing	self service storage	344	N	ordinary-hazard group 1	1000	90			29
240	garage, family housing	self service storage	2342	N	ordinary-hazard group 1	1000	90			66
243	administrative building	office	13125	Y	light hazard	250	45	0.1	300	51 or 52
245	child development center	day care center	8190	Y	light hazard	250	45	0.1	300	16
247	administrative building	office	2704	N	light hazard	750	60			9A
250	storage building, general purpose, installation	warehouse (mixed use)	88	N	ordinary-hazard group 2	1500	90			19A
478	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			66

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
479	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			68
556	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
557	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
558	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
559	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
560	access control building	industrial facility	135	N	light hazard	750	60			46
1093	trailer park near Dog Beach (permanent)	trailer court		N	light hazard	1125	90			2 or 3
A0027	training aids center	office	2222	N	light hazard	750	60			41
Bank	Old Point National Bank	bank	1400	Y	light hazard	250	45	0.1	140	19A or 23
Hotel	Chamberlin Hotel	hotel	185788	N	light hazard	1500	120			32
Marina	Permanent	pier/wharf (1031, 1032, 1033, 1034)		N	ordinary-hazard group 2	2250	120			37A
Park1	parking area, near bldgs. 32 & 1104	parking		N	vehicle parking area	500	120			2
Park2	parking area, near bldg. 185	parking		N	vehicle parking area	500	120			4
Park3	parking area, near abandoned airfield and football field	parking		N	vehicle parking area	500	120			9 or 9A
Park4	parking area, near bldg. 201	parking		N	vehicle parking area	500	120			11
Park5	parking area, behind bldgs. 96 & 175	parking		N	vehicle parking area	500	120			12
Park6	parking area, around bldg. 245	parking		N	vehicle parking area	500	120			16
Park7	parking area, around bldgs. 164 & 165	parking		N	vehicle parking area	500	120			13 or 14
Park8	parking area, around bldgs. 12 & 249	parking		N	vehicle parking area	500	120			14 or 19
Park9	parking area, near bldg. 210	parking		N	vehicle parking area	500	120			18, 18A, 19, or 19A
Park10	parking area, near Old Point National Bank	parking		N	vehicle parking area	500	120			19A or 23
Park11	parking area, near bldg. 36	parking		N	vehicle parking area	500	120			27
Park12	parking area, next to Chamberlin Hotel	parking		N	vehicle parking area	500	120			32 or 33
Park13	parking area, behind bldg. 11	parking		N	vehicle parking area	500	120			33
Park14	parking area, around bldg. 181	parking		N	vehicle parking area	500	120			36 or 37A
Park15	parking area, between bldgs. 110-113 & 114, 115	parking		N	vehicle parking area	500	120			36 or 37A
Park16	parking area, near bldgs. 25, 30, 31, & 42	parking		N	vehicle parking area	500	120			38
Park17	parking area, near bldgs. 56, 57, & 243	parking		N	vehicle parking area	500	120			52 or 60
Park18	parking area, near bldgs. 59 & 252	parking		N	vehicle parking area	500	120			59
Park19	parking area, near bldgs. T-100 & T-101	parking		N	vehicle parking area	500	120			57

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
Park20	parking area, behind bldgs. 81 & T-99	parking		N	vehicle parking area	500	120			56
Park21	parking area, near bldgs. T-58 & T-59	parking		N	vehicle parking area	500	120			46 or 47
Park22	parking area, between bldgs. 87 & 89	parking		N	vehicle parking area	500	120			46
Park23	parking area, between bldg. 197 & basketball court	parking		N	vehicle parking area	500	120			46
Park24	parking area, in moat near bldgs. 8 & 9	parking		N	vehicle parking area	500	120			70
Park25	parking area, in moat behind bldg. 5	parking		N	vehicle parking area	500	120			62 or moat
Park26	parking area, in moat near bldg. 117	parking		N	vehicle parking area	500	120			61
Park27	parking area, in moat near bldg. 78	parking		N	vehicle parking area	500	120			64
T0028	garage, family housing	self service storage	498	N	ordinary-hazard group 1	1000	90			68
T0099	storage building, general purpose, installation	warehouse (mixed use)	7744	N (should)	ordinary-hazard group 2	1500	90			56
T0100	storage building, general purpose, installation	warehouse (mixed use)	9374	N (should)	ordinary-hazard group 2	1500	90			52
T0101	installation, maintenance, and repair building	industrial facility	9364	N (should)	ordinary-hazard group 2	1500	90			57 or 58
T0104	storage building, general purpose, installation	warehouse (mixed use)	10076	Y	class IV commodities	500	120	0.11	330	57
T0216	garage, family housing	self service storage	705	N	ordinary-hazard group 1	1000	90			31
T0457	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
T0468	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
NEW1	new building along Darby Street	office	7500	N	light hazard	750	60			55
NEW2	new building along Fenwick Rd. @ Griffith St.	office	7500	N	light hazard	750	60			22
NEW3	new building along Fenwick Rd. next to NEW2	office	7500	N	light hazard	750	60			22
NEW4	new building along Fenwick Rd. at old T-249	office	7500	N	light hazard	750	60			18
NEW5	new building at old T-264	office	7500	N	light hazard	750	60			19
NEW, Admin1	administrative building replacing T-247	office	7500	N	light hazard	750	60			18
NEW, Storage	storage building, general purpose, installation, replacing T-24	warehouse (mixed use)	2000	N	ordinary-hazard group 2	1500	90			70
NEW, Admin2	administrative building replacing T-181, T-182	office	7500	N	light hazard	750	60			54
NEW, Admin3	administrative building replacing T-194 - T-196	office	7500	N	light hazard	750	60			55
NEW, YS1	youth services building behind 221	office	3200	Y	light hazard	250	45	0.1	390	56
NEW, YS2	youth services building behind 245	office	5000	Y	light hazard	250	45	0.1	390	15
NEW, Admin4	administrative building	office	7500	N	light hazard	750	60			15

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
	replacing 176									
NEW, VTC	video teleconference center	office	7500	N	light hazard	750	60			36 or 37A
NEW, Admin5	administrative building replacing T-260, T-261	office	7500	N	light hazard	750	60			14
NEW, Admin6	administrative building replacing T-183, T-184, T-191, & T-192	office	7500	N	light hazard	750	60			54 or 55
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**7**
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**8**
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**9**
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**11**
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**15**
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**16**
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**21**
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**24**
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**25**
NEW, FH	**family housing replacing Wherry**	**family housing**	**?**	**N**	**light hazard**	**750**	**90**			**26**

Notes: New construction in bold typeface.

By the end of YR3, all 206 Wherry housing units are to be replaced. Although there is no firm design for the rebuild, 88 units without sprinkler systems will replace the current 206 units. Fire flow requirements for the Wherry housing rebuild have been allocated to the same 10 fire hydrants as the original Wherry housing

Table C-5
Fire Flow Requirements

YR5

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
1	family housing	family housing	6689	N	light hazard	750	90			64
2	private/organizational club building	shopping/exchange	7488	N	ordinary-hazard group 2	1500	90			64
3	family housing	family housing	5643	N	light hazard	750	90			64
5	exchange cafeteria	restaurant	97408	Y	ordinary-hazard group 1	500	60	0.15	450	62 or moat
7	library branch	office	4856	N	ordinary-hazard group 2	1500	90			70
8	organizational storage building	warehouse (mixed use)	659	N	ordinary-hazard group 2	1500	90			70
9	band training building	auditorium	12965	Y	ordinary-hazard group 1	500	60	0.15	585	70
10	administrative building	office	33548	Y	light hazard	250	45	0.1	300	69
10	storage building, general purpose, installation	warehouse (mixed use)	7315	Y	class IV commodities	500	120	0.09	270	69
11	administrative building	office	7974	N	light hazard	750	60			33
13	garage, family housing	self service storage	1160	N	ordinary-hazard group 1	1000	90			53A
14	museum	shopping/exchange	3694	N	ordinary-hazard group 2	1500	90			68
15	family housing	family housing	6965	N	light hazard	750	90			66
16	family housing	family housing	5220	N	light hazard	750	90			66
17	family housing	family housing	10234	N	light hazard	750	90			67
18	family housing	family housing	10234	N	light hazard	750	90			67 or 68
19	family housing	family housing	3204	N	light hazard	750	90			68
20	museum	shopping/exchange	34704	N	ordinary-hazard group 2	2250	120			67
21	chapel	self service storage	29122	N	ordinary-hazard group 2	2250	120			66
22	museum	shopping/exchange	26520	N	ordinary-hazard group 2	2250	120			65
23	museum	shopping/exchange	7800	N	ordinary-hazard group 2	2250	120			61
24	fire/rescue station	self service storage	3751	N	ordinary-hazard group 2	1500	90			40
25	family housing	family housing	4370	N	light hazard	750	90			38
26	family housing	family housing	4370	N	light hazard	750	90			38
27	administrative building	office	16836	Y	light hazard	250	45	0.1	390	41
28	installation, maintenance, and repair building	industrial facility	39521	N (should)	ordinary-hazard group 2	2250	120			53
30	family housing	family housing	4370	N	light hazard	750	90			38
31	family housing	family housing	4370	N	light hazard	750	90			38
32	recreational equipment checkout	industrial facility	3532	N	light hazard	750	60			2
33	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	30
34	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	near100
35	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
37	administrative building	office	10235	N	light hazard	1125	90			32 or behind37
38	fire/rescue station	office	2171	N	light hazard	750	60			1
39	garage, family housing	self service storage	528	N	ordinary-hazard group 1	1000	90			42 or 43
40	garage, family housing	self service storage	552	N	ordinary-hazard group 1	1000	90			31
42	auditorium, general purpose	auditorium	10450	N	ordinary-hazard group 1	1000	90			38

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
43	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
44	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	44
45	family housing	family housing	10837	Y	light hazard	250	45	0.1	390	49
46	storage building, general purpose, installation	warehouse (mixed use)	860	N	ordinary-hazard group 2	1500	90			62
47	administrative building	office	1186	N	light hazard	750	60			moat
48	storage building, general purpose, installation	warehouse (mixed use)	2736	N	ordinary-hazard group 2	1500	90			69
49	administrative building	office	561	N	light hazard	750	60			61
50	family housing	family housing	10882	N	light hazard	750	90			65
51	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	48 or 49
52	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
53	administrative building	office	3091	N	light hazard	750	60			61
54	family housing	family housing	11194	Y	light hazard	250	45	0.1	390	45
55	family housing	family housing	3387	N	light hazard	750	90			35
56	administrative building	office	19878	N	light hazard	1125	90			60
57	installation, maintenance, and repair building	industrial facility	48178	Y	ordinary-hazard group 2	500	75	0.2	600	60
59	information systems facility	office	20161	Y	light hazard	250	45	0.1	390	59
60	family housing	family housing	2143	N	light hazard	750	90			29
61	transient UPH	BOQ/BEQ	3044	N	light hazard	750	60			35
62	family housing	family housing	7370	N	light hazard	750	90			69
63	family housing	family housing	7370	N	light hazard	750	90			69
64	family housing	family housing	2351	N	light hazard	750	90			29
71	garage, family housing	self service storage	1979	N	ordinary-hazard group 1	1000	90			35
73	administrative building	office	1736	N	light hazard	750	60			37A
76	garage, family housing	self service storage	868	N	ordinary-hazard group 1	1000	90			35
77	administrative building	office	8392	N	light hazard	750	60			40
78	garage, family housing	self service storage	2287	N	ordinary-hazard group 1	1000	90			64
80	transient officers UPH	BOQ/BEQ	9634	N	light hazard	750	60			50
82	army continuing education system facility	adult education center	2809	Y	ordinary-hazard group 1	500	60	0.15	421.35	40
82	dental clinic	clinic	4452	Y	light hazard	250	45	0.1	300	40
82	troop dispensary/health clinic	clinic	31569	Y	light hazard	250	45	0.1	300	40
82	administrative building	office	21379	Y	light hazard	250	45	0.1	300	40
82	automation-aided instructional building	office	1032	Y	light hazard	250	45	0.1	103.2	40
82	company headquarters building	office	2240	Y	light hazard	250	45	0.1	224	40
82	general instruction building	office	3341	Y	light hazard	250	45	0.1	300	40
83	administrative building	office	8540	N	light hazard	1125	90			32
84	administrative building	office	3927	N	light hazard	750	60			moat
85	community support facility	office	897	N	light hazard	750	60			62 or moat
86	storage building, general purpose, installation	warehouse (mixed use)	668	N	ordinary-hazard group 2	1500	90			moat
87	enlisted unaccompanied	BOQ/BEQ	35138	Y	light hazard	250	45	0.1	300	46

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
	personnel housing									
87	storage building, general purpose, installation	warehouse (mixed use)	4264	Y	class IV commodities	500	120	0.1	300	46
89	storage building, general purpose, installation	warehouse (mixed use)	2575	N	ordinary-hazard group 2	1500	90			47
90	family housing	family housing	1399	N	light hazard	750	90			51
91	hazardous material storage building, installation	warehouse (mixed use)	210	N	ordinary-hazard group 2	1500	90			18
93	family housing	family housing	5958	N	light hazard	750	90			42
94	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			near158
96	administrative building	office	27687	N	light hazard	1125	90			15
99	private/organizational club building	swimming pool	1703	N	ordinary-hazard group 1	1000	90			11
100	administrative building	office	25911	Y	light hazard	250	45	0.1	300	near100
101	family housing	family housing	11742	N	light hazard	750	90			38
102	family housing	family housing	11742	N	light hazard	750	90			38
103	family housing	family housing	5871	N	light hazard	750	90			41
105	administrative building	office	18527	N	light hazard	1125	90			70
107	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			48
108	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
109	family housing	family housing	3071	N	light hazard	750	90			39
110	family housing	family housing	3071	N	light hazard	750	90			37
111	family housing	family housing	3071	N	light hazard	750	90			37
112	family housing	family housing	3071	N	light hazard	750	90			37
113	family housing	family housing	3071	N	light hazard	750	90			37
114	family housing	family housing	3071	N	light hazard	750	90			34
115	family housing	family housing	3071	N	light hazard	750	90			34
116	administrative building	office	5246	Y	light hazard	250	45	0.1	390	34
117	administrative building	office	10962	N	light hazard	1125	90			61
118	family housing	family housing	7273	N	light hazard	750	90			32
119	family housing	family housing	12173	N	light hazard	750	90			31
120	family housing	family housing	7584	N	light hazard	750	90			31
121	family housing	family housing	10550	N	light hazard	750	90			31
122	garage, family housing	self service storage	302	N	ordinary-hazard group 1	1000	90			32
123	family housing	family housing	10548	N	light hazard	750	90			39
124	family housing	family housing	10548	N	light hazard	750	90			41
125	family housing	family housing	7720	N	light hazard	750	90			41
126	family housing	family housing	10549	N	light hazard	750	90			63
127	family housing	family housing	10226	N	light hazard	750	90			65
128	family housing	family housing	10228	N	light hazard	750	90			66
129	family housing	family housing	10816	N	light hazard	750	90			44
130	family housing	family housing	3071	N	light hazard	750	90			37
131	family housing	family housing	3071	N	light hazard	750	90			37
132	family housing	family housing	3071	N	light hazard	750	90			36
133	auditorium, general purpose	auditorium	42558	N	ordinary-hazard group 1	1500	120			behind37
134	administrative building	office	22696	N	light hazard	1125	90			behind37

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
135	administrative building	office	17010	Y	light hazard	250	45	0.1	390	59
136	transient UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
137	transient officers UPH	BOQ/BEQ	1693	N	light hazard	750	60			51
138	administrative building	office	14468	N	light hazard	750	60			near158
139	administrative building	office	37970	Y	light hazard	250	45	0.1	390	63
140	family housing	family housing	3578	N	light hazard	750	90			51
141	family housing	family housing	4928	N	light hazard	750	90			30
142	family housing	family housing	4928	N	light hazard	750	90			30
143	family housing	family housing	16430	N	light hazard	750	90			35
144	family housing	family housing	16430	N	light hazard	750	90			35
145	CIDC field operations building	office	1366	N	light hazard	750	60			46
146	family housing	family housing	4212	N	light hazard	750	90			28
147	transient officers UPH	BOQ/BEQ	1270	N	light hazard	750	60			28
148	family housing	family housing	3578	N	light hazard	750	90			40
149	family housing	family housing	3578	N	light hazard	750	90			40
150	family housing	family housing	3578	N	light hazard	750	90			40
151	family housing	family housing	3930	N	light hazard	750	90			50
152	family housing	family housing	3579	N	light hazard	750	90			50
153	family housing	family housing	3578	N	light hazard	750	90			51
154	family housing	family housing	3578	N	light hazard	750	90			51
155	family housing	family housing	3578	N	light hazard	750	90			62
156	family housing	family housing	3578	N	light hazard	750	90			62
157	family housing	family housing	7021	N	light hazard	750	90			66
158	family housing	family housing	7021	N	light hazard	750	90			near158
159	administrative building	office	4994	N	light hazard	750	60			moat
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	34
161	administrative building	office	40468	Y	light hazard	250	45	0.1	300	near161
163	administrative building	office	15103	N	light hazard	1125	90			34
166	chapel	auditorium	3678	N	light hazard	750	60			66
167	family housing	family housing	3883	N	light hazard	750	90			50
168	storage building, general purpose, installation	warehouse (mixed use)	12200	Y	class IV commodities	500	120	0.11	429	52
170	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			49
171	physical fitness center	swimming pool	34020	Y	light hazard	250	45	0.1	390	40
177	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			near100
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			20
178	hazardous material storage building, installation	warehouse (mixed use)	1470	N	ordinary-hazard group 2	1500	90			22
182	information systems facility	office	3106	N	light hazard	750	60			40
183	private/organizational club building	swimming pool	5370	N	ordinary-hazard group 1	1000	90			33 or 37A
185	open dining facility	restaurant	21929	Y	light hazard	250	45	0.1	390	4
186	family housing	family housing	4464	N	light hazard	750	90			52
187	family housing	family housing	4464	N	light hazard	750	90			53

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
188	family housing	family housing	4464	N	light hazard	750	90			53
191	family housing	family housing	4370	N	light hazard	750	90			53
192	family housing	family housing	4370	N	light hazard	750	90			53
193	family housing	family housing	4370	N	light hazard	750	90			53
194	family housing	family housing	4370	N	light hazard	750	90			53
195	family housing	family housing	4370	N	light hazard	750	90			53
196	family housing	family housing	4370	N	light hazard	750	90			53
198	garage, family housing	self service storage	79	N	ordinary-hazard group 1	1000	90			65
201	bowling center	bowling alley	11569	Y	ordinary-hazard group 1	500	60	0.15	450	11
204	electronic and communications equipment RTD&E building	office	9410	N	ordinary-hazard group 1	1500	120			33
207	cafeteria	restaurant	12776	Y	ordinary-hazard group 1	500	60	0.15	585	37A
208	exchange cafeteria	restaurant	499	N	ordinary-hazard group 1	1500	120			11
209	administrative building	office	1872	N	light hazard	1125	90			65
210	exchange automotive service station	service station	34066	Y	ordinary-hazard group 2	500	75	0.2	600	18, 18A, 19, 19A, or 20
211	storage building, general purpose, installation	warehouse (mixed use)	303	N	ordinary-hazard group 2	1500	90			8
215	hazardous material storage building, installation	warehouse (mixed use)	94	N	ordinary-hazard group 2	1500	90			37 or 37A
217	administrative building	office	1221	N	light hazard	750	60			65
220	garage, family housing	self service storage	3364	N	ordinary-hazard group 1	1000	90			53A
221	recreational equipment checkout	industrial facility	23329	Y	light hazard	250	45	0.1	300	56
222	garage, family housing	self service storage	1415	N	ordinary-hazard group 1	1000	90			53A
223	garage, family housing	self service storage	2348	N	ordinary-hazard group 1	1000	90			29 or 30
224	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1500	90			38
226	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
227	garage, family housing	self service storage	325	N	ordinary-hazard group 1	1000	90			42
228	garage, family housing	self service storage	1137	N	ordinary-hazard group 1	1000	90			42
234	storage building, general purpose, installation	warehouse (mixed use)	30543	N (should)	ordinary-hazard group 2	2250	120			28
235	indoor morale, welfare, and recreation facility	swimming pool	681	N	light hazard	750	60			4
238	garage, family housing	self service storage	344	N	ordinary-hazard group 1	1000	90			29
240	garage, family housing	self service storage	2342	N	ordinary-hazard group 1	1000	90			66
243	administrative building	office	13125	Y	light hazard	250	45	0.1	300	51 or 52
245	child development center	day care center	8190	Y	light hazard	250	45	0.1	300	16
247	administrative building	office	2704	N	light hazard	750	60			9A
250	storage building, general purpose, installation	warehouse (mixed use)	88	N	ordinary-hazard group 2	1500	90			19A
478	garage, family housing	self service storage	2250	N	ordinary-hazard group 1	1000	90			66
479	garage, family housing	self service storage	1694	N	ordinary-hazard group 1	1000	90			68
556	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
557	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
558	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
559	installation and ready-issue ammunition storage	warehouse (mixed use)	114	N	ordinary-hazard group 1	1000	90			5
560	access control building	industrial facility	135	N	light hazard	750	60			46
1093	trailer park near Dog Beach (permanent)	trailer court		N	light hazard	1125	90			2 or 3
A0027	training aids center	office	2222	N	light hazard	750	60			41
Bank	Old Point National Bank	bank	1400	Y	light hazard	250	45	0.1	140	19A or 23
Hotel	Chamberlin Hotel	hotel	185788	N	light hazard	1500	120			32
Marina	Permanent	pier/wharf (1031, 1032, 1033, 1034)		N	ordinary-hazard group 2	2250	120			37A
Park1	parking area, near bldgs. 32 & 1104	parking		N	vehicle parking area	500	120			2
Park2	parking area, near bldg. 185	parking		N	vehicle parking area	500	120			4
Park3	parking area, near abandoned airfield and football field	parking		N	vehicle parking area	500	120			9 or 9A
Park4	parking area, near bldg. 201	parking		N	vehicle parking area	500	120			11
Park5	parking area, behind bldgs. 96 & 175	parking		N	vehicle parking area	500	120			12
Park6	parking area, around bldg. 245	parking		N	vehicle parking area	500	120			16
Park7	parking area, around bldgs. 164 & 165	parking		N	vehicle parking area	500	120			13 or 14
Park8	parking area, around bldgs. 12 & 249	parking		N	vehicle parking area	500	120			14 or 19
Park9	parking area, near bldg. 210	parking		N	vehicle parking area	500	120			18, 18A, 19, or 19A
Park10	parking area, near Old Point National Bank	parking		N	vehicle parking area	500	120			19A or 23
Park11	parking area, near bldg. 36	parking		N	vehicle parking area	500	120			27
Park12	parking area, next to Chamberlin Hotel	parking		N	vehicle parking area	500	120			32 or 33
Park13	parking area, behind bldg. 11	parking		N	vehicle parking area	500	120			33
Park14	parking area, around bldg. 181	parking		N	vehicle parking area	500	120			36 or 37A
Park15	parking area, between bldgs. 110-113 & 114, 115	parking		N	vehicle parking area	500	120			36 or 37A
Park16	parking area, near bldgs. 25, 30, 31, & 42	parking		N	vehicle parking area	500	120			38
Park17	parking area, near bldgs. 56, 57, & 243	parking		N	vehicle parking area	500	120			52 or 60
Park18	parking area, near bldgs. 59 & 252	parking		N	vehicle parking area	500	120			59
Park19	parking area, near bldgs. T-100 & T-101	parking		N	vehicle parking area	500	120			57
Park20	parking area, behind bldgs. 81 & T-99	parking		N	vehicle parking area	500	120			56
Park21	parking area, near bldgs. T-58 & T-59	parking		N	vehicle parking area	500	120			46 or 47

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
Park22	parking area, between bldgs. 87 & 89	parking		N	vehicle parking area	500	120			46
Park23	parking area, between bldg. 197 & basketball court	parking		N	vehicle parking area	500	120			46
Park24	parking area, in moat near bldgs. 8 & 9	parking		N	vehicle parking area	500	120			70
Park25	parking area, in moat behind bldg. 5	parking		N	vehicle parking area	500	120			62 or moat
Park26	parking area, in moat near bldg. 117	parking		N	vehicle parking area	500	120			61
Park27	parking area, in moat near bldg. 78	parking		N	vehicle parking area	500	120			64
T0028	garage, family housing	self service storage	498	N	ordinary-hazard group 1	1000	90			68
T0099	storage building, general purpose, installation	warehouse (mixed use)	7744	N (should)	ordinary-hazard group 2	1500	90			56
T0100	storage building, general purpose, installation	warehouse (mixed use)	9374	N (should)	ordinary-hazard group 2	1500	90			52
T0101	installation, maintenance, and repair building	industrial facility	9364	N (should)	ordinary-hazard group 2	1500	90			57 or 58
T0104	storage building, general purpose, installation	warehouse (mixed use)	10076	Y	class IV commodities	500	120	0.11	330	57
T0216	garage, family housing	self service storage	705	N	ordinary-hazard group 1	1000	90			31
T0457	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
T0468	garage, family housing	self service storage	531	N	ordinary-hazard group 1	1000	90			31
NEW1	new building along Darby Street	office	7500	N	light hazard	750	60			55
NEW2	new building along Fenwick Rd. @ Griffith St.	office	7500	N	light hazard	750	60			22
NEW3	new building along Fenwick Rd. next to NEW2	office	7500	N	light hazard	750	60			22
NEW4	new building along Fenwick Rd. at old T-249	office	7500	N	light hazard	750	60			18
NEW5	new building at old T-264	office	7500	N	light hazard	750	60			19
NEW, Admin1	administrative building replacing T-247	office	7500	N	light hazard	750	60			18
NEW, Storage	storage building, general purpose, installation, replacing T-24	warehouse (mixed use)	2000	N	ordinary-hazard group 2	1500	90			70
NEW, Admin2	administrative building replacing T-181, T-182	office	7500	N	light hazard	750	60			54
NEW, Admin3	administrative building replacing T-194 - T-196	office	7500	N	light hazard	750	60			55
NEW, YS1	youth services building behind 221	office	3200	Y	light hazard	250	45	0.1	390	56
NEW, YS2	youth services building behind 245	office	5000	Y	light hazard	250	45	0.1	390	15
NEW, Admin4	administrative building replacing 176	office	7500	N	light hazard	750	60			15
NEW, VTC	video teleconference center	office	7500	N	light hazard	750	60			36 or 37A
NEW, Admin5	administrative building	office	7500	N	light hazard	750	60			14

Building No.	Description	Facility Type	Area (ft2)	Sprinklers (Y/N)	Occupancy Classification	Hose Flow Rate (gpm)	Hose Duration (min)	Sprinkler Design Density (gpm/sq. ft)	Sprinkler Sprinkler Demand (gpm)	Hydrant No.
NEW, Admin6	replacing T-260, T-261 administrative building	office	7500	N	light hazard	750	60			54 or 55
NEW, FH	replacing T-183, T-184, T-191, & T-192 family housing replacing Wherry	family housing	?	N	light hazard	750	90			7
NEW, FH	family housing replacing Wherry	family housing	?	N	light hazard	750	90			8
NEW, FH	family housing replacing Wherry	family housing	?	N	light hazard	750	90			9
NEW, FH	family housing replacing Wherry	family housing	?	N	light hazard	750	90			11
NEW, FH	family housing replacing Wherry	family housing	?	N	light hazard	750	90			15
NEW, FH	family housing replacing Wherry	family housing	?	N	light hazard	750	90			16
NEW, FH	family housing replacing Wherry	family housing	?	N	light hazard	750	90			21
NEW, FH	family housing replacing Wherry	family housing	?	N	light hazard	750	90			24
NEW, FH	family housing replacing Wherry	family housing	?	N	light hazard	750	90			25
NEW, FH	family housing replacing Wherry	family housing	?	N	light hazard	750	90			26
NEW, 52052	**emergency services building, fire/rescue station**	**office**	**3000**	**Y**	**light hazard**	**250**	**45**	**0.1**	**390**	**13 or 14**
NEW, 52052	**emergency services building, police/mp station**	**office**	**3000**	**Y**	**light hazard**	**250**	**45**	**0.1**	**390**	**13 or 14**
NEW, 52052	**emergency services building, storage**	**self service storage**	**9500**	**Y**	**class IV commodities**	**500**	**120**	**0.17**	**663**	**13 or 14**
NEW, 52052	**emergency services building, BOQ/BEQ**	**BOQ/BEQ**	**2500**	**Y**	**light hazard**	**250**	**45**	**0.1**	**390**	**13 or 14**

Note: New construction in bold typeface.

Table C-6
Rates Used for Fire Flow Analysis

Existing Conditions

Hose			Sprinkler	
Hydrant No.	Flow Rate (gpm)	Duration (min)	Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)
1	750	60		
2	1125	90		
3	1500	90		
4	750	60		
5	1000	90		
7	750	90		
8	1500	90		
9	750	90		
11	1500	120		
12	500	120		
13	250	45	0.1	390
13	500	120		
14	1500	90		
15	1125	90		
16	750	90		
18	1500	90		
19	500	75	0.2	600
19	750	60		
20	1500	90		
21	750	90		
22	1500	90		
23	500	120		
24	1500	90		
25	750	90		
26	1500	90		
27	500	60	0.15	585
27	500	120		
28	2250	120		
29	1000	90		
30	1000	90		
31	1000	90		
32	1500	120		
33	1500	120		
34	1125	90		
35	1000	90		
36	750	90		
36	500	75	0.2	780

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
37	1500	90		
38	1500	90		
39	750	90		
40	1500	90		
41	750	90		
42	1000	90		
43	1000	90		
44	750	90		
45	250	45	0.1	390
46	500	120	0.1	300
47	1500	90		
48	1000	90		
49	1000	90		
50	750	90		
51	750	90		
52	1500	90		
53	2250	120		
54	750	60		
55	1500	90		
56	1500	90		
57	1500	90		
58	1500	90		
59	250	45	0.1	390
59	500	120		
60	1125	90		
61	2250	120		
62	1500	90		
63	750	90		
64	1500	90		
65	2250	120		
66	2250	120		
67	2250	120		
68	1500	90		
69	1500	90		
70	1500	90		
18A	500	75	0.2	600
18A	750	60		
19A	1500	90		
37A	2250	120		
53A	1000	90		
9A	750	60		

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
behind37	1500	120		
moat	1500	90		
near100	1000	90		
near158	1000	90		
near161	250	45	0.1	300

Table C-7
Rates Used for Fire Flow Analysis

YR1

Hose			Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
1	750	60		
2	1125	90		
3	**1125**	**90**		
4	750	60		
5	1000	90		
7	750	90		
8	1500	90		
9	750	90		
11	1500	120		
12	500	120		
13	250	45	0.1	390
13	500	120		
14	1500	90		
15	1125	90		
16	750	90		
18	1500	90		
19	500	75	0.2	600
19	750	60		
20	1500	90		
21	750	90		
22	1500	90		
23	500	120		
24	**750**	**90**		
25	750	90		
26	**750**	**90**		
27	500	120		
28	2250	120		
29	1000	90		
30	1000	90		
31	1000	90		
32	1500	120		
33	1500	120		
34	1125	90		
35	1000	90		
36	750	90		
36	500	75	0.2	780
37	1500	90		

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
38	1500	90		
39	750	90		
40	1500	90		
41	750	90		
42	1000	90		
43	1000	90		
44	750	90		
45	250	45	0.1	390
46	500	120	0.1	300
47	1500	90		
48	1000	90		
49	1000	90		
50	750	90		
51	750	90		
52	1500	90		
53	2250	120		
54	750	60		
55	**750**	**60**		
56	1500	90		
57	1500	90		
58	1500	90		
59	250	45	0.1	390
59	500	120		
60	1125	90		
61	2250	120		
62	1500	90		
63	750	90		
64	1500	90		
65	2250	120		
66	2250	120		
67	2250	120		
68	1500	90		
69	1500	90		
70	1500	90		
18A	500	75	0.2	600
18A	500	120		
19A	1500	90		
37A	2250	120		
53A	1000	90		
9A	750	60		
behind37	1500	120		

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
moat	1500	90		
near100	1000	90		
near158	1000	90		
near161	250	45	0.1	300

Note: Fire flow requirements that differ from the existing conditions are bold and italicized.

Table C-8
Rates Used for Fire Flow Analysis

YR2

Hose		Sprinkler		
Hydrant No.	Flow Rate (gpm)	Duration (min)	Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)
1	750	60		
2	1125	90		
3	1125	90		
4	750	60		
5	1000	90		
7	750	90		
8	1500	90		
9	750	90		
11	1500	120		
12	500	120		
13	250	45	0.1	390
13	500	120		
14	1500	90		
15	1125	90		
16	750	90		
18	1500	90		
19	500	75	0.2	600
19	750	60		
20	1500	90		
21	750	90		
22	1500	90		
23	500	120		
24	750	90		
25	750	90		
26	750	90		
27	500	120		
28	2250	120		
29	1000	90		
30	1000	90		
31	1000	90		
32	1500	120		
33	1500	120		
34	1125	90		
35	1000	90		
36	750	90		
37	1500	90		
38	1500	90		

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
39	750	90		
40	1500	90		
41	750	90		
42	1000	90		
43	1000	90		
44	750	90		
45	250	45	0.1	390
46	500	120	0.1	300
47	1500	90		
48	1000	90		
49	1000	90		
50	750	90		
51	750	90		
52	1500	90		
53	2250	120		
54	750	60		
55	750	60		
56	1500	90		
57	1500	90		
58	1500	90		
59	250	45	0.1	390
59	500	120		
60	1125	90		
61	2250	120		
62	1500	90		
63	750	90		
64	1500	90		
65	2250	120		
66	2250	120		
67	2250	120		
68	1500	90		
69	1500	90		
70	1500	90		
18A	500	75	0.2	600
18A	500	120		
19A	1500	90		
37A	2250	120		
53A	1000	90		
9A	750	60		
behind37	1500	120		
moat	1500	90		

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
near100	1000	90		
near158	1000	90		
near161	250	45	0.1	300

Note: Fire flow requirements that differ from YR1 are bold and italicized.

