City of Cheyenne
Board of Public Utilities

# Volume 5 – Potable Water Storage and Distribution

## 2013 Cheyenne Water and Wastewater Master Plans

**Final**

November 27, 2013

Prepared for:

**City of Cheyenne**

**Board of Public Utilities**

2416 Snyder Ave.

Cheyenne, WY 82001

Prepared by:

**HDR Engineering**

1670 Broadway, Suite 3400

Denver, CO 80202

HDR

ONE COMPANY | *Many Solutions*℠

# Table of Contents

## List of Tables

## List of Charts



## List of Figures

## List of Appendices

(THIS PAGE WAS INTENTIONALLY LEFT BLANK)

# Abbreviations and Acronyms

| | |
|---|---|
| AC | Acre |
| ACP | Asbestos Cement Pipe |
| ADD | Average Day Demand |
| BOPU | Board of Public Utilities |
| CCWRF | Crow Creek Water Reclamation Facility |
| CIP | Capital Improvement Plan |
| CIPL | Cast Iron Lined Pipe |
| CIPU | Cast Iron Unlined Pipe |
| CIS | Customer Information System |
| City | City of Cheyenne |
| CMMS | Computerized Maintenance Management System |
| CoF | Consequence of Failure |
| DBPs | Disinfection By-products |
| DIP | Ductile Iron Pipe |
| DMA | District Metering Area |
| EAM | Enterprise Asset Management |
| EPA | Environmental Protection Agency |
| gal | Gallon |
| gpcd | Gallons per Capita per Day |
| GIS | Geographic Information System |
| GPS | Global Positioning System |
| gpm | Gallons per Minute |
| HDPE | High Density Polyethylene Pipe |
| HDR | HDR Engineering, Inc. |
| HGL | Hydraulic Grade Line |
| LoF | Likelihood of Failure |

| | |
|---|---|
| Master Plans | 2013 Cheyenne Water and Wastewater Master Plans |
| MDD | Maximum Day Demand |
| MG | Million Gallons |
| mgd | Million Gallons per Day |
| Mn | Manganese |
| O&M | Operations and Maintenance |
| NRBP | North Range Business Park |
| PCCP | Pre-stressed Concrete Cylinder Pipe |
| PHD | Peak Hour Demand |
| PRV | Pressure Reducing Valve |
| PS | Pump Station |
| PSV | Pressure Sustaining Valve |
| PVC | Polyvinyl Chloride |
| RTU | Remote Telemetry Unit |
| SCADA | Supervisory Control and Data Acquisition |
| SCWSD | South Cheyenne Water & Sewer District |
| SP | Steel Pipe |
| UDF | Unidirectional Flushing |
| UFW | Unaccounted-for Water |
| VFD | Variable Frequency Drive |
| Volume 2 | Volume 2 – Future Capacity Requirements |
| Volume 4 | Volume 4 – Potable Water Treatment |
| Volume 5 | Volume 5 – Potable Water Storage and Distribution |
| Volume 10 | Volume 10 – Information Technology Master Plan |
| Warren AFB | F.E. Warren Air Force Base |
| WDEQ | Wyoming Department of Environmental Quality |
| WTP | Water Treatment Plant |
| yr | Year |

# 5.1 Introduction

This Volume describes the existing potable water storage and distribution facilities for the City of Cheyenne (City) Board of Public Utilities (BOPU) and presents recommendations for improvements due to pipe condition and/or system growth over the three planning periods: near-term (2014-2023), mid-term (2024-2033), and long-term (2034-2063).

Water distribution system modeling provides insight into how potable water is delivered and where there may be areas that have low delivery pressure, cannot provide required fire protection, and/or pipelines that have excessive headloss or flow rate problems. This Volume presents an evaluation of the existing and future potable water distribution system and recommends improvements to eliminate current deficiencies and meet future growth demands. Distribution system performance requirements include providing adequate storage, flow rates, pressure and storage volume for peak hour demands and fire-flow events. The distribution system must also be configured to provide high quality water at all times.

The following items are documented in this Volume:

- Summary of existing system facilities and operation.
- Update of the hydraulic model, including updates to model facilities, allocation of demand, validation using field data, and addition of analysis scenarios.
- Analysis of the distribution system under peak hour demand and fire flow conditions.
- Analysis of the existing and future pressure zones and pressure management recommendations.
- Analysis of existing and future pump station capacities and locations.
- Analysis of existing and future storage capacities and locations.
- Recommendations for system monitoring including flow, level, pressure, and water quality.
- Development of a method for distribution system assessment for rehabilitation and replacement.
- Recommendations for a preventative maintenance plan including asset management, hydrant inspection and flushing, valve inspection and exercising, main break response, backflow prevention inspection, and customer complaint tracking.
- Summary of recommendations for infrastructure improvements, water age, pressure management, system monitoring, distribution assessment, and preventative maintenance.
- Presentation of capital improvement projects with estimated costs for the near-term and mid-term planning periods.

(THIS PAGE WAS INTENTIONALLY LEFT BLANK)

## 5.2 Existing Distribution System

This section summarizes the existing system including pipelines, pressure zones, pump stations, and storage.

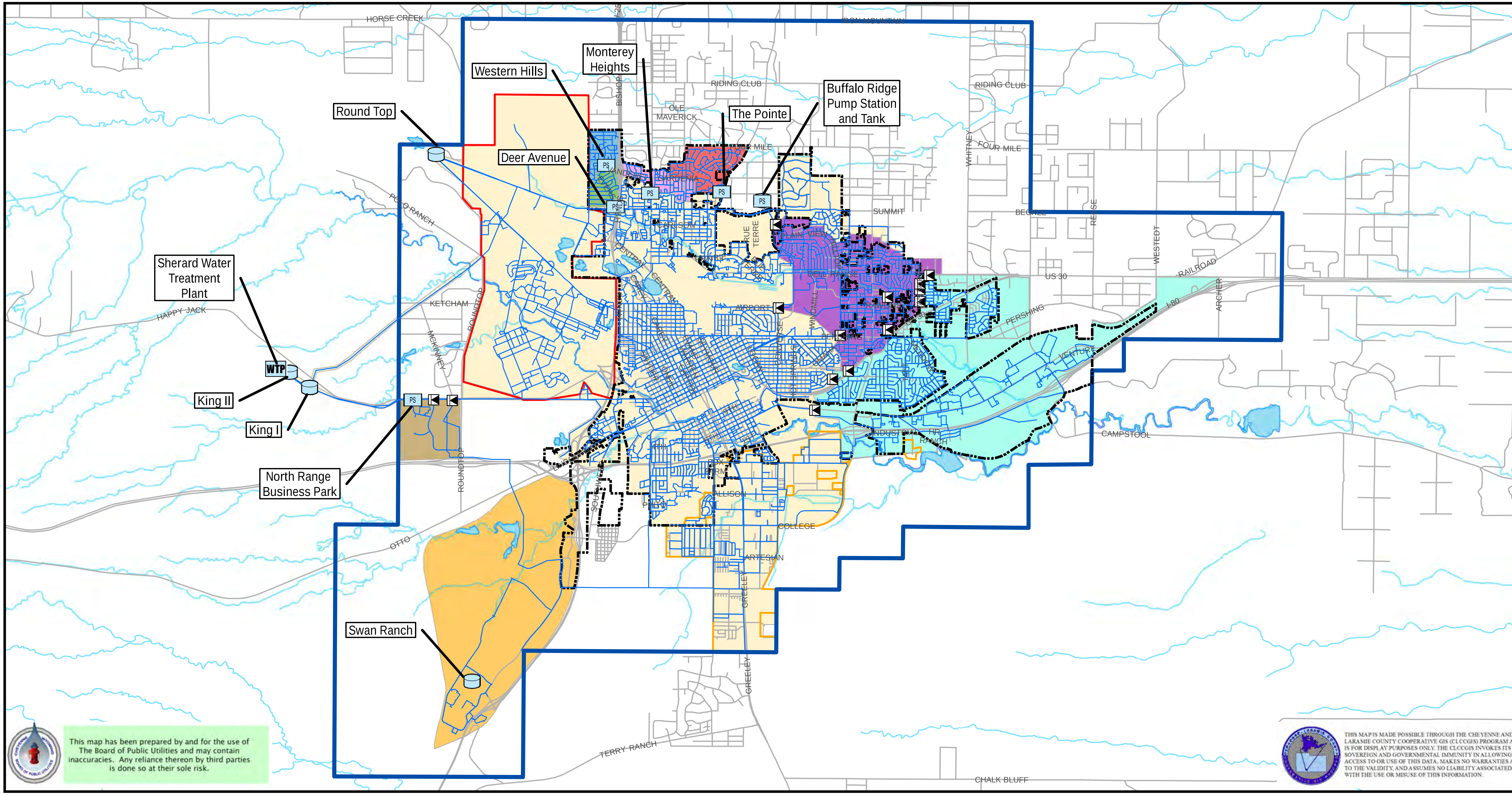
Figure 5-1 shows the existing water service boundary, distribution system, major facilities, and pressure zone boundaries.

### 5.2.1 Pipelines

The existing distribution system consists of approximately 645 miles of pipeline ranging in size from 2 to 54 inches according to BOPU's December 2012 pipe inventory. Table 5-1 lists the total length of water pipelines by diameter from the pipe inventory and by material and pipe diameter from the geographic information system (GIS) database as of March 2013. The GIS database pipe lengths and materials were used as the basis for hydraulic modeling of the distribution system.

**Table 5-1**
**Water Pipelines by Material and Diameter**

| | | GIS Database (March 2013) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Diameter | Pipe Inventory (December 2012) | Polyvinyl Chloride Pipe (PVC) | Steel Pipe (SP) | Ductile Iron Pipe (DIP) | Cast Iron Unlined Pipe (CIPU) | Cast Iron Lined Pipe (CIPL) | Prestressed Concrete Cylinder Pipe (PCCP) | High Density Polyethylene Pipe (HDPE) | Asbestos Mil Wrapped Steel Pipe | Asbestos Cement Pipe (ACP) | Unknown | Total Length (ft) |
| 2" | 0 | 1,444 | 0 | 1,973 | 125 | 0 | 0 | 0 | 0 | 0 | 0 | 3,543 |
| 3" | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| 4" | 294,315 | 52,035 | 45 | 40,257 | 152,334 | 22,270 | 0 | 0 | 0 | 0 | 0 | 266,941 |
| 6" | 515,921 | 64,999 | 758 | 189,489 | 100,701 | 162,693 | 0 | 0 | 149 | 0 | 2,611 | 521,401 |
| 8" | 910,772 | 499,235 | 1,040 | 539,215 | 47,237 | 150,174 | 0 | 4,732 | 8,099 | 917 | 711 | 1,251,361 |
| 10" | 51,323 | 18,775 | 25 | 47,835 | 3,028 | 8,980 | 0 | 0 | 0 | 0 | 0 | 78,643 |
| 12" | 312,965 | 169,778 | 133 | 104,558 | 22,502 | 21,532 | 0 | 0 | 0 | 2,703 | 0 | 321,206 |
| 14" | 31,258 | 463 | 0 | 7,974 | 7,613 | 325 | 0 | 0 | 0 | 0 | 0 | 16,375 |
| 16" | 38,588 | 4,415 | 18,714 | 35,611 | 3,786 | 6,852 | 304 | 0 | 0 | 0 | 240 | 69,922 |
| 18" | 8,423 | 0 | 0 | 581 | 2,493 | 1,489 | 0 | 0 | 0 | 0 | 0 | 4,563 |
| 20" | 47,940 | 1,607 | 0 | 6,864 | 2,094 | 0 | 6,727 | 0 | 0 | 0 | 0 | 17,291 |
| 24" | 870,835 | 3,890 | 17 | 72,218 | 48 | 641 | 27,725 | 0 | 0 | 347 | 0 | 104,886 |
| 30" | 291,533 | 5,965 | 190 | 20,710 | 16,942 | 2,581 | 20,782 | 0 | 0 | 0 | 0 | 67,170 |
| 36" | 18,283 | 0 | 115 | 24,600 | 2,062 | 0 | 0 | 0 | 0 | 0 | 0 | 26,777 |
| 42" | 12,900 | 0 | 15,200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15,200 |
| 54" | 0 | 0 | 0 | 0 | 272 | 206 | 0 | 0 | 0 | 0 | 0 | 478 |
| Total | 3,405,056 | 822,606 | 36,239 | 1,091,933 | 361,237 | 377,743 | 55,538 | 4,732 | 8,248 | 3,967 | 3,562 | 2,765,805 |




1 inch = 2 miles

N

## Legend

- WTP Water Treatment Plant
- Storage Tank
- PS Pump Station
- Pressure Reducing Valve
- Water Main
- Roads
- Creeks
- Lakes
- City of Cheyenne
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District

**Existing Pressure Zones**

- City
- Deer Avenue
- Dell Range
- Monterey Heights
- North Range Business Park
- Sun Valley
- Swan Ranch
- The Pointe
- Western Hills

HDR

# Figure 5-1
# Existing Potable Water Distribution System

**Volume 5 – Potable Water Storage and Distribution**
2013 Water and Wastewater Master Plans

Last Updated: 9/27/2013

### 5.2.2 Pressure Zones

Zones are used to manage service pressures. If pressures are too low, customers have inadequate pressure for normal operation of water fixtures. Pressures that are too high, however, increase the water usage and the risk of damaging interior piping and fixtures. In addition, high pressures are often associated with increased distribution system pipeline breakage and leakage.

BOPU serves the majority of existing customers by gravity flow from King I Reservoir, King II Reservoir via the King Intertie, and Round Top Reservoir. Some customers in the northwest part of the service area require pumping to provide adequate pressures, and customers on the east side of the City are served through pressure regulating valves (PRVs) to reduce the system pressures. Existing potable water pressure zones are summarized in Table 5-2.

**Table 5-2**
**Potable Water Pressure Zones**

| Zone | Hydraulic Grade (ft) | Service Elevations (ft) |
|---|---|---|
| City | 6,363 | 6,011 - 6,225 |
| Deer Avenue | 6,384 | 6,245 – 6,153 |
| Dell Range | 6,268 | 6,123 – 5,969 |
| Monterey Heights | 6,426 | 6,263 – 6,170 |
| North Range Business Park | 6,488 | 6,296 – 6,228 |
| Sun Valley | 6,236 | 6,064 – 5,901 |
| Swan Ranch | 6,477 | 6,377 – 6,173 |
| The Pointe | 6,423 | 6,259 – 6,154 |
| Western Hills | 6,420 | 6,255 – 6,188 |

### 5.2.3 Pump Stations

The existing distribution system includes six pump stations. Although all of the pump stations serve similar elevations in the northern portion of the service area, they are operated as separate pressure zones and are not hydraulically connected due to topography limitations or closed isolation valves. The Deer Avenue pump station feeds its pressure zone as well as the Western Hills pump station suction line. All of the other connections between Deer Avenue and Western Hills pressure zones are normally closed. All of the connections between The Pointe and Monterey Heights pressure zones are normally closed. Table 5-3 summarizes existing potable water pump stations.

**Table 5-3**
**Existing Potable Water Pump Station Data**

| Name | Pumps | | | Pumping Capacity | |
|---|---|---|---|---|---|
| | Number | Rated Capacity (gpm) | Rated Head (ft) | Total (gpm) | Firm (gpm) |
| Buffalo Ridge | 1 | 1,750 | 107 | 1,750 | 0 |
| Deer Avenue | 1 to 4 | 760 | 89 | 3,040 | 2,280 |
| Monterey Heights | 1 to 2 | 480 | 160 | 960 | 1,460 |
| | 3 | 500 | 225 | 500 | |
| | 4 | 890 | 180 | 890 | |
| North Range Business Park | 1 to 2 | 300 | 293 | 600 | 1,800 |
| | 3 to 5 | 600 | 293 | 1,800 | |
| Western Hills | 1 to 5 | 640 | 165 | 3,200 | 2,560 |
| The Pointe | 1 | 263.5 | 127.5 | 263.5 | 1,163.5 |
| | 2 to 4 | 450 | 210 | 1,350 | |

### 5.2.4 Potable Water Storage

The existing distribution system includes several potable water storage facilities. King II Reservoir provides chlorine contact time for the Sherard Water Treatment Plant (WTP) and groundwater from the Happy Jack, Borie, and Bell well fields. It is located at a higher elevation than the existing City Pressure Zone so it can distribute water as needed to both King I and Round Top Reservoirs (to Round Top Reservoir via the King Intertie). These latter two reservoirs float at the hydraulic grade line (HGL) of the City Pressure Zone and provide the majority of operational storage for the City.

Buffalo Ridge Reservoir is located in the north end of the distribution system in the area of Storey Boulevard and Converse Avenue. It is located at an elevation slightly below the City Pressure Zone HGL. In order to effectively use this volume for stored water, BOPU added a booster pump station at the Buffalo Ridge Reservoir that pumps water out of the tank to the City Pressure Zone HGL. The pumps are manually operated by Sherard WTP staff to help meet peak demands and to cycle water out of the reservoir into the distribution system to prevent water from becoming too old in the reservoir.

Swan Ranch I Reservoir is a newer reservoir that was built with the distribution system within the Swan Ranch development area. This reservoir is currently fed by a well and provides fire flow storage. In the near-term, a pump station will be constructed to feed this reservoir from the City Pressure Zone. Table 5-4 summarizes information on the existing potable water storage facilities.

**Table 5-4**
**Existing Potable Water Storage Facilities**

| Name | Total Volume (MG) | Effective Volume (MG) | Equivalent Diameter (ft) | Base Elevation (ft) | Overflow Elevation (ft) | Depth (ft) |
|---|---|---|---|---|---|---|
| Buffalo Ridge Reservoir | 5 | 5 | 111 | 6,248.0 | 6,310.0 | 64.6 |
| King I Reservoir | 5 | 5 | 234 | 6,350.0 | 6,365.5 | 15.5 |
| King II Reservoir(1) | 15 | 7.5 | 294 | 6,356.0 | 6,385.5 | 29.5 |
| Round Top Reservoir(2) | 11 | 10.75 | 306 | 6,343.5 | 6,363.7 | 20.0 |
| Swan Ranch I Reservoir | 0.5 | 0.5 | 43 | 6,347.0 | 6,477.0 | 40.0 |
| Total Storage | 36.5 | 28.75 | - | - | - | - |

1. 7.5 MG of storage volume in King II is reserved for disinfection contact time.
2. 0.25 MG of storage volume in Round Top is reserved for disinfection contact time.

# 5.3 Model Update and Validation

BOPU had already created a hydraulic water model using the GIS-based InfoWater software (Version 10.0 Update 2) by Innovyze. HDR utilized the existing hydraulic model as a basis of analysis for this study. The existing version of the InfoWater model was updated with 2012 demands and current operational procedures.

## 5.3.1 System Components

The hydraulic model contains all the distribution system reservoirs, pump stations, and PRVs. The model includes 448 miles of distribution piping which is approximately 86% of the total piping in the system. Piping less than 4" inches and mains serving individual customers are not included in the model as they do not significantly impact the hydraulics of the distribution system. **Appendix 5-**A contains the existing operations information including pump curves and PRV settings used during model development and validation.

### Hazen-Williams' Numbers

The distribution system model was run using Hazen-Williams' Equation for pressurized pipes to calculate headloss in the system.

$$h_L = 4.727C^{-1.852}d^{-4.871}Lq^{1.852}$$

where:

$h_L$ = headloss, ft

C = Hazen-William's roughness coefficient

d = Pipe diameter, ft

L = Pipe Length, ft

q = Flow, cfs

Hazen-Williams roughness coefficients were assigned to each type of pipe based on the material and age in the original model received from BOPU. Table 5-5 lists a matrix of roughness coefficients used in the model. These existing roughness coefficients were not modified in the original model as part of this study during the model update or validation phases. For future piping, all proposed piping is assumed to be PVC or SP with a roughness coefficient of 130.

**Table 5-5**
**Matrix of Pipe Material, Age and Roughness Coefficients**

| Material / Decade | Asbestos Cement Pipe (ACP) | Cast Iron Pipe Lined (CIPL) | Cast Iron Pipe Unlined (CIPU) | Ductile Iron Pipe (DIP) | High Density Polyethylene (HDPE) | Prestressed Concrete Cylinder Pipe (PCCP) | Polyvinylchloride (PVC) | Steel Pipe (SP) | Transite | Unknown |
|---|---|---|---|---|---|---|---|---|---|---|
| (Unknown) | 100 | 100 | 90 | 100.00 | 120 | 100 | 120 | 100 | 100.00 | 110 |
| 1870 | - | 80 | 70 | - | - | - | . | 80 | - | 90 |
| 1880 | - | 80 | 70 | - | - | - | - | 80 | - | 90 |
| 1890 | - | 80 | 70 | - | - | - | - | 80 | - | 90 |
| 1900 | - | 80 | 70 | - | - | - | - | 80 | - | 90 |
| 1910 | - | 90 | 80 | - | - | - | - | 90 | - | 90 |
| 1920 | - | 90 | 80 | - | - | - | - | 90 | - | 90 |
| 1930 | 100 | 90 | 80 | - | - | - | - | 90 | 100 | 90 |
| 1940 | 100 | 100 | 90 | - | - | - | - | 100 | 100 | 100 |
| 1950 | 100 | 100 | 90 | 100 | - | 100 | - | 100 | 100 | 100 |
| 1960 | 100 | 100 | 90 | 100 | - | 100 | - | 100 | 100 | 110 |
| 1970 | 100 | 110 | 90 | 110 | - | 100 | 120 | 100 | 100 | 110 |
| 1980 | 110 | 110 | 90 | 110 | - | 110 | 120 | 100 | 110 | 120 |
| 1990 | 110 | - | - | 120 | 120 | 110 | 120 | 100 | 110 | 120 |
| 2000 | - | - | - | 120 | 130 | 120 | 130 | 110 | - | 120 |
| 2010 | - | - | - | 130 | 130 | 120 | 130 | 110 | - | 120 |

### 5.3.2 Water Demand Allocation

Historical consumption data for each meter was used to develop an estimate of the average water usage and the spatial distribution of water usage in the distribution system for the 2013 planning year. Combined consumption data from 2012 was allocated to each model junction that represents the location of one or multiple water meters. Unaccounted for water, estimated to be 7.8% of the metered water consumption, was applied evenly across all model junctions. The 2012 consumption data and estimated unaccounted for water were adjusted globally to equal the water demand projection for year 2013 developed in Volume 2. Table 5-6 lists the water demand projection for year 2013 and future planning years. The average day demand was adjusted with peaking factors listed in Table 5-7 to estimate the maximum day and peak hour demand.

Appendix 5-B includes additional demand allocation information including a workflow on how the existing and future demands were assigned to model junctions.

**Table 5-6**
**Potable Water Demand Projections**

| Year | Planning Period | Average Day (ADD) | Maximum Day (MDD) | Peak Hour (PHD) |
|---|---|---|---|---|
| 2013 | Existing | 15.7 | 35.8 | 65.7 |
| 2023 | Near-Term | 18.0 | 40.9 | 74.5 |
| 2033 | Mid-Term | 21.2 | 47.7 | 86.1 |
| 2043 | Long-Term | 24.2 | 54.0 | 96.9 |
| 2053 | | 27.1 | 60.1 | 107.2 |
| 2063 | | 29.6 | 65.3 | 115.8 |

**Table 5-7**
**Potable Water Peaking Factors**

| Parameter | Normal Users | Large Users |
|---|---|---|
| Average Day | | |
| Demand, gpcd | 202 | - |
| Maximum Day | | |
| Ratio (MDD/ADD) | 2.3 | 1.75 |
| Demand, gpcd | 465 | - |
| Peak Hour | | |
| Ratio (PHD/ADD) | 4.25 | 2.25 |
| Demand, gpcd | 859 | - |

A portion of the water demand was assigned to new large users scheduled to be online by 2013. These demands were assigned to a single model junction based on the location of the user. The global adjustments of demands to meet does not apply to these new large users but the large user peaking factors presented in  Table 5-7 were applied. Table 5-8 lists the average demand associated with each large user.

**Table 5-8**
**New Large Users Allocated in the Model**

| Future Large User | 2013 ADD (mgd) |
|---|---|
| Microsoft | 0.2 |
| Swan Ranch | 0.1 |
| NCAR | 0.2 |

## Future Water Demand Allocation and Fire Flow

The additional future water demand projections were allocated in the model based on analysis of future developable lands and unit demand factors. The unit demand factors were developed by spatially joining the 2012 water demands with the GIS layer of the County's Zoning areas. By dividing the total demand by the number of acres within the total area of each zoning polygon and averaging the unit demands for each zoning type, the overall unit factors were developed to apply to the future developable land. Table 5-9 lists the unit demands for each zoning type. Figure 5-2 shows a map of the future developable areas.

Each of the developable land areas was assigned a percent buildout for each planning period (near-term, mid-term and long-term) based on current and anticipated development plans. Appendix 5-C contains figures showing the assumed percent buildout of developable land areas for each of the planning periods. The following equation was used to calculate future demands for these areas:

> Average Day Future Demand (gpd) = Unit Demand Factor (gpd/ac) x Developable Land Area (ac) x Zoning Building Coverage Allowance (%) x Buildout Factor (%)

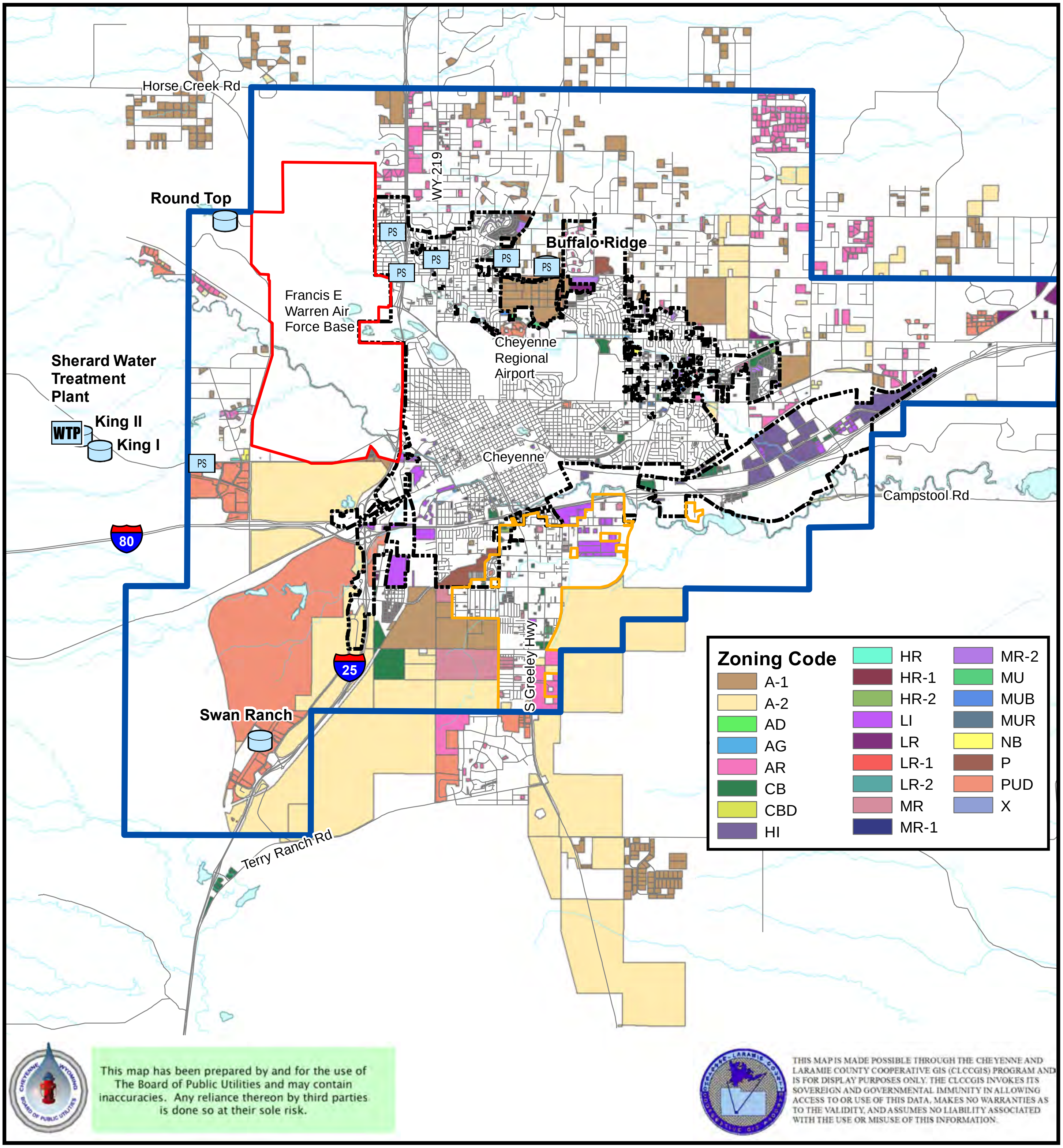
The total future average day demand was adjusted slightly to match the demand projections for each planning period in Volume 2 as summarized in Table 5-6. The resulting demands were assigned to the nearest junction in the model for each planning period scenario. The peaking factors were used to develop the maximum day and peak hour scenarios from the average day demand allocation.

In addition to water demand, modeled fire flow demands were assigned based on the zoning type overlaying each model junction representing a hydrant. The analyzed fire flow values in Table 5-9 were confirmed by the City's Fire Department.

Figure 5-3 depicts the current zoning information and associated fire flow demands overlaid with the model junctions.

**Table 5-9**
**County Zoning Codes with Unit Water Demands and Fire Flow**

| Zoning Code | Zoning Type | Zoning Area (acres) | Percent of Total Area | Fire Flow (gpm) | Assigned Future Unit Demand (gpd/ac) |
|---|---|---|---|---|---|
| A-2 | Agricultural | 75,998 | 55.8% | 500 | 350 |
| A-1 | Agricultural and Rural Residential | 15,749 | 11.6% | 500 | 350 |
| AR | Agricultural Residential | 7,381 | 5.4% | 500 | 350 |
| AD | Airport District | 907 | 0.7% | 4,000 | N/A |
| CBD | Central Business District | 123 | 0.1% | 3,500 | 1400 |
| AG | City Agricultural | 158 | 0.1% | 1,000 | 350 |
| CB | Community Business | 2,484 | 1.8% | 3,000 | 850 |
| X | Military Public | 6,006 | 4.4% | 3,500 | N/A |
| HI | Heavy Industrial | 2,256 | 1.7% | 3,500 | 100 |
| HR | High Density Residential - County | 61 | 0.0% | 2,500 | 1,900 |
| HR-2 | High Density Residential Developing | 117 | 0.1% | 2,500 | 1,900 |
| HR-1 | High Density Residential Established | 223 | 0.2% | 2,500 | 1,900 |
| LI | Light Industrial | 3,477 | 2.6% | 3,500 | 350 |
| LR | Low Density Residential - County | 703 | 0.5% | 750 | 1,300 |
| LR-2 | Low Density Residential Developing | 519 | 0.4% | 1,500 | 1,300 |
| LR-1 | Low Density Residential Established | 668 | 0.5% | 1,500 | 1,300 |
| MR | Medium Density Residential - County | 1,581 | 1.2% | 750 | 1,200 |
| MR-2 | Medium Density Residential Developing | 1,386 | 1.0% | 1,500 | 1,200 |
| MR-1 | Medium Density Residential Established | 3,302 | 2.4% | 1,500 | 1,200 |
| MU | Mixed Use - County | 452 | 0.3% | 1,500 | 500 |
| MUB | Mixed Use Business Emphasis | 591 | 0.4% | 2,500 | 1,000 |
| MUR | Mixed Use Residential Emphasis | 107 | 0.1% | 2,500 | 1,600 |
| NB | Neighborhood Business | 211 | 0.2% | 2,500 | 800 |
| PUD | Planned Unit Development | 6,711 | 4.9% | 3,500 | 1,100 |
| P | Public | 4,908 | 3.6% | 3,000 | 1,500 |
| | Total | 136,079 | 100.0% | - | - |




## Legend

City of Cheyenne
Water Service Area Boundary
F.E. Warren Air Force Base
South Cheyenne Water and Sewer District
WTP Water Treatment Plant
Storage Tank
PS Pump Station
Roads
Creeks
Lakes

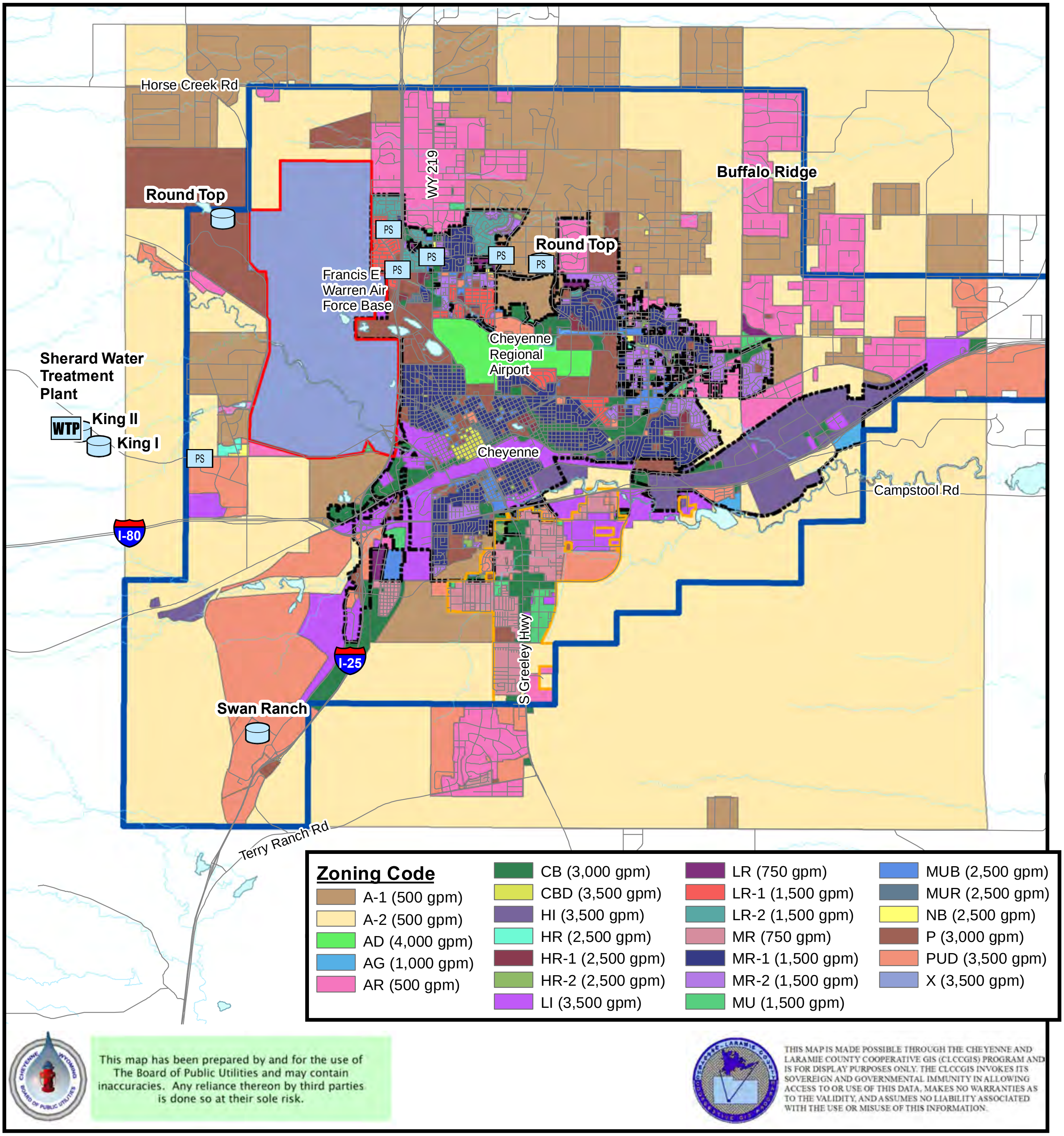
HDR

Last Updated: 9/27/2013

1 inch = 3 miles

N

# Figure 5-2
# Future Developable Land Map




## Legend

- City of Cheyenne
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- WTP Water Treatment Plant
- Storage Tank
- PS Pump Station
- Roads
- Creeks
- Lakes

1 inch = 3 miles

N

HDR

Last Updated: 9/27/2013

# Figure 5-3
# Fire Flow Zoning Map

### 5.3.3 Validation

Model results were validated with the following three data sources:

- Pressure logger data from the 2010 Pressure Management Study collected during the summer and winter of 2009.
- Pressure logger data collected from April and May of 2013 in the Dell Range pressure zone.
- Master meter data from 2012.

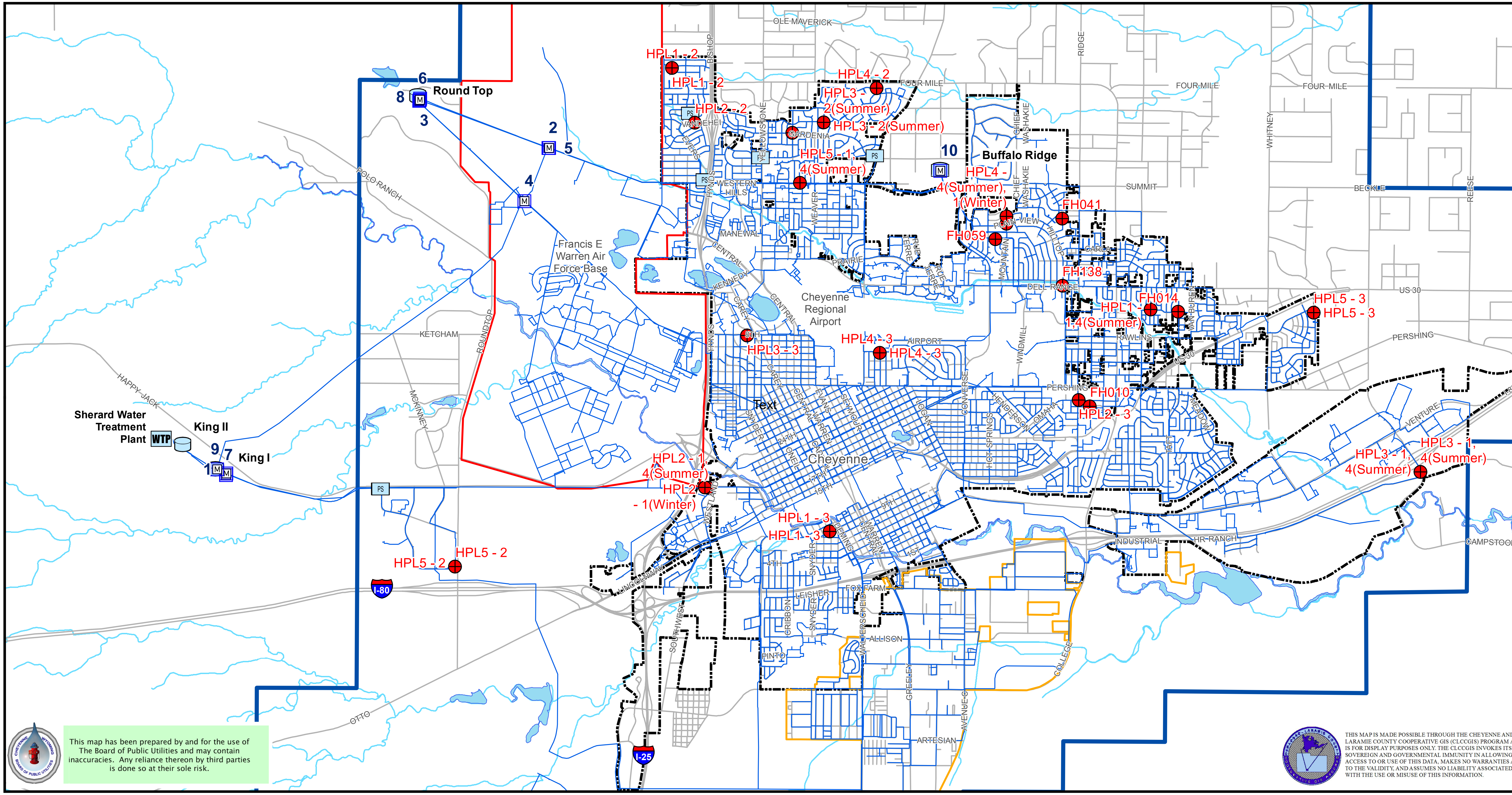
Data from these sources was compared with model results to determine if the model was simulating pressures and flow that correspond to actual observations. The locations of each pressure logger and master meter are shown in Figure 5-4. Fire hydrant flow data is recommended for future model validation and calibration as it puts the system under stress conditions to determine how the model responds under peak flow conditions.

#### 2010 Pressure Management Study Data

Five hydrant pressure loggers were purchased from Global Water Instrumentation, Inc. for data collection during this project. The pressure loggers, model PL200-H-2, allow for capturing direct system pressures wherever there is a fire hydrant. Four cycles of summer and winter installations were conducted to collect data for model calibration and high pressure monitoring at select locations throughout the system.

Table 5-10 and Table 5-11 provide a summary of the pressure data collected at each pressure logger during the summer and winter cycles. Simulated pressures from the model are compared with the data collected and the difference between the pressure logger data and the simulated pressures is shown. The data from pressure loggers located in the Dell Range pressure zone have been omitted from this table because the zone was created after the data was collected and the system pressure in the area has changed as a result.

(THIS PAGE WAS INTENTIONALLY LEFT BLANK)




## Legend

| | | | |
|---|---|---|---|
| Master Meters | Water Treatment Plant | City of Cheyenne | Roads |
| Pressure Logger Installations | Storage Tank | Water Service Area Boundary | Creeks |
| | Pump Station | F.E. Warren Air Force Base | Lakes |
| | Water Main | South Cheyenne Water and Sewer District | |

1 inch = 1.25 miles

N

# Figure 5-4
# Pressure Logger and Master Meter Map

**Volume 5 – Potable Water Storage and Distribution**
2013 Water and Wastewater Master Plans

Last Updated: 9/27/2013

**Table 5-10**
**Pressure Management Study – Summer Cycle Pressure and Model Results**

| Logger | Cycle | Data Collection Dates | Address | Pressure Zone | Average Pressure From Study (psi) | Modeled Pressure (psi) | Difference (psi) |
|---|---|---|---|---|---|---|---|
| HPL2 | 1 | 5/13 - 5/27/09 | Old Happy Jack Rd and Westland Rd | City | 111.5 | 109.0 | -2.4 |
| HPL3 | 1 | 5/13 - 5/27/09 | HR Ranch and Campstool | Sun Valley | 128.0 | 132.4 | 4.4 |
| HPL5 | 1 | 5/13 - 5/27/09 | Storey Blvd and Shaun Ave | City | 85.4 | 81.3 | -4.1 |
| HPL2 | 2 | 6/2 - 6/16/09 | Vandehei Ave and Ranger Dr | Deer Avenue | 76.3 | 68.1 | -8.2 |
| HPL3 | 2 | 6/2 - 6/16/09 | New Bedford Dr and Windsor Blvd | The Pointe | 92.0 | 84.8 | -7.2 |
| HPL4 | 2 | 6/2 - 6/16/09 | Wendy Ln and Miracle Pkwy | The Pointe | 121.5 | 116.0 | -5.5 |
| HPL5 | 2 | 6/2 - 6/16/09 | Horizon Dr and Round Top Rd | NRBP | 86.7 | 92.1 | 5.4 |
| HPL1 | 3 | 6/17 - 6/30/09 | 9th St and O'Neil Ave | City | 135.0 | 131.1 | -3.9 |
| HPL3 | 3 | 6/17 - 6/30/09 | 8th Ave and Snyder Ave | City | 93.2 | 87.0 | -6.2 |
| HPL4 | 3 | 6/17 - 6/30/09 | Gunsmoke Rd and Saddle Ridge Trl | City | 108.4 | 103.0 | -5.4 |
| HPL5 | 3 | 6/17 - 6/30/09 | 5th Ave and Alexander Ave | Sun Valley | 65.4 | 75.4 | 9.9 |
| HPL2 | 4 | 7/1 - 7/15/09 | Old Happy Jack Rd and Westland Rd | City | 115.6 | 109.0 | -6.5 |
| HPL3 | 4 | 7/1 - 7/15/09 | HR Ranch and Campstool | Sun Valley | 127.9 | 132.4 | 4.5 |
| HPL5 | 4 | 7/1 - 7/15/09 | Storey Blvd and Shaun Ave | City | 86.4 | 81.3 | -5.1 |

**Table 5-11**
**Pressure Management Study – Winter Cycle Pressure and Model Results**

| Logger | Cycle | Data Collection Dates | Address | Pressure Zone | Average Pressure From Study | Modeled Pressure (psi) | Study to Model Difference (psi) |
|---|---|---|---|---|---|---|---|
| HPL2 | 1 | 10/23 - 11/13/09 | Old Happy Jack Rd and Westland Rd | City | 115.5 | 106.9 | -8.6 |
| HPL3 | 1 | 10/23 – 11/13/09 | HR Ranch and Campstool | Sun Valley | 129.6 | 132.4 | 2.8 |
| HPL5 | 1 | 10/23 – 11/13/09 | Storey Blvd and Shaun Ave | City | 89.3 | 81.3 | -8.0 |
| HPL1 | 2 | 11/13 – 12/1/09 | West Dale and Shadow Mountain Cir | Western Hills | 87.6 | 77.8 | -9.8 |
| HPL2 | 2 | 11/13 – 12/1/09 | Vandehei Ave and Ranger Dr | Deer Avenue | 71.5 | 68.1 | -3.4 |
| HPL3 | 2 | 11/13 – 12/1/09 | Hydrant: 048FH013 | Monterey Heights | 76 | 71.8 | -4.2 |
| HPL4 | 2 | 11/13 – 12/1/09 | Wendy Ln and Miracle Pkwy | The Pointe | 122.6 | 116.0 | -6.6 |
| HPL5 | 2 | 11/13 – 12/1/09 | Horizon Dr and Round Top Rd | NRBP | 75.9 | 92.1 | 16.2 |
| HPL1 | 3 | 12/18/09 – 1/4/10 | 9th St and O'Neil Ave | City | 146.9 | 131.1 | -15.8 |
| HPL3 | 3 | 12/18/09 – 1/4/10 | 8th Ave and Snyder Ave | City | 99.9 | 87.0 | -12.9 |
| HPL4 | 3 | 12/18/09 – 1/4/10 | Gunsmoke Rd and Saddle Ridge Trl | City | 113.5 | 103.0 | -10.5 |
| HPL5 | 3 | 12/18/09 – 1/4/10 | 5th Ave and Alexander Ave | Sun Valley | 70 | 75.4 | 5.4 |

For most of the data records, the difference between the pressure logger data and the simulated pressure is greater than 5 psi. In some of the records from data collected in the winter, the difference exceeds 10 psi. The exact reasons why many data records have discrepancies with the hydraulic model is unknown. Possible explanations are provided below.

First, the pressure loggers may contain inaccurate data. HDR cited that pressure loggers provide inconsistent data during periods of cold temperatures or storm events (HDR, 2010).

Second, reservoir levels, pump operation (flow and output pressure), and master meter supervisory control and data acquisition (SCADA) data was not available to be reviewed review for the periods in which the pressure data was collected. Typical reservoir operation levels, pump operation, and the system demands were assumed based on an average day demand condition (ie. reservoir levels are not drawn down, pump operation based on variable frequency drive (VFD) settings provided by BOPU, and the demand in the system equals average day demand for predicted for 2013). Any of these parameters can translate into differences in system pressures as conditions change. The system operation should be verified for the periods of the pressure data collection.

And third, the elevation of each pressure logger was not provided. The elevations of model junctions that represent hydrants in the model were estimated from GIS 2' foot contour data. There is a margin of error for the accuracy of the GIS contours and the actual elevation of the pressure logger may differ from the estimated elevation in the model. For some of the records, the hydraulic grade calculated by adding the pressure recorded at the pressure logger and the estimated elevation of the hydrant from the model equated to a hydraulic grade that exceeded the overflow of a reservoir or the VFD output pressure setting for a pump station. For these cases, a possible explanation is the assumed elevation of the hydrant is not correct. The elevation of each pressure logger location should be verified with a very accurate handheld global positioning system (GPS) unit or lidar ground elevation plus the height to the hydrant nozzle.

For these reasons, the data from the 2010 pressure management study did not provide a consistent set of data with which to validate the model. Without additional data and verification of system operation, it is not possible to determine the source of the inconsistencies between the pressure logger data and the hydraulic model.

## Dell Range Pressure Logger Data from 2013

Five pressure loggers were connected to hydrants in the Dell Range pressure zone. The data collected is listed in Table 5-12 and compared with simulated pressures in the model. Each pressure logger location is shown in Figure 5-4.

**Table 5-12**
**Pressure Logger Data Collection in April and May 2013 and Model Results**

| Hydrant with Pressure Logger | Cycle | Data Collection Dates | Pressure Zone | Average Pressure from Loggers (psi) | Modeled Pressure (psi) | Difference (psi) |
|---|---|---|---|---|---|---|
| FH041 | 1 | 4/11 - 5/2/13 | City | 86.5 | 95.9 | 9.4 |
| FH059 | 1 | | Dell Range | 92.9 | 91.9 | -1.0 |
| FH138 | 1 | | Dell Range | 109.8 | 110.3 | 0.5 |
| FH014 | 1 | | Dell Range | 111.7 | 112.7 | 1.0 |
| FH010 | 1 | | Dell Range | 111.0 | 111.8 | 0.8 |
| FH041 | 2 | 5/2 - 5/30/13 | City | 83.5 | 95.9 | 12.4 |
| FH059 | 2 | | Dell Range | 91.3 | 91.9 | -0.6 |
| FH138 | 2 | | Dell Range | 103.3 | 110.3 | 7.0 |
| FH059 | 2 | | Dell Range | 91.3 | 91.9 | 0.6 |
| FH138 | 2 | | Dell Range | 103.3 | 110.3 | 7.0 |

Most of the data collected at these locations were consistent with pressures simulated in the model. The pressure logger located in the City zone on hydrant FH041 was inconsistent with model simulated pressures. One possible explanation for the inconsistency is the elevation of the pressure logger is different from the estimated elevation of the hydrant in the model.

## Master Meter Data from 2012

The master meter and reservoir levels from SCADA data from 2012 were also used to validate the model. Table 5-13 and Table 5-14 lists selected events that approximated a maximum day or average day demand condition. Each model simulation had the total demand and reservoir levels adjusted to match the SCADA data for each event. The operation of the Buffalo Ridge pump station and the "X" control valve were set according to the operation reported in the SCADA data. Each master meter location is shown in Figure 5-4.

**Table 5-13**
**Master Meter SCADA Data – Peak Hour Comparison**

| | 6/18/12 8:00 PM | | | 7/1/12 8:00 PM | | | 8/18/12 7:00 PM | | |
|---|---|---|---|---|---|---|---|---|---|
| Master Meter Location | Master Meter | Model | Diff. | Master Meter | Model | Diff. | Master Meter | Model | Diff. |
| | Flow (mgd) | | % | Flow (mgd) | | % | Flow (mgd) | | % |
| System Demand | 43.6 | 43.4 | -1% | 39.1 | 39.0 | 0% | 29.0 | 28.9 | 0% |
| 1- 30" Hynds Line | 10.5 | 11.4 | 8% | 9.8 | 10.4 | 6% | 7.5 | 7.6 | 1% |
| 2 - 24" WH Base | 6.5 | 4.5 | -31% | 5.9 | 3.9 | -34% | 5.0 | 3.5 | -30% |
| 3 - 24" Round Top to Town | 4.1 | 4.1 | -1% | 3.6 | 3.4 | -5% | 3.2 | 2.7 | -16% |
| 4 - 30" City Base | 11.1 | 14.3 | 29% | 9.4 | 13.1 | 40% | 7.1 | 10.0 | 41% |
| 5 - 30" WH Base | 11.3 | 9.0 | -20% | 10.2 | 7.7 | -24% | 8.4 | 7.0 | -17% |
| 6 - 30" Round Top | 8.0 | 9.5 | 18% | 7.0 | 8.0 | 15% | 6.2 | 6.2 | 1% |
| 7 - 42" Southern Main | 1.0 | 1.3 | 25% | 1.1 | 1.2 | 11% | 0.9 | 0.9 | -8% |
| 8 - 30" Round Top Influent | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| 9 - 36" Intertie | 15.7 | 14.3 | -9% | 14.3 | 13.3 | -7% | 10.3 | 11.6 | 13% |
| | Flow (gpm) | | % | Flow (gpm) | | % | Flow (gpm) | | % |
| 10 - Buffalo Ridge | 2,155 | 1,980 | -8% | 1,985 | 1,922 | -3% | 0 | 0 | |

**Table 5-14**
**Master Meter SCADA Data – Average Day Comparison**

| Master Meter Location | 4/21/12 2:00 PM | | | 9/30/12 9:00 AM | | | 12/2/12 3:00 PM | | |
|---|---|---|---|---|---|---|---|---|---|
| | Master Meter | Model | Diff. | Master Meter | Model | Diff. | Master Meter | Model | Diff. |
| | Flow (mgd) | | % | Flow (mgd) | | % | Flow (mgd) | | % |
| System Demand | 16.0 | 15.9 | -1% | 13.5 | 13.0 | -3% | 12.0 | 11.6 | -4% |
| 1- 30" Hynds Line | 3.6 | 4.1 | 15% | 3.6 | 3.1 | -12% | 3.7 | 2.7 | -28% |
| 2 - 24" WH Base | 1.9 | 1.2 | -39% | 2.3 | 1.7 | -28% | 1.6 | 1.5 | -11% |
| 3 - 24" Round Top to Town | 2.8 | 2.5 | -11% | 0.9 | 0.8 | -18% | 2.2 | 0.6 | -75% |
| 4 - 30" City Base | 3.2 | 4.7 | 45% | 3.2 | 4.2 | 32% | 2.7 | 3.8 | 40% |
| 5 - 30" WH Base | 3.7 | 2.4 | -34% | 3.6 | 3.3 | -10% | 3.0 | 2.9 | -3% |
| 6 - 30" Round Top | 5.5 | 5.8 | 5% | 1.8 | 1.5 | -17% | 4.4 | 1.1 | -75% |
| 7 - 42" Southern Main | 0.8 | 0.8 | 7% | 0.8 | 0.7 | -8% | 0.9 | 0.7 | -24% |
| 8 - 30" Round Top Influent | 7.6 | 8.3 | 9% | 2.3 | 2.0 | -13% | 4.8 | 2.3 | -53% |
| 9 - 36" Intertie | 8.5 | 8.3 | -3% | 9.4 | 8.9 | -6% | 5.4 | 8.8 | 62% |
| | Flow (gpm) | | % | Flow (gpm) | | % | Flow (gpm) | | % |
| 10 - Buffalo Ridge | 1,952 | 1,862 | -5% | 0 | 0 | | 0 | 0 | |

The following observations were made after comparing the SCADA data and the model simulations results.