Table C-9
Rates Used for Fire Flow Analysis

YR3

Hose			Sprinkler	
Hydrant No.	Flow Rate (gpm)	Duration (min)	Design Density (gpm/sq. ft)	Sprinkler Demand (gpm)
1	750	60		
2	1125	90		
3	1125	90		
4	750	60		
5	1000	90		
7	750	90		
8	1500	90		
9	750	90		
11	1500	120		
12	500	120		
13	250	45	0.1	390
13	500	120		
14	1500	90		
15	1125	90		
16	750	90		
18	1500	90		
19	500	75	0.2	600
19	750	60		
20	1500	90		
21	750	90		
22	1500	90		
23	500	120		
24	750	90		
25	750	90		
26	750	90		
27	500	120		
28	2250	120		
29	1000	90		
30	1000	90		
31	1000	90		
32	1500	120		
33	1500	120		
34	1125	90		
35	1000	90		
36	750	90		
37	1500	90		
38	1500	90		

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
39	750	90		
40	1500	90		
41	750	90		
42	1000	90		
43	1000	90		
44	750	90		
45	250	45	0.1	390
46	500	120	0.1	300
47	1500	90		
48	1000	90		
49	1000	90		
50	750	90		
51	750	90		
52	1500	90		
53	2250	120		
54	750	60		
55	750	60		
56	1500	90		
57	1500	90		
58	1500	90		
59	250	45	0.1	390
59	500	120		
60	1125	90		
61	2250	120		
62	1500	90		
63	750	90		
64	1500	90		
65	2250	120		
66	2250	120		
67	2250	120		
68	1500	90		
69	1500	90		
70	1500	90		
18A	500	75	0.2	600
18A	500	120		
19A	1500	90		
37A	2250	120		
53A	1000	90		
9A	750	60		
behind37	1500	120		
moat	1500	90		

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
near100	1000	90		
near158	1000	90		
near161	250	45	0.1	300

Note: Fire flow requirements for YR3 are consistent with YR2.

Table C-10
Rates Used for Fire Flow Analysis

YR5

Hose			Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
1	750	60		
2	1125	90		
3	1125	90		
4	750	60		
5	1000	90		
7	750	90		
8	1500	90		
9	750	90		
11	1500	120		
12	500	120		
13	**500**	**120**	**0.17**	**663**
14	750	60		
14	**500**	**120**	**0.17**	**663**
15	1125	90		
16	750	90		
18	1500	90		
19	500	75	0.2	600
19	750	60		
20	1500	90		
21	750	90		
22	1500	90		
23	500	120		
24	750	90		
25	750	90		
26	750	90		
27	500	120		
28	2250	120		
29	1000	90		
30	1000	90		
31	1000	90		
32	1500	120		
33	1500	120		
34	1125	90		
35	1000	90		
36	750	90		
36	500	120		
37	1500	90		

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
38	1500	90		
39	750	90		
40	1500	90		
41	750	90		
42	1000	90		
43	1000	90		
44	750	90		
45	250	45	0.1	390
46	500	120	0.1	300
47	1500	90		
48	1000	90		
49	1000	90		
50	750	90		
51	750	90		
52	1500	90		
53	2250	120		
54	750	60		
55	750	60		
56	1500	90		
57	1500	90		
58	1500	90		
59	250	45	0.1	390
59	500	120		
60	1125	90		
61	2250	120		
62	1500	90		
63	750	90		
64	1500	90		
65	2250	120		
66	2250	120		
67	2250	120		
68	1500	90		
69	1500	90		
70	1500	90		
18A	500	75	0.2	600
18A	500	120		
19A	1500	90		
37A	2250	120		
53A	1000	90		
9A	750	60		
behind37	1500	120		

	Hose		Sprinkler	
Hydrant No.	**Flow Rate (gpm)**	**Duration (min)**	**Design Density (gpm/sq. ft)**	**Sprinkler Demand (gpm)**
moat	1500	90		
near100	1000	90		
near158	1000	90		
near161	250	45	0.1	300

Note: Flow requirements that differ from YR3 are bold and italicized.

Appendix D: Leak Detection Reports

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M.E. SIMPSON Co., Inc.

3406 Enterprise Avenue
P.O. Box 1995
Valparaiso, IN 46384-1995

800/255-1521
Fax: 888/531-2444
www.mesimpson.com

Branch offices:
Grayslake, IL
Indianapolis, IN

December 2, 2003

Mr. Michael J. Barbachem, P.E., DEE
URS Corporation
277 Bendix Road Suite 500
Virginia Beach, VA 23452

Dear Mr. Barbachem,

M.E. Simpson Company is a technical service company that offers Leak Survey Programs, Large Meter Testing and Repair Programs, Water Main Location, and Valve Exercising, Location and Computer Mapping Programs. These "Technical Services" offered by M. E. Simpson Company are designed to aid a utility in reducing unaccounted for water and lost revenue.

M. E. Simpson Company is pleased to submit this report of our leak detection survey for the URS Corporation. This survey addressed the Fort Monroe water distribution system, consisting of approximately 18 miles of water main. The report contains the results of our investigation that includes the following:

1. A DESCRIPTION OF THE AREA SURVEYED.
2. METHODOLOGY OF THE SURVEY.
3. A LIST OF LEAKS AND TYPE OF LEAK LOCATED.
4. GENERAL RECOMMENDATIONS BASED ON OUR INVESTIGATION.

DESCRIPTION OF THE AREA SURVEYED

Approximately 95,040 lineal feet were surveyed as part of the system investigation. This included all fire hydrants, all accessible mainline valves, and 12 services.

METHODOLOGY

Your survey was conducted using the latest state of the art leak computers, the **FLUID CONSERVATION SYSTEMS' Tri-Corr 2001** the **90/90** or **C2000** with the **MP90** preamplifier-transducer system. All of these correlators are manufactured by Fluid Conservation Systems of Milford, Ohio. These electronic instruments are microprocessor units that measure the time it takes the sound of the leak to travel from the leak to the point where the leak correlator is connected to the water line. By connecting the leak correlator to the water line at two locations, it will compute the distance from the leak to each connection point thus enabling us to determine the exact leak location. Our experienced technicians used these devices, along with the **S20** electronically enhanced listening device, as listening equipment to survey your pipeline network. Each hydrant and accessible valve was used as listening points to identify leaks. Twelve services, b-boxes, were used on an as needed basis to keep the listening distances under five hundred feet (500'). All PVC style watermains were investigated via correlation. Correlation distances for PVC did not exceeding five hundred feet (500') unless listening points were unavailable. **"Pin-Pointing"** of the leak, as well as locating leaks that other methods fail to reveal was also done with this equipment.

LEAKAGE LOCATED

All water mains within the project area were surveyed and 5 leaks were located. These leaks have been grouped as follows: Main Line Leak - 0, Service Line Leak - 0, Fire Service Leak-0, Valve Leak - 1, Hydrant Leak - 2, Other Type Leak - 2. All of these leaks have been verbally reported to your office with these locations, so many have probably been repaired already. Following are the leak locations with an estimated GPD (Gallons Per Day) leakage potential.

Type	Location	SIZE
Valve (packing)	Ingalls Road & Reeder Circle see enclosed diagram	720 GPD
Hydrant	20 Bernard Road see enclosed diagram **Fixed**	720 GPD
Hydrant	Ruckman Road & Bernard Road see enclosed diagram **Fixed**	720 GPD
Other	McNair Drive & Family House see enclosed diagram	14,400 GPD
Other	Fenwick Road (across from the Heliport) see enclosed diagram	2,880 GPD
5 Leaks Located	**ESTIMATED LEAKAGE TOTAL**	**19,440 GPD**

LEAK QUANTITIES

Quantifying leaks is difficult because there is not any accurate means of doing so. Pipe material, size of the leak, system pressure, soil material and water table will effect the noise that a leak makes. Small leaks under high system pressure will make more noise than a large leak under low system pressure. However, the above leaks are of sufficient noise levels that the above estimates should be very conservative. Using a purchase price of $3.61 per one hundred cubic feet, these leaks were costing your utility in excess of $93.70 per day or $34,200.79 annually. It's obvious that this Leak Survey Program has proven to be cost effective. Naturally the main line leaks have the greatest potential for loss followed by service line, valves, and finally hydrants. Once leaks have been repaired, we would recommend that the Utility compare pumping rates before and after. This information will be more meaningful and accurate.

RECOMMENDATIONS

This survey confirms that the Fort Monroe's water distribution system will benefit from this project by a reduction in underground leakage. There is always a concern over the cost effectiveness of leak detection because of the uncertainty of the number of leaks located. However, with your present cost of water and the discovery of these five leaks, the cost of this 2003 leak survey will pay for itself within three months. It only takes a recovery of about 4,547 gallons per day on an annual basis (3.2 gallons per day is only 4,547 gallons per minute throughout your entire water distribution system) to recover your investment. We would recommend that you conduct a Leak Survey Program every year. This recommendation becomes more critical as your cost of water increases.

We appreciate your cooperation and that of the utility staff who were available to answer our questions during this project. If you have any questions with the information in this report, please do not hesitate to call.

Sincerely Yours,

Gregory J. Engel
Customer Service Manager
GJE/mem

M.E. SIMPSON COMPANY, INC. - Professional Services

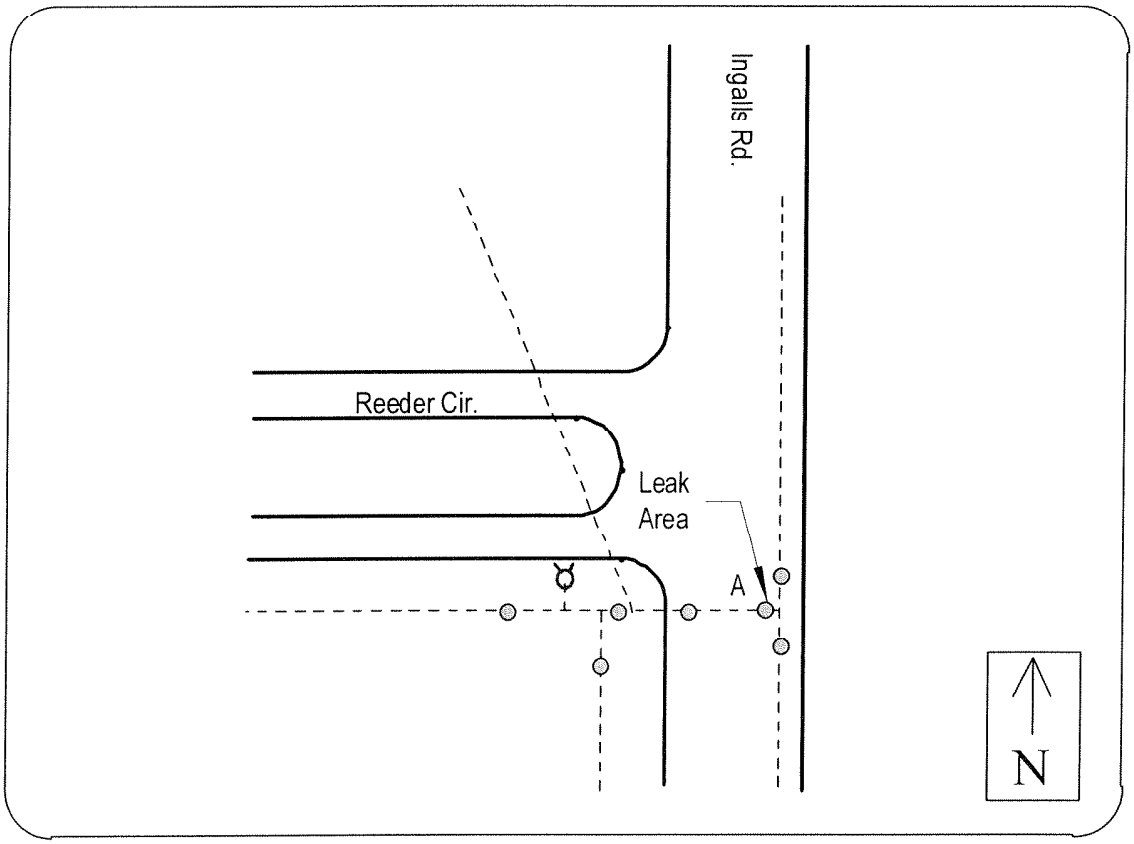
LEAK LOCATION REPORT

Client: URS Corporation (Ft. Monroe, Virgi **Time:** 10:00

Date: Tuesday, November 18, 2003 **Tech:** Sandison P. & Clinton B.

Address: Ingalls Road & Reeder Circle

Below is a diagram of the area surveyed for a suspect leak.



Distance: 0' from A

Connection point: A= Main Line Valve

Connection point:

Connection point:

Connection point:

Leak Location: 0' from A

Comments: This is a packing leak.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

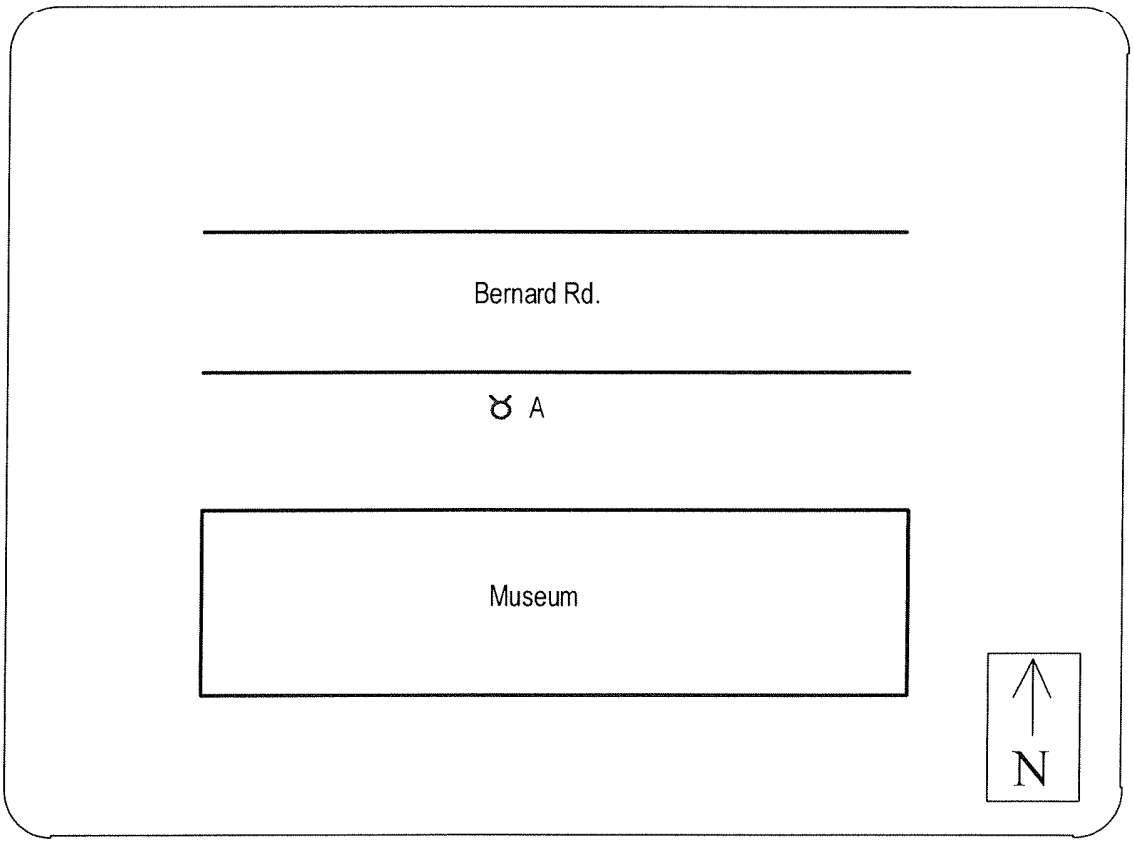
LEAK LOCATION REPORT

Client: URS Corporation (Ft. Monroe, Virgi **Time:** 11:00

Date: Wednesday, November 19, 2003 **Tech:** Sandison P. & Clinton B.

Address: 20 Bernard Road

Below is a diagram of the area surveyed for a suspect leak.



Distance: 0' from A

Connection point: A= Hydrant

Connection point:

Connection point:

Connection point:

Leak Location: 0' from A

Comments: This was a hydrant leak. We tightened the hydrant top nut and the leak noise quit. This leak is fixed.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

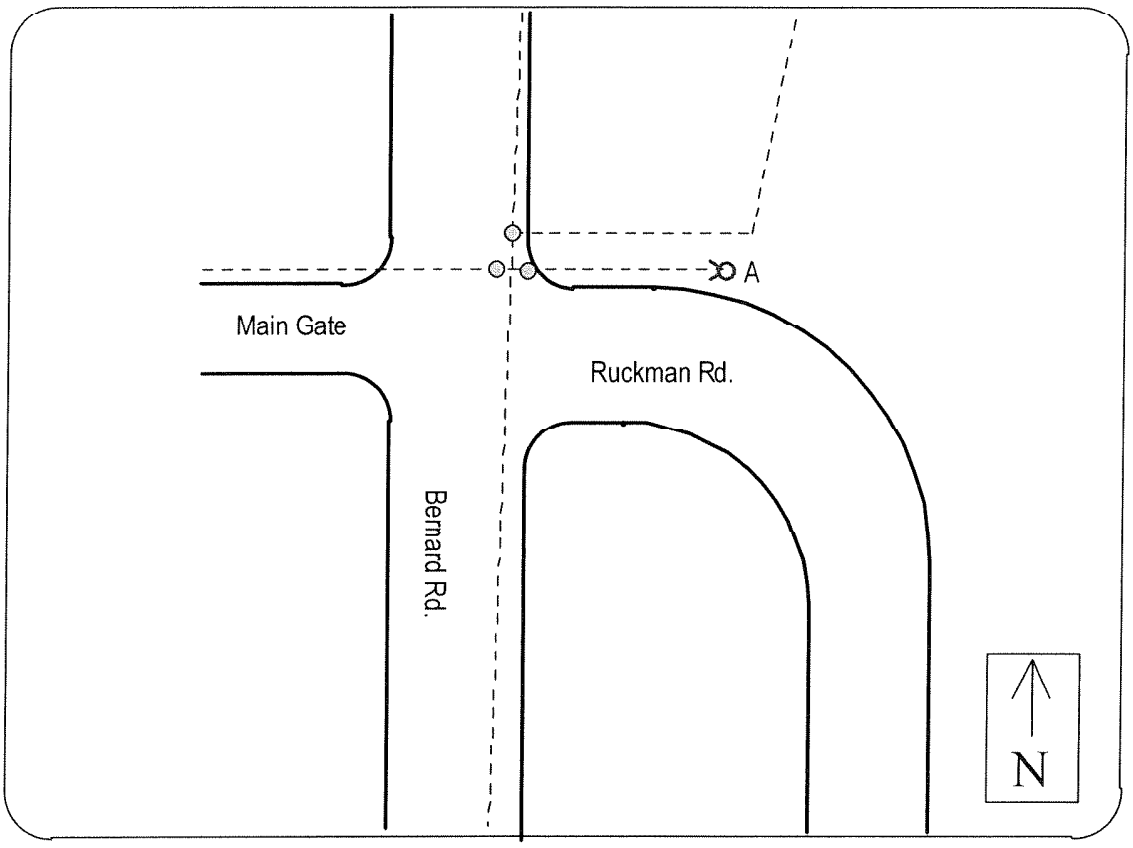
LEAK LOCATION REPORT

Client: URS Corporation (Ft. Monroe, Virgi **Time:** 12:00

Date: Wednesday, November 19, 2003 **Tech:** Sandison P. & Clinton B.

Address: Ruckman Road & Bernard Road

Below is a diagram of the area surveyed for a suspect leak.



Distance: 0' from A

Connection point: A= Hydrant

Connection point:

Connection point:

Connection point:

Leak Location: 0' from A

Comments: This was a hydrant leak. We tightened the hydrant top nut and the leak noise quit. This leak is fixed.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

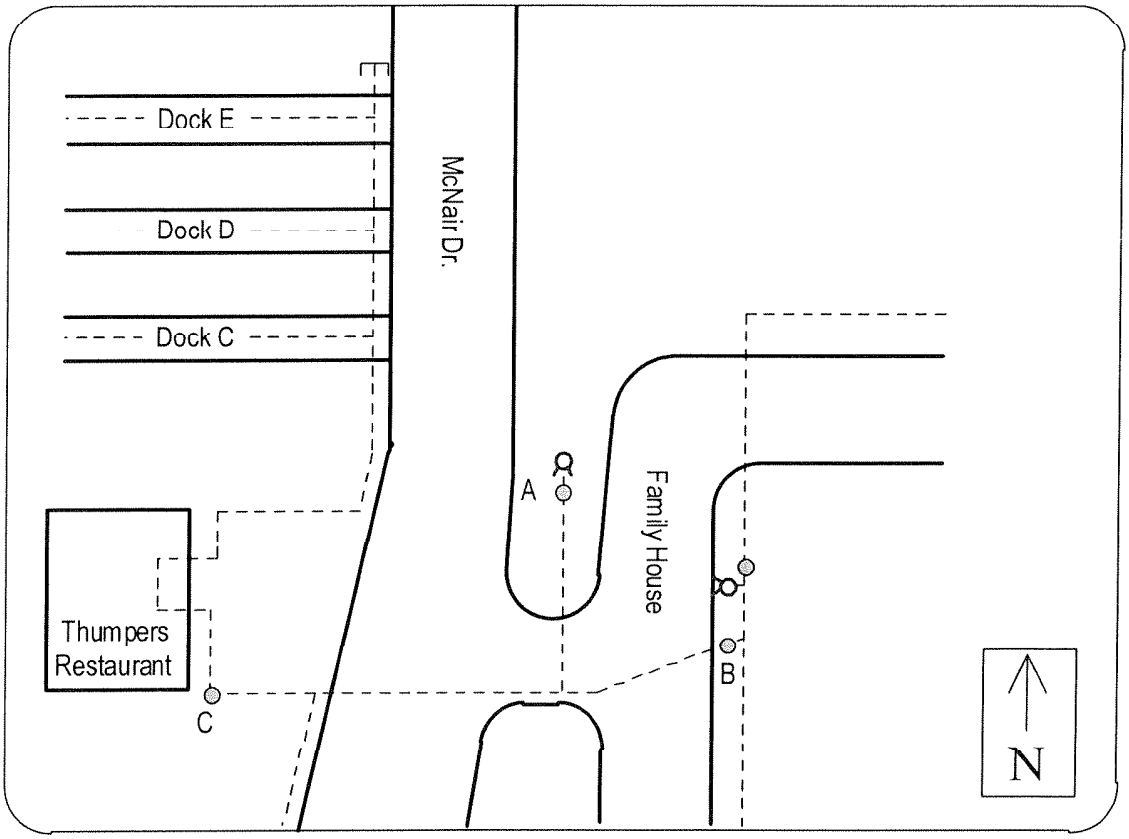
LEAK LOCATION REPORT

Client: URS Corporation (Ft. Monroe, Virginia) **Time:** 09:30

Date: Thursday, November 20, 2003 **Tech:** Sandison P. & Clinton B.

Address: McNair Drive & Family House

Below is a diagram of the area surveyed for a suspect leak.



Distance: 228' from A to B / 240' from A to C

Connection point: A= Hydrant Valve

Connection point: B= Main Line Valve

Connection point: C= Post Indicator Valve

Connection point:

Leak Location:

Comments: There is a leak on the boat dock between dock C, D or E. There is a large amount of leak noise in this area.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

M.E. SIMPSON COMPANY, INC. - Professional Services

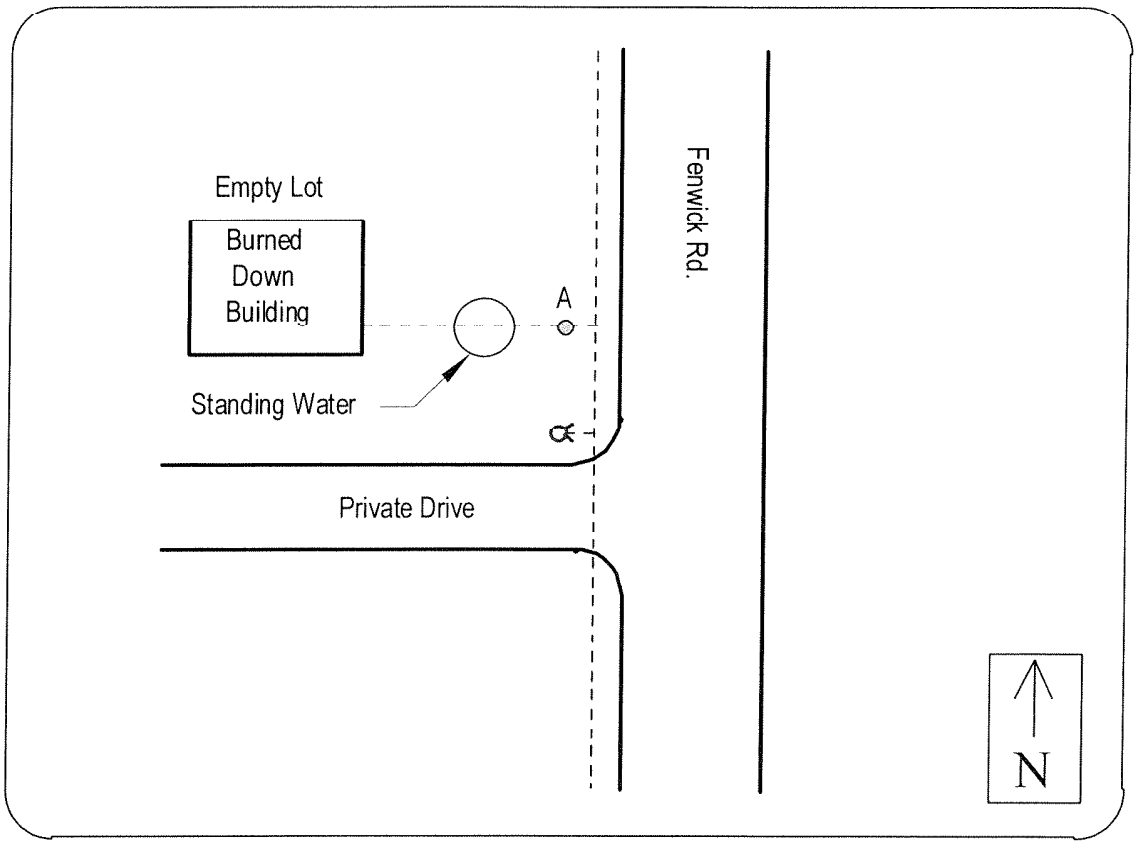
LEAK LOCATION REPORT

Client: URS Corporation (Ft. Monroe, Virgi **Time:** 14:00

Date: Wednesday, November 19, 2003 **Tech:** Sandison P. & Clinton B.

Address: Fenwick Road (across from the Heliport)

Below is a diagram of the area surveyed for a suspect leak.



Distance: 0' from A

Connection point: A= Service Valve

Connection point:

Connection point:

Connection point:

Leak Location:

Comments: Only one connection could be used in this setting. We suggested that they dig where the standing water is.

We thank you for the opportunity to work for your Utility and look forward to serving you again. If you have any questions please don't hesitate to call.

Appendix E: C-Factor Tests

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Table E-1
Summary of C-factor Test Data after Gauge Calibration

		Flow Hydrant				Pressure Hydrant 1 (downstr.)			Pressure Hydrant 2 (upstr.)			Calculate C-Factor		
Test No.	Material	D_{nozzle} (in)	$Coef._Q$	$P_{flowing}$ (psi)	Q (gpm)	P_{static} (psi)	$P_{residual}$ (psi)	P_{st}-P_{res} (psi)	P_{static} (psi)	$P_{residual}$ (psi)	P_{st}-P_{res} (psi)	$L_{1,2}$ (ft)	D (ft)	$C_{1,2}$
1	cast iron	2.5	0.9	5.5	394.43	47.5	46.5	1	48	47.5	0.5	420	1	49
2	cast iron	2.5	0.9	0.5	118.93	48	36	12	48	43	5	570	0.833	7
3	cast iron	2.5	0.9	23.5	815.32	48	35	13	48	43	5	570	0.833	43
4	cast iron	2.5	0.9	18.5	723.4	48	29	19	49	31	18	247	0.833	75
5	cast iron	2.5	0.9	18.5	723.4	48.5	29	19.5	48	37	11	810	0.833	45
6	cast iron	2.5	0.9	4.5	356.78	48	12.5	35.5	48	18	30	380	0.75	25
7	cast iron	2.5	0.9	2.5	265.93	48	9	39	48	25	23	1693	0.75	23
8	cast iron	2.5	0.9	3.5	314.65	49	13	36	49	18	31	1612	0.75	50
9	cast iron	2.5	0.9	3.5	314.65	49	13	36	49	28	21	2852	0.75	37
10	cast iron	2.5	0.9	4.5	356.78	48	13.5	34.5	48	23	25	208	0.5	38
11	cast iron	2.5	0.9	4.5	356.78	48	13.5	34.5	48	46	2	711	0.5	38
12	cast iron	2.5	0.9	10.5	544.99	48.5	27	21.5	48.5	44	4.5	596	0.5	76
13	cast iron	2.5	0.9	11.5	570.35	48.5	27.5	21	49	46.5	2.5	1034	0.5	102
14	cast iron	2.5	0.9	32.5	958.82	49	44.5	4.5	49	45.5	3.5	402	0.5	496
15	cast iron	2.5	0.9	32.5	958.82	48.5	45	3.5	48.5	45.5	3	629	0.5	919
16	cast iron	2.5	0.9	0.5	118.93	48.5	22	26.5	48	33	15	422	0.5	17
17	cast iron	2.5	0.9	2.5	265.93	49.5	13	36.5	48.5	22	26.5	370	0.5	38
18	cast iron	2.5	0.9	7.5	460.6	49.5	15	34.5	49.5	37.5	12	399	0.5	44
19	cast iron	2.5	0.9	6.5	428.8	50	17.5	32.5	48.5	40.5	8	715	0.5	54
20	cast iron	2.5	0.9	7	444.98	49.5	32	17.5	48.5	40	8.5	275	0.5	57
21	cast iron	2.5	0.9	8.5	490.35	50.5	23.5	27	50	22.5	27.5	327	0.5	#NUM!
22	cast iron	2.5	0.9	10.5	544.99	51	23.5	27.5	50	42.5	7.5	735	0.5	78
23	cast iron	2.5	0.9	9.5	518.39	51	23.5	27.5	49.5	42	7.5	1216	0.5	97
24	cast iron	2.5	0.9		0	50	23	27	50	23	27	327	0.5	#DIV/0!
25	cast iron	2.5	0.9	7.5	460.6	49.5	45	4.5	50	45.5	4.5		0.5	#DIV/0!
26	cast iron	2.5	0.9	7.5	460.6	49.5	45	4.5	50	45.5	4.5		0.5	#DIV/0!
27	cast iron	2.5	0.9	9.5	518.39	49.5	6.5	43	50	44	6	408	0.5	38

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Table E-2
Fort Monroe C-factor Test Locations
Listed by Diameter

1) **12 inch cast iron line near main gate.**
   Procedure – Close valves 2-16, 2-17, and 1-41. Flow hydrant 44 (at Reeder Circle) and record pressures at hydrants 45 and 46.

2) **10 inch cast iron line along St. Mary's Rectory and St. Mary's Church.**
   Procedure – Close valves 1-26, 1-33, 1-34, and the unknown valve in front of the theater. Flow hydrant 37 (near Marina and Restaurant) and record pressures on hydrants 38 and 42. (NO GOOD, BAD DIFFUSER).

3) **10 inch cast iron line along St. Mary's Rectory and St. Mary's Church (redo).**
   Procedure – Close valves 1-26, 1-33, 1-34, and the unknown valve in front of the theater. Flow hydrant 37 (near Marina and Restaurant) and record pressures on hydrants 38 and 42.

4) **10 inch cast iron line down by the Chamberlin Hotel.**
   Procedure – Close valves 1-26, 1-33, and 1-34. Flow hydrant 34 (close to Chamberlin Hotel) and record pressures on hydrants 36 and 37.

5) **10 inch cast iron line down by the Chamberlin Hotel.**
   Procedure – Close valves 1-26, 1-33, and 1-34. Flow hydrant 34 (close to Chamberlin Hotel) and record pressures on hydrants 36 and 38.

6) **8 inch cast iron line along Fenwick between Wharf 1114 and Battery Parrott.**
   Procedure – Close valve 1-12. Flow hydrant 30 (by Wharf 1114) and record pressures on hydrants 29 and 28.

7) **8 inch cast iron line along Fenwick between Wharf 1114 and Battery Parrott.**
   Procedure – Close valves 1-12 and 1-1. Flow hydrant 30 (by Wharf 1114) and record pressures on hydrants 29 and 26.

8) **8 inch cast iron line along Fenwick between Battery DeRussey and Dog Beach.**
   Procedure – Close valve 4-3 (permanently) and the unknown valve on 6 inch PVC line near hydrant 1. Flow hydrant 1 (near Dog Beach) and record pressures at hydrants 2 and 7.

9) **8 inch cast iron line along Fenwick between Battery DeRussey and Dog Beach.**
   Procedure – Close valve 4-3 (permanently) and the unknown valve on 6 inch PVC line near hydrant 1. Flow hydrant 1 (near Dog Beach) and record pressures at hydrants 2 and 9.

10) **6 inch cast iron line along Exchange Service Station and the PX.**

Procedure – Close unknown valve on 6 inch line behind hydrant 12. Flow hydrant 12 (near intersection with Fenwick) and record pressures at hydrants 13 and 14.

11) 6 inch cast iron line along Exchange Service Station and the PX.
Procedure – Close unknown valve on 6 inch line behind hydrant 12. Flow hydrant 12 (near intersection with Fenwick) and record pressures at hydrants 13 and 19.

12) 6 inch cast iron line along Ingalls Rd. from Administration Bldg (#100) to St. Mary's Church.
Procedure – Close valve 1-35 and unknown valve on 10 inch line close to Chamberlin Hotel. Flow hydrant 35 (just past Harrison Street) and record pressures on hydrants 39 and 41.

13) 6 inch cast iron line along Ingalls Rd. from Administration Bldg (#100) to St. Mary's Church.
Procedure – Close valve 1-35 and unknown valve on 10 inch line close to Chamberlin Hotel. Flow hydrant 35 (just past Harrison Street) and record pressures on hydrants 39 and 43.

14) 6 inch cast iron line between Pratt Street and Ingalls Rd.
Procedure – Close valve 2-16. Flow hydrant 44 (at Reeder Circle and Ingalls Rd.) and record pressures at hydrants 49 and 48. (NO GOOD).

15) 6 inch cast iron line between Pratt Street and Ingalls Rd.
Procedure – Close valve 2-16. Flow hydrant 44 (at Reeder Circle and Ingalls Rd.) and record pressures at hydrants 49 and 47. (NO GOOD).

16) 6 inch cast iron line along Patch Rd.
Procedure – Close valves 2-39 and 3-6. Flow hydrant 59 (towards ADP center) and record pressures at hydrants 60 and 51.

17) 6 inch cast iron line between Fenwick and Old Point National Bank.
Procedure – Close valves 4-43, 4-22, and 4-29. Flow hydrant 23 (by Old Point National Bank) and record pressures at hydrants 20 and 18.

18) 6 inch cast iron line between Pratt Street and Ingalls Rd.
Procedure – Close valves 2-25 and 2-17. Flow hydrant 47 (on Eustis Lane) and record pressures at hydrants 48 and 49.

19) 6 inch cast iron line along Patton Rd.
Procedure – Close valve 4-33. Flow hydrant 15 (on north end of Patton) and record pressures at hydrants 16 and 24.

20) 6 inch cast iron line along Patton Rd.
Procedure – Close valve 4-33. Flow hydrant 15 (on north end of Patton) and record pressures at hydrants 21 and 24.

21) Circular 6 inch cast iron line across the moat.
Procedure – Close valves 1-1, 3-6, and 3-9. Flow hydrant 61 (near North Gate) and record pressures at hydrants 63 and 64. (NO GOOD).

22) Circular 6 inch cast iron line across the moat.
Procedure – Close valves 1-1, 3-6, and 3-9. Flow hydrant 61 (near North Gate) and record pressures at hydrants 63 and 65. (NO GOOD).

23) Circular 6 inch cast iron line across the moat.
Procedure – Close valves 1-1, 3-6, and 3-9. Flow hydrant 61 (near North Gate) and record pressures at hydrants 63 and 66. (NO GOOD).

24) Circular 6 inch cast iron line across the moat.
Procedure – Close valves 1-1, 3-6, 3-9, and 3-12. Flow hydrant 61 (near North Gate) and record pressures at hydrants 63 and 64. (NO GOOD).

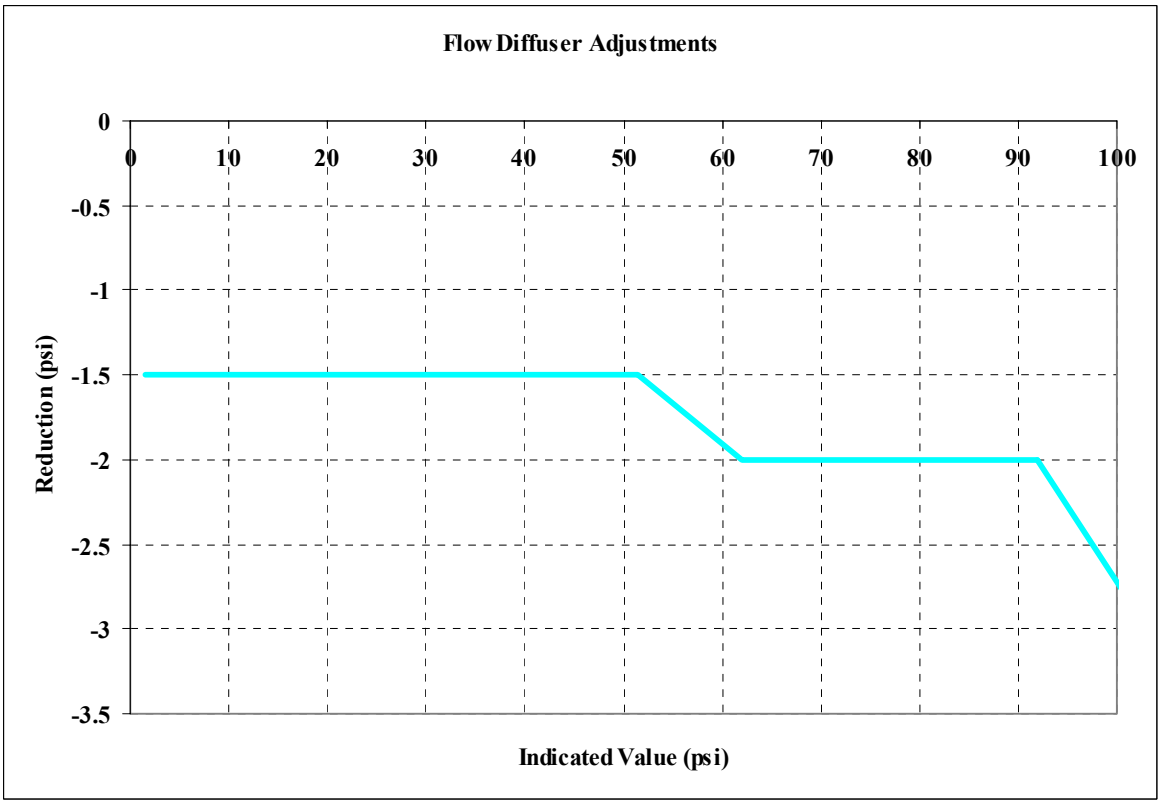
25) Circular 6 inch cast iron line across the moat.
Procedure – Close valves 1-1, 3-6, and 3-9. Flow hydrant 64 (near East Gate) and record pressures at hydrants 65 and 66. (NO GOOD).

26) Circular 6 inch cast iron line across the moat.
Procedure – Close valves 1-1, 3-6, 3-9, and 3-12. Flow hydrant 64 (near East Gate) and record pressures at hydrants 65 and 66. (NO GOOD).

27) Circular 6 inch cast iron line across the moat.
Procedure – Close valves 1-1, 3-6, 3-9, and 3-12. Flow hydrant 66 (at intersection of Mathews lane and Bernard Rd.) and record pressures at hydrants 65 and 64

Table E-3
Flow Rate Adjustments

Flow Hydrant Diffuser Calibration Results		
True Value (psi)	**Indicated Value (psi)**	**Difference (psi)**
0	1.5	-1.5
10	11.5	-1.5
20	21.5	-1.5
30	31.5	-1.5
40	41.5	-1.5
50	51.5	-1.5
60	62	-2
70	72	-2
80	82	-2
90	92	-2
100	103	-3



C-Factor Test Data

Test No.: 1 Start Time: _____ Pipe Material: cast iron

Date: 12/16/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #37

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 2

Discharge Coef.: 0.9 Flow (gpm): 237.85
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #38

Static Pressure (psi): 48 Residual Pressure (psi): 36

Static – Residual= 12 (psi) 27.7 (ft)

Pressure Hydrant 2 (Downstream) #42

Static Pressure (psi): 48 Residual Pressure (psi): 43

Static – Residual= 5 (psi) 11.5 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	16.2	570	0.833	237.85	14
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments: thrown out - diffuser #1 is not calibrated correctly, pitot tube appears clogged.

valve closures: I-26, I-33, I-34, unknown valve on 10" cast iron

C-Factor Test Data

Test No.: 2 Start Time: _____ Pipe Material: cast iron

Date: 12/16/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #37

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 25

Discharge Coef.: 0.9 Flow (gpm): 840.94

(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #38

Static Pressure (psi): 48 Residual Pressure (psi): 35

Static – Residual= 13 (psi) 30 (ft)

Pressure Hydrant 2 (Downstream) #42

Static Pressure (psi): 48 Residual Pressure (psi): 43

Static – Residual= 5 (psi) 11.5 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	18.5	570	0.833	840.94	75
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: I-26, I-33, I-34, unknown valve on 10" CI

C-Factor Test Data

Test No.: 3 Start Time: _____ Pipe Material: Castiron

Date: 12/16/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #34

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 20

Discharge Coef.: 0.9 Flow (gpm): 752.16
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #36

Static Pressure (psi): 48 Residual Pressure (psi): 29

Static – Residual= 19 (psi) 43.8 (ft)

Pressure Hydrant 2 (Downstream) #37

Static Pressure (psi): 49 Residual Pressure (psi): 31

Static – Residual= 18 (psi) 41.5 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	2.3	247	0.833	752.16	78
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: I-26, I-33, I-34, unknown valve on 10" CI

C-Factor Test Data

Test No.: 4 Start Time: _____ Pipe Material: Cast Iron

Date: 12/16/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #34

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 20

Discharge Coef.: 0.9 Flow (gpm): 752.16
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #36

Static Pressure (psi): 48.5 Residual Pressure (psi): 29

Static – Residual= 19.5 (psi) 43.8 (ft)

Pressure Hydrant 2 (Downstream) #38

Static Pressure (psi): 48 Residual Pressure (psi): 37

Static – Residual= 11 (psi) 25.4 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	18.4	810	0.833	752.16	47
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: I-26, I-33, I-34, unknown valve on 10" CI

C-Factor Test Data

Test No.: 5 Start Time: _____ Pipe Material: cast iron

Date: 12/16/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant # 30

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 6

Discharge Coef.: 0.9 Flow (gpm): 411.97
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) # 29

Static Pressure (psi): 48 Residual Pressure (psi): 12.5

Static – Residual= 35.5 (psi) 81.9 (ft)

Pressure Hydrant 2 (Downstream) # 28

Static Pressure (psi): 48 Residual Pressure (psi): 18

Static – Residual= 30 (psi) 69.2 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	12.7	380	0.75	411.97	28
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: J-12

C-Factor Test Data

Test No.: 6 Start Time: _____ Pipe Material: cast iron

Date: 12/16/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #30

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 4

Discharge Coef.: 0.9 Flow (gpm): 336.38
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #29

Static Pressure (psi): 48 Residual Pressure (psi): 9

Static – Residual= 39 (psi) 90 (ft)

Pressure Hydrant 2 (Downstream) #26

Static Pressure (psi): 48 Residual Pressure (psi): 25

Static – Residual= 23 (psi) 53.1 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	36.9	1693	0.75	336.38	29
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: I-12, I-1

C-Factor Test Data

Test No.: 7 Start Time: _____ Pipe Material: Cast iron

Date: 12/16/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #1

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 5

Discharge Coef.: 0.9 Flow (gpm): 376.08
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #2

Static Pressure (psi): 49 Residual Pressure (psi): 13

Static – Residual= 36 (psi) 83.1 (ft)

Pressure Hydrant 2 (Downstream) #7

Static Pressure (psi): 49 Residual Pressure (psi): 18

Static – Residual= 31 (psi) 71.5 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	11.6	1612	0.75	376.08	60
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 4-3 (permanent)
unknown valve on 6" PVC

C-Factor Test Data

Test No.: 8 Start Time: _____ Pipe Material: cast iron

Date: 12/16/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #1

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 5

Discharge Coef.: 0.9 Flow (gpm): 376.08
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #2

Static Pressure (psi): 49 Residual Pressure (psi): 13

Static – Residual= 36 (psi) 83.1 (ft)

Pressure Hydrant 2 (Downstream) #9

Static Pressure (psi): 49 Residual Pressure (psi): 28

Static – Residual= 21 (psi) 48.5 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	33.6	2852	0.75	376.08	45
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 4-3 (permanent)
unknown valve on 6" PVC

C-Factor Test Data

Test No.: 9 Start Time: _____ Pipe Material: Cast Iron

Date: 12/10/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #12

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 6

Discharge Coef.: 0.9 Flow (gpm): 411.97
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #13

Static Pressure (psi): 48 Residual Pressure (psi): 13.5

Static – Residual= 34.5 (psi) 79.6 (ft)

Pressure Hydrant 2 (Downstream) #14

Static Pressure (psi): 48 Residual Pressure (psi): 23

Static – Residual= 25 (psi) 57.7 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	21.9	208	0.5	411.97	44
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: unknown value on 6" CI

C-Factor Test Data

Test No.: 10 Start Time: _____ Pipe Material: CAST IRON

Date: 12/16/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #12

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 6

Discharge Coef.: 0.9 Flow (gpm): 411.97
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #13

Static Pressure (psi): 48 Residual Pressure (psi): 13.5

Static – Residual= 34.5 (psi) 79.6 (ft)

Pressure Hydrant 2 (Downstream) #19

Static Pressure (psi): 48 Residual Pressure (psi): 46

Static – Residual= 2 (psi) 4.6 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	15.0	711	0.5	411.97	44
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: unknown valve on 16" CI

C-Factor Test Data

Test No.: 1 Start Time: _____ Pipe Material: cast iron

Date: 12/18/03 Stop Time: Pipe Vintage:

Flow Hydrant #44

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 7

Discharge Coef.: 0.9 Flow (gpm): 444.98
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #45

Static Pressure (psi): 47.5 Residual Pressure (psi): 46.5

Static – Residual= 1 (psi) 2.308 (ft)

Pressure Hydrant 2 (Downstream) #46

Static Pressure (psi): 48 Residual Pressure (psi): 47.5

Static – Residual= 0.5 (psi) 1.154 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	1.154	420	1	444.98	55.4
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 2-16, 2-17, 1-41

we don't believe that hydrant #44 is actually on the 12" CI.

C-Factor Test Data

Test No.: 2-2 Start Time: _____ Pipe Material: cast iron

Date: 12/18/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #35

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 12

Discharge Coef.: 0.9 Flow (gpm): 582.62
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #39

Static Pressure (psi): 48.5 Residual Pressure (psi): 27

Static – Residual= 21.5 (psi) 49.6 (ft)

Pressure Hydrant 2 (Downstream) #41

Static Pressure (psi): 48.5 Residual Pressure (psi): 44

Static – Residual= 4.5 (psi) 10.4 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	39.2	~~565~~ 596	0.5	582.62	80.8
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 1-35, unknown on 10" CI, flemwick

C-Factor Test Data

Test No.: ~~2~~ 3 Start Time: _____ Pipe Material: cast iron

Date: 12/18/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #35

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 13

Discharge Coef.: 0.9 Flow (gpm): 606.41
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) # ~~38~~ ~~34~~ 39

Static Pressure (psi): 48.5 Residual Pressure (psi): 27.5

Static – Residual= 21 (psi) 48.5 (ft)

Pressure Hydrant 2 (Downstream) #43

Static Pressure (psi): 49 Residual Pressure (psi): 46.5

Static – Residual= 2.5 (psi) 5.8 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	42.7	1034	0.5	606.41	108.2
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 1-35, unknown on 10" CI, Fenwick

C-Factor Test Data

Test No.: 4 Start Time: _____ Pipe Material: cast iron

Date: 12/18/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #44

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 34

Discharge Coef.: 0.9 Flow (gpm): 980.7
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #49

Static Pressure (psi): 49 Residual Pressure (psi): 44.5

Static – Residual= 4.5 (psi) 10.4 (ft)

Pressure Hydrant 2 (Downstream) #48

Static Pressure (psi): 49 Residual Pressure (psi): 45.5

Static – Residual= 3.5 (psi) 8.1 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	2.307	402	0.5	980.7	507.8
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 2-16

line has not been sufficiently isolated

C-Factor Test Data

Test No.: 5 Start Time: _____ Pipe Material: Cast Iron

Date: 12/18/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #441

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 34

Discharge Coef.: 0.9 Flow (gpm): 980.7
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #49

Static Pressure (psi): 48.5 Residual Pressure (psi): 45

Static – Residual= 3.5 (psi) 8.08 (ft)

Pressure Hydrant 2 (Downstream) #47

Static Pressure (psi): 48.5 Residual Pressure (psi): 45.5

Static – Residual= 3 (psi) 6.92 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	1.157	629	0.5	980.7	938.1
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 2-16

line has not been sufficiently isolated

C-Factor Test Data

Test No.: 6 Start Time: _____ Pipe Material: Cast Iron

Date: 12/18/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #59

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 2

Discharge Coef.: 0.9 Flow (gpm): 237.85

(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #60

Static Pressure (psi): 48.5 Residual Pressure (psi): 22

Static – Residual= 26.5 (psi) 61.2 (ft)

Pressure Hydrant 2 (Downstream) #51

Static Pressure (psi): 48 Residual Pressure (psi): 33

Static – Residual= 15 (psi) 34.6 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	26.6	422	0.5	237.85	33.8
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

Valve closures: 2-39, 3-6

C-Factor Test Data

Test No.: 7 Start Time: _____ Pipe Material: cast iron

Date: 12/18/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #23

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 4

Discharge Coef.: 0.9 Flow (gpm): 336.38
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #20

Static Pressure (psi): 49.5 Residual Pressure (psi): 13

Static – Residual= 36.5 (psi) 84.2 (ft)

Pressure Hydrant 2 (Downstream) #18

Static Pressure (psi): 48.5 Residual Pressure (psi): 22

Static – Residual= 26.5 (psi) 61.2 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	23	370	0.5	336.38	48.1
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

Valve closures: 4-43, 4-22, 4-29

C-Factor Test Data

Test No.: 1 Start Time: _____ Pipe Material: Cast Iron

Date: 12/22/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #47

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 9

Discharge Coef.: 0.9 Flow (gpm): 504.56
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #48

Static Pressure (psi): 49.5 Residual Pressure (psi): 15

Static – Residual= 34.5 (psi) 79.6 (ft)

Pressure Hydrant 2 (Downstream) #49

Static Pressure (psi): 49.5 Residual Pressure (psi): 37.5

Static – Residual= 12 (psi) 27.7 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	51.9	399	0.5	504.56	48.4
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: ~~2-18~~, 2-25, 2-17

redo of test #4/5 on 12/18/03

→ note: diffuser is reading 4 psi @ rest

C-Factor Test Data

Test No.: 2 Start Time: _____ Pipe Material: cast iron

Date: 12/22/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #15

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 8

Discharge Coef.: 0.9 Flow (gpm): 475.7
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #16

Static Pressure (psi): 50 Residual Pressure (psi): 17.5

Static – Residual= 32.5 (psi) 75 (ft)

Pressure Hydrant 2 (Downstream) #24

Static Pressure (psi): 48.5 Residual Pressure (psi): 40.5

Static – Residual= 8 (psi) 18.5 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	56.5	715	0.5	475.7	~~475.7~~ 59.8
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 4-33

→ note: diffuser is reading 4psi @ rest

C-Factor Test Data

Test No.: 3 Start Time: _____ Pipe Material: Cast iron

Date: 12/22/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant # 15

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 8.5

Discharge Coef.: 0.9 Flow (gpm): 490.35
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) # ~~16~~ 21

Static Pressure (psi): 49.5 Residual Pressure (psi): 32

Static – Residual= 17.5 (psi) 40.4 (ft)

Pressure Hydrant 2 (Downstream) # 24

Static Pressure (psi): 48.5 Residual Pressure (psi): 40

Static – Residual= 8.5 (psi) 19.6 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	20.8	275	0.5	490.35	63.1
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

Valve closures: 4-33

→ note: diffuser is reading 4 psi @ rest

C-Factor Test Data

Test No.: 4 Start Time: _____ Pipe Material: cast iron

Date: 12/22/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #61

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 10

Discharge Coef.: 0.9 Flow (gpm): _____
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #63

Static Pressure (psi): 50.5 Residual Pressure (psi): 23.5

Static – Residual= 27 (psi) _____ (ft)

Pressure Hydrant 2 (Downstream) #64

Static Pressure (psi): 50 Residual Pressure (psi): 22.5

Static – Residual= 27.5 (psi) _____ (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2		327			
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 1-1, 3-4, 3-9

→ note: diffuser is reading 4 psi @ rest

line not isolated sufficiently

additional valve closures needed → 3-6 in place of 3-4 was closed

3-12

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C-Factor Test Data

Test No.: 5 Start Time: _____ Pipe Material: cast iron

Date: 12/22/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #61

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 12

Discharge Coef.: 0.9 Flow (gpm): 582.62
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #63

Static Pressure (psi): 51 Residual Pressure (psi): 23.5

Static – Residual= 27.5 (psi) 63.5 (ft)

Pressure Hydrant 2 (Downstream) #65

Static Pressure (psi): 50 Residual Pressure (psi): 42.5

Static – Residual= 17.5 (psi) 17.3 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	46.2	735	0.5	582.62	82.8
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

Valve closures: 1-1, ~~3-4~~ 3-6, 3-9

→ note: diffuser is reading 4psi @ rest

line not isolated sufficiently

additional valve closures needed → 3-12

C-Factor Test Data

Test No.: 6 Start Time: _____ Pipe Material: Cast iron

Date: 12/22/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #61

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 11

Discharge Coef.: 0.9 Flow (gpm): 557.81
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #63

Static Pressure (psi): ~~3~~ 51 Residual Pressure (psi): 23.5

Static – Residual= 27.5 (psi) 63.5 (ft)

Pressure Hydrant 2 (Downstream) #66

Static Pressure (psi): 49.5 Residual Pressure (psi): 42

Static – Residual= 7.5 (psi) 17.3 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	46.2	1216	0.5	557.81	104.1
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 1-1, ~~3-4~~ 3-6, 3-9

note → diffuser is reading 4 psi @ rest

line not isolated sufficiently
additional valve closures needed → 3-12

C-Factor Test Data

Test No.: 1 Start Time: _____ Pipe Material: Cast iron

Date: 12/23/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #61

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): _____

Discharge Coef.: 0.9 Flow (gpm): _____
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #63

Static Pressure (psi): 50 Residual Pressure (psi): 23

Static – Residual= 27 (psi) _____ (ft)

Pressure Hydrant 2 (Downstream) #64

Static Pressure (psi): 50 Residual Pressure (psi): 23

Static – Residual= 27 (psi) _____ (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	0	327	0.5		
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 1-1, 3-6, 3-9, 3-12

→ no drop between pressure hydrants

C-Factor Test Data

Test No.: 2 Start Time: _____ Pipe Material: cast iron

Date: 12/23/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #64

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 9

Discharge Coef.: 0.9 Flow (gpm): _____
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #65

Static Pressure (psi): 49.5 Residual Pressure (psi): 45

Static – Residual= 4.5 (psi) _____ (ft)

Pressure Hydrant 2 (Downstream) #66

Static Pressure (psi): 50 Residual Pressure (psi): 45.5

Static – Residual= 4.5 (psi) _____ (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	0	481	0.5		
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 1-1, 3-6, 3-9

→ no drop between pressure hydrants

C-Factor Test Data

Test No.: 3 Start Time: _____ Pipe Material: Cast iron

Date: 12/23/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #64

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 9

Discharge Coef.: 0.9 Flow (gpm): _____
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #65

Static Pressure (psi): 49.5 Residual Pressure (psi): 45

Static – Residual= 4.5 (psi) _____ (ft)

Pressure Hydrant 2 (Downstream) #66

Static Pressure (psi): 50 Residual Pressure (psi): 45.5

Static – Residual= 4.5 (psi) _____ (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	0	481	0.5		
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

valve closures: 1-1, 3-6, 3-9, 3-12

→ no drop between pressure hydrants

C-Factor Test Data

Test No.: 4 Start Time: _____ Pipe Material: Cast iron

Date: 12/23/03 Stop Time: _____ Pipe Vintage: _____

Flow Hydrant #66

Nozzle Dia. (in): 2.5 Flowing Pressure (psi): 11

Discharge Coef.: 0.9 Flow (gpm): 557.81
(Flow = 29.9 $C_d D^2 P^{1/2}$)

Pressure Hydrant 1 (Downstream) #65

Static Pressure (psi): 49.5 Residual Pressure (psi): 6.5

Static – Residual= 43 (psi) 99.2 (ft)

Pressure Hydrant 2 (Downstream) #64

Static Pressure (psi): 50 Residual Pressure (psi): 44

Static – Residual= 6 (psi) 13.8 (ft)

Calculate C-Factor

Segment	ΔH (feet)	L (feet)	D (feet)	Q (gpm)	C
1-2	85.4	408	0.5	557.81	41.4
2-3					

$C = Q/(194\ D^{2.63}(\Delta H/L)^{0.54})$

Comments:

Valve closures: 1-1, 3-6, 3-9, 3-12

F. H. Gaskins Co., Inc.

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Baltimore, MD 21221
410-686-1800
FAX 410-686-5184

CUSTOMER URS CUST. ORD. NO. VERBAL MARVIN P. ITEM NO. 001

F.H.G., CO. NO. 82175 LINE NO. 001 DESCRIPTION 3.5" PITOT / HYDRANT GAGE

RANGE 0-100 PSI ACCURACY 2% SERIAL OR TAG NO. PG 1

AS RECEIVED READINGS ☑ Acceptable ☐ Out of Tolerance at Circled Readings

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	.5	+.5	SAME	
10	10.5			
20	20.5			
30	30.5			
40	40.5			
50	50.5			
60	60.5			
70	70.5			
80	80.5			
90	90.5			
100	101			

READINGS AFTER CALIBRATION

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	0	0.0	SAME	
10	10			
20	20			
30	30			
40	40			
50	50			
60	60			
70	70			
80	80			
100	100			

Pressure Standard Used For Above Readings 1305 B DEADWGT Range 0-10K Accuracy .01%

Serial No. 60291 Date Calibrated 8-2-2002 Calibration Due Date 8-2-2005

Our calibration system complies with MIL-STD-45662-A and the above Standard is traceable for accuracy to the National Institute of Standards and Technology.

Tested By C. [illegible] Date 12-30-03

F. H. Gaskins Co., Inc.

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CUSTOMER URS CUST. ORD. NO. VERBAL MARVIN P. ITEM NO. 001

F.H.G., CO. NO. 82175 LINE NO. 001 DESCRIPTION 3.5" PITCK/HYRANT GAGE

RANGE 0-100 PSI ACCURACY 2% SERIAL OR TAG NO. PG 2

AS RECEIVED READINGS ☑ Acceptable ☐ Out of Tolerance at Circled Readings

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	.75	+.75		
10	11	+1	S	
20	21	+1		
30	31		A	
40	41			
50	51		M	
60	61			
70	71		E	
80	81			
90	91			
100	101			

READINGS AFTER CALIBRATION

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	0	0.0		
10	10		S	
20	20			
30	30		A	
40	40			
50	50		M	
60	60			
70	70		E	
80	80			
100	100			

Pressure Standard Used For Above Readings 1305 B DEADWGT Range 0-10K Accuracy .01%

Serial No. 60291 Date Calibrated 8-2-2002 Calibration Due Date 8-2-2005

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Tested By C. [illegible] Date 12-30-03

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CUSTOMER URS CUST. ORD. NO. VERBAL MARVIN P. ITEM NO. 001

F.H.G., CO. NO. 82175 LINE NO. 001 DESCRIPTION 3.5" HYDRANT GAGE

RANGE 0-100 PSI ACCURACY 2% SERIAL OR TAG NO. PG 3

AS RECEIVED READINGS ☑ Acceptable ☐ Out of Tolerance at Circled Readings

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	1.75	+ 1.75	SAME	
10	11.75			
20	21.75			
30	31.75			
40	41.75			
50	51.75			
60	61.75			
70	71.75			
80	81.75			
90	91.75			
100	102	+2		

READINGS AFTER CALIBRATION

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	0	0.0	SAME	
10	10			
20	20			
30	30			
40	40			
50	50			
60	60			
70	70			
80	80			
100	100			

Pressure Standard Used For Above Readings 1305 B DEADWGT Range 0-10K Accuracy .01%

Serial No. 60291 Date Calibrated 8-2-2002 Calibration Due Date 8-2-2005

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Tested By C. [illegible] Date 12-30-03

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CUSTOMER URS CUST. ORD. NO. VERBAL MARVIN P. ITEM NO. 001

F.H.G., CO. NO. 82175 LINE NO. 001 DESCRIPTION 3.5" HYDRANT GAGE

RANGE 0-100 PSI ACCURACY 2% SERIAL OR TAG NO. PG 4

AS RECEIVED READINGS ☑ Acceptable ☐ Out of Tolerance at Circled Readings

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	2	+2#		
10	12		S	
20	22			
30	32		A	
40	42			
50	52		M	
60	62			
70	72		E	
80	82			
90	92			
100	102			

READINGS AFTER CALIBRATION

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	0	0.0		
10	10		S	
20	20			
30	30		A	
40	40			
50	50		M	
60	60			
70	70		E	
80	80			
100	100			

Pressure Standard Used For Above Readings 1305 B DEADWGT Range 0-10K Accuracy .01%

Serial No. 60291 Date Calibrated 8-2-2002 Calibration Due Date 8-2-2005

Our calibration system complies with MIL-STD-45662-A and the above Standard is traceable for accuracy to the National Institute of Standards and Technology.

Tested By [signature] Date 12-30-03

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CUSTOMER URS CUST. ORD. NO. VERBAL MARVIN P. ITEM NO. 001

F.H.G., CO. NO. 82175 LINE NO. 001 DESCRIPTION WIKA 2.5" PRESS GAGE

RANGE 0-100 PSI ACCURACY 2% SERIAL OR TAG NO. PG 5

AS RECEIVED READINGS ☐ Acceptable ☐ Out of Tolerance at Circled Readings

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	0	0		
10	8.75	-1.25	S	
20	18.75	-1.25		
30	28.75	-1.25	A	
40	38.75	-1.25		
50	48.5	-1.5	M	
60	58.5	-1.5		
70	68.5	-1.5	F	
80	78	-2		
90	88	-2		
100	98	2		

READINGS AFTER CALIBRATION

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	0	0.0		
10	10		S	
20	20			
30	30			
40	40		A	
50	50			
60	60			
70	70		M	
80	80			
100	100		F	

Pressure Standard Used For Above Readings 1305 B DEADWGT Range 0-10K Accuracy .01%

Serial No. 60291 Date Calibrated 8-2-2002 Calibration Due Date 8-2-2005

Our calibration system complies with MIL-STD-45662-A and the above Standard is traceable for accuracy to the National Institute of Standards and Technology.

Tested By [signature] Date 12-30-03

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CUSTOMER URS CUST. ORD. NO. VERBAL MARVIN P. ITEM NO. 001

F.H.G., CO. NO. 82175 LINE NO. 001 DESCRIPTION WIKA 2.5" PRESS GAGE

RANGE 0-100 PSI ACCURACY 2% SERIAL OR TAG NO. PG 6

AS RECEIVED READINGS ☐ Acceptable ☐ Out of Tolerance at Circled Readings

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	+ 1.5	+ 1.5		
10	11.5		S	
20	21.5			
30	31.5			
40	41.5		A	
50	51.5			
60	62	+2		
70	72		M	
80	82			
90	92		E	
100	103	+3		

READINGS AFTER CALIBRATION

TRUE VALUE	INDICATED VALUE			
	INCREASING READINGS		DECREASING READINGS	
0	0	0.0		
10	10		S	
20	20			
30	30			
40	40		A	
50	50			
60	60		M	
70	70			
80	80		E	
100	100			

Pressure Standard Used For Above Readings 1305 B DEADWGT Range 0-10K Accuracy .01%

Serial No. 60291 Date Calibrated 8-2-2002 Calibration Due Date 8-2-2005

Our calibration system complies with MIL-STD-45662-A and the above Standard is traceable for accuracy to the National Institute of Standards and Technology.