- 30" Hynds Line – The SCADA data and model results are consistent for the flow through the 30" Hynds Line meter. The records for the three events approximating peak demand conditions are within 10% of the modeled results. During an average day demand condition, the difference between the SCADA data and the model results is greater than 10%.
- 24" WH Base, 30" WH Base – The model consistently under predicts the flow through the WH base meters and over predicts the flow through the 30" City Base meter. All three meters feed the northern portion of the distribution system and the cause of the imbalance in flow between the three meters is unknown. This imbalance occurred in the 2003 Master Plan hydraulic model as well. The meters on these lines should be recalibrated and the area reevaluated to determine the cause of the flow difference.
- 24" Round Top to Town, 30" Round Top – The flow from Round Top is recorded by these two meters. The data is relatively consistent with the model simulations. While the percent difference is as great as 18% during the peak demand conditions, the actual difference in flow is within 2 mgd.

- 42" Southern Main – The flow through this meter is 1.3 mgd at its highest value. The simulated flow in the model is within 0.3 mgd of the SCADA data. The simulated flows are consistent with the SCADA data.
- 36" Intertie – The simulated flow through the 36" intertie is within 15% of SCADA data during the peak demand conditions. For the average day conditions, the flow is also consistent with the exception of the 12/2/12 event.
- Round Top Influent – The simulated flow in the model is consistent with the master meter recording the influent flow to the Round Top reservoirs. During the peak demand conditions, there is no flow into Round Top. All flow is divert through the "X" control structure and bypasses Round Top. During the average demand conditions, the reservoir is able to fill, and the model simulated flow rates are consistent with the master meter data.
- Buffalo Ridge – The master meter records flow into and out of the Buffalo Ridge Reservoir. Positive values correspond to when the Buffalo Ridge pump station is pumping out of the reservoir. When values are zero, the reservoir is closed and the reservoir is neither filling nor being pumped into the distribution system. The modeled flow rate through the pump station is consistent with the master meter data.

### Validation Summary and Recommendations

In general, the model is in a condition adequate for planning level analysis. The settings for pumps stations, PRVs, and reservoirs levels are all assigned based on current system operational information. Pipe roughness is assumed based on the pipe age and material which is adequate for the purpose of this analysis. Hydrant flow tests may be conducted in the future to further refine the roughness coefficients assigned to the pipes in the model and to validate model performance for high stress conditions. Operational data from the SCADA system should be reviewed during the periods when pressure logger data was collected to verify the system operation. Also, the elevations of the pressure logger locations should be verified to ensure that they correlate to elevations in the model.

# 5.4 Distribution System Analysis

## 5.4.1 Modeling Scenarios

In accordance with Wyoming Department of Environmental Quality (WDEQ) Water Quality Rules and Regulations Chapter 12, Section 14 (b) (i), distribution systems shall be designed to maintain a minimum pressure of 20 psi (138 kPa) at ground level at all points in the distribution system under all conditions of flow. The City of Cheyenne desires to maintain a minimum service pressure of 35 psi (207 kPa) which is the minimum pressure utilized for the system analysis. Under peak hour demand (PHD) conditions, this minimum pressure must be maintained with the equalizing and operational storage depleted in the reservoirs. Under fire flow conditions, this minimum pressure must be maintained under maximum day demand (MDD) conditions with equalizing, operational, and fire flow storage depleted. If these criteria could not be met as demonstrated by the model, improvements were identified through an iterative trial-and-error process, and implemented until pressure criteria could be satisfied with a minimum of pipe and facility additions.

Steady state hydraulic analyses were completed for each pressure zone for existing (2013), near-term (2023), mid-term (2033), and long-term (2063) demand conditions. These analyses considered peak hour demand and fire flow demand (MDD plus fire flow) conditions. Table 5-15 describes the modeling scenarios conducted, and the sequence within which they were performed. The results of the peak hour and fire flow analyses are described in greater detail below.

**Table 5-15**
**Modeling Scenarios**

| Description | Demand | Purpose |
|---|---|---|
| Existing (2013) Year Peak Hour | Existing (2013) Peak Hour Demand | Evaluate existing system performance |
| Existing (2013) Year Fire Flow | Existing (2013) Maximum Day Demand plus fire flow | Evaluate existing system performance |
| Near-Term (2023) Peak Hour | Near-Term (2023) Peak Hour Demand | Evaluate system performance and develop CIP for peak hour conditions |
| Near-term (2023) Fire Flow | Near-Term (2023) Maximum Day Demand plus fire flow | Evaluate system performance and develop CIP for Plan Year 2023 fire flow conditions |
| Mid-term (2033) Peak Hour | Mid-term (2033) Peak Hour Demand | Evaluate system performance and develop CIP for peak hour conditions |
| Mid-term (2033) Fire Flow | Mid-term (2033) Maximum Day Demand plus fire flow | Evaluate system performance and develop CIP for Plan Year 2033 fire flow conditions |
| Long-term (2063) Peak Hour | Long-term (2063) Peak Hour Demand | Evaluate system performance and develop CIP for peak hour conditions |
| Long-term (2063) Fire Flow | Long-term (2063) Maximum Day Demand plus fire flow | Evaluate system performance and develop CIP for Plan Year 2063 fire flow conditions |

### 5.4.2 Peak Hour Analysis Results

The simulated pressures during a peak hour demand condition are depicted in Table 5-16 through Table 5-19. Each table includes the pressure recorded at a single junction in the model. New pressure zones that would be created by proposed pressure management improvements and future boosted pressure zones are included in the tables in subsequent planning years.

Figure 5-5 through Figure 5-8 depict the system pressures graphically in the system. Junctions with pressure less than 35 psi are labeled on the figures.

Junctions in close proximity to the Buffalo Ridge Reservoir and King I, II and Round Top Reservoirs are omitted from the evaluation, as there are no customer meters near these junctions and the available pressure is less than 35 psi during static conditions. The evaluation focuses on pressure in the distribution system that is affected by demand conditions and water main friction losses.

**Table 5-16**
**2013 Junction Pressure by Pressure Zone during Peak Hour Demand**

| Pressure Zone | <35 psi | 35-60 psi | 60-100 psi | >100 psi |
|---|---|---|---|---|
| City | 385 | 2820 | 2897 | 0 |
| Western Hills | 0 | 0 | 199 | 5 |
| Monterey Heights | 0 | 2 | 206 | 21 |
| Deer Avenue | 0 | 4 | 98 | 0 |
| The Pointe | 0 | 15 | 282 | 29 |
| Dell Range | 0 | 38 | 1542 | 9 |
| Sun Valley | 0 | 7 | 1186 | 661 |
| North Range Business Park | 0 | 8 | 68 | 35 |
| Swan Ranch | 0 | 103 | 53 | 51 |
| **Total** | **385** | **2997** | **6531** | **811** |

**Table 5-17**
**2023 Junction Pressure by Pressure Zone during Peak Hour Demand**

| Pressure Zone | <35 psi | 35-60 psi | 60-100 psi | >100 psi |
|---|---|---|---|---|
| City North | 23 | 1186 | 1275 | 6 |
| Western Hills | 0 | 0 | 199 | 5 |
| Monterey Heights | 0 | 2 | 207 | 21 |
| Deer Avenue | 0 | 2 | 97 | 3 |
| The Pointe | 0 | 18 | 289 | 18 |
| Dell Range | 0 | 30 | 1503 | 47 |
| North East | 0 | 0 | 4 | 0 |
| Sun Valley | 0 | 2 | 1150 | 709 |
| City Central | 0 | 107 | 3037 | 139 |
| North Range Business Park | 0 | 8 | 70 | 33 |
| City South | 1 | 170 | 165 | 15 |
| Swan Ranch | 1 | 103 | 37 | 65 |
| **Total** | **25** | **1628** | **8033** | **1061** |

**Table 5-18**
**2033 Junction Pressure by Pressure Zone during Peak Hour Demand**

| Pressure Zone | <35 psi | 35-60 psi | 60-100 psi | >100 psi |
|---|---|---|---|---|
| City North | 66 | 1406 | 1015 | 4 |
| Western Hills | 0 | 0 | 199 | 5 |
| Monterey Heights | 0 | 2 | 207 | 21 |
| Deer Avenue | 0 | 3 | 96 | 3 |
| The Pointe | 0 | 24 | 283 | 18 |
| Dell Range | 0 | 39 | 1531 | 10 |
| North East | 1 | 5 | 7 | 0 |
| Sun Valley | 0 | 8 | 1173 | 685 |
| South East | 1 | 1 | 0 | 0 |
| City Central | 0 | 170 | 3041 | 72 |
| Chalk Bluff | 0 | 0 | 1 | 2 |
| North Range Business Park | 0 | 8 | 71 | 32 |
| City South | 1 | 262 | 81 | 13 |
| Swan Ranch | 1 | 105 | 44 | 61 |
| **Total** | **70** | **2033** | **7749** | **926** |

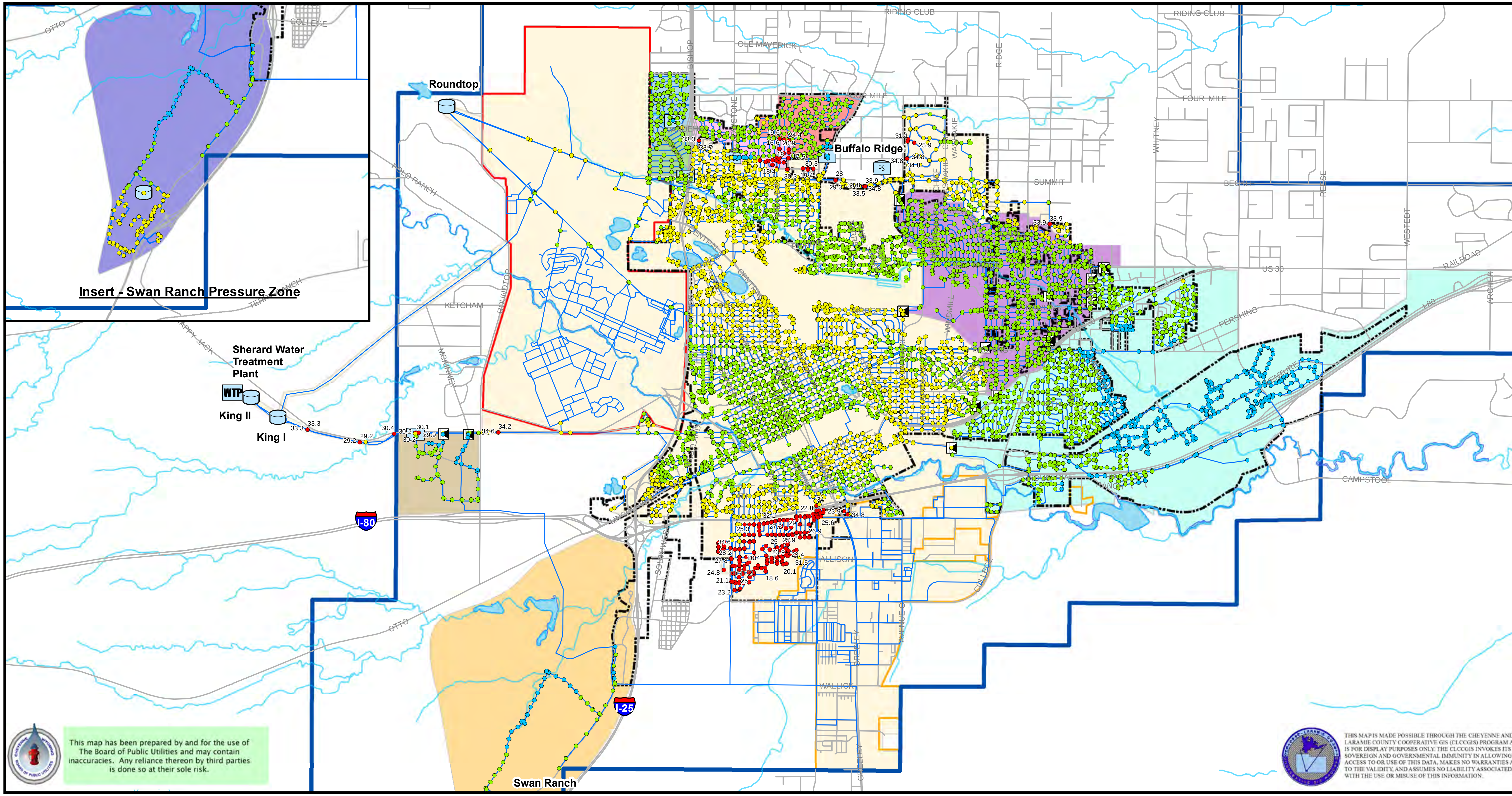
**Table 5-19**
**2063 Junction Pressure by Pressure Zone during Peak Hour Demand**

| Pressure Zone | <35 psi | 35-60 psi | 60-100 psi | >100 psi |
|---|---|---|---|---|
| City North | 268 | 1456 | 767 | 0 |
| Western Hills | 0 | 0 | 199 | 5 |
| Monterey Heights | 1 | 2 | 206 | 21 |
| Deer Avenue | 0 | 7 | 92 | 3 |
| The Pointe | 4 | 30 | 279 | 12 |
| Dell Range | 1 | 67 | 1512 | 0 |
| North East | 8 | 7 | 0 | 0 |
| Sun Valley | 0 | 8 | 1229 | 631 |
| South East | 2 | 0 | 0 | 0 |
| City Central | 0 | 277 | 2980 | 26 |
| Chalk Bluff | 0 | 6 | 5 | 0 |
| North Range Business Park | 0 | 8 | 72 | 31 |
| City South | 1 | 313 | 31 | 12 |
| Swan Ranch | 1 | 113 | 49 | 48 |
| **Total** | **286** | **2294** | **7421** | **789** |

### Summary of Observations

- In the existing scenario, an area south of I-80 between Greeley Highway and I-25 experiences low pressures during peak hour demand conditions. By 2023, the implementation of the Southern Water Transmission Main – Phases I, II, and III will increase the pressures in the area.
- North of Storey Boulevard in the City pressure zone, there are areas of low pressure during peak hour demand conditions. The areas of low pressure are due to the friction losses in the distribution mains conveying water from Round Top and King II Reservoirs and the relative high elevation of the area. Buffalo Ridge pump station is designed to boost pressures in the northern distribution system, but the capacity limits flow to provide only a portion of the peak hour demand in the area. By 2063, the number of junctions with pressure less than 35 psi during a peak hour demand will increase. Potential improvements may include expanding the Monterey Heights and Pointe pressure zones, reducing conveyance friction losses by increasing the capacity of the 24" distribution main along Storey Boulevard, or increasing the capacity of the Buffalo Ridge pump station.
- Along Panorama Lane, there is an area of low pressure during peak hour demand conditions. Friction losses in the distribution water mains that convey flow from Round Top and King II Reservoirs may cause pressures less than 35 psi in the area. The pressure may be improved by expanding the Northeast pressure zone to serve the customers in the area. Pressures could also be improved by increasing the capacity of the Buffalo Ridge pump station or increasing the capacity of the 24" distribution main along Storey Boulevard. A pressure sustaining valve (PSV) from the Dell Range pressure zone could be installed to provide a redundant supply to this area in case the main City pressure supply is temporarily disconnected.

(THIS PAGE WAS INTENTIONALLY LEFT BLANK)




## Legend

**Peak Hour Pressure (psi)**
- <35
- 35 - 60
- 60 - 100
- >100

- WTP Water Treatment Plant
- PS Pump Station
- Storage Tank
- PRV
- Water Main

- Roads
- Creeks
- Lakes
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- City of Cheyenne

**Existing Pressure Zones**
- City
- Deer Avenue
- Dell Range
- Monterey Heights
- North Range Business Park
- Sun Valley
- Swan Ranch
- The Pointe
- Western Hills

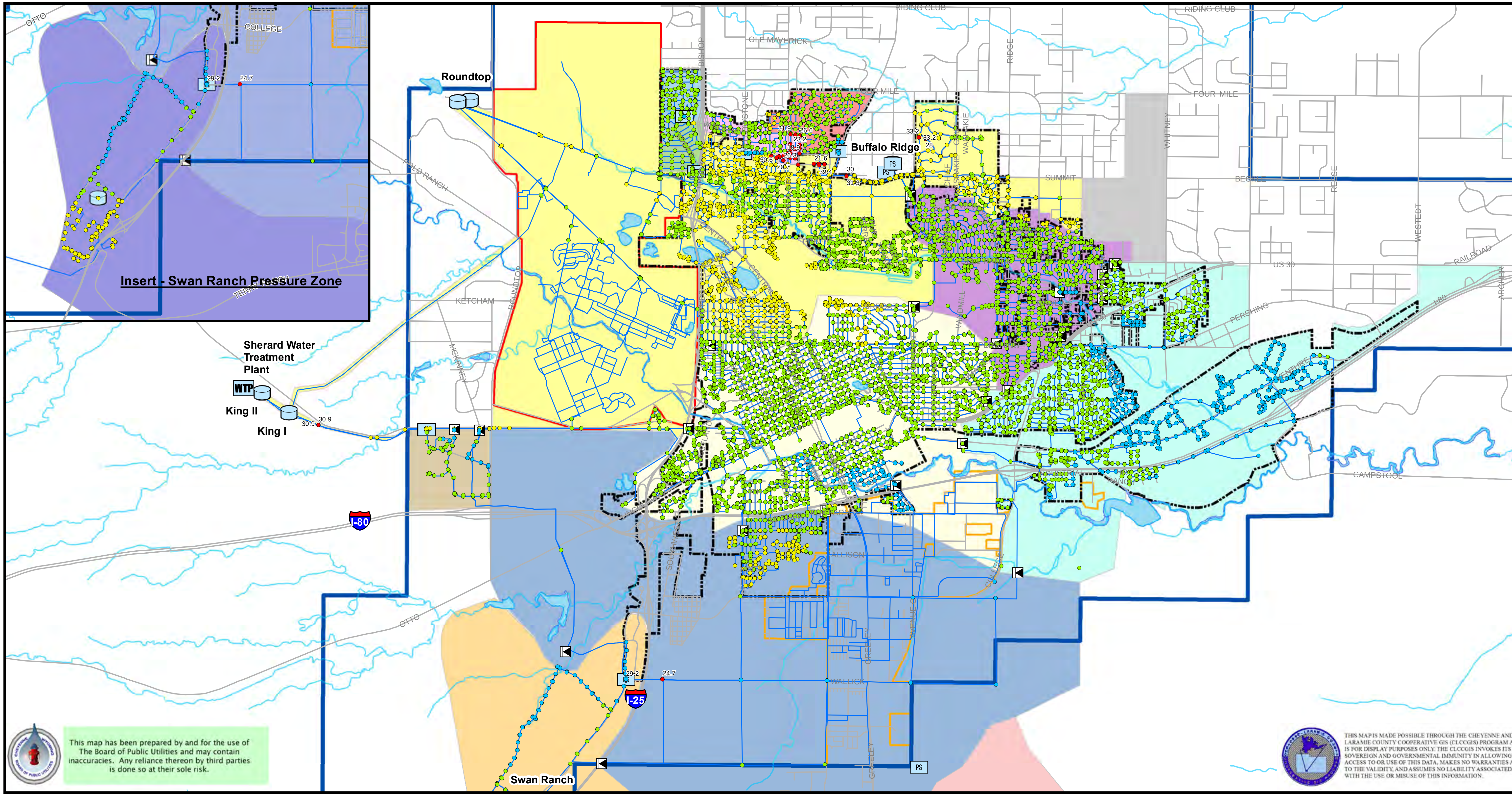
1 inch = 1.5 miles

N

HDR

Last Updated: 9/27/2013

# Figure 5-5
# Existing Peak Hour Pressure Map




## Legend

**Peak Hour Pressure (psi)**
- <35
- 35 - 60
- 60 - 100
- >100

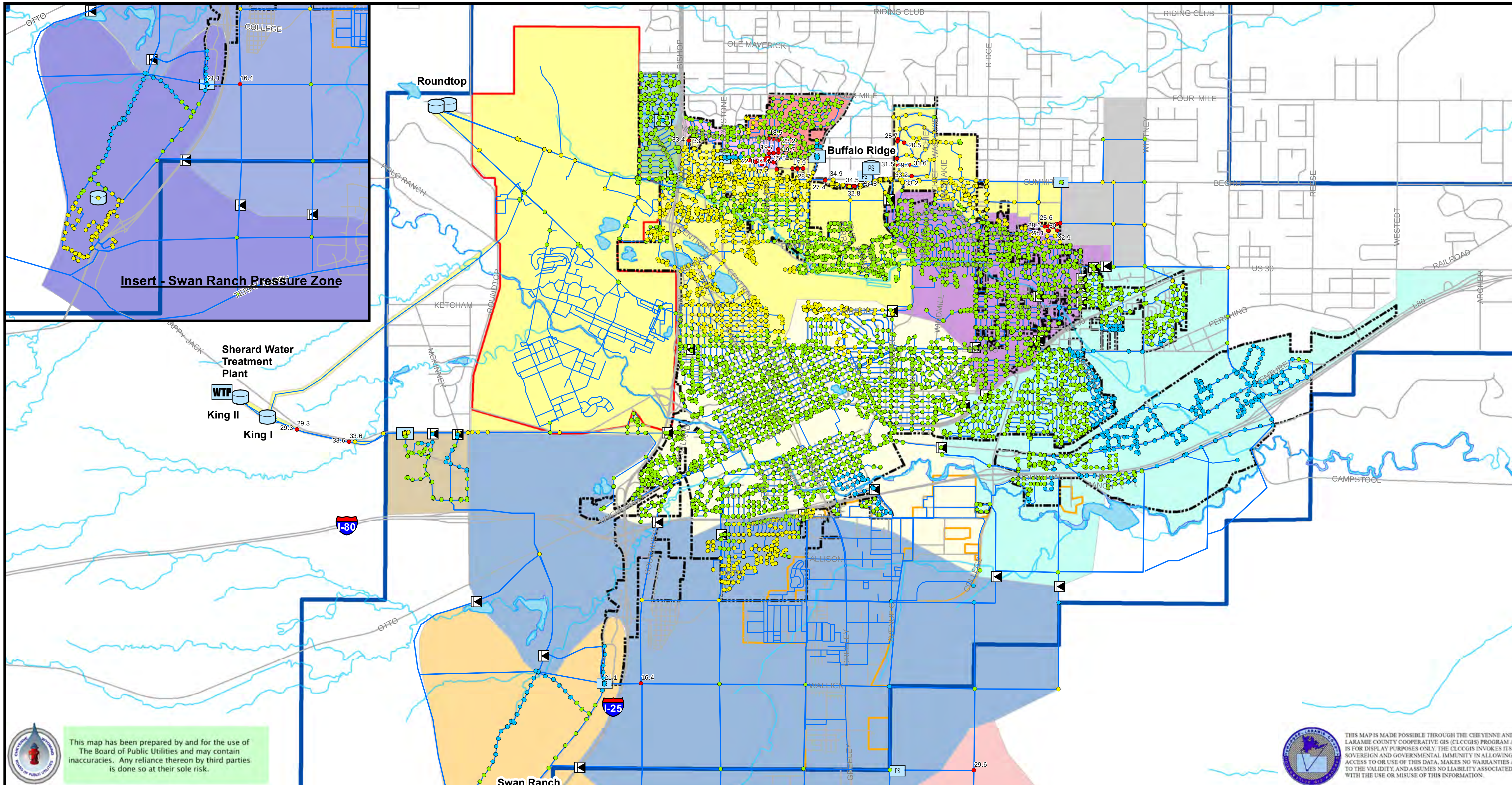
- WTP Water Treatment Plant
- PS Pump Station
- Storage Tank
- PRV
- Water Main
- Roads
- Creeks
- Lakes
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- City of Cheyenne

**Future Pressure Zones**
- Chalk Bluff
- City Central
- City North
- City South
- Deer Avenue
- Dell Range
- Monterey Heights
- North Range Business Park
- Northeast
- Southeast
- Sun Valley
- Swan Ranch
- The Pointe
- Western Hills

1 inch = 1.5 miles

N

**Figure 5-6**
**2023 Peak Hour Pressure Map**




1 inch = 1.5 miles

N

## Legend

**Peak Hour Pressure (psi)**
- <35
- 35 - 60
- 60 - 100
- >100

WTP Water Treatment Plant
PS Pump Station
Storage Tank
PRV
Water Main

Roads
Creeks
Lakes
Water Service Area Boundary
F.E. Warren Air Force Base
South Cheyenne Water and Sewer District
City of Cheyenne

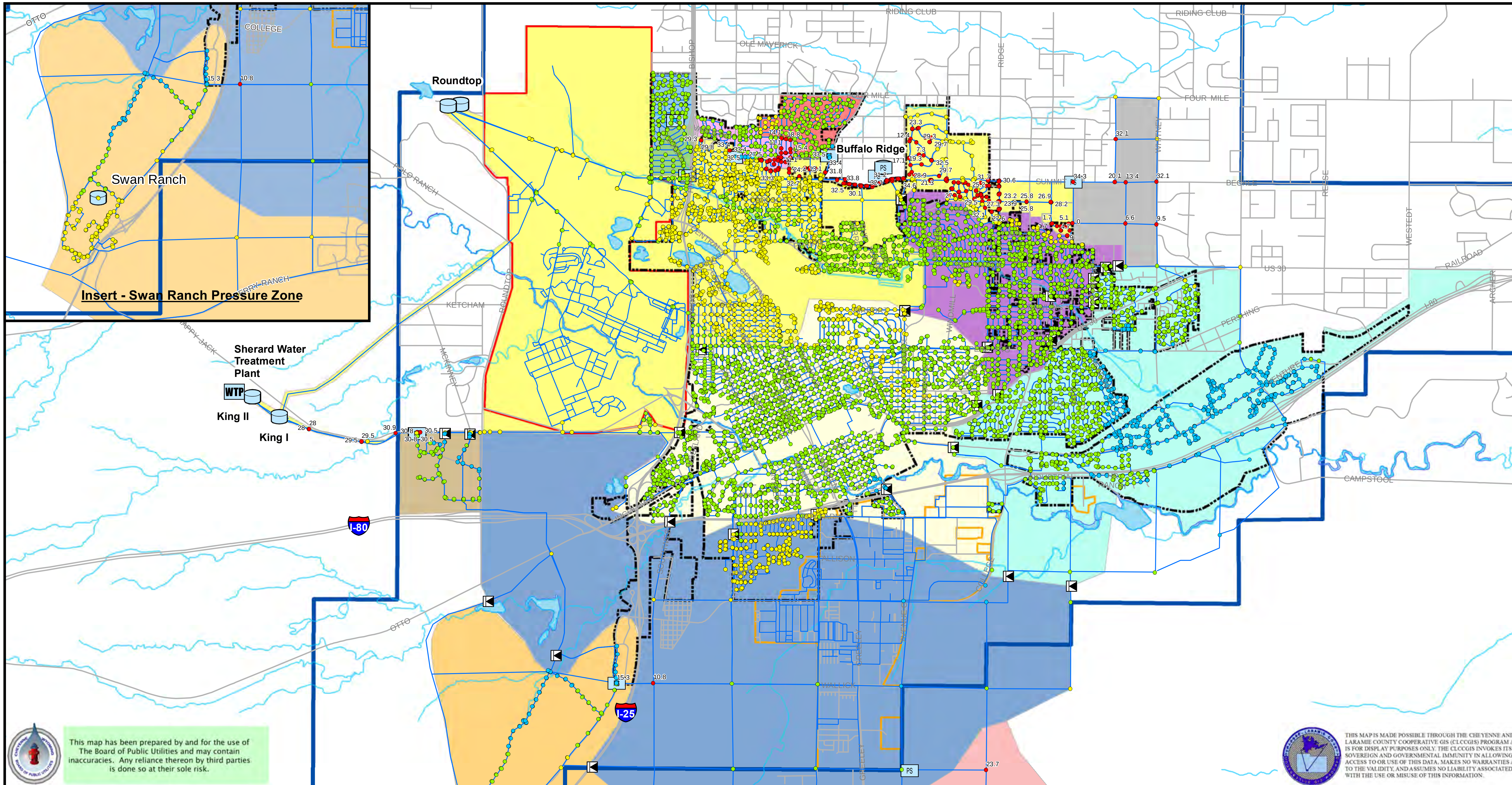
**Future Pressure Zones**
- Chalk Bluff
- City Central
- City North
- City South
- Deer Avenue
- Dell Range
- Monterey Heights
- North Range Business Park
- Northeast
- Southeast
- Sun Valley
- Swan Ranch
- The Pointe
- Western Hills

HDR

Last Updated: 9/27/2013

# Figure 5-7
# 2033 Peak Hour Pressure Map

**Volume 5 – Potable Water Storage and Distribution**
2013 Water and Wastewater Master Plans




1 inch = 1.5 miles

N

## Legend

**Peak Hour Pressure (psi)**
- <35
- 35 - 60
- 60 - 100
- >100

- WTP Water Treatment Plant
- PS Pump Station
- Storage Tank
- PRV
- Water Main

- Roads
- Creeks
- Lakes
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- City of Cheyenne

**Future Pressure Zones**
- Chalk Bluff
- City Central
- City North
- City South
- Deer Avenue
- Dell Range
- Monterey Heights
- North Range Business Park
- Northeast
- Southeast
- Sun Valley
- Swan Ranch
- The Pointe
- Western Hills

HDR

# Figure 5-8
# 2063 Peak Hour Pressure Map

**Volume 5 – Potable Water Storage and Distribution**
2013 Water and Wastewater Master Plans

Last Updated: 9/27/2013

### 5.4.3 Fire Flow Analysis Results

The available fire flow was simulated in the hydraulic model for each planning horizon during a maximum day demand condition. The fire flow goal for each hydrant is assigned based on the adjacent zoning type. Table 5-20 contains a list of the fire flow goal for each zoning type. A summary of the fire flow results are shown in Table 5-20 through Table 5-23 for each scenario. The tables provide the summation of every hydrant according to the available fire flow as a percentage of the fire flow goal and the pressure zone containing the hydrant.

Figure 5-9 through

Figure 5-12 depict the fire flow results graphically. Each figure depicts hydrants where the available fire flow is less than the fire flow goal. Appendix 5-D contains a table with fire hydrant model results for each of the planning periods.

**Table 5-20**
**2013 Fire Flow Availability from Hydrant Summary Table**

| Pressure Zone | % Fire Flow Goal Available (number of hydrants) | | | | | Total |
|---|---|---|---|---|---|---|
| | <25% | 25-50% | 50-75% | 75-100% | 100% | |
| City | 41 | 122 | 262 | 259 | 951 | 1635 |
| Western Hills | 0 | 0 | 0 | 0 | 58 | 58 |
| Monterey Heights | 0 | 0 | 2 | 24 | 42 | 68 |
| Deer Avenue | 0 | 0 | 0 | 2 | 26 | 28 |
| The Pointe | 0 | 3 | 14 | 65 | 28 | 110 |
| Dell Range | 2 | 2 | 9 | 18 | 415 | 446 |
| Sun Valley | 2 | 20 | 10 | 37 | 513 | 582 |
| North Range Business Park | 0 | 0 | 1 | 12 | 21 | 34 |
| Swan Ranch | 3 | 27 | 27 | 17 | 12 | 86 |
| **Total** | **48** | **174** | **325** | **434** | **2066** | **3047** |

**Table 5-21**
**2023 Fire Flow Availability from Hydrant Summary Table**

| Pressure Zone | % Fire Flow Goal Available (number of hydrants) | | | | | Total |
|---|---|---|---|---|---|---|
| | <25% | 25-50% | 50-75% | 75-100% | 100% | |
| City North | 12 | 35 | 78 | 75 | 454 | 654 |
| Western Hills | 0 | 0 | 0 | 0 | 58 | 58 |
| Monterey Heights | 0 | 0 | 0 | 23 | 46 | 69 |
| Deer Avenue | 0 | 0 | 0 | 1 | 27 | 28 |
| The Pointe | 0 | 3 | 10 | 48 | 49 | 110 |
| Dell Range | 2 | 2 | 9 | 17 | 415 | 445 |
| Sun Valley | 0 | 4 | 10 | 40 | 528 | 582 |
| City Central | 34 | 73 | 136 | 102 | 535 | 880 |
| North Range Business Park | 0 | 0 | 24 | 8 | 2 | 34 |
| City South | 1 | 1 | 3 | 19 | 79 | 103 |
| Swan Ranch | 0 | 8 | 17 | 12 | 47 | 84 |
| **Total** | **49** | **126** | **287** | **345** | **2240** | **3047** |

**Table 5-22**
**2033 Fire Flow Availability from Hydrant Summary Table**

| Pressure Zone | % Fire Flow Goal Available (number of hydrants) | | | | | Total |
|---|---|---|---|---|---|---|
| | <25% | 25-50% | 50-75% | 75-100% | 100% | |
| City North | 12 | 35 | 81 | 76 | 450 | 654 |
| Western Hills | 0 | 0 | 0 | 0 | 58 | 58 |
| Monterey Heights | 0 | 0 | 0 | 24 | 45 | 69 |
| Deer Avenue | 0 | 0 | 0 | 1 | 27 | 28 |
| The Pointe | 0 | 3 | 12 | 60 | 35 | 110 |
| Dell Range | 2 | 2 | 9 | 17 | 415 | 445 |
| Sun Valley | 0 | 4 | 9 | 38 | 531 | 582 |
| City Central | 29 | 70 | 146 | 105 | 530 | 880 |
| North Range Business Park | 0 | 0 | 30 | 4 | 0 | 34 |
| City South | 1 | 1 | 9 | 29 | 63 | 103 |
| Swan Ranch | 0 | 11 | 16 | 11 | 46 | 84 |
| **Total** | **44** | **126** | **312** | **365** | **2200** | **3047** |

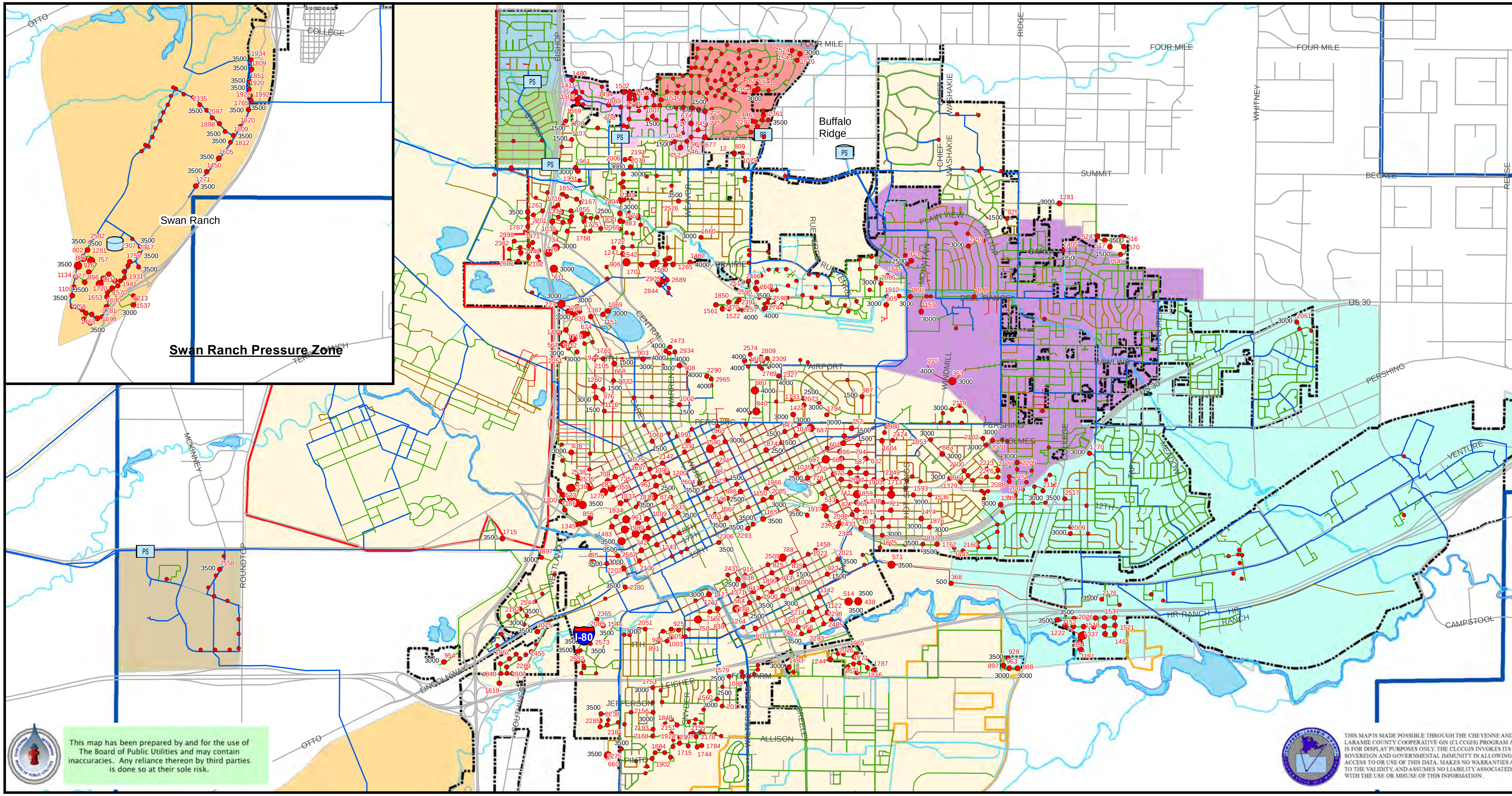
**Table 5-23**
**2063 Fire Flow Availability from Hydrant Summary Table**

| Pressure Zone | % Fire Flow Goal Available (number of hydrants) | | | | | Total |
|---|---|---|---|---|---|---|
| | <25% | 25-50% | 50-75% | 75-100% | 100% | |
| City North | 13 | 43 | 77 | 88 | 433 | 654 |
| Western Hills | 0 | 0 | 0 | 0 | 58 | 58 |
| Monterey Heights | 0 | 0 | 1 | 24 | 44 | 69 |
| Deer Avenue | 0 | 0 | 0 | 1 | 27 | 28 |
| The Pointe | 0 | 5 | 14 | 79 | 12 | 110 |
| Dell Range | 2 | 2 | 9 | 17 | 415 | 445 |
| Sun Valley | 0 | 4 | 9 | 39 | 530 | 582 |
| City Central | 30 | 73 | 145 | 109 | 523 | 880 |
| North Range Business Park | 0 | 0 | 30 | 4 | 0 | 34 |
| City South | 1 | 1 | 13 | 27 | 61 | 103 |
| Swan Ranch | 1 | 12 | 18 | 7 | 46 | 84 |
| **Total** | **47** | **140** | **316** | **395** | **2149** | **3047** |

## Summary of Observations

- In 2013, approximately 68% of all hydrants have an available fire flow that exceeds the fire flow goal.
- A majority of the hydrants that have an available fire flow less than a large fire flow goal (2,500 gpm or more) are located on 4" or 6" waterlines. The small diameter water lines are not sufficiently sized to convey the fire flow goal. Most of these hydrants are located in the downtown area of the system. The replacement of small diameter water mains would increase the fire flow to these hydrants.
- Where a single hydrant cannot produce the full fire flow goal, multiple hydrants are available to produce the full fire flow goal.
- All new water lines and hydrants installed in BOPU's distribution system are assumed to be designed to provide the applicable fire flow goal.
- In the Swan Ranch pressure zone, the existing fire flow is limited by a dead end 12" water main to the north portion of the zone. Installing additional pipe to loop this dead end pipeline and the proposed Swan Ranch pump station would increase fire flow. Fire flow in the southern portion of the pressure zone is limited by the elevation of the hydrants. No improvement is recommended.
- The Southern Water Transmission Main improves fire flow to portions of BOPU and Sun Valley pressure zones south of I-80.

- The available fire flows in hydrants along Panorama Lane are limited by a dead-end 8" water main. Installing additional pipe to loop this dead end pipeline will improve fire flow to the hydrants. A PSV from the Dell Range pressure could provide flow during a fire flow condition. Also, the implementation of the Northeast pump station could boost pressures in the area by transferring the piping along Panorama Lane into the proposed North East pressure zone.
- The available fire flow from hydrants in the Monterey and Pointe pressure zones is limited by the capacity of the pump station, high elevations in the zone, and or large fire flow goals for some hydrants that exceed 2,500 gpm. The capacity of the pump station and the size of the water lines may not be sufficient to satisfy the large fire flow goals.




## Legend

**% of Fire Flow Goal**
- <25
- 25 - 50
- 50 - 75
- >75

Available Fire Flow (gpm)
Fire Flow Goal (gpm)

- WTP Water Treatment Plant
- PS Pump Station
- Storage Tank

Water Main Diameter (in)
- <4"
- 4"
- 6"
- 8"
- 10"
- 12" and Greater

- Roads
- Creeks
- Lakes
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- City of Cheyenne

**Existing Pressure Zones**
- City
- Deer Avenue
- Dell Range
- Monterey Heights
- North Range Business Park
- Sun Valley
- Swan Ranch
- The Pointe
- Western Hills

1 inch = 1 miles

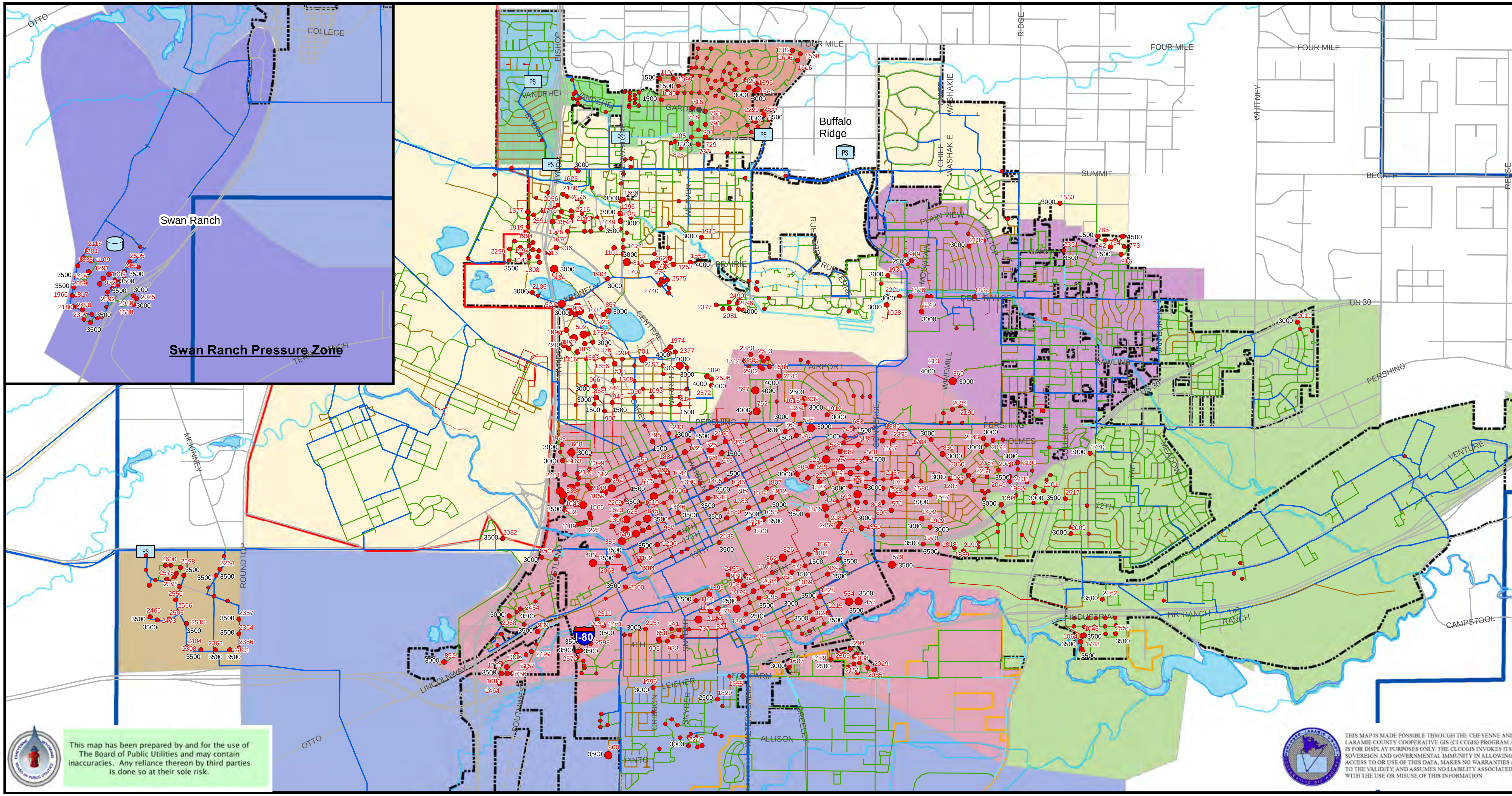
N

HDR

Last Updated: 9/27/2013

# Figure 5-9
# Existing Fire Flow Map

**Volume 5 – Potable Water Storage and Distribution**
2013 Water and Wastewater Master Plans




## Legend

**% of Fire Flow Goal**
- <25
- 25 - 50
- 50 - 75
- >75

Available Fire Flow (gpm)
Fire Flow Goal (gpm)

WTP Water Treatment Plant
PS Pump Station
Storage Tank

Water Main Diameter (in)
- <4"
- 4"
- 6"
- 8"
- 10"
- 12" and Greater

- Roads
- Creeks
- Lakes
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- City of Cheyenne

**Pressure Zones**
- Chalk Bluff
- City Central
- City North
- City South
- Deer Avenue
- Dell Range
- Monterey Heights
- North East
- North Range Business Park
- South East
- Sun Valley
- Swan Ranch
- The Pointe
- Western Hills

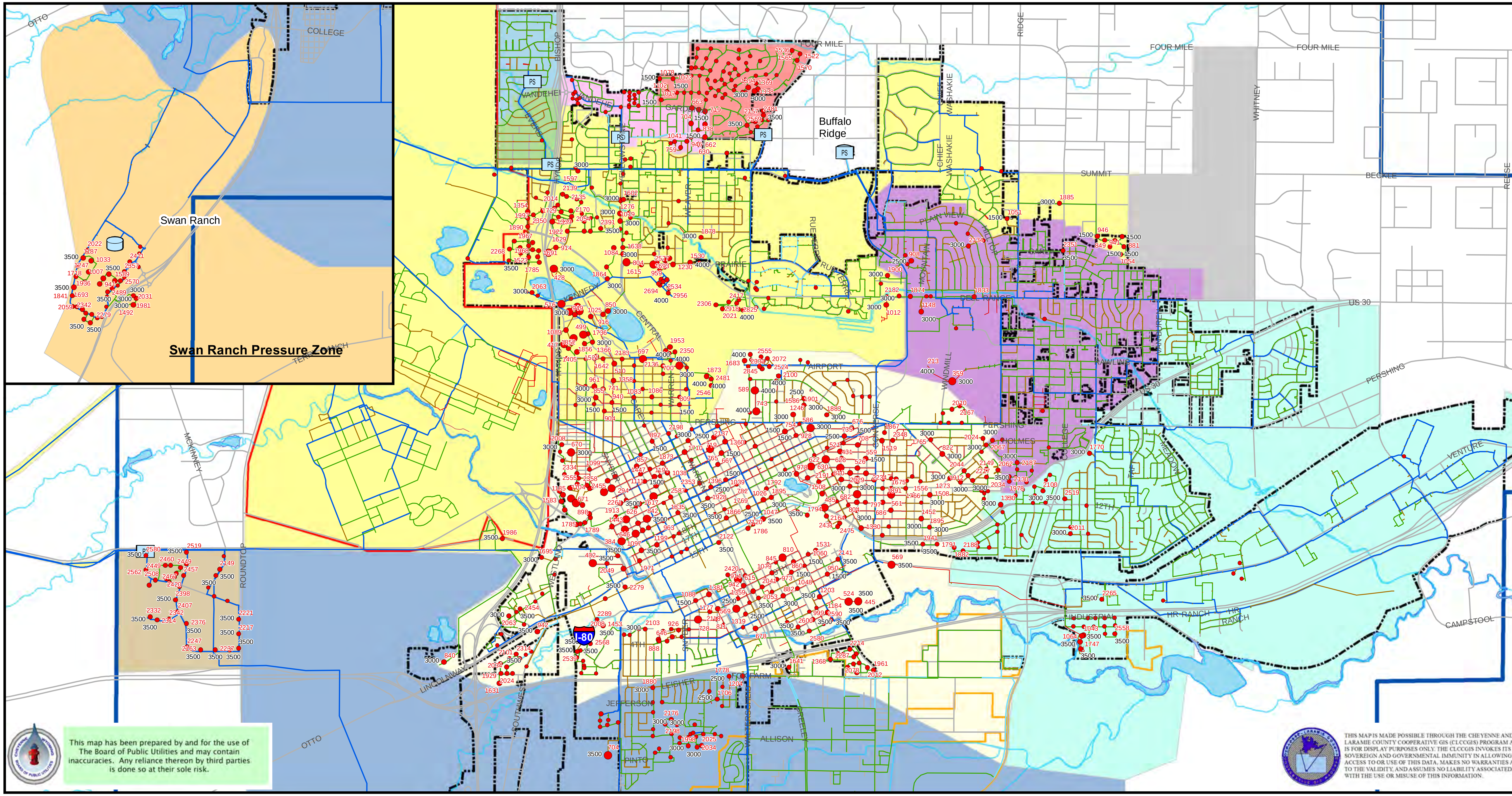
1 inch = 1 miles

N

Last Updated: 9/27/2013

**Figure 5-10**
**2023 Fire Flow Map**

**Volume 5 – Potable Water Storage and Distribution**
2013 Water and Wastewater Master Plans




1 inch = 1 miles

N

## Legend

**% of Fire Flow Goal**
- <25
- 25 - 50
- 50 - 75
- >75

Available Fire Flow (gpm)
Fire Flow Goal (gpm)

WTP Water Treatment Plant
PS Pump Station
Storage Tank

Water Main Diameter (in)
- <4"
- 4"
- 6"
- 8"
- 10"
- 12" and Greater

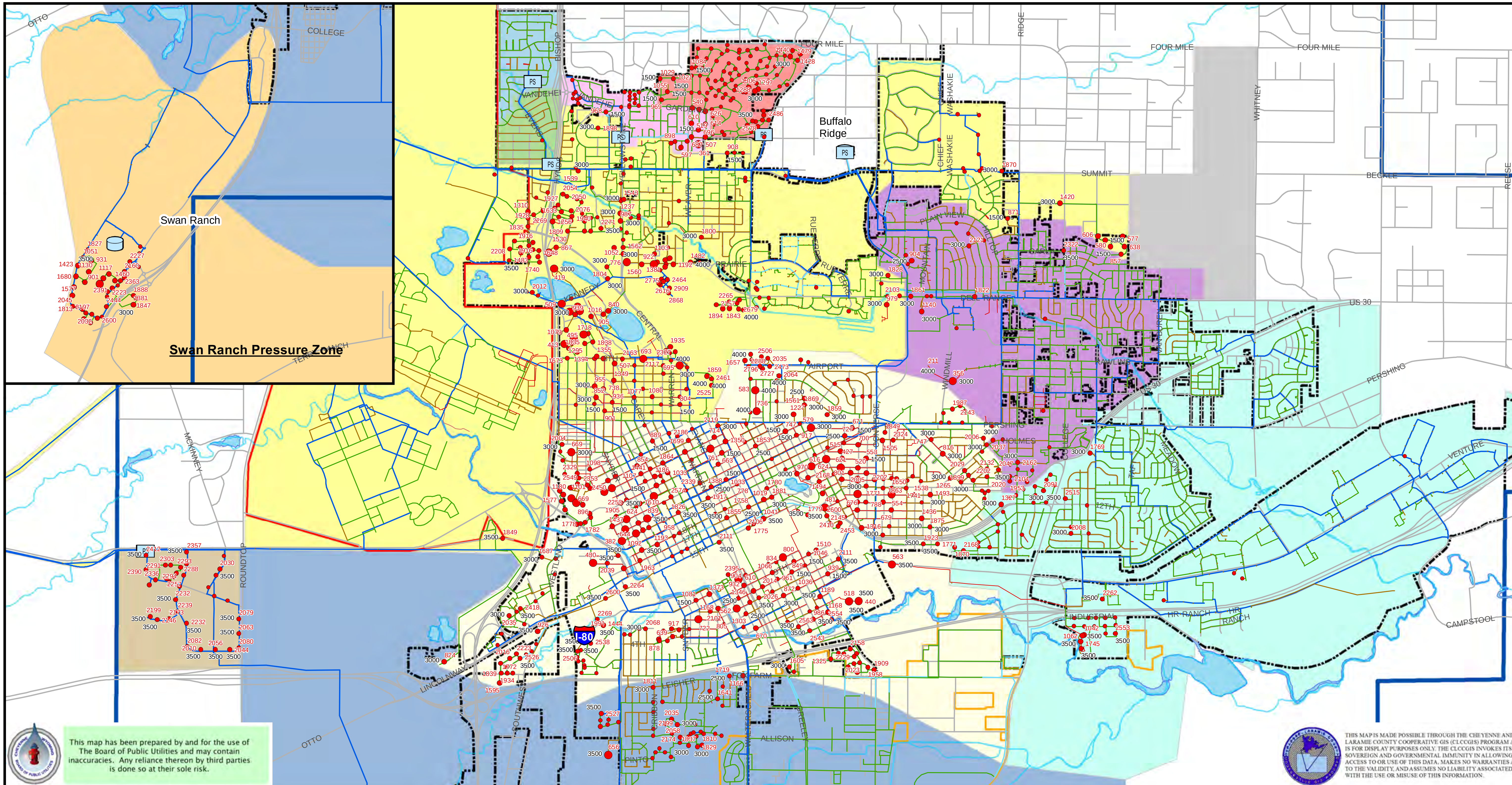
- Roads
- Creeks
- Lakes
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- City of Cheyenne

**Future Pressure Zones**
- Chalk Bluff
- City Central
- City North
- City South
- Deer Avenue
- Dell Range
- Monterey Heights
- North Range Business Park
- Northeast
- Southeast
- Sun Valley
- Swan Ranch
- The Pointe
- Western Hills

# Figure 5-11
# 2033 Fire Flow Map

**Volume 5 – Potable Water Storage and Distribution**
2013 Water and Wastewater Master Plans

Last Updated: 9/27/2013




## Legend

**% of Fire Flow Goal**
- <25
- 25 - 50
- 50 - 75
- >75

Available Fire Flow (gpm)
Fire Flow Goal (gpm)

WTP Water Treatment Plant
PS Pump Station
Storage Tank

Water Main Diameter (in)
- <4"
- 4"
- 6"
- 8"
- 10"
- 12" and Greater

Roads
Creeks
Lakes
Water Service Area Boundary
F.E. Warren Air Force Base
South Cheyenne Water and Sewer District
City of Cheyenne

**Future Pressure Zones**
- Chalk Bluff
- City Central
- City North
- City South
- Deer Avenue
- Dell Range
- Monterey Heights
- North Range Business Park
- Northeast
- Southeast
- Sun Valley
- Swan Ranch
- The Pointe
- Western Hills

1 inch = 1 miles

N

CHEYENNE WYOMING BOARD OF PUBLIC UTILITIES

HDR

# Figure 5-12
# 2063 Fire Flow Map

**Volume 5 – Potable Water Storage and Distribution**
2013 Water and Wastewater Master Plans

Last Updated: 9/27/2013

### 5.4.4 Pressure Zone Analysis and Pressure Management

The water service elevations vary across the distribution system from 6,377 to 5,901 feet. BOPU has 9 pressure zones in the system. As the distribution system grows, new pressure zones have been identified to reduce high pressures or to pump to serve additional high elevation areas.

Figure 5-13 depicts the future pressure zone boundaries and the PRVs and pump stations that would transfer water between zones. The future pressure zones will increase to 14 and the following are descriptions of the new pressure zones.

**City North (2016) –** The City North pressure zone would be created by closing isolation valves and the installation of PRVs associated with the Pressure Management Phase II - City North/Central/South Zones improvement scheduled to be implemented in 2016. The improvements would divide the City pressure zone into three parts. The City North pressure zone would operate at the same hydraulic grade as the City pressure zone which is based on the operating levels in the King II and Round Top reservoirs.

**City Central (2016) –** The City Central pressure zone would be created by closing isolation valves and the installation of PRVs associated with the Pressure Management Phase II - City North/Central/South Zones improvement scheduled to be implemented in 2016. The improvements would divide the City pressure zone into three parts The PRVs would reduce pressures in the City Central zone lower than the hydraulic grade of the existing City pressure zone. This would reduce the pressure in a high pressure area identified in the 2010 Pressure Management Study (HDR, 2010).

**City South (2016) –** The City South pressure zone would be created by closing isolation valves and the installation of PRVs associated with the Pressure Management Phase II - City North/Central/South Zones improvement scheduled to be implemented in 2016. The improvements would divide the City pressure zone into three parts. The hydraulic grade in the City South pressure zone would be determined by the King II and Southeast storage reservoirs. The pressure zone would include a small portion of the existing City pressure zone and expand to cover an area of growth to the south of the City. The boundary of the pressure zone depicted in Figure 5-13 is preliminary and subject to change as development occurs.

**Chalk Bluff (2033) –** The Chalk Bluff pressure zone would be created by the Chalk Bluff pump station scheduled to be implemented by 2033. The pressure zone was identified to serve an area of growth in a high elevation area in the Southern portion of the distribution system. The proposed Chalk Bluff pump station would provide the hydraulic grade for the proposed pressure zone. By 2063, the Chalk Bluff reservoir would provide the hydraulic grade of the zone when implemented.  Elevations in the pressure zone range from 6,150 to greater than 6,300 feet. The boundary of the pressure zone depicted in

Figure 5-13 is preliminary and subject to change as development occurs.

**Northeast (2033) –** The Northeast pressure zone would be created by the Northern pump station scheduled to be implemented by 2033. The pressure zone was identified to serve an area of growth in the northeast portion of the distribution system. This pump station could also provide pressures to the area along Panorama Lane which is identified for potential fire flow and peak hour pressure deficiencies. The proposed Northern pump station would provide the hydraulic grade of the zone which ranges in elevations from 6,035 to 6,160. No storage reservoir is planned for this pressure zone so the pump station would need to provide both peak hour or maximum day plus fire flow whichever is larger. The boundary of the pressure zone depicted in

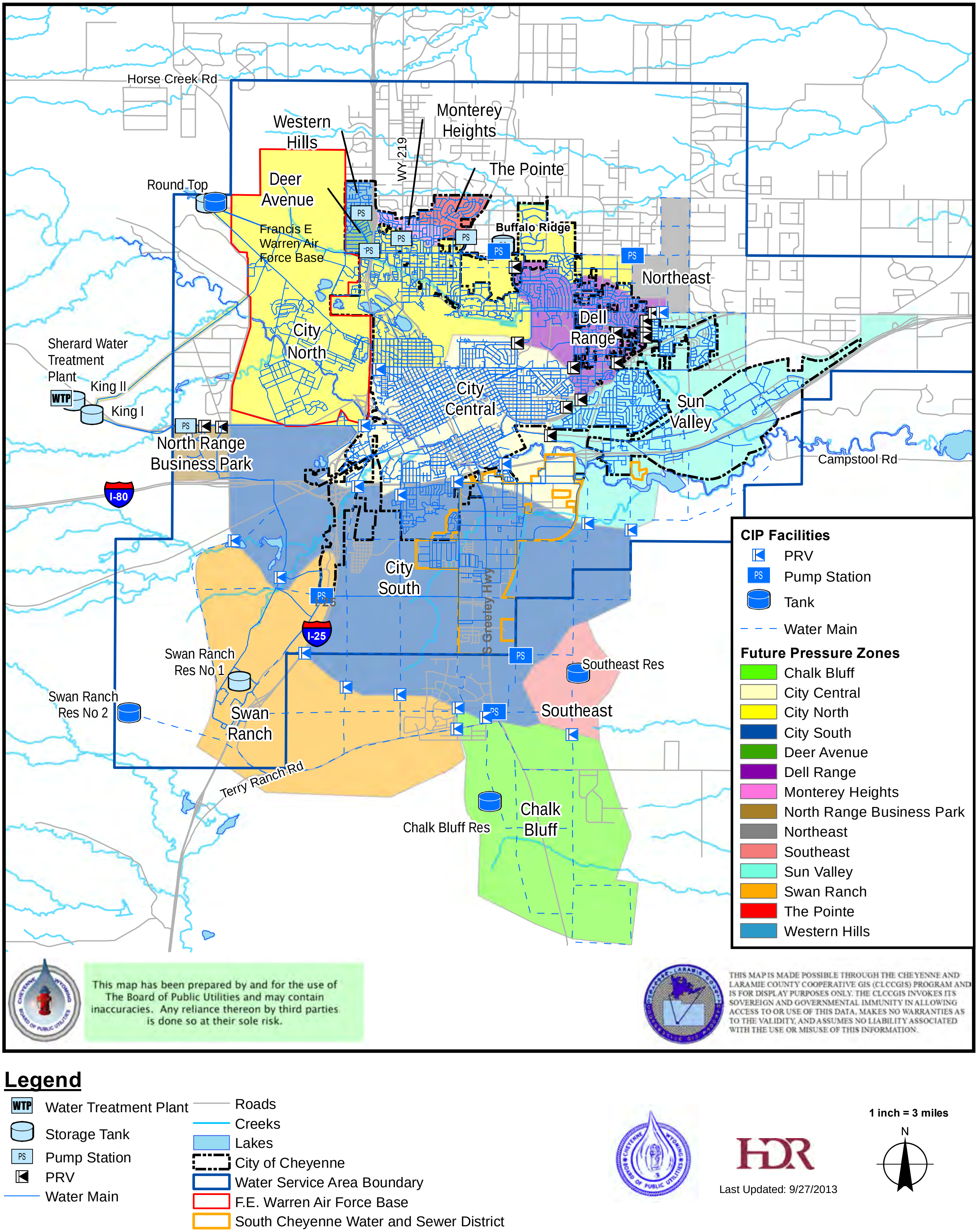
Figure 5-13 is preliminary and subject to change as development occurs.

**Southeast (2033) –** The Southeast pressure zone would be created by the installation of the Southeast pump station scheduled to be implemented by 2033. The pressure zone was identified to serve an area of growth in a high elevation area in the southern portion of the distribution system. The proposed Southeast pump station would provide the hydraulic grade for the proposed pressure zone. No storage reservoir is planned for this pressure zone so the pump station would need to provide both peak hour or maximum day plus fire flow whichever is larger. Elevations in the pressure zone range from 6,100 to greater than 6,200 feet. The boundary of the pressure zone depicted in

Figure 5-13 is preliminary and subject to change as development occurs.

**Swan Ranch (2014) –** The Swan Ranch pressure zone would be connected to BOPU's distribution system with the implementation of the Swan Ranch pump station scheduled for 2014. There is an existing reservoir that provides the hydraulic grade of the zone. The zone is a high elevation area located along a ridge in the southern portion of the distribution system. The pressure zone would expand to serve areas of new development. The boundary of the pressure zone depicted in

Figure 5-13 is preliminary and subject to change as development occurs.




# Figure 5-13
# Future Pressure Zone Map

# 5.5 Pump Station Capacity Analysis

## 5.5.1 Evaluation Criteria

According to WDEQ Water Quality Rules and Regulations, the maximum pumping capacity in a system shall be provided by a pumping station with the largest pump out of service. For boosted pressure zones without storage, the maximum pumping capacity is defined as the peak hour demand or maximum day demand plus fire flow, whichever is greater.

While these guidelines apply to the design of new pump stations, BOPU has established criteria for the purpose of evaluating the existing pump stations. Each pump station is evaluated based on the ability to provide the peak hour demand with the largest pump out of service. BOPU elects to assume that all pumps would be active for a fire flow scenario. Also, during a fire flow, downstream pressures would lower and the pumps would operate at a higher flow rate on their pump curves providing additional flow capacity beyond the values listed in Table 5-3.

## 5.5.2 Pump Station Capacity Evaluation

### Buffalo Ridge Pump Station

The Buffalo Ridge pump station pumps from the Buffalo Ridge reservoir into BOPU pressure zone. The storage reservoir is below the hydraulic grade of the zone and requires pumping to supply BOPU's distribution system. The pump station consists of 1 pump with a capacity of 1,750 gpm. Installation of an additional pump for redundancy at the pump station is recommended. Without the pump station in operation, the water in the storage reservoir cannot flow into the distribution system under normal conditions.

The peak hour pressure analysis demonstrated that significant friction losses in the distribution piping from Round Top Reservoir and the "X" control vault may occur in the future as demand increases. Increasing the capacity of the pump station can increase the system pressure in the northern portion of the distribution system during peak hour demand conditions.

## Deer Avenue Pump Station

The Deer Avenue pump station is the sole source of supply to the Deer Avenue and Western Hills pressure zones. The pump station consists of 4 pumps that have a total capacity of 3,040 gpm and a firm capacity of 2,280 gpm with the largest pump offline. Table 5-24 lists the results of an evaluation of the pump station. Based on the firm capacity, the pump station has sufficient capacity to supply the peak hour demand through the 50-year planning period. Additional fire flow may be provided by operating all pumps or by operating the pumps at a higher flow rate on the pump curves.

The largest fire flow goal in the pressure zone is 3,000 gpm. The firm capacity of the pump station is insufficient for the fire flow goal. Additional flow beyond the firm capacity of the pump station can be provided by operating all pumps and operating the pumps at a higher point on their pump curves while maintaining 35 psi in the pressure zone.

**Table 5-24**
**Pump Station Capacity Analysis for Deer Avenue Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand [1] | | | | |
| Estimated Population Served | 2,479 | 2,480 | 2,480 | 2,868 |
| Average Day Demand (gpd) | 500,818 | 500,909 | 501,047 | 579,250 |
| Maximum Day Demand (gpd) | 1,190,534 | 1,190,735 | 1,191,030 | 1,194,195 |
| Peak Hour Demand (gpm) | 1,580 | 1,580 | 1,581 | 1,584 |
| Evaluation of Existing Sources | | | | |
| Available Existing Source (gpm) [2] | | | | |
| Deer Avenue | 2,280 | 2,280 | 2,280 | 2,280 |
| Total Available Source (gpm) | 2,280 | 2,280 | 2,280 | 2,280 |
| Source Surplus/(Deficiency) (gpm) [3] | 700 | 700 | 699 | 696 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes largest pump is offline.
(3) Source surplus is the amount of available sources greater than peak hour demand.

During lower demand periods, it may be possible to take the Western Hills or Deer Avenue Pump Station offline to reduce pumping costs. Controls could be added to the pumps to turn them on if the discharge pressure fell below a set point required to maintain a minimum of 35 psi in both pressure zones.

## Western Hills Pump Station

The Western Hills pump station is the source of supply for the Western Hills pressure zone. It boosts pressure from the Deer Avenue pump station. During lower demand periods, the pump station could be shut down and Deer Avenue pump station could provide pressure to the Western Hills pressure zone. The pump station consists of 5 pumps that have a total capacity of 3,200 gpm and a firm capacity of 2,560 gpm with the largest pump offline. Table 5-25 lists the results of an evaluation of the pump station. The pump station has sufficient capacity to supply the peak hour demand through the 50-year planning period. Additional fire flow may be provided by operating all pumps or by operating the pumps at a higher flow rate on the pump curves.

The largest fire flow goal in the pressure zone is 1,500 gpm. The firm capacity of the pump station is sufficient to provide the fire flow goal. There are no recommended capacity related improvements to the pump station.

**Table 5-25**
**Pump Station Capacity Analysis for Western Hills Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand (1) | | | | |
| Estimated Population Served | 1,653 | 1,653 | 1,654 | 1,914 |
| Average Day Demand (gpd) | 333,878 | 333,970 | 334,108 | 386,643 |
| Maximum Day Demand (gpd) | 793,670 | 793,871 | 794,166 | 797,331 |
| Peak Hour Demand (gpm) | 1,053 | 1,053 | 1,054 | 1,058 |
| Evaluation of Existing Sources | | | | |
| Available Existing Source (gpm) (2) | | | | |
| Western Hills | 2,560 | 2,560 | 2,560 | 2,560 |
| Total Available Source (gpm) | 2,560 | 2,560 | 2,560 | 2,560 |
| Source Surplus/(Deficiency) (gpm) (3) | 1,507 | 1,507 | 1,506 | 1,502 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes largest pump is offline.
(3) Source surplus is the amount of available sources greater than peak hour demand.

## Monterey Heights

The Monterey Heights pump station is the source of supply to the Monterey Heights pressure zone. The pump station consists of 4 pumps that have a total capacity of 2,350 gpm and a firm capacity of 1,460 gpm with the largest pump offline. Table 5-26 lists the results of an evaluation of the pump station. Based on the firm capacity, the pump station has sufficient capacity to supply the peak hour demand through the 50-year planning period. Additional fire flow may be provided by operating all pumps or by operating the pumps at a higher flow rate on the pump curves.

The largest fire flow goal in the pressure zone is 3,000 gpm. The firm capacity of the pump station is insufficient for the fire flow goal delivered at its design pressure. Additional flow beyond the firm capacity of the pump station can be provided by operating all pumps and operating the pumps at a higher point on their pump curves while maintaining 35 psi in the pressure zone. There are no recommended capacity related improvements to the pump station.

**Table 5-26**
**Pump Station Capacity Analysis for Monterey Heights Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand (1) | | | | |
| Estimated Population Served | 1,420 | 1,422 | 1,424 | 1,661 |
| Average Day Demand (gpd) | 286,934 | 287,226 | 287,667 | 335,606 |
| Maximum Day Demand (gpd) | 682,128 | 682,768 | 683,708 | 693,799 |
| Peak Hour Demand (gpm) | 906 | 907 | 908 | 920 |
| Evaluation of Existing Sources | | | | |
| Available Existing Source (gpm) (2) | | | | |
| Monterey Heights | 1,460 | 1,460 | 1,460 | 1,460 |
| Total Available Source (gpm) | 1,460 | 1,460 | 1,460 | 1,460 |
| Source Surplus/(Deficiency) (gpm) (3) | 554 | 553 | 552 | 540 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes largest pump is offline.
(3) Source surplus is the amount of available sources greater than peak hour demand.

### The Pointe

The Pointe pump station is the source of supply to The Pointe pressure zone. The pump station consists of 4 pumps that have a total capacity of 1,614 gpm and a firm capacity of 1,164 gpm with the largest pump offline. Table 5-27 lists the results of an evaluation of the pump station. With the largest pump out of service and the other pumps operating at the design point, the pump station cannot provide the peak hour predicted from the demand allocation. The projected demand can be satisfied by operating all pumps or by operating the pumps at a higher flow rate on the pump curve.

The largest fire flow goal in the pressure zone is 3,500 gpm. The firm capacity of the pump station is insufficient for the fire flow goal. Additional flow beyond the firm capacity of the pump station can be provided by operating all pumps and operating the pumps at a higher point on their pump curves while maintaining 35 psi in the pressure zone.

There is no recommended capacity related improvements to the pump station. The operation of the pump station should be monitored to determine if an upgrade in the future is necessary to supply the peak hour demands with adequate pressure.

**Table 5-27**
**Pump Station Capacity Analysis for The Pointe Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand (1) | | | | |
| Estimated Population Served | 1,881 | 2,066 | 2,192 | 2,643 |
| Average Day Demand (gpd) | 379,901 | 417,337 | 442,769 | 533,884 |
| Maximum Day Demand (gpd) | 902,866 | 985,170 | 1,038,402 | 1,147,839 |
| Peak Hour Demand (gpm) | 1,201 | 1,299 | 1,362 | 1,490 |
| Evaluation of Existing Sources | | | | |
| Available Existing Source (gpm) (2) | | | | |
| The Pointe | 1,164 | 1,164 | 1,164 | 1,164 |
| Total Available Source (gpm) | 1,164 | 1,164 | 1,164 | 1,164 |
| Source Surplus/(Deficiency) (gpm) (3) | -37 | -136 | -198 | -326 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes largest pump is offline.
(3) Source surplus is the amount of available sources greater than peak hour demand.

## North Range Business Park

The North Range Business Park pump station is the source of supply to the North Range Business Park pressure zone. The pump station consists of 5 pumps that have a total capacity of 2,400 gpm and a firm capacity of 1,800 gpm with the largest pump offline. Table 5-28 lists the results of an evaluation of the pump station. Based on the firm capacity, the pump station has sufficient capacity to supply the peak hour demand through the 20-year planning period. By 2063, the firm capacity of the pump station is not sufficient to supply the peak hour demand. The projected demand could be satisfied by operating all pumps, operating the pumps at a higher flow rate on the pump curve, and or increasing the capacity of the pump station.

The fire flow goal in the pressure zone is 3500 gpm. The firm capacity of the pump station is insufficient for the fire flow goal. Additional flow beyond the firm capacity of the pump station can be provided by operating all pumps and operating the pumps at a higher point on their pump curves while maintaining 35 psi in the pressure zone. There are also two pressure sustaining valves that allow flow into the pressure zone during a fire flow.

There is no recommended capacity related improvements to the pump station. The operation of the pump station should be monitored to determine if an upgrade in the future is necessary to supply the peak hour demands with adequate pressure.

**Table 5-28**
**Pump Station Capacity Analysis for North Range Business Park Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand [1] | | | | |
| Estimated Population Served | 2,301 | 3,062 | 3,499 | 4,098 |
| Average Day Demand (gpd) | 464,731 | 618,623 | 706,776 | 827,883 |
| Maximum Day Demand (gpd) | 853,704 | 1,192,038 | 1,375,527 | 1,601,397 |
| Peak Hour Demand (gpm) | 831 | 1,237 | 1,453 | 1,713 |
| Evaluation of Existing Sources | | | | |
| Available Existing Source (gpm) [2] | | | | |
| North Range Business Park | 1,800 | 1,800 | 1,800 | 1,800 |
| Total Available Source (gpm) | 1,800 | 1,800 | 1,800 | 1,800 |
| Source Surplus/(Deficiency) (gpm) [3] | 969 | 563 | 347 | 87 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes largest pump is offline.
(3) Source surplus is the amount of available sources greater than peak hour demand.

## Swan Ranch (Future)

The proposed Swan Ranch pump station would be the source of supply to the Swan Ranch pressure zone. The projected demands in the Swan Ranch pressure zone are shown in Table 5-29. The pump station does not need to be sized for the peak hour demand because the Swan Ranch pressure zone contains an elevated reservoir that provides equalizing storage.

The proposed pump station should be sized with a firm capacity of 4,000 gpm to supply the projected maximum day demand.

**Table 5-29**
**Pump Station Capacity Analysis for Swan Ranch Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand (1) | | | | |
| Estimated Population Served | | 2,326 | 4,722 | 11,279 |
| Average Day Demand (gpd) | | 469,931 | 953,906 | 2,278,387 |
| Maximum Day Demand (gpd) | | 990,741 | 2,019,134 | 5,708,277 |
| Evaluation of Existing Sources | | | | |
| Available Existing Source (gpm) (2) | | | | |
| Swan Ranch PS (4,000 gpm) | | 5,760,000 | 5,760,000 | 5,760,000 |
| Total Available Source (gpm) | | 5,760,000 | 5,760,000 | 5,760,000 |
| Source Surplus/(Deficiency) (gpd) (3) | | 4,769,259 | 3,740,866 | 51,723 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes largest pump is offline.
(3) Source surplus is the amount of available sources greater than maximum day demand.

## Chalk Bluff (Future)

The Chalk Bluff pump station is proposed to be the source of supply to the proposed Chalk Bluff pressure zone. The projected demands are shown in Table 5-30. Initially, the pressure zone would not include storage so the pump station will be sized to supply peak hour and fire flow demands. The capacity is based on a future fire flow requirement of 3,500 gpm assigned to the future zoning type, Planned Unit Development. By 2063, an elevated storage reservoir is proposed for the Chalk Bluff pressure zone. Once installed, the pump station would only need to convey the maximum day demand. The elevated storage would be sized to provide equalizing and fire flow storage.

The proposed pump station should be sized with a firm capacity of 3,500 gpm to supply the fire flow goal initially and in the long term to supply the projected maximum day demand. Before proceeding with design, the fire flow goal in the area should be confirmed by the fire authority.

**Table 5-30**
**Pump Station Capacity Analysis for Chalk Bluff Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand (1) | | | | |
| Estimated Population Served | | | 720 | 5,680 |
| Average Day Demand (gpd) | | | 145,473 | 1,147,261 |
| Maximum Day Demand (gpd) | | | 313,626 | 2,940,728 |
| Peak Hour Demand (gpm) | | | 373 | 3,468 |
| Fire Flow Demand (gpm) | | | 3,500 | 3,500 |
| Evaluation of Existing Sources | | | | |
| Available Existing Source (gpm) (2) | | | | |
| Chalk Bluff PS (3,500 gpm) | | | 3,500 | 3,500 |
| Total Available Source (gpm) | | | 3,500 | 3,500 |
| Source Surplus/(Deficiency) (gpm) (3) | | | 0 | 0 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes largest pump is offline.
(3) Source surplus is the amount of available sources greater than maximum day demand.

### Northeast (Future)

The Northeast pump station is proposed to be the source of supply to the proposed Northeast pressure zone. It may also boost pressures to the area along Panorama Lane. The projected demands are shown in Table 5-31.

The proposed pump station should be sized with a firm capacity of 2,500 gpm to supply the fire flow goal assigned to the future zoning type, Neighborhood Business, in the pressure zone. Before proceeding with design, the fire flow requirements in the area should be confirmed with the fire authority.

**Table 5-31**
**Pump Station Capacity Analysis for Northeast Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand [1] | | | | |
| Estimated Population Served | | | 1,081 | 2,343 |
| Average Day Demand (gpd) | | | 218,345 | 473,372 |
| Maximum Day Demand (gpd) | | | 470,730 | 1,213,377 |
| Peak Hour Demand (gpm) | | | 560 | 1,431 |
| Fire Flow Demand (gpm) | | | 2,500 | 2,500 |
| Evaluation of Existing Sources | | | | |
| Available Existing Source (gpm) [2] | | | | |
| Northern PS (3,000 gpm) | | | 2,500 | 2,500 |
| Total Available Source (gpm) | | | 2,500 | 2,500 |
| Source Surplus/(Deficiency) (gpm) [3] | | | 0 | 0 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes largest pump is offline.
(3) Source surplus is the amount of available sources greater than maximum day demand.

### Southeast (Future)

The Southeast pump station is proposed to be the source of supply to the proposed Southeast pressure zone. The projected demands are shown in Table 5-32.

The proposed pump station should be sized with a firm capacity of 3,500 gpm to supply the fire flow goal assigned to the future zoning type, Planned Unit Development, in the pressure zone. Before proceeding with design, the fire flow requirements in the area should be confirmed with the fire authority.

**Table 5-32**
**Pump Station Capacity Analysis for Southeast Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand (1) | | | | |
| Estimated Population Served | | | 67 | 237 |
| Average Day Demand (gpd) | | | 13,583 | 47,792 |
| Maximum Day Demand (gpd) | | | 31,240 | 109,922 |
| Peak Hour Demand (gpm) | | | 40 | 141 |
| Fire Flow Demand (gpm) | | | 3,500 | 3,500 |
| Evaluation of Existing Sources | | | | |
| Available Existing Source (gpm) (2) | | | | |
| Southeast PS (3,500 gpm) | | | 3,500 | 3,500 |
| Total Available Source (gpm) | | | 3,500 | 3,500 |
| Source Surplus/(Deficiency) (gpm) (3) | | | 0 | 0 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes largest pump is offline.
(3) Source surplus is the amount of available sources greater than than larger of peak hour demand or fire flow

# 5.6 Storage Capacity Analysis

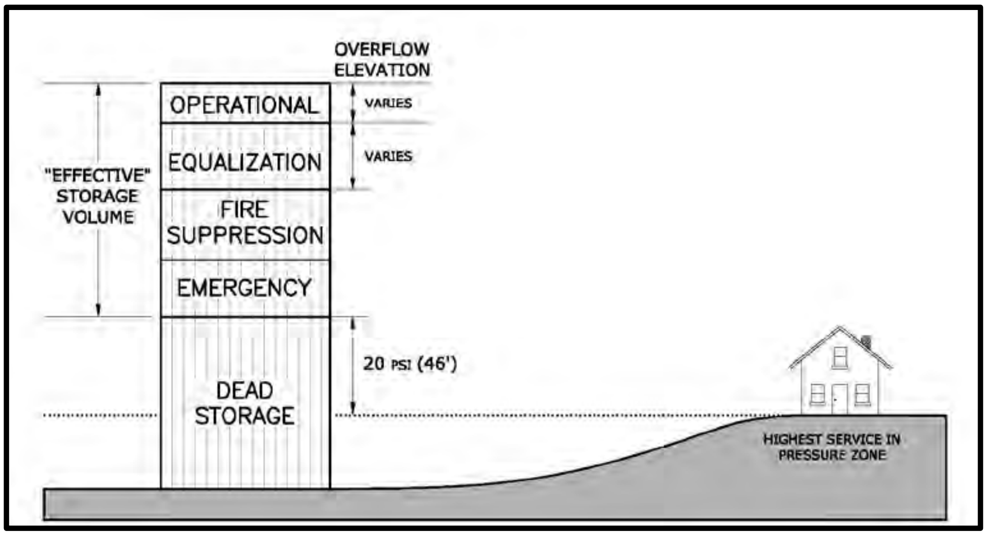
## 5.6.1 Evaluation Criteria

Water system storage volume is comprised of five separate components:

- Operational volume
- Equalizing volume
- Fire flow volume
- Emergency volume
- Dead storage volume

These required volume components are illustrated in Figure 5-14. The storage components are described in more detail below.

**Figure 5-14**
**Storage Components**




### Operating and Dead Storage Volumes

Operating volume is the water above the high water storage elevations set by City operations staff. Dead volume is the volume at the bottom of the reservoir that cannot be used because it is physically too low to provide sufficient pressures. Operational and dead volumes are subtracted from total storage to determine the effective storage available for equalizing, emergency, and fire flow.

### Equalizing Volume

Equalizing volume is the total volume needed to moderate daily fluctuations in diurnal demands during periods when the demand exceeds the capacity of the supply system. The equalizing volume is calculated as the difference between the total source capacity and the peak hour demand for 150 minutes. Equalizing volume requirements are greatest on the day of peak demand. Operation of a properly balanced system results in replenishment of storage facilities during times of day when the demand curve is below the capacity of the supply system, and depletion of storage facilities when the demand exceeds the supply capacity. The equalizing volume of a storage reservoir must be located at an elevation that provides a minimum pressure of 20 pounds per square inch (psi) to all customers served by the reservoir.

### Fire Flow Volume

The required fire flow volume for a given pressure zone is calculated as the required fire flow multiplied by the required duration, as established by the local fire authority. Required fire flows and durations vary across BOPU's service area, as it includes multiple zoning designations. The maximum fire flow volume considered in this analysis is 4,000 gpm for 3 hours, within the City pressure zone. The fire flow volume of a storage reservoir must be located at an elevation that provides a minimum pressure of 35 psi to all customers served by the reservoir.

### Emergency Volume

Emergency volume is required to supply reasonable system demands during a foreseeable system emergency or outage. A key concept is that establishing standby volume involves planning for reasonable system outages – those that can be expected to occur under normal operating conditions, such as a pipeline failure, power outage or valve failure. Major system emergencies, such as those created by an earthquake, are intended to be covered by emergency system operations planning, since construction of sufficient reserve volume to accommodate sustained system demands under emergency conditions is not economically feasible. The required emergency storage volume is equal to the maximum day demand for 8 hours.

## 5.6.2 Storage Capacity Evaluation

### Total System

There are 4 storage reservoirs with a combined effective storage volume of 28.75 million gallons (MG) that serve the City of Cheyenne's potable water distribution system. The Swan Ranch storage reservoir serves the Swan Ranch pressure zone which is scheduled to be connected to BOPU's distribution system within the next 5 years. Table 5-33 provides an evaluation of BOPU's storage needs for the 50-year planning horizon.

**Table 5-33**
**Storage Capacity Analysis for the Total System**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand(1) | | | | |
| Estimated Population Served | 77,723 | 89,109 | 104,950 | 146,535 |
| Average Day Demand (mgd) | 15.70 | 18.00 | 21.20 | 29.60 |
| Maximum Day Demand (mgd) | 35.80 | 40.90 | 47.70 | 65.30 |
| Peak Hour Demand (mgd) | 65.70 | 74.50 | 86.10 | 115.80 |
| Available Source (mgd)(2) | | | | |
| Bell, Borie, Happy Jack Well Field | 6.90 | 6.90 | 6.90 | 6.90 |
| Federal Well Field | 2.27 | 2.27 | 2.27 | 2.27 |
| Water Treatment Plant | 35.00 | 35.00 | 35.00 | 35.00 |
| Future Capacity | | | 3.53 | 21.13 |
| Total Available Source (mgd) | 44.17 | 44.17 | 47.70 | 65.30 |
| Required Storage Calculations | | | | |
| Operational Storage (MG)(3) | 6.98 | 2.16 | 2.56 | 2.88 |
| Equalizing Storage (MG)(4) | 2.24 | 3.16 | 4.00 | 5.26 |
| Emergency Storage (MG)(5) | 11.92 | 13.62 | 15.88 | 21.74 |
| Fire Flow Storage (MG)(6) | 0.72 | 0.72 | 0.72 | 0.72 |
| Required Storage | | | | |
| Greater than 35 psi at highest meter (MG)(7) | 21.86 | 19.66 | 23.16 | 30.60 |
| WDEQ Minimum (MG) (8) | 16.65 | 13.10 | 15.20 | 19.92 |
| Existing Effective Storage Greater Than 35 psi (MG)(9) | | | | |
| King 1 | 5.00 | 5.00 | 5.00 | 5.00 |
| King 2 | 7.50 | 7.50 | 7.50 | 7.50 |
| Round Top | 10.75 | | | |
| Buffalo Ridge | 5.00 | 5.00 | 5.00 | 5.00 |
| Swan Ranch | | .24 | 0.24 | 0.24 |
| Round Top Reservoir No. 2 | | 5.00 | 5.00 | 5.00 |
| Swan Ranch Reservoir No. 2 | | 3.00 | 3.00 | 3.00 |
| Southeast Reservoir | | | 3.00 | 3.00 |
| Chalk Bluff Reservoir | | | | 2.00 |
| Total Existing Storage at 35 psi (MG) | 28.75 | 26.00 | 29.00 | 31.00 |

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Storage Surplus/(Deficiency) at 35 psi (MG) | 6.39 | 6.08 | 5.58 | 0.14 |

Notes:

(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).

(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate: Borie Well Field (1,550 gpm), Bell Well Field (2,445 gpm), Federal Well Field (1,575 gpm), Happy Jack Well Field (800 gpm), and the water treatment plant (35 mgd).

(3) Operational Storage is the volume above the normal high operating level in each reservoir. The high operating levels are: Buffalo Ridge (50'), King 1 (12'). King 2 (22'), Round Top (15').

(4) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes].

(5) Required Emergency Storage is 12 Hours x ADD.

(6) Required Fire Flow Storage = 4000 gpm x 3 hours.

(7) Total required storage greater than 35 psi is equal to the total of operational, equalizing, emergency, and fire flow storage.

(8) WDEQ minimum storage requirement is 25 percent of maximum day demand, fire flow storage, and operational storage.

(9) The storage volume available in existing reservoirs at 35 psi is based on the elevation of the highest customer (6224 ft) in the City pressure zone. In the Swan Ranch pressure zone, the highest customer is at an elevation of 6377 ft. In addition, 7.5 MG at the King II tank and 0.25 MG at Round Top were subtracted from total storage to determine effective storage based on chlorine disinfection contact time requirements.

A significant component of BOPU's storage reservoirs is operating storage. This is based on the normal high operating level of the reservoir. Any storage above the normal high operating level is unused. BOPU could decrease the operating storage of each reservoir by raising the normal high operating water level to within 2 feet of the overflow in each reservoir. This would increase the amount of storage available to the distribution system for equalizing, fire flow, and emergency storage. BOPU will need additional storage to satisfy the projected growth in the distribution system. Proposed storage reservoirs are discussed in the following paragraphs.

By 2023, BOPU should replace the existing Round Top storage reservoir, an aging structure, to reduce maintenance and operations complications associated with potable water storage. The existing Round Top Reservoir began as a series of open, unlined ponds constructed over 100 years ago. Various improvements over the years have left BOPU with an aging, three-cell reservoir that is too large for the amount of potable water it receives from the Federal and Bell well fields and the intertie from King II. Its unique geometry leaves it too shallow to operate effectively without an excessive amount of manual operations by BOPU staff. The concrete is deteriorating in spite of repairs and its remaining useful life is uncertain. A new 5 MG storage reservoir is proposed to replace the potable water currently stored in the existing Round Top Reservoir. An adequate volume of water should be accounted for in a separate chamber of the tank for establishing necessary chlorine contact time from the wells without taking away from effective storage within the new Round Top Reservoir. The existing Round Top Reservoir will potentially be used for non-potable water storage.

By 2023, installation of a new 3 MG storage reservoir is recommended in the Swan Ranch pressure zone to satisfy the projected demand. Table 5-34 provides an evaluation of the storage requirements for the Swan Ranch pressure zone. Storage in the proposed reservoir would be available to lower pressure zones through PRVs. Potential siting alternatives are a ground level reservoir almost 2 miles to the west of the Swan Ranch area or an additional elevated reservoir closer to the Swan Ranch area. The location and design of the proposed reservoir should be determined with a siting study.

By 2033, installation of a 3 MG storage reservoir is recommended in the southeast portion of the water distribution system. The reservoir would be elevated and provide storage to the projected growth in the City South pressure zone. The reservoir would be located within the City South pressure zone, and filled by gravity from King II. Similar to Buffalo Ridge, the proposed reservoir may include a pump station to meet the hydraulic grade of the City South pressure zone. Storage in the proposed reservoir would be available to lower pressure zones through PRVs. The location and design of the proposed reservoir should be determined with a siting study.

By 2063, a proposed 2 MG storage reservoir would be installed in the Chalk Bluff pressure zone to provide equalizing, fire flow and emergency storage to the boosted pressure zone. Table 5-35 provides an evaluation of the projected storage requirements for the Chalk Bluff pressure zone. Storage in the proposed reservoir would be available to lower pressure zones through PRVs. The location and design of the proposed reservoir should be determined with a siting study.

**Table 5-34**
**Storage Capacity Analysis for Swan Ranch Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand[1] | | | | |
| Estimated Population Served | | 2,326 | 4,722 | 11,279 |
| Average Day Demand (mgd) | | 0.47 | 0.95 | 2.28 |
| Maximum Day Demand (mgd) | | 0.99 | 2.02 | 5.71 |
| Peak Hour Demand (mgd) | | 1.65 | 3.40 | 9.64 |
| Available Source (mgd)[2] | | | | |
| Swan Ranch PS (4,000 gpm) | | 5.76 | 5.76 | 5.76 |
| Total Available Source (mgd) | | 5.76 | 5.76 | 5.76 |
| Required Storage Calculations | | | | |
| Operational Storage (MG)[3] | | 0.30 | 0.30 | 0.30 |
| Equalizing Storage (MG)[4] | | 0.00 | 0.00 | 0.40 |
| Emergency Storage (MG)[5] | | 0.33 | 0.67 | 1.90 |
| Fire Flow Storage (MG)[6] | | 0.42 | 0.42 | 0.42 |
| Required Storage | | | | |
| Greater than 35 psi at highest meter (MG)[7] | | 1.05 | 1.40 | 3.03 |
| WDEQ Minimum (MG) [8] | | 0.97 | 1.23 | 2.15 |
| Existing Storage Greater Than 35 psi (MG)[9] | | | | |
| Swan Ranch | | 0.24 | 0.24 | 0.24 |
| Swan Ranch Res No 2 | | 3.00 | 3.00 | 3.00 |
| Total Existing Storage at 35 psi (MG) | | 3.50 | 3.50 | 3.50 |
| Storage Surplus/(Deficiency) at 35 psi (MG) | | 2.19 | 1.84 | 0.21 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
(3) Operational Storage is the volume above the normal high operating level in each reservoir.
(4) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes] .
(5) Required Emergency Storage is 8 Hours x MDD
(6) Required Fire Flow Storage = 3,500 gpm x 2 hours.
(7) Total required storage greater than 35 psi is equal to the total of operational, equalizing, emergency, and fire flow storage.
(8) WDEQ minimum storage requirement is 25 percent of maximum day demand, fire flow storage, and operational storage.
(9) The storage volume available in existing reservoirs at 35 psi is based on the elevation of the highest customer. (6377 ft)

**Table 5-35**
**Storage Capacity Analysis for Chalk Bluff Zone**

| | Year | | | |
|---|---|---|---|---|
| | 2013 | 2023 | 2033 | 2063 |
| Projected Population and Demand(1) | | | | |
| Estimated Population Served | | | 720 | 5,680 |
| Average Day Demand (mgd) | | | 0.15 | 1.15 |
| Maximum Day Demand (mgd) | | | 0.31 | 2.94 |
| Peak Hour Demand (mgd) | | | 0.54 | 4.99 |
| Available Source (mgd)(2) | | | | |
| Chalk Bluff PS (3,500 gpm) | | | 5.04 | 5.04 |
| Total Available Source (mgd) | | | 5.04 | 5.04 |
| Required Storage Calculations | | | | |
| Operational Storage (MG)(3) | | | 0.16 | 0.16 |
| Equalizing Storage (MG)(4) | | | 0.00 | 0.00 |
| Emergency Storage (MG)(5) | | | 0.10 | 0.98 |
| Fire Flow Storage (MG)(6) | | | 0.42 | 0.42 |
| Required Storage | | | | |
| Greater than 35 psi at highest meter (MG)(7) | | | 0.68 | 1.56 |
| WDEQ Minimum (MG) (8) | | | 0.66 | 1.32 |
| Existing Storage Greater Than 35 psi (MG)(9) | | | | |
| Chalk Bluff Res | | | 2.00 | 2.00 |
| Total Existing Storage at 35 psi (MG) | | | 2.00 | 2.00 |
| Storage Surplus/(Deficiency) at 35 psi (MG) | | | 1.32 | 0.44 |

Notes:
(1) Projected demands taken from Volume 2. Estimated population served calculated as Average Day Demand / water demand per capita factor (202 gpcd).
(2) Available source assumes source pumps are on for 24 hours in a day, at the maximum production rate.
(3) Operational Storage is the volume above the normal high operating level in each reservoir.
(4) Required Equalizing Storage is equal to [(PHD - Total Available Source) x 150 minutes].
(5) Required Emergency Storage is 8 Hours x MDD.
(6) Required Fire Flow Storage = 3,500 gpm x 2 hours.
(7) Total required storage greater than 35 psi is equal to the total of operational, equalizing, emergency, and fire flow storage.
(8) WDEQ minimum storage requirement is 25 percent of maximum day demand, fire flow storage, and operational storage.
(9) The storage volume available in existing reservoirs at 35 psi is based on the elevation of the highest customer. (6250 ft)

(THIS PAGE WAS INTENTIONALLY LEFT BLANK)

## 5.7 South Cheyenne Water & Sewer District Evaluation

South Cheyenne Water & Sewer District (SCWSD) is a consecutive distribution system that serves an area south of the City. SCWSD was not included in the modeling of the distribution system because detailed demand information was not available within the district. However, SCWSD's total water demands were assigned to the master meter junctions within the model. This accounts for the demand required to be delivered to the area of the distribution system in the model to confirm necessary pressure is available in the future to maintain adequate service to the customers. It was assumed for modeling purposes that the water demand within SCWSD would not significantly change in the future.

Based on the hydraulic modeling completed for this Volume and the general topography of the SCWSD service area, adequate potable water supply to SCWSD should be maintained throughout the planning periods. With the Southern Transmission Mains delivering water to the City pressure zones through the area of SCWSD, connecting to these transmission mains to provide additional sources of potable water supply to the district through future master meters. In addition, these connections would help balance flows out in the southern part of the system while keeping water moving through the Southern Transmission mains in the near-term. However, this option was not modeled as it was understood that this was not a currently desired improvement by SCWSD.

(THIS PAGE WAS INTENTIONALLY LEFT BLANK)

## 5.8 System Monitoring

Monitoring of pressure, level and/or flows at key locations throughout the potable water distribution system will benefit the operation and maintenance of the system in following ways:

- Operations and Maintenance
  - Operating the distribution system day to day through SCADA and/or an operations dashboard.
  - Real-time and predictive hydraulic modeling.
  - Increasing operational awareness of the movement of flow through the system.
  - Diagnosing maintenance and rehabilitation needs.
  - Locating areas of high flows/pressures and/or low pressures due to leaks, high demands, or fire flows.
- Planning and System Analysis
  - Completing model calibration of steady-state and extended period conditions including in-depth operations and water quality analysis.
  - Creating demand characterization (diurnal patterns, etc.) by pressure zone.
  - Assisting improvement projects with up-to-date flow and pressure data.
  - Increasing accuracy of distribution system analysis and planning.
- Performance Tracking and Optimization
  - Developing historical trending of distribution system performance.
  - Evaluating unaccounted for water (UFW) by pressure zone (district metering areas).
  - Assessing the need and performance of pressure management.
  - Optimizing distribution system operations including water supply balancing, power consumption, and chemical expenditure.

Additionally, water quality monitoring is beneficial in areas where there is low turnover of water during low demand periods including storage reservoirs, large transmission mains, distribution dead ends, and the east most extent of BOPU's distribution system including the Sun Valley pressure zone which is farthest from potable water sources.

### 5.8.1 Existing Monitoring Locations

BOPU currently monitors pressure, level and flow at a number of water distribution facilities through their SCADA system. Currently each of the reservoirs has level monitoring, each of the pump stations has flow and pressure monitoring, and many of the major transmission lines from Sherard WTP and Round Top Reservoir have flow monitoring. There are a few additional pressure monitoring data points within the distribution system, mostly at PRV stations. Round Top Reservoir has turbidity and residual chlorine monitoring. Table 5-36 lists the current locations, data type, and pressure zone of SCADA data collection. The list is not all-inclusive of all SCADA data points but those that apply to pressure, level, flow, and quality data types in the distribution system. Figure 5-15 shows the existing monitoring locations in the distribution system and their data type.

**Table 5-36**
**Existing System Monitoring Locations**

| Name | Data Type(s) | Data Point Location | Pressure Zone | Notes |
|---|---|---|---|---|
| Storage Reservoirs | | | | |
| King I Reservoir | Level / Chlorine | At Reservoir | City | |
| King II Reservoir | Level / Turbidity / Chlorine | At Reservoir | City | |
| Round Top Reservoir | Level / Turbidity / Chlorine | At Reservoir | City | Level data point for each of three chambers |
| Buffalo Ridge Reservoir | Level / Turbidity / Chlorine | At Reservoir | City | |
| Pump Stations | | | | |
| Buffalo Ridge Pump Station | Pressure/Flow | Suction/Discharge at Pump Station | City | |
| Western Hills Pump Station | Pressure/Flow | Suction/Discharge at Pump Station | Western Hills | |
| Monterey Heights Pump Station | Pressure/Flow | Suction/Discharge at Pump Station | Monterey Heights | |
| Deer Avenue Pump Station | Pressure/Flow | Discharge at Pump Station | Deer Avenue | |
| The Pointe Pump Station | Pressure/Flow | Suction/Discharge at Pump Station | The Pointe | |
| North Range Business Park Pump Station | Pressure/Flow | Suction/Discharge at Pump Station | North Range Business Park | |
| Transmission Mains | | | | |
| 30-inch Hynds Line | Flow | Downstream of King I | City | |
| 42-inch Southern Delivery Phase I Line | Flow | Downstream of King I | City | |
| 24-inch Round Top Line | Flow | Downstream of Round Top Reservoir | City | |
| 30-inch Round Top Influent Line | Flow | Upstream of Round Top Reservoir | City | |
| 30-inch Round Top Line | Flow | Downstream of Round Top Reservoir | City | |
| 30-inch Base Line | Flow | Downstream of the “X” | City | |
| 24-inch Western Hills Line | Flow | Downstream of the “X” | City | |

| Name | Data Type(s) | Data Point Location | Pressure Zone | Notes |
|---|---|---|---|---|
| 30-inch Western Hills Line | Flow | Downstream of the “X” | City | |
| 36-inch King Intertie Line | Flow | Downstream of King I Reservoir | City | |
| 36-inch King I Reservoir Influent | Flow | Upstream of King I Reservoir | City | Currently data is not available at this location |
| Buffalo Ridge Influent | Flow | Upstream of Buffalo Ridge Reservoir | City | |
| Pressure / PRV Stations | | | | |
| Snyder Avenue | Pressure | BOPU Shop | City | |
| Converse Avenue PRV Stations (2 locations) | Pressure | Upstream/Downstream at PRV Station | Dell Range | Two PRV stations on parallel 24-inch mains |
| Airport Blvd PRV Station | Pressure | Upstream/Downstream at PRV Station | Dell Range | |
| Pershing Blvd PRV Station | Pressure | Upstream/Downstream at PRV Station | Dell Range | |
| Water Sources | | | | |
| Federal Well Field | Flow | Upstream of Round Top Reservoir | City | |
| Bell Well Field | Flow | Upstream of Round Top Reservoir | City | |
| Happy Jack Well Field | Flow | Upstream of King II Reservoir | City | |
| Borie Well Field | Flow | Upstream of King II Reservoir | City | |
| Sherard WTP Discharge | Flow | Upstream of King II Reservoir | City | |

### 5.8.2 Recommended Monitoring Locations

At a minimum level of monitoring, permanent system monitoring (SCADA) data points are recommended at locations for the following data types:

- Pressure at:
    - Suction and discharge of all pump stations.
    - Upstream and downstream of all PRVs.
- Level at:
    - All clearwells.
    - All storage reservoirs.

- Flow at:
    - Major transmission mains (24-inch and greater) feeding system between any significant flow diversions (examples: the “X”, King Intertie).
    - Pump stations, individual pump flow preferred, at a minimum total pump station flow.
    - Well field and WTP discharges to distribution system.

At an advanced level of monitoring, permanent system monitoring (SCADA) data points are recommended at locations for the following data types:

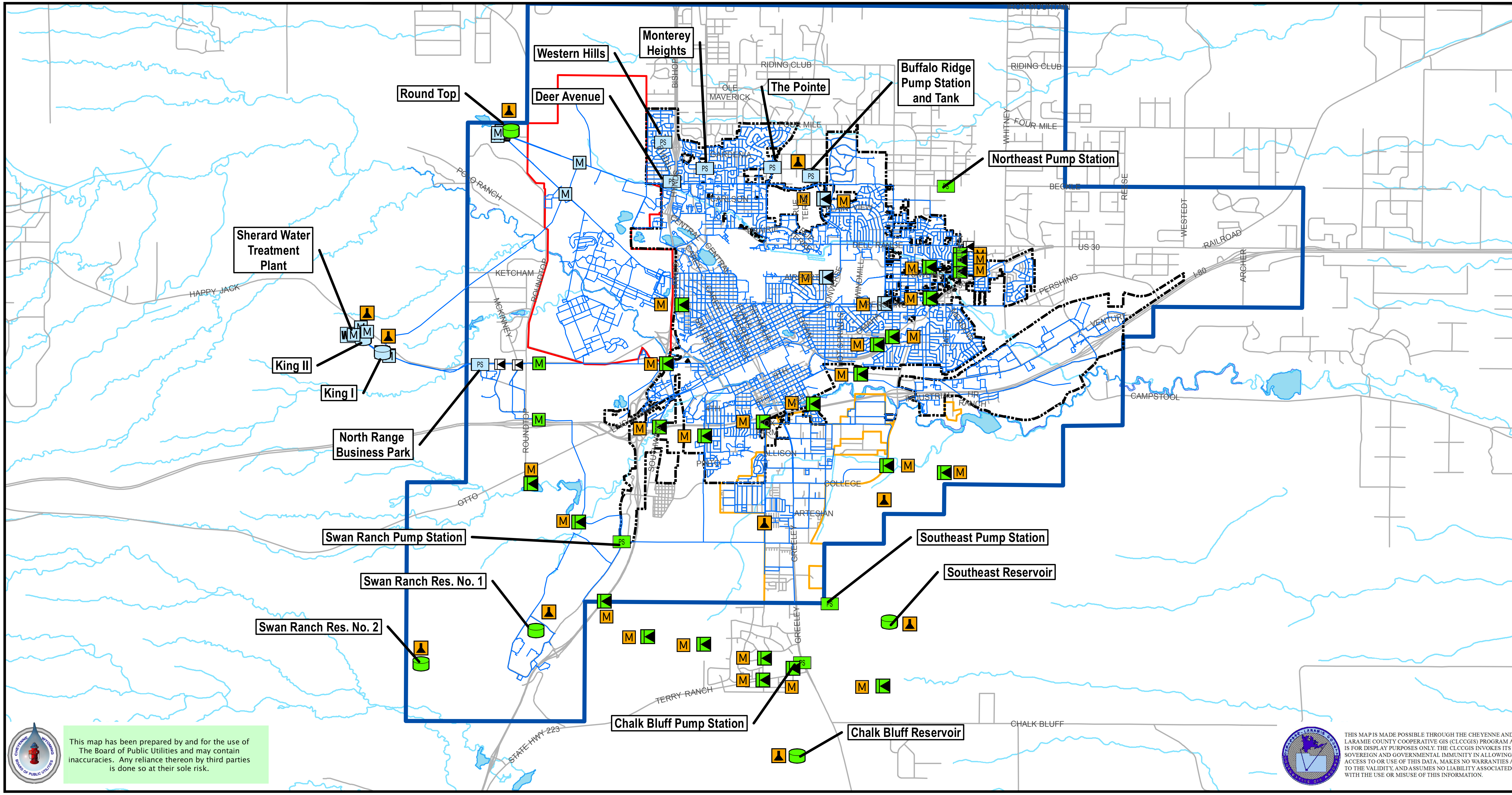
- Flow at:
    - Entrances to and exits from pressure zones, located at PRV stations if possible.
- Quality at:
    - Turbidity and chlorine residual at storage reservoirs and reservoirs.
    - Turbidity, chlorine residual, pH and temperature at select locations along major transmission mains (potentially at flow meter vaults) and at the extents of the system. If possible, include pressure monitoring at these locations as well.

According to the minimum and advanced levels of monitoring recommended, Table 5-37 lists the recommended locations, data type, pressure zone, and planning period implementation of SCADA data collection. Figure 5-15 shows the recommended monitoring locations in the distribution system, their data type, and planning period implementation.

**Table 5-37**
**Recommended System Monitoring Locations**

| Name | Data Type(s) | Data Point Location | Pressure Zone | Implementation Timing |
|---|---|---|---|---|
| Minimum Level of Monitoring | | | | |
| Storage Reservoirs | | | | |
| Swan Ranch Reservoir 1 | Level | At Reservoir | Swan Ranch | Near-term |
| Swan Ranch Reservoir 2 | Level | At Reservoir | Swan Ranch | Near-term |
| Round Top Reservoir 2 | Level | At Reservoir | City North | Near-term |
| Southeast Reservoir | Level | At Reservoir | Southeast | Mid-term |
| Chalk Bluff Reservoir | Level | At Reservoir | Chalk Bluff | Long-term |
| Pump Stations | | | | |
| Deer Avenue Pump Station | Pressure | Suction at Pump Station | Deer Avenue | Near-term |
| Swan Ranch Pump Station | Flow/Pressure | Suction/Discharge at Pump Station | Swan Ranch | Near-term |
| Southeast Pump Station | Flow/Pressure | Suction/Discharge at Pump Station | Southeast | Near-term |
| Northeast Pump Station | Flow/Pressure | Suction/Discharge at Pump Station | Northeast | Mid-term |
| Chalk Bluff Reservoir | Flow/Pressure | Suction/Discharge at Pump Station | Chalk Bluff | Mid-term |
| Transmission Mains | | | | |
| Southern Delivery Ph I 42-inch Line | Flow | As shown on figure | City South | Near-term |
| Hynds Line | Flow | As shown on figure | City Central | Near-term |
| Pressure / PRV Stations | | | | |
| All Sun Valley PRVs (10 locations) | Pressure | Upstream/Downstream at PRV Stations | Sun Valley | Near-term/ Mid-term |
| All City Central PRVs (6 locations) | Pressure | Upstream/Downstream at PRV Station | City Central | Near-term |
| All City South PRVs (7 locations) | Pressure | Upstream/Downstream at PRV Station | City South | Near-term/ Mid-term |
| Southeast PRV | Pressure | Upstream/Downstream at PRV Station | Southeast | Mid-term |
| Chalk Bluff PRV | Pressure | Upstream/Downstream at PRV Station | Chalk Bluff | Mid-term |

| Name | Data Type(s) | Data Point Location | Pressure Zone | Implementation Timing |
|---|---|---|---|---|
| Advanced Level of Monitoring | | | | |
| Storage Reservoirs | | | | |
| King I Reservoir | Turbidity | At Reservoir | City North/South | Near-term |
| Round Top Reservoir 2 | Turbidity / Chlorine | At Reservoir | City North | Near-term |
| Swan Ranch Reservoir 1 | Turbidity / Chlorine | At Reservoir | Swan Ranch | Near-term |
| Swan Ranch Reservoir 2 | Turbidity / Chlorine | At Reservoir | Swan Ranch | Near-term |
| Southeast Reservoir | Turbidity / Chlorine | At Reservoir | Southeast | Mid-term |
| Chalk Bluff Reservoir | Turbidity / Chlorine | At Reservoir | Chalk Bluff | Long-term |
| Transmission Mains | | | | |
| Southern Transmission Mains (2 locations) | Turbidity / Chlorine / pH / Temperature | As shown on figure | City South | Near-term |
| Pressure / PRV Stations | | | | |
| All Dell Range PRVs (4 locations) | Flow | At PRV Station | Dell Range | Near-term |
| All Sun Valley PRVs (10 locations) | Flow | At PRV Station | Sun Valley | Near-term/ Mid-term |
| All City Central PRVs (6 locations) | Flow | At PRV Station | City Central | Near-term |
| All City South PRVs (7 locations) | Flow | At PRV Station | City South | Near-term/ Mid-term |
| Southeast PRV | Flow | At PRV Station | Southeast | Mid-term |
| Chalk Bluff PRV | Flow | At PRV Station | Chalk Bluff | Mid-term |
| System Extents | | | | |
| System Extents (6 locations) | Turbidity / Chlorine / pH / Temperature | Not shown | - | Mid-term |




## Legend

- WTP Water Treatment Plant
- Storage Tank
- PS Pump Station
- Pressure Reducing Valve
- Water Main
- Future Water Main
- Roads
- Creeks
- Lakes
- City of Cheyenne
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District

**Existing Monitoring**

- Pressure
- PS Pressure/Flow
- Quality
- Level
- M Flow

**Minimum Level of Monitoring**

- Pressure
- PS Pressure/Flow
- Level
- M Flow

**Advanced Level of Monitoring**

- Quality
- M Flow

1 inch = 2.11 miles

N

Last Updated: 9/27/2013

# Figure 5-15
# Existing and Recommended System Monitoring Locations

### 5.8.3 System Monitoring Data Types and Equipment

A variety of distribution system monitoring equipment is available for utilities. Intended use of pressure, flow, level, and water quality data types can influence the preferred monitoring equipment.