Tested By [signature] Date 12-30-03

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Appendix F: Newport News Available Pressure

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Table F-1
Newport News Available Pressure

	Residual Pressure (psi)		**Pressure Head (ft)**	
	Water St.	Old Buckroe Rd.	Water St.	Old Buckroe Rd.
0	54.44	54.44	125.63	125.63
Individual Test				
500	49.48	51.49	114.18	118.82
1000	42.85	48.75	98.88	112.5
1500	34.28	45.68	79.11	105.42
2000	23.85	42.41	55.04	97.87
2500	11.65	38.95	26.88	89.88
Combined Test	Water St.	Old Buckroe Rd.	Water St.	Old Buckroe Rd.
1000	46.72	48.82	107.82	112.66
2000	36.77	42.6	84.85	98.31
3000	24.35	35.61	56.19	82.18
4000	9.54	27.86	22.02	64.29
5000	-7.61	19.3	-17.56	44.54

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Appendix G: WaterCAD Results

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Scenario: Run 1 Base Conditions
Steady State Analysis
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpm)	Demand Summary	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-100-A	7.50	Demand	0.00	Simple	Fixed	0.00	122.89	49.92
J-101-A	5.00	Demand	1.03	Composite	Composite	1.03	122.88	51.00
J-102-A	7.00	Demand	0.00	Simple	Fixed	0.00	122.89	50.14
J-103-A	6.50	Demand	1.28	Composite	Composite	1.28	122.86	50.35
J-104-A	6.00	Demand	10.57	Composite	Composite	10.57	122.88	50.57
J-105-A	7.00	Demand	4.72	Composite	Composite	4.72	122.89	50.14
J-106-A	5.00	Demand	4.82	Simple	Fixed	4.82	122.82	50.98
J-107-A	5.00	Demand	3.04	Composite	Composite	3.04	122.83	50.98
J-108-A	5.00	Demand	0.00	Simple	Fixed	0.00	122.89	51.01
J-109-A	7.00	Demand	0.00	Simple	Fixed	0.00	122.89	50.14
J-110-A	5.00	Demand	0.00	Simple	Fixed	0.00	122.88	51.00
J-111-A	4.00	Demand	0.00	Simple	Fixed	0.00	122.86	51.43
J-112-A	5.00	Demand	2.04	Composite	Composite	2.04	122.88	51.00
J-113-A	7.50	Demand	0.00	Simple	Fixed	0.00	122.89	49.92
J-114-A	7.00	Demand	0.00	Simple	Fixed	0.00	122.89	50.14
J-115-A	6.00	Demand	0.00	Simple	Fixed	0.00	122.89	50.57
J-116-A	5.50	Demand	0.58	Simple	Fixed	0.58	122.89	50.79
J-117-A	4.00	Demand	0.06	Simple	Fixed	0.06	122.90	51.44
J-118-A	4.00	Demand	0.00	Simple	Fixed	0.00	122.86	51.43
J-119-A	5.50	Demand	0.00	Simple	Fixed	0.00	122.89	50.79
J-120-A	6.00	Demand	0.42	Composite	Composite	0.42	122.89	50.57
J-121-A	5.00	Demand	2.43	Composite	Composite	2.43	122.89	51.01
J-122-A	6.00	Demand	0.00	Simple	Fixed	0.00	122.89	50.57
J-123-A	5.50	Demand	3.60	Composite	Composite	3.60	122.90	50.79
J-124-A	5.00	Demand	0.21	Composite	Composite	0.21	122.84	50.98
J-125-A	5.00	Demand	0.78	Simple	Fixed	0.78	122.83	50.98
J-126-A	6.00	Demand	0.17	Composite	Composite	0.17	122.89	50.57
J-127-A	6.50	Demand	0.00	Simple	Fixed	0.00	122.96	50.39
J-128-A	7.00	Demand	0.52	Composite	Composite	0.52	122.89	50.14
J-129-A	5.00	Demand	0.03	Composite	Composite	0.03	122.92	51.02
J-130-A	6.00	Demand	1.78	Composite	Composite	1.78	122.89	50.57
J-131-A	6.00	Demand	1.56	Composite	Composite	1.56	122.89	50.57
J-132-A	6.00	Demand	0.42	Simple	Fixed	0.42	122.89	50.57
J-133-A	8.00	Demand	0.43	Simple	Fixed	0.43	122.89	49.71
J-134-A	5.00	Demand	1.00	Composite	Composite	1.00	122.83	50.98
J-135-A	5.00	Demand	4.89	Composite	Composite	4.89	122.83	50.98
J-136-A	7.00	Demand	0.65	Composite	Composite	0.65	122.87	50.13
J-137-A	6.00	Demand	0.42	Composite	Composite	0.42	122.86	50.56
J-138-A	5.00	Demand	2.72	Composite	Composite	2.72	122.86	50.99
J-139-A	6.00	Demand	0.00	Simple	Fixed	0.00	122.89	50.57
J-140-A	7.50	Demand	0.00	Simple	Fixed	0.00	122.89	49.92
J-141-A	5.50	Demand	0.21	Composite	Composite	0.21	122.90	50.79
J-142-A	6.00	Demand	4.80	Composite	Composite	4.80	122.89	50.57
J-200-B	7.00	Demand	0.01	Simple	Fixed	0.01	123.27	50.30
J-201-B	7.00	Demand	1.30	Composite	Composite	1.30	123.10	50.23
J-202-B	4.00	Demand	5.97	Composite	Composite	5.97	122.86	51.42
J-203-B	7.00	Demand	0.32	Simple	Fixed	0.32	123.21	50.28
J-204-B	7.50	Demand	0.92	Composite	Composite	0.92	123.28	50.09

Scenario: Run 1 Base Conditions
Steady State Analysis
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpm)	Demand Summary	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-205-B	8.00	Demand	0.83	Simple	Fixed	0.83	123.23	49.86
J-206-B	4.50	Demand	0.00	Simple	Fixed	0.00	122.87	51.21
J-207-B	5.00	Demand	0.00	Simple	Fixed	0.00	122.87	51.00
J-208-B	7.00	Demand	0.00	Simple	Fixed	0.00	123.23	50.29
J-209-B	8.00	Demand	0.00	Simple	Fixed	0.00	123.14	49.82
J-210-B	7.00	Demand	0.00	Simple	Fixed	0.00	123.09	50.23
J-211-B	6.00	Demand	0.42	Simple	Fixed	0.42	122.93	50.59
J-212-B	7.00	Demand	0.00	Simple	Fixed	0.00	123.02	50.19
J-213-B	5.00	Demand	0.00	Simple	Fixed	0.00	122.90	51.01
J-214-B	8.00	Demand	1.67	Composite	Composite	1.67	123.23	49.85
J-215-B	7.00	Demand	0.84	Composite	Composite	0.84	123.12	50.24
J-216-B	7.00	Demand	0.00	Simple	Fixed	0.00	123.23	50.29
J-217-B	7.00	Demand	0.00	Simple	Fixed	0.00	123.27	50.31
J-218-B	8.00	Demand	1.67	Composite	Composite	1.67	123.24	49.86
J-219-B	8.00	Demand	0.00	Simple	Fixed	0.00	123.41	49.93
J-220-B	8.00	Demand	0.00	Simple	Fixed	0.00	123.23	49.85
J-221-B	6.00	Demand	2.01	Composite	Composite	2.01	123.03	50.63
J-222-B	8.00	Demand	0.00	Simple	Fixed	0.00	123.14	49.82
J-223-B	4.50	Demand	0.00	Simple	Fixed	0.00	122.87	51.21
J-224-B	5.00	Demand	0.22	Simple	Fixed	0.22	122.90	51.01
J-225-B	4.00	Demand	0.07	Composite	Composite	0.07	122.90	51.44
J-226-B	8.00	Demand	7.73	Composite	Composite	7.73	123.44	49.94
J-227-B	8.00	Demand	0.81	Simple	Fixed	0.81	123.35	49.90
J-228-B	8.00	Demand	1.69	Composite	Composite	1.69	123.35	49.91
J-229-B	7.00	Demand	1.92	Composite	Composite	1.92	123.24	50.29
J-230-B	7.00	Demand	1.17	Composite	Composite	1.17	123.23	50.29
J-231-B	7.50	Demand	0.87	Composite	Composite	0.87	123.24	50.08
J-232-B	7.00	Demand	0.56	Composite	Composite	0.56	123.22	50.28
J-233-B	7.50	Demand	0.66	Simple	Fixed	0.66	123.21	50.06
J-234-B	7.50	Demand	0.00	Simple	Fixed	0.00	123.21	50.06
J-235-B	7.00	Demand	5.28	Composite	Composite	5.28	123.13	50.24
J-236-B	6.50	Demand	1.84	Composite	Composite	1.84	123.15	50.47
J-237-B	5.50	Demand	0.00	Simple	Fixed	0.00	123.16	50.90
J-238-B	5.50	Demand	0.00	Simple	Fixed	0.00	123.67	51.13
J-239-B	5.50	Demand	0.02	Composite	Composite	0.02	122.91	50.80
J-240-B	6.00	Demand	1.46	Composite	Composite	1.46	123.02	50.63
J-241-B	5.00	Demand	2.21	Composite	Composite	2.21	122.88	51.00
J-242-B	4.50	Demand	0.06	Simple	Fixed	0.06	122.88	51.22
J-243-B	4.50	Demand	0.21	Simple	Fixed	0.21	122.90	51.22
J-244-B	5.00	Demand	1.24	Composite	Composite	1.24	122.89	51.01
J-245-B	7.00	Demand	5.05	Composite	Composite	5.05	123.01	50.19
J-246-B	7.00	Demand	2.66	Composite	Composite	2.66	123.01	50.19
J-247-B	7.00	Demand	0.63	Composite	Composite	0.62	123.17	50.26
J-248-B	7.00	Demand	0.00	Simple	Fixed	0.00	123.14	50.25
J-300-C	7.50	Demand	0.00	Simple	Fixed	0.00	123.53	50.20
J-301-C	7.50	Demand	0.08	Composite	Composite	0.08	123.55	50.21
J-302-C	7.00	Demand	0.00	Simple	Fixed	0.00	124.70	50.92
J-303-C	7.00	Demand	0.00	Simple	Fixed	0.00	123.78	50.52

Scenario: Run 1 Base Conditions
Steady State Analysis
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpm)	Demand Summary	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-304-C	7.00	Demand	0.00	Simple	Fixed	0.00	123.79	50.53
J-305-C	9.00	Inflow	0.00	Simple	Fixed	0.00	123.78	49.66
J-400-E	5.00	Demand	0.00	Simple	Fixed	0.00	122.85	50.99
J-401-E	5.00	Demand	0.00	Simple	Fixed	0.00	122.85	50.99
J-402-E	6.00	Demand	0.00	Simple	Fixed	0.00	122.85	50.56
J-403-E	6.00	Demand	5.42	Composite	Composite	5.42	122.86	50.56
J-404-E	7.50	Demand	2.42	Composite	Composite	2.42	122.85	49.91
J-405-E	5.00	Demand	1.69	Composite	Composite	1.69	122.85	50.99
J-406-E	8.00	Demand	0.00	Simple	Fixed	0.00	122.85	49.69
J-407-E	7.00	Demand	2.50	Composite	Composite	2.50	122.85	50.12
J-408-E	6.00	Demand	5.63	Composite	Composite	5.63	122.85	50.56
J-500-F	5.00	Demand	0.00	Simple	Fixed	0.00	123.12	51.10
J-501-F	6.00	Demand	0.00	Simple	Fixed	0.00	123.12	50.67
J-502-F	7.50	Demand	0.06	Simple	Fixed	0.06	123.14	50.03
J-503-F	7.00	Demand	0.00	Simple	Fixed	0.00	123.14	50.25
J-504-F	6.00	Demand	0.00	Simple	Fixed	0.00	123.10	50.66
J-505-F	5.00	Demand	0.03	Composite	Composite	0.03	122.88	51.00
J-506-F	6.00	Demand	0.00	Simple	Fixed	0.00	122.84	50.55
J-507-F	6.00	Demand	0.00	Simple	Fixed	0.00	122.87	50.57
J-508-F	6.00	Demand	0.10	Simple	Fixed	0.10	122.87	50.56
J-509-F	5.00	Demand	0.00	Simple	Fixed	0.00	122.96	51.04
J-510-F	5.50	Demand	0.00	Simple	Fixed	0.00	122.96	50.82
J-511-F	5.50	Demand	0.00	Simple	Fixed	0.00	123.12	50.89
J-512-F	5.50	Demand	0.00	Simple	Fixed	0.00	123.03	50.85
J-513-F	6.00	Demand	1.26	Composite	Composite	1.26	123.02	50.63
J-514-F	6.00	Demand	1.25	Composite	Composite	1.25	122.88	50.57
J-515-F	5.00	Demand	0.00	Simple	Fixed	0.00	122.96	51.04
J-516-F	6.00	Demand	0.00	Simple	Fixed	0.00	122.88	50.57
J-517-F	6.00	Demand	0.00	Simple	Fixed	0.00	122.89	50.57
J-518-F	6.00	Demand	3.72	Composite	Composite	3.72	122.87	50.57
J-519-F	6.00	Demand	0.00	Simple	Fixed	0.00	122.83	50.55
J-520-F	6.00	Demand	0.00	Simple	Fixed	0.00	122.88	50.57
J-521-F	6.00	Demand	5.00	Composite	Composite	5.00	122.85	50.56
J-522-F	6.00	Demand	2.50	Composite	Composite	2.50	122.85	50.56
J-523-F	6.00	Demand	0.00	Simple	Fixed	0.00	123.02	50.63
J-524-F	6.00	Demand	5.53	Composite	Composite	5.53	123.04	50.64
J-525-F	6.00	Demand	0.21	Simple	Fixed	0.21	122.98	50.61
J-526-F	6.00	Demand	0.62	Simple	Fixed	0.62	122.94	50.59
J-527-F	6.00	Demand	0.00	Simple	Fixed	0.00	122.89	50.57
J-528-F	6.00	Demand	1.09	Composite	Composite	1.09	122.85	50.56
J-529-F	6.00	Demand	0.67	Simple	Fixed	0.67	122.85	50.56
J-600-G	6.00	Demand	0.00	Simple	Fixed	0.00	122.82	50.54
J-601-G	6.50	Demand	0.00	Simple	Fixed	0.00	122.82	50.33
J-602-G	7.50	Demand	0.00	Simple	Fixed	0.00	122.82	49.89
J-603-G	5.00	Demand	0.00	Simple	Fixed	0.00	122.82	50.97
J-604-G	5.50	Demand	0.00	Simple	Fixed	0.00	122.82	50.76
J-605-G	7.00	Demand	0.02	Simple	Fixed	0.02	122.82	50.11
J-606-G	5.00	Demand	0.10	Simple	Fixed	0.10	122.82	50.98

Scenario: Run 1 Base Conditions
Steady State Analysis
Junction Report

Label	Elevation (ft)	Type	Base Flow (gpm)	Demand Summary	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)
J-607-G	6.00	Demand	7.00	Composite	Composite	7.00	122.82	50.54
J-700-H	7.00	Demand	0.00	Simple	Fixed	0.00	122.82	50.11
J-701-H	4.50	Demand	0.00	Simple	Fixed	0.00	122.82	51.19
J-702-H	6.00	Demand	0.00	Simple	Fixed	0.00	122.82	50.54
J-703-H	6.00	Demand	0.00	Simple	Fixed	0.00	122.82	50.54
J-704-H	6.00	Demand	0.00	Simple	Fixed	0.00	122.82	50.54
J-705-H	6.00	Demand	1.91	Composite	Composite	1.91	122.82	50.54
J-706-H	6.00	Demand	3.96	Composite	Composite	3.96	122.82	50.54
J-707-H	6.50	Demand	0.00	Simple	Fixed	0.00	122.82	50.33
J-708-H	5.50	Demand	0.03	Composite	Composite	0.03	122.82	50.76
J-800-I	8.00	Demand	0.00	Simple	Fixed	0.00	122.82	49.68
J-801-I	2.00	Inflow	0.00	Simple	Fixed	0.00	99.43	42.15

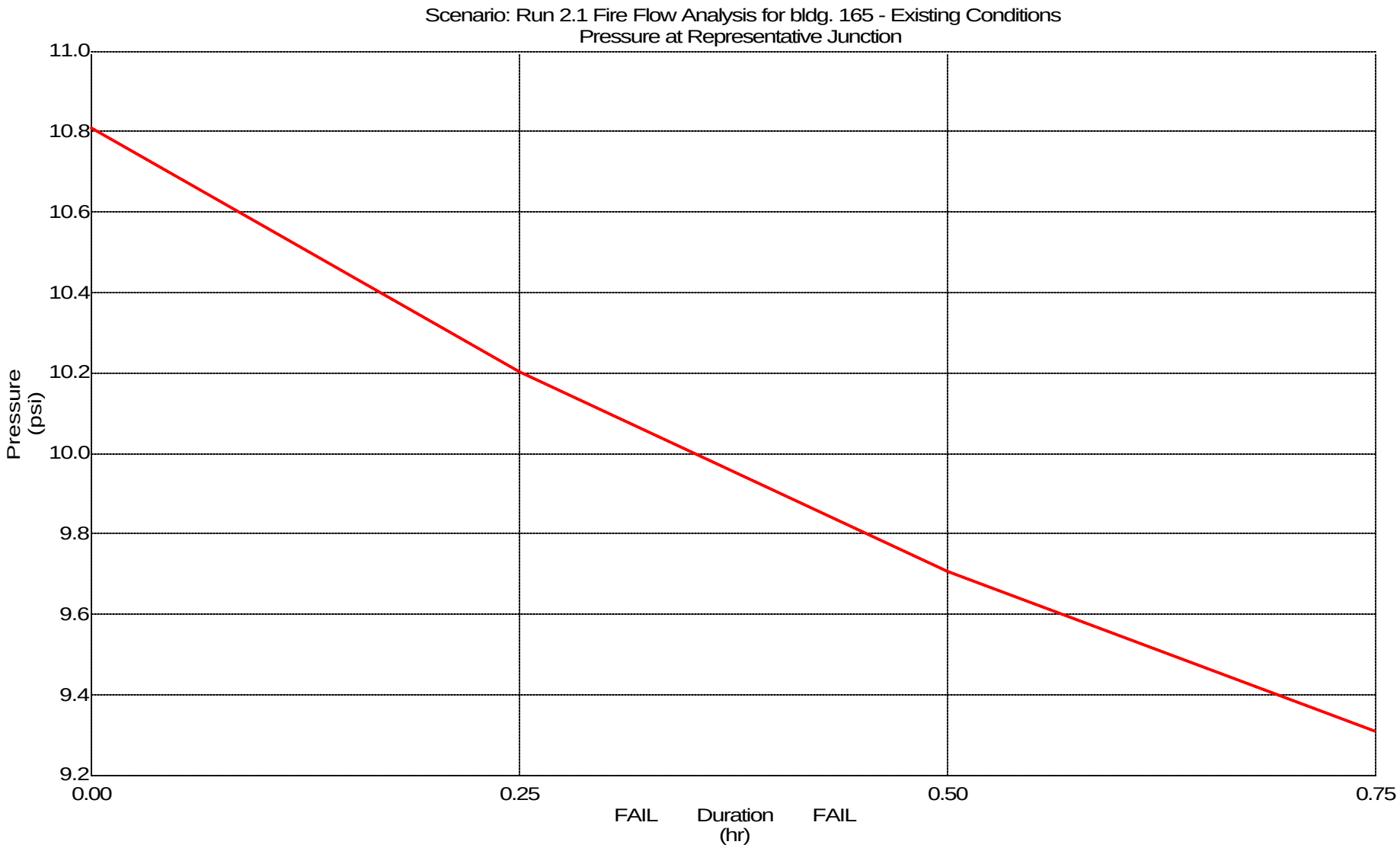
Scenario: Run 2 Fire Flow Analysis - Existing Conditions
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	false	750.00	370.24	20.00	20.31	J-800-I
H-2	false	1,125.00	386.55	20.00	20.01	J-800-I
H-3	false	1,500.00	385.21	20.00	20.00	J-800-I
H-4	false	750.00	299.69	20.00	20.05	J-702-H
H-5	false	1,000.00	367.41	20.00	20.00	J-707-H
H-6	false	500.00	402.42	20.00	20.38	J-602-G
H-7	false	750.00	401.36	20.00	20.05	J-602-G
H-8	false	1,500.00	403.17	20.00	20.03	J-602-G
H-9	false	750.00	429.74	20.00	20.04	J-607-G
H-9A	false	750.00	417.85	20.00	20.04	J-600-G
H-11	false	1,500.00	502.53	20.00	20.00	J-528-F
H-12	true	500.00	627.54	20.00	20.01	J-527-F
H-13	true	500.00	583.31	20.00	20.00	J-526-F
H-14	false	1,500.00	590.11	20.00	20.00	J-525-F
H-15	false	1,125.00	718.59	20.00	20.00	J-518-F
H-16	false	750.00	624.20	20.00	20.01	J-522-F
H-18	false	1,500.00	833.10	20.00	20.00	J-523-F
H-18A	true	750.00	839.93	20.00	20.00	J-524-F
H-19	true	750.00	1,143.47	20.00	20.00	J-504-F
H-19A	false	1,500.00	1,293.41	20.00	20.00	J-502-F
H-20	false	1,500.00	935.45	20.00	20.00	J-512-F
H-21	false	750.00	616.19	20.00	20.01	J-521-F
H-22	false	1,500.00	808.93	20.00	20.00	J-508-F
H-23	true	500.00	509.04	20.00	20.04	J-510-F
H-24	false	1,500.00	678.55	20.00	20.00	J-408-E
H-25	false	750.00	648.62	20.00	20.00	H-23
H-26	false	1,500.00	716.67	20.00	20.00	J-407-E
H-27	true	500.00	760.40	20.00	20.00	J-406-E
H-28	false	2,250.00	600.47	20.00	20.00	J-404-E
H-29	false	1,000.00	586.50	20.00	20.02	J-137-A
H-30	false	1,000.00	600.13	20.00	20.03	J-103-A
H-31	false	1,000.00	605.79	20.00	20.03	J-136-A
H-32	false	1,500.00	884.96	20.00	20.00	J-133-A
H-33	false	1,500.00	830.47	20.00	20.00	J-126-A
H-34	false	1,125.00	991.68	20.00	20.01	J-131-A
H-35	false	1,000.00	639.62	20.00	20.01	J-129-A
H-36	true	750.00	1,015.63	20.00	20.00	J-132-A
H-37	false	1,500.00	1,023.06	20.00	20.00	J-105-A
H-37A	false	2,250.00	829.88	20.00	20.00	J-104-A
H-38	false	1,500.00	1,089.21	20.00	20.00	J-139-A
H-39	false	750.00	573.32	20.00	20.00	J-127-A
H-40	false	1,500.00	1,034.69	20.00	20.00	J-128-A
H-41	false	750.00	687.53	20.00	20.00	J-240-B
H-42	true	1,000.00	1,076.00	20.00	20.00	J-239-B
H-43	false	1,000.00	784.74	20.00	20.00	J-237-B
H-44	true	750.00	2,500.00	20.00	33.05	J-218-B
H-45	true	500.00	2,500.00	20.00	28.74	J-228-B

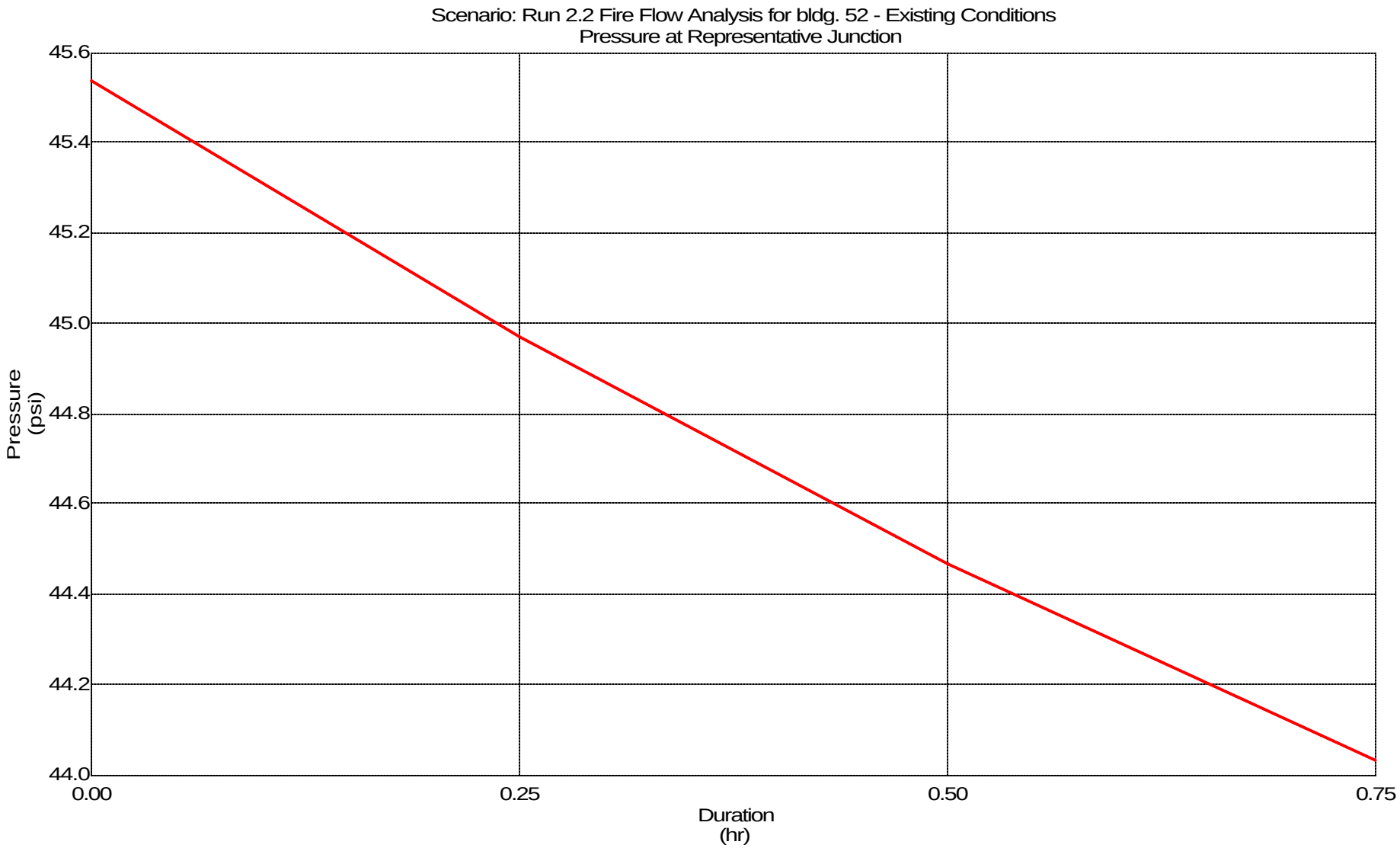
Scenario: Run 2 Fire Flow Analysis - Existing Conditions
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	28.61	J-226-B
H-47	false	1,500.00	1,178.41	20.00	20.00	J-227-B
H-48	true	1,000.00	1,159.64	20.00	20.00	J-217-B
H-49	true	1,000.00	1,048.72	20.00	20.00	J-231-B
H-50	true	750.00	1,061.92	20.00	20.00	J-211-B
H-51	false	750.00	597.27	20.00	20.00	J-245-B
H-52	true	1,500.00	2,500.00	20.00	21.57	J-236-B
H-53	false	2,250.00	1,507.56	20.00	20.00	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	29.84	J-215-B
H-54	true	750.00	1,049.89	20.00	20.00	J-230-B
H-55	false	1,500.00	912.36	20.00	20.00	J-229-B
H-56	false	1,500.00	879.24	20.00	20.00	J-232-B
H-57	false	1,500.00	1,153.95	20.00	20.00	J-233-B
H-58	false	1,500.00	1,326.66	20.00	20.00	J-234-B
H-59	true	500.00	1,136.20	20.00	20.00	J-247-B
H-60	false	1,125.00	666.50	20.00	20.01	J-246-B
H-61	false	2,250.00	696.25	20.00	20.00	J-241-B
H-62	false	1,500.00	539.28	20.00	20.04	J-242-B
H-63	false	750.00	641.28	20.00	20.01	J-138-A
H-64	false	1,500.00	671.38	20.00	20.00	J-405-E
H-65	false	2,250.00	600.00	20.00	20.00	J-135-A
H-66	false	2,250.00	576.62	20.00	20.00	J-134-A
H-67	false	2,250.00	397.67	20.00	20.00	J-106-A
H-68	false	1,500.00	597.65	20.00	20.00	J-124-A
H-69	false	1,500.00	946.68	20.00	20.00	J-101-A
H-70	false	1,500.00	723.86	20.00	20.00	J-244-B
H-behind37	false	1,500.00	764.43	20.00	20.00	J-140-A
H-moat	false	1,500.00	830.79	20.00	20.00	J-243-B
H-near100	false	1,000.00	448.48	20.00	20.01	J-238-B
H-near158	false	1,000.00	779.18	20.00	20.01	J-141-A
H-near161	true	500.00	976.45	20.00	20.00	J-100-A

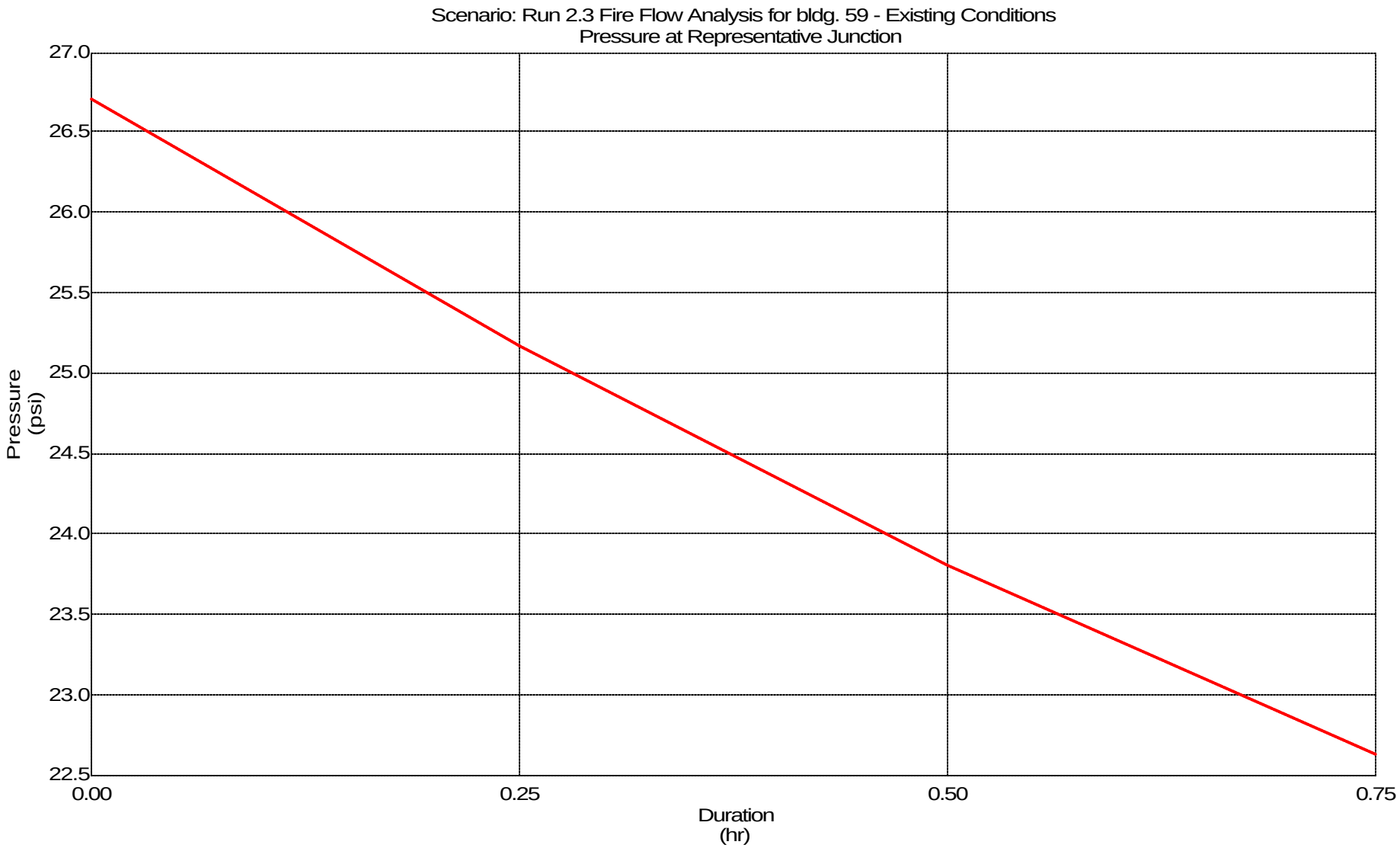
Graph


Scenario: Run 2.1 Fire Flow Analysis for bldg. 165 - Existing Conditions
Pressure at Representative Junction
11.0
10.8
10.6
10.4
10.2
10.0
9.8
9.6
9.4
9.2
Pressure (psi)
0.00
0.25
0.50
0.75
FAIL
Duration (hr)
FAIL

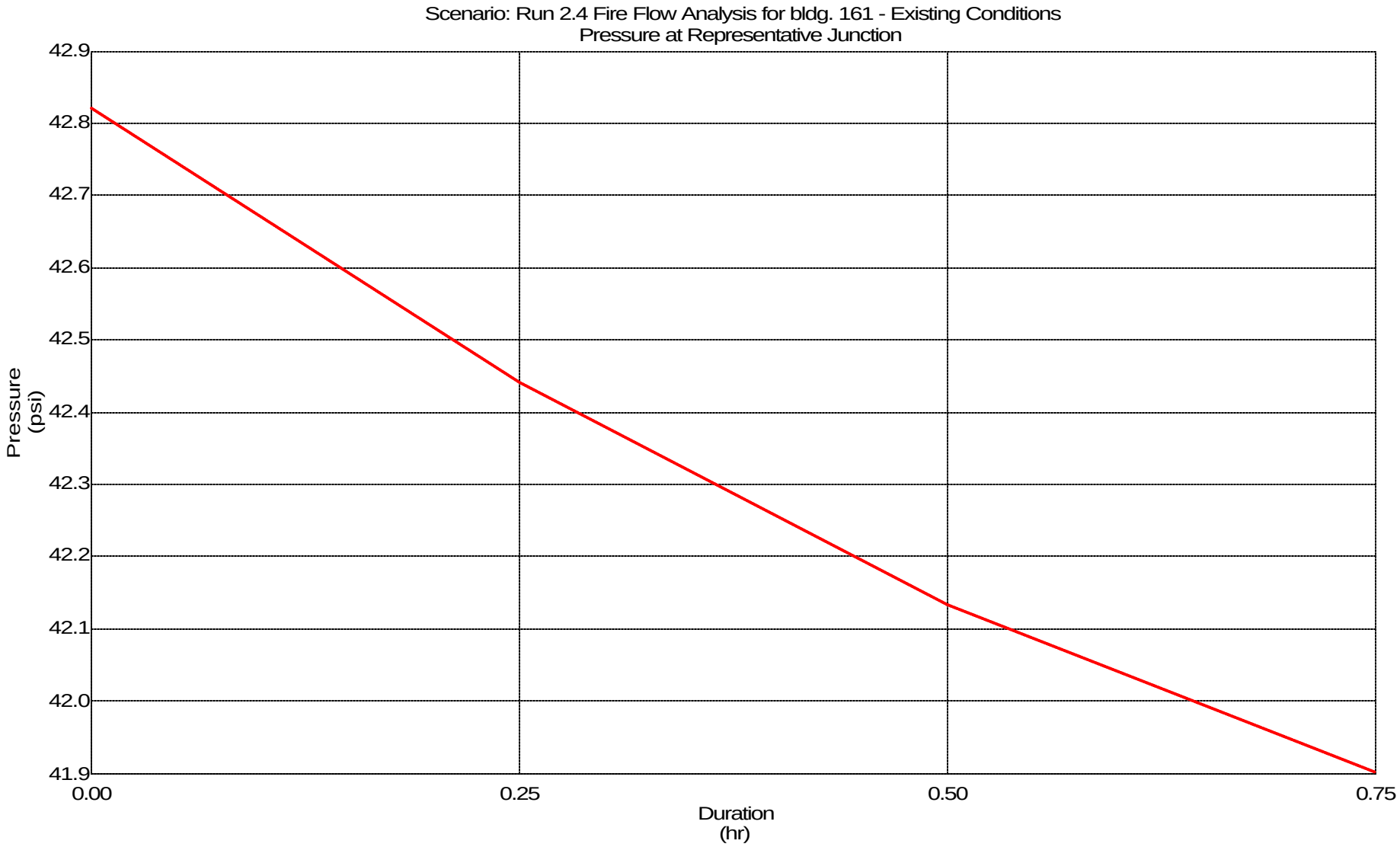
Graph


Scenario: Run 2.2 Fire Flow Analysis for bldg. 52 - Existing Conditions
Pressure at Representative Junction
45.6
45.4
45.2
45.0
44.8
44.6
44.4
44.2
44.0
Pressure
(psi)
0.00
0.25
0.50
0.75
Duration
(hr)