#### Pressure

Pressure data in distribution systems provides information for pressure management, hydraulic model calibration, pump station operation, leak detection, pressure zone isolation, and pressure surges. Permanent pressure monitoring equipment for distribution systems is common and easily obtainable. Pressure monitoring equipment usually consists of a pressure transducer and remote terminal unit (RTU) to transmit information back to the SCADA system.

Finding locations to install the equipment in the system can be more difficult. Locating pressure monitoring in existing or future vaults (meter, valve, etc.) or buildings (pump stations, City buildings, etc.) is recommended rather than expending the cost to put in new vaults or manholes solely for pressure monitoring. The pressure transducer can be mounted in a pipe or on a hydrant. Use locations that are easily accessible for maintenance. Long-term exposure of hydrant mounted pressure loggers to the elements (freezing, sun, etc.) could be a maintenance concern. However, temporary pressure monitoring using the hydrant pressure loggers is still recommended as a portable method for troubleshooting or improvement planning purposes.

Transient pressure events can be captured with certain types of pressure monitors that have high speed data collection. This can be a helpful feature if there is the need to locate causes or effects of surge pressures within the system.

#### Flow

Flow data in distribution systems can be used for a number of purposes including day-to-day operations, hydraulic modeling calibration, leak detection, and demand characterization. Flow meters assist in determining where demand in the system is located and in balancing supply throughout the system to customers, storage, and pump stations. Permanent flow meters for distribution systems are common and easily obtainable. Flow monitoring equipment usually consists of a flow meter and a remote terminal unit (RTU) to transmit information back to the SCADA system. Electromagnetic meters (mag meters) are the preferred type as they are most accurate and incur very low headloss to the system.

Finding locations to install the flow monitoring equipment in the system can be difficult. Typically new vaults are required to implement flow monitoring; however, they can be coupled with PRV vaults and pump stations. Pressure and water quality monitoring can be provided at the same location, if desired.

Another use for flow meters in the system is creating District Metered Areas (DMAs). DMAs can be an effective technique of measuring and locating real water losses. The objective of DMA monitoring is to isolate and monitor a small area of the distribution system, with supply flows into the DMA of sufficient scale so that flows can be analyzed to distinguish components of normal consumption from leak rates. The areas are established by installing flow meters on one or more of water supply mains to the DMA and installing new or closing existing isolation valves on all of the other mains entering the DMA. A DMA could be a pressure zone or an even smaller area of the system. Having flow meters at all locations into and out of a DMA can be costly, so for BOPU, use of existing PRV vaults is recommended as the locations to establish DMAs throughout the system. The existing pressure zones are already isolated and can be converted to DMAs fairly easily. In addition to helping find leaks, the flow data from the DMA meters can be also used for demand characterization, hydraulic model calibration information, and pressure zone supply optimization in each pressure zone.

### Level

Level data in distribution systems is essential for determining the amount of water stored in reservoirs. Level data can also be correlated to flow in and out of the storage reservoirs using the associated time step data. This information can be used to calibrate hydraulic models over an extended period simulation, demand characterization by pressure zone, and determine optimal turnover intervals. In addition, by analyzing reservoir levels and trends, water retention time within the storage reservoirs can be determined which can be an indicator of water quality within the reservoir and the potential need for chlorine boosters at these sites.

Permanent level sensors for distribution systems are common and easily obtainable. Level equipment usually consists of a level sensor and a remote terminal unit (RTU) to transmit information back to the SCADA system. There are many types of level sensors, including ultrasonic sensors that measure down to the water level, pressure sensors that measure based on hydrostatic pressure at the bottom of the reservoir, capacity sensors use a voltage difference to equate to level changes, and radar sensors send an electromagnetic signal at the water surface and calculate level based on the travel time. Ultrasonic or pressure sensors are recommended as they tend to work best in water storage reservoirs.

### Water Quality

Water quality monitors enable access to almost real-time quality data such as turbidity, disinfectant residual, pH, and temperature in the system, allowing for optimization of distribution system water quality. Proper location of these monitors along with the sampled parameters can be used as a water quality event early warning system and as an indicator of overall water quality in the distribution system. Eventually, equipment will become available that will replace the need for manual sample collection for distribution system water quality reporting.

However, water quality monitoring in distribution systems is currently an emerging application of continuous water quality testing equipment. Water quality monitoring in the distribution system should be delayed until the technology has been refined and proven. The equipment can be costly and may not always work as expected. The data needs to be analyzed and interpreted carefully. Also, if it used as an early warning detection system for water quality events in the distribution system, potential exists for false positives if anomaly detection process is inadequate.

The following is a list of some of the current manufacturers that supply permanent water quality monitoring equipment:

- In-situ
- Hach
- JMAR
- GE Instruments
- s::can
- YSI
- Aquas Smart Water Solutions
- Endetec

### 5.8.4 System Monitoring Implementation

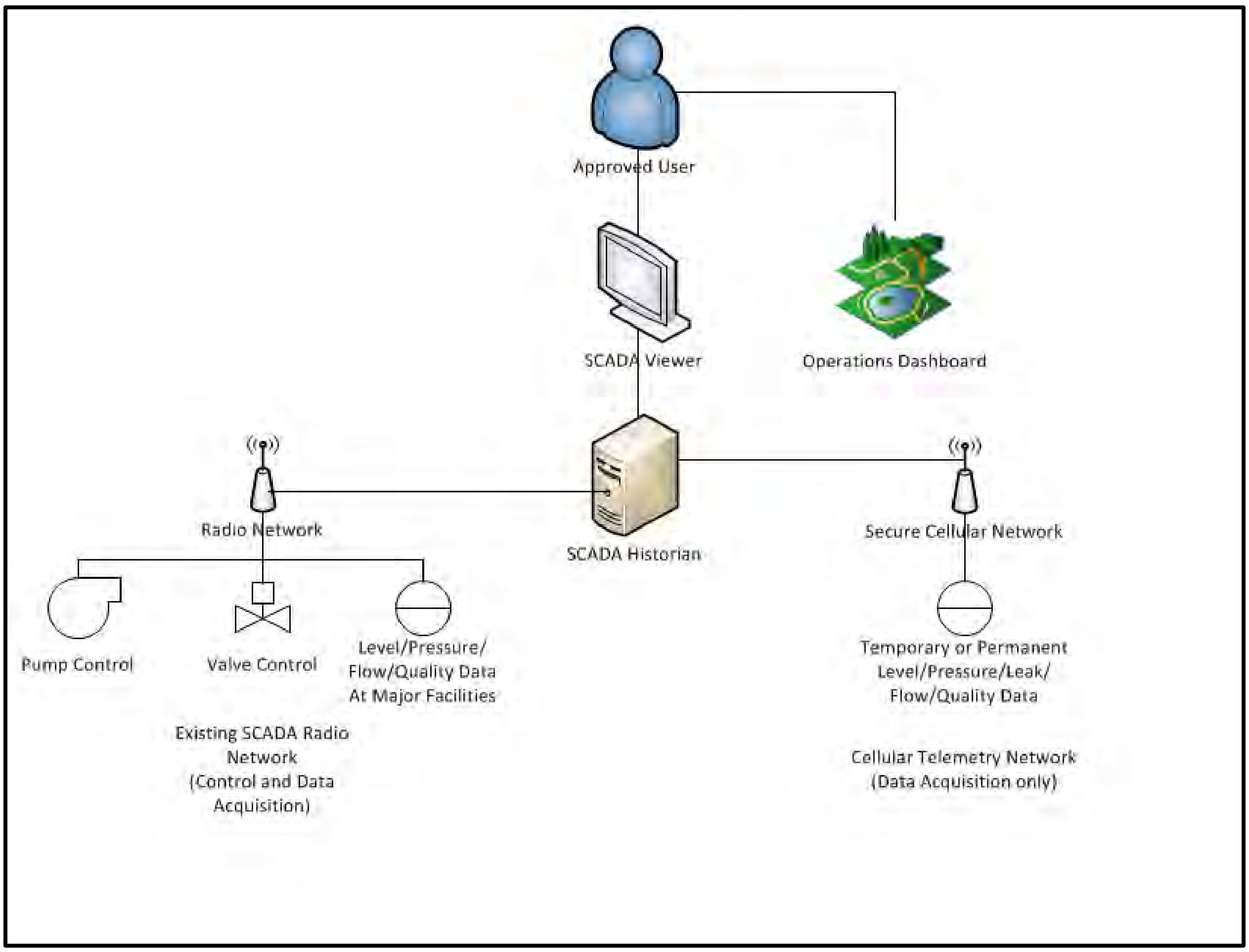
BOPU's existing radio-based SCADA system could be used to implement further system monitoring. An alternative is using cellular signal telemetry to wirelessly transmit data securely to the SCADA system. Cellular technology is becoming increasingly secure, stable, and relatively inexpensive compared to the radio-based technology. The cellular telemetry network would only send data to the SCADA system and have no control over distribution system operations. It should be considered as an alternative in the future especially considering the remote sites such as PRV stations, flow meters, and water quality monitoring. Solar or hydro-powered monitoring solutions for non-essential data points are recommended to reduce initial construction costs and on-going energy consumption. Major facilities such as storage reservoirs and pump stations as well as control valves could still use the radio-based network. Figure 5-16 shows a schematic of the general monitoring data collection system using the traditional radio network extended with a cellular-based telemetry network.

The following is a list of suppliers that currently offer cellular-based telemetry equipment:

- Telog (Pressure, Level, Computed Flow)
- Global Water (Pressure, Level Flow, Quality)
- Newfields/Aquas Smart Water Solutions (Pressure, Quality, Flow)
- Mueller Systems (Leak, Flow, Pressure)

Prior to purchasing any monitoring sensor and telemetry equipment, a comprehensive evaluation of each type of equipment (pressure, flow, level, and water quality) should be completed to determine the preferred equipment for standardization. The evaluation could involve leasing or purchasing one unit for testing purposes or an equipment demonstration by a vendor. Installation of monitoring equipment should be accomplished through a capital improvement project, with a certain number of sites completed annually, starting with the near-term minimum level of monitoring locations. An annual capital improvement project budget of $250,000/yr for near-term starting in 2015 until 2023 is recommended to implement the near-term minimum level of monitoring locations and a portion of the advanced level of monitoring locations. After 2023, in the mid-term and long-term planning periods, a budget $150,000/yr for maintenance and improvements to the system monitoring program is recommended. Any future monitoring locations associated with major improvements (storage, pump stations, transmission mains) should be included in the design and construction cost of those improvements.

**Figure 5-16**
**Radio/Cellular Telemetry Monitoring Data Collection Schematic**



Once the data is collected, it should be used and analyzed consistently by BOPU. To maximize the usefulness of monitoring data:

- Flows should be equated to velocities in the mains using diameters.
- Levels should be equated to flows in and out of storage reservoirs using the time steps.
- Pressures should be equated to hydraulic grades using installation elevations.

Pressure data should be reviewed consistently and analyzed annually to monitor pressures during low and high flow periods for anomalies or to detect pressure zones that are not completely isolated. Pressure data can help optimize pressure management and monitor system performance throughout the year and during fire flows.

Flow data should be reviewed consistently and analyzed annually to monitor the travel of water through the system and detect large flows associated with main breaks, fire flows, and high use by customers. Flow data can be used to optimize system operations through an understanding of demand quantities and locations.

Level data should be reviewed consistently and analyzed annually to monitor reservoir level trends and balancing of water supply to various parts of the distribution system. Level data can help optimize how water is stored and distributed into the system throughout the year. By analyzing the reservoir level trends, decisions can be made on standard operating procedures and reservoir levels to maintain water quality and balance water in the system during different demand scenarios.

Water quality data should be reviewed consistently and analyzed monthly to monitor general water quality in the system and determine if modifying operations would improve water quality, including increasing chlorine residual in the system at storage reservoirs and the extents of the system. The data could be used to analyze and optimize operations in a way that would improve or at least not deteriorate water quality the in system.

Some systems such as Mueller are building in leak detection equipment (Echologics) through into their wireless monitoring systems.

To assist in the review and analysis of system monitoring data, an operations dashboard is recommended with alert capability to monitor the system in near-real time. Web-based GIS solutions are beginning to emerge offering a flexible, customizable dashboard for reviewing operations through the system. Alerts can be sent out via email or text messaging when a set performance parameter is exceeded. Any alerts should be investigated and compared with multiple data sources so as not to respond to false positives due to malfunctioning monitoring equipment.

A few examples of companies that supply customized water utility operations dashboards are:

- ESRI (Water Operations Dashboard)

- Innovyze (IWLive/Demand/Pressure Watch)
- IDModeling (Sedaru)
- IBM (Intelligent Operations Center)
- GE (Proficy Vision)
- Element Blue (Smarter Water)
- Geo-jobe (Utility Operations Dashboard)
- Critigen (Operations Dashboard)
- TaKaDu
- NewFields (iSENS)

## 5.9 Assessment and Rehabilitation

An initial means and method for assessing and prioritizing the replacement or upgrading of existing mains within the water distribution system is presented in this section. The distribution system assessment method is based on an industry-accepted practice of determining likelihood of failure (LoF) and consequence of failure (CoF) to determine critical assets for rehabilitation or replacement. Asset attributes and performance parameters have been established and organized into LoF or CoF factors and each is assigned a relative category multiplier from 1 to 5 to weight the different factors by their relative affect on failure.

A scoring system has been set up for each factor to determine which asset attributes or performance parameters receive which score. The higher the total score across all attributes and parameters, the more critical the asset is for replacement or rehabilitation. Scoring established in the 2010 Pressure Management Study, by HDR Engineering, developed from an in-depth main break analysis is used as the basis of some of the attributes and parameters used in the assessment method. The means and methods presented within this section should be re-evaluated at least every water master plan cycle to review data availability and scoring of the attributes and parameters based on updated main break and condition data.

### 5.9.1 Assessment Means

The first part of the distribution system assessment process is developing asset attributes and performance parameters that will participate in the assessment method. Asset attributes and performance parameters have been categorized into two phases:

- Phase 1 – Enough accurate data is available to include in assessment; immediate implementation into scoring method; continue collecting and refining data from source.
- Phase 2 – Not enough or no data available to include in the assessment; delayed implementation into scoring method; start or continue collecting data from source.

Appendix 5-E contains a list of all asset attributes and performance parameters that are recommended for inclusion in the distribution system assessment means.

All asset attributes and performance parameters much be tied back to a pipe asset by a pipe facility ID in GIS for scoring. Several performance parameters need to be converted from point data to the pipe; for example, main breaks are collected as points that need to be tied back to a polyline pipe asset; these types of parameters are noted.

#### Asset Attributes

Asset attributes include information about the particular asset or its condition. Example asset attributes include diameter, material, or bedding type. The full list of asset attributes included in the Phase 1 and Phase 2 assessment means are included in Appendix 5-E. This information is obtained either through field inspection/testing, as-builts, or previously compiled GIS data. All asset attributes are LoF factors.

### Performance Parameters

Performance parameters are typically non-material in nature and have a historical context based on how particular classes of assets have performed in the past under various conditions. Example performance parameters include operating pressure, main break occurrences, main criticality, or water quality. The full list of performance parameters is included in the Phase 1 and Phase 2 assessment means are included in Appendix 5-E. This information is obtained either through field observation, hydraulic model, system performance tracking, or previously compiled GIS data. Performance parameters can be either LoF or CoF factors.

## 5.9.2 Assessment Method

The assessment method takes the assessment means information collected from various sources and calculates a pipe condition score based on a weighted scoring matrix. Once the assets are scored, a process to review the results and select pipe segments for rehabilitation needs to be implemented. A recommended data structure to contain the distribution system assessment information from the various data sources can be found in Appendix 5-E.

### Scoring

Each asset attribute and performance parameter was assigned values or ranges of values for scoring. Each value or range of values was assigned a score from 1 to 5 with higher scores assigned to those affecting LoF or CoF at a greater level based on an observed or perceived level. A relative category multiplier from 1 to 5 is assigned to each asset attribute and performance parameter to weight the different factors by their relative affect on failure. Therefore, the maximum score for each scored category is multiples of 5 from 5 to 25. Appendix 5-E includes the initial scoring matrix to use while developing the distribution system assessment and rehabilitation selection process.

### Rehabilitation Selection Process

A rehabilitation selection process will take the asset attributes and performance parameters from the sources of data combined with the scoring method to calculate total scores for each pipe segment. Geoprocessing and python tools can be built to perform these functions once the data is compiled into one geodatabase. Any recently improved pipes should be filtered out of the results to ensure the process does not inadvertently select recently rehabilitated pipe. The process results should be sorted by pipe score from high to low and pipe diameter from low to high. An initial rehabilitation list can be created by selecting approximately 2 to 3 miles of pipe segments with the highest scores and lowest diameters.

The next step of the rehabilitation selection process, user-based selection, prioritization, and grouping of rehabilitation segments, can be a manual GIS process or a semi-automated process within a customized GIS-based web browser dashboard. The manual GIS process could be an interim solution until a dashboard is developed or purchased. The user-based selection, prioritization and grouping of rehabilitation segments should allow for external information to be included in the assessment to capture known problem areas or opportunity improvement areas that may have not shown at the top of the list in the scoring results.

External information could include specific field data of pipe needing immediate replacement or City-related street improvements such as overlays or reconstruction when there is an opportunity to replace pipe when the streets are already torn up. In addition, supplement information in addition to the total segment scoring for prioritizing and grouping of rehabilitation projects should be made available to the user. Supplemental information could include aerial photography, pipe attributes (material, age, diameter, etc.), main break locations, main breaks per 100 miles by pipe attribute type, estimated remaining life based on main break data, hydraulic model results data (flow, velocity, pressure), and valve and hydrant condition data from inspection programs. Renewal technology (open cut, line, burst) alternatives should be presented for selection for each rehabilitation project.

Finally, cost estimating information should be included in the assessment process to tally the total rehabilitation costs to maximum replacement projects while remaining within the planned annual rehabilitation program budget. Figure 5-17 depicts the general process to select pipe rehabilitation segments based on the assessment method.

### Distribution System Assessment and Rehabilitation Planning Tools

Several software companies have developed various distribution system assessment and rehabilitation planning tools including the following examples:

- InfoMaster Water / CapPlan Water (Innovyze)
- Water Utility Capital Improvement Planning (ESRI)
- KANEW (Water Research Foundation)
- Check Up Program for Small Systems (EPA)
- CARE-W (National Civil Engineering Laboratory)
- Riva DS (Riva Modeling)
- Buried No Longer Pipe Replacement Modeling Tool (AWWA)
- Baseform (AWARE-P)

These software tools could be used in conjunction with a customized rehabilitation selection tool or as the assessment method itself incorporating the assessment means and the scoring matrix presented above.

### Main Breaks

Main break information should continue to be collected to support scoring matrix updates, predict vulnerable areas, and estimate remaining asset life. GIS can be used to manually or automatically associate main breaks to a pipe facility ID for use in the assessment method. All historical data should be kept even after a repair or replacement is completed as it provides more data for analysis of similar pipe segments. The main break information should be used to calculate and trend yearly main breaks per 100 miles for performance tracking and effectiveness of pipe and pressure management improvements. Section **Error! Reference source not found.** discusses a recommended main break response and data collection program in more detail.

### Assessment Updates

The distribution system assessment means should be updated annually prior to selecting the next year's rehabilitation projects. During the recommended annual update the following items should be updated in the distribution system assessment database:

- Pipe attributes from the master GIS database.
- Hydraulic model based on the previous years' demand and any operational and infrastructure changes.
- Main break and leak locations from the main breaks database.
- Valve inspection data from the valve inspection and exercising database.
- Hydrant inspection data from the hydrant inspection and flushing database.
- Customer complaints from the complaints tracking database.

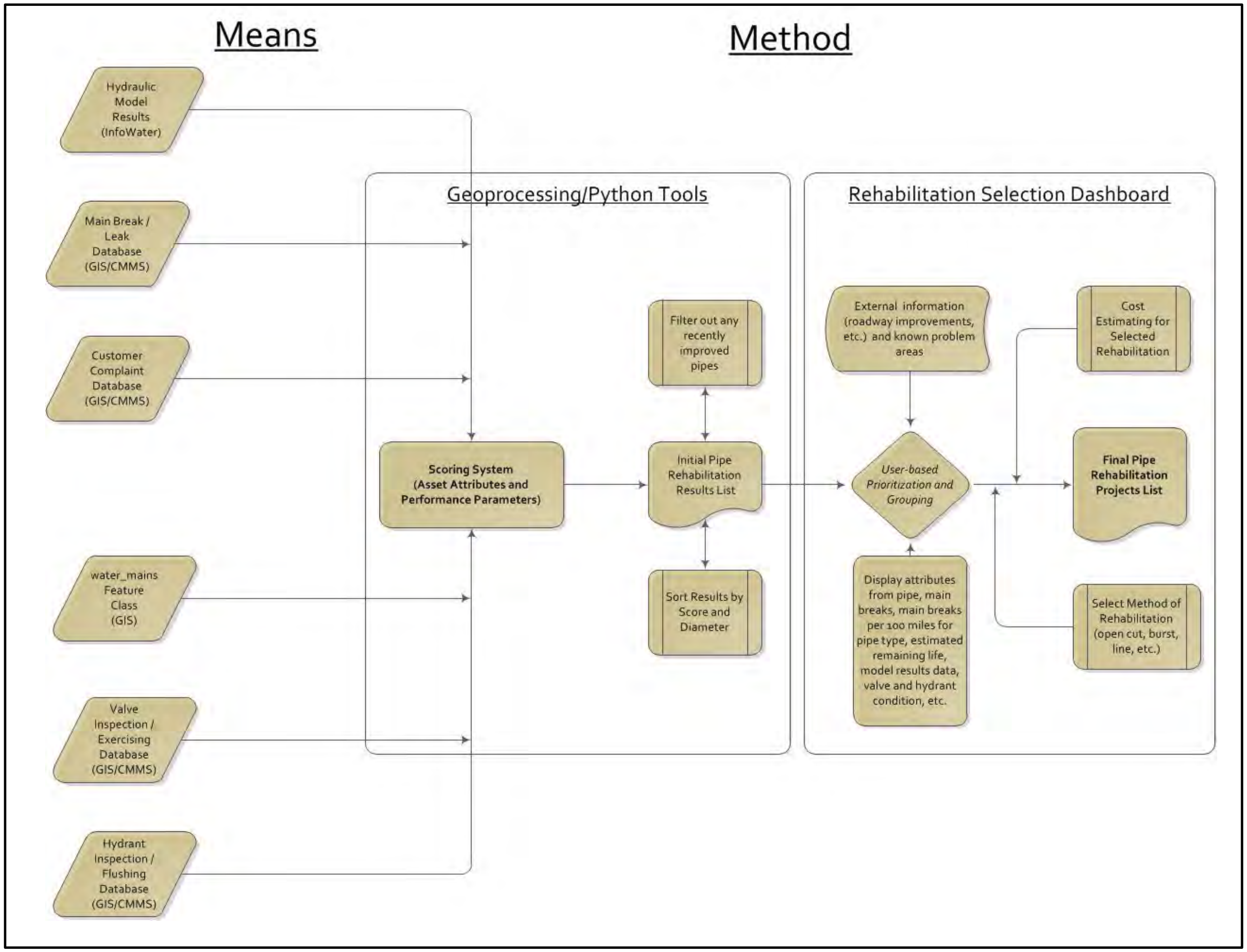
Once the assessment means information is compiled into the distribution system assessment database the scoring and rehabilitation selection process can be updated.

## 5.9.3 Distribution System Assessment Implementation

The distribution system assessment means should be implemented in the next two years for Phase 1 asset attributes and performance parameters. Phase 2 asset attributes and performance parameters should be implemented in 5-10 years when enough data is collected to support inclusion those scoring categories. The assessment method should be integrated with any future computerized maintenance management system (CMMS) to hold as much of the source information as possible. This integration will cut down on the number of data sources necessary to update and export to run the distribution system assessment. A GIS based user-selection process can be used in the near-term until a dashboard or other rehabilitation planning software is implemented.

## Figure 5-17

## Assessment Scoring and Rehabilitation Selection Process



### 5.9.4 Recent Rehabilitation Progress

BOPU has already been actively rehabilitating their distribution system in the last 10 years including replacing, lining or upsizing water mains. Over the past 10 years from 2003 to 2012, a total of 25.5 miles of mains (average of 2.6 miles per year) have been replaced, lined, or upsized. These rehabilitation and replacement projects completed from 2003 to 2012 are presented in Figure 5-18.

### 5.9.5 Rehabilitation Recommendations

Currently, BOPU has about 110 miles of 4- and 6-inch cast iron lines in older portions of the City. These lines are reaching the end of their service life and in some areas they cause deficiencies in fire flow availability. The pipe replacement and upsizing program for this classification of pipes, especially in areas of higher main break occurrence and deficient fire flow, should be continued. PVC should be used as the primary pipe replacement material and BOPU should continue work to reduce pressures in the system to reduce main breaks and pressure-related stress on the system. Hydraulic modeling should be conducted for each replacement to determine the impact on peak hour pressures and fire flow availability in the local area, to properly size the improvement and to establish the most beneficial connections into the existing system. These classifications of pipes receive a higher scoring in the distribution system assessment method so they have a higher priority for replacement.

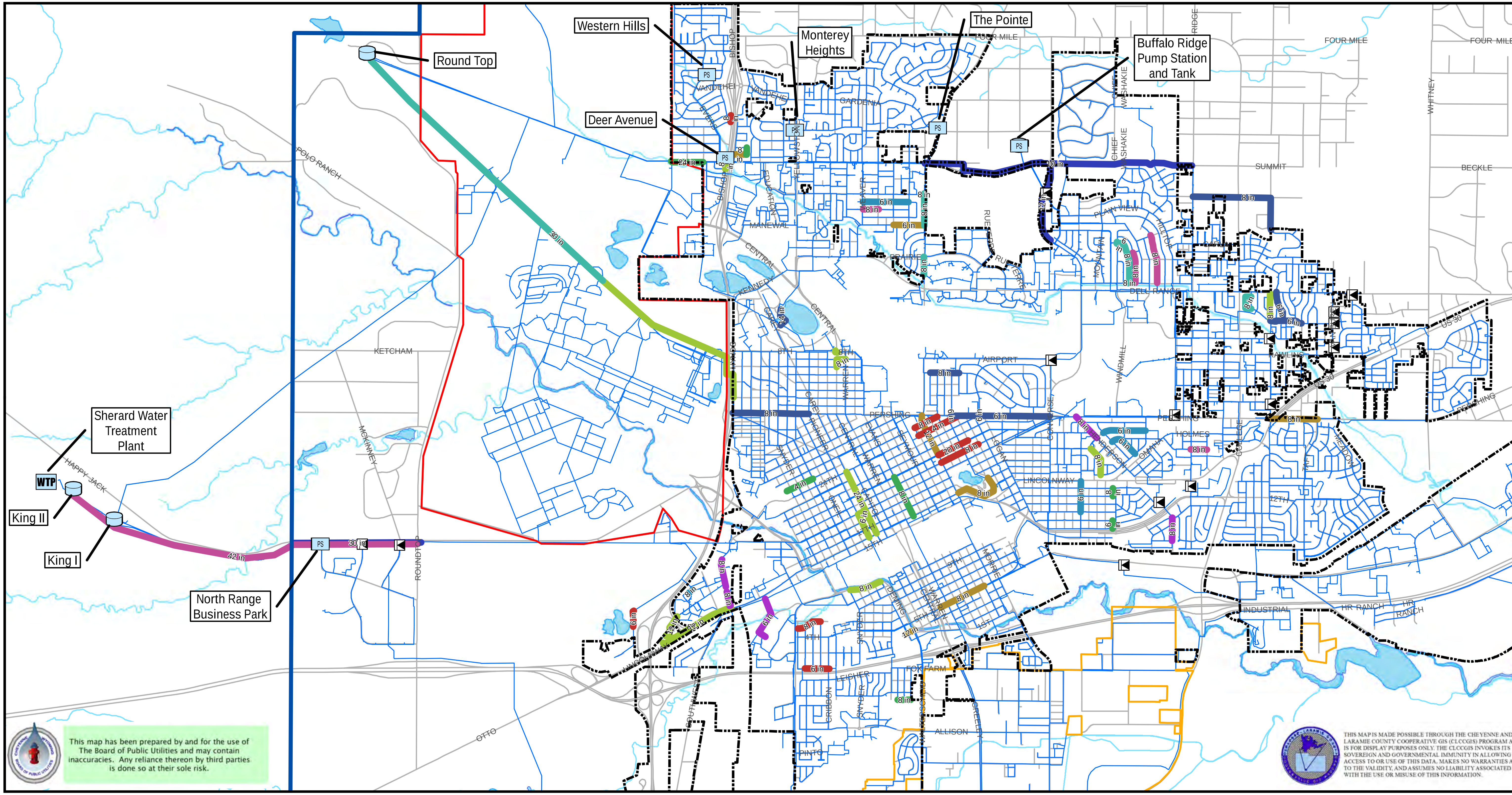
Continue to replace, line, or upsize a minimum of 2 miles of pipe per year for the near-term (2013-2017) which would equate to approximately a 270 year rehabilitation cycle of the entire system based on a current total length of 540 miles of pipe. As a comparison, Denver Water has 3,000 miles of water mains and they replace just over 11.4 miles of main per year which equates to an approximate 263 year rehabilitation cycle.

From 2018 onwards, increase the pipeline rehabilitation rate to a minimum of 3 miles per year, which equates to an approximate 180 year rehabilitation cycle based on the current length of pipe. The rehabilitation cycle will increase as pipe is added to the system; however newer pipe should have a longer life than the existing pipe due to improvements in pipe material and installation as long as quality materials and installation inspection is completed to ensure design and construction standards are being followed. Therefore, a final near-term (2018-2023) and mid-term (2024-2033) rehabilitation rate of 3 miles per year is recommended.

BOPU's yearly cost for the rehabilitation program has been approximately $2,000,000 for an average of 2 miles per year of replaced, lined, or upsized pipes. Therefore, a starting capital improvement project cost of $2,000,000 per 2 miles ($189/ft) of pipe rehabilitated is recommended with an annual increase of 4%. This equates to a capital expenditure of $27.2 million in the near-term (2014-2023) and $45.6 million in the mid-term (2024-2033).

Currently, planned rehabilitation and replacement projects from 2013 to 2018 are presented in Figure 5-19. These projects represent only 7.5 miles of pipe rehabilitation in the next 5 years, from 2013 to 2017 (1.5 miles/year) with 2.75 miles accounted for in 2014 and 1.1 miles of pipe rehabilitation in 2018. Additional rehabilitation to meet 2 miles per year through 2017 and 3 miles per year starting in 2018 onward should be planned.

(THIS PAGE WAS INTENTIONALLY LEFT BLANK)




1 inch = 1 miles

N

## Legend

**Rehabilitated Water Main (Year)**

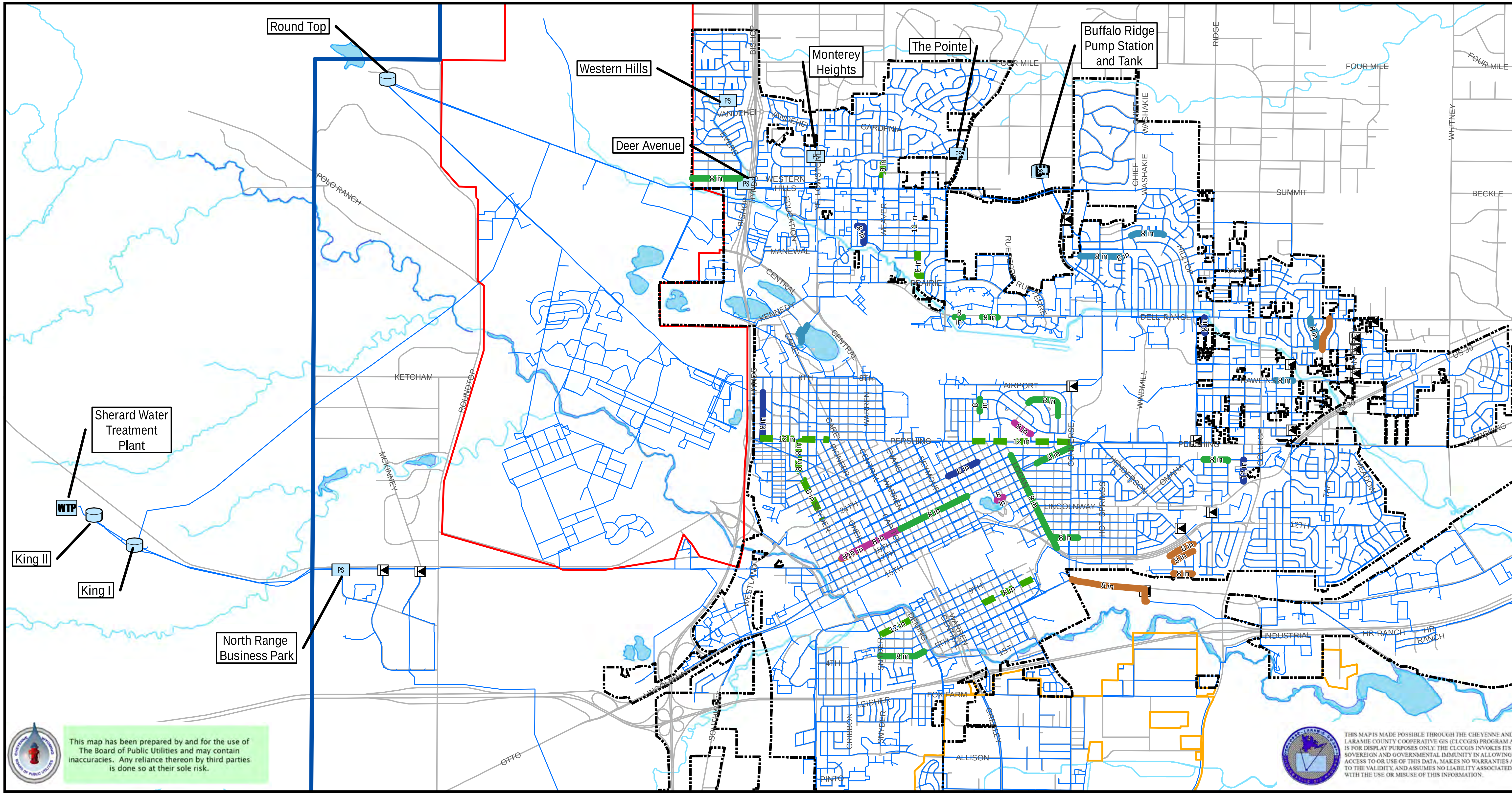
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010
- 2011
- 2012

- WTP Water Treatment Plant
- Storage Tank
- PS Pump Station
- Pressure Reducing Valve
- Water Main
- Roads
- Creeks
- Lakes
- City of Cheyenne
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District

Last Updated: 9/27/2013

**Figure 5-18**

**Recently Rehabilitated Mains (2003-2012)**




## Legend

**Near-term Water Main Rehabilitation (Year)**

- In Progress
- 2014
- 2015
- 2016
- 2017
- 2018

- WTP Water Treatment Plant
- Storage Tank
- PS Pump Station
- Pressure Reducing Valve
- Water Main

- Roads
- Creeks
- Lakes

- City of Cheyenne
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District

1 inch = 1 miles

N

HDR

Last Updated: 9/27/2013

# Figure 5-19
# Near-term Mains to be Rehabilitated (2013-2018)

**Volume 5 – Potable Water Storage and Distribution**
2013 Water and Wastewater Master Plans

# 5.10 Preventative Maintenance

This section recommends implementation of a preventative maintenance plan including levels of service, asset management, preventative maintenance practices, and field data collection for enhancing and tracking performance of the potable water distribution system.

## 5.10.1 Level of Service

There are two key facets to asset management – defining the level of service (LOS) the system will strive to provide its customers over the long term and determining the most efficient and economical way to deliver that service (the least cost approach). Therefore, determining and detailing the LOS goals that the system will provide is a key first step in the overall asset management plan development process. The asset management program will determine the least cost approach for meeting those established LOS goals.

A LOS agreement defines the way in which the utility owners, managers, and operators want the system to perform over the long term. An established LOS allows utilities to track performance of their systems over a number of years to determine effectiveness of preventative maintenance, customer service, and regulatory compliance. An LOS agreement can be kept for internal uses or externally shared with the public on an annual or semi-annual basis.

Examples of performance indicators that can be included in the LOS agreement include, but are not limited to the following (more in-depth examples are provided in Appendix 5-F):

- Number of breaks per mile that are acceptable.
- Length of time from report of a leak or break until repair.
- Amount of notification (and method) prior to a scheduled shut down.
- Amount of notification (and method) prior to a non -scheduled but nonemergency shutdown.
- Quantity of unplanned interruptions in service verses planned interruptions.
- Number of hours to fix the pipe break once on site.
- System losses (UFW) maintained at less than X% overall.
- Maximum system flow will be X gpd.
- Water pressure will be maintained throughout the system at X psi.
- Rates will be raised annually to avoid rate shock in the system.
- Rates will be reviewed annually.
- Fire flow will be provided X percent of required flow at all hydrants.
- Storage capacity will be maintained at X gallons total.
- No water outage will be longer than X hours total.
- Maximum water quality complaints will be X total annually.
- Customers will be notified of planned system outages at least X hours or X days before the interruption.

- Customers will be notified at least X minutes prior to shut down for an emergency condition, unless life threatening conditions cause a need for immediate shut down.
- Water conservation will be instituted to reduce average daily use by X percent in Y years.
- Response time to customer complaints and service requests.
- Positive total coliform samples throughout the system will be zero.

The performance indicators in the LOS agreement should be established with baseline values initially and updated at least annually to determine the effectiveness and any refinements needed to the asset management and preventative maintenance programs.

### 5.10.2 Asset Management

Asset management is a framework being widely adopted as a means to pursue and achieve sustainable infrastructure. An Enterprise Assessment Management (EAM) program is made up of asset inventory or registry and asset management plan to determine the least cost approach to delivering the agreement established. The asset inventory is an always up-to-date and accurate record of:

- What and where all of the assets the utility owns and maintains are.
- What condition they are in.
- What their estimated remaining useful life is.
- What their estimated value and replacement cost is.

While the asset management plan generally includes:

- Asset maintenance management approach, procedures and records.
- Emergency maintenance response information.
- Critical and vulnerable assets with resulting special maintenance procedures.
- Assets that are in need of rehabilitation, repair, or replacement due to their current condition.

EAM provides utilities the following benefits[1]:

- Increases knowledge of your system, which will allow you to make better financial decisions. This is useful information when considering options to address various system challenges such as meeting regulatory requirements or upgrading system security.
- Reduces system “down-time” and the number of emergency repairs, since you will have planned for the replacement and rehabilitation of your assets.

[1] http://simple.werf.org/Books/Contents/How-Can-Asset-Management-Help-Me-

- Prioritizes rehabilitation and replacement needs and providing time to research cost-effective alternatives.
- Shows investors and the public that you are using their money effectively and efficiently, which may make them more likely to increase investment or tolerate rate increases.
- Gives you greater access to financial assistance. Some funding sources give applicants extra credit (higher priority ratings) for having an asset management plan or a capital improvement plan.

Chart 5-1 shows the general asset management plan approach in flowchart form.

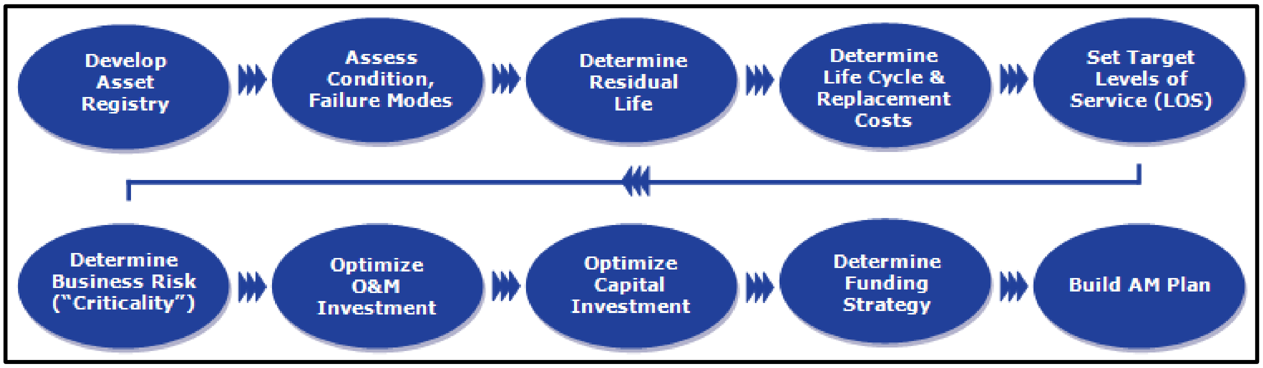



**Chart 5-1**
**Asset Management Plan Development Flowchart**

The Sustainable Infrastructure Management Program Learning Environment (SIMPLE) framework created by Water Research Foundation and Water Environment Research Foundation can help determine asset management gaps and needs for BOPU. The SIMPLE website has an intuitive and user-friendly set of on-line process and practice guidelines, templates and decision support tools that will:

- Simplify the development of consistent Asset Management Plans
- Provide effective Implementation Guidelines for agencies to assess and drive meaningful improvements in asset management.

In addition, the Partnership for Safe Water program has a self-assessment for distribution system optimization that could help form the vision and goals for cost-effective distribution system asset management and operation and maintenance[2].

## Computerized Maintenance Management System

Adjustments to the utility infrastructure during utility maintenance activities must be collected and cataloged so that the information is recallable and useable within BOPU's overall

[2] http://www.awwa.org/resources-tools/water-utility-management/partnership-for-safe-water.aspx

information management system. Maintenance activities represent one of the largest day-to-day changes to BOPU's utility infrastructure and without a system to collect and store this information uniformly and consistently the utility data in the GIS and other asset management databases no longer represent the utility infrastructure in the field. BOPU should implement a Computerized Maintenance Management System (CMMS) to track these daily activities to maintain BOPU's infrastructure assets.

The CMMS would allow BOPU to not only track the changes to the GIS data representing the utility systems but also effectively schedule maintenance and track all effort and costs associated with these activities. The CMMS provides BOPU with the ability to capture labor, equipment and material costs for all maintenance activities and use this information to plan for future activities and analyze past maintenance practices.

The CMMS is a tool by which BOPU is able to not only respond to immediate maintenance issues but also develop preventative and ongoing maintenance plans to ensure that the utility systems are operating at an optimum level of service. Additionally, the CMMS can be expanded into other aspects of BOPU's utilities such as collection system, vehicle, meter, and treatment maintenance operations which will provide better data access, scheduling and maintenance across many different BOPU systems.

Along with GIS, CMMS would be a major part of on-going success of the EAM program. Therefore, a GIS-based CMMS solution is recommended such as (a comparative review of these CMMS software packages can be found in Appendix 5-F):

- Cityworks
- Accela
- Infor/Hansen
- Lucidity
- Oracle
- Maximo
- VueWorks
- Cartegraph
- MaintStar
- Elements XS
- GeoStack
- Cityview
- Agile Assets

Other important components or modules that can be found in common CMMS packages are:

- Facilities (for tracking assets not found in the GIS)
- Customer Request Portal (customer input)
- Service Request (customer response)
- Work Odors (labor, material, and equipment planning)
- Parts Inventory
- Resource Manager (labor, material, and equipment planning)
- Fleet (Vehicle) Maintenance
- Asset Registry
- Asset Condition
- Asset Risk
- Asset Valuation
- Budget Forecasting
- Capital Improvement Plan Management
- Permits and Inspections
- Analytics

The selected CMMS system should be able to be fully integrated into the future customer information system (CIS) and utility billing system. A beneficial feature of some of the CMMS systems is mobile access using iPads, iPhones, or similar mobile devices that allows in the field updates to maintenance databases. This can be a powerful tool for maximizing work order response and efficiency and minimizing loss of information between the field and the office.

### 5.10.3 Preventative Maintenance Practices

Preventative maintenance is essential to prolonging infrastructure life and meeting the LOS goals established for the distribution system. The following preventative maintenance practices are recommended along with a method to plan and track their completion (sorted in recommended implementation order):

- Hydrant Inspection and Flushing
- Main Break and Leak Response
- Valve Inspection and Exercising
- Backflow Prevention Inspection

- Customer Complaint Tracking

Depending on the CMMS software implemented, some or all of these preventative maintenance practices may be able to be planned and tracked in the CMMS using mobile applications. Another option is to use ArcGIS Online Configuration for Water Utilities & Water Utility Apps which allows utility organizations to maximize their use with out-of-the-box configurations for desktop and mobile mapping, data collection, and inspection/maintenance tracking solutions. These apps can be customized and expanded on to create BOPU-specific preventative maintenance applications. In addition, there are several other vendors who offer tailored solutions to collect this information such as Cartegraph, Fulcrum, or Sedaru. Some of the apps including ArcGIS Online require data connections at all times to function correctly while some allow intermittent data connections and sync at reconnection; this could cause issues if there are areas of the system with unreliable data connections. If out-of-the-box mobile apps are used, care should be taken to ensure they will be compatible with the future CMMS and other BOPU systems (CIS, assessment method, system monitoring, etc.) as necessary.

### Hydrant Flushing and Inspection

Arguably, a flushing program is the single most effective maintenance practice for improving system reliability and water quality. It can also be time and manpower intensive, and is, therefore, often abbreviated or sacrificed altogether for more reactive maintenance. A regular flushing program, however, can reduce a water system's need for reactive maintenance.

Regular system flushing improves water quality in several ways. The flushing removes biofilm and other bacteriological growth which can cause positive coliforms, taste and odor problems. Flushing also removes sediment, corrosion products and encrustation, which cause turbidity or discoloration. These sediments provide an environment for future biofilm growth and a higher chlorine demand. Finally, flushing introduces fresh water with higher chlorine residual. Flushing also improves system reliability by preventing tuberculation and maintaining adequate flow. Through its implementation, it helps the collection of data on valves, blow-offs, hydrants and improve distribution system maps.

BOPU has a history of discolored water events and has known manganese (Mn) accumulation in their raw water feed lines and distribution system piping. They have taken significant measures to prevent additional Mn from entering the distribution system by installing improvements at the WTP and within their raw water collection system. These projects have been very successful. However, they do continue to experience on-going challenges related to colored water events. This is attributed to Mn accumulation and associated periodic destabilization/release events.

Discoloration events are typically associated with release of accumulated precipitates and/or dispersion of black slime layers. The degree of discoloration depends on the amount of material entrained. Release events occur due to physical/hydraulic mobilization resulting from flow reversals and velocity changes, as well as chemical destabilization and solubilization resulting from water chemistry shifts.

BOPU can often associate a colored water event with street sweeping in the area. The street sweeping crew will often use a large volume of water from a single hydrant which can mobilize sediment. Similarly, Cheyenne can expect to have calls related to dirty or colored water following a water line break or a fire event.

BOPU recently participated in a research project which focused on the impact and implications of manganese accumulation in the distribution system. The project was funded by the Water Research Foundation and resulted in a report titled "Legacy of Manganese Accumulation in Water Systems: Assessment, Consequence and Prevention." The report is still under review by the participating utilities and by the Water Research Foundation. A draft version of the write-up on Cheyenne can be found in Appendix 5-F.

BOPU regularly performs distribution system monitoring and pipe cleaning practices to control the occurrence of colored water events. They currently flush their distribution system as part of their annual maintenance program. The annual flush is performed in the late spring before the system velocities increase with peak summer demands. The flushing is used to increase the velocity in the distribution system to mobilize and purge sediment from the system. BOPU has experienced an increase in colored water complaints in years when the peak system demands occurred prior to the annual system flush. The high velocities in the system resulting from the peak demands are thought to have acted as an unintentional system flush, dislodging scale in the pipes and resulting in colored water events.

BOPU developed a conventional flushing program in 1995 in response to a Mn event. Prior to this, the utility only performed conventional spot flushing as needed to address discoloration complaints. Annual flushing is performed on the entire system, but only using half of the hydrants; selected hydrants are alternated each year. The purpose of this effort is to control solids and metals buildup, including but not exclusive to Mn, with the goal to prevent further colored water events.

System pressures are fairly consistent throughout the distribution system, ranging from ~60-150 psi. The flushing velocity is difficult to predict because lines are not isolated during a flush. Water velocity is dependent on the quantity and diameter of lines feeding the flush site, which is further dependent on other system demands during the time of the flush.

BOPU has provided anecdotal evidence that they often just "chase Mn around the system" during large scale colored water events. It is likely that sediment in the distribution system has already been transported from various locations within the system and its origin is unknown. BOPU has been very proactive in preventing Mn from entering their distribution system. They have made improvements to their treatment process and in their raw water system. The next step is to eliminate the previously accumulated Mn sediment from their distribution system. The most effective way to do this is through a unidirectional flushing (UDF) program.

A unidirectional flushing (UDF) program would offer many benefits that conventional flushing does not provide. In UDF the line being flushed is isolated and the utility can calculate the velocity in the pipe and can control the number of pipe volumes flushed and the direction of water travel. The water containing the mobilized sediment is purged from an isolated location. This is performed throughout the system in a prescribed pattern. UDF is more thorough than conventional flushing which tends to purge some sediment, but in an uncontrolled manner, without control of the sediments origin, the velocity needed to mobilize the sediment or the number of pipe volumes needed to thoroughly clean the pipe segment.

Implementation of a UDF program would help minimize the number and intensity of colored water events and should eventually eliminate most of the sediment from the system. System wide flushing may not need to be an annual expense. UDF uses less water than conventional since not every hydrant needs to be flushed. Valve exercising is accomplished at the same time

As documented in the Water Research Foundation draft report, “Legacy of Manganese Accumulation in Water Systems: Assessment, Consequence and Prevention,” routine system flushing costs approximately $70,000 per year. Note this does not include the cost of treated water lost during flushing events.

A unidirectional flushing program study is recommended to develop annual UDF routes using hydraulic modeling and related software. A UDF system would cost approximately $75,000 to design and $25,000 in capital improvements to implement. However, implementation of a UDF program would help minimize the number and intensity of colored water events and should eventually eliminate most of the sediment from the system. It would eventually reduce the overall cost of flushing by eliminating the need to flush as well as using less water. System wide flushing may be reduced to an occasional need rather than an annual expense. The UDF is expected to have a payback period of 5 years with on-going costs at approximately $50,000/annually.

Hydrant flushing should be coupled with hydrant inspection since most of the hydrants in the system will be visited during UDF flushing activities either for flowing or residual measurement. The remainder of the hydrants not inspection should be visited after UDF flushing is complete. Hydrant inspection and subsequent repair or replacement, as needed, will ensure that hydrants are operable when needed. Data collection recommendations for hydrant inspection and flushing can be found in Appendix 5-F.

### Main Break and Leak Response

A main break and leak response program should be developed collect data from main breaks and leaks for further analysis of overall pipe condition in the distribution system. The main break and leak response and repair process can helpful data on distribution system assets from these occurrences including verifying GIS data, operations data, and maintenance needs. The increased amount of main attribute and break data collected will allow a more refined assessment method for rehabilitation. A soil sample should be taken from a selection of main breaks across the system and sent to a geotechnical laboratory for analysis for corrosivity, moisture content, resistivity, etc. This soils information can be compiled across the system to determine the areas with the most externally corrosive conditions for pipe materials and appurtenances. By understanding the corrosive conditions across the system, repair materials and designs of new pipelines can account for the proper cathodic protection methods in such areas. A leak survey should be completed for the entire system every 3 years (1/3 of the system per year). Data collection recommendations for main break response can be found in Appendix 5-F.

### Valve Exercising and Inspection

Valve exercise and inspection is a proactive maintenance practice with highly tangible results. Most systems are designed with a sufficient number of valves to isolate distribution system breaks. If those valves are found to be broken, stuck, buried, or otherwise not locatable the amount of time required to isolate and ultimately repair the break will increase as the crews must attempt to find working valves. All types of valves including isolation, hydrant, bypass and pressure reducing should be included in the program. Service valves such as curb stops and fire service valves should be incorporated into the future for a complete valve inspection and exercising program but are typically more difficult to implement due to continual consumption needs by consumers.

Inoperable valves found should be put on a rehabilitation or replacement list to be scheduled for maintenance. Critical valves such as those that affect hospitals, major employers, industrial users, large and/or old valves, and those in major intersections should be identified in the system and exercised more often. A properly completed valve exercising program will allow distribution valves to be used as needed, when needed. Data collection recommendations for valve exercising and inspection can be found in Appendix 5-F.

### Backflow Prevention Inspection

To protect the water distribution system from backflow from residences and businesses, backflow prevention is a necessary element of any service connection. BOPU currently conducts inspection of backflow preventors for new residential taps and continuous commercial and industrial services. Having a way to collect the data in the field using an electronic system would reduce paperwork and office data entry involved in the inspection process. Data collection recommendations for backflow prevention inspection can be found in Appendix 5-F.

### Customer Complaint Tracking

Data collection and mapping of customer complaints in GIS is recommended to monitor conditions in the distribution system, track operational issues, and determine the boundary of water quality events. Data collection recommendations for customer complaint tracking can be found in Appendix 5-F.

### 5.10.4 Preventative Maintenance Implementation

A detailed preventative maintenance plan and complete implementation of that plan is recommended for the distribution system. Preventative maintenance practices are proven to support system sustainability and increase remaining life of assets. If recommended preventative maintenance frequencies can not be met, a prioritized maintenance schedule should be developed to ensure that critical assets are being maintained regularly.

At a minimum the following components are recommended for implementation in the next 3 years:

- Enterprise asset management (EAM) and computerized maintenance management system (CMMS).
- Field data collection for increased accuracy and completeness of GIS data.
- Hydrant inspection and flushing program to be completed across the entire system once every 3 years (1/3 of the system per year).
- Valve inspection and exercising program to be completed across the entire system once every 3 years (1/3 of the system per year).
- Main break and leak response program and data collection to support the assessment method. A leak survey should be conducted across the entire system once every 3 years (1/3 of the system per year).
- Backflow prevention inspection program to be completed across the entire system once every 3 years (1/3 of the system per year).
- Customer complaint tracking program to support the flushing and water quality programs.

Levels of service goals for performance indicators such as breaks per 100 miles of pipe and customer complaints should be established and tracked to determine the improvement of system performance over time. Appendix 5-F contains examples of common water system performance indicators that are used for tracking level of service.