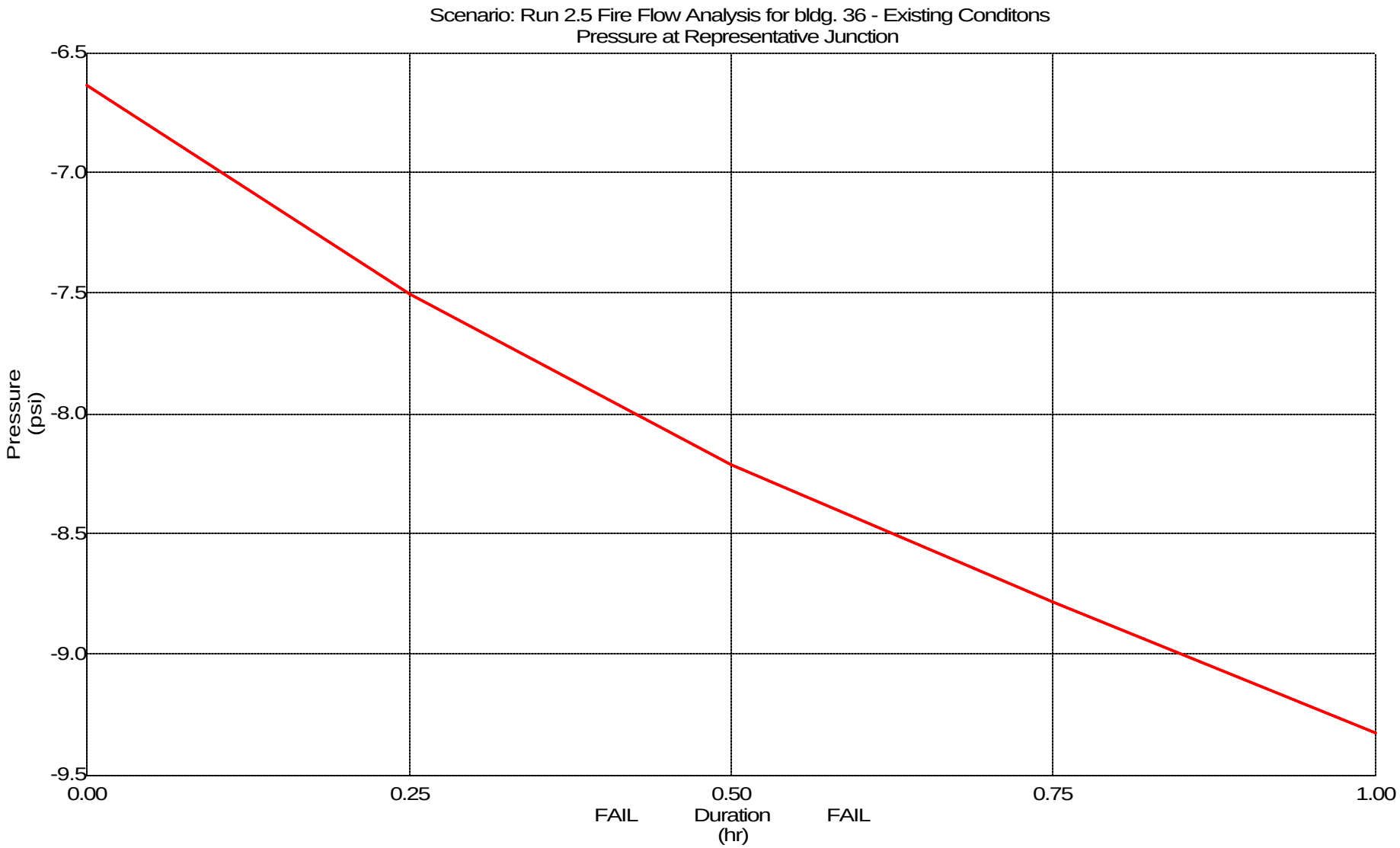
Graph


Scenario: Run 2.3 Fire Flow Analysis for bldg. 59 - Existing Conditions
Pressure at Representative Junction
27.0
26.5
26.0
25.5
25.0
24.5
24.0
23.5
23.0
22.5
Pressure
(psi)
0.00
0.25
0.50
0.75
Duration
(hr)

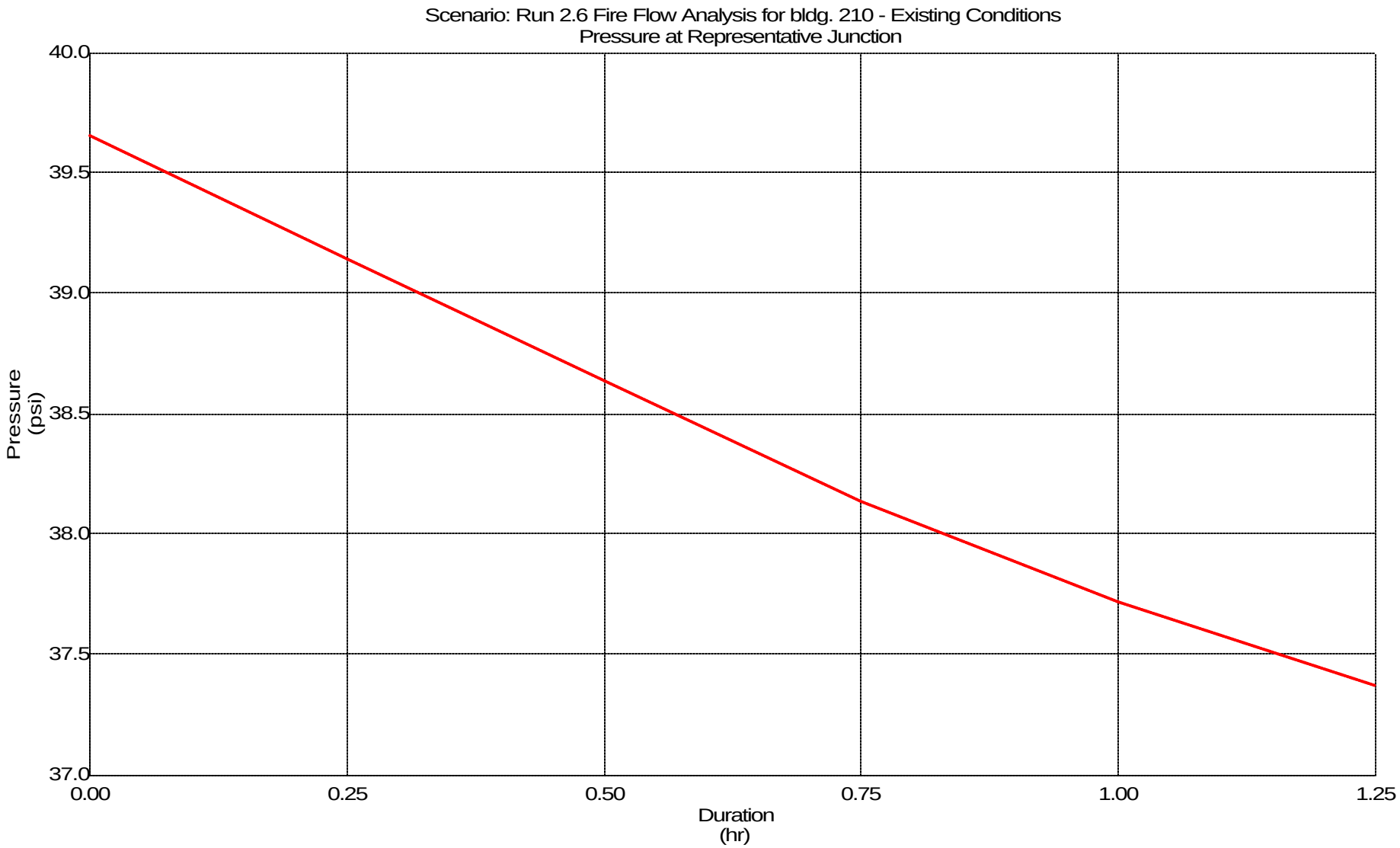
Graph


Scenario: Run 2.4 Fire Flow Analysis for bldg. 161 - Existing Conditions
Pressure at Representative Junction
Pressure (psi)
42.9
42.8
42.7
42.6
42.5
42.4
42.3
42.2
42.1
42.0
41.9
0.00
0.25
0.50
0.75
Duration (hr)

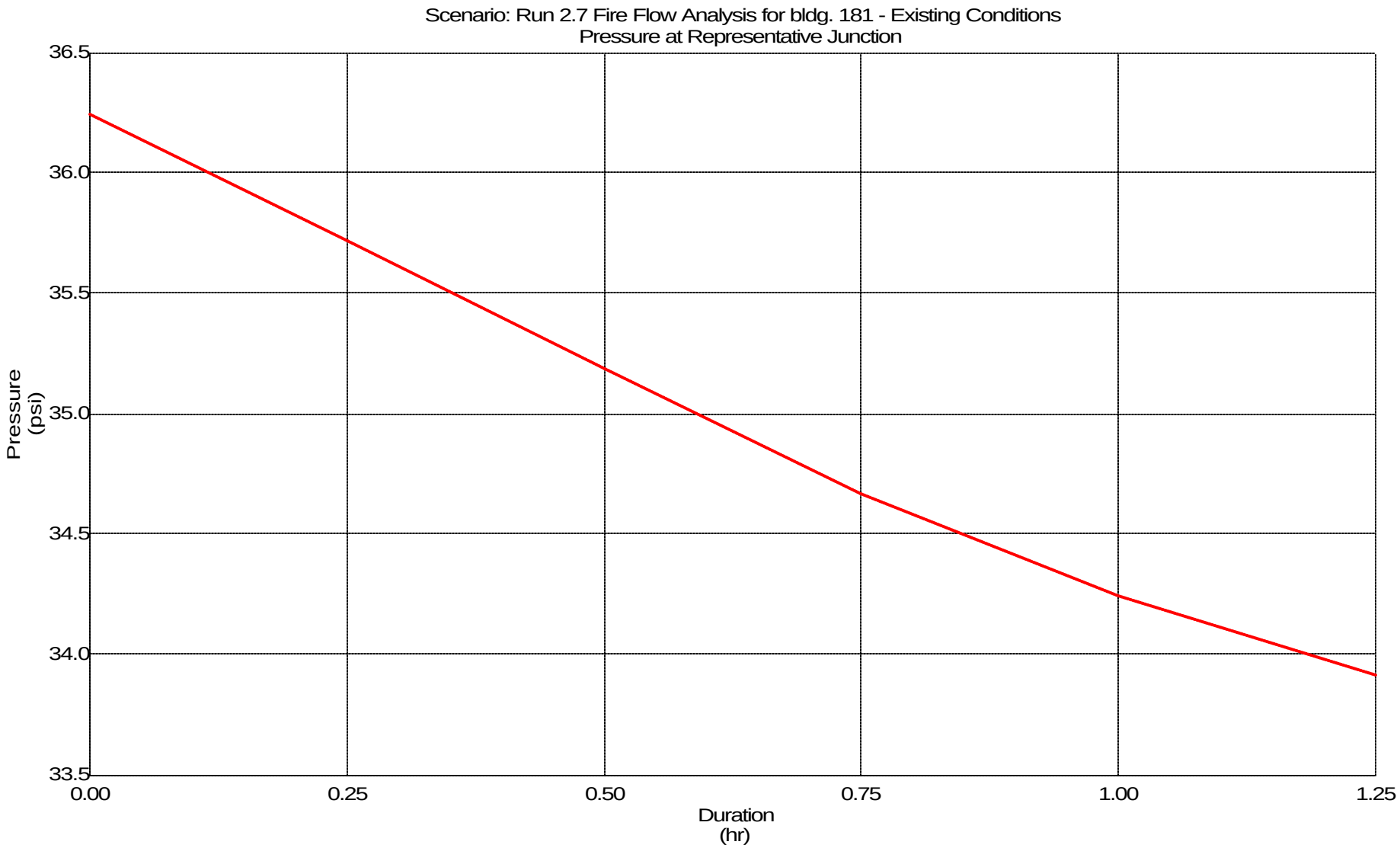
Graph


Scenario: Run 2.5 Fire Flow Analysis for bldg. 36 - Existing Conditons
Pressure at Representative Junction
-6.5
-7.0
-7.5
-8.0
-8.5
-9.0
-9.5
Pressure
(psi)
0.00
0.25
0.50
0.75
1.00
FAIL
Duration
(hr)
FAIL

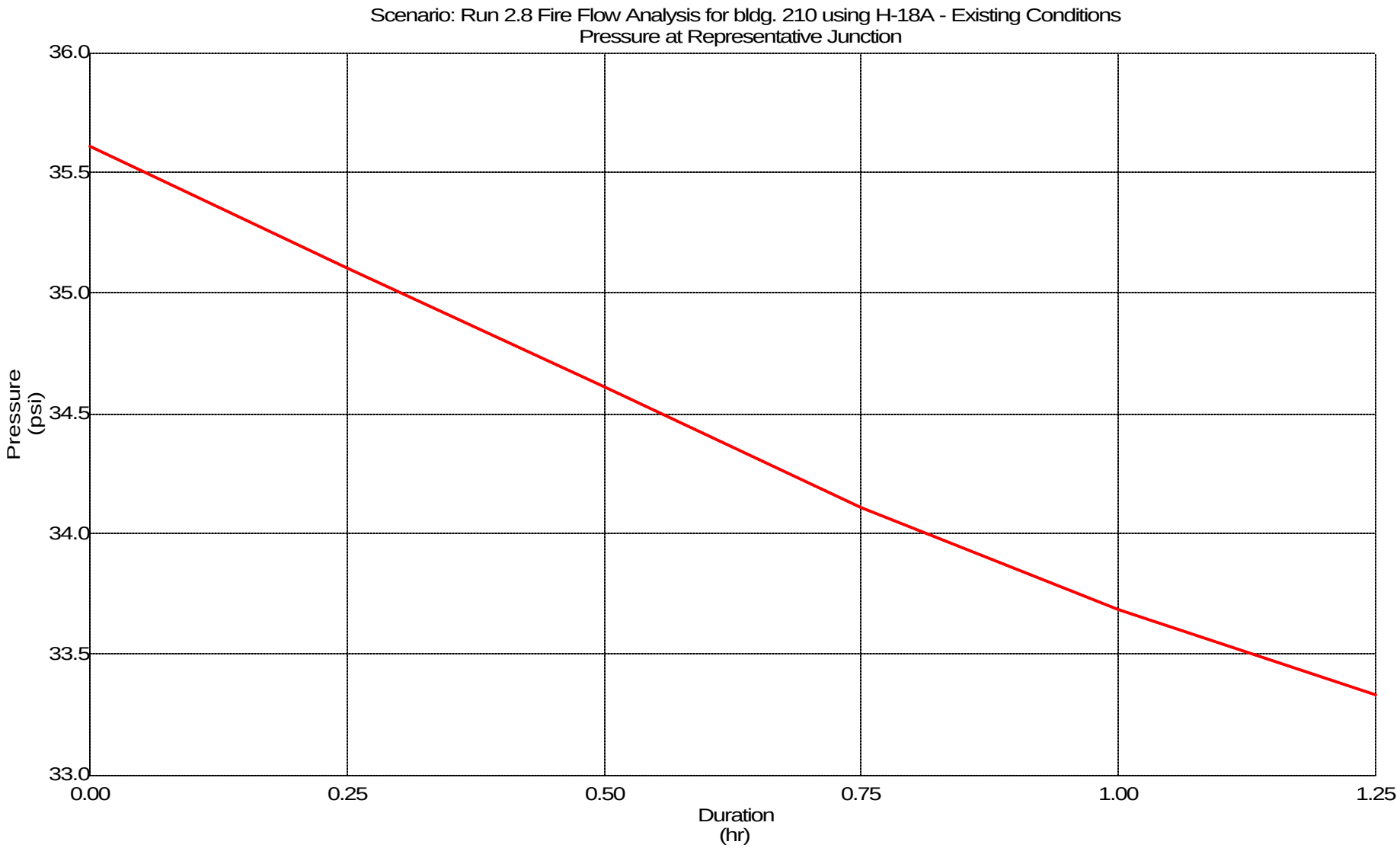
Graph


Scenario: Run 2.6 Fire Flow Analysis for bldg. 210 - Existing Conditions
Pressure at Representative Junction
40.0
39.5
39.0
38.5
38.0
37.5
37.0
Pressure
(psi)
0.00
0.25
0.50
0.75
1.00
1.25
Duration
(hr)

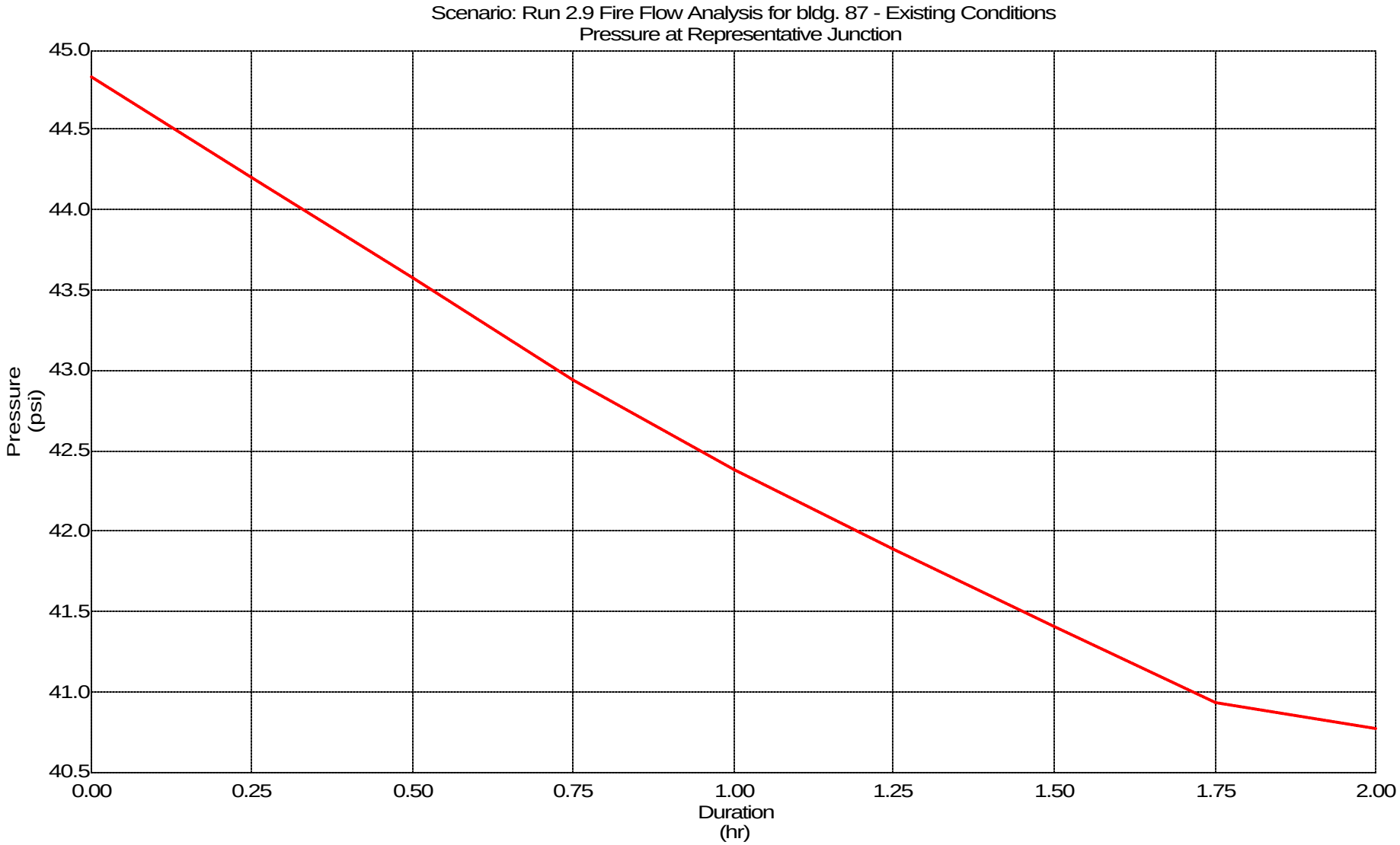
Graph


Scenario: Run 2.7 Fire Flow Analysis for bldg. 181 - Existing Conditions
Pressure at Representative Junction
36.5
36.0
35.5
35.0
34.5
34.0
33.5
Pressure
(psi)
0.00
0.25
0.50
0.75
1.00
1.25
Duration
(hr)

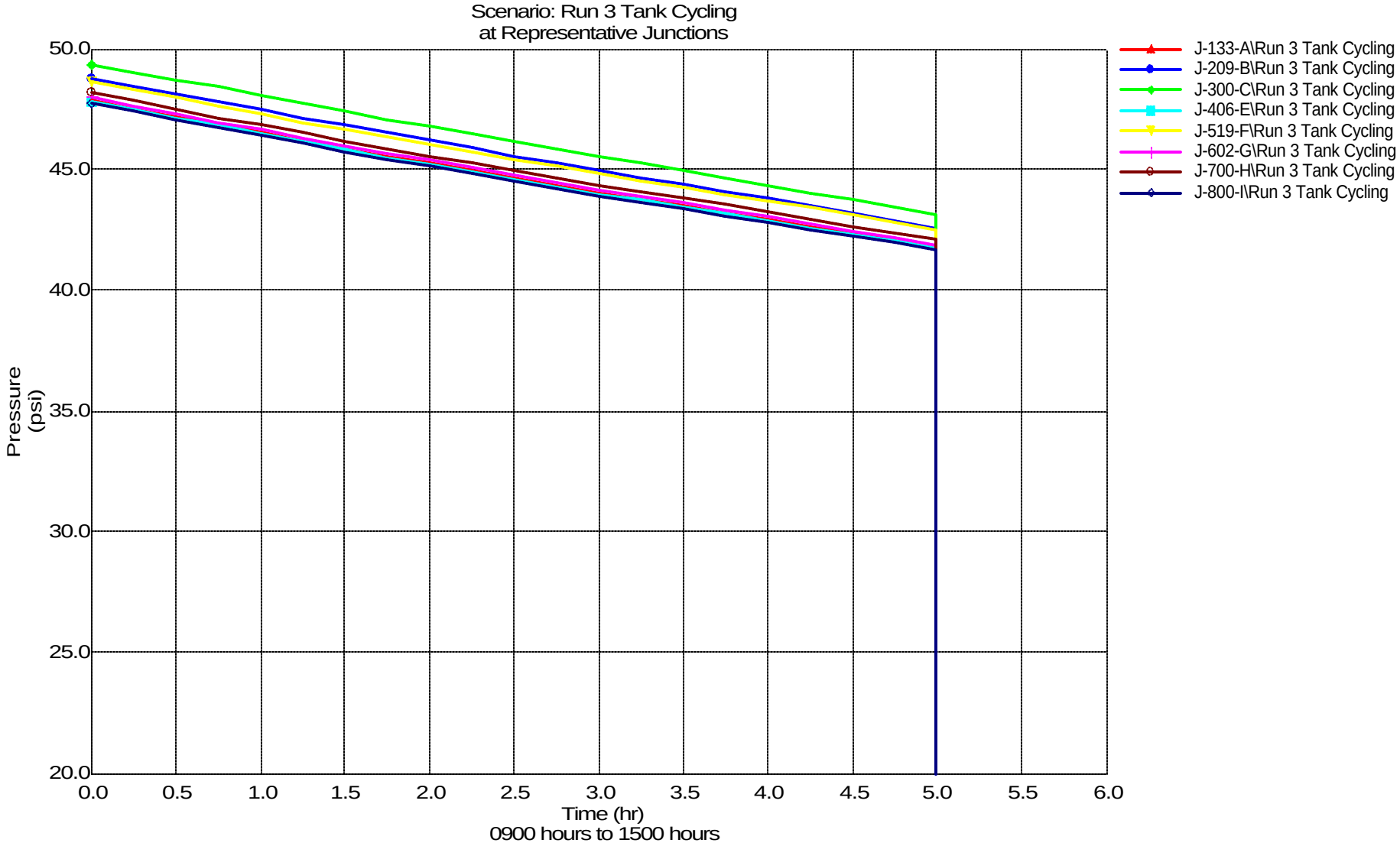
Graph


Scenario: Run 2.8 Fire Flow Analysis for bldg. 210 using H-18A - Existing Conditions
Pressure at Representative Junction
36.0
35.5
35.0
34.5
34.0
33.5
33.0
Pressure
(psi)
0.00
0.25
0.50
0.75
1.00
1.25
Duration
(hr)

Graph


Scenario: Run 2.9 Fire Flow Analysis for bldg. 87 - Existing Conditions
Pressure at Representative Junction
Pressure (psi)
45.0
44.5
44.0
43.5
43.0
42.5
42.0
41.5
41.0
40.5
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
Duration (hr)

Graph


Scenario: Run 3 Tank Cycling
at Representative Junctions
Pressure
(psi)
50.0
45.0
40.0
35.0
30.0
25.0
20.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
Time (hr)
0900 hours to 1500 hours
J-133-A\Run 3 Tank Cycling
J-209-B\Run 3 Tank Cycling
J-300-C\Run 3 Tank Cycling
J-406-E\Run 3 Tank Cycling
J-519-F\Run 3 Tank Cycling
J-602-G\Run 3 Tank Cycling
J-700-H\Run 3 Tank Cycling
J-800-I\Run 3 Tank Cycling

Scenario: Run 4 Water Age Analysis - Existing Conditions
Age Analysis: 168.00 hr / 168.00
Junction Report

Label	Type	Base Flow (gpm)	Demand Summary	Pattern	Demand (Calculated) (gpm)	Calculated Hydraulic Grade (ft)	Pressure (psi)	Calculated Age (hr)
J-102-A	Demand	0.00	Simple	Fixed	0.00	134.73	55.26	87.08
J-106-A	Demand	0.00	Simple	Fixed	0.00	134.72	56.12	168.00
J-113-A	Demand	0.00	Simple	Fixed	0.00	134.73	55.05	93.86
J-114-A	Demand	0.00	Simple	Fixed	0.00	134.73	55.26	77.24
J-116-A	Demand	0.00	Simple	Fixed	0.00	134.73	55.91	168.00
J-117-A	Demand	0.00	Simple	Fixed	0.00	134.73	56.56	168.00
J-118-A	Demand	0.00	Simple	Fixed	0.00	134.73	56.56	168.00
J-126-A	Demand	0.00	Simple	Fixed	0.00	134.73	55.70	73.91
J-140-A	Demand	0.00	Simple	Fixed	0.00	134.73	55.05	101.82
J-202-B	Demand	0.00	Simple	Fixed	0.00	134.73	56.56	168.00
J-222-B	Demand	0.00	Simple	Fixed	0.00	134.77	54.85	168.00
J-230-B	Demand	0.00	Simple	Fixed	0.00	134.79	55.29	165.44
J-500-F	Demand	0.00	Simple	Fixed	0.00	134.75	56.14	168.00
J-510-F	Demand	0.00	Simple	Fixed	0.00	134.71	55.90	168.00
J-515-F	Demand	0.00	Simple	Fixed	0.00	134.71	56.12	168.00
J-602-G	Demand	0.00	Simple	Fixed	0.00	134.65	55.01	78.13
J-603-G	Demand	0.00	Simple	Fixed	0.00	134.65	56.10	94.95
J-604-G	Demand	0.00	Simple	Fixed	0.00	134.65	55.88	98.10
J-605-G	Demand	0.00	Simple	Fixed	0.00	134.65	55.23	75.91
J-700-H	Demand	0.00	Simple	Fixed	0.00	134.65	55.23	167.21
J-701-H	Demand	0.00	Simple	Fixed	0.00	134.65	56.31	158.35
J-702-H	Demand	0.00	Simple	Fixed	0.00	134.65	55.66	168.00
J-703-H	Demand	0.00	Simple	Fixed	0.00	134.65	55.66	135.40
J-704-H	Demand	0.00	Simple	Fixed	0.00	134.65	55.66	125.67
J-705-H	Demand	0.00	Simple	Fixed	0.00	134.65	55.66	85.21
J-706-H	Demand	3.96	Composite	Composite	3.96	134.65	55.66	109.00
J-707-H	Demand	0.00	Simple	Fixed	0.00	134.65	55.45	168.00
J-708-H	Demand	0.00	Simple	Fixed	0.00	134.66	55.88	98.52
J-800-I	Demand	0.00	Simple	Fixed	0.00	134.65	54.80	161.85

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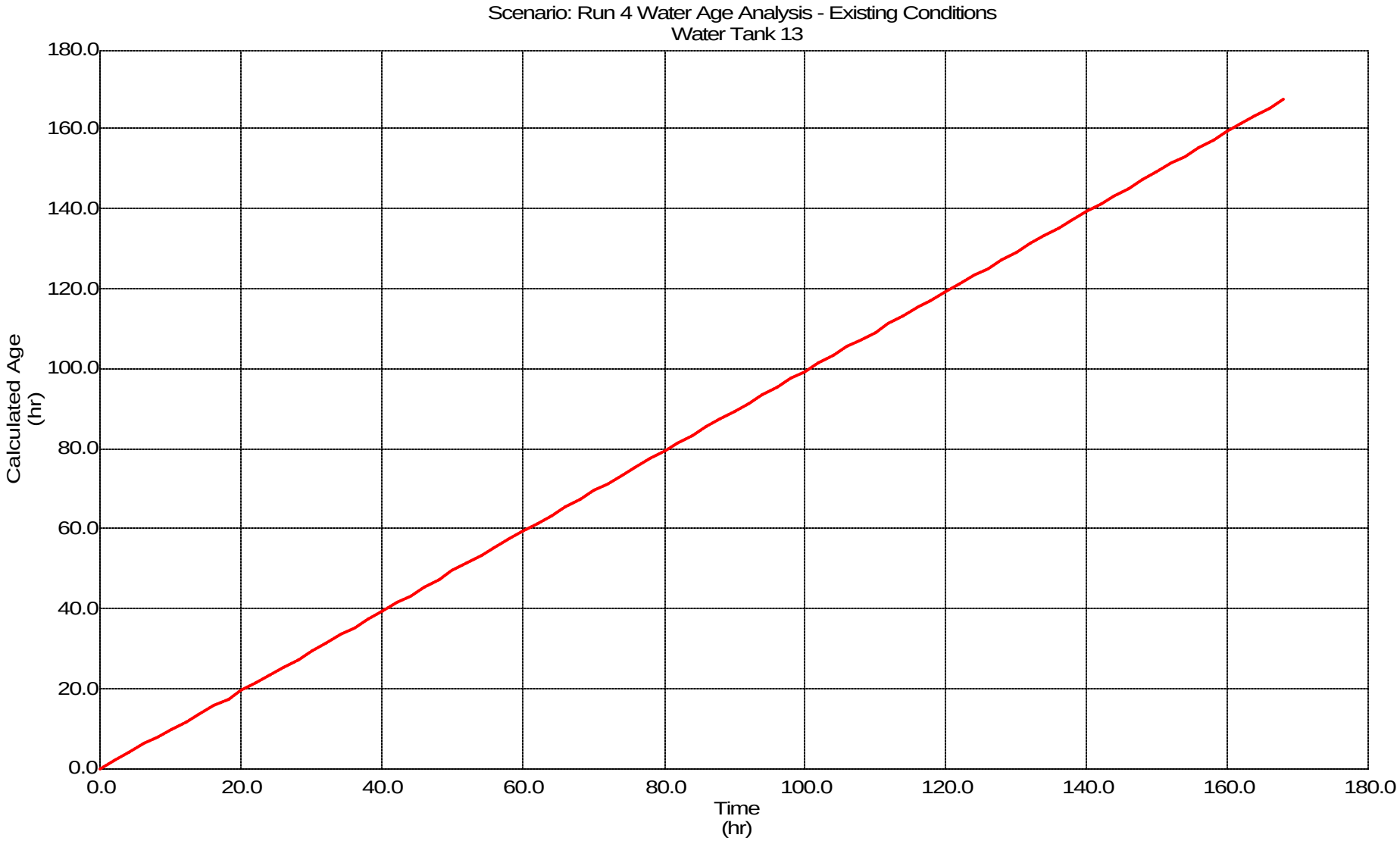
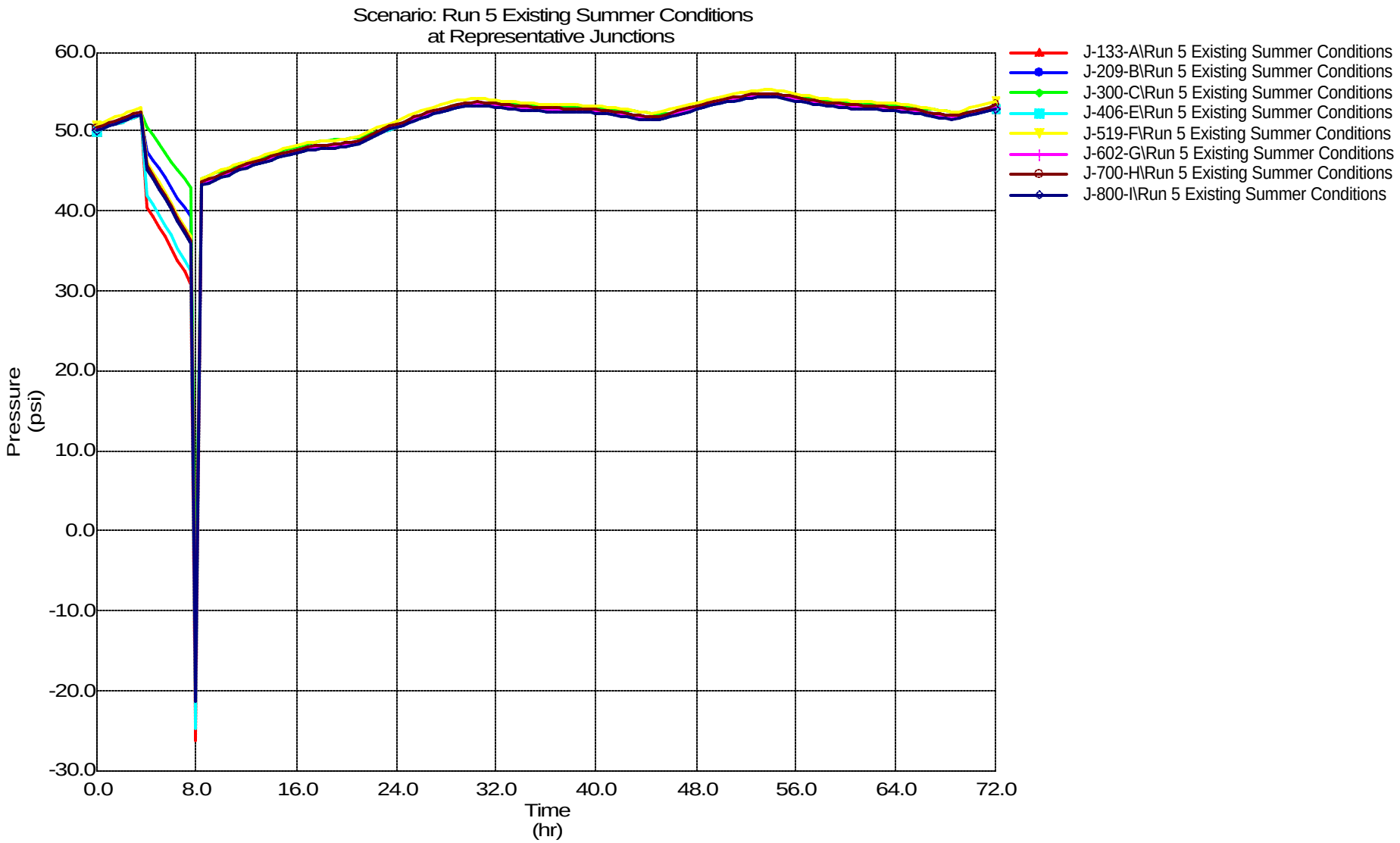
Graph


Scenario: Run 4 Water Age Analysis - Existing Conditions
Water Tank 13
Calculated Age
(hr)
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
Time
(hr)

Graph


Scenario: Run 5 Existing Summer Conditions
at Representative Junctions
Pressure
(psi)
60.0
50.0
40.0
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
0.0
8.0
16.0
24.0
32.0
40.0
48.0
56.0
64.0
72.0
Time
(hr)
J-133-A\Run 5 Existing Summer Conditions
J-209-B\Run 5 Existing Summer Conditions
J-300-C\Run 5 Existing Summer Conditions
J-406-E\Run 5 Existing Summer Conditions
J-519-F\Run 5 Existing Summer Conditions
J-602-G\Run 5 Existing Summer Conditions
J-700-H\Run 5 Existing Summer Conditions
J-800-I\Run 5 Existing Summer Conditions

Scenario: Run 6 Fire Flow Analysis - 10- & 14-in NN supply only
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	false	750.00	375.21	20.00	20.31	J-800-I
H-2	false	1,125.00	391.83	20.00	20.00	J-800-I
H-3	false	1,500.00	390.33	20.00	20.00	J-800-I
H-4	false	750.00	303.13	20.00	20.03	J-702-H
H-5	false	1,000.00	372.18	20.00	20.00	J-707-H
H-6	false	500.00	408.12	20.00	20.36	J-602-G
H-7	false	750.00	406.91	20.00	20.04	J-602-G
H-8	false	1,500.00	408.89	20.00	20.02	J-602-G
H-9	false	750.00	436.04	20.00	20.03	J-607-G
H-9A	false	750.00	423.76	20.00	20.04	J-600-G
H-11	false	1,500.00	510.70	20.00	20.00	J-528-F
H-12	true	500.00	639.80	20.00	20.01	J-527-F
H-13	true	500.00	593.88	20.00	20.00	J-526-F
H-14	false	1,500.00	600.89	20.00	20.00	J-525-F
H-15	false	1,125.00	734.58	20.00	20.00	J-518-F
H-16	false	750.00	636.24	20.00	20.00	J-522-F
H-18	false	1,500.00	854.54	20.00	20.02	J-523-F
H-18A	true	750.00	862.22	20.00	20.00	J-524-F
H-19	true	750.00	1,188.98	20.00	20.00	J-504-F
H-19A	false	1,500.00	1,355.40	20.00	20.00	J-502-F
H-20	false	1,500.00	963.09	20.00	20.02	J-512-F
H-21	false	750.00	627.92	20.00	20.00	J-521-F
H-22	false	1,500.00	829.29	20.00	20.00	J-508-F
H-23	true	500.00	517.46	20.00	20.00	J-510-F
H-24	false	1,500.00	692.57	20.00	20.00	J-408-E
H-25	false	750.00	661.28	20.00	20.00	H-23
H-26	false	1,500.00	731.68	20.00	20.00	J-407-E
H-27	true	500.00	776.35	20.00	20.00	J-406-E
H-28	false	2,250.00	610.23	20.00	20.00	J-404-E
H-29	false	1,000.00	595.58	20.00	20.02	J-137-A
H-30	false	1,000.00	609.63	20.00	20.02	J-103-A
H-31	false	1,000.00	615.53	20.00	20.02	J-136-A
H-32	false	1,500.00	905.63	20.00	20.00	J-133-A
H-33	false	1,500.00	848.04	20.00	20.00	J-126-A
H-34	false	1,125.00	1,017.10	20.00	20.01	J-131-A
H-35	false	1,000.00	649.99	20.00	20.01	J-129-A
H-36	true	750.00	1,042.27	20.00	20.00	J-132-A
H-37	false	1,500.00	1,050.47	20.00	20.00	J-105-A
H-37A	false	2,250.00	847.49	20.00	20.00	J-104-A
H-38	false	1,500.00	1,119.29	20.00	20.00	J-139-A
H-39	false	750.00	581.96	20.00	20.00	J-127-A
H-40	false	1,500.00	1,062.32	20.00	20.00	J-128-A
H-41	false	750.00	700.12	20.00	20.00	J-240-B
H-42	true	1,000.00	1,103.46	20.00	20.00	J-239-B
H-43	false	1,000.00	802.01	20.00	20.00	J-237-B
H-44	true	750.00	2,500.00	20.00	37.35	J-218-B
H-45	true	500.00	2,500.00	20.00	34.48	J-228-B

Scenario: Run 6 Fire Flow Analysis - 10- & 14-in NN supply only
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	35.16	J-226-B
H-47	false	1,500.00	1,224.96	20.00	20.00	J-227-B
H-48	true	1,000.00	1,200.36	20.00	20.00	J-217-B
H-49	true	1,000.00	1,079.52	20.00	20.00	J-231-B
H-50	true	750.00	1,087.73	20.00	20.00	J-211-B
H-51	false	750.00	606.97	20.00	20.00	J-245-B
H-52	true	1,500.00	2,500.00	20.00	25.06	J-236-B
H-53	false	2,250.00	1,557.78	20.00	20.00	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	32.94	J-215-B
H-54	true	750.00	1,080.57	20.00	20.00	J-230-B
H-55	false	1,500.00	935.63	20.00	20.00	J-229-B
H-56	false	1,500.00	900.03	20.00	20.00	J-232-B
H-57	false	1,500.00	1,191.00	20.00	20.00	J-233-B
H-58	false	1,500.00	1,376.76	20.00	20.00	J-234-B
H-59	true	500.00	1,175.42	20.00	20.00	J-247-B
H-60	false	1,125.00	678.58	20.00	20.01	J-246-B
H-61	false	2,250.00	708.65	20.00	20.00	J-241-B
H-62	false	1,500.00	546.88	20.00	20.03	J-242-B
H-63	false	750.00	651.89	20.00	20.01	J-138-A
H-64	false	1,500.00	683.03	20.00	20.00	J-405-E
H-65	false	2,250.00	609.41	20.00	20.00	J-135-A
H-66	false	2,250.00	585.24	20.00	20.00	J-134-A
H-67	false	2,250.00	401.98	20.00	20.00	J-106-A
H-68	false	1,500.00	606.86	20.00	20.00	J-124-A
H-69	false	1,500.00	968.81	20.00	20.00	J-101-A
H-70	false	1,500.00	737.12	20.00	20.00	J-244-B
H-behind37	false	1,500.00	779.16	20.00	20.00	J-140-A
H-moat	false	1,500.00	848.41	20.00	20.00	J-243-B
H-near100	false	1,000.00	454.28	20.00	20.01	J-238-B
H-near158	false	1,000.00	794.60	20.00	20.01	J-141-A
H-near161	true	500.00	1,001.00	20.00	20.00	J-100-A

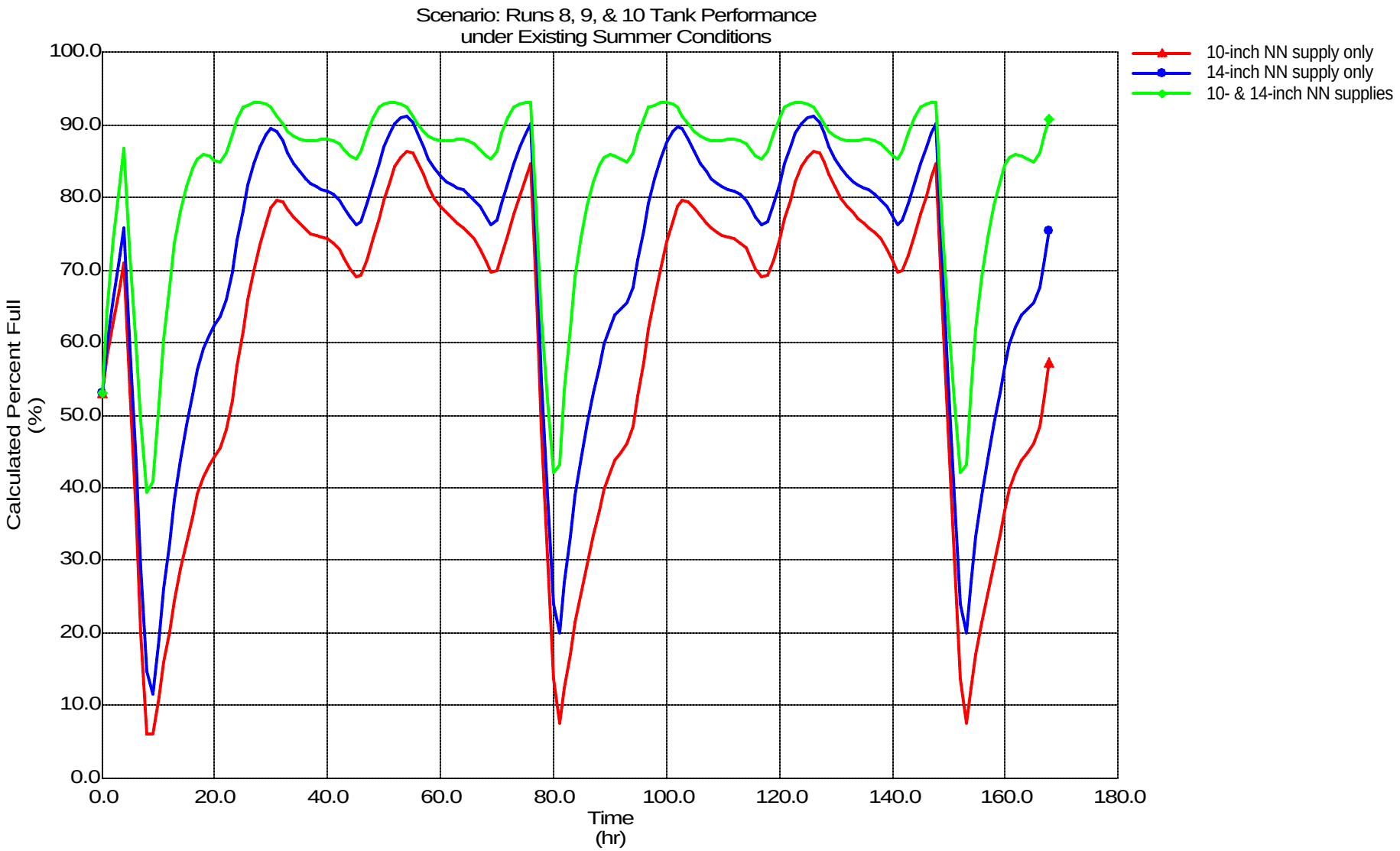
Scenario: Run 7 Fire Flow Analysis - 14-in NN supply only
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	false	750.00	371.60	20.00	20.31	J-800-I
H-2	false	1,125.00	388.03	20.00	20.00	J-800-I
H-3	false	1,500.00	386.63	20.00	20.00	J-800-I
H-4	false	750.00	300.59	20.00	20.05	J-702-H
H-5	false	1,000.00	368.72	20.00	20.00	J-707-H
H-6	false	500.00	404.02	20.00	20.37	J-602-G
H-7	false	750.00	402.90	20.00	20.05	J-602-G
H-8	false	1,500.00	404.77	20.00	20.02	J-602-G
H-9	false	750.00	431.53	20.00	20.04	J-607-G
H-9A	false	750.00	419.51	20.00	20.04	J-600-G
H-11	false	1,500.00	505.04	20.00	20.00	J-528-F
H-12	true	500.00	631.72	20.00	20.01	J-527-F
H-13	true	500.00	586.86	20.00	20.00	J-526-F
H-14	false	1,500.00	593.43	20.00	20.03	J-525-F
H-15	false	1,125.00	723.67	20.00	20.03	J-518-F
H-16	false	750.00	628.16	20.00	20.01	J-522-F
H-18	false	1,500.00	840.58	20.00	20.03	J-523-F
H-18A	true	750.00	848.08	20.00	20.00	J-524-F
H-19	true	750.00	1,159.59	20.00	20.02	J-504-F
H-19A	false	1,500.00	1,315.90	20.00	20.00	J-502-F
H-20	false	1,500.00	945.16	20.00	20.02	J-512-F
H-21	false	750.00	620.01	20.00	20.01	J-521-F
H-22	false	1,500.00	816.00	20.00	20.00	J-508-F
H-23	true	500.00	511.96	20.00	20.00	J-510-F
H-24	false	1,500.00	683.20	20.00	20.00	J-408-E
H-25	false	750.00	652.98	20.00	20.00	J-510-F
H-26	false	1,500.00	721.33	20.00	20.00	J-407-E
H-27	true	500.00	764.78	20.00	20.00	J-406-E
H-28	false	2,250.00	602.83	20.00	20.00	J-404-E
H-29	false	1,000.00	588.62	20.00	20.02	J-137-A
H-30	false	1,000.00	602.32	20.00	20.02	J-103-A
H-31	false	1,000.00	608.04	20.00	20.02	J-136-A
H-32	false	1,500.00	890.04	20.00	20.00	J-133-A
H-33	false	1,500.00	834.66	20.00	20.00	J-126-A
H-34	false	1,125.00	997.94	20.00	20.01	J-131-A
H-35	false	1,000.00	642.08	20.00	20.01	J-129-A
H-36	true	750.00	1,022.19	20.00	20.00	J-132-A
H-37	false	1,500.00	1,029.85	20.00	20.00	J-105-A
H-37A	false	2,250.00	834.08	20.00	20.00	J-104-A
H-38	false	1,500.00	1,096.85	20.00	20.00	J-139-A
H-39	false	750.00	575.40	20.00	20.00	J-127-A
H-40	false	1,500.00	1,041.76	20.00	20.00	J-128-A
H-41	false	750.00	690.74	20.00	20.00	J-240-B
H-42	true	1,000.00	1,082.93	20.00	20.00	J-239-B
H-43	false	1,000.00	789.19	20.00	20.00	J-237-B
H-44	true	750.00	2,500.00	20.00	34.38	J-218-B
H-45	true	500.00	2,500.00	20.00	30.67	J-228-B

Scenario: Run 7 Fire Flow Analysis - 14-in NN supply only
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	30.83	J-226-B
H-47	false	1,500.00	1,193.01	20.00	20.00	J-227-B
H-48	true	1,000.00	1,172.67	20.00	20.00	J-217-B
H-49	true	1,000.00	1,058.29	20.00	20.02	J-231-B
H-50	true	750.00	1,068.38	20.00	20.00	J-211-B
H-51	false	750.00	599.78	20.00	20.00	J-245-B
H-52	true	1,500.00	2,500.00	20.00	22.77	J-236-B
H-53	false	2,250.00	1,523.41	20.00	20.00	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	30.85	J-215-B
H-54	true	750.00	1,059.86	20.00	20.00	J-230-B
H-55	false	1,500.00	920.03	20.00	20.00	J-229-B
H-56	false	1,500.00	886.19	20.00	20.00	J-232-B
H-57	false	1,500.00	1,166.56	20.00	20.00	J-233-B
H-58	false	1,500.00	1,343.92	20.00	20.00	J-234-B
H-59	true	500.00	1,149.37	20.00	20.01	J-247-B
H-60	false	1,125.00	669.79	20.00	20.01	J-246-B
H-61	false	2,250.00	699.43	20.00	20.00	J-241-B
H-62	false	1,500.00	541.06	20.00	20.04	J-242-B
H-63	false	750.00	643.89	20.00	20.01	J-138-A
H-64	false	1,500.00	674.32	20.00	20.00	J-405-E
H-65	false	2,250.00	602.26	20.00	20.00	J-135-A
H-66	false	2,250.00	578.60	20.00	20.00	J-134-A
H-67	false	2,250.00	398.60	20.00	20.00	J-106-A
H-68	false	1,500.00	599.78	20.00	20.00	J-124-A
H-69	false	1,500.00	952.39	20.00	20.00	J-101-A
H-70	false	1,500.00	727.25	20.00	20.00	J-244-B
H-behind37	false	1,500.00	767.88	20.00	20.00	J-140-A
H-moat	false	1,500.00	835.58	20.00	20.00	J-243-B
H-near100	false	1,000.00	448.32	20.00	20.00	J-238-B
H-near158	false	1,000.00	782.96	20.00	20.01	J-141-A
H-near161	true	500.00	982.49	20.00	20.00	J-100-A

Graph


Scenario: Runs 8, 9, & 10 Tank Performance
under Existing Summer Conditions
10-inch NN supply only
14-inch NN supply only
10- & 14-inch NN supplies
Calculated Percent Full
(%)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
Time
(hr)

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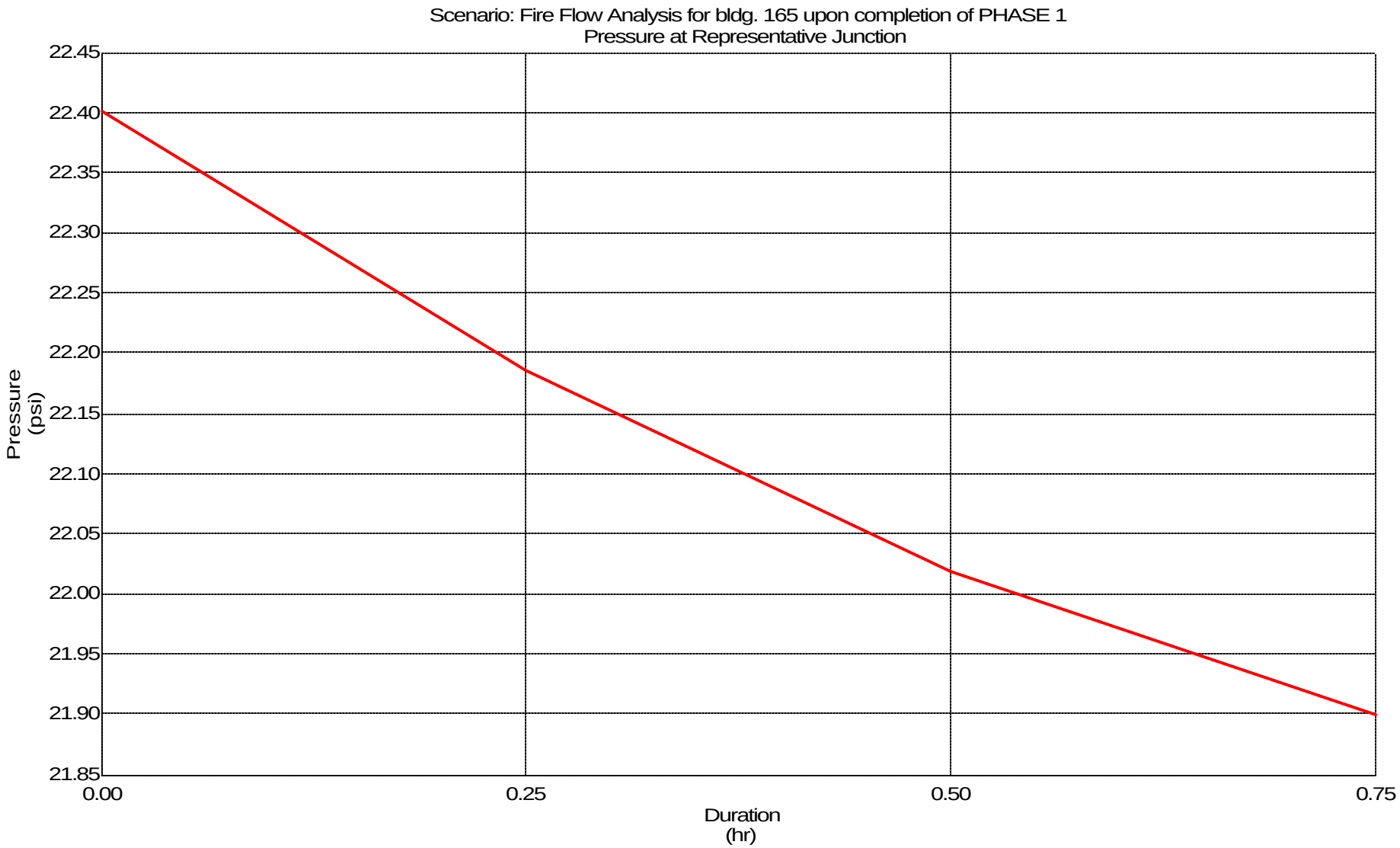
Scenario: PHASE 1 design, based on Maximum Day Existing Conditions
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	false	750.00	419.31	20.00	20.28	J-800-I
H-2	false	1,125.00	438.91	20.00	20.04	J-706-H
H-3	false	1,500.00	436.00	20.00	20.05	J-701-H
H-4	false	750.00	326.81	20.00	20.02	J-702-H
H-5	false	1,000.00	412.11	20.00	20.03	J-707-H
H-6	false	500.00	460.42	20.00	20.19	J-602-G
H-7	false	750.00	457.32	20.00	20.02	J-604-G
H-8	false	1,500.00	460.76	20.00	20.04	J-602-G
H-9	false	750.00	495.51	20.00	20.01	J-607-G
H-9A	false	750.00	478.02	20.00	20.01	J-600-G
H-11	false	1,500.00	596.96	20.00	20.02	J-528-F
H-12	true	500.00	790.81	20.00	20.01	J-527-F
H-13	true	500.00	688.83	20.00	20.00	J-526-F
H-14	false	1,500.00	685.65	20.00	20.01	J-525-F
H-15	true	1,125.00	1,141.39	20.00	20.00	J-518-F
H-16	true	750.00	878.98	20.00	20.00	J-522-F
H-18	true	1,500.00	2,313.30	20.00	20.01	J-523-F
H-18A	true	750.00	1,210.14	20.00	20.00	J-524-F
H-19	true	750.00	1,627.93	20.00	20.00	J-504-F
H-19A	true	1,500.00	1,875.15	20.00	20.00	J-248-B
H-20	true	1,500.00	2,500.00	20.00	20.68	J-512-F
H-21	true	750.00	872.34	20.00	20.00	J-521-F
H-22	true	1,500.00	2,500.00	20.00	24.56	J-800-I
H-23	true	500.00	713.73	20.00	20.00	J-510-F
H-24	false	1,500.00	1,118.35	20.00	20.01	J-408-E
H-25	true	750.00	1,214.12	20.00	20.00	H-23
H-26	true	1,500.00	2,500.00	20.00	25.55	J-407-E
H-27	true	500.00	2,500.00	20.00	27.23	J-406-E
H-28	true	2,250.00	2,500.00	20.00	24.53	J-404-E
H-29	true	1,000.00	2,500.00	20.00	22.95	J-137-A
H-30	true	1,000.00	2,500.00	20.00	21.51	J-103-A
H-31	true	1,000.00	2,338.80	20.00	20.00	J-136-A
H-32	true	1,500.00	2,365.31	20.00	20.01	J-133-A
H-33	true	1,500.00	2,353.89	20.00	20.01	J-126-A
H-34	true	1,125.00	2,229.05	20.00	20.00	J-131-A
H-35	false	1,000.00	803.97	20.00	20.00	J-129-A
H-36	true	750.00	2,342.95	20.00	20.00	J-132-A
H-37	true	1,500.00	2,388.95	20.00	20.00	J-105-A
H-37A	true	2,250.00	2,385.36	20.00	20.00	J-104-A
H-38	true	1,500.00	2,500.00	20.00	20.98	J-139-A
H-39	false	750.00	699.05	20.00	20.00	J-127-A
H-40	true	1,500.00	2,325.81	20.00	20.01	J-128-A
H-41	true	750.00	1,222.45	20.00	20.00	J-240-B
H-42	true	1,000.00	2,500.00	20.00	23.84	J-239-B
H-43	false	1,000.00	983.12	20.00	19.99	J-237-B
H-44	true	750.00	2,500.00	20.00	39.67	J-218-B
H-45	true	500.00	2,500.00	20.00	37.63	J-228-B

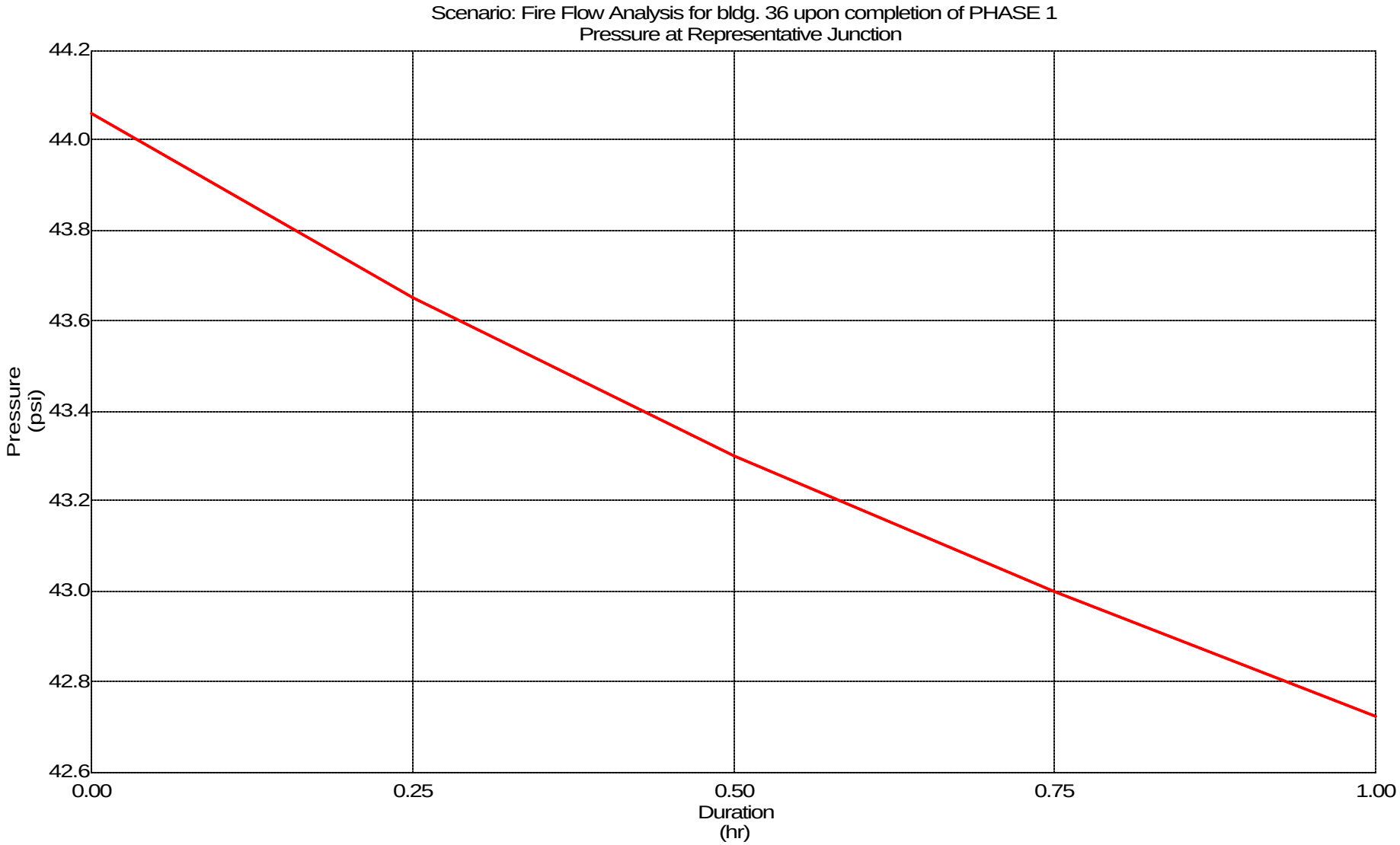
Scenario: PHASE 1 design, based on Maximum Day Existing Conditions
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	38.92	J-226-B
H-47	true	1,500.00	2,500.00	20.00	36.75	J-227-B
H-48	true	1,000.00	2,500.00	20.00	35.51	J-217-B
H-49	true	1,000.00	1,262.60	20.00	20.00	J-231-B
H-50	true	750.00	2,500.00	20.00	41.35	J-211-B
H-51	true	750.00	2,500.00	20.00	27.90	J-245-B
H-52	true	1,500.00	2,500.00	20.00	27.67	J-236-B
H-53	false	2,250.00	1,587.58	20.00	20.00	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	34.38	J-215-B
H-54	true	750.00	1,740.71	20.00	20.00	J-230-B
H-55	true	1,500.00	2,500.00	20.00	33.56	J-229-B
H-56	true	1,500.00	2,500.00	20.00	32.62	J-232-B
H-57	true	1,500.00	2,500.00	20.00	33.48	J-233-B
H-58	true	1,500.00	2,229.19	20.00	20.00	J-234-B
H-59	true	500.00	2,500.00	20.00	32.18	J-209-B
H-60	true	1,125.00	2,500.00	20.00	29.31	J-246-B
H-61	true	2,250.00	2,500.00	20.00	28.22	J-241-B
H-62	true	1,500.00	2,500.00	20.00	24.22	J-242-B
H-63	true	750.00	2,500.00	20.00	26.88	J-138-A
H-64	true	1,500.00	2,500.00	20.00	27.41	J-405-E
H-65	true	2,250.00	2,500.00	20.00	25.62	J-135-A
H-66	true	2,250.00	2,500.00	20.00	22.85	J-134-A
H-67	true	2,250.00	2,435.57	20.00	20.00	J-106-A
H-68	true	1,500.00	2,500.00	20.00	23.47	J-124-A
H-69	true	1,500.00	2,185.23	20.00	20.00	J-101-A
H-70	true	1,500.00	2,500.00	20.00	28.00	J-244-B
H-behind37	true	1,500.00	1,967.48	20.00	20.00	J-140-A
H-moat	true	1,500.00	2,500.00	20.00	25.63	J-243-B
H-near100	true	1,000.00	1,015.89	20.00	20.01	J-238-B
H-near158	true	1,000.00	1,196.67	20.00	20.00	J-141-A
H-near161	true	500.00	2,313.20	20.00	20.00	J-130-A

Graph


Scenario: Fire Flow Analysis for bldg. 165 upon completion of PHASE 1
Pressure at Representative Junction
22.45
22.40
22.35
22.30
22.25
22.20
22.15
22.10
22.05
22.00
21.95
21.90
21.85
Pressure
(psi)
0.00
0.25
0.50
0.75
Duration
(hr)

Graph


Scenario: Fire Flow Analysis for bldg. 36 upon completion of PHASE 1
Pressure at Representative Junction
44.2
44.0
43.8
43.6
43.4
43.2
43.0
42.8
42.6
Pressure
(psi)
0.00
0.25
0.50
0.75
1.00
Duration
(hr)

Scenario: Fire Flow Analysis upon completion of PHASE 1 with tank off-line
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	false	750.00	426.54	20.00	20.27	J-800-I
H-2	false	1,125.00	445.27	20.00	20.00	J-706-H
H-3	false	1,500.00	442.56	20.00	20.00	J-701-H
H-4	false	750.00	336.45	20.00	20.05	J-702-H
H-5	false	1,000.00	419.73	20.00	20.00	J-707-H
H-6	false	500.00	465.32	20.00	20.17	J-602-G
H-7	false	750.00	462.10	20.00	20.04	J-604-G
H-8	false	1,500.00	465.96	20.00	20.00	J-602-G
H-9	false	750.00	497.73	20.00	20.03	J-607-G
H-9A	false	750.00	481.44	20.00	20.03	J-600-G
H-11	false	1,500.00	590.14	20.00	20.00	J-528-F
H-12	true	500.00	756.35	20.00	20.00	J-527-F
H-13	true	500.00	670.45	20.00	20.02	J-526-F
H-14	false	1,500.00	668.04	20.00	20.00	J-525-F
H-15	false	1,125.00	1,024.17	20.00	20.00	J-518-F
H-16	true	750.00	827.73	20.00	20.00	J-522-F
H-18	true	1,500.00	1,646.81	20.00	20.00	J-523-F
H-18A	true	750.00	1,073.44	20.00	20.00	J-524-F
H-19	true	750.00	1,331.58	20.00	20.00	J-504-F
H-19A	false	1,500.00	1,456.12	20.00	20.00	J-248-B
H-20	true	1,500.00	1,728.65	20.00	20.00	J-512-F
H-21	true	750.00	822.41	20.00	20.00	J-521-F
H-22	true	1,500.00	1,788.06	20.00	20.00	J-800-I
H-23	true	500.00	692.27	20.00	20.01	J-510-F
H-24	false	1,500.00	1,008.22	20.00	20.00	J-408-E
H-25	true	750.00	1,078.37	20.00	20.00	H-23
H-26	true	1,500.00	1,798.04	20.00	20.00	J-407-E
H-27	true	500.00	1,821.18	20.00	20.00	J-406-E
H-28	false	2,250.00	1,770.23	20.00	20.00	J-404-E
H-29	true	1,000.00	1,755.56	20.00	20.00	H-30
H-30	true	1,000.00	1,728.92	20.00	20.00	J-103-A
H-31	true	1,000.00	1,640.81	20.00	20.00	J-136-A
H-32	true	1,500.00	1,643.34	20.00	20.00	J-133-A
H-33	true	1,500.00	1,651.70	20.00	20.00	J-113-A
H-34	true	1,125.00	1,603.88	20.00	20.00	J-131-A
H-35	false	1,000.00	767.27	20.00	20.01	J-129-A
H-36	true	750.00	1,646.61	20.00	20.00	J-132-A
H-37	true	1,500.00	1,655.59	20.00	20.00	J-105-A
H-37A	false	2,250.00	1,660.65	20.00	20.00	H-37
H-38	true	1,500.00	1,715.36	20.00	20.00	J-139-A
H-39	false	750.00	678.82	20.00	20.00	J-127-A
H-40	true	1,500.00	1,635.55	20.00	20.01	J-128-A
H-41	true	750.00	1,079.64	20.00	20.00	J-240-B
H-42	true	1,000.00	1,757.37	20.00	20.00	J-239-B
H-43	false	1,000.00	916.95	20.00	20.00	J-237-B
H-44	true	750.00	2,151.48	20.00	20.00	J-218-B
H-45	true	500.00	2,175.14	20.00	20.00	J-228-B