Volume 10 includes more details on the system hardware and software requirements to support a preventative maintenance plan including CMMS, EAM, and mobile requirements. A full time equivalent, a preventative maintenance technician, with previous asset management and GIS experience, is recommended to lead and implement this program utilizing O&M staff for field work.

**Recommended Implementation Phase 1**

5-year Plan

- Level of Service – Year 1
  - Develop Level of Service agreement
  - Develop performance indicators
- Data Collection Implementation – Years 1 and 2
  - Hydrant flushing and inspection
  - Main break and leak response
  - Valve exercising and inspection
  - Backflow prevention inspection
  - Customer complaint tracking
- Interface/Dashboard for Distribution Assessment Method – Year 3
- Asset Management System Implementation – Years 3 through 5
  - Remaining life analysis
  - Main break analysis
  - Valuation analysis

**Recommended Implementation Phase 2**

10-year Plan

- Performance Indicator Tracking – Annually from Year 2 on
- Data Collection Tracking, Analysis, and Process Refinement – Annually from Year 2 on
- Distribution Assessment Method Update – Annually from Year 3 on
- Asset Management Integration with CIS - Year 5

### 5.10.5 Field Data Collection

Capturing information while in the field when pipe and appurtenances are already dug up will help in verifying GIS data while preforming preventative and emergency maintenance such as main break repairs, valve inspection, hydrant inspection, main replacement and rehabilitation maximizes time and efforts in the field for continual improvement of the data that BOPU relies on daily. All attributes for the assets in the GIS geodatabase should be made available for verification and editing if needed. Monthly edits from the field should be merged back into the master GIS geodatabase.

A few of the GIS field data collection apps currently available for iOS (iPad/iPhone) are:

- ArcGIS Online (only online data compatible)
- Cartography (online/offline data compatible)
- Fulcrum App (online/offline data compatible)
- GIS Cloud (online/offline data compatible)
- GIS Roam / iGeoTrak (online/offline data compatible)
- GIS Kit and GIS Pro (online/offline data compatible)
- Trimble Connect (online/offline data compatible)

# 5.11 Improvement Recommendations

This section presents the improvement recommendations from the distribution, storage, and pumping analyses including:

- Infrastructure improvements to support system growth and rehabilitation.
- Pressure management to support system integrity and reduced main breaks.
- Monitoring improvements to support system operations and progress towards system optimization.
- Water age considerations to support system water quality.
- Distribution system assessment method implementation to support system rehabilitation.
- Preventative maintenance practices to support system sustainability and increased remaining asset life.

The improvement projects are all assigned a capital improvement ID with the following format, Planning Period-System-Project Number:

- Planning Period-
  - 2013 – In Progress/Completed
  - NT – Near-term (2014-2023)
  - MT – Mid-term (2024-2033)
  - LT – Long-term (2034-2063)
- System-
  - PD - Potable Distribution
- Project Number
  - Sequential number for each project

## 5.11.1 Infrastructure Improvements

Infrastructure improvements including transmission mains, distribution mains, storage reservoirs, and pump stations are recommended for each of the planning periods to support system growth and rehabilitation. The infrastructure improvements are shown on

Figure 5-20 identified by their capital improvement ID.

### Transmission Mains

Transmission mains are those primarily 16-inches and larger that supply the distribution system from the potable water sources. The following transmission main projects are recommended to deliver water generally west to east through the system sorted by year installed.

#### *Current (2013)*

**Improvement: Southern Water Transmission Main - Phase II**

**Improvement ID:** 2013-PD-1

**Year:** 2013-2015

**Description:** Second phase of the Southern Delivery System from the end of Phase I at North Range Business Park south to the north end of Swan Ranch then east to Walterscheid Blvd and north to connect to the existing system into the existing system in the area of I-80 via S Parsley Blvd and Walterscheid. This project is currently under construction.

**Scope:** 38,120 ft of 42-inch; 12,850 ft of 18-inch; 5,360 ft of 16-inch; 5,180 ft of 12-inch

**Purpose:** To deliver water to the southern part of the system to serve growth areas and reinforce delivery of water from west to east. This project builds the backbone for serving development to the south.

#### *Near-term (2014-2023)*

**Improvement Name: Southern Water Transmission Main - Phase III**

**Improvement ID:** NT-PD-7

**Year:** 2015-2016

**Description:** Third phase of the Southern Delivery System from the end of Phase II at Walterscheid Blvd east to Avenue C north to E College Drive and connect into the existing system in the area of I-80 via Avenue C and E College Drive.

**Scope:** 10,640 ft of 36-inch; 6,220 ft of 30-inch; 9,370 ft of 20-inch; 6,290 ft of 16-inch.

**Purpose:** To deliver water to the southern part of the system to serve growth areas and reinforce delivery of water from west to east. This project continues building the backbone for serving development to the south.

**Improvement Name: Southern Transmission Mains by 2023 (Year 2017)**

**Improvement ID:** NT-PD-17

**Year:** 2017

**Description:** Transmission main extensions to connect portions of the Southern Transmission Main – Phases II and III.

**Scope:** 10,800 ft of 16-inch

**Purpose:** To provide connections between the Southern Transmission Mains to support growth and improve hydraulics between transmission mains.

**Improvement Name: Southern Transmission Mains by 2023 (Year 2018)**

**Improvement ID:** NT-PD-17

**Year:** 2018

**Description:** Main delivering water from Swan Ranch area to and from the Swan Ranch Reservoir No. 2. To be built in conjunction with Swan Ranch Reservoir No. 2.

**Scope:** 11,780 ft of 24-inch

**Purpose:** To deliver water to southwest areas of development including light to heavy industrial development and provide a way for water back feed from the Swan Ranch zone and storage to the City South zone.

### *Mid-term (2024-2033)*

**Improvement Name: Southern Transmission Mains by 2033**

**Improvement ID:** MT-PD-6

**Year:** 2024-2033

**Description:** Main delivering water from Southern Water Transmission Main Phase III to the south along Avenue C and east along E Wallick Rd.

**Scope:** 5,210 ft of 24-inch; 41,860 ft of 18-inch; 29,000 ft of 16-inch

**Purpose:** To deliver water to the south and southeast parts of the system to serve growth areas, provide water to the Southeast pump station and continue developing delivery of water capabilities south along the S Greeley Hwy corridor.

**Improvement Name: Southern Water Transmission Main - Phase IV**

**Improvement ID:** MT-PD-12

**Year:** 2024-2033

**Description:** Mains delivering water from Southern Water Transmission Main – Phase III to the Sun Valley pressure zone.

**Scope:** 3,920 ft of 30-inch; 17,860 ft of 16-inch; 19,920 ft of 12-inch

**Purpose:** To deliver water to the eastern area of the distribution system to improve hydraulics through the system west to east and serve existing and future areas of development.

### *Long-term (2034-2063)*

**Improvement Name: Southern Transmission Mains by 2063**

**Improvement ID:** LT-PD-5

**Year:** 2034-2063

**Description:** Mains delivering water throughout the southern area of the distribution system including the Chalk Bluff pressure zone and storage reservoir.

**Scope:** 28,400 ft of 18-inch

**Purpose:** To deliver water throughout the southern area of the distribution system to serve existing and future areas of development.

## Distribution Mains

Distribution mains are those pipelines primarily less than 16-inches in diameter that deliver water from the transmission mains to the customers. The following distribution main projects are recommended for to deliver water to new developments or replacement due to the City or Wyoming Department of Transportation (WYDOT) projects sorted by year installed.

### *Current (2013)*

**Improvement Name: East Pershing Blvd from Dunn to Converse – City Project**

**Improvement ID:** 2013-PD-2

**Year:** 2013

**Description:** A main replacement along E Pershing Blvd from Dunn Ave to Converse Ave. This is a City coordinated project funded by BOPU and is currently under construction.

**Scope:** 4,105ft of 12-inch

**Purpose:** To rehabilitate main coordinated with a street project.

**Improvement Name: West Pershing from I-25 to Pioneer - WYDOT Project**

**Improvement ID:** 2013-PD-3

**Year:** 2013

**Description:** A main replacement along W Pershing Blvd from I-25 to Pioneer Avenue. This is a WYDOT coordinated project funded by BOPU and was completed in the spring of 2013.

**Scope:** 3,187 ft of 12-inch

**Purpose:** To rehabilitate main coordinated with a street project.

**Improvement Name: Snyder Avenue Reconstruction – City Project**

**Improvement ID:** 2013-PD-5

**Year:** 2013

**Description:** A main replacement and upsize from 4- and 6-inch mains along Snyder Ave from W 24th St to W Pershing Blvd. This is a City coordinated project funded by BOPU and is currently under construction.

**Scope:** 3,640 ft of 8-inch

**Purpose:** To rehabilitate main coordinated with a street project.

**Improvement Name: East 7th from Warren to Alexander**

**Improvement ID:** 2013-PD-6

**Year:** 2013

**Description:** Replacement main along E 7th Street from Warren to Alexander. This project is currently under construction.

**Scope:** 2,435 ft of 8-inch

**Purpose:** To rehabilitate main coordinated with a BOPU rehab project.

### *Near-term (2014-2023)*

**Improvement Name: Logan Avenue from Nationway to Pershing – City Project**

**Improvement ID:** NT-PD-9

**Year:** 2014

**Description:** Replacement main and upsize from 4- and 6-inch mains along Logan Avenue from Nationway to East Pershing Blvd. This is a City coordinated project funded by BOPU.

**Scope:** 4,330 ft of 8-inch

**Purpose:** To rehabilitate main coordinated with a street project.

**Improvement Name: 19th Street (Central Ave to Morrie Ave) – City Project**

**Improvement ID:** NT-PD-10

**Year:** 2015

**Description:** Replacement main and upsize from 4- and 6-inch to 8-inch mains along 19th Street from Central Ave to Morrie Ave. This is a City coordinated project funded by BOPU.

**Scope:** 3,097 ft of 8-inch

**Purpose:** To rehabilitate main coordinated with a street project.

**Improvement Name: 19th Street (Snyder Ave to Central Ave) – City Project**

**Improvement ID:** NT-PD-22

**Year:** 2016

**Description:** Replacement main and upsize from 4- and 6-inch to 8-inch mains and replacement of 24-inch main along 19th Street from Snyder Ave to Morrie Ave. This is a City coordinated project funded by BOPU.

**Scope:** 1,000 ft of 8-inch; 1,100 ft of 24-inch

**Purpose:** To rehabilitate main coordinated with a street project.

**Improvement Name: Southern Distribution Mains by 2023 (Year 2015)**

**Improvement ID:** NT-PD-18

**Year:** 2015

**Description:** A main extension to connect two 12-inch mains in the Swan Ranch area.

**Scope:** 3,680 ft of 12-inch

**Purpose:** To complete the distribution loop in Swan Ranch.

**Improvement Name: Campstool Road from Frontier Refinery to Livingston**

**Improvement ID:** NT-PD-12

**Year:** 2016

**Description:** Replacement main and upsize from 4-inch mains along Campstool Road from Frontier Refinery to Livingston Ave.

**Scope:** 5,020 ft of 8-inch

**Purpose:** To rehabilitate and upsize a main.

**Improvement Name: Southern Distribution Mains by 2023 (Year 2017)**

**Improvement ID:** NT-PD-18

**Year:** 2017

**Description:** Main extensions to connect portions of the Southern Transmission Main – Phases II and III.

**Scope:** 11,190 ft of 12-inch

**Purpose:** To provide connections between the Southern Transmission Mains to support growth and improve hydraulics between transmission mains.

**Improvement Name: Northern Distribution Mains by 2023 (Year 2019)**

**Improvement ID:** NT-PD-19

**Year:** 2019

**Description:** Main extensions to connect portions of the distribution system to the north between Powerhouse Rd and Converse Ave.

**Scope:** 7,540 ft of 12-inch

**Purpose:** To deliver water to previously unserved areas to provide service supporting growth and development.

**Improvement Name: Southern Distribution Mains by 2023 (Year 2021)**

**Improvement ID:** NT-PD-18

**Year:** 2021

**Description:** Main extensions to connect portions of the Southern Transmission Main – Phases II and III.

**Scope:** 21,050 ft of 12-inch

**Purpose:** To provide connections between the Southern Transmission Mains to support growth and improve hydraulics between transmission mains.

**Improvement Name: Southern Distribution Mains by 2023 (Year 2022)**

**Improvement ID:** NT-PD-18

**Year:** 2022

**Description:** Main extensions to connect portions of the Southern Transmission Main – Phase II and existing extensions.

**Scope:** 10,680 ft of 12-inch

**Purpose:** To provide connections between the Southern Transmission Mains to support growth and improve hydraulics between transmission mains.

**Improvement Name: Southern Distribution Mains by 2023 (Year 2023)**

**Improvement ID:** NT-PD-17

**Year:** 2023

**Description:** Mains delivering water from Swan Ranch Pump Station west.

**Scope:** 13,030 ft of 12-inch

**Purpose:** To deliver water to southwest areas of development including light to heavy industrial development.

### *Mid-term (2024-2033)*

**Improvement Name: Southern Distribution Mains by 2033**

**Improvement ID:** MT-PD-7

**Year:** 2024-2033

**Description:** Mains delivering water throughout the southern area of the distribution system including the City South, Swan Ranch, Southeast, and Chalk Bluff pressure zones.

**Scope:** 121,300 ft of 12-inch

**Purpose:** To deliver water throughout the southern area of the distribution system to serve existing and future areas of development.

**Improvement Name: Northern Distribution Mains by 2033**

**Improvement ID:** MT-PD-10

**Year:** 2024-2033

**Description:** Mains delivering water to the northern area of the distribution system including the Sun Valley and new Northeast pressure zones.

**Scope:** 53,210 ft of 12-inch; 1,290 ft of 8-inch

**Purpose:** To deliver water throughout the northern area of the distribution system to serve existing and future areas of development.

### *Long-term (2034-2063)*

**Improvement Name: Southern Distribution Mains by 2063**

**Improvement ID:** LT-PD-6

**Year:** 2034-2063

**Description:** Mains delivering water throughout the southern area of the distribution system including the Chalk Bluff pressure zone.

**Scope:** 35,060 ft of 12-inch

**Purpose:** To deliver water throughout the southern area of the distribution system to serve existing and future areas of development.

**Improvement Name: Northern Distribution Mains by 2063**

**Improvement ID:** LT-PD-8

**Year:** 2034-2063

**Description:** Mains delivering water to the northern area of the distribution system including the Northeast pressure zone.

**Scope:** 7,900 ft of 12-inch

**Purpose:** To deliver water throughout the northern area of the distribution system to serve existing and future areas of development.

## Storage

Storage projects include constructing reservoirs to either replace existing storage due to condition or to support growth and the overall need for additional storage in the distribution system.

### *Near-term (2014-2023)*

**Improvement Name: Swan Ranch Reservoir No. 2 – 3 MG**

**Improvement ID:** NT-PD-16

**Year:** 2017

**Description:** A 3 MG storage reservoir to add to the current 0.5 MG elevated storage in the Swan Ranch area. It should be well baffled and about 40 feet deep. In addition, the Swan Ranch Reservoir No. 2 should be piped with separated inlet and outlet openings to force flow through and maximize turnover of water. The alternative shown on the figure is a ground level reservoir approximately 1.8 miles west of the Swan Ranch area. Another potential alternative is an additional elevated reservoir closer to the Swan Ranch area that would have a shorter feed/draw line reducing water age within that pipeline.

**Scope:** 3 MG Storage Reservoir

**Purpose:** To provide a new reservoir for storage of potable water to meet peak hour, fire flow and emergency demands in the developing Swan Ranch area and downstream pressure zones. Between this reservoir and the replacement Round Top Storage Reservoir No.2 near-term storage requirements for the distribution system can be met with the abandonment of the existing Round Top Storage Reservoir.

**Improvement Name: Round Top Storage Reservoir No. 2 - 5 MG**

**Improvement ID:** NT-PD-13

**Year:** 2019

**Description:** A 5 MG storage reservoir to replace the existing Round Top reservoir. It should be well baffled and about 40 feet deep. In addition, the replacement Round Top Storage Reservoir No. 2 should be piped with separated inlet and outlet openings to force flow through and maximize turnover of water.

**Scope:** 5 MG Storage Reservoir

**Purpose:** To provide a new reservoir for storage of potable water to meet peak hour, fire flow and emergency demands. **This reservoir should contain a separate volume of water around 0.25 MG not accounted for in the 5 MG to be used solely to meet chlorine contact time for the groundwater fed to it from the well fields to meet 4-log inactivation for viruses**. Between this reservoir and the Swan Ranch Storage Reservoir No. 2 near-term storage requirements for the distribution system can be met with the abandonment of the existing Round Top Storage Reservoir.

### *Mid-term (2024-2033)*

**Improvement Name: Southeast Storage Reservoir – 3 MG**

**Improvement ID:** MT-PD-8

**Year:** 2024-2033

**Description:** A 3 MG storage reservoir to add to the current storage in the City South zone. It should be well baffled and about 40 feet deep. In addition, the Southeast Storage Reservoir should be piped with separated inlet and outlet openings to force flow through and maximize turnover of water. The alternative shown on the figure is an elevated reservoir to the east of the City South zone.

**Scope:** 3 MG Storage Reservoir

**Purpose:** To provide a new reservoir for storage of potable water to meet peak hour, fire flow and emergency demands in the developing City South area and downstream pressure zones. This storage reservoir enables the system to meet mid-term storage requirements.

### *Long-term (2034-2063)*

**Improvement Name: Chalk Bluff Storage Reservoir – 2 MG**

**Improvement ID:** LT-PD-7

**Year:** 2034-2063

**Description:** A 2 MG storage reservoir for the Chalk Bluff pressure zone. It should be well baffled and about 40 feet deep. In addition, the Chalk Bluff Storage Reservoir should be piped with separated inlet and outlet openings to force flow through and maximize turnover of water. The alternative shown on the figure is a ground level reservoir to the south of the Chalk Bluff zone.

**Scope:** 2 MG Storage Reservoir

**Purpose:** To provide a new reservoir for storage of potable water to meet peak hour, fire flow and emergency demands in the Chalk Bluff and downstream pressure zones. This storage reservoir enables the system to meet long-term storage requirements.

## Pump Stations

Pump station improvements will help support growth and increased demands in the system including the higher pump stations. **The existing pump stations can meet current (2013) demands but The Pointe and North Range Business Park Pump Stations should be evaluated further for their ability to meet all future demands including fire flow requirements with firm capacity.** Pump upgrades may be necessary after the evaluation; however, no capital improvements are currently recommended as the pumps can provide higher flow if the pumps are operated further out on their curve. The fire flow demands in each pumped pressure zone are assumed based on zoning and should be validated based on actual building construction and size during the pump station evaluations.

### *Near-term (2014-2023)*

**Improvement Name: Swan Ranch Pump Station**

**Improvement ID:** NT-PD-15

**Year:** 2014

**Description:** A pump station to provide service from the Southern Transmission Main – Phase II to the Swan Ranch pressure zone.

**Scope:** 4,000 gpm firm capacity pump station.

**Purpose:** To provide potable water service to the Swan Ranch area and for filling the existing and future Swan Ranch Storage Reservoirs.

**Improvement Name: Buffalo Ridge Pump Station Upgrade**

**Improvement ID:** NT-PD-21

**Year:** 2016

**Description:** A pump station upgrade to provide redundancy and future pressure sustainability.

**Scope:** Additional 2,000 gpm pump installed in or next to the existing pump station.

**Purpose:** To provide redundancy from Buffalo Ridge Storage Reservoir and future pressure boosting in the City North pressure zone during peak demand periods.

### *Mid-term (2024-2033)*

**Improvement Name: Chalk Bluff Pump Station**

**Improvement ID:** MT-PD-5

**Year:** 2024-2033

**Description:** A pump station to provide service from the City South pressure zone to the Chalk Bluff pressure zone.

**Scope:** 3,500 gpm firm capacity pump station.

**Purpose:** To provide potable water service to the higher elevation area in the southeast area of the distribution system.

**Improvement Name: Northeast Pump Station**

**Improvement ID:** MT-PD-9

**Year:** 2024-2033

**Description:** A pump station to provide service from the City North pressure zone to the Northeast pressure zone.

**Scope:** 2,500 gpm firm capacity pump station.

**Purpose:** To provide potable water service to the higher elevation area in the northeast area of the distribution system. This pump station would also help alleviate low peak hour pressures along Panorama Drive.

**Improvement Name: Southeast Pump Station**

**Improvement ID:** MT-PD-13

**Year:** 2024-2033

**Description:** A pump station to provide service from the City South pressure zone to the Southeast pressure zone and pump out of the Southeast Storage Reservoir as needed during high demand periods.

**Scope:** 3,500 gpm firm capacity pump station.

**Purpose:** To provide potable water service to the higher elevation area in the southeast area of the distribution system and pump out of the Southeast Storage Reservoir as needed.

### *Long-term (2034-2063)*

Currently no long-term pump station projects are recommended.

## Other Capital Improvements

Other capital improvement and facilities planned include the following items.

**Improvement Name: Dillon Avenue Water Dispensing Station**

**Improvement ID:** NT-PD-5

**Year:** 2014

**Description:** An improved water dispensing station nearby the BOPU shop on Dillon Avenue.

**Scope:** Water dispensing station.

**Purpose:** To provide an improved dispensing location of potable water for contractors and other bulk water users to fill their portable reservoirs.

**Improvement Name: Demolish Round Top WTP Building**

**Improvement ID:** NT-PD-14

**Year:** 2020

**Description:** This project includes demolishing the Round Top WTP building.

**Scope:** Demolish an abandoned WTP building.

**Purpose:** To remove an abandoned building at the Round Top site.

**Improvement Name: Reimburse Oversized Water Mains**

**Improvement IDs:** NT-PD-2 / MT-PD-2 / LT-PD-2

**Year:** 2014-2063

**Description:** A fund to provide re-imbursement to developers for oversized water mains due to BOPU direction for providing additional capacity in their distribution systems.

**Purpose:** To provide available funds to pay back developers for oversized water mains to improve system reliability and provide capacity to future growth areas.

**Improvement Name: Special Water Projects**

**Improvement IDs:** NT-PD-3 / MT-PD-3 / LT-PD-3

**Year:** 2014-2063

**Description:** Special unforeseen distribution projects that come up such as major distribution system repairs, storage reservoir rehabilitation, and replacement or rehabilitation of mains coordinated with street projects.

**Purpose:** To provide available funds for special water projects as described above.

### 5.11.2 Pressure Management

Pressure management supports system integrity by reducing the prolonged pressure on the infrastructure while still providing adequate pressures during high demand periods and fire flows. Pressure management reduces the factors that lead to main breaks including higher sustained and surge pressures. Recommended PRV stations included for the following planning periods create new pressure zones which further the pressure management objectives in the system.

#### *Current (2013)*

**Improvement Name: Pressure Management Phase I – Dell Range Zone**

**Improvement ID:** 2013-PD-4

**Year:** 2013

**Description:** A pressure management implementation including four PRV stations including two on Converse Blvd, to create the Dell Range Pressure Zone. This project was completed in the spring of 2013.

**Scope:** Four PRV Stations.

**Purpose:** To provide pressure management to reduce high pressures aimed at reducing main breaks.

### *Near-term (2014-2023)*

**Improvement Name: Pressure Management Phase II – City North/Central/South Zones**

**Improvement ID:** NT-PD-11

**Year:** 2017

**Description:** A pressure management implementation with four PRV stations including ones on W Pershing Blvd, the 30-inch Hynds line, Parsley Blvd, and Walterscheid Blvd to create the City North, City Central, and City South pressure zones. Locations and design for these PRV stations could be established during Southern Water Transmission Main - Phase II construction and implemented a year or two later to determine the impact of the pressures in the system due to the significant connections that this improvement project brings to the existing system.

**Scope:** Four PRV Stations

**Purpose:** To provide pressure management to reduce high pressures aimed at reducing main breaks.

**Improvement Name: Pressure Management Phase III – Additional Near-term Pressure Zones**

**Improvement ID:** NT-PD-20

**Year:** 2016, 2022, 2023

**Description:** A pressure management implementation with four PRV stations including one feeding Sun Valley (2016), one feeding City Central (2016) and two feeding City South (2022, 2023) pressure zones.

**Scope:** Four PRV Stations

**Purpose:** To provide pressure management to reduce high pressures aimed at reducing main breaks.

### *Mid-term (2024-2033)*

**Improvement Name: Pressure Management Phase IV – Mid-term Pressure Zones**

**Improvement ID:** MT-PD-11

**Year:** 2024-2033

**Description:** A pressure management implementation with eight PRV stations including two feeding Sun Valley, one feeding City Central, four feeding City South, and one feeding Chalk Bluff pressure zones.

**Scope:** Eight PRV Stations

**Purpose:** To provide pressure management to reduce high pressures aimed at reducing main breaks.

### *Long-term (2034-2063)*

**Improvement Name: Pressure Management Phase V – Long-term Pressure Zones**

**Improvement ID:** LT-PD-9

**Year:** 2034-2063

**Description:** A pressure management implementation with two PRV stations including one feeding City South and one feeding Southeast pressure zones.

**Scope:** Two PRV Stations

**Purpose:** To provide pressure management to reduce high pressures aimed at reducing main breaks.

## 5.11.3 System Monitoring

System monitoring is recommended to support system operations and progress towards system optimization. By collecting pressure, flow, level, and water quality data over time, trends can be developed and reviewed upon which operations improvements can be made to improve system performance and optimize use of energy and other resources. By understanding system operations using data and optimization, a more sustainable system can be obtained by removing unnecessary stresses and maximizing hydraulic benefits provided by the flexibility of existing facilities.

Existing data collected from the system should be take advantage of through annual analysis and use in hydraulic modeling. Additional distribution system monitoring equipment and SCADA infrastructure should be installed to collect data from existing and future facilities. Recommended system monitoring locations are presented in Table 5-37. Approximately $75,000/yr should be budgeted in the near-term to implement new system monitoring capabilities at existing facilities (the cost of these improvements is covered in Volume 10). Future capital projects such as transmission mains, PRV stations, or storage reservoirs should include system monitoring as part of the design and construction of the improvement.

An operations dashboard and analysis platform is recommended for implementation in the near-term to use this information for day-to-day operations and longer-term optimization of the distribution system.

**Improvement Name: Distribution System Monitoring**

**Improvement IDs:** NT-PD-4 / MT-PD-4 / LT-PD-4

**Year:** 2014-2063

**Description:** Installation of system monitoring equipment and SCADA infrastructure to collect pressure, flow, level, and water quality data at select locations in the system.

**Purpose:** To provide system performance data for day-to-day operations and analysis of optimization opportunities.

### 5.11.4 Water Age Considerations

Water quality due to water age should be considered when developing distribution system improvements and optimizing operations. Of particular concern is maintaining disinfectant residuals, in BOPU's case it would residual free chlorine levels, and minimizing disinfection by-products (DBPs). Generally as water age increases, disinfectant residuals decrease and disinfection by-products increase. The goal is to have at least a detectable amount of disinfectant residual and as little of DBPs as possible at all locations in the system. In the past, there have been reports of low to no chlorine residual near the Crow Creek Water Reclamation Facility (CCWRF). BOPU has not reported any major DBP issues.

Storage reservoirs and large transmission or distribution mains that are far from the source will have increased water age, especially when they are first built and the demands in the system have not increased yet as development catches up. Water age should be estimated using the hydraulic model to locate areas of potential water quality concerns. Then water quality system monitoring should be conducted in these areas of potential concerns using manual or automatic sampling equipment as discussed in Section 5.8.

Yearly water age hydraulic modeling should be completed based on updates to water demands from billing records and a water quality system monitoring program to understand the water age and quality within the growing distribution system.

Particular areas of concern may include:

- Existing Round Top Reservoir with unusual geometry and large volume sometimes has water quality issues during low demand periods. This has been partially addressed with valving at the "X" during the fall through winter seasons. The existing Round Top Reservoir is recommended for replacement in the near-term with a smaller reservoir that should have a proper passive (baffling) or active mixing (solar mixer, etc.) design.
- Large transmission and distribution mains as well as storage reservoirs in the southern area of the system including the Southern Transmission Mains. Sampling stations with remote monitoring capabilities should be installed at a minimum at the storage

reservoirs and preferably along the transmission mains as well to determine residual chlorine levels within the expansion areas until the demand increases as customers tap into the system.

- Extents of the system including the Sun Valley pressure zone. Areas of the distribution system downstream of PRVs will not always have low age water since the PRVs are operated to open in a sequence based on downstream pressure. If the area immediately downstream of a PRV that is lower in the sequence, it will typically not open unless during very high demands (peak hour or fire flow) and will have increased water age the rest of the time. PRV operations should evaluated to break up these potentially more stale water areas and open more PRVs during average demands.

Capital improvements for water age and quality considerations are included as part of other capital improvement projects.

### 5.11.5 Assessment and Rehabilitation

Continued assessment and rehabilitation is vital to the sustainability of the distribution system. The distribution system assessment method described in Section 5.9 should be implemented in the next two years to support data-based system rehabilitation. This assessment method will aid the yearly selection of rehabilitation pipe segments based on both probability of failure and consequence of failure factors.

The distribution main rehabilitation program begun 10 years ago should be continued. Continue replacing 4- and 6-inch aging cast iron water mains with 8-inch PVC mains for rehabilitation purposes and fire flow improvements. Cast iron mains historically have the greatest number main breaks per mile in the system and receive a higher scoring in the assessment method.

The target for main rehabilitation is recommended to be 2 miles per year from 2014 to 2017 and then increased to 3 miles per year from 2018 onwards including any City projects that present opportunities for rehabilitation along with transportation improvements. At 3 miles per year, the entire existing system replacement cycle would be approximately 180 years. Future system improvements should last longer due to increased quality of materials and installation; however, the replacement rate should be evaluated to be increased again during the next water master plan. Identified near-term rehabilitation projects from 2013 to 2018 are shown on

Figure 5-20. Additional pipe segments should be added to each of the years as necessary to reach the main rehabilitation targets. A separate list of additional distribution main rehabilitation projects has been identified for 2014.

**Improvement Name: Distribution Main Rehabilitation Program (Rehab/Replace/Upsize)**

**Improvement IDs:** NT-PD-1 / MT-PD-1 / LT-PD-1

**Year:** 2014-2063

**Description:** Replacement, upsizing or lining of distribution mains.

**Purpose:** To provide continued rehabilitation to aging water mains and improve system performance including fire flow.

**Improvement Name: FY 14 Distribution Main Rehabilitation B List**

**Improvement IDs:** NT-PD-8

**Year:** 2014

**Description:** Replacement, upsizing or lining of select distribution mains in 2014.

**Purpose:** To provide rehabilitation to aging water mains and improve system performance including fire flow in the near-term.

### 5.11.6 Preventative Maintenance

A detailed preventative maintenance plan and complete implementation of that plan is recommended for the distribution system. Preventative maintenance practices are proven to support system sustainability and increase remaining life of assets.

At a minimum the following components are recommended for implementation in the next 3 years:

- Enterprise asset management (EAM) and computerized maintenance management system (CMMS).
- Field data collection for increased accuracy and completeness of GIS data.
- Hydrant inspection and flushing program to be completed across the entire system once every 3 years (1/3 of the system per year).
- Valve inspection and exercising program to be completed across the entire system once every 3 years (1/3 of the system per year).
- Main break and leak response program and data collection to support the assessment method. A leak survey should be conducted across the entire system once every 3 years (1/3 of the system per year).

- Backflow prevention inspection program to be completed across the entire system once every 3 years (1/3 of the system per year).
- Customer complaint tracking program to support the flushing and water quality programs.

Levels of service goals for performance indicators such as breaks per 100 miles of pipe and customer complaints should be established and tracked to determine the improvement of system performance over time. Appendix 5-F contains examples of common water system performance indicators that are used for tracking level of service.

Due to reoccurring legacy manganese release events in the distribution system, a unidirectional flushing instead of conventional flushing is recommended for increased effectiveness of flushing and reduced lost water. Therefore, a unidirectional flushing program study is recommended to develop UDF routes using hydraulic modeling and related software. UDF also helps support the valve exercising program due to the use of isolation valves for maximizing flushing velocities in specific areas of the system.

Volume 10 includes more details on the system hardware and software requirements to support a preventative maintenance plan including CMMS, EAM, and mobile requirements. A full time equivalent, a preventative maintenance technician, with previous asset management and GIS experience, is recommended to lead and implement this program utilizing O&M staff for field work.

**Improvement Name: Unidirectional Flushing Program Study**

**Improvement IDs:** NT-PD-6

**Year:** 2015

**Description:** Hydraulic modeling and UDF route development study develop to create a unidirectional flushing program.

**Purpose:** To support preventative maintenance of the distribution system including sediment accumulation removal, improved water quality and restored capacity.

(THIS PAGE WAS INTENTIONALLY LEFT BLANK)

# 5.12 Capital Improvement Plan

From the recommended improvements in Section 5.11, a capital improvement plan was developed outlining the implementation phasing and cost of the distribution system projects.

Figure 5-20 presents the capital improvement projects in the distribution system.

## 5.12.1 Cost Estimating Assumptions

Cost estimates were developed for each of the capital improvement projects yearly from 2015 to 2023 and as a total cost for mid-term (2024-2033) projects. 2013 and 2014 are currently budgeted years and the cost estimates from the financial projections provided by BOPU were not changed except for the addition of two projects (NT-PD-15 and NT-PD-17) in 2014. Cost estimates were not provided for the long-term projects since they too far in the future to be certain of their implementation or costs.

The cost estimates developed are order of magnitude costs to give an indication of probable cost to implement. It is normally expected that an estimate of this type would be accurate within +50% or -30%. A 30% design contingency was applied to the total construction costs and a 3.5% per year escalation rate to the construction year was used to account for inflation. Table 5-38 presents the 2013 unit pipe costs used for the estimates which include a fittings allowance, bedding materials, and installation costs. Appendix 5-G contains more detailed cost estimates for the pipeline projects.

**Table 5-38**
**Pipe Material and Unit Cost Assumptions**

| Pipe Size (inches) | Pipe Material | 2013 Unit Cost ($/lf) (1) |
|---|---|---|
| 8 | PVC | $120 |
| 12 | PVC | $135 |
| 16 | PVC | $150 |
| 18 | PVC | $175 |
| 20 | PVC | $180 |
| 21 | PVC | $190 |
| 24 | PVC/DIP | $275 |
| 30 | Steel/DIP | $325 |
| 36 | Steel/DIP | $350 |
| 42 | Steel/DIP | $375 |

(1) Unit costs include a fittings allowance, bedding materials, and installation.

### 5.12.2 Capital Improvement Plans by Planning Period

Table 5-39, Table 5-40, and Table 5-41 present the near-term (2014-2023), mid-term (2024-2033), and long-term (2034-2063) capital improvement plans for potable water storage and distribution, respectively. Table 5-39 includes 2013 projects for reference but those projects are not considered part of the near-term capital improvement plan as they are currently in progress or under construction. The 2014 budget is based on the actual BOPU budget and uses cost estimates established by BOPU. Prior to these capital improvement projects being implemented, the scope and sizing of each project should be verified via pre-design investigation and planning including field confirmations, hydraulic modeling, cost estimating, and siting and/or alignment studies.

**Table 5-39**
**Near-term (2014-2023) Recommended Capital Improvement Plan**

| Item # | CIP ID | Project | Adjusted Budget FY 2013 | Proposed Budget FY 2014[(5)] | Projection FY 2015 | Projection FY 2016 | Projection FY 2017 | Projection FY 2018 | Projection FY 2019 | Projection FY 2020 | Projection FY 2021 | Projection FY 2022 | Projection FY 2023 | Near-term Expenditures Based on Year of Construction Dollars |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2013-PD-1 | Southern Water Transmission Main - Phase II (In Progress) | $25,202,039 | $4,261,200 | | | | | | | | | | $4,261,200 |
| 2 | 2013-PD-2 | East Pershing Blvd from Dunn to Converse - City Project (In Progress) | $1,513,220 | | | | | | | | | | | - |
| 3 | 2013-PD-3 | West Pershing Blvd from I-25 to Pioneer - WYDOT Project (Completed) | $536,265 | | | | | | | | | | | - |
| 4 | 2013-PD-4 | Pressure Management Project Phase I - Dell Range Zone (Completed) | $1,414,528 | | | | | | | | | | | - |
| 5 | 2013-PD-5 | Snyder Avenue Reconstruction - City Project (In Progress) | $853,900 | | | | | | | | | | | - |
| 6 | 2013-PD-6 | East 7th St from Warren to Alexander (In Progress) | $461,400 | | | | | | | | | | | - |
| 7 | NT-PD-1 | Distribution Main Rehabilitation Program (Rehab/Replace/Upsize) | $1,879,137 | $1,292,400 | $2,000,000 | $2,070,000 | $2,142,500 | $2,217,500 | $2,295,100 | $2,375,400 | $2,458,500 | $2,544,500 | $2,633,600 | $22,029,500 |
| 8 | NT-PD-2 | Reimburse Oversized Water Mains[(1)] | $519,483 | | $300,000 | $310,500 | $321,400 | $332,600 | $344,200 | $356,200 | $368,700 | $381,600 | $395,000 | $3,110,200 |
| 9 | NT-PD-3 | Special Water Projects[(1)] | $219,390 | $400,000 | $400,000 | $414,000 | $428,500 | $443,500 | $459,000 | $475,100 | $491,700 | $508,900 | $526,700 | $4,547,400 |
| 10 | NT-PD-4 | Distribution System Monitoring | | *Costs in Volume 10* | | | | | | | | | | - |
| 11 | NT-PD-5 | Dillon Avenue Water Dispensing Station | | $50,000 | | | | | | | | | | $50,000 |
| 12 | NT-PD-6 | Unidirectional Flushing Program Study | | | $75,000 | | | | | | | | | $75,000 |
| 13 | NT-PD-7 | Southern Water Transmission Main - Phase III | | $1,800,000 | $14,276,000 | | | | | | | | | $16,076,000 |
| 14 | NT-PD-8 | FY 14 Distribution Main Rehabilitation B List | | $1,170,600 | | | | | | | | | | $1,170,600 |
| 15 | NT-PD-9 | Logan Ave from Nationway to Pershing - City Project | $75,000 | $1,540,000 | | | | | | | | | | $1,540,000 |
| 16 | NT-PD-10 | 19th St from Central to Morrie - City Project | | | $635,500 | | | | | | | | | $635,500 |
| 17 | NT-PD-11 | Pressure Management Phase II - City North/Central/South Zones[(2)] | | | | | $2,000,000 | | | | | | | $2,000,000 |
| 18 | NT-PD-12 | Campstool Road from Frontier Refinery to Livingston | | | | $922,500 | | | | | | | | $922,500 |
| 19 | NT-PD-13 | Round Top Storage Reservoir No. 2 - 5 MG | | | | | | | $10,000,000 | | | | | $10,000,000 |
| 20 | NT-PD-14 | Demolish Round Top WTP Building[(2)] | | | | | | | | $2,000,000 | | | | $2,000,000 |
| 21 | NT-PD-15 | Swan Ranch Pump Station - 4,000 gpm | | *Cost included in Item 1* | | | | | | | | | | - |

| Item # | CIP ID | Project | Adjusted Budget FY 2013 | Proposed Budget FY 2014[5] | Projection FY 2015 | Projection FY 2016 | Projection FY 2017 | Projection FY 2018 | Projection FY 2019 | Projection FY 2020 | Projection FY 2021 | Projection FY 2022 | Projection FY 2023 | Near-term Expenditures Based on Year of Construction Dollars |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | NT-PD-16 | Swan Ranch Storage Reservoir No. 2 - 3 MG[2/4] | | | | | | $6,000,000 | | | | | | $6,000,000 |
| 23 | NT-PD-17 | Southern Transmission Mains by 2023[2] | | | | | $3,864,000 | $6,768,000 | | | | | | $10,632,000 |
| 24 | NT-PD-18 | Southern Distribution Mains by 2023[2/3] | | | $972,000 | | $3,089,000 | | | | $6,316,000 | $2,905,000 | $4,066,000 | $17,348,000 |
| 25 | NT-PD-19 | Northern Distribution Mains by 2023[2/3] | | | | | | | $2,172,000 | | | | | $2,172,000 |
| 26 | NT-PD-20 | Pressure Management Phase III - Additional Near-term Pressure Zones[2/4] | | | | | $1,000,000 | | | | | $500,000 | $500,000 | $2,000,000 |
| 27 | NT-PD-21 | Buffalo Ridge Pump Station Upgrade - 2,000 gpm | | | | $1,000,000 | | | | | | | | $1,000,000 |
| 28 | NT-PD-22 | 19th Street (Snyder to Central) – City Project | | | | $430,500 | | | | | | | | $430,500 |
| **Total Projects by Year** | | | $32,674,400 | $10,514,200 | $18,658,500 | $5,147,500 | $12,845,400 | $15,761,600 | $15,270,300 | $5,206,700 | $9,634,900 | $6,840,000 | $8,121,300 | $108,000,400 |
| | | | | | | | | | | | | | Average Cost per Year (over 10 years) | $10,800,000 |

[1] This project can involve unused funds being transferred over year to year. Value shown is estimated maximum expenditure per year (including escalation) which does not estimate transferred funding from previous year.

[2] This project could be delayed to future years due to actual development or budgeting priority; year shown is only representative of anticipated development timing or system need and project sequencing, actual project timing could vary.

[3] This project is system growth-related to serve future development areas with a majority of the project paid by developers (assumed 100% of shown cost) and BOPU participating in infrastructure oversizing costs, if necessary.

[4] This project is system growth-related to serve future development areas with a majority of the project by developers paid (assumed 80% of shown cost) and BOPU participating in infrastructure oversizing costs (assumed 20% of shown cost), if necessary.

[5] The proposed FY2014 budget does not include funds carried over from FY 2013 for projects that were not yet completed.

**Table 5-40**
**Mid-term (2024-2033) Recommended Capital Improvement Plan**

| Item # | CIP ID | Project | Cost Estimate (Based on 2028 Dollars) |
|---|---|---|---|
| 1 | MT-PD-1 | Distribution Main Rehabilitation Program (Rehab/Replace/Upsize) | $31,977,400 |
| 2 | MT-PD-2 | Reimburse Oversized Water Mains(1) | $4,795,600 |
| 3 | MT-PD-3 | Special Water Projects(1) | $6,395,000 |
| 4 | MT-PD-4 | Distribution System Monitoring | *Costs in Volume 10* |
| 5 | MT-PD-5 | Chalk Bluff Pump Station - 3,500 gpm(2/4) | $3,000,000 |
| 6 | MT-PD-6 | Southern Transmission Mains by 2033(2) | $32,212,000 |
| 7 | MT-PD-7 | Southern Distribution Mains by 2033(2/3) | $41,490,000 |
| 8 | MT-PD-8 | Southeast Storage Reservoir - 3 MG(2/4) | $7,500,000 |
| 9 | MT-PD-9 | Northeast Pump Station - 2,500 gpm(2/4) | $2,000,000 |
| 10 | MT-PD-10 | Northern Distribution Mains by 2033(2/3) | $18,592,000 |
| 11 | MT-PD-11 | Pressure Management Phase IV - Mid-term Pressure Zones(2/4) | $5,000,000 |
| 12 | MT-PD-12 | Southern Water Transmission Main - Phase IV(2) | $16,829,000 |
| 13 | MT-PD-13 | Southeast Pump Station - 3,500 gpm(2/4) | $3,000,000 |
| - | | Total Projects | $173,791,000 |
| | | Average Cost per Year (over 10 years) | $17,379,100 |

(1) This project can involve unused funds being transferred over year to year. Value shown is estimated maximum expenditure per year (including escalation) which does not estimate transferred funding from previous year.

(2) This project could be delayed to future years due to actual development or budgeting priority; year shown is only representative of anticipated development timing or system need and project sequencing, actual project timing could vary.

(3) This project is system growth-related to serve future development areas with a majority of the project paid by developers (assumed 100% of shown cost) and BOPU participating in infrastructure oversizing costs, if necessary.

(4) This project is system growth-related to serve future development areas with a majority of the project by developers paid (assumed 80% of shown cost) and BOPU participating in infrastructure oversizing costs (assumed 20% of shown cost), if necessary.

**Table 5-41**
**Long-term (2034-2063) Recommended Capital Improvement Plan**

| Item # | CIP ID | Project |
|---|---|---|
| 1 | LT-PD-1 | Distribution Main Rehabilitation Program (Rehab/Replace/Upsize) |
| 2 | LT-PD-2 | Reimburse Oversized Water Mains[(1)] |
| 3 | LT-PD-3 | Special Water Projects[(1)] |
| 4 | LT-PD-4 | Distribution System Monitoring |
| 5 | LT-PD-5 | Southern Transmission Mains by 2063[(2)] |
| 6 | LT-PD-6 | Southern Distribution Mains by 2063[(2/3)] |
| 7 | LT-PD-7 | Chalk Bluff Storage Reservoir - 2 MG[(2/4)] |
| 8 | LT-PD-8 | Northern Distribution Mains by 2063[(2/3)] |
| 9 | LT-PD-9 | Pressure Management Phase V - Long-term Pressure Zones[(2/4)] |

[(1)] This project can involve unused funds being transferred over year to year.

[(2)] This project could be delayed to future years due to actual development or budgeting priority; year shown is only representative of anticipated development timing or system need and project sequencing, actual project timing could vary.

[(3)] This project is system growth-related to serve future development areas with a majority of the project paid by developers and BOPU participating in infrastructure oversizing costs, if necessary.

[(4)] This project is system growth-related to serve future development areas with a majority of the project paid by developers and BOPU participating in infrastructure oversizing costs, if necessary.

# Figure 5-20
# Potable Storage and Distribution Capital Improvement Projects

**(available in the inside back cover pocket of this binder)**

# Appendices

# Volume 5 – Potable Water Storage and Distribution

(THIS PAGE WAS INTENTIONALLY LEFT BLANK)

# Appendix 5-A
# Existing Operations Information

- Pump Curves and Related Information
- PRV Settings

BUFFALO RIDGE VAULT

# KEYSTONE

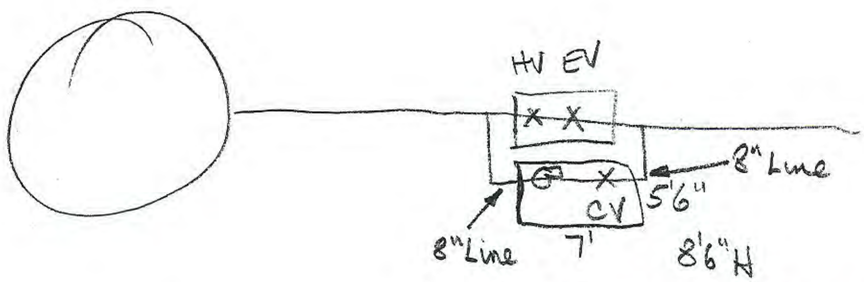
## VALVE SPECIALISTS

—Keystone Valve—Keystone Actuators & Controls— Keystone Ballcentric Plug—SVF—

—Golden Anderson—Fabri Valve—Prince Check—Dynaquip Ball—Flow Design Balancing—

RTmax To BRmax = 58'
BRmax To BRpump = 70'

$$\frac{\text{GPM} \times \text{HEAD}}{3960 \times .7} = \text{HP}$$




21" Dia manhole in roof

AURORA CENTRIFUGAL PUMP
(Aurora Ill) 708

TYPE OJV
GPM 2000
ORD 66-7034
SIZE 8X8X11B
HEAD FT 75'
RPM 1800

MCLEMORE - KENT KERWOOD
303 371 5730
ROTATING ASSEMBLY ~~$3329~~ 3214 + SHIPPING
$3500
4WKS

US MOTORS
50 HP 3 Ø

65AMP / 50HP

US MOTORS DEN CO
303 337 3588
VITO

ELECTRIC

RL PALMER MAGNATEC
ROBAKON

HEAT

VENTILATION

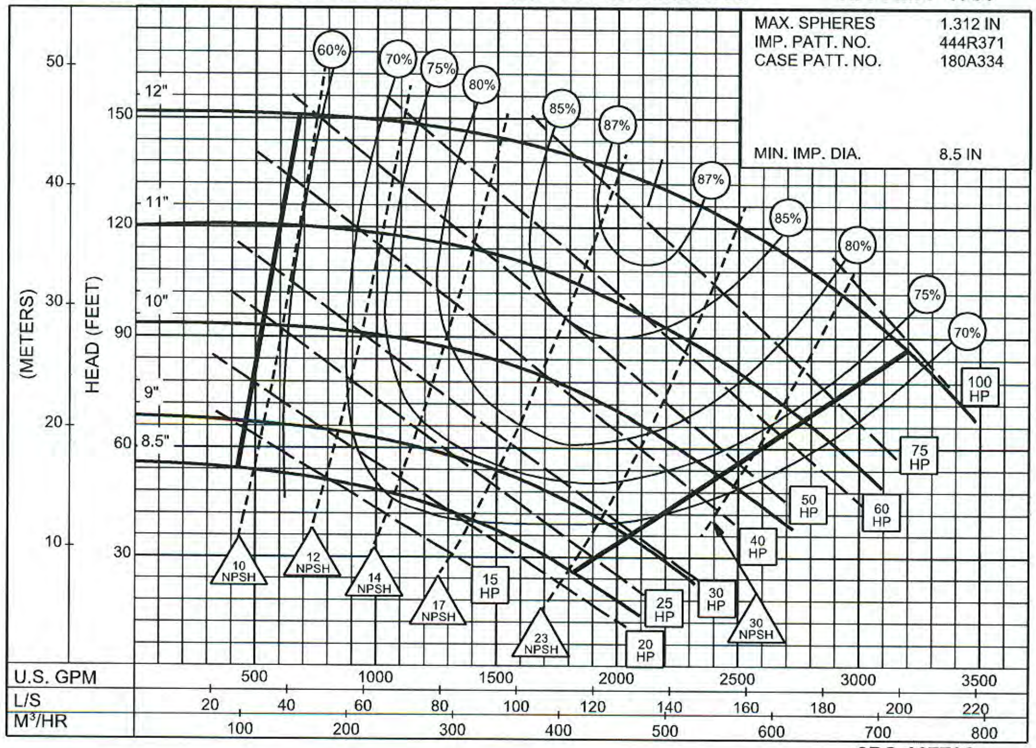
Keystone Sales — Denver 3250 Quentin St., Suite 126
Aurora, CO 80011 303-343-0425
Fax. No. 303-343-0930 800-525-0561

Supersedes Section 340/360 Page 434
Dated January 1999

# 6 x 6 x 12B
# SERIES 340 OR 360
## ENCLOSED IMPELLER

**1750** RPM

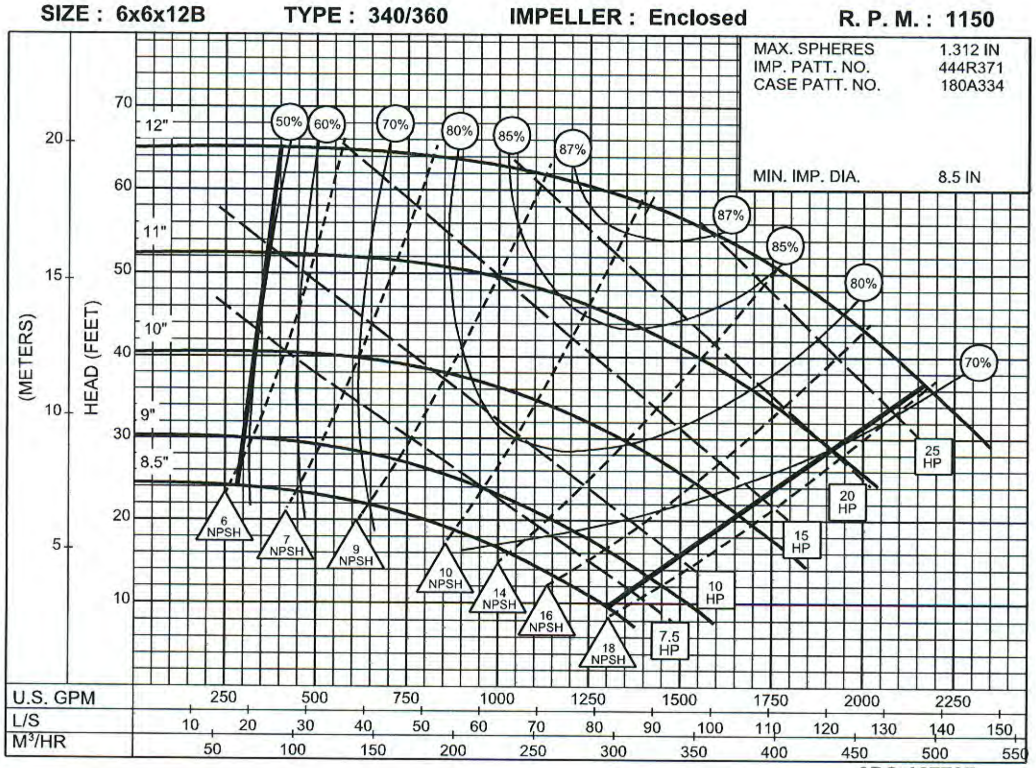
**SIZE : 6x6x12B TYPE : 340/360 IMPELLER : Enclosed R. P. M. : 1750**




3PC-167796

**1150** RPM

**SIZE : 6x6x12B TYPE : 340/360 IMPELLER : Enclosed R. P. M. : 1150**




3PC-167797

AURORA®
Pentair Pump Group

STATES WEST
WATER RESOURCES CORPORATION

1904 East 15th Street
Cheyenne, Wyoming 82001
Telephone: (307) 634-7848

P.O. Box 2092
Cheyenne, Wyoming 82003
Fax: (307) 634-7851

# Facsimile Transmission Sheet

## Fax Number (307) 634-7851

Date: 12/21/01 # of Pages Following: 2

To: JEFF P.

From: BRANDON

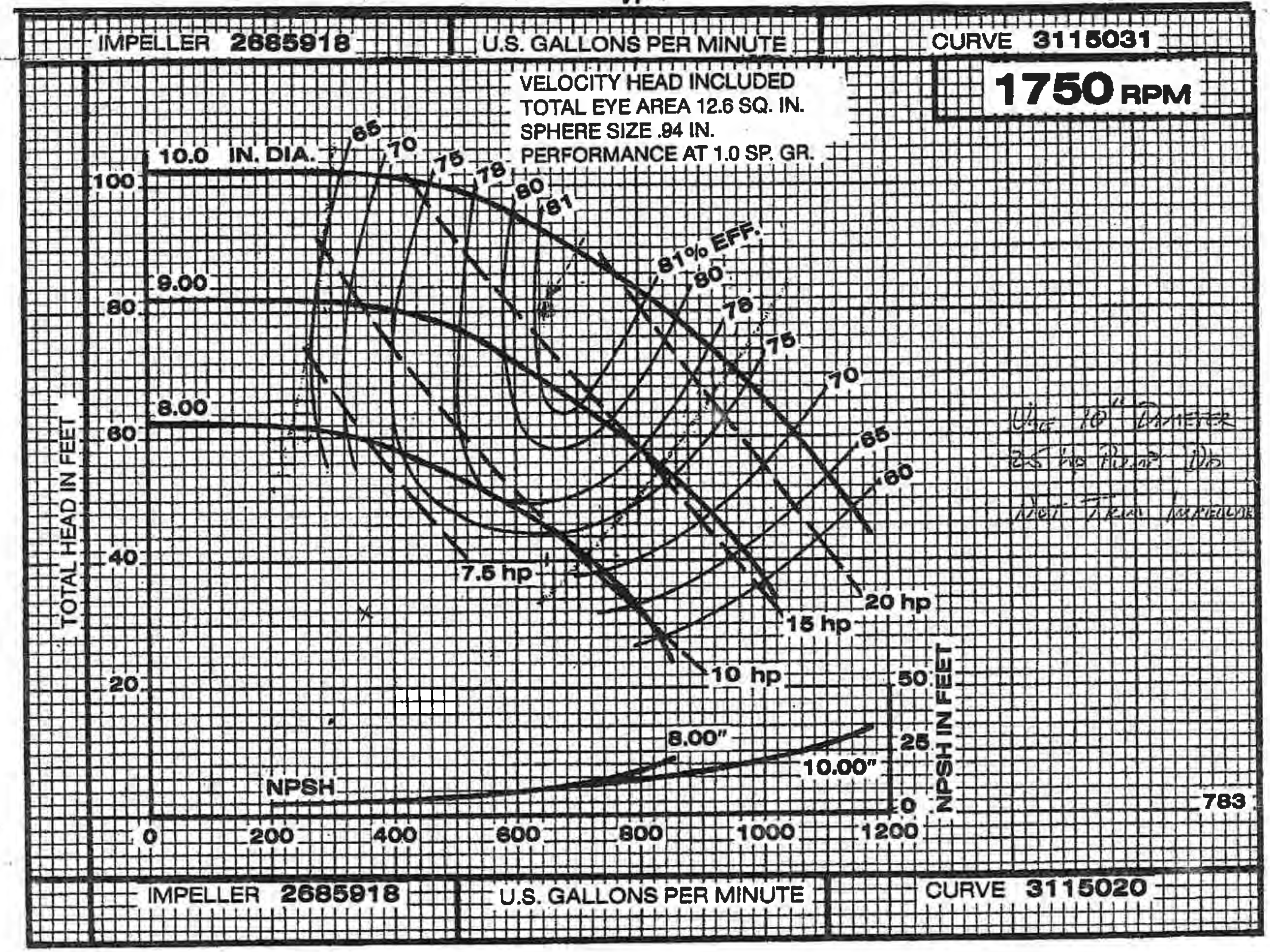
Comments: HERE IS THE PUMP CURVE FOR DEER AVE. THE IMPELLARS SHOULD NOT BE TRIMMED AS PER SUBMITTAL

**Peerless Pump Company**
a member of the Sterling Group

# END SUCTION GENERAL SERVICE PUMPS

**Series C & F Type 1040A Size 4 x 5 x 10**

**SECTION 2340**
**Page 15**
**July 5, 1991**



Customer: Systems By Moltec,Inc.
805 West Platte Rd

82001-1718
Casper
Phone: 307-234-5309
Fax: 307-234-3407
Project:

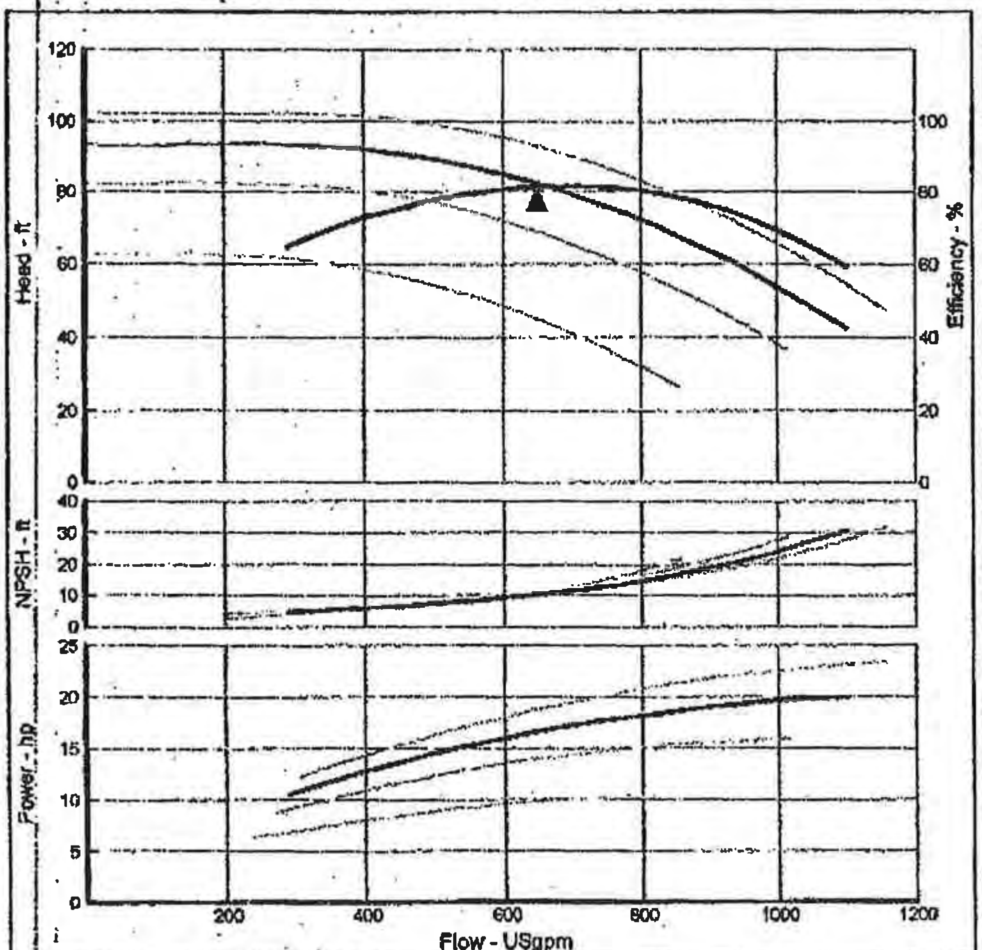
STERLING

STERLING PEERLESS PUMP

Sterling Fluid Systems (USA), Inc. 2005 Dr M L King Jr St
P O Box 7026 Indianapolis, IN 46207-7026
Fax: 317-924-7388 Ph 317-925-9661

Page No: 2
Quote No.: 2709-2
Date: 15th May 1998

| | | | |
|---|---|---|---|
| Type: | C - End Suction Close Coupled General Purpose | Item: | Item1 |
| Pump Model: | Peerless - C1040A | Market: | Basic Selection |
| Nom. Speed: | 1750 RPM | Fluid: | Water |
| Impeller Dia.: | 9.56 inch | Temperature: | 70 °F |
| Curve No.: | 3115020 | Viscosity: | 1 cStokes |
| Impeller No.: | | Sp. Gravity: | 1 |




| | |
|---|---|
| Duty Flow | 650 USgpm |
| Duty Head | 80 ft |
| Diameter | 9.56 inch |
| Power Required | 16.58 hp |
| NPSH Required | 10.302 ft |
| Efficiency | 81.6 % |

| | |
|---|---|
| Peak Power | 19.94 hp |
| Tolerance | Hydraulic Institute |

| Flow (USgpm) | Head (ft) | Pump Efficiency (%) | Power Required (hp) | NPSH Required (ft) |
|---|---|---|---|---|
| 0.0 | 93.42 | 0.0 | 5.30 | |
| 289.7 | 93.31 | 64.5 | 10.58 | 4.61 |
| 405.2. | 91.77 | 72.9 | 12.88 | 6.08 |
| 520.8 | 88.45 | 78.4 | 14.83 | 7.77 |
| 636.4 | 83.16 | 81.4 | 16.41 | 9.99 |
| 751.9 | 75.88 | 81.5 | 17.68 | 13.06 |
| 867.5 | 66.70 | 78.1 | 18.71 | 17.30 |
| 983.1 | 55.67 | 70.8 | 19.51 | 23.02 |
| 1098.6 | 42.70 | 59.4 | 19.94 | 30.55 |

Deer Ave Pumps

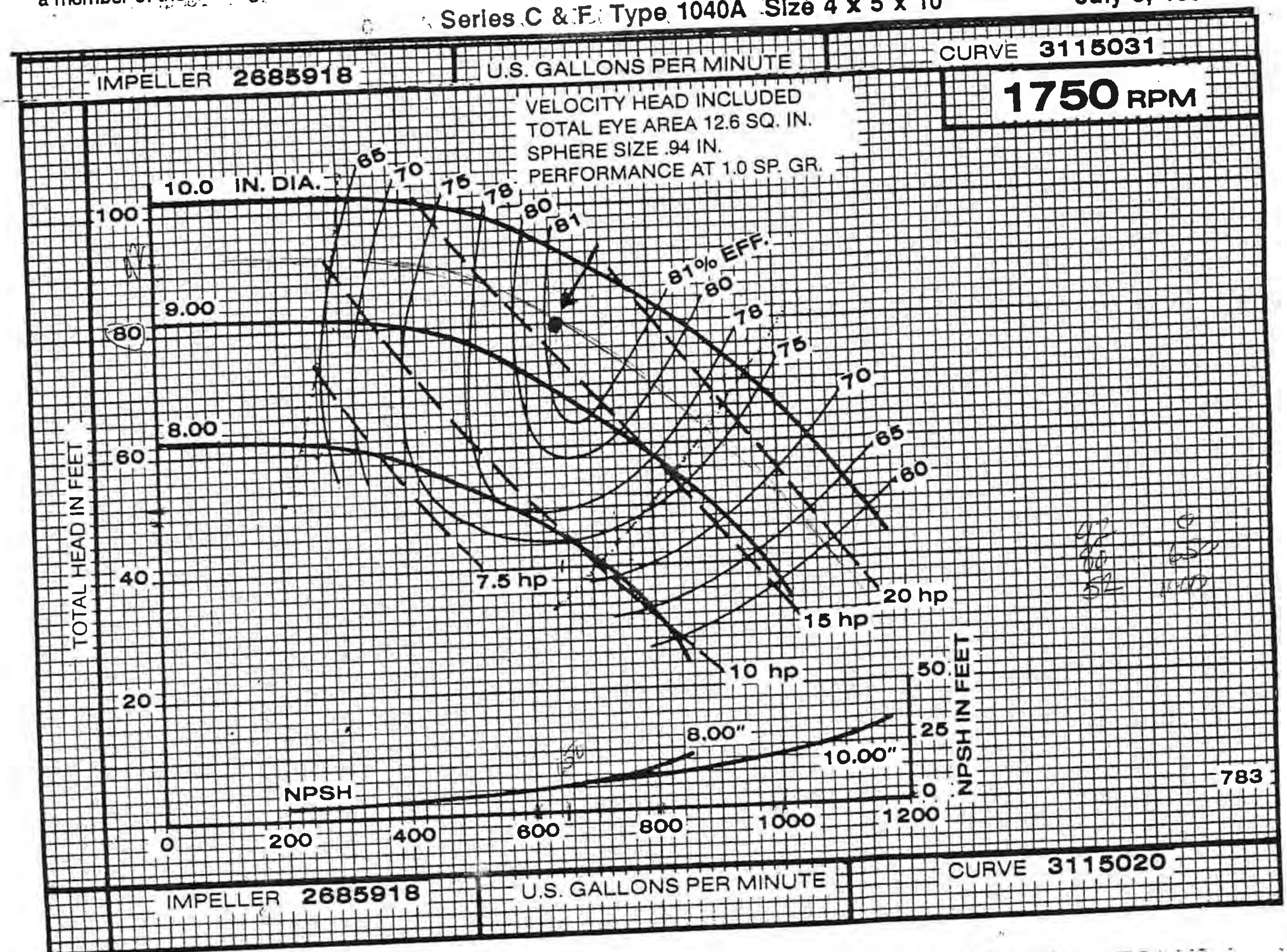
Set Pt = 100 psi discharge pressure

**Peerless Pump Company**
a member of the Sterling Group

# END SUCTION GENERAL SERVICE PUMPS

Series C & F Type 1040A Size 4 x 5 x 10

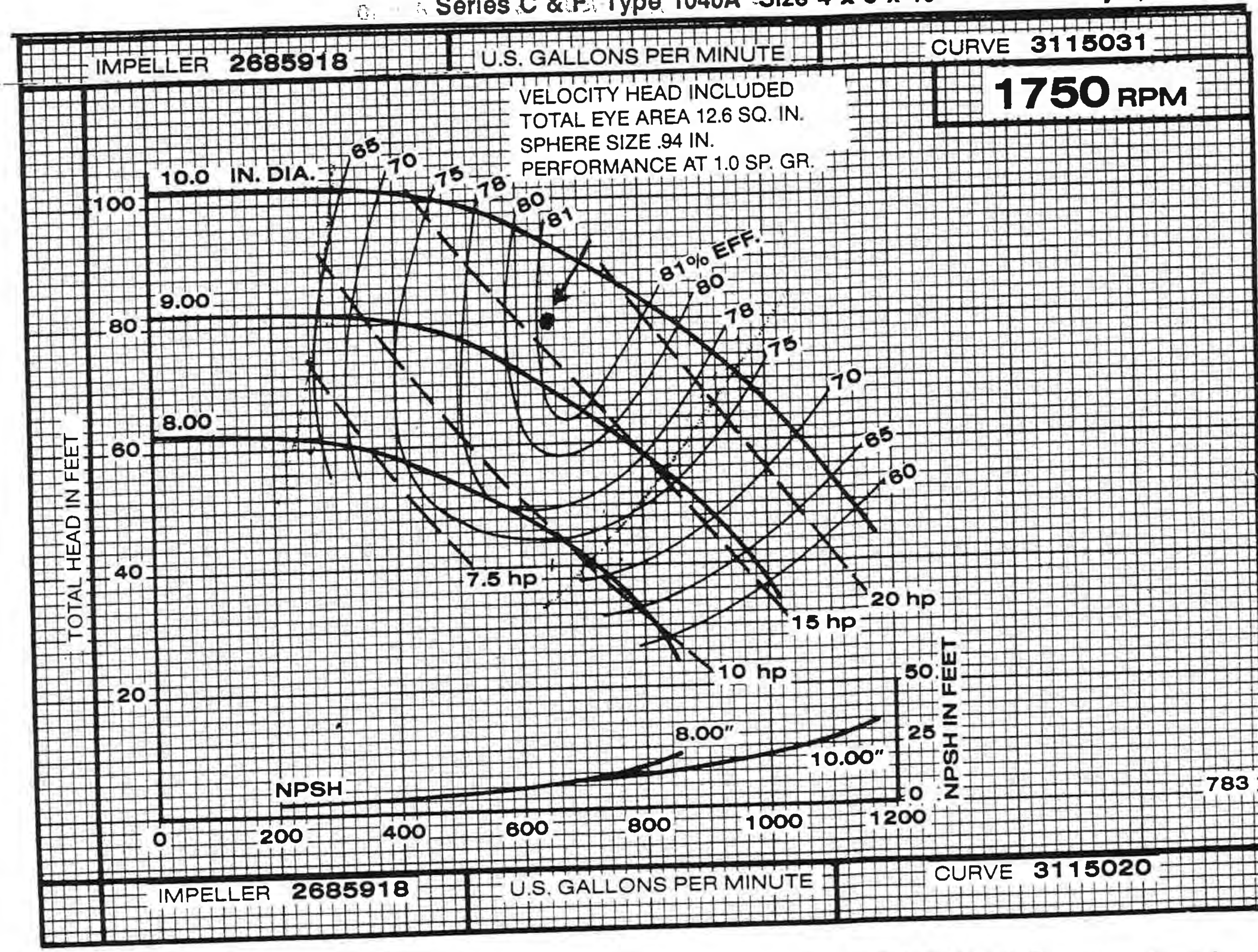




Peerless Pump Company
a member of the Sterling Group

# END SUCTION GENERAL SERVICE PUMPS
Series C & F Type 1040A Size 4 x 5 x 10






Deer Ave

Customer : Systems By Moltec,Inc.
805 West Platte Rd

82001-1718
Casper
Phone : 307-234-5309
Fax : 307-234-3407
Project :

**STERLING**

STERLING PEERLESS PUMP

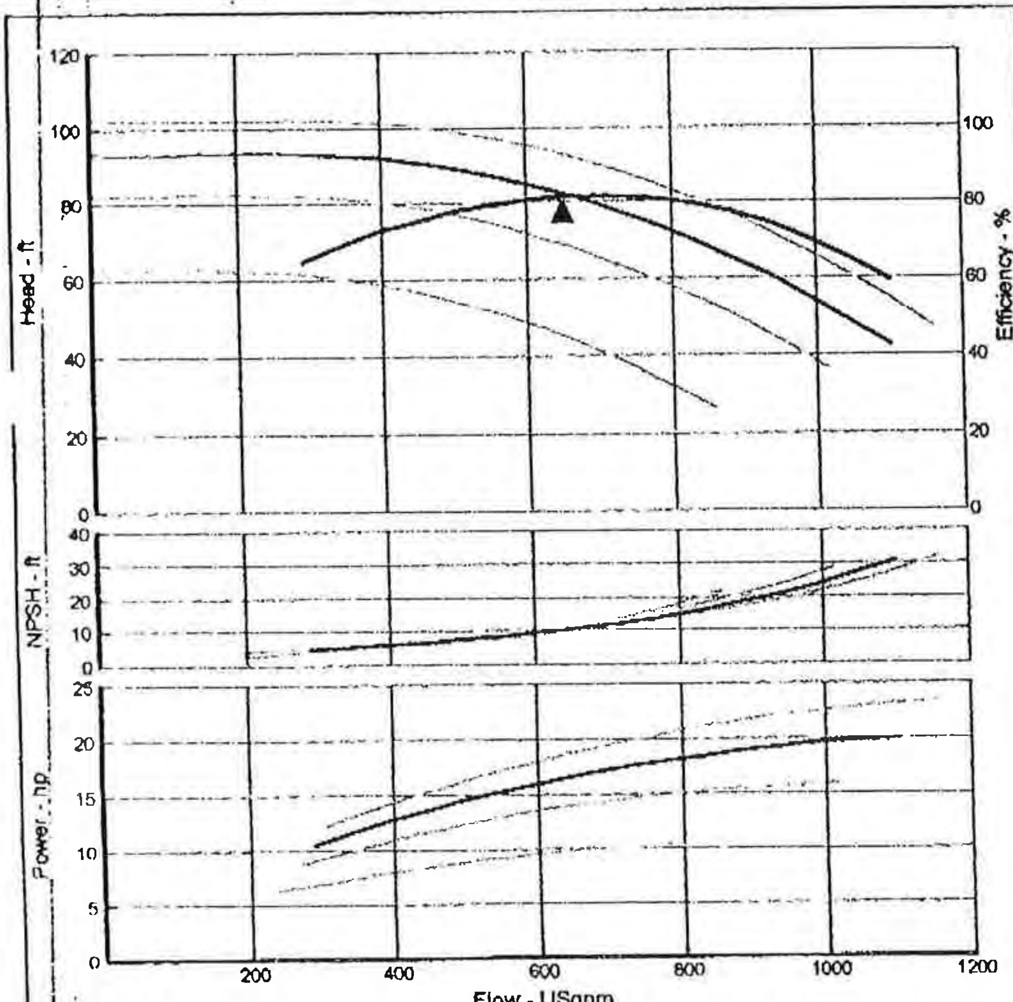
Sterling Fluid Systems (USA), Inc. 2005 Dr M L King Jr St
P O Box 7026 Indianapolis, IN 46207-7026
Fax: 317-924-7388 Ph 317-925-9661



Quote No. : 2709-2

Date : 15th May 1998

| | | | |
|---|---|---|---|
| Type: | C - End Suction Close Coupled General Purpose | Item : | Item1 |
| Pump Model: | Peerless - C1040A | Market : | Basic Selection |
| Nom. Speed: | 1750 RPM | Fluid: | Water |
| Impeller Dia.: | 9.56 Inch | Temperature: | 70 °F |
| Curve No.: | 3115020 | Viscosity: | 1 cStokes |
| Impeller No.: | | Sp. Gravity: | 1 |




| | |
|---|---|
| Duty Flow | 650 USgpm |
| Duty Head | 80 ft |
| Diameter | 9.56 Inch |
| Power Required | 16.58 hp |
| NPSH Required | 10.302 ft |
| Efficiency | 81.6 % |

| | |
|---|---|
| Peak Power | 19.94 hp |
| Tolerance | Hydraulic Institute |

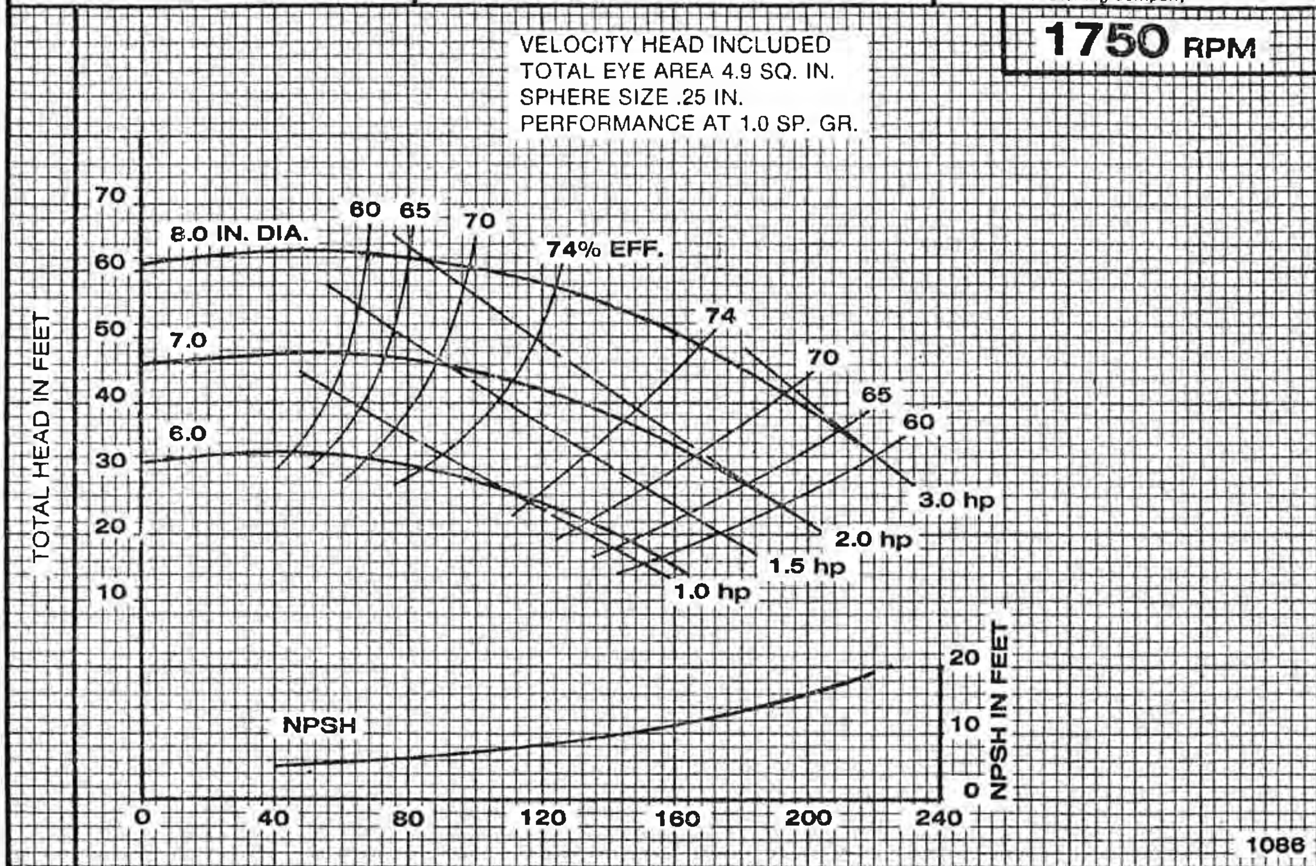
| Flow (USgpm) | Head (ft) | Pump Efficiency (%) | Power Required (hp) | NPSH Required (ft) |
|---|---|---|---|---|
| 0.0 | 93.42 | 0.0 | 5.30 | |
| 289.7 | 93.31 | 64.5 | 10.58 | 4.61 |
| 405.2 | 91.77 | 72.9 | 12.88 | 6.08 |
| 520.8 | 88.45 | 78.4 | 14.83 | 7.77 |
| 636.4 | 83.16 | 81.4 | 16.41 | 9.99 |
| 751.9 | 75.88 | 81.5 | 17.68 | 13.06 |
| 867.5 | 66.70 | 78.1 | 18.71 | 17.30 |
| 983.1 | 55.67 | 70.8 | 19.51 | 23.02 |
| 1098.6 | 42.70 | 59.4 | 19.94 | 30.55 |

Monterey Heights

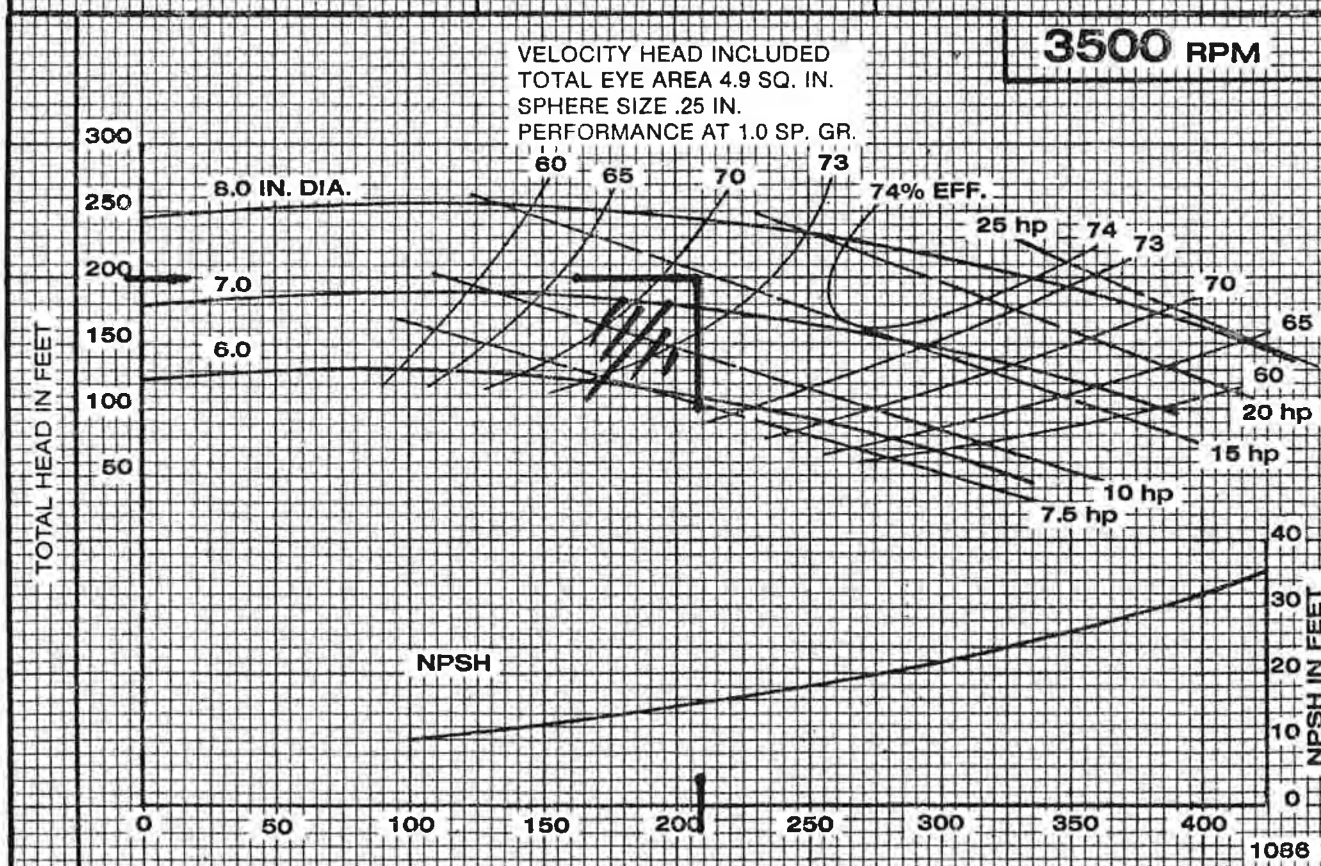
# SECTION 2340

**END SUCTION PUMPS**
Series C&F Type 820A Size 2x2½x8

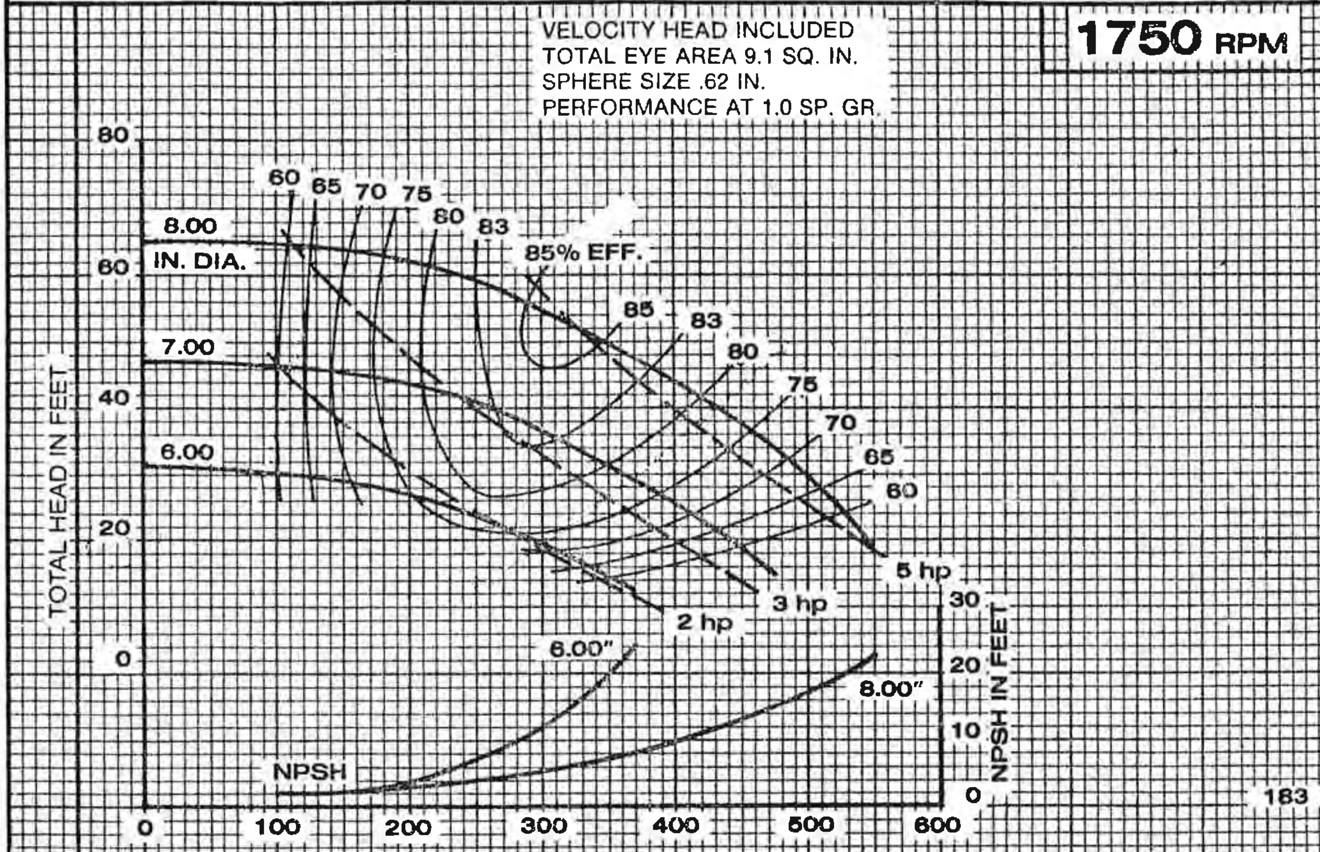
Peerless Pump
A Sterling Company



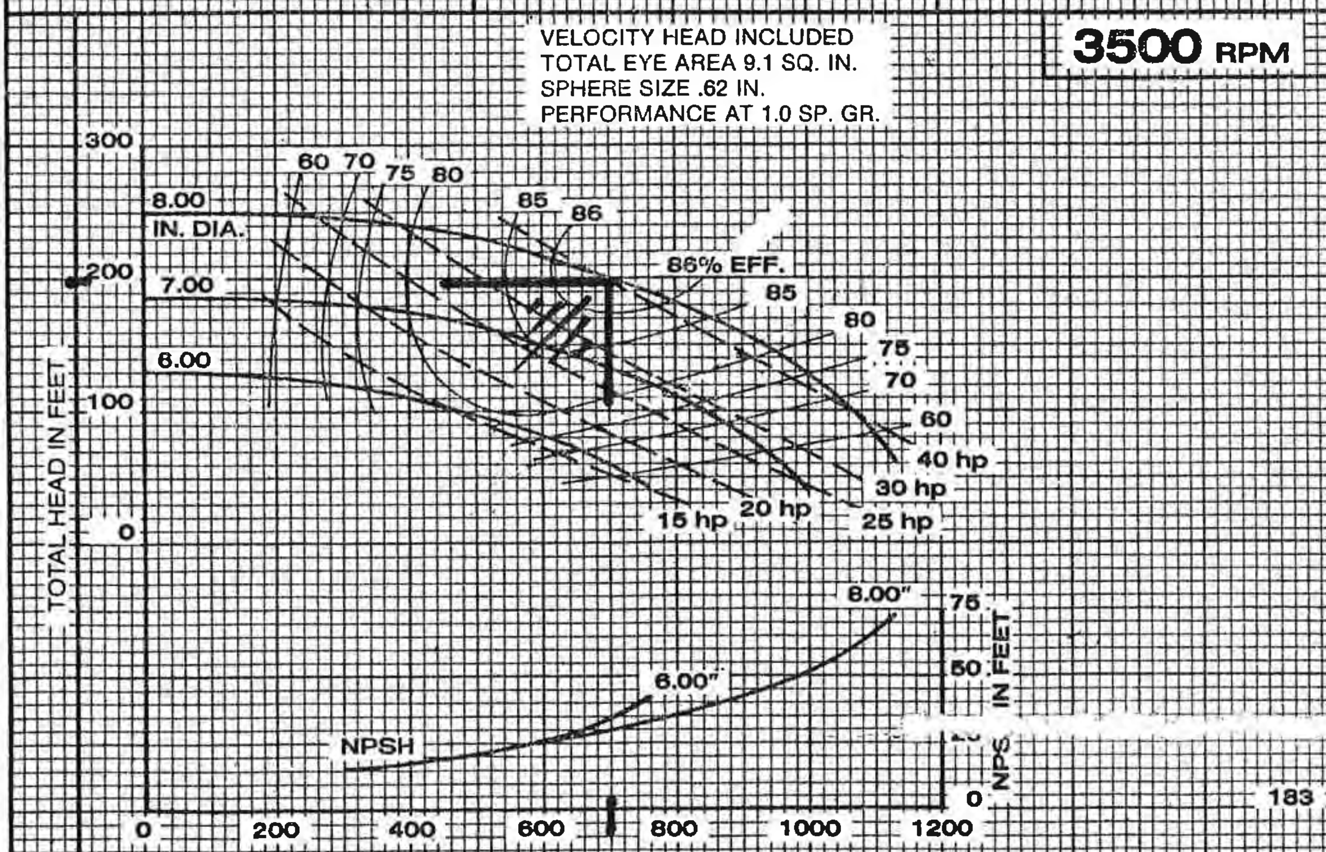

IMPELLER **V1735B** | U.S. GALLONS PER MINUTE | CURVE **3115056**



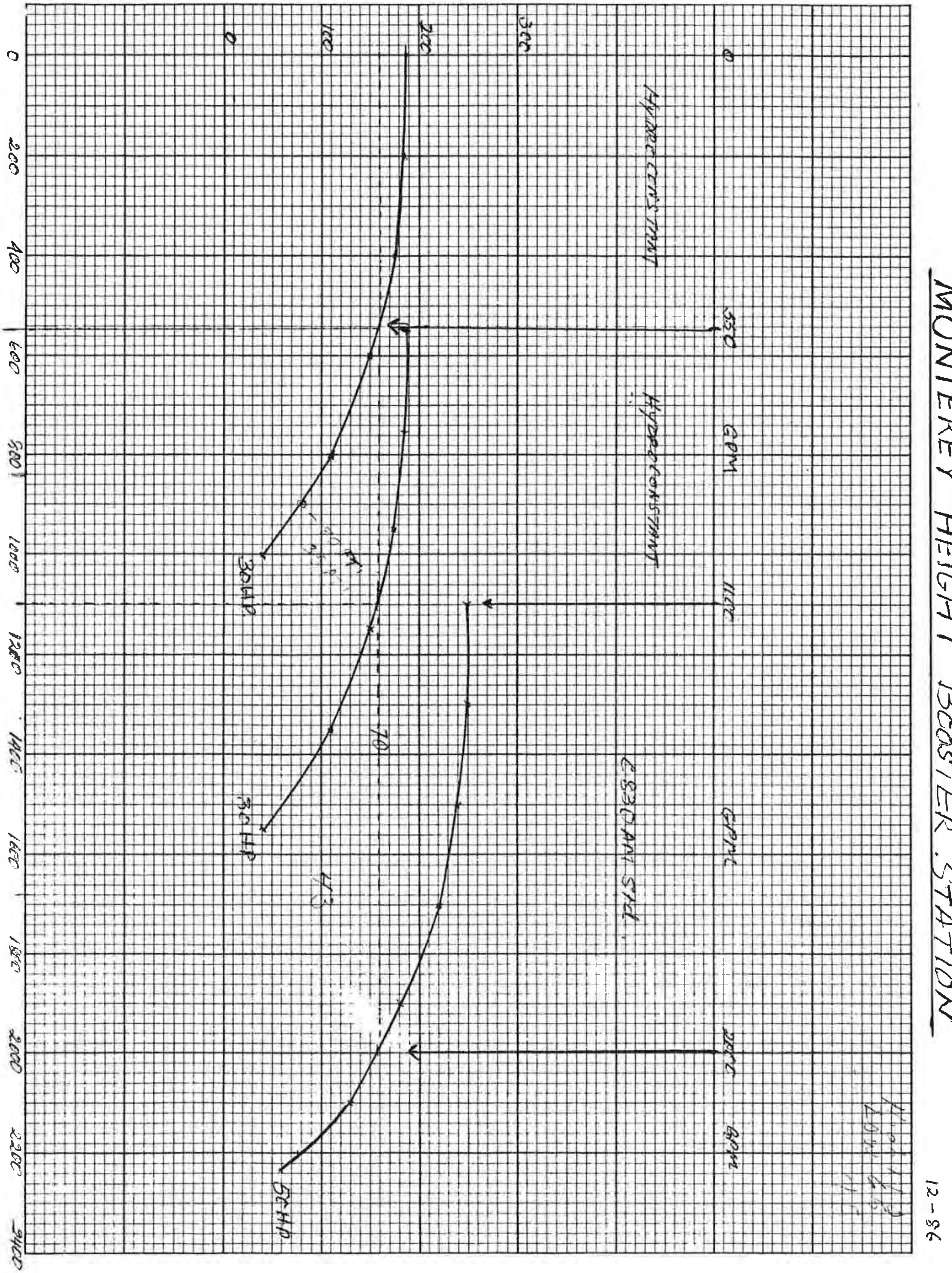

IMPELLER **V3289B** | U.S. GALLONS PER MINUTE | CURVE **3115054**




IMPELLER 2683739 | U.S. GALLONS PER MINUTE | CURVE 3115014




IMPELLER 2683747 | U.S. GALLONS PER MINUTE | CURVE 3115015

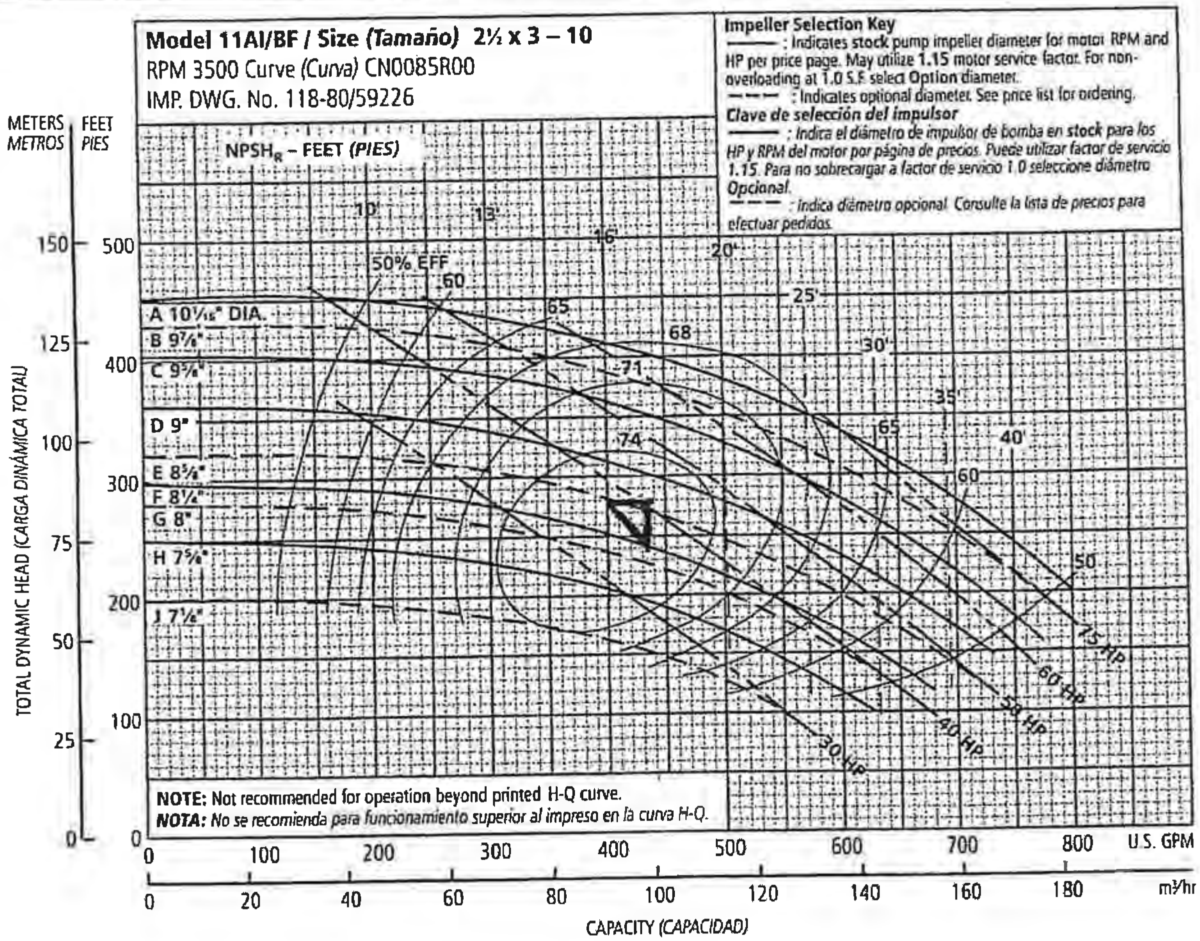

BPU CHEYENNE
MONTEREY HEIGHT BOOSTER STATION
12-86
HYDROCONSTANT
HYDROCONSTANT
C830 AM STd
30 HP
30 HP
50 HP
GPM
GPM
GPM
550
1100
2200
70
0
100
200
300
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400

# PUMP STATION TEST PRESSURE SHEET

| | WESTERN HILLS | HYDRANT #A-398 | MONTEREY HEIGHTS | WILSHIRE AVENUE A440 |
|---|---|---|---|---|
| | PUMP STATION PRESSURE | TEST POINT PRESSURE | PUMP STATION PRESSURE | TEST POINT PRESSURE |
| 27-Feb | 92 psi | 85 psi | 100 psi | 80 psi |
| 5-Mar | 92 | 85 | 99 | 85 |
| 12-Mar | 92 | 88 | 103 | 84 |
| 19-Mar | 92 | 85 | 101 | 82 |
| 26-Mar | 92 | 82-90 | 99 | 84 |
| 2-Apr | 95 | 85 | 96-102 | 80-82 |
| 9-Apr | 91 | 80-82 | 98-101 | 80 |
| 16-Apr | 98 | 84 | 100 | 78-82 |
| 23-Apr | 90 | 85 | 100 | 80-85 |
| 30-Apr | 94 | 80 | 98 | 79 |
| 7-May | 89 | 80 | 99 | 80 |
| 14-May | 84 | 75-79 | 98 | 80 |
| 21-May | 86 | 76 | 98 | 81 |
| 28-May | 102 | 84 | 100 | 82 |
| 4-Jun | 94 | 82 | 99 | 80 |
| 11-Jun | 94 | 82-84 | 99 | 80 |
| 18-Jun | 92 | 80 | 100 | 76 |
| 25-Jun | 94 | 82 | 98 | 78 |
| 2-Jul | 94 | 82 | 99 | 80 |
| 9-Jul | 94 | 80 | 99 | 78 |
| 16-Jul | 96 | 80 | 100 | 80 |
| 23-Jul | 96 | 85 | 99 | 80 |
| 30-Jul | 96 | 78 | 98 | 80 |
| 6-Aug | 94 | 80 | 99 | 80 |
| 13-Aug | 92 | 81 | 98 | 77 |
| 20-Aug | 94 | 80 | 98 | 76 |
| 27-Aug | 94 | 84 | 99 | 80 |
| 3-Sep | 92 | 80 | 99 | 78 |
| 10-Sep | 94 | 78 | 100 | 76 |
| 17-Sep | 92 | 80 | 99 | 76 |
| 24-Sep | 92 | 80 | 99 | 77 |
| 1-Oct | 94 | 78 | 99 | 78 |
| 8-Oct | 96 | 81-84 | 99 | 80 |
| 15-Oct | 100 | 76 | 99 | 76 |
| 22-Oct | 101 | 80 | 98-101 | 80 |
| 29-Oct | 94 | 83 | 100 | 80 |
| 5-Nov | 98 | 82 | 99 | 55 |
| 12-Nov | 98 | 75 | 100 | 77 |
| 19-Nov | 100 | 80 | 99 | 82 |
| 26-Nov | 100 | 80 | 99 | 78 |
| 3-Dec | 102 | 82 | 100 | 75-85 |
| 10-Dec | | | | |
| 17-Dec | | | | |
| 24-Dec | | | | |
| 31-Dec | | | | |

NRBP

# Performance Curves – 60 Hz, 3500 RPM
## *Curvas de desempeño – 60 Hz, 3500 RPM*



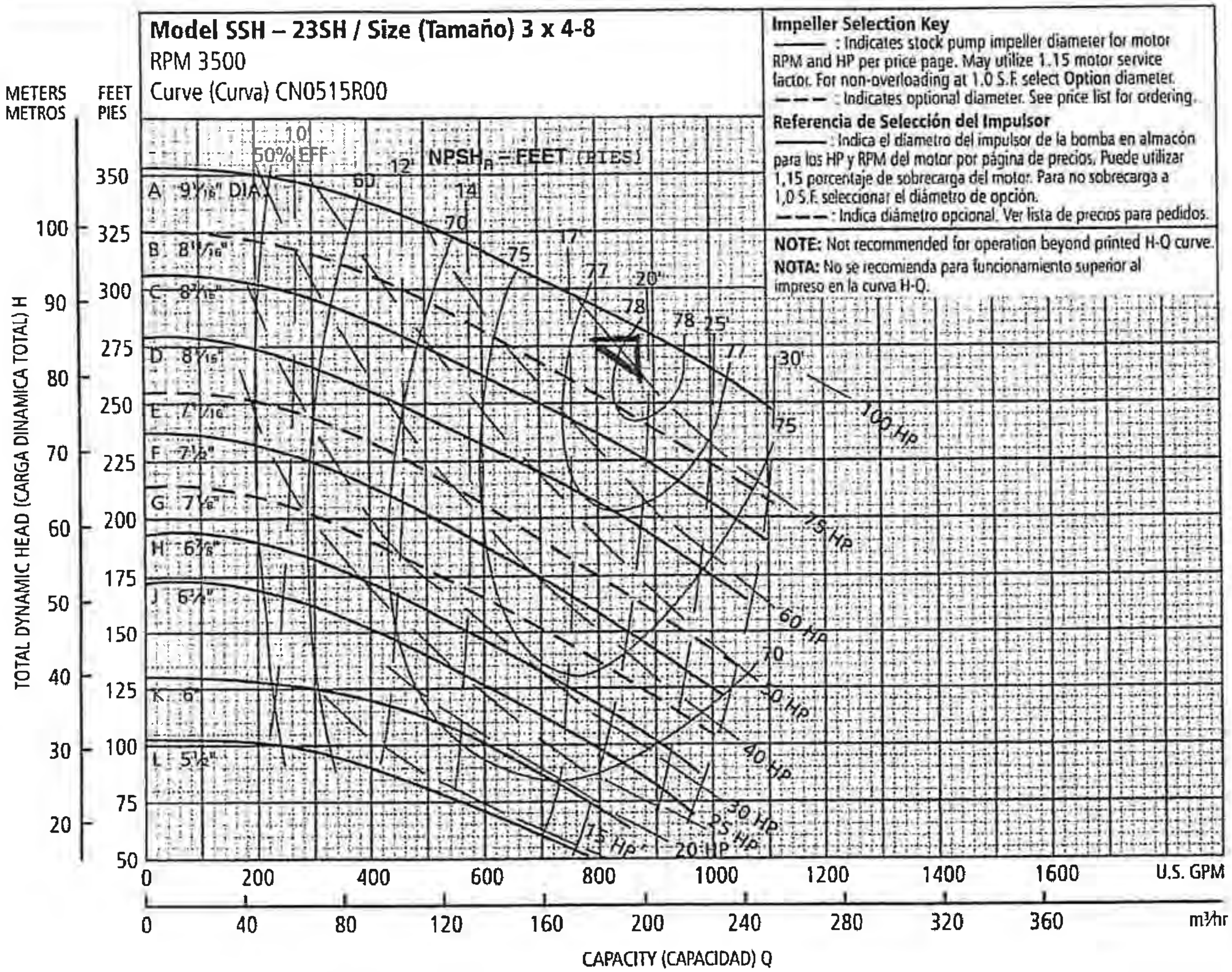

P-1 & P-2

| Optional Impeller *Impulsor optativo* | |
|---|---|
| **Ordering Code** ***Código de pedido*** | **Dia.** ***Diá.*** |
| A | 10¹⁄₁₆" |
| B | 9⅞ |
| C | 9⅝ |
| D | 9 |
| E | 8⅝ |
| F | 8¼ |
| G | 8 |
| H | 7⅝ |
| J | 7⅛ |

**NOTE:** Pump will pass a sphere to ⁵⁄₁₆" diameter.

***NOTA:*** *La bomba dejará pasar una esfera de hasta ⁵⁄₁₆ de pulgada de diámetro.*

# Performance Curves – 60 Hz, 3500 RPM
## *Curvas de Funcionamiento – 60 Hz, 3500 RPM*



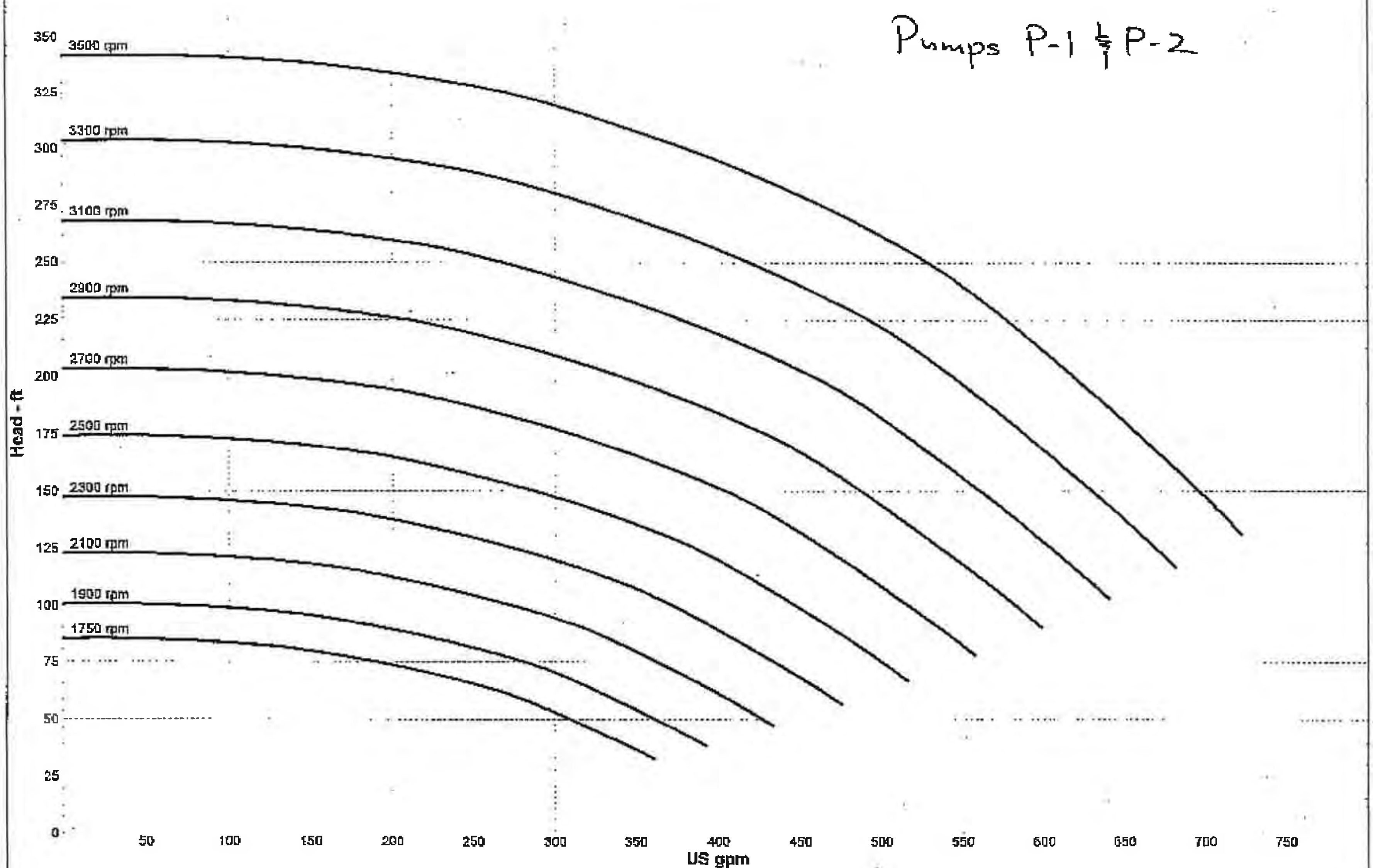

| Optional Impeller, *Impulsor Opcional* | | |
|---|---|---|
| **Impeller Code, *Código del Impulsor*** | **Dia., *Diá.*** | **Standard HP Rating, *Estándar HP Potencia*** |
| A | 9⁵⁄₁₆" | 75 |
| B | 8¹¹⁄₁₆ | 75 |
| C | 8⁷⁄₁₆ | 60 |
| D | 8¹⁄₁₆ | 50 |
| E | 7¹¹⁄₁₆ | 50 |
| F | 7½ | 40 |
| G | 7⅛ | 40 |
| H | 6⅞ | 30 |
| J | 6½ | 25 |
| K | 6 | 20 |
| L | 5½ | 15 |