Scenario: Fire Flow Analysis upon completion of PHASE 1 with tank off-line
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,323.24	20.00	20.00	J-226-B
H-47	true	1,500.00	2,173.12	20.00	20.00	J-227-B
H-48	true	1,000.00	2,118.82	20.00	20.00	J-217-B
H-49	true	1,000.00	1,117.35	20.00	20.00	J-231-B
H-50	true	750.00	2,036.93	20.00	20.00	J-211-B
H-51	true	750.00	1,834.68	20.00	20.01	J-245-B
H-52	true	1,500.00	1,801.86	20.00	20.00	J-236-B
H-53	false	2,250.00	1,294.75	20.00	20.00	J-235-B
H-53A	true	1,000.00	1,911.45	20.00	20.00	J-215-B
H-54	true	750.00	1,412.17	20.00	20.00	J-230-B
H-55	true	1,500.00	2,049.40	20.00	20.00	J-229-B
H-56	true	1,500.00	2,006.16	20.00	20.00	J-232-B
H-57	true	1,500.00	2,014.26	20.00	20.00	J-233-B
H-58	true	1,500.00	1,629.24	20.00	20.00	J-234-B
H-59	true	500.00	1,942.59	20.00	20.00	J-209-B
H-60	true	1,125.00	1,868.44	20.00	20.00	J-246-B
H-61	false	2,250.00	1,856.09	20.00	20.00	J-241-B
H-62	true	1,500.00	1,789.77	20.00	20.00	J-242-B
H-63	true	750.00	1,831.44	20.00	20.01	J-138-A
H-64	true	1,500.00	1,843.63	20.00	20.00	J-405-E
H-65	false	2,250.00	1,806.36	20.00	20.00	J-135-A
H-66	false	2,250.00	1,757.56	20.00	20.00	J-134-A
H-67	false	2,250.00	1,692.96	20.00	20.00	J-106-A
H-68	true	1,500.00	1,770.88	20.00	20.00	J-124-A
H-69	true	1,500.00	1,602.62	20.00	20.01	J-101-A
H-70	true	1,500.00	1,854.28	20.00	20.00	J-244-B
H-behind37	false	1,500.00	1,494.80	20.00	20.00	J-140-A
H-moat	true	1,500.00	1,814.67	20.00	20.00	J-243-B
H-near100	false	1,000.00	939.51	20.00	20.00	J-238-B
H-near158	false	1,000.00	1,062.79	20.00	19.99	J-141-A
H-near161	true	500.00	1,636.33	20.00	20.00	J-130-A

Scenario: PHASE 2 design, based on Maximum Day Existing Conditions
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	true	750.00	1,095.59	20.00	20.00	J-800-I
H-2	true	1,125.00	1,156.81	20.00	20.02	J-800-I
H-3	false	1,500.00	1,069.43	20.00	20.00	J-800-I
H-4	true	750.00	1,231.83	20.00	20.01	J-702-H
H-5	true	1,000.00	1,287.69	20.00	20.00	J-707-H
H-6	true	500.00	1,257.61	20.00	20.01	J-603-G
H-7	true	750.00	1,346.81	20.00	20.01	J-800-I
H-8	false	1,500.00	1,368.43	20.00	20.00	J-602-G
H-9	true	750.00	1,619.94	20.00	20.00	J-602-G
H-9A	true	750.00	1,276.78	20.00	20.00	J-602-G
H-11	true	1,500.00	2,262.21	20.00	20.01	J-800-I
H-12	true	500.00	2,500.00	20.00	20.61	J-800-I
H-13	false	500.00	2,472.51	20.00	19.99	J-526-F
H-14	true	1,500.00	2,468.98	20.00	20.01	J-525-F
H-15	true	1,125.00	2,348.74	20.00	20.00	J-518-F
H-16	true	750.00	2,393.54	20.00	20.00	J-522-F
H-18	true	1,500.00	2,500.00	20.00	25.11	J-523-F
H-18A	true	750.00	2,361.35	20.00	20.00	J-524-F
H-19	true	750.00	2,500.00	20.00	23.32	J-504-F
H-19A	true	1,500.00	2,106.56	20.00	20.00	J-248-B
H-20	true	1,500.00	2,500.00	20.00	26.04	J-512-F
H-21	true	750.00	2,461.84	20.00	20.00	J-521-F
H-22	true	1,500.00	2,500.00	20.00	28.36	J-800-I
H-23	true	500.00	720.67	20.00	20.00	J-510-F
H-24	true	1,500.00	2,500.00	20.00	24.28	J-408-E
H-25	true	750.00	1,242.03	20.00	20.00	H-23
H-26	true	1,500.00	2,500.00	20.00	29.39	J-407-E
H-27	true	500.00	2,500.00	20.00	31.20	J-406-E
H-28	true	2,250.00	2,500.00	20.00	28.85	J-404-E
H-29	true	1,000.00	2,500.00	20.00	27.66	J-137-A
H-30	true	1,000.00	2,500.00	20.00	26.44	J-103-A
H-31	true	1,000.00	2,500.00	20.00	26.14	J-136-A
H-32	true	1,500.00	2,500.00	20.00	27.67	J-133-A
H-33	true	1,500.00	2,500.00	20.00	26.95	J-126-A
H-34	true	1,125.00	2,500.00	20.00	21.84	J-131-A
H-35	true	1,000.00	2,500.00	20.00	24.80	J-129-A
H-36	true	750.00	2,500.00	20.00	24.73	J-132-A
H-37	true	1,500.00	2,500.00	20.00	25.15	J-105-A
H-37A	true	2,250.00	2,500.00	20.00	25.28	J-104-A
H-38	true	1,500.00	2,500.00	20.00	25.25	J-139-A
H-39	true	750.00	2,500.00	20.00	27.15	J-127-A
H-40	true	1,500.00	2,494.74	20.00	20.00	J-128-A
H-41	true	750.00	2,500.00	20.00	35.21	J-240-B
H-42	true	1,000.00	2,500.00	20.00	27.02	J-239-B
H-43	true	1,000.00	2,500.00	20.00	36.53	J-237-B
H-44	true	750.00	2,500.00	20.00	41.22	J-218-B
H-45	true	500.00	2,500.00	20.00	38.36	J-228-B

Scenario: PHASE 2 design, based on Maximum Day Existing Conditions
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	39.54	J-226-B
H-47	true	1,500.00	2,500.00	20.00	37.46	J-227-B
H-48	true	1,000.00	2,500.00	20.00	36.38	J-217-B
H-49	true	1,000.00	1,343.35	20.00	20.00	J-231-B
H-50	true	750.00	2,500.00	20.00	41.94	J-211-B
H-51	true	750.00	2,500.00	20.00	32.83	J-245-B
H-52	true	1,500.00	2,500.00	20.00	30.61	J-236-B
H-53	true	2,250.00	2,500.00	20.00	38.92	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	39.31	J-215-B
H-54	true	750.00	1,789.26	20.00	20.00	J-230-B
H-55	true	1,500.00	2,500.00	20.00	34.54	J-229-B
H-56	true	1,500.00	2,500.00	20.00	33.76	J-232-B
H-57	true	1,500.00	2,500.00	20.00	34.85	J-233-B
H-58	true	1,500.00	2,287.67	20.00	20.00	J-234-B
H-59	true	500.00	2,500.00	20.00	34.86	J-209-B
H-60	true	1,125.00	2,500.00	20.00	33.37	J-246-B
H-61	true	2,250.00	2,500.00	20.00	31.88	J-241-B
H-62	true	1,500.00	2,500.00	20.00	27.93	J-242-B
H-63	true	750.00	2,500.00	20.00	30.71	J-138-A
H-64	true	1,500.00	2,500.00	20.00	31.25	J-405-E
H-65	true	2,250.00	2,500.00	20.00	29.47	J-135-A
H-66	true	2,250.00	2,500.00	20.00	26.72	J-134-A
H-67	true	2,250.00	2,500.00	20.00	22.63	J-106-A
H-68	true	1,500.00	2,500.00	20.00	27.40	J-124-A
H-69	true	1,500.00	2,316.29	20.00	20.00	J-101-A
H-70	true	1,500.00	2,500.00	20.00	31.77	J-244-B
H-behind37	true	1,500.00	2,269.64	20.00	20.00	J-140-A
H-moat	true	1,500.00	2,500.00	20.00	29.30	J-243-B
H-near100	true	1,000.00	1,020.72	20.00	20.01	J-238-B
H-near158	true	1,000.00	2,500.00	20.00	23.53	J-141-A
H-near161	true	500.00	2,500.00	20.00	25.38	J-130-A

Scenario: Fire Flow Analysis upon completion of PHASE 2 with tank off-line
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	true	750.00	1,023.83	20.00	20.03	J-800-I
H-2	false	1,125.00	1,070.12	20.00	20.13	J-800-I
H-3	false	1,500.00	1,005.09	20.00	20.00	J-800-I
H-4	true	750.00	1,128.81	20.00	20.00	J-702-H
H-5	true	1,000.00	1,168.66	20.00	20.01	J-707-H
H-6	true	500.00	1,149.20	20.00	20.00	J-603-G
H-7	true	750.00	1,212.94	20.00	20.00	J-800-I
H-8	false	1,500.00	1,225.61	20.00	20.00	J-602-G
H-9	true	750.00	1,395.66	20.00	20.00	J-602-G
H-9A	true	750.00	1,163.37	20.00	20.00	J-800-I
H-11	true	1,500.00	1,754.74	20.00	20.00	J-800-I
H-12	true	500.00	1,876.08	20.00	20.00	J-800-I
H-13	true	500.00	1,852.38	20.00	20.00	J-526-F
H-14	true	1,500.00	1,851.31	20.00	20.00	J-525-F
H-15	true	1,125.00	1,796.18	20.00	20.00	J-518-F
H-16	true	750.00	1,816.55	20.00	20.01	J-522-F
H-18	true	1,500.00	1,972.15	20.00	20.00	J-523-F
H-18A	true	750.00	1,802.86	20.00	20.00	J-524-F
H-19	true	750.00	1,932.15	20.00	20.01	J-504-F
H-19A	true	1,500.00	1,675.00	20.00	20.00	J-248-B
H-20	true	1,500.00	1,997.03	20.00	20.00	J-512-F
H-21	true	750.00	1,847.16	20.00	20.01	J-521-F
H-22	true	1,500.00	2,050.77	20.00	20.00	J-800-I
H-23	true	500.00	712.29	20.00	20.01	J-510-F
H-24	true	1,500.00	1,952.86	20.00	20.00	J-408-E
H-25	true	750.00	1,138.68	20.00	20.00	H-23
H-26	true	1,500.00	2,072.33	20.00	20.00	J-407-E
H-27	true	500.00	2,117.43	20.00	20.00	J-406-E
H-28	false	2,250.00	2,050.16	20.00	20.00	J-404-E
H-29	true	1,000.00	2,029.09	20.00	20.00	J-137-A
H-30	true	1,000.00	1,996.95	20.00	20.00	J-103-A
H-31	true	1,000.00	1,986.79	20.00	20.00	J-136-A
H-32	true	1,500.00	2,019.92	20.00	20.00	J-133-A
H-33	true	1,500.00	2,012.16	20.00	20.00	J-126-A
H-34	true	1,125.00	1,897.65	20.00	20.00	J-131-A
H-35	true	1,000.00	1,973.58	20.00	20.00	J-129-A
H-36	true	750.00	1,954.72	20.00	20.01	J-132-A
H-37	true	1,500.00	1,960.93	20.00	20.00	J-105-A
H-37A	false	2,250.00	1,965.08	20.00	20.00	J-104-A
H-38	true	1,500.00	1,966.18	20.00	20.00	J-139-A
H-39	true	750.00	2,023.72	20.00	20.01	J-127-A
H-40	true	1,500.00	1,851.44	20.00	20.00	J-128-A
H-41	true	750.00	2,263.64	20.00	20.00	J-240-B
H-42	true	1,000.00	1,996.07	20.00	20.00	J-239-B
H-43	true	1,000.00	2,348.99	20.00	20.01	J-237-B
H-44	true	750.00	2,420.32	20.00	20.00	J-218-B
H-45	true	500.00	2,405.08	20.00	20.00	J-228-B

Scenario: Fire Flow Analysis upon completion of PHASE 2 with tank off-line
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	21.32	J-226-B
H-47	true	1,500.00	2,401.66	20.00	20.00	J-227-B
H-48	true	1,000.00	2,341.38	20.00	20.01	J-217-B
H-49	true	1,000.00	1,209.63	20.00	20.01	J-231-B
H-50	true	750.00	2,321.52	20.00	20.00	J-211-B
H-51	true	750.00	2,173.06	20.00	20.00	J-245-B
H-52	true	1,500.00	2,067.89	20.00	20.00	J-236-B
H-53	true	2,250.00	2,292.78	20.00	20.00	J-235-B
H-53A	true	1,000.00	2,306.27	20.00	20.01	J-215-B
H-54	true	750.00	1,506.52	20.00	20.00	J-230-B
H-55	true	1,500.00	2,264.98	20.00	20.00	J-229-B
H-56	true	1,500.00	2,233.06	20.00	20.00	J-232-B
H-57	true	1,500.00	2,266.81	20.00	20.00	J-233-B
H-58	true	1,500.00	1,774.29	20.00	20.00	J-234-B
H-59	true	500.00	2,240.95	20.00	20.00	J-209-B
H-60	true	1,125.00	2,188.49	20.00	20.00	J-246-B
H-61	false	2,250.00	2,146.28	20.00	20.01	J-241-B
H-62	true	1,500.00	2,047.08	20.00	20.00	J-242-B
H-63	true	750.00	2,112.86	20.00	20.00	J-138-A
H-64	true	1,500.00	2,132.22	20.00	20.00	J-405-E
H-65	false	2,250.00	2,078.63	20.00	20.00	J-135-A
H-66	false	2,250.00	2,008.92	20.00	20.00	J-134-A
H-67	false	2,250.00	1,917.52	20.00	20.00	J-106-A
H-68	true	1,500.00	2,029.20	20.00	20.00	J-124-A
H-69	true	1,500.00	1,791.09	20.00	20.00	J-101-A
H-70	true	1,500.00	2,146.98	20.00	20.00	J-244-B
H-behind37	true	1,500.00	1,758.28	20.00	20.00	J-140-A
H-moat	true	1,500.00	2,082.21	20.00	20.00	J-243-B
H-near100	false	1,000.00	967.53	20.00	20.00	J-238-B
H-near158	true	1,000.00	1,942.21	20.00	20.00	J-141-A
H-near161	true	500.00	1,972.84	20.00	20.00	J-130-A

Scenario: PHASE 3 design, based on Maximum Day Existing Conditions
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	true	750.00	1,358.01	20.00	20.00	J-800-I
H-2	true	1,125.00	1,431.32	20.00	20.00	J-800-I
H-3	false	1,500.00	1,258.33	20.00	20.00	J-800-I
H-4	true	750.00	1,459.86	20.00	20.00	J-702-H
H-5	true	1,000.00	1,555.29	20.00	20.00	J-707-H
H-6	true	500.00	1,479.75	20.00	20.01	J-603-G
H-7	true	750.00	1,630.96	20.00	20.01	J-604-G
H-8	true	1,500.00	1,659.13	20.00	20.00	J-602-G
H-9	true	750.00	1,960.23	20.00	20.00	J-607-G
H-9A	true	750.00	1,439.55	20.00	20.00	J-602-G
H-11	true	1,500.00	2,500.00	20.00	27.27	J-528-F
H-12	true	500.00	2,500.00	20.00	33.19	J-527-F
H-13	true	500.00	2,500.00	20.00	32.05	J-526-F
H-14	true	1,500.00	2,500.00	20.00	32.08	J-525-F
H-15	true	1,125.00	2,500.00	20.00	27.36	J-518-F
H-16	true	750.00	2,500.00	20.00	28.43	J-522-F
H-18	true	1,500.00	2,500.00	20.00	37.06	J-523-F
H-18A	true	750.00	2,500.00	20.00	29.31	J-524-F
H-19	true	750.00	2,500.00	20.00	37.12	J-504-F
H-19A	true	1,500.00	2,500.00	20.00	36.13	J-502-F
H-20	true	1,500.00	2,500.00	20.00	38.32	J-512-F
H-21	true	750.00	2,500.00	20.00	30.03	J-521-F
H-22	true	1,500.00	2,500.00	20.00	39.36	J-800-I
H-23	true	500.00	2,300.55	20.00	20.00	J-510-F
H-24	true	1,500.00	2,500.00	20.00	35.03	J-408-E
H-25	false	750.00	2,246.82	20.00	19.99	H-23
H-26	true	1,500.00	2,500.00	20.00	39.24	J-407-E
H-27	true	500.00	2,500.00	20.00	39.92	J-406-E
H-28	true	2,250.00	2,500.00	20.00	37.15	J-404-E
H-29	true	1,000.00	2,500.00	20.00	35.79	J-137-A
H-30	true	1,000.00	2,500.00	20.00	34.52	J-103-A
H-31	true	1,000.00	2,500.00	20.00	36.65	J-136-A
H-32	true	1,500.00	2,500.00	20.00	39.57	J-133-A
H-33	true	1,500.00	2,500.00	20.00	38.93	J-126-A
H-34	true	1,125.00	2,500.00	20.00	40.62	J-131-A
H-35	true	1,000.00	2,500.00	20.00	31.84	J-129-A
H-36	true	750.00	2,500.00	20.00	40.99	J-132-A
H-37	true	1,500.00	2,500.00	20.00	41.00	J-105-A
H-37A	true	2,250.00	2,500.00	20.00	40.82	J-104-A
H-38	true	1,500.00	2,500.00	20.00	43.01	H-40
H-39	true	750.00	2,500.00	20.00	33.86	J-127-A
H-40	true	1,500.00	2,500.00	20.00	41.68	J-128-A
H-41	true	750.00	2,500.00	20.00	41.54	J-240-B
H-42	true	1,000.00	2,500.00	20.00	44.26	H-32
H-43	true	1,000.00	2,500.00	20.00	41.33	J-237-B
H-44	true	750.00	2,500.00	20.00	45.90	J-218-B
H-45	true	500.00	2,500.00	20.00	45.55	J-228-B

Scenario: PHASE 3 design, based on Maximum Day Existing Conditions
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	45.63	J-226-B
H-47	true	1,500.00	2,500.00	20.00	42.99	J-227-B
H-48	true	1,000.00	2,500.00	20.00	42.59	J-217-B
H-49	true	1,000.00	2,500.00	20.00	35.72	J-231-B
H-50	true	750.00	2,500.00	20.00	45.65	H-32
H-51	true	750.00	2,500.00	20.00	39.25	J-245-B
H-52	true	1,500.00	2,500.00	20.00	45.00	J-236-B
H-53	true	2,250.00	2,500.00	20.00	44.59	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	45.79	J-215-B
H-54	true	750.00	2,500.00	20.00	38.74	J-230-B
H-55	true	1,500.00	2,500.00	20.00	40.86	J-229-B
H-56	true	1,500.00	2,500.00	20.00	40.64	J-232-B
H-57	true	1,500.00	2,500.00	20.00	42.80	J-233-B
H-58	true	1,500.00	2,500.00	20.00	41.75	J-234-B
H-59	true	500.00	2,500.00	20.00	42.70	J-222-B
H-60	true	1,125.00	2,500.00	20.00	39.80	J-246-B
H-61	true	2,250.00	2,500.00	20.00	40.11	J-241-B
H-62	true	1,500.00	2,500.00	20.00	36.93	J-242-B
H-63	true	750.00	2,500.00	20.00	39.10	J-138-A
H-64	true	1,500.00	2,500.00	20.00	39.76	J-405-E
H-65	true	2,250.00	2,500.00	20.00	38.08	J-135-A
H-66	true	2,250.00	2,500.00	20.00	36.10	J-134-A
H-67	true	2,250.00	2,500.00	20.00	32.46	J-106-A
H-68	true	1,500.00	2,500.00	20.00	37.52	J-124-A
H-69	true	1,500.00	2,500.00	20.00	26.83	J-101-A
H-70	true	1,500.00	2,500.00	20.00	40.48	J-244-B
H-behind37	true	1,500.00	2,500.00	20.00	26.19	J-140-A
H-moat	true	1,500.00	2,500.00	20.00	37.53	J-243-B
H-near100	true	1,000.00	2,500.00	20.00	33.16	J-238-B
H-near158	true	1,000.00	2,500.00	20.00	30.85	J-141-A
H-near161	true	500.00	2,500.00	20.00	40.61	J-100-A

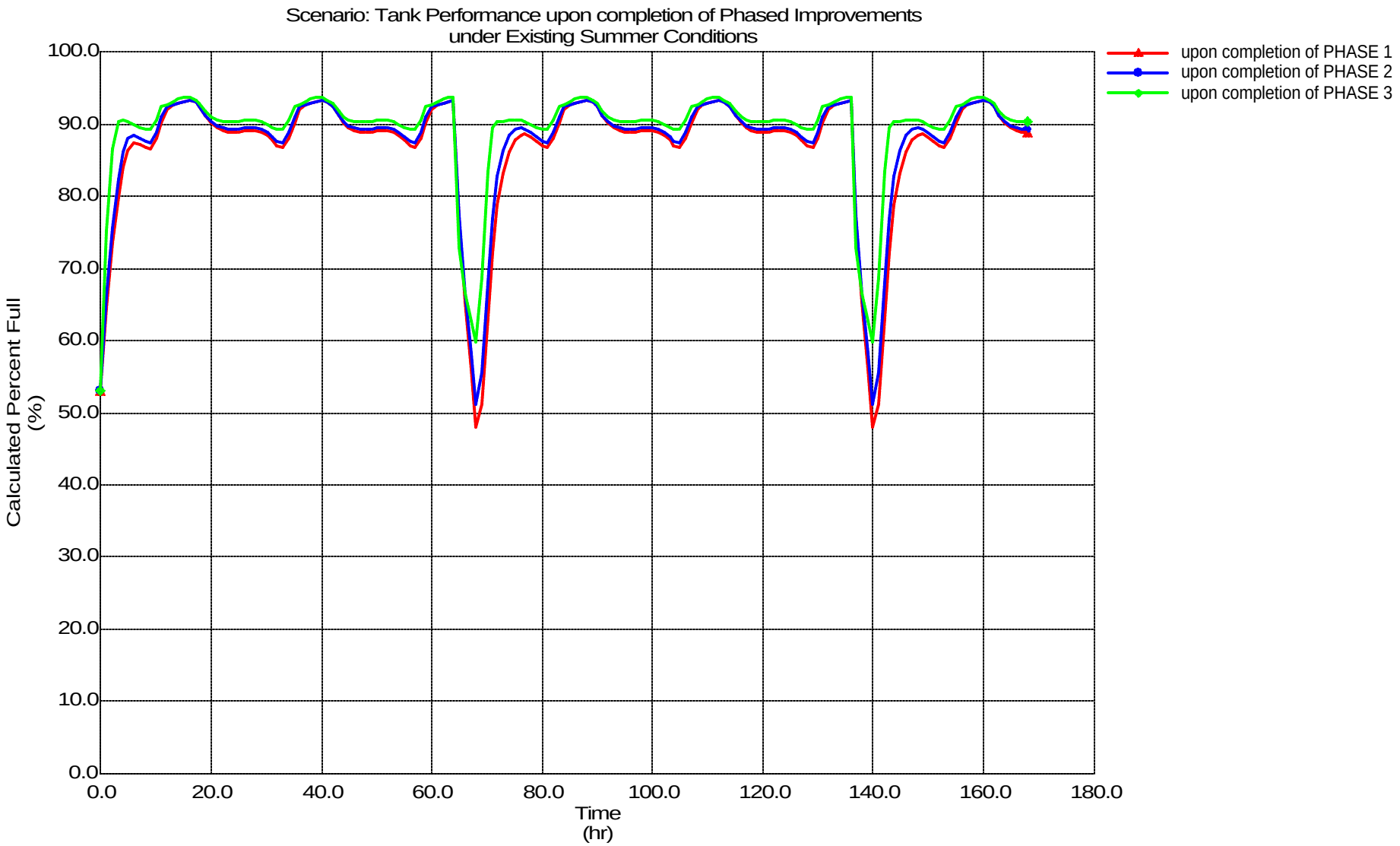
Scenario: Fire Flow Analysis upon completion of PHASE 3 with tank off-line
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	true	750.00	1,314.71	20.00	20.00	J-800-I
H-2	true	1,125.00	1,375.64	20.00	20.01	J-800-I
H-3	false	1,500.00	1,231.00	20.00	20.01	J-800-I
H-4	true	750.00	1,399.31	20.00	20.00	J-702-H
H-5	true	1,000.00	1,475.47	20.00	20.00	J-707-H
H-6	true	500.00	1,416.44	20.00	20.00	J-603-G
H-7	true	750.00	1,536.13	20.00	20.00	J-604-G
H-8	true	1,500.00	1,555.99	20.00	20.00	J-602-G
H-9	true	750.00	1,781.12	20.00	20.00	J-607-G
H-9A	true	750.00	1,383.54	20.00	20.00	J-602-G
H-11	true	1,500.00	2,368.39	20.00	20.00	J-528-F
H-12	true	500.00	2,500.00	20.00	22.57	J-527-F
H-13	true	500.00	2,500.00	20.00	21.43	J-526-F
H-14	true	1,500.00	2,500.00	20.00	21.55	J-525-F
H-15	true	1,125.00	2,371.74	20.00	20.00	J-518-F
H-16	true	750.00	2,411.21	20.00	20.01	J-522-F
H-18	true	1,500.00	2,500.00	20.00	26.49	J-523-F
H-18A	true	750.00	2,446.29	20.00	20.01	J-524-F
H-19	true	750.00	2,500.00	20.00	26.53	J-504-F
H-19A	true	1,500.00	2,500.00	20.00	25.57	J-502-F
H-20	true	1,500.00	2,500.00	20.00	27.76	J-512-F
H-21	true	750.00	2,475.47	20.00	20.01	J-521-F
H-22	true	1,500.00	2,500.00	20.00	28.78	J-800-I
H-23	true	500.00	2,016.29	20.00	20.01	J-510-F
H-24	true	1,500.00	2,500.00	20.00	24.45	J-408-E
H-25	true	750.00	1,982.36	20.00	20.00	H-23
H-26	true	1,500.00	2,500.00	20.00	28.65	J-407-E
H-27	true	500.00	2,500.00	20.00	29.25	J-406-E
H-28	true	2,250.00	2,500.00	20.00	26.41	J-404-E
H-29	true	1,000.00	2,500.00	20.00	25.21	J-137-A
H-30	true	1,000.00	2,500.00	20.00	23.99	J-103-A
H-31	true	1,000.00	2,500.00	20.00	26.01	J-136-A
H-32	true	1,500.00	2,500.00	20.00	28.89	J-133-A
H-33	true	1,500.00	2,500.00	20.00	28.24	J-126-A
H-34	true	1,125.00	2,500.00	20.00	29.93	J-131-A
H-35	true	1,000.00	2,500.00	20.00	21.50	J-129-A
H-36	true	750.00	2,500.00	20.00	30.34	J-132-A
H-37	true	1,500.00	2,500.00	20.00	30.30	J-105-A
H-37A	true	2,250.00	2,500.00	20.00	30.05	J-104-A
H-38	true	1,500.00	2,500.00	20.00	32.30	H-40
H-39	true	750.00	2,500.00	20.00	23.31	J-127-A
H-40	true	1,500.00	2,500.00	20.00	30.99	J-128-A
H-41	true	750.00	2,500.00	20.00	31.09	J-240-B
H-42	true	1,000.00	2,500.00	20.00	33.52	H-32
H-43	true	1,000.00	2,500.00	20.00	31.41	J-237-B
H-44	true	750.00	2,500.00	20.00	35.49	J-218-B
H-45	true	500.00	2,500.00	20.00	36.03	J-228-B

Scenario: Fire Flow Analysis upon completion of PHASE 3 with tank off-line
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	36.78	J-226-B
H-47	true	1,500.00	2,500.00	20.00	33.46	J-227-B
H-48	true	1,000.00	2,500.00	20.00	32.83	J-217-B
H-49	true	1,000.00	2,500.00	20.00	25.67	J-231-B
H-50	true	750.00	2,500.00	20.00	34.65	H-32
H-51	true	750.00	2,500.00	20.00	28.67	J-245-B
H-52	true	1,500.00	2,500.00	20.00	34.14	J-236-B
H-53	true	2,250.00	2,500.00	20.00	33.83	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	34.80	J-215-B
H-54	true	750.00	2,500.00	20.00	28.66	J-230-B
H-55	true	1,500.00	2,500.00	20.00	30.92	J-229-B
H-56	true	1,500.00	2,500.00	20.00	30.38	J-232-B
H-57	true	1,500.00	2,500.00	20.00	32.39	J-233-B
H-58	true	1,500.00	2,500.00	20.00	31.28	J-234-B
H-59	true	500.00	2,500.00	20.00	32.13	J-222-B
H-60	true	1,125.00	2,500.00	20.00	29.16	J-246-B
H-61	true	2,250.00	2,500.00	20.00	29.38	J-241-B
H-62	true	1,500.00	2,500.00	20.00	26.27	J-242-B
H-63	true	750.00	2,500.00	20.00	28.54	J-138-A
H-64	true	1,500.00	2,500.00	20.00	29.12	J-405-E
H-65	true	2,250.00	2,500.00	20.00	27.33	J-135-A
H-66	true	2,250.00	2,500.00	20.00	25.33	J-134-A
H-67	true	2,250.00	2,500.00	20.00	21.65	J-106-A
H-68	true	1,500.00	2,500.00	20.00	26.85	J-124-A
H-69	true	1,500.00	2,353.12	20.00	20.00	J-101-A
H-70	true	1,500.00	2,500.00	20.00	29.82	J-244-B
H-behind37	true	1,500.00	2,326.85	20.00	20.00	J-140-A
H-moat	true	1,500.00	2,500.00	20.00	26.88	J-243-B
H-near100	true	1,000.00	2,500.00	20.00	22.86	J-238-B
H-near158	true	1,000.00	2,500.00	20.00	20.25	J-141-A
H-near161	true	500.00	2,500.00	20.00	29.88	J-100-A

Graph


Scenario: Tank Performance upon completion of Phased Improvements
under Existing Summer Conditions
upon completion of PHASE 1
upon completion of PHASE 2
upon completion of PHASE 3
Calculated Percent Full
(%)
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
Time
(hr)

Intentionally left blank

Scenario: YR1 assuming completion of PHASE 1
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	false	750.00	417.85	20.00	20.27	J-800-I
H-2	false	1,125.00	437.01	20.00	20.05	J-706-H
H-3	false	1,125.00	434.95	20.00	20.05	J-706-H
H-4	false	750.00	327.47	20.00	20.02	J-702-H
H-5	false	1,000.00	412.98	20.00	20.03	J-707-H
H-6	false	500.00	461.73	20.00	20.17	J-602-G
H-7	false	750.00	458.47	20.00	20.02	J-604-G
H-8	false	1,500.00	462.18	20.00	20.05	J-602-G
H-9	false	750.00	500.01	20.00	20.01	J-607-G
H-9A	false	750.00	481.69	20.00	20.01	J-600-G
H-11	false	1,500.00	601.58	20.00	20.01	J-528-F
H-12	true	500.00	796.22	20.00	20.00	J-527-F
H-13	true	500.00	692.48	20.00	20.00	J-526-F
H-14	false	1,500.00	688.91	20.00	20.01	J-525-F
H-15	true	1,125.00	1,150.05	20.00	20.00	J-518-F
H-16	true	750.00	885.06	20.00	20.00	J-522-F
H-18	true	1,500.00	2,334.27	20.00	20.01	J-523-F
H-18A	true	750.00	1,217.52	20.00	20.00	J-524-F
H-19	false	750.00	1,639.29	20.00	19.99	J-504-F
H-19A	true	1,500.00	1,888.94	20.00	20.00	J-248-B
H-20	true	1,500.00	2,500.00	20.00	21.19	J-512-F
H-21	true	750.00	878.53	20.00	20.00	J-521-F
H-22	true	1,500.00	2,500.00	20.00	25.07	J-800-I
H-23	true	500.00	716.00	20.00	20.00	J-510-F
H-24	true	750.00	1,127.28	20.00	20.00	J-408-E
H-25	true	750.00	1,220.22	20.00	20.00	H-23
H-26	true	750.00	2,500.00	20.00	26.18	J-407-E
H-27	true	500.00	2,500.00	20.00	27.74	J-406-E
H-28	true	2,250.00	2,500.00	20.00	25.04	J-404-E
H-29	true	1,000.00	2,500.00	20.00	23.47	J-137-A
H-30	true	1,000.00	2,500.00	20.00	22.07	J-103-A
H-31	true	1,000.00	2,363.22	20.00	20.00	J-136-A
H-32	true	1,500.00	2,391.29	20.00	20.00	J-133-A
H-33	true	1,500.00	2,378.82	20.00	20.01	J-126-A
H-34	true	1,125.00	2,252.01	20.00	20.00	J-131-A
H-35	false	1,000.00	806.97	20.00	20.00	J-129-A
H-36	true	750.00	2,368.21	20.00	20.00	J-132-A
H-37	true	1,500.00	2,416.61	20.00	20.01	J-105-A
H-37A	true	2,250.00	2,413.13	20.00	20.00	J-104-A
H-38	true	1,500.00	2,500.00	20.00	21.48	J-139-A
H-39	false	750.00	701.16	20.00	20.00	J-127-A
H-40	true	1,500.00	2,345.59	20.00	20.00	J-128-A
H-41	true	750.00	1,228.04	20.00	20.00	J-240-B
H-42	true	1,000.00	2,500.00	20.00	24.23	J-239-B
H-43	false	1,000.00	984.99	20.00	19.99	J-237-B
H-44	true	750.00	2,500.00	20.00	39.84	J-218-B
H-45	true	500.00	2,500.00	20.00	37.82	J-228-B

Scenario: YR1 assuming completion of PHASE 1
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	39.11	J-226-B
H-47	true	1,500.00	2,500.00	20.00	36.95	J-227-B
H-48	true	1,000.00	2,500.00	20.00	35.73	J-217-B
H-49	true	1,000.00	1,265.40	20.00	20.00	J-231-B
H-50	true	750.00	2,500.00	20.00	41.53	J-211-B
H-51	true	750.00	2,500.00	20.00	28.33	J-245-B
H-52	true	1,500.00	2,500.00	20.00	27.90	J-236-B
H-53	false	2,250.00	1,592.56	20.00	20.00	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	34.58	J-215-B
H-54	true	750.00	1,745.44	20.00	20.00	J-230-B
H-55	true	750.00	2,500.00	20.00	33.79	J-229-B
H-56	true	1,500.00	2,500.00	20.00	32.90	J-232-B
H-57	true	1,500.00	2,500.00	20.00	33.78	J-233-B
H-58	true	1,500.00	2,241.02	20.00	20.00	J-234-B
H-59	true	500.00	2,500.00	20.00	32.57	J-222-B
H-60	true	1,125.00	2,500.00	20.00	29.73	J-246-B
H-61	true	2,250.00	2,500.00	20.00	28.69	J-241-B
H-62	true	1,500.00	2,500.00	20.00	24.69	J-242-B
H-63	true	750.00	2,500.00	20.00	27.39	J-138-A
H-64	true	1,500.00	2,500.00	20.00	27.91	J-405-E
H-65	true	2,250.00	2,500.00	20.00	26.12	J-135-A
H-66	true	2,250.00	2,500.00	20.00	23.36	J-134-A
H-67	true	2,250.00	2,457.26	20.00	20.00	J-106-A
H-68	true	1,500.00	2,500.00	20.00	23.97	J-124-A
H-69	true	1,500.00	2,202.42	20.00	20.00	J-101-A
H-70	true	1,500.00	2,500.00	20.00	28.48	J-244-B
H-behind37	true	1,500.00	1,985.43	20.00	20.00	J-140-A
H-moat	true	1,500.00	2,500.00	20.00	26.09	J-243-B
H-near100	true	1,000.00	1,017.64	20.00	20.01	J-238-B
H-near158	true	1,000.00	1,203.58	20.00	20.00	J-141-A
H-near161	false	500.00	2,337.54	20.00	20.00	J-130-A