**NOTE:** Pump will pass a sphere to ¾" diameter.

***NOTA:** La bomba pasará una esfera a ¾" diámetro.*

P-3, P-4, P-5

Pumps P-1 & P-2




Company: Janssen Pump
Name: John Janssen
12/20/2006

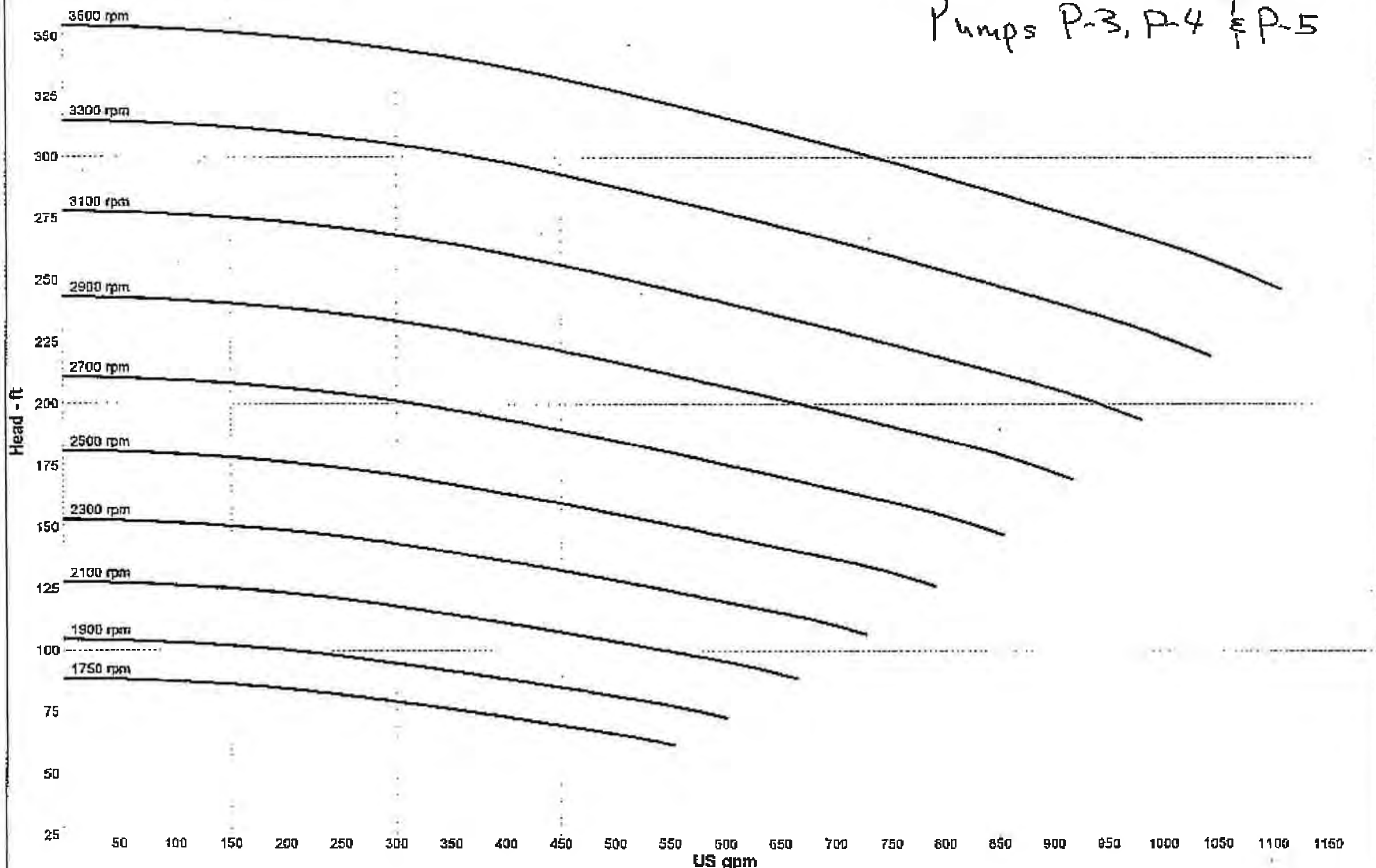
GOULDS
Catalog: Goulds GL.60, Vers 2
CC_ENDSUCT_C - 3600

Size: 11BF
~~Speed: 1750 - 3500 rpm~~
Dia: 8.8125 in
Curve: GP 3656/3756

Trimmed

GOULDS PUMPS

Pumps P-3, P-4 & P-5




Company: Janssen Pump
Name: John Janssen
12/20/2006

GOULDS
Catalog: Goulds GL.60, Vers 2
CC_ENDSUCT_C - 3600

Size: 23SH-1
Speed: 1750 - 3500 rpm
Dia: 9.0625 in
Curve: GP SSH/SSH-F

Full size impeller

GOULDS PUMPS

# ENGINEERING ORDER

The Point 1 LS

GORMAN-RUPP PUMPS

ENGINEERED SYSTEMS
Mansfield, Ohio 44902

Date: 03/26/03

Revisions: 

Serial No.: 03-6323

## SUPPLEMENT SHEET

### Pump Data

| | |
|---|---|
| Pump No. 1 Serial No.: | 1258682 |
| Pump No. 2 Serial No.: | 1258683 |
| Pump No. 3 Serial No.: | NONE |
| Pump No. 4 Serial No.: | NONE |

### Engine Data

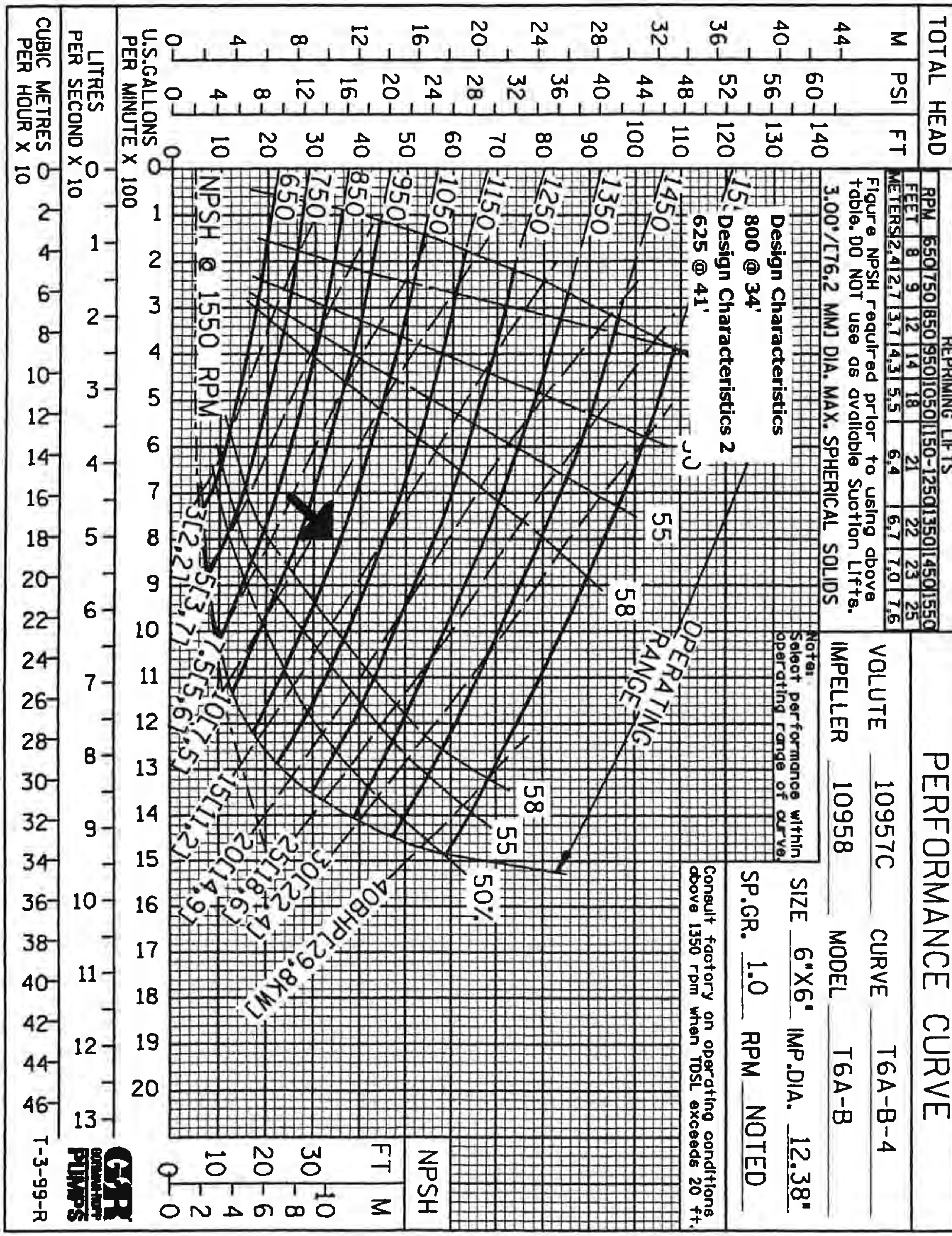
| | |
|---|---|
| Engine Serial No. ( When Applicable ) | NONE |

### Motor Data

| | |
|---|---|
| R. P. M. Full Load: | 1765 |
| Full Load Amps: | 37.4 |
| Service Factor: | 1.15 |
| Motor O/L Heater | N/A |
| Full Load Amp Setting: | 37.4 |
| Pump Motor No. 1 Serial No.: | BE95284 |
| Pump Motor No. 2 Serial No.: | BE95285 |
| Pump Motor No. 3 Serial No.: | NONE |
| Pump Motor No. 4 Serial No.: | NONE |

| Curve Data | The Point ILS | Sec. 55 | PAGE 1254 / JUNE 1999 |
|---|---|---|---|

C D




THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO

GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA

Specifications Subject to Change Without Notice

Printed In U.S.A.

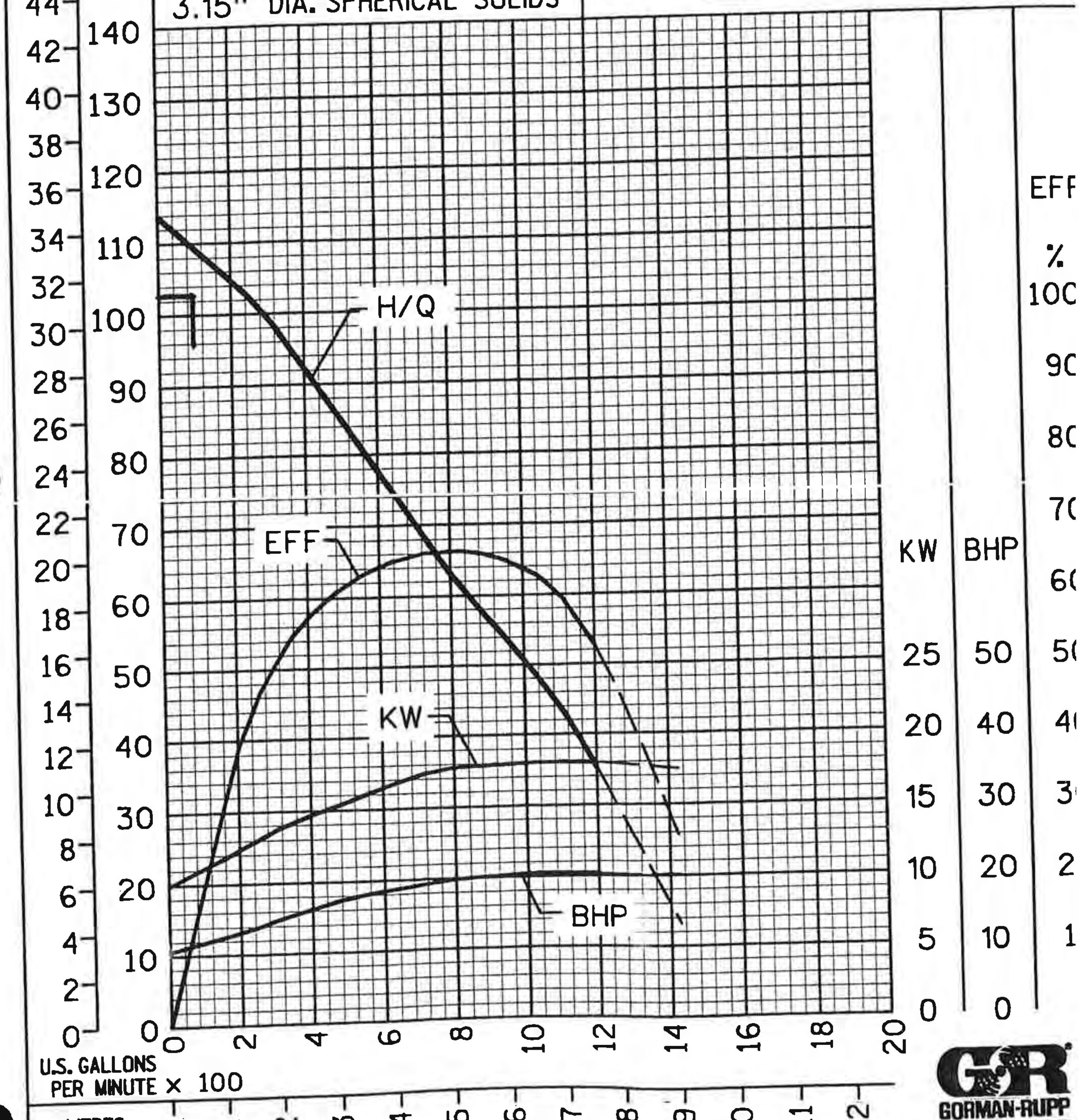
Point II LS

# PERFORMANCE CURVE

H/Q=Head/Capacity
EFF=Hydraulic Efficiency
BHP=Brake Horsepower
KW=Kilowatts Input

CURVE NO. JS4H-E21-1
MODEL JS/JT4H-E21/X21
SIZE 4" IMP. DIA. 9.76"/10.39"
SP.GR. 1.0 RPM 1750

3.15" DIA. SPHERICAL SOLIDS




GORMAN-RUPP PUMPS

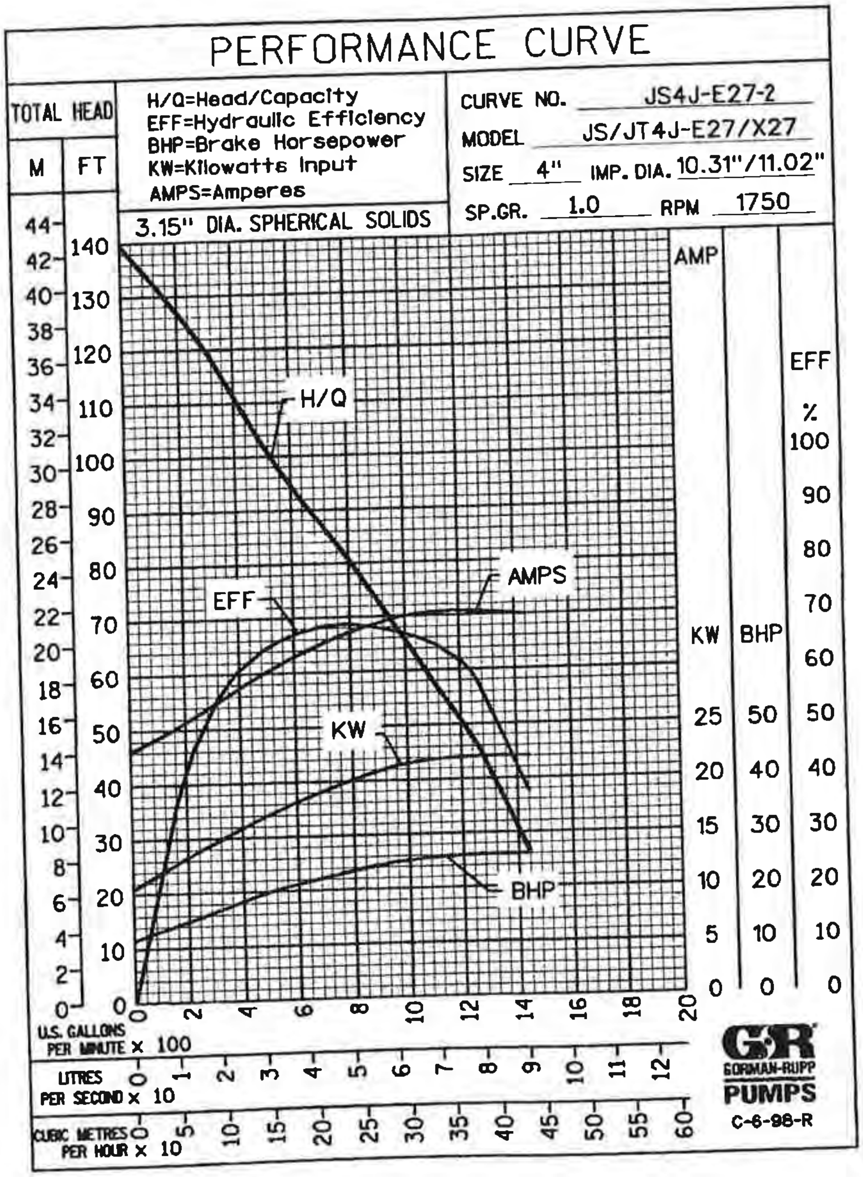
C-6-98-R

The Point Lift Station II LS

FM APPROVED



## PERFORMANCE CURVE – MODEL JS4J60–X27 ALL VOLTAGES




**CAUTION**

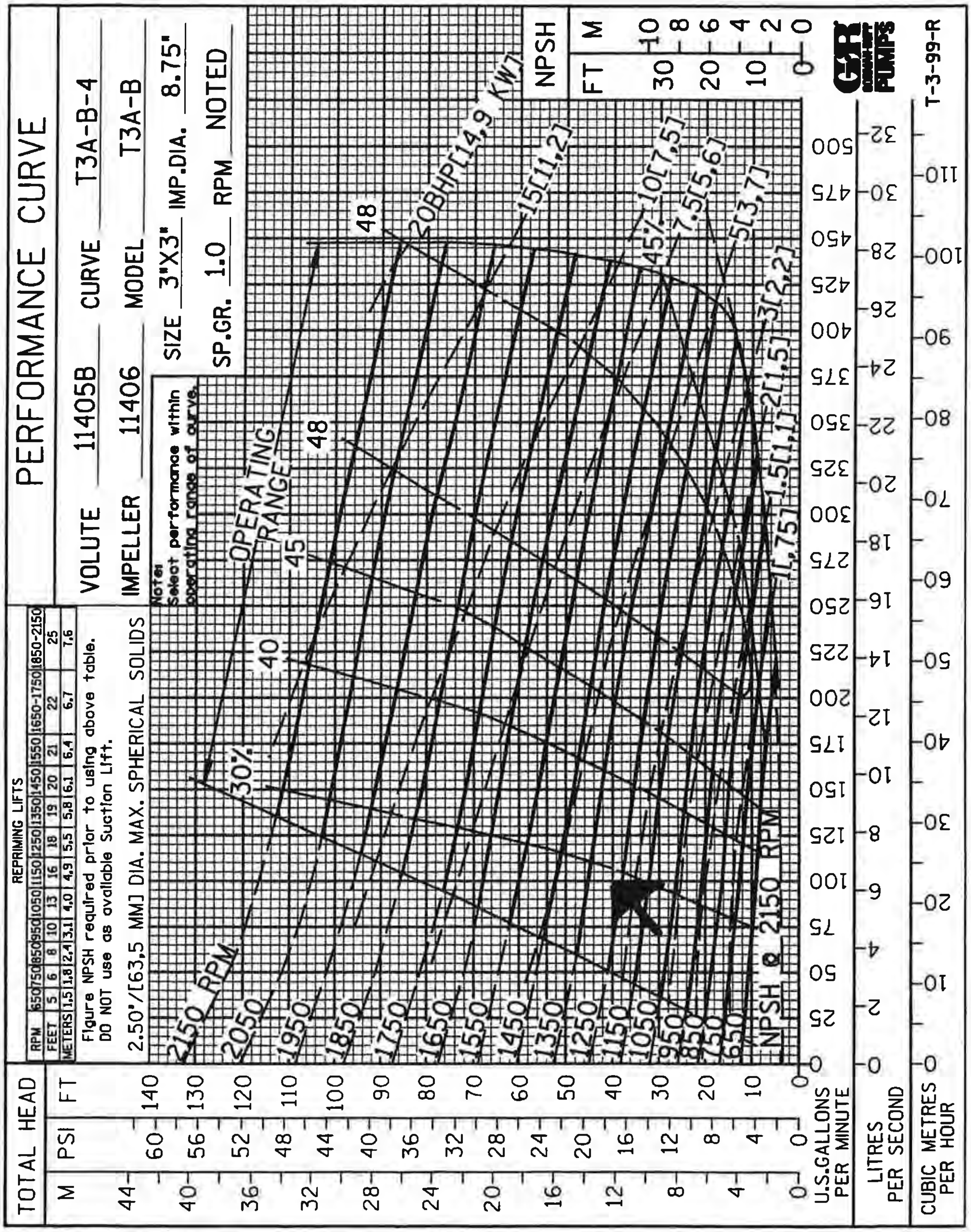
Pump speed and operating condition points must be within the continuous performance range shown on the curve.

### NOTE

*The curve shows 460 volt performance only. For 200 or 230 volt performance, multiply amperage shown by 2.3 or 2, respectively.*

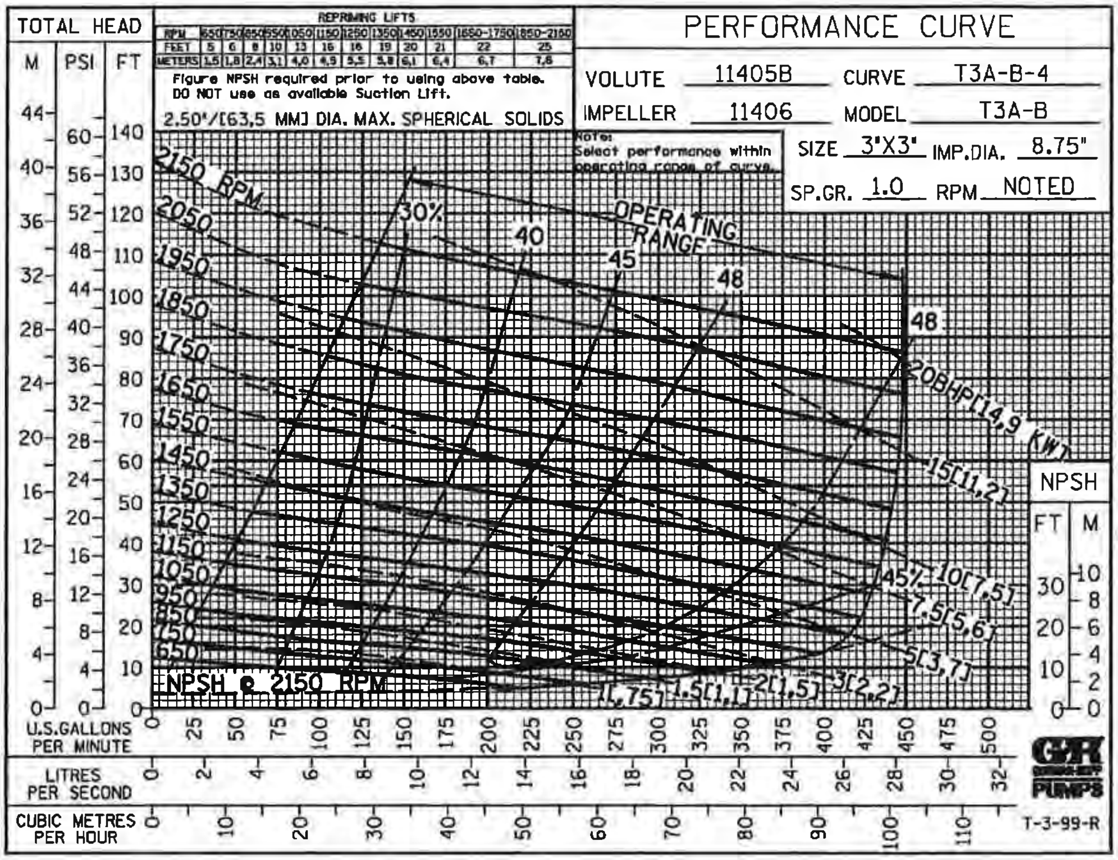
| Curve Data | North Park LS | Sec. 55 | PAGE 1054<br>SEPTEMBER 2000 |
|---|---|---|---|

CDSW



# PUMP MAINTENANCE AND REPAIR – SECTION E

**MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.**



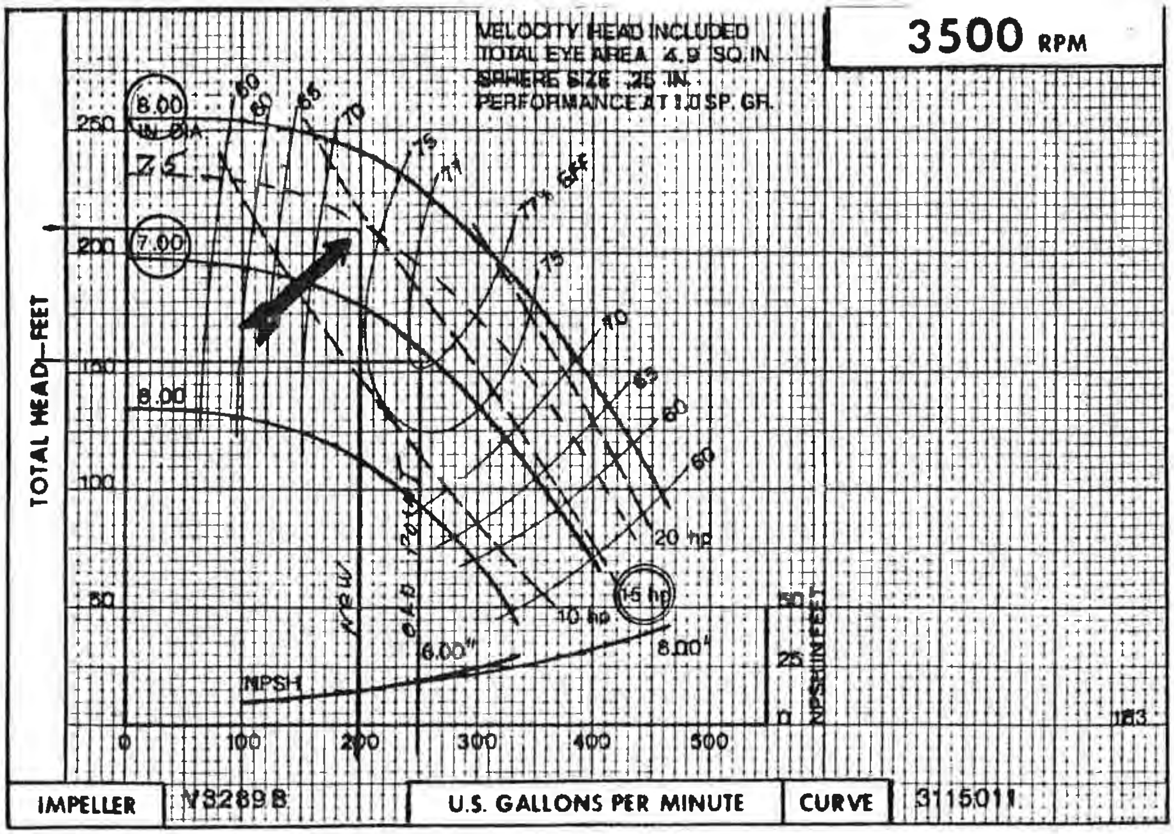

**∗ STANDARD PERFORMANCE FOR PUMP MODEL T3A3S-B**

∗Based on 70°F (21°C) clear water at sea level with minimum suction lift. Since pump installations are seldom identical, your performance may be different due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

If your pump serial number is followed by an “N”, your pump is **NOT** a standard production model. Contact the Gorman-Rupp Company to verify performance or part numbers.

**CAUTION**

Pump speed and operating condition points must be within the continuous performance range shown on the curve.




CUSTOMER ______ JOB NAME ______

P O NO ______ ITEM NO ______ S O NO ______ SERIAL NO ______

(2) PUMP MODEL NO *HC-820* RPM *3460* GPM *200* TOTAL HD. FEET *208 (90PSI)*

CERT FOR [ ] APPROVAL [ ] CONSTRUCTION BY *H.B.N.* DATE *9/20/85*

**PAGE 8 REV. 7-83**

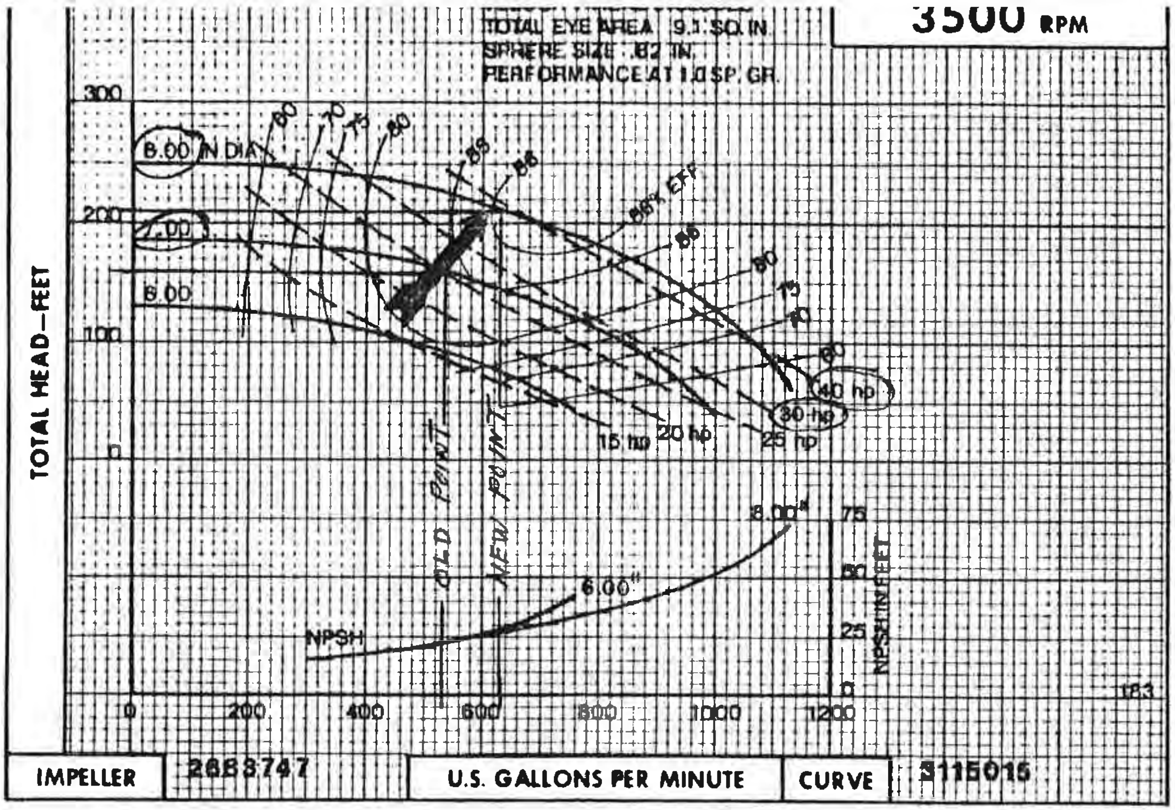
WESTERN Hills

The present system uses 2 Hydro Constants with 7.00" impellers and produced 250 G.P.M. @ 160' (69 PSI) of head

The proposed system would have 7.50" impellers and would give us 200 GPM @ 208' (90PSI)

Proposed System 2150 G.P.M.

| | | | |
|---|---|---|---|
| HC-820AM | 200 | 0-200 | Change impellers |
| HC-821AM | 200 | 200-400 | Change impellers |
| HC-830AM | 550 | 400-1000 | New (550 GPM Rec.) |
| C-830AM | 600 | 1000-1600 | Change Impellers |
| C-830AM | 600 | 1600-2200 | And Motors (40HP) |




CUSTOMER ______ JOB NAME ______

P.O. NO. ______ ITEM NO. ______ S.O. NO. ______ SERIAL NO. ______

3 PUMP MODEL NO. C-830AM RPM 3460 GPM 1800 TOTAL HD FEET 208 (90PSI)

CERT. FOR ☐ APPROVAL ☐ CONSTRUCTION BY H.B.N. DATE 9/20/85

PAGE 10 REV. 7-83

The old point gave us 530 GPM @ 160' using a 30 H.P. MOTOR.

By changing out the impeller from a 7.00" to 8.00" Diameter and the motor to a 40 H.P. we will have 208' (90PSI) and increase our flow to 600+ GPM

Therefore: No Piping Change
No Control Center Change (only Heaters)

The new Hydro Constant will have the same pump and motor but will need a base modification.

# PRV Stations--Settings and Sequences (December 2012)

## Cleveland Vault

| Sequence* | Size (in) | Elevation (ft) | Pressure (psi) | HGL (ft) |
|---|---|---|---|---|
| 8 | 10 | 5978 | 99 | 6207 |
| 12 | 24 | 5978 | 93 | 6193 |

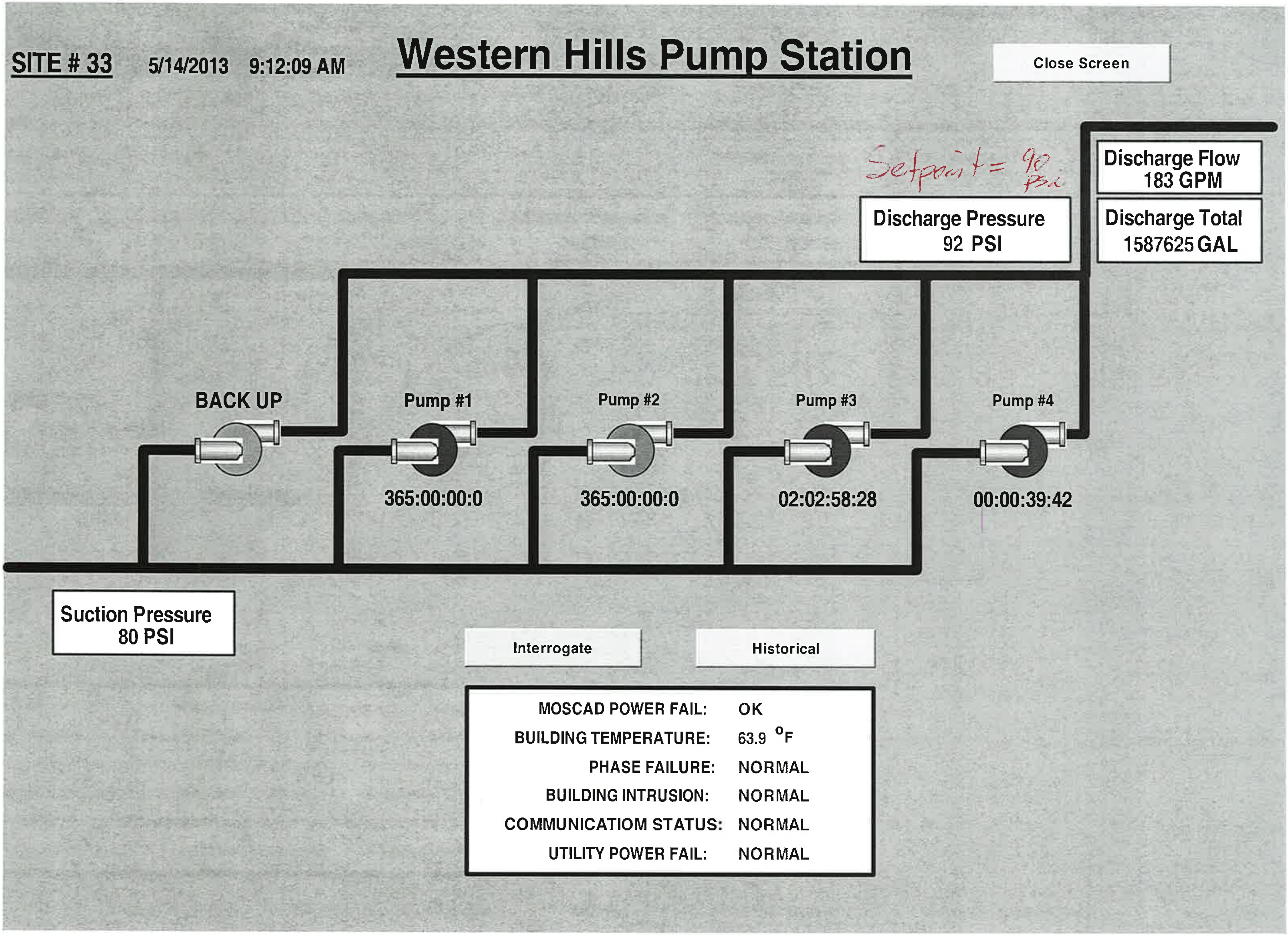
*Note: Sequence listed is for the Sun Valley/East Lakeview Zone

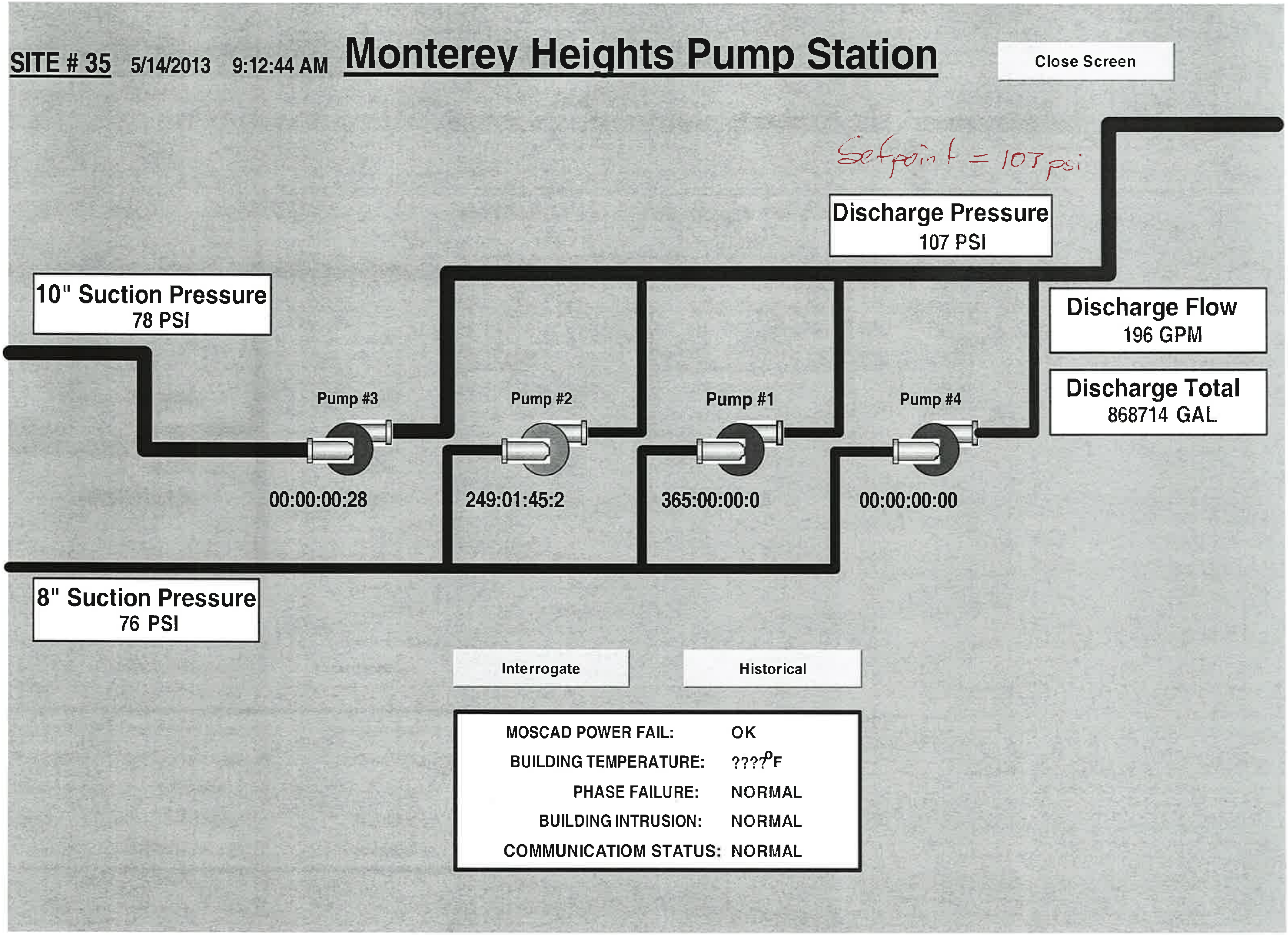
### Dell Range Zone

| Zone Sequence | Station Name | Elevation (ft) | Pressure (psi) | HGL (ft |
|---|---|---|---|---|
| 1 | Converse South-4" | 6095 | 75 | 6268 |
| 2 | Pershing-4" | 6016.5 | 108 | 6266 |
| 3 | Converse North-4" | 6095.5 | 72 | 6262 |
| 4 | Airport Parkway-4" | 6088.3 | 73 | 6257 |
| 5 | Converse South-12" | 6095 | 65 | 6245 |
| 6 | Pershing-12" | 6016.5 | 98 | 6243 |
| 7 | Converse North-12" | 6095.5 | 62 | 6239 |
| 8 | Airport Parkway-12" | 6088.3 | 63 | 6234 |
| 9 | Converse North-24" | 6095.5 | 55 | 6223 |
| 10 | Converse South-24" | 6095 | 55 | 6222 |
| 11 | Airport Parkway-24" | 6088.3 | 55 | 6215 |

### Sun Valley and East Lakeview Zone

| Zone Sequence | Station Name | Elevation (ft) | Pressure (psi) | HGL (ft) |
|---|---|---|---|---|
| 1 | Eastview-3" | 5982 | 110 | 6236 |
| 2 | Henderson-3" | 6009 | 95 | 6228 |
| 3 | Green River-3" | 6002 | 96 | 6224 |
| 4 | Lumis-2" | 6001 | 94 | 6218 |
| 5 | Ridge Road-3" | 6010 | 89 | 6216 |
| 6 | Liberty-3" | 6016 | 85 | 6212 |
| 7 | Henderson-8" | 6009 | 88 | 6212 |
| 8 | Cleveland-10" | 5978 | 99 | 6207 |
| 9 | Ridge Road-8" | 6010 | 84 | 6204 |
| 10 | El Camino-3" | 6028 | 75 | 6201 |
| 11 | Transfer Sta-8" | 5977 | 96 | 6199 |
| 12 | Cleveland-24" | 5978 | 93 | 6193 |
| 13 | Eastview-8" | 5982 | 90 | 6190 |
| 14 | Lumis-4" | 6001 | 80 | 6186 |
| 15 | Green River-8" | 6002 | 76 | 6178 |
| 16 | Liberty-8" | 6016 | 65 | 6166 |
| 17 | El Camino-8" | 6028 | 55 | 6155 |


SITE # 33
5/14/2013 9:12:09 AM
Western Hills Pump Station
Close Screen
Setpoint = 90 PSI
Discharge Pressure
92 PSI
Discharge Flow
183 GPM
Discharge Total
1587625 GAL
BACK UP
Pump #1
365:00:00:0
Pump #2
365:00:00:0
Pump #3
02:02:58:28
Pump #4
00:00:39:42
Suction Pressure
80 PSI
Interrogate
Historical
MOSCAD POWER FAIL: OK
BUILDING TEMPERATURE: 63.9 °F
PHASE FAILURE: NORMAL
BUILDING INTRUSION: NORMAL
COMMUNICATIOM STATUS: NORMAL
UTILITY POWER FAIL: NORMAL


SITE # 35
5/14/2013
9:12:44 AM
Monterey Heights Pump Station
Close Screen
Setpoint = 107 psi
Discharge Pressure
107 PSI
10" Suction Pressure
78 PSI
Discharge Flow
196 GPM
Discharge Total
868714 GAL
Pump #3
Pump #2
Pump #1
Pump #4
00:00:00:28
249:01:45:2
365:00:00:0
00:00:00:00
8" Suction Pressure
76 PSI
Interrogate
Historical
MOSCAD POWER FAIL: OK
BUILDING TEMPERATURE: ????°F
PHASE FAILURE: NORMAL
BUILDING INTRUSION: NORMAL
COMMUNICATIOM STATUS: NORMAL

**SITE # 65** 9:13:04 AM **North Range Business Park** 5/14/2013

Close Screen

# Booster Pump Station

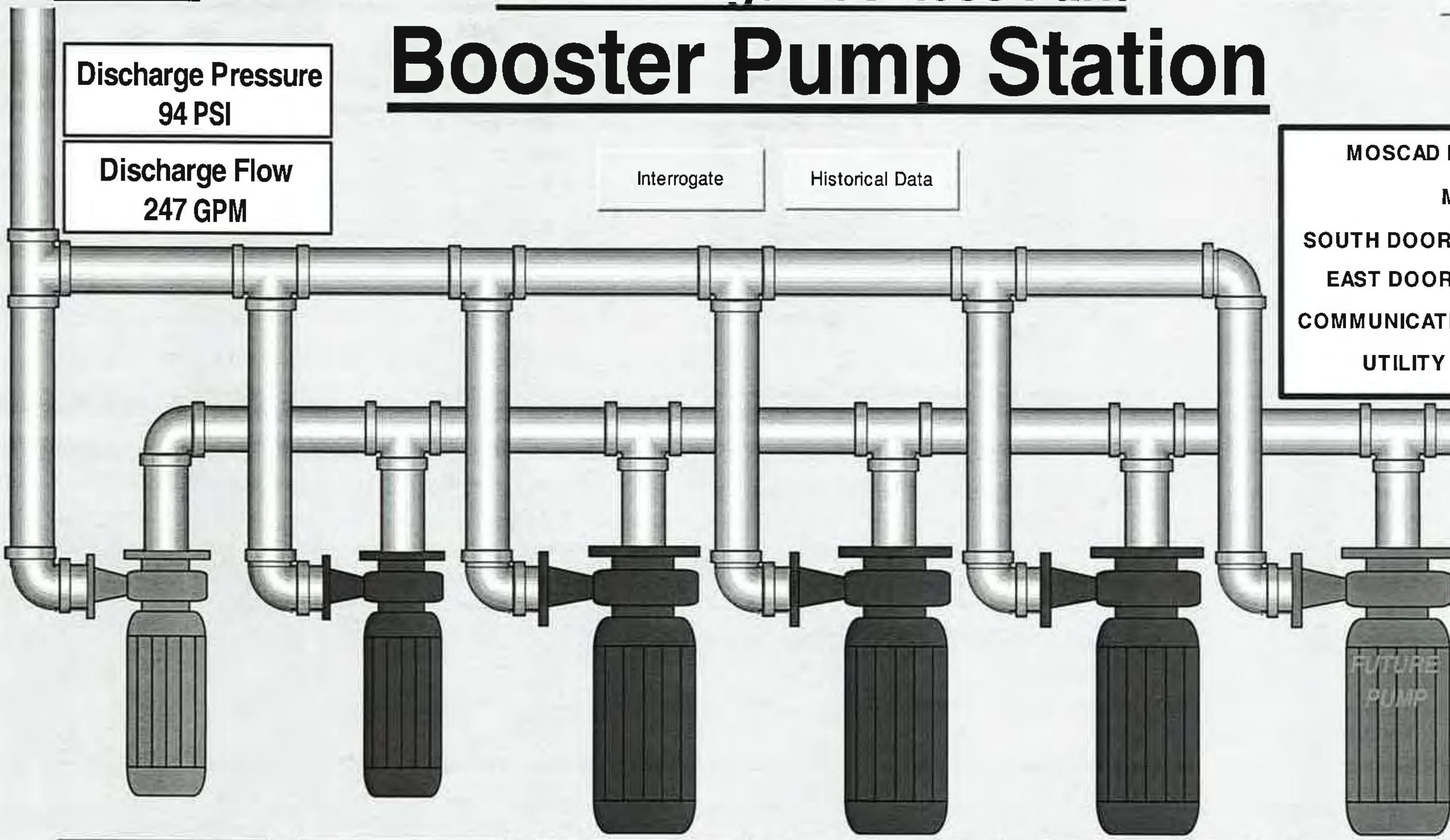
**Discharge Pressure**
**94 PSI**

**Discharge Flow**
**247 GPM**

Interrogate

Historical Data

| | |
|---|---|
| MOSCAD POWER FAIL: | OK |
| MCC POWER: | NORMAL |
| SOUTH DOOR INTRUSION: | NORMAL |
| EAST DOOR INTRUSION: | NORMAL |
| COMMUNICATIOM STATUS: | NORMAL |
| UTILITY POWER FAIL: | NORMAL |




**Suction Pressure**
**67 PSI**

**Pressure Setpoint**
90 psi
**Setpoint Deadband**
1 psi
**Low Suction Shutdown SP**
??? psi
**Low Suction Reset SP**
??? psi
**Low Flow Disable Time**
???sec

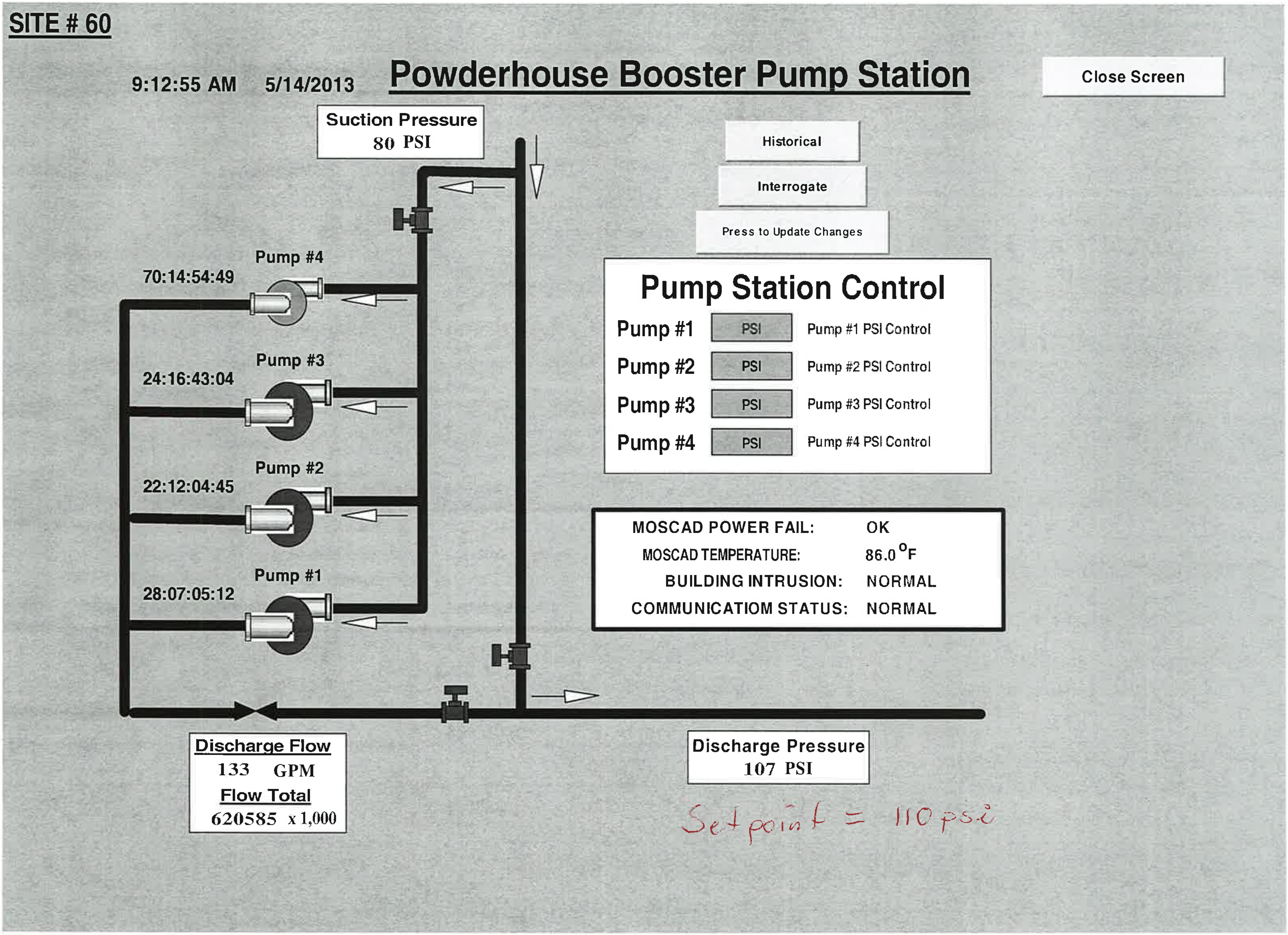
Change Setpoints

| | PUMP #1 | PUMP #2 | PUMP #3 | PUMP #4 | PUMP #5 | PUMP #6 |
|---|---|---|---|---|---|---|
| HOA Position | IN AUTO | IN AUTO | IN AUTO | IN AUTO | IN AUTO | NOT IN AUTO |
| Starts | 2084 | 230 | 99 | 43 | 13 | 0 |
| Runtime in Hours | 5455 | 11291 | 8 | 0 | 0 | 0 |
| Run Sequence # | 1 | 2 | 3 | ?? | ?? | ?? |

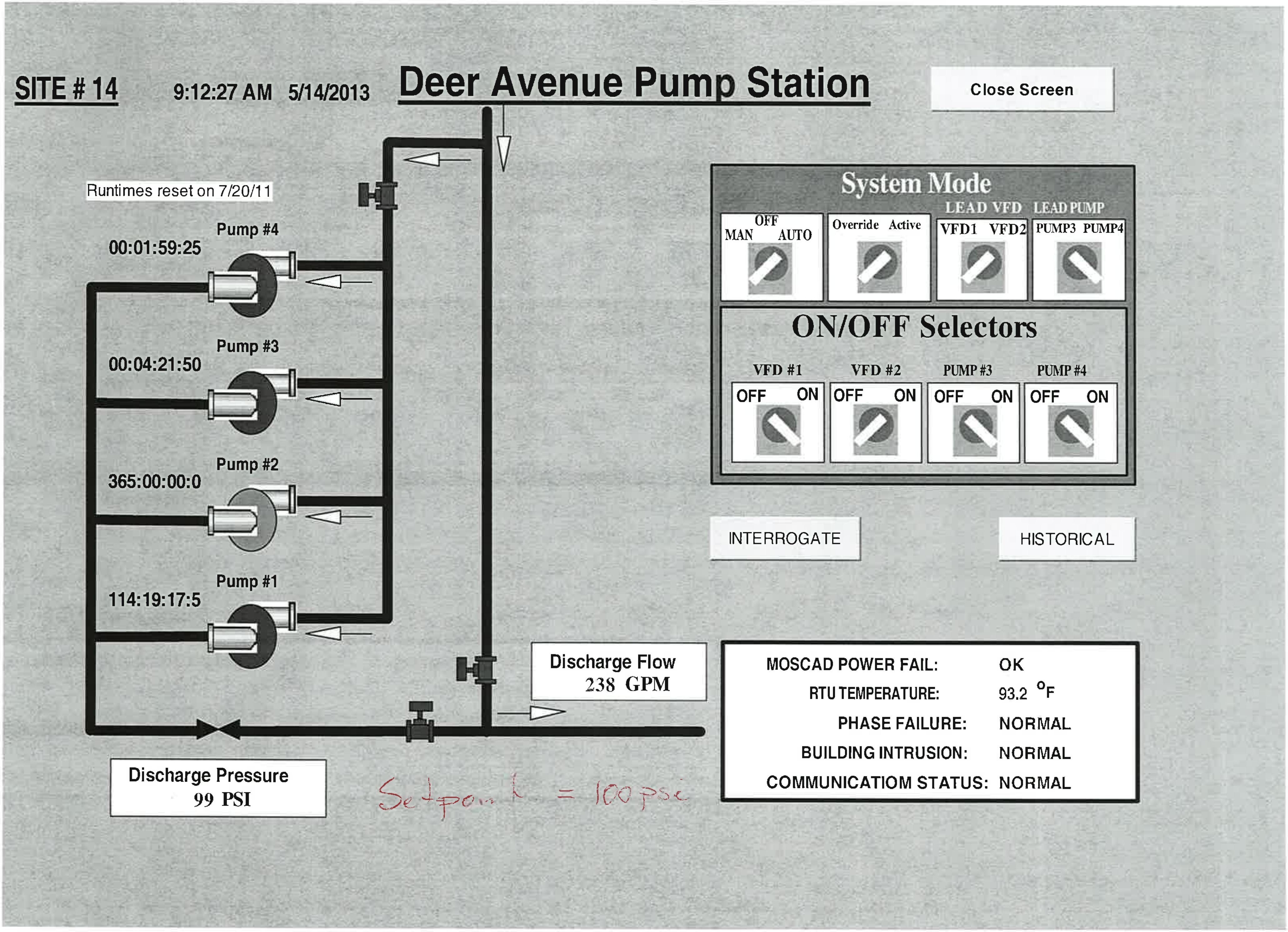
Generator Status: OFF

**Generator starts every Thur mid morning for a 30 min test.**

| | | |
|---|---|---|
| N.R.B.P. BPS, MCC current | 11.2 | AMPS |
| N.R.B.P. BPS, MCC power | 10.0 | KVA |




Setpoint = 110 psi


SITE # 14
9:12:27 AM 5/14/2013
Deer Avenue Pump Station
Close Screen
Runtimes reset on 7/20/11
Pump #4
00:01:59:25
Pump #3
00:04:21:50
Pump #2
365:00:00:0
Pump #1
114:19:17:5
System Mode
OFF
MAN AUTO
Override Active
LEAD VFD
VFD1 VFD2
LEAD PUMP
PUMP3 PUMP4
ON/OFF Selectors
VFD #1
OFF ON
VFD #2
OFF ON
PUMP #3
OFF ON
PUMP #4
OFF ON
INTERROGATE
HISTORICAL
Discharge Flow
238 GPM
MOSCAD POWER FAIL: OK
RTU TEMPERATURE: 93.2 °F
PHASE FAILURE: NORMAL
BUILDING INTRUSION: NORMAL
COMMUNICATIOM STATUS: NORMAL
Discharge Pressure
99 PSI
Setpoint = 100 psi

NX SuperE 25HP (1725) 1040A

W Hills

S 1 40HP 215MOTOR (3500) Peerless ? 830A

40HP 215 MOTOR (3500) 830A

40HP Baldor 830A

40HP 215MOTOR C830A

N 5 40HP 215MOTOR (3520RPM) 830A

MH

E1 50HP (215) (3550) C830A

40HP BALDOR (3500) C830A

40HP BALDOR (3510) C830A

W 50HP GEC (1775) 1040 ? 11.5K

Deer

E1 75HP Emerson 3565 ~~6564~~ C1140A

2 75HP Emerson 3565 C1140 A

3 75HP Emerson 3565 C1140A

W 4 25 HP Emerson (3565) 825A

NRBPS 100HP Baldor (3510)

4 100 5

3 100

2 50 (3530)

1 50 (3530)

# Appendix 5-B
# Model Demand Allocation Process
# Additional Information

- Workflow for assigning existing and future demands to the hydraulic model (referenced spreadsheet in workflow was sent with final electronic model and supporting files deliverable)

**Introduction:**

The following are a series of steps for the allocation of water meter consumption data from an access database spatially assigned to the closed junction in the City's Infowater hydraulic model. The steps are intended to be followed using the spreadsheet "Meter Data Master Import Template.xltx" Sub items below each step describe specific actions in Microsoft Access, Excel, and ARCMap.

**STEP 1: Export Data from the Access Database into this Workbook**
Copy and paste data from Access Database; Filter records in Access first.

a. Filter the UTLCID column for values I, W, and WC (or whatever criteria are desired) found under the "Service" column.
b. Filter the UTBILY column for the desired year(s).
c. Copy and paste data into cell A1 in tab "A. Access Database"

*Note: Data may need to be copied in sections of 65,000 rows at a time. Attempting to copy all data at once may result in an error (max is 65,000)*

**STEP 2: Create a Compiled List of Unique Meter Records**
To create a compiled list of unique records, follow these steps:

1. Select the column titles above rows or records that you want to sort.
2. On the Data menu, point to Filter, and then click Advanced Filter. If you are prompted as follows, click OK.
3. Under Action, click Copy to another location.
4. In the List range box, type or select the range of records for the entire column "UTLCID". $B$1:$B$269112 is used in this table. Depending on the number of records copied from Access, the range will increase or decrease (e.g. $B$1:$B$65535 or $B$1:$B$1000000). This applies to many following steps; the end of the range could be any value depending on the length of the data set.
5. In the Criteria range box, type or select the same range of records, the entire column "UTLCID".
6. In the Copy to box, select cell L1.
7. Click to select the "Unique records only" check box.
8. Click OK.

*Note: The Filter may take several minutes to process. If the first record of original data is duplicated, it appears twice in the new list. Just delete the first line.*

**STEP 3: Sum Total Meter Consumption Data Values for each Unique Meter Record**

1. Use a SUMIF formula to sum the "Gallons" values for each unique UTLCID Record. The formula is described below.

   =SUMIF(range, criteria, [sum_range])

   **Range** = UTLCID column (B2:B###### - then hit F4 to lock the range to $E$2:$E$######)
   **Criteria** = Unique UTLCID value (L2 - for the first record)
   **[sum_range]** = Gallons column (E2:E####### - then hit F4 to lock the range to $E$2:$E$######)

   The following SUMIF formula was used in this table.
   =SUMIF($B$2:$B$#######,L2,$E$2:$E$######)

2. Then copy the formula below for each record. The formulas should proceed as:
   M2: =SUMIF($B$2:$B$######,L2,$E$2:$E$######)
   M3: =SUMIF($B$2:$B$######,L3,$E$2:$E$######)
   M4: =SUMIF($B$2:$B$######,L4,$E$2:$E$######)
   M5: =SUMIF($B$2:$B$######,L5,$E$2:$E$######)
   etc.....

*Note: The SUMIF formula will take a few minutes to process for every record. Once finished, the results should be copied and pasted in place as values; otherwise, keeping all the values in place will take a lot of memory in the spreadsheet.*

**STEP 4: Convert Meter Consumption Data Values to Gallons per Minute (STEP 5 in tab B.GIS Database)**

Convert the "Gallons" values to gallons per minute (gpm). Column M includes the values 1,000 gallons per year. To convert to gallons per minute follow the steps below.

1. Multiply by 1,000 to convert from 1,000 gallons per year to gallons per year.
2. Divide by 365 days per year (366 for leap years)
3. Divide by 24 hours per day
4. Divide by 60 minutes per hour.

This can be included in a single formula. 2012 is a leap year, so the factor 366 is used in the formula below.
=M2*1000/366/24/60

**STEP 5: Import GIS Meter Database to Excel**

Copy all records from the GIS Meter Database file. Open the attribute table in ArcGIS and copy and paste records into this document. This step is used to verify the records in the Access Database have a corresponding match in the GIS database before creating a join in ArcGIS.

*Note: May need to copy in sections of 5000 rows at a time as all data might be too large to copy. Select range and right click to copy selection.*

**STEP 6: Check for Meter Record Match in the GIS Meter Database**
Verify that there is a corresponding match in the GIS database. Copy and paste all data records in the attribute table in ArcGIS into the tab "B.GIS Database." The GIS Data at the time of this study is MeterLocations.shp.

The VLOOKUP and ISNUMBER formulas are used to report if there is a match between each meter record in the Access Database and the meter records in the GIS Database.

The formula is created as follows:
=ISNUMBER(VLOOKUP(L2,'B.GIS Database'!$E$2:$E$23298,1,FALSE))

1. The VLOOKUP function is defined as follows.

   VLOOKUP(lookup_value, table_array, col_index_num, [range_lookup])

   **lookup_value** *Required*
   The value to search in the first column of the table or range. The lookup_value argument can be a value or a reference. If the value you supply for the lookup_value argument is not found in the first column of the table_array argument, VLOOKUP returns the #N/A error value. This is referencing the meter records in UTLCID in Column L. It will tell the VLOOKUP function to look for this value in the GIS database. When a record is not found, the #N/A error value is returned. This record does not have a match in the GIS database.
   **table_array** *Required*
   The range of cells that contains the data.  The values in the first column of table_array are the values searched by lookup_value. These values can be text, numbers, or logical values. Uppercase and lowercase texts are equivalent. This is referencing the values in the GIS Database for the column "location_i."
   **col_index_num** *Required*
   The column number in the table_array argument from which the matching value must be returned. A col_index_num argument of 1 returns the value in the first column in table_array; a col_index_num of 2 returns the value in the second column in table_array, and so on. In this formula, a col_index_num of 1 is used to return the matched meter record in the GIS Database.

   If the col_index_num argument is:

   - Less than 1, VLOOKUP returns the #VALUE! error value
   - Greater than the number of columns in table_array, VLOOKUP returns the #REF! error value

   **range_lookup** *Optional*
   A logical value that specifies whether you want VLOOKUP to find an exact match or an approximate match:
   If range_lookup is either TRUE or is omitted, an exact or approximate match is returned. If an exact match is not found, the next largest value that is less than lookup_value is returned.
   *Important*: If range_lookup is either TRUE or is omitted, the values in the first column of table_array must be placed in ascending sort order; otherwise, VLOOKUP might not return the correct value.

2. The ISNUMBER formula is used to return a value of TRUE of FALSE. If the VLOOKUP function returns a value, the formula will return TRUE. These are where the meter records match. If the VLOOKUP formula returns a #N/A error value indicating there is no match for the meter record, the ISNUMBER formula will return a FALSE.

**STEP 7: Check for Multiple Meter Records in the GIS Meter Database**
A COUNTIF formula is used to count how many meter records are in the GIS Database for each unique meter record in the UTLCID column L.

The formula is defined as follows:
COUNTIF(range, criteria)
**range** = the column that will be searched for multiple records. In this case, the column "location_i" in the GIS Database will be set at the range.
**criteria** = the is to select the unique meter record in Column L "UTLCID"

The formula as input in this spreadsheet is:
=COUNTIF('B.GIS Database'!$E$2:$E$23298,'A.Access Database'!L2)

**STEP 8: Adjust Demand Values for Meters with Multiple Records in the GIS Meter Database**
**(STEP 9 in Tab C.Table for Spatial Join)**

When there are multiple records in the GIS Database for a unique meter ID, the total demand is divided by the number of records. This represents the average day demand per meter. When a join is performed in ArcGIS, the adjusted values for meters with multiple records will be applied so the sum of is equal to the total demand for a unique record.

To accomplish this, the values in Column N are divided by the values in Column P. Because there are some meters that have no corresponding match in the GIS Database, the formula used in Column P returns a zero. As you cannot divided number by zero, an IF formula is used. See below.

IF(logical_test,value_if_true,value_if_false)
**logical test** = value in Column O. This provides the "TRUE" or "FALSE" aspect of the formula.
**value_if_true** = the formula for value in Column N divided by value in Column P.
**value_if_false** = this should be a value 0. If there is no match, there is no demand that can be matched.

An example for the first line:
=IF(O2,N2/P2,0)

**STEP 9: Paste Columns with Unique Meter Records and Adjusted Consumption Values for to Create a Join Table for ArcGIS**
**(STEP 10 and 11 are performed in ArcGIS, STEP 12 is in tab D.Spatial Join Meter DB)**
Copy and Paste the "UTLCID" and "Adjusted Average Day Demand (gpm)" columns from the tab "A.Access Database." The columns are L and Q in this table.

1. Paste Special only the values into this table.
2. Change the heading on each column to be compatible with GIS. Only 10 characters and no spaces or special characters.
3. This table can be copied in to another excel file solely for the purpose of joining it to the GIS Database in ArcGIS.

**STEP 10: Create Join in ArcGIS between the GIS Meter Database and the Table Prepared in Step 9**

a. Right click on GIS Meter Database, select Joins and Relates, then select Join…
b. In the Join Data dialog box make the following selections
    1. "location_i" is the field in the GIS Meter Database selected for the join to be based on
    2. “2012 ADD” is the table that was created from STEP 9 to join to the GIS Meter Database (can be any file name that contains the data from STEP 9)
    3. UTLCID is the field in the excel table that the join will be based on.
    4. Join option Keep All Records is selected

**STEP 11: Perform a Spatial Join between the GIS Meter Database and Model Junctions**

a. Open up the Spatial Join dialog box from the ArcToolbox. In the Spatial Join Tool, make the following selections:
    1. Set the Target Features to the GIS Meter Database
    2. Set the Join Features to the Model Junctions
    3. Save the resulting file
    4. The Join Operation should be ONE_TO_ONE
    5. The Match Option should be set to "Closest"
    6. Click OK to create the spatial join

**STEP 12: Import Spatial Join Shapefile Attribute Table to Excel**
**(STEP 13 in tab E.DB Model Junction)**

After performing a spatial join between the model demand junctions and the GIS Database joined to the Access Demand values, paste the values from the Attribute Table in ArcGIS into this table.

This spatially joined GIS shapefile will contain a link between each meter in the GIS database and the closest Model Junction.

**STEP 13: Copy Model Junction ID from Infowater and Paste in Excel**
Copy all Model Junction IDs from the DB Editor. This table will be used to sum all the demands to each model junction location.

1. Open the DB Editor
2. Select Junction Demand (Modeling) Data, Select Entire Table for Data Scope, and uncheck Edit Active Elements Only box, Click OK
3. Select the ID (Char) column and paste into excel

**STEP 14: Sum Meter Consumption Data Values for each Model Junction**
Sum the total demand for each Model Junction

Use SUMIF formula to sum all demand values for each Model Junction. The range is the Column titled "MOID" in the spatially joined GIS shapefile. The criteria is the value in the ID (Char) in Column A in this tab. The [sum_range] is the Demand Values in the spatially joined GIS shapefile.

The formula in this spreadsheet is below:
=SUMIF('D.Spatial Join Meter DB'!$AH$2:$AH$23298,'E.DB Model Junction'!A2,'D.Spatial Join Meter DB'!$AF$2:$AF$23298)

**STEP 15: Adjust Model Demands Globally to Account for Meters Records that Could Not be Joined to the GIS Meter Database**

Formulas: IF, SUM, COUNTIF

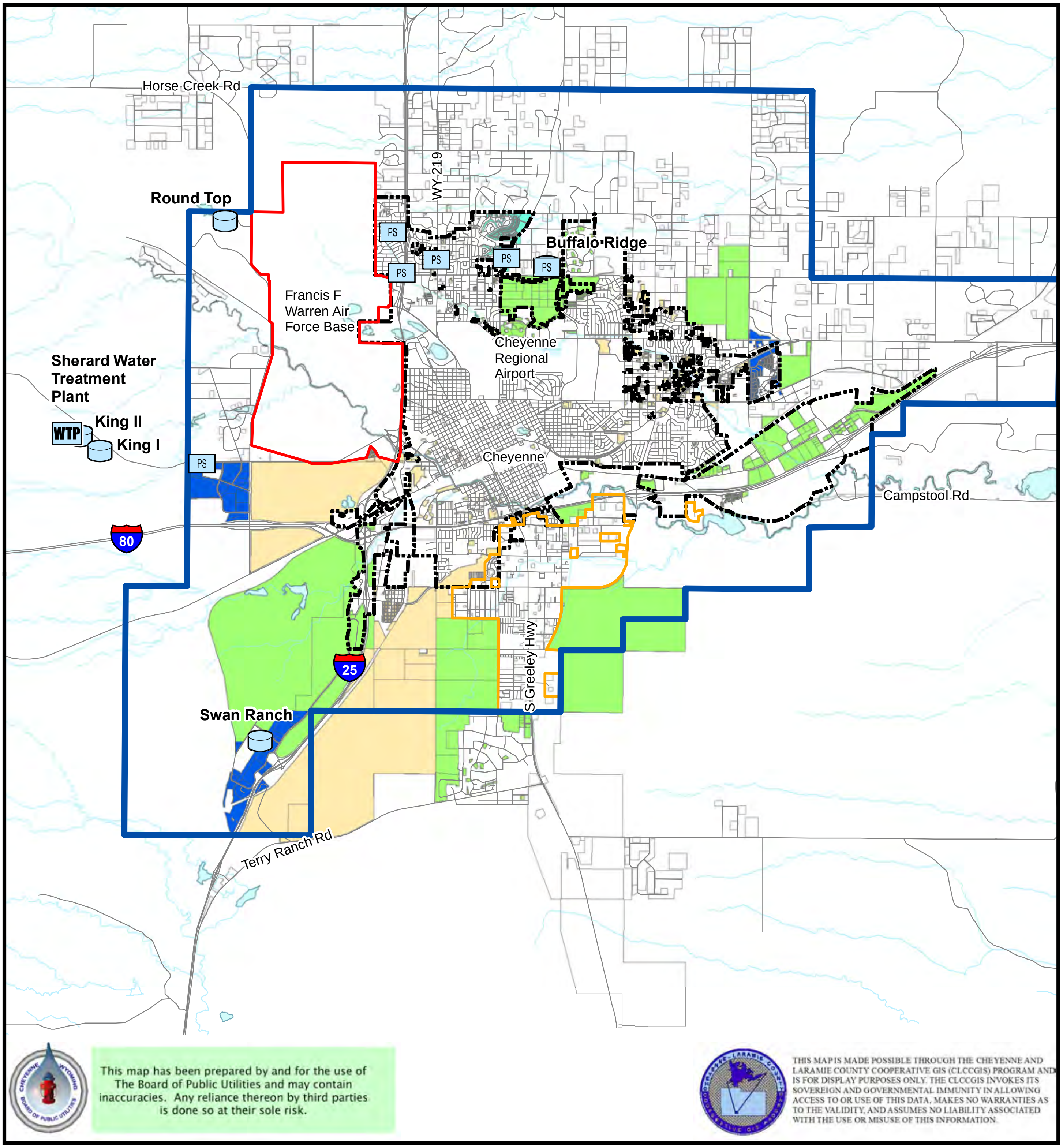
1. Use IF formula to only apply global adjustment to Model Nodes where demand does not equal zero

2. The compound formula that calculates a global adjustment if the Model Demand is greater than zero is described as follows. The total demand in Column B subtracted from the total demand from the Access Database (column N in tab A.Access Database) is the difference between the demand values from STEP 4 and the demand values from STEP 14. The resulting difference is divided by the total number of Model Junctions with demand greater than zero (COUNTIF formula used). The resulting value is then added to each demand value determined in STEP 14. The sum of all adjusted demand should equal the sum of the demands in STEP 4.

Excel Formula used:
=IF(B2=0,0,B2+(SUM('A.Access Database'!$N$2:$N$#####)-SUM($B$2:$B$######))/COUNTIF($B$2:$B$#####,">0"))

# Appendix 5-C
# Future Developable Land Buildout Figures

- Figure C-1 - 2023 Future Developable Land Map
- Figure C-2 - 2033 Future Developable Land Map
- Figure C-3 - 2063 Future Developable Land Map




## Legend

- City of Cheyenne
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- WTP Water Treatment Plant
- Storage Tank
- PS Pump Station
- Roads
- Creeks
- Lakes

**Percent Buildout (%)**

- 0
- <20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100

Last Updated: 9/12/2013

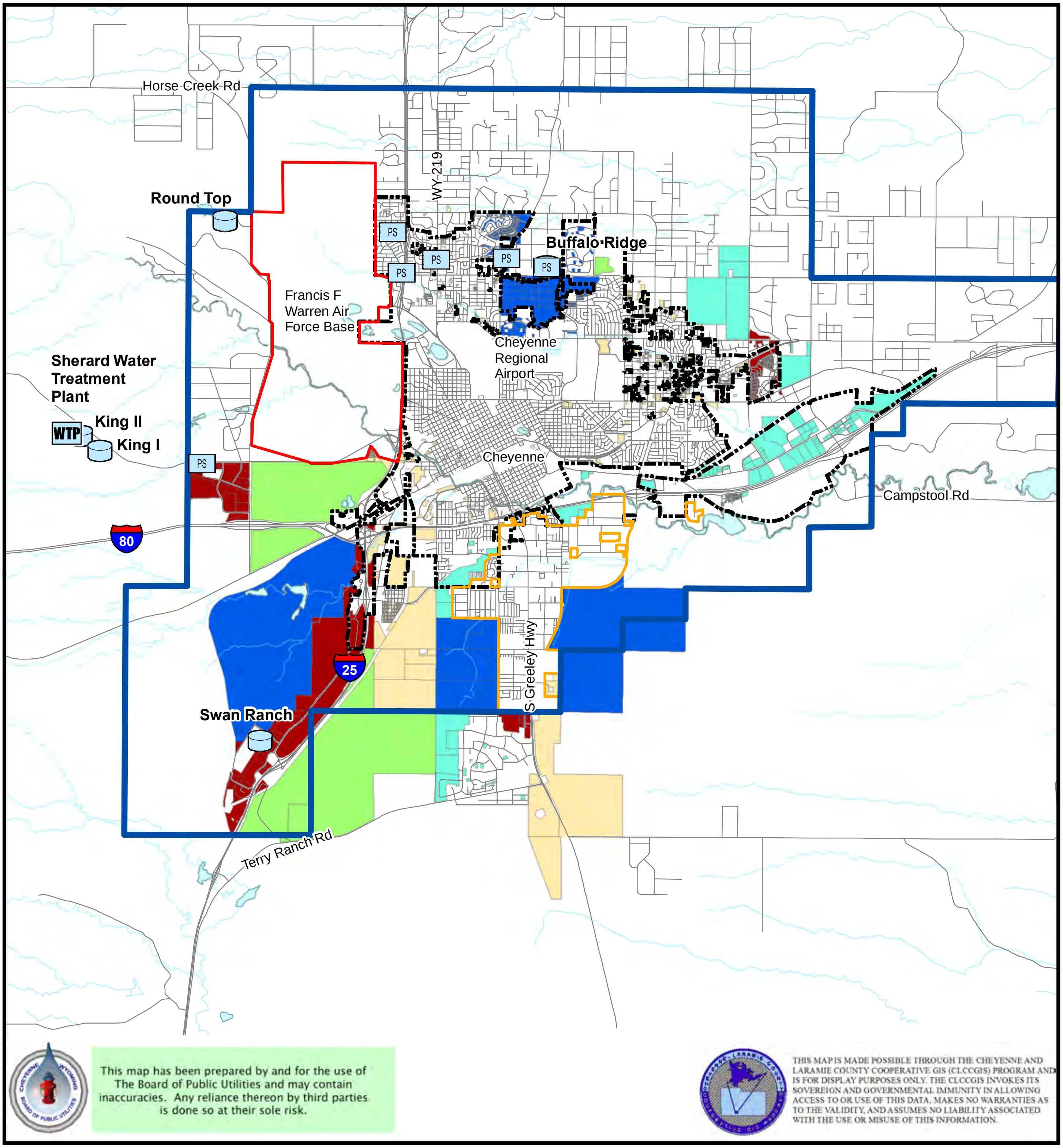
1 inch = 3 miles

N

# Figure C-1
# 2023 Developable Land Map

**Volume 5 – Potable Water Storage and Distribution**

2013 Water and Wastewater Master Plans




## Legend

- City of Cheyenne
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- WTP Water Treatment Plant
- Storage Tank
- PS Pump Station
- Roads
- Creeks
- Lakes

**Percent Buildout (%)**

- 0
- <20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100

HDR

Last Updated: 9/12/2013

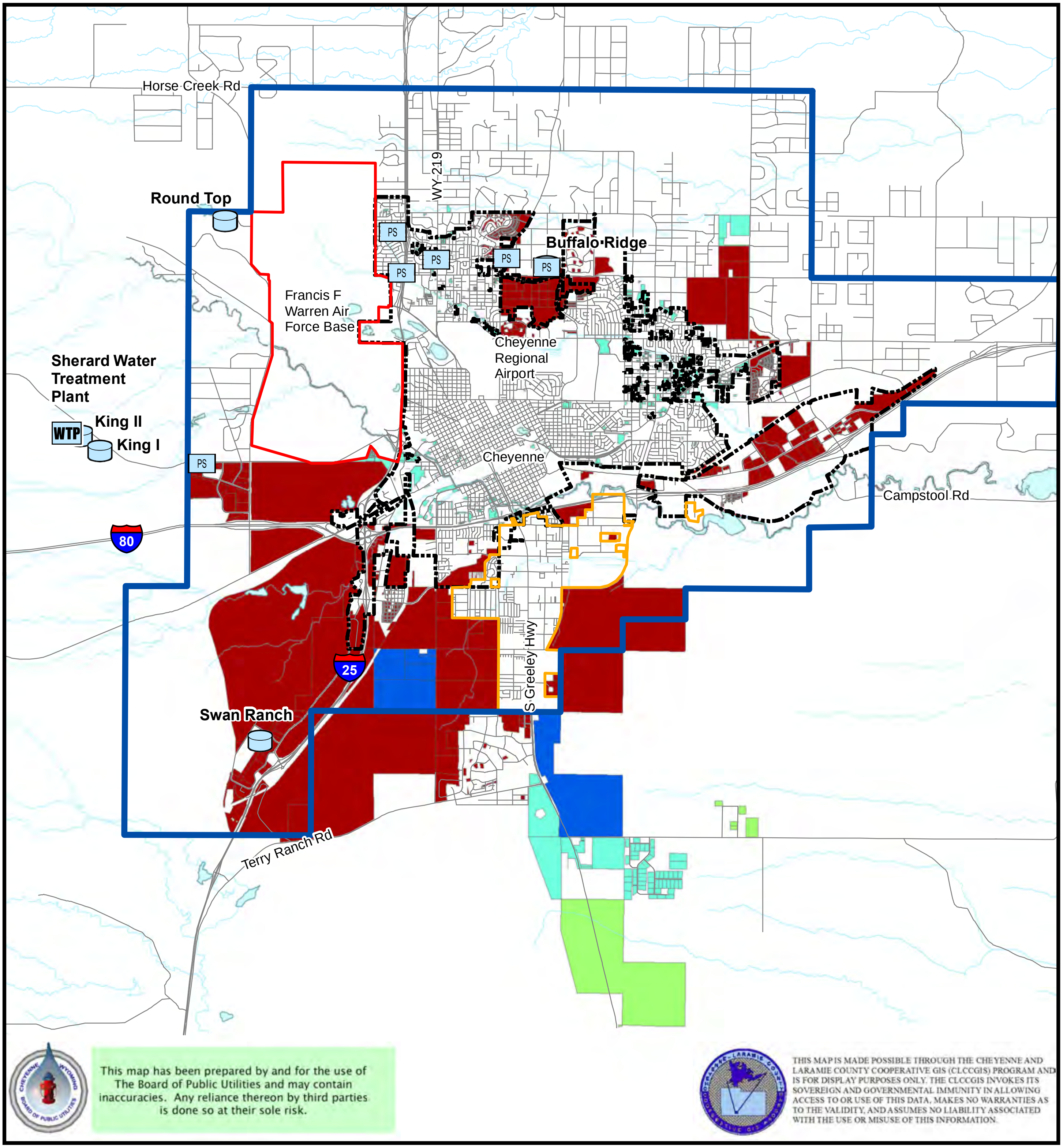
**1 inch = 3 miles**

N

# Figure C-2
# 2033 Developable Land Map

**Volume 5 – Potable Water Storage and Distribution**

2013 Water and Wastewater Master Plans




## Legend

- City of Cheyenne
- Water Service Area Boundary
- F.E. Warren Air Force Base
- South Cheyenne Water and Sewer District
- WTP Water Treatment Plant
- Storage Tank
- PS Pump Station
- Roads
- Creeks
- Lakes

**Percent Buildout (%)**

- 0
- <20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100

Last Updated: 9/12/2013

1 inch = 3 miles

N

# Figure C-3
# 2063 Developable Land Map

**Volume 5 – Potable Water Storage and Distribution**

2013 Water and Wastewater Master Plans

# Appendix 5-D
# Existing Fire Hydrant Model Results Table

## Fire Hydrant Model Results for Available Fire Flow for Year 2013, 2023, 2033, and 2063 Scenarios

| | | 2013 | | 2023 | | 2033 | | 2063 | |
|---|---|---|---|---|---|---|---|---|---|
| ID | Fire Flow Goal (gpm) | Available Fire Flow (gpm) | % of Fire Flow Goal | Available Fire Flow (gpm) | % of Fire Flow Goal | Available Fire Flow (gpm) | % of Fire Flow Goal | Available Fire Flow (gpm) | % of Fire Flow Goal |
| 2013 Available Fire Flow <25% of Fire Flow Goal | | | | | | | | | |
| 047FH052 | 1,500 | -536 | -36% | 1,329 | 89% | 1,215 | 81% | 959 | 64% |
| 048FH142 | 1,500 | -128 | -9% | 1,213 | 81% | 1,121 | 75% | 910 | 61% |
| 061FH068 | 3,000 | 738 | 25% | 936 | 31% | 914 | 30% | 867 | 29% |
| 061FH072 | 3,000 | 612 | 20% | 777 | 26% | 758 | 25% | 720 | 24% |
| 061FH078 | 3,000 | 606 | 20% | 434 | 14% | 428 | 14% | 419 | 14% |
| 062FH102 | 4,000 | 903 | 23% | 819 | 20% | 804 | 20% | 776 | 19% |
| 062FH106 | 4,000 | 999 | 25% | 977 | 24% | 959 | 24% | 922 | 23% |
| 075FH003 | 3,000 | 717 | 24% | 521 | 17% | 516 | 17% | 509 | 17% |
| 075FH005 | 3,000 | 661 | 22% | 488 | 16% | 483 | 16% | 478 | 16% |
| 075FH012 | 3,000 | 668 | 22% | 502 | 17% | 499 | 17% | 495 | 16% |
| 075FH014 | 3,000 | 686 | 23% | 515 | 17% | 511 | 17% | 507 | 17% |
| 075FH017 | 3,000 | 560 | 19% | 420 | 14% | 417 | 14% | 413 | 14% |
| 077FH053 | 4,000 | 677 | 17% | 597 | 15% | 589 | 15% | 583 | 15% |
| 077FH061 | 4,000 | 837 | 21% | 752 | 19% | 743 | 19% | 736 | 18% |
| 078FH002 | 4,000 | 215 | 5% | 213 | 5% | 213 | 5% | 211 | 5% |
| 078FH004 | 3,000 | 363 | 12% | 360 | 12% | 359 | 12% | 356 | 12% |
| 089FH034 | 1,500 | 353 | 24% | 294 | 20% | 294 | 20% | 293 | 20% |
| 089FH037 | 3,500 | 286 | 8% | 237 | 7% | 237 | 7% | 236 | 7% |
| 089FH089 | 3,500 | 656 | 19% | 538 | 15% | 671 | 19% | 669 | 19% |
| 089FH090 | 3,500 | 622 | 18% | 512 | 15% | 620 | 18% | 618 | 18% |
| 089FH091 | 3,500 | 855 | 24% | 707 | 20% | 898 | 26% | 896 | 26% |
| 089FH092 | 3,500 | 737 | 21% | 604 | 17% | 1,185 | 34% | 1,180 | 34% |
| 089FH093 | 3,500 | 752 | 21% | 617 | 18% | 1,265 | 36% | 1,260 | 36% |
| 090FH073 | 3,500 | 871 | 25% | 765 | 22% | 762 | 22% | 759 | 22% |
| 090FH087 | 3,500 | 715 | 20% | 623 | 18% | 626 | 18% | 624 | 18% |
| 090FH095 | 3,500 | 721 | 21% | 628 | 18% | 630 | 18% | 628 | 18% |
| 090FH100 | 3,500 | 739 | 21% | 649 | 19% | 646 | 18% | 644 | 18% |
| 090FH103 | 3,500 | 638 | 18% | 3,956 | 100% | 3,925 | 100% | 3,902 | 100% |
| 090FH105 | 3,500 | 442 | 13% | 385 | 11% | 384 | 11% | 382 | 11% |
| 091FH005 | 3,000 | 684 | 23% | 595 | 20% | 586 | 20% | 579 | 19% |
| 091FH045 | 3,000 | 695 | 23% | 629 | 21% | 622 | 21% | 616 | 21% |
| 091FH046 | 3,000 | 682 | 23% | 637 | 21% | 628 | 21% | 621 | 21% |
| 091FH054 | 3,000 | 628 | 21% | 576 | 19% | 567 | 19% | 560 | 19% |
| 091FH087 | 3,000 | 738 | 25% | 692 | 23% | 682 | 23% | 676 | 23% |
| 091FH093 | 3,500 | 531 | 15% | 492 | 14% | 485 | 14% | 481 | 14% |
| 092FH060 | 3,000 | 602 | 20% | 571 | 19% | 561 | 19% | 554 | 18% |
| 103FH012 | 3,500 | 483 | 14% | 435 | 12% | 432 | 12% | 430 | 12% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 104FH038 | 2,500 | 562 | 22% | 578 | 23% | 569 | 23% | 562 | 22% |
| 105FH002 | 3,500 | 782 | 22% | 826 | 24% | 810 | 23% | 800 | 23% |
| 105FH050 | 3,500 | 437 | 12% | 453 | 13% | 445 | 13% | 440 | 13% |
| 105FH051 | 3,500 | 513 | 15% | 534 | 15% | 524 | 15% | 518 | 15% |
| 106FH005 | 3,500 | 569 | 16% | 579 | 17% | 569 | 16% | 563 | 16% |
| 107FH040 | 3,500 | 842 | 24% | 1,043 | 30% | 1,043 | 30% | 1,042 | 30% |
| 107FH041 | 3,500 | 854 | 24% | 1,064 | 30% | 1,064 | 30% | 1,062 | 30% |
| 117FH008 | 3,500 | 655 | 19% | 800 | 23% | 704 | 20% | 656 | 19% |
| 156FH006 | 3,500 | 802 | 23% | 1,284 | 37% | 1,187 | 34% | 1,051 | 30% |
| 156FH007 | 3,500 | 757 | 22% | 1,109 | 32% | 1,033 | 30% | 931 | 27% |
| 157FH020 | 3,500 | 826 | 24% | 972 | 28% | 941 | 27% | 867 | 25% |
| **2013 Available Fire Flow 25 - 50% of Fire Flow Goal** | | | | | | | | | |
| 048FH152 | 3,000 | 1,381 | 46% | 1,420 | 47% | 1,394 | 46% | 1,306 | 44% |
| 049FH022 | 3,000 | 1,371 | 46% | 1,395 | 47% | 1,369 | 46% | 1,298 | 43% |
| 049FH034 | 3,000 | 1,356 | 45% | 1,362 | 45% | 1,338 | 45% | 1,288 | 43% |
| 061FH005 | 3,000 | 1,356 | 45% | 1,624 | 54% | 1,596 | 53% | 1,539 | 51% |
| 061FH026 | 3,000 | 1,406 | 47% | 1,776 | 59% | 1,729 | 58% | 1,633 | 54% |
| 061FH027 | 3,000 | 1,125 | 38% | 1,295 | 43% | 1,276 | 43% | 1,237 | 41% |
| 061FH036 | 3,000 | 887 | 30% | 1,035 | 34% | 1,019 | 34% | 987 | 33% |
| 061FH037 | 3,000 | 1,168 | 39% | 1,496 | 50% | 1,456 | 49% | 1,373 | 46% |
| 061FH054 | 3,000 | 1,415 | 47% | 1,788 | 60% | 1,741 | 58% | 1,644 | 55% |
| 061FH057 | 3,500 | 1,267 | 36% | 1,376 | 39% | 1,354 | 39% | 1,310 | 37% |
| 061FH060 | 3,000 | 1,048 | 35% | 1,378 | 46% | 1,339 | 45% | 1,256 | 42% |
| 061FH065 | 3,000 | 1,295 | 43% | 1,676 | 56% | 1,629 | 54% | 1,530 | 51% |
| 061FH091 | 3,500 | 1,452 | 41% | 1,543 | 44% | 1,523 | 44% | 1,483 | 42% |
| 062FH017 | 3,000 | 1,403 | 47% | 1,630 | 54% | 1,602 | 53% | 1,543 | 51% |
| 062FH098 | 3,000 | 1,242 | 41% | 1,102 | 37% | 1,084 | 36% | 1,052 | 35% |
| 062FH103 | 4,000 | 1,261 | 32% | 1,254 | 31% | 1,230 | 31% | 1,192 | 30% |
| 062FH105 | 4,000 | 1,694 | 42% | 1,644 | 41% | 1,615 | 40% | 1,560 | 39% |
| 062FH128 | 4,000 | 1,484 | 37% | 1,553 | 39% | 1,530 | 38% | 1,482 | 37% |
| 062FH169 | 4,000 | 1,574 | 39% | 1,464 | 37% | 1,436 | 36% | 1,381 | 35% |
| 064FH072 | 2,500 | 913 | 37% | 909 | 36% | 908 | 36% | 904 | 36% |
| 065FH038 | 1,500 | 521 | 35% | 786 | 52% | 947 | 63% | 607 | 40% |
| 065FH039 | 1,500 | 514 | 34% | 734 | 49% | 831 | 55% | 577 | 38% |
| 065FH040 | 1,500 | 553 | 37% | 794 | 53% | 942 | 63% | 638 | 43% |
| 065FH041 | 1,500 | 532 | 35% | 760 | 51% | 877 | 58% | 604 | 40% |
| 065FH044 | 1,500 | 568 | 38% | 773 | 52% | 882 | 59% | 639 | 43% |
| 065FH045 | 1,500 | 514 | 34% | 742 | 49% | 849 | 57% | 581 | 39% |
| 065FH108 | 3,000 | 1,278 | 43% | 1,554 | 52% | 1,886 | 63% | 1,421 | 47% |
| 075FH004 | 3,000 | 772 | 26% | 573 | 19% | 568 | 19% | 562 | 19% |
| 075FH006 | 3,000 | 824 | 27% | 618 | 21% | 614 | 20% | 607 | 20% |
| 075FH007 | 3,000 | 1,275 | 42% | 957 | 32% | 949 | 32% | 939 | 31% |
| 075FH008 | 3,000 | 1,359 | 45% | 1,034 | 34% | 1,025 | 34% | 1,016 | 34% |
| 075FH010 | 3,000 | 1,464 | 49% | 1,097 | 37% | 1,089 | 36% | 1,079 | 36% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 075FH011 | 3,000 | 1,049 | 35% | 783 | 26% | 777 | 26% | 770 | 26% |
| 075FH024 | 1,500 | 662 | 44% | 513 | 34% | 510 | 34% | 507 | 34% |
| 075FH033 | 3,000 | 1,247 | 42% | 966 | 32% | 961 | 32% | 955 | 32% |
| 075FH037 | 3,000 | 1,086 | 36% | 858 | 29% | 855 | 29% | 852 | 28% |
| 075FH048 | 3,000 | 1,064 | 35% | 857 | 29% | 850 | 28% | 840 | 28% |
| 075FH049 | 3,000 | 1,145 | 38% | 923 | 31% | 916 | 31% | 905 | 30% |
| 076FH011 | 4,000 | 1,821 | 46% | 2,491 | 62% | 2,419 | 60% | 2,267 | 57% |
| 076FH013 | 4,000 | 1,727 | 43% | 2,378 | 59% | 2,307 | 58% | 2,158 | 54% |
| 076FH017 | 4,000 | 1,501 | 38% | 2,024 | 51% | 1,967 | 49% | 1,844 | 46% |
| 076FH018 | 4,000 | 1,539 | 38% | 2,081 | 52% | 2,022 | 51% | 1,895 | 47% |
| 076FH021 | 3,000 | 897 | 30% | 701 | 23% | 697 | 23% | 693 | 23% |
| 076FH026 | 3,000 | 902 | 30% | 706 | 24% | 700 | 23% | 695 | 23% |
| 076FH051 | 4,000 | 1,875 | 47% | 1,714 | 43% | 1,683 | 42% | 1,657 | 41% |
| 077FH060 | 3,000 | 1,414 | 47% | 1,271 | 42% | 1,246 | 42% | 1,227 | 41% |
| 078FH001 | 3,000 | 1,159 | 39% | 1,149 | 38% | 1,148 | 38% | 1,140 | 38% |
| 078FH012 | 3,000 | 901 | 30% | 1,029 | 34% | 1,013 | 34% | 979 | 33% |
| 089FH013 | 3,000 | 837 | 28% | 668 | 22% | 670 | 22% | 669 | 22% |
| 089FH026 | 1,500 | 733 | 49% | 605 | 40% | 605 | 40% | 603 | 40% |
| 089FH029 | 1,500 | 736 | 49% | 612 | 41% | 612 | 41% | 611 | 41% |
| 089FH035 | 3,500 | 1,271 | 36% | 1,059 | 30% | 1,104 | 32% | 1,101 | 31% |
| 089FH036 | 3,500 | 941 | 27% | 810 | 23% | 1,223 | 35% | 1,219 | 35% |
| 089FH040 | 3,500 | 1,094 | 31% | 956 | 27% | 1,583 | 45% | 1,577 | 45% |
| 089FH041 | 3,500 | 1,213 | 35% | 1,148 | 33% | 1,144 | 33% | 1,141 | 33% |
| 089FH044 | 3,500 | 1,180 | 34% | 1,043 | 30% | 1,672 | 48% | 1,666 | 48% |
| 089FH045 | 3,500 | 1,214 | 35% | 1,065 | 30% | 1,342 | 38% | 1,336 | 38% |
| 089FH047 | 3,500 | 1,427 | 41% | 1,256 | 36% | 1,781 | 51% | 1,773 | 51% |
| 089FH048 | 3,500 | 1,380 | 39% | 1,225 | 35% | 1,789 | 51% | 1,782 | 51% |
| 089FH049 | 3,500 | 1,339 | 38% | 1,189 | 34% | 1,785 | 51% | 1,778 | 51% |
| 089FH050 | 3,500 | 1,308 | 37% | 1,162 | 33% | 1,727 | 49% | 1,721 | 49% |
| 089FH052 | 3,500 | 1,476 | 42% | 1,300 | 37% | 1,443 | 41% | 1,437 | 41% |
| 089FH056 | 3,500 | 1,708 | 49% | 2,082 | 59% | 1,986 | 57% | 1,849 | 53% |
| 089FH058 | 3,500 | 970 | 28% | 837 | 24% | 1,306 | 37% | 1,301 | 37% |
| 090FH025 | 2,500 | 1,023 | 41% | 859 | 34% | 857 | 34% | 854 | 34% |
| 090FH027 | 3,000 | 1,196 | 40% | 1,044 | 35% | 1,038 | 35% | 1,033 | 34% |
| 090FH043 | 2,500 | 859 | 34% | 725 | 29% | 719 | 29% | 714 | 29% |
| 090FH047 | 3,500 | 889 | 25% | 756 | 22% | 750 | 21% | 746 | 21% |
| 090FH066 | 2,500 | 956 | 38% | 830 | 33% | 827 | 33% | 823 | 33% |
| 090FH075 | 3,500 | 1,466 | 42% | 2,269 | 65% | 2,261 | 65% | 2,253 | 64% |
| 090FH086 | 3,500 | 957 | 27% | 845 | 24% | 842 | 24% | 839 | 24% |
| 090FH090 | 3,500 | 1,085 | 31% | 967 | 28% | 963 | 28% | 958 | 27% |
| 090FH092 | 3,500 | 1,119 | 32% | 990 | 28% | 988 | 28% | 983 | 28% |
| 090FH097 | 3,500 | 1,338 | 38% | 1,193 | 34% | 1,188 | 34% | 1,182 | 34% |
| 090FH107 | 3,500 | 1,339 | 38% | 1,206 | 34% | 1,199 | 34% | 1,193 | 34% |
| 090FH114 | 2,500 | 942 | 38% | 2,584 | 100% | 2,562 | 100% | 2,545 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 090FH118 | 3,500 | 1,064 | 30% | 5,259 | 100% | 5,207 | 100% | 5,166 | 100% |
| 091FH014 | 2,500 | 871 | 35% | 4,206 | 100% | 4,156 | 100% | 4,115 | 100% |
| 091FH024 | 2,500 | 717 | 29% | 639 | 26% | 630 | 25% | 624 | 25% |
| 091FH027 | 3,000 | 1,032 | 34% | 989 | 33% | 978 | 33% | 970 | 32% |
| 091FH029 | 2,500 | 776 | 31% | 774 | 31% | 765 | 31% | 759 | 30% |
| 091FH032 | 1,500 | 749 | 50% | 683 | 46% | 676 | 45% | 671 | 45% |
| 091FH036 | 2,500 | 841 | 34% | 745 | 30% | 735 | 29% | 727 | 29% |
| 091FH037 | 2,500 | 1,019 | 41% | 2,103 | 84% | 2,069 | 83% | 2,041 | 82% |
| 091FH041 | 1,500 | 599 | 40% | 528 | 35% | 521 | 35% | 515 | 34% |
| 091FH043 | 1,500 | 494 | 33% | 438 | 29% | 431 | 29% | 427 | 28% |
| 091FH044 | 1,500 | 630 | 42% | 568 | 38% | 559 | 37% | 553 | 37% |
| 091FH047 | 1,500 | 584 | 39% | 534 | 36% | 526 | 35% | 520 | 35% |
| 091FH049 | 1,500 | 602 | 40% | 549 | 37% | 540 | 36% | 533 | 36% |
| 091FH050 | 1,500 | 701 | 47% | 650 | 43% | 641 | 43% | 634 | 42% |
| 091FH053 | 3,000 | 869 | 29% | 821 | 27% | 810 | 27% | 801 | 27% |
| 091FH055 | 3,000 | 1,334 | 44% | 1,294 | 43% | 1,273 | 42% | 1,257 | 42% |
| 091FH067 | 3,000 | 1,146 | 38% | 1,034 | 34% | 1,026 | 34% | 1,019 | 34% |
| 091FH080 | 3,500 | 1,161 | 33% | 1,055 | 30% | 1,047 | 30% | 1,041 | 30% |
| 091FH091 | 3,000 | 824 | 27% | 816 | 27% | 804 | 27% | 796 | 27% |
| 091FH095 | 3,000 | 958 | 32% | 981 | 33% | 966 | 32% | 956 | 32% |
| 091FH104 | 3,000 | 1,075 | 36% | 1,350 | 45% | 1,330 | 44% | 1,316 | 44% |
| 092FH011 | 3,500 | 1,599 | 46% | 1,537 | 44% | 1,519 | 43% | 1,505 | 43% |
| 092FH042 | 3,000 | 881 | 29% | 830 | 28% | 822 | 27% | 816 | 27% |
| 092FH054 | 3,000 | 1,325 | 44% | 1,283 | 43% | 1,273 | 42% | 1,265 | 42% |
| 092FH066 | 1,500 | 718 | 48% | 697 | 46% | 686 | 46% | 679 | 45% |
| 092FH071 | 3,000 | 1,467 | 49% | 1,472 | 49% | 1,452 | 48% | 1,436 | 48% |
| 093FH054 | 3,000 | 1,342 | 45% | 1,334 | 44% | 1,330 | 44% | 1,327 | 44% |
| 102FH007 | 3,000 | 949 | 32% | 852 | 28% | 840 | 28% | 824 | 27% |
| 103FH045 | 3,500 | 1,539 | 44% | 1,471 | 42% | 1,453 | 42% | 1,444 | 41% |
| 103FH081 | 3,500 | 1,161 | 33% | 1,055 | 30% | 3,324 | 95% | 3,201 | 91% |
| 103FH146 | 3,500 | 1,021 | 29% | 919 | 26% | 942 | 27% | 926 | 26% |
| 104FH001 | 3,500 | 1,211 | 35% | 1,102 | 31% | 1,097 | 31% | 1,092 | 31% |
| 104FH010 | 3,000 | 1,440 | 48% | 1,324 | 44% | 1,316 | 44% | 1,310 | 44% |
| 104FH025 | 2,500 | 632 | 25% | 624 | 25% | 615 | 25% | 610 | 24% |
| 104FH029 | 2,500 | 941 | 38% | 958 | 38% | 942 | 38% | 932 | 37% |
| 104FH031 | 3,000 | 1,422 | 47% | 1,395 | 47% | 1,381 | 46% | 1,373 | 46% |
| 104FH037 | 3,000 | 1,196 | 40% | 1,191 | 40% | 1,177 | 39% | 1,168 | 39% |
| 104FH041 | 3,000 | 756 | 25% | 737 | 25% | 728 | 24% | 722 | 24% |
| 104FH060 | 1,500 | 667 | 44% | 658 | 44% | 646 | 43% | 639 | 43% |
| 105FH018 | 3,500 | 1,056 | 30% | 1,101 | 31% | 1,080 | 31% | 1,067 | 30% |
| 105FH023 | 3,000 | 855 | 29% | 898 | 30% | 882 | 29% | 872 | 29% |
| 105FH031 | 3,500 | 1,044 | 30% | 1,566 | 45% | 1,531 | 44% | 1,510 | 43% |
| 105FH035 | 3,500 | 1,136 | 32% | 2,191 | 63% | 2,141 | 61% | 2,111 | 60% |
| 105FH048 | 3,500 | 1,138 | 33% | 1,228 | 35% | 1,203 | 34% | 1,189 | 34% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 105FH053 | 3,500 | 1,119 | 32% | 1,215 | 35% | 1,184 | 34% | 1,168 | 33% |
| 105FH060 | 2,500 | 668 | 27% | 689 | 28% | 678 | 27% | 670 | 27% |
| 105FH070 | 3,000 | 1,485 | 49% | 1,687 | 56% | 1,641 | 55% | 1,605 | 54% |
| 105FH072 | 3,500 | 953 | 27% | 1,024 | 29% | 999 | 29% | 986 | 28% |
| 105FH082 | 3,500 | 1,660 | 47% | 1,925 | 55% | 1,851 | 53% | 1,798 | 51% |
| 105FH093 | 2,500 | 1,238 | 50% | 1,429 | 57% | 1,368 | 55% | 1,325 | 53% |
| 107FH018 | 3,500 | 1,152 | 33% | 4,168 | 100% | 4,169 | 100% | 4,161 | 100% |
| 107FH019 | 3,500 | 1,222 | 35% | 3,564 | 100% | 3,564 | 100% | 3,557 | 100% |
| 107FH020 | 3,500 | 928 | 27% | 3,649 | 100% | 3,649 | 100% | 3,643 | 100% |
| 107FH022 | 3,500 | 1,275 | 36% | 3,178 | 91% | 3,178 | 91% | 3,172 | 91% |
| 107FH023 | 3,500 | 1,337 | 38% | 3,028 | 87% | 3,028 | 87% | 3,022 | 86% |
| 107FH024 | 3,500 | 1,719 | 49% | 3,046 | 87% | 3,047 | 87% | 3,041 | 87% |
| 107FH025 | 3,500 | 1,602 | 46% | 2,992 | 85% | 2,992 | 85% | 2,986 | 85% |
| 107FH026 | 3,500 | 1,447 | 41% | 2,997 | 86% | 2,997 | 86% | 2,991 | 85% |
| 107FH034 | 3,500 | 1,537 | 44% | 2,808 | 80% | 2,808 | 80% | 2,803 | 80% |
| 107FH035 | 3,500 | 1,533 | 44% | 2,789 | 80% | 2,789 | 80% | 2,784 | 80% |
| 107FH036 | 3,500 | 1,521 | 43% | 2,758 | 79% | 2,758 | 79% | 2,753 | 79% |
| 107FH037 | 3,500 | 1,518 | 43% | 2,858 | 82% | 2,859 | 82% | 2,853 | 82% |
| 107FH038 | 3,500 | 1,496 | 43% | 2,675 | 76% | 2,675 | 76% | 2,670 | 76% |
| 107FH039 | 3,500 | 1,481 | 42% | 2,558 | 73% | 2,558 | 73% | 2,553 | 73% |
| 107FH042 | 3,500 | 1,139 | 33% | 1,748 | 50% | 1,747 | 50% | 1,745 | 50% |
| 107FH043 | 3,500 | 1,181 | 34% | 1,856 | 53% | 1,856 | 53% | 1,853 | 53% |
| 107FH044 | 3,000 | 988 | 33% | 4,964 | 100% | 4,965 | 100% | 4,955 | 100% |
| 107FH045 | 3,000 | 963 | 32% | 4,145 | 100% | 4,145 | 100% | 4,137 | 100% |
| 107FH046 | 3,000 | 897 | 30% | 3,838 | 100% | 3,838 | 100% | 3,834 | 100% |
| 117FH011 | 3,500 | 1,612 | 46% | 1,464 | 42% | 1,631 | 47% | 1,595 | 46% |
| 118FH003 | 3,000 | 1,081 | 36% | 1,355 | 45% | 1,204 | 40% | 1,166 | 39% |
| 144FH001 | 3,500 | 1,271 | 36% | 4,879 | 100% | 4,711 | 100% | 4,376 | 100% |
| 144FH002 | 3,500 | 1,450 | 41% | 5,486 | 100% | 5,320 | 100% | 4,972 | 100% |
| 144FH003 | 3,500 | 1,605 | 46% | 6,171 | 100% | 6,001 | 100% | 5,642 | 100% |
| 156FH002 | 3,500 | 1,281 | 37% | 2,116 | 60% | 2,022 | 58% | 1,827 | 52% |
| 156FH003 | 3,500 | 887 | 25% | 1,838 | 53% | 1,718 | 49% | 1,423 | 41% |
| 156FH004 | 3,500 | 1,134 | 32% | 2,059 | 59% | 1,936 | 55% | 1,680 | 48% |
| 156FH005 | 3,500 | 954 | 27% | 1,817 | 52% | 1,693 | 48% | 1,397 | 40% |
| 156FH008 | 3,500 | 916 | 26% | 1,319 | 38% | 1,247 | 36% | 1,130 | 32% |
| 156FH009 | 3,500 | 977 | 28% | 1,407 | 40% | 1,339 | 38% | 1,211 | 35% |
| 157FH001 | 3,500 | 1,570 | 45% | 2,592 | 74% | 2,489 | 71% | 2,223 | 64% |
| 157FH002 | 3,500 | 1,720 | 49% | 2,728 | 78% | 