Scenario: YR2 assuming completion of PHASE 1
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	false	750.00	417.53	20.00	20.27	J-800-I
H-2	false	1,125.00	436.68	20.00	20.05	J-706-H
H-3	false	1,125.00	434.63	20.00	20.05	H-2
H-4	false	750.00	327.28	20.00	20.02	J-702-H
H-5	false	1,000.00	412.70	20.00	20.03	J-707-H
H-6	false	500.00	461.40	20.00	20.17	J-602-G
H-7	false	750.00	458.15	20.00	20.02	J-604-G
H-8	false	1,500.00	461.84	20.00	20.05	J-602-G
H-9	false	750.00	499.67	20.00	20.01	J-607-G
H-9A	false	750.00	481.37	20.00	20.01	J-600-G
H-11	false	1,500.00	601.17	20.00	20.01	J-528-F
H-12	true	500.00	795.65	20.00	20.00	J-527-F
H-13	true	500.00	692.10	20.00	20.00	J-526-F
H-14	false	1,500.00	688.57	20.00	20.01	J-525-F
H-15	true	1,125.00	1,148.50	20.00	20.00	J-518-F
H-16	true	750.00	884.34	20.00	20.00	J-522-F
H-18	true	1,500.00	2,331.76	20.00	20.01	J-523-F
H-18A	false	500.00	1,217.03	20.00	19.99	J-524-F
H-19	false	750.00	1,638.13	20.00	19.99	J-504-F
H-19A	true	1,500.00	1,887.52	20.00	20.00	J-248-B
H-20	true	1,500.00	2,500.00	20.00	21.14	J-512-F
H-21	true	750.00	877.93	20.00	20.00	J-521-F
H-22	true	1,500.00	2,500.00	20.00	25.02	J-800-I
H-23	true	500.00	715.77	20.00	20.00	J-510-F
H-24	true	750.00	1,126.58	20.00	20.00	J-408-E
H-25	true	750.00	1,219.59	20.00	20.00	H-23
H-26	true	750.00	2,500.00	20.00	26.13	J-407-E
H-27	true	500.00	2,500.00	20.00	27.69	J-406-E
H-28	true	2,250.00	2,500.00	20.00	24.99	J-404-E
H-29	true	1,000.00	2,500.00	20.00	23.43	J-137-A
H-30	true	1,000.00	2,500.00	20.00	22.03	J-103-A
H-31	true	1,000.00	2,361.42	20.00	20.00	J-136-A
H-32	true	1,500.00	2,389.43	20.00	20.00	J-133-A
H-33	true	1,500.00	2,377.25	20.00	20.00	J-126-A
H-34	true	1,125.00	2,250.32	20.00	20.00	J-131-A
H-35	false	1,000.00	806.76	20.00	20.00	J-129-A
H-36	true	750.00	2,366.27	20.00	20.00	J-132-A
H-37	true	1,500.00	2,414.73	20.00	20.01	J-105-A
H-37A	true	2,250.00	2,411.29	20.00	20.00	J-104-A
H-38	true	1,500.00	2,500.00	20.00	21.44	J-139-A
H-39	false	750.00	701.02	20.00	20.00	J-127-A
H-40	true	1,500.00	2,344.16	20.00	20.00	J-128-A
H-41	true	750.00	1,227.66	20.00	20.00	J-240-B
H-42	true	1,000.00	2,500.00	20.00	24.21	J-239-B
H-43	false	1,000.00	984.86	20.00	19.99	J-237-B
H-44	true	750.00	2,500.00	20.00	39.83	J-218-B
H-45	true	500.00	2,500.00	20.00	37.81	J-228-B

Scenario: YR2 assuming completion of PHASE 1
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	39.10	J-226-B
H-47	true	1,500.00	2,500.00	20.00	36.94	J-227-B
H-48	true	1,000.00	2,500.00	20.00	35.72	J-217-B
H-49	true	1,000.00	1,265.29	20.00	20.00	J-231-B
H-50	true	750.00	2,500.00	20.00	41.52	J-211-B
H-51	true	750.00	2,500.00	20.00	28.30	J-245-B
H-52	true	1,500.00	2,500.00	20.00	27.89	J-236-B
H-53	false	2,250.00	1,592.33	20.00	20.00	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	34.57	J-215-B
H-54	true	750.00	1,745.90	20.00	20.00	J-230-B
H-55	true	750.00	2,500.00	20.00	33.78	J-229-B
H-56	true	1,500.00	2,500.00	20.00	32.88	J-232-B
H-57	true	1,500.00	2,500.00	20.00	33.76	J-233-B
H-58	true	1,500.00	2,240.15	20.00	20.00	J-234-B
H-59	true	500.00	2,500.00	20.00	32.54	J-209-B
H-60	true	1,125.00	2,500.00	20.00	29.70	J-246-B
H-61	true	2,250.00	2,500.00	20.00	28.65	J-241-B
H-62	true	1,500.00	2,500.00	20.00	24.66	J-242-B
H-63	true	750.00	2,500.00	20.00	27.35	J-138-A
H-64	true	1,500.00	2,500.00	20.00	27.87	J-405-E
H-65	true	2,250.00	2,500.00	20.00	26.08	J-135-A
H-66	true	2,250.00	2,500.00	20.00	23.32	J-134-A
H-67	true	2,250.00	2,455.65	20.00	20.00	J-106-A
H-68	true	1,500.00	2,500.00	20.00	23.93	J-124-A
H-69	true	1,500.00	2,201.14	20.00	20.00	J-101-A
H-70	true	1,500.00	2,500.00	20.00	28.45	J-244-B
H-behind37	true	1,500.00	1,984.15	20.00	20.00	J-140-A
H-moat	true	1,500.00	2,500.00	20.00	26.06	J-243-B
H-near100	true	1,000.00	1,017.53	20.00	20.01	J-238-B
H-near158	true	1,000.00	1,203.11	20.00	20.00	J-141-A
H-near161	true	500.00	2,335.79	20.00	20.00	J-130-A

Scenario: YR3 assuming completion of PHASE 1
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	false	750.00	415.94	20.00	20.28	J-800-I
H-2	false	1,125.00	435.33	20.00	20.00	J-706-H
H-3	false	1,125.00	432.76	20.00	20.05	J-706-H
H-4	false	750.00	326.07	20.00	20.02	J-702-H
H-5	false	1,000.00	410.81	20.00	20.04	J-707-H
H-6	false	500.00	459.06	20.00	20.18	J-602-G
H-7	false	750.00	455.90	20.00	20.02	J-604-G
H-8	false	1,500.00	459.89	20.00	20.00	J-602-G
H-9	false	750.00	497.59	20.00	20.01	J-607-G
H-9A	false	750.00	479.35	20.00	20.01	J-600-G
H-11	false	1,500.00	599.60	20.00	20.02	J-528-F
H-12	true	500.00	795.20	20.00	20.00	J-527-F
H-13	true	500.00	692.01	20.00	20.00	J-526-F
H-14	false	1,500.00	688.65	20.00	20.01	J-525-F
H-15	true	1,125.00	1,152.27	20.00	20.00	J-518-F
H-16	true	750.00	890.66	20.00	20.00	J-522-F
H-18	true	1,500.00	2,337.13	20.00	20.01	J-523-F
H-18A	false	500.00	1,218.57	20.00	19.99	J-524-F
H-19	false	750.00	1,640.50	20.00	19.99	J-504-F
H-19A	true	1,500.00	1,890.68	20.00	20.00	J-248-B
H-20	true	1,500.00	2,500.00	20.00	21.27	J-512-F
H-21	true	750.00	885.60	20.00	20.00	J-521-F
H-22	true	1,500.00	2,500.00	20.00	25.16	J-800-I
H-23	true	500.00	716.36	20.00	20.00	J-510-F
H-24	true	750.00	1,135.42	20.00	20.00	J-408-E
H-25	true	750.00	1,221.12	20.00	20.00	H-23
H-26	true	750.00	2,500.00	20.00	26.26	J-407-E
H-27	true	500.00	2,500.00	20.00	27.78	J-406-E
H-28	true	2,250.00	2,500.00	20.00	25.07	J-404-E
H-29	true	1,000.00	2,500.00	20.00	23.50	J-137-A
H-30	true	1,000.00	2,500.00	20.00	22.09	J-103-A
H-31	true	1,000.00	2,362.40	20.00	20.00	J-136-A
H-32	true	1,500.00	2,390.18	20.00	20.00	J-133-A
H-33	true	1,500.00	2,377.92	20.00	20.00	J-126-A
H-34	true	1,125.00	2,250.70	20.00	20.00	J-131-A
H-35	false	1,000.00	806.90	20.00	20.00	J-129-A
H-36	true	750.00	2,366.64	20.00	20.00	J-132-A
H-37	true	1,500.00	2,414.69	20.00	20.01	J-105-A
H-37A	true	2,250.00	2,411.29	20.00	20.00	J-104-A
H-38	true	1,500.00	2,500.00	20.00	21.37	J-139-A
H-39	false	750.00	701.13	20.00	20.00	J-127-A
H-40	true	1,500.00	2,343.20	20.00	20.00	J-128-A
H-41	true	750.00	1,227.98	20.00	20.00	J-240-B
H-42	true	1,000.00	2,500.00	20.00	24.19	J-239-B
H-43	false	1,000.00	984.98	20.00	19.99	J-237-B
H-44	true	750.00	2,500.00	20.00	39.84	J-218-B
H-45	true	500.00	2,500.00	20.00	37.82	J-228-B

Scenario: YR3 assuming completion of PHASE 1
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	39.11	J-226-B
H-47	true	1,500.00	2,500.00	20.00	36.96	J-227-B
H-48	true	1,000.00	2,500.00	20.00	35.74	J-217-B
H-49	true	1,000.00	1,265.49	20.00	20.00	J-231-B
H-50	true	750.00	2,500.00	20.00	41.53	J-211-B
H-51	true	750.00	2,500.00	20.00	28.34	J-245-B
H-52	true	1,500.00	2,500.00	20.00	27.91	J-236-B
H-53	false	2,250.00	1,592.63	20.00	20.00	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	34.58	J-215-B
H-54	true	750.00	1,746.39	20.00	20.00	J-230-B
H-55	true	750.00	2,500.00	20.00	33.80	J-229-B
H-56	true	1,500.00	2,500.00	20.00	32.91	J-232-B
H-57	true	1,500.00	2,500.00	20.00	33.79	J-233-B
H-58	true	1,500.00	2,241.51	20.00	20.00	J-234-B
H-59	true	500.00	2,500.00	20.00	32.58	J-209-B
H-60	true	1,125.00	2,500.00	20.00	29.75	J-246-B
H-61	true	2,250.00	2,500.00	20.00	28.71	J-241-B
H-62	true	1,500.00	2,500.00	20.00	24.71	J-242-B
H-63	true	750.00	2,500.00	20.00	27.41	J-138-A
H-64	true	1,500.00	2,500.00	20.00	27.94	J-405-E
H-65	true	2,250.00	2,500.00	20.00	26.15	J-135-A
H-66	true	2,250.00	2,500.00	20.00	23.37	J-134-A
H-67	true	2,250.00	2,457.67	20.00	20.00	J-106-A
H-68	true	1,500.00	2,500.00	20.00	23.98	J-124-A
H-69	true	1,500.00	2,202.54	20.00	20.00	J-101-A
H-70	true	1,500.00	2,500.00	20.00	28.49	J-244-B
H-behind37	true	1,500.00	1,984.67	20.00	20.00	J-140-A
H-moat	true	1,500.00	2,500.00	20.00	26.11	J-243-B
H-near100	true	1,000.00	1,017.60	20.00	20.01	J-238-B
H-near158	true	1,000.00	1,203.38	20.00	20.00	J-141-A
H-near161	false	500.00	2,336.37	20.00	20.00	J-130-A

Scenario: YR5 assuming completion of PHASE 2
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	true	750.00	1,094.52	20.00	20.00	J-800-I
H-2	true	1,125.00	1,155.49	20.00	20.02	J-800-I
H-3	false	1,125.00	1,068.79	20.00	20.00	J-800-I
H-4	true	750.00	1,233.04	20.00	20.01	J-702-H
H-5	true	1,000.00	1,289.12	20.00	20.00	J-707-H
H-6	true	500.00	1,259.36	20.00	20.02	J-603-G
H-7	true	750.00	1,349.11	20.00	20.00	J-800-I
H-8	false	1,500.00	1,371.13	20.00	20.00	J-602-G
H-9	true	750.00	1,628.84	20.00	20.00	J-602-G
H-9A	true	750.00	1,281.68	20.00	20.00	J-602-G
H-11	true	1,500.00	2,279.59	20.00	20.00	J-800-I
H-12	true	500.00	2,500.00	20.00	21.08	J-800-I
H-13	false	500.00	2,493.04	20.00	19.99	J-526-F
H-14	false	750.00	2,490.00	20.00	19.99	J-525-F
H-15	true	1,125.00	2,369.77	20.00	20.00	J-518-F
H-16	false	750.00	2,416.37	20.00	19.99	J-522-F
H-18	true	1,500.00	2,500.00	20.00	25.58	J-523-F
H-18A	true	500.00	2,380.32	20.00	20.00	J-524-F
H-19	true	750.00	2,500.00	20.00	23.79	J-504-F
H-19A	true	1,500.00	2,121.59	20.00	20.00	J-248-B
H-20	true	1,500.00	2,500.00	20.00	26.52	J-512-F
H-21	false	750.00	2,486.23	20.00	19.99	J-521-F
H-22	true	1,500.00	2,500.00	20.00	28.85	J-800-I
H-23	true	500.00	722.52	20.00	20.00	J-510-F
H-24	true	750.00	2,500.00	20.00	24.81	J-408-E
H-25	true	750.00	1,247.52	20.00	20.00	H-23
H-26	true	750.00	2,500.00	20.00	30.06	J-407-E
H-27	true	500.00	2,500.00	20.00	31.63	J-406-E
H-28	true	2,250.00	2,500.00	20.00	29.27	J-404-E
H-29	true	1,000.00	2,500.00	20.00	28.06	J-137-A
H-30	true	1,000.00	2,500.00	20.00	26.85	J-103-A
H-31	true	1,000.00	2,500.00	20.00	26.55	J-136-A
H-32	true	1,500.00	2,500.00	20.00	28.07	J-133-A
H-33	true	1,500.00	2,500.00	20.00	27.35	J-126-A
H-34	true	1,125.00	2,500.00	20.00	22.25	J-131-A
H-35	true	1,000.00	2,500.00	20.00	25.14	J-129-A
H-36	true	750.00	2,500.00	20.00	25.15	J-132-A
H-37	true	1,500.00	2,500.00	20.00	25.60	J-105-A
H-37A	true	2,250.00	2,500.00	20.00	25.73	J-104-A
H-38	true	1,500.00	2,500.00	20.00	25.52	J-139-A
H-39	true	750.00	2,500.00	20.00	27.45	J-127-A
H-40	true	1,500.00	2,500.00	20.00	20.19	J-128-A
H-41	true	750.00	2,500.00	20.00	35.50	J-240-B
H-42	true	1,000.00	2,500.00	20.00	27.26	J-239-B
H-43	true	1,000.00	2,500.00	20.00	36.69	J-237-B
H-44	true	750.00	2,500.00	20.00	41.38	J-218-B
H-45	true	500.00	2,500.00	20.00	38.54	J-228-B

Scenario: YR5 assuming completion of PHASE 2
Fire Flow Analysis
Fire Flow Report

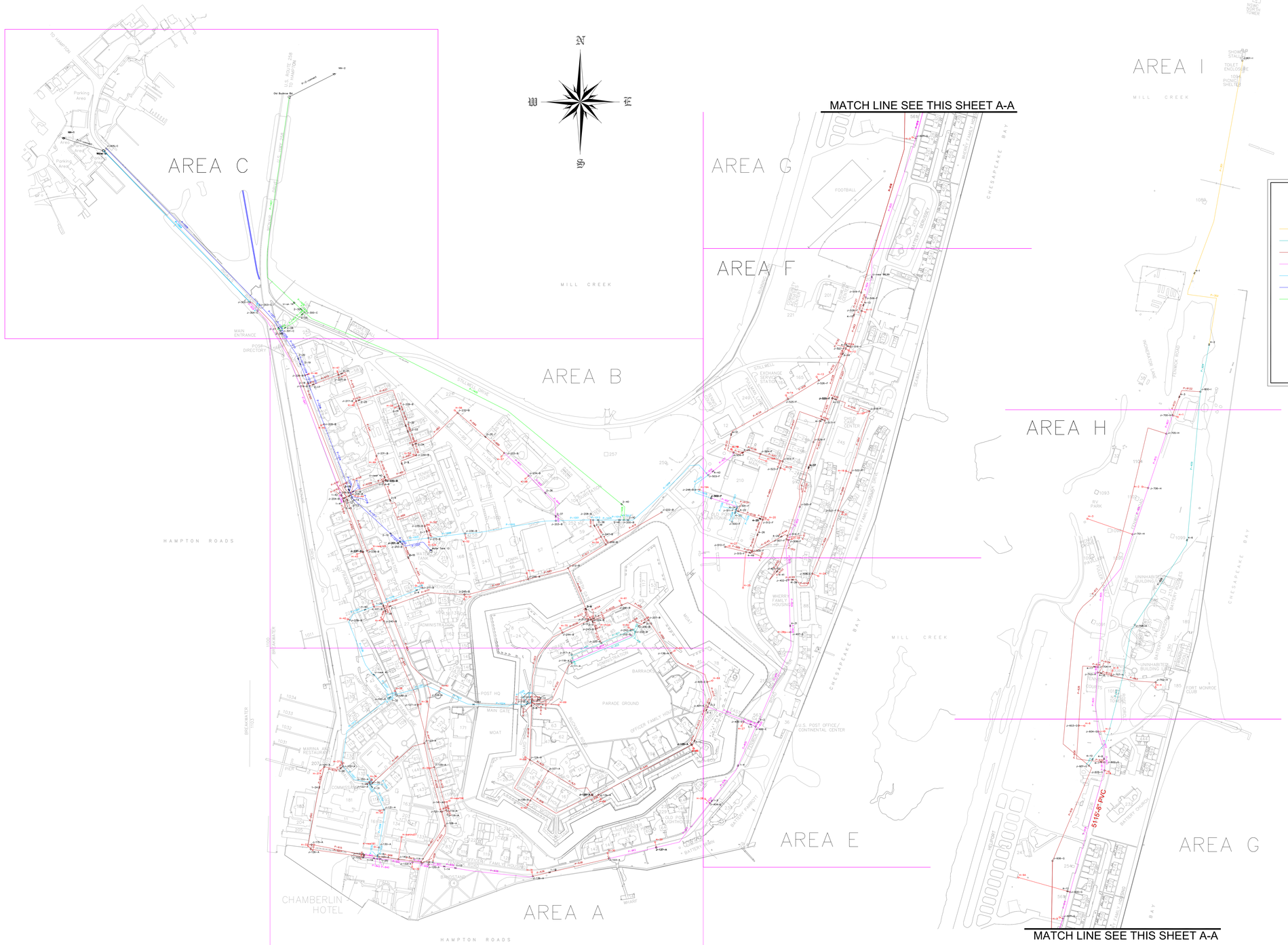
Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	39.72	J-226-B
H-47	true	1,500.00	2,500.00	20.00	37.64	J-227-B
H-48	true	1,000.00	2,500.00	20.00	36.57	J-217-B
H-49	true	1,000.00	1,346.00	20.00	20.00	J-231-B
H-50	true	750.00	2,500.00	20.00	42.09	J-211-B
H-51	true	750.00	2,500.00	20.00	33.15	J-245-B
H-52	true	1,500.00	2,500.00	20.00	30.81	J-236-B
H-53	true	2,250.00	2,500.00	20.00	39.09	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	39.48	J-215-B
H-54	true	750.00	1,794.18	20.00	20.00	J-230-B
H-55	true	750.00	2,500.00	20.00	34.75	J-229-B
H-56	true	1,500.00	2,500.00	20.00	34.00	J-232-B
H-57	true	1,500.00	2,500.00	20.00	35.11	J-233-B
H-58	true	1,500.00	2,297.72	20.00	20.00	J-234-B
H-59	true	500.00	2,500.00	20.00	35.17	J-209-B
H-60	true	1,125.00	2,500.00	20.00	33.68	J-246-B
H-61	true	2,250.00	2,500.00	20.00	32.25	J-241-B
H-62	true	1,500.00	2,500.00	20.00	28.31	J-242-B
H-63	true	750.00	2,500.00	20.00	31.14	J-138-A
H-64	true	1,500.00	2,500.00	20.00	31.66	J-405-E
H-65	true	2,250.00	2,500.00	20.00	29.88	J-135-A
H-66	true	2,250.00	2,500.00	20.00	27.12	J-134-A
H-67	true	2,250.00	2,500.00	20.00	23.04	J-106-A
H-68	true	1,500.00	2,500.00	20.00	27.80	J-124-A
H-69	true	1,500.00	2,330.73	20.00	20.00	J-101-A
H-70	true	1,500.00	2,500.00	20.00	32.15	J-244-B
H-behind37	true	1,500.00	2,284.39	20.00	20.00	J-140-A
H-moat	true	1,500.00	2,500.00	20.00	29.67	J-243-B
H-near100	true	1,000.00	1,022.07	20.00	20.01	J-238-B
H-near158	true	1,000.00	2,500.00	20.00	23.88	J-141-A
H-near161	true	500.00	2,500.00	20.00	25.79	J-130-A

Scenario: YR5 assuming completion of PHASE 3
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-1	true	750.00	1,354.37	20.00	20.01	J-800-I
H-2	true	1,125.00	1,427.11	20.00	20.00	J-800-I
H-3	true	1,125.00	1,255.52	20.00	20.00	J-800-I
H-4	true	750.00	1,458.18	20.00	20.01	J-702-H
H-5	true	1,000.00	1,553.43	20.00	20.00	J-707-H
H-6	true	500.00	1,478.52	20.00	20.02	J-603-G
H-7	true	750.00	1,629.53	20.00	20.01	J-604-G
H-8	true	1,500.00	1,658.13	20.00	20.00	J-602-G
H-9	true	750.00	1,964.66	20.00	20.00	J-607-G
H-9A	true	750.00	1,441.33	20.00	20.00	J-602-G
H-11	true	1,500.00	2,500.00	20.00	27.42	J-528-F
H-12	true	500.00	2,500.00	20.00	33.35	J-527-F
H-13	true	500.00	2,500.00	20.00	32.21	J-526-F
H-14	true	750.00	2,500.00	20.00	32.25	J-525-F
H-15	true	1,125.00	2,500.00	20.00	27.58	J-518-F
H-16	true	750.00	2,500.00	20.00	28.67	J-522-F
H-18	true	1,500.00	2,500.00	20.00	37.21	J-523-F
H-18A	true	500.00	2,500.00	20.00	29.49	J-524-F
H-19	true	750.00	2,500.00	20.00	37.27	J-504-F
H-19A	true	1,500.00	2,500.00	20.00	36.28	J-502-F
H-20	true	1,500.00	2,500.00	20.00	38.48	J-512-F
H-21	true	750.00	2,500.00	20.00	30.27	J-521-F
H-22	true	1,500.00	2,500.00	20.00	39.52	J-800-I
H-23	true	500.00	2,306.17	20.00	20.00	J-510-F
H-24	true	750.00	2,500.00	20.00	35.27	J-408-E
H-25	true	750.00	2,251.71	20.00	20.00	H-23
H-26	true	750.00	2,500.00	20.00	39.42	J-407-E
H-27	true	500.00	2,500.00	20.00	40.07	J-406-E
H-28	true	2,250.00	2,500.00	20.00	37.28	J-404-E
H-29	true	1,000.00	2,500.00	20.00	35.92	J-137-A
H-30	true	1,000.00	2,500.00	20.00	34.65	J-103-A
H-31	true	1,000.00	2,500.00	20.00	36.76	J-136-A
H-32	true	1,500.00	2,500.00	20.00	39.68	J-133-A
H-33	true	1,500.00	2,500.00	20.00	39.04	J-126-A
H-34	true	1,125.00	2,500.00	20.00	40.73	J-131-A
H-35	true	1,000.00	2,500.00	20.00	31.92	J-129-A
H-36	true	750.00	2,500.00	20.00	41.11	J-132-A
H-37	true	1,500.00	2,500.00	20.00	41.11	J-105-A
H-37A	true	2,250.00	2,500.00	20.00	40.94	J-104-A
H-38	true	1,500.00	2,500.00	20.00	43.09	H-40
H-39	true	750.00	2,500.00	20.00	33.94	J-127-A
H-40	true	1,500.00	2,500.00	20.00	41.77	J-128-A
H-41	true	750.00	2,500.00	20.00	41.60	J-240-B
H-42	true	1,000.00	2,500.00	20.00	44.33	H-32
H-43	true	1,000.00	2,500.00	20.00	41.38	J-237-B
H-44	true	750.00	2,500.00	20.00	45.93	J-218-B
H-45	true	500.00	2,500.00	20.00	45.58	J-228-B

Scenario: YR5 assuming completion of PHASE 3
Fire Flow Analysis
Fire Flow Report

Label	Satisfies Fire Flow Constraints?	Needed Fire Flow (gpm)	Available Fire Flow (gpm)	Required Residual Pressure (psi)	Calculated Residual Pressure (psi)	Minimum Zone Junction
H-46	true	500.00	2,500.00	20.00	45.66	J-226-B
H-47	true	1,500.00	2,500.00	20.00	43.02	J-227-B
H-48	true	1,000.00	2,500.00	20.00	42.60	J-217-B
H-49	true	1,000.00	2,500.00	20.00	35.75	J-231-B
H-50	true	750.00	2,500.00	20.00	45.69	H-32
H-51	true	750.00	2,500.00	20.00	39.32	J-245-B
H-52	true	1,500.00	2,500.00	20.00	45.04	J-236-B
H-53	true	2,250.00	2,500.00	20.00	44.62	J-235-B
H-53A	true	1,000.00	2,500.00	20.00	45.82	J-215-B
H-54	true	750.00	2,500.00	20.00	38.78	J-230-B
H-55	true	750.00	2,500.00	20.00	40.90	J-229-B
H-56	true	1,500.00	2,500.00	20.00	40.69	J-232-B
H-57	true	1,500.00	2,500.00	20.00	42.86	J-233-B
H-58	true	1,500.00	2,500.00	20.00	41.82	J-234-B
H-59	true	500.00	2,500.00	20.00	42.78	J-222-B
H-60	true	1,125.00	2,500.00	20.00	39.88	J-246-B
H-61	true	2,250.00	2,500.00	20.00	40.21	J-241-B
H-62	true	1,500.00	2,500.00	20.00	37.03	J-242-B
H-63	true	750.00	2,500.00	20.00	39.21	J-138-A
H-64	true	1,500.00	2,500.00	20.00	39.88	J-405-E
H-65	true	2,250.00	2,500.00	20.00	38.20	J-135-A
H-66	true	2,250.00	2,500.00	20.00	36.22	J-134-A
H-67	true	2,250.00	2,500.00	20.00	32.58	J-106-A
H-68	true	1,500.00	2,500.00	20.00	37.63	J-124-A
H-69	true	1,500.00	2,500.00	20.00	26.93	J-101-A
H-70	true	1,500.00	2,500.00	20.00	40.58	J-244-B
H-behind37	true	1,500.00	2,500.00	20.00	26.30	J-140-A
H-moat	true	1,500.00	2,500.00	20.00	37.63	J-243-B
H-near100	true	1,000.00	2,500.00	20.00	33.20	J-238-B
H-near158	true	1,000.00	2,500.00	20.00	30.93	J-141-A
H-near161	true	500.00	2,500.00	20.00	40.73	J-100-A



Legend

- Existing 3" Water Main
- Existing 4" Water Main
- Existing 6" Water Main
- Existing 8" Water Main
- Existing 10" Water Main
- Existing 12" Water Main
- Existing 14" Water Main
- Junction in Area X
- Fire Hydrant
- Valve Location
- Reservoir
- Pump

US Army Corps of Engineers
Norfolk District

REV.	DATE	DESCRIPTION	BY	APP.

DESIGNED:
CHECKED:
DRAWN:
SUBMITTED:
DATE: MAY 04
SCALE: 1"=200'
PROJECT NO. 1165537
NORFOLK DISTRICT FILE NO.
DRAWING NO. Exhibit 1
SPECIFICATION NO.
Last revised on:
File name:
Plot scale: 1:1

NORFOLK DISTRICT
CORPS OF ENGINEERS
NORFOLK, VIRGINIA

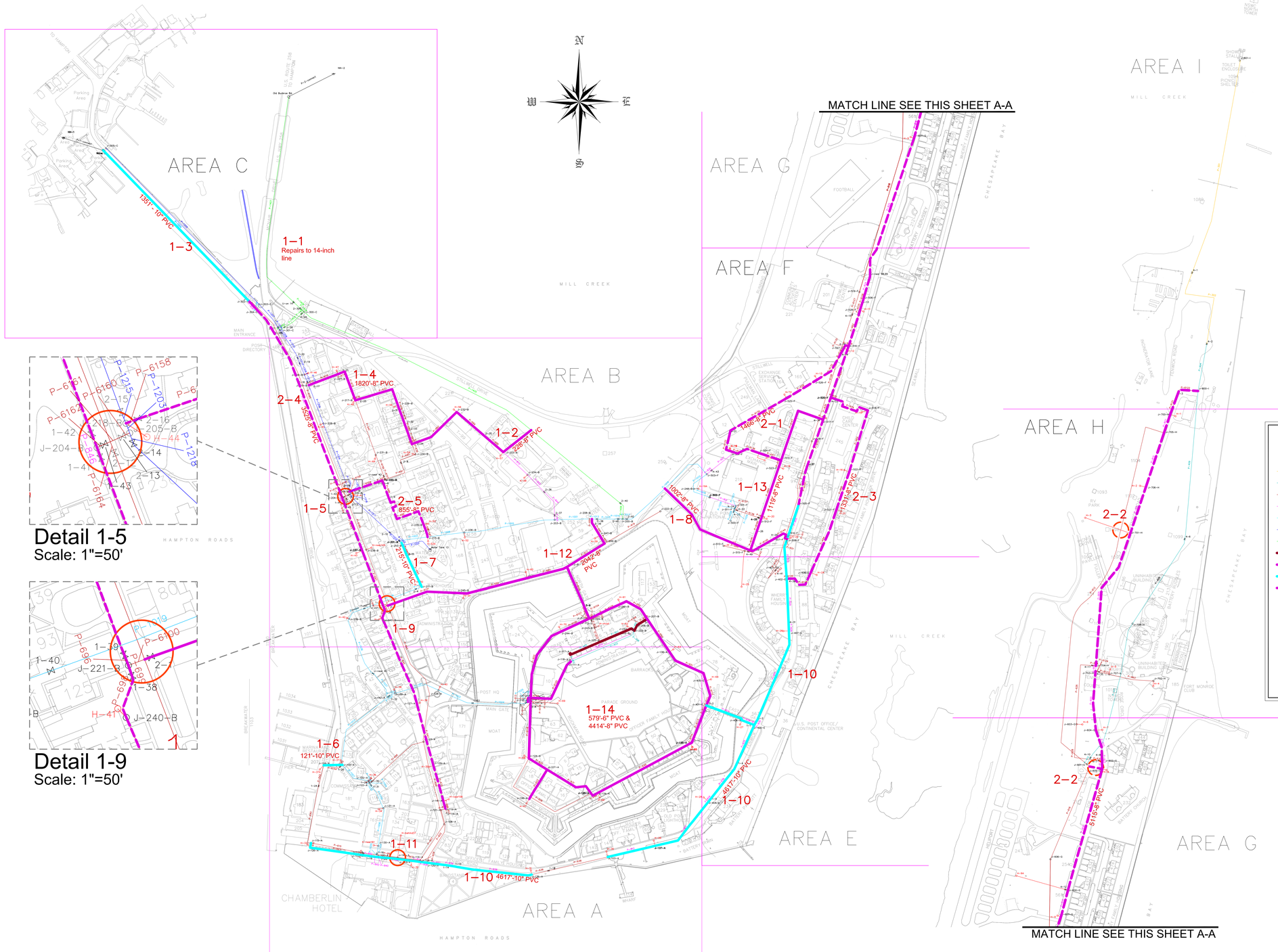
HQ. FORT MONROE
FORT MONROE, VIRGINIA

FORT MONROE
WATER DISTRIBUTION SYSTEM

EXHIBIT 1
EXISTING SYSTEM

URS
277 Bendix Road, Suite 500
Convergence Center
Virginia Beach, VA 23452
Telephone: (757) 499-4224
Fax: (757) 473-8214

Exhibit 1



US Army Corps of Engineers
Norfolk District

REV.	DATE	DESCRIPTION	BY	APP.

DESIGNED: | CHECKED: | DATE: MAY 04
DRAWN: | SUBMITTED: | SCALE: 1"=200'
PROJECT NO. 1165537 | NORFOLK DISTRICT FILE NO. | SPECIFICATION NO.
DRAWING NO. Exhibit 2 | Last revised on: File name: | Plot scale: 1:1

NORFOLK DISTRICT
CORPS OF ENGINEERS
NORFOLK, VIRGINIA

HQ. FORT MONROE
FORT MONROE, VIRGINIA

FORT MONROE
WATER DISTRIBUTION SYSTEM

EXHIBIT 2
PROPOSED SYSTEM IMPROVEMENTS

URS
277 Bendix Road, Suite 500
Convergence Center
Virginia Beach, VA 23452
Telephone: (757) 499-4224
Fax: (757) 473-8214

Exhibit 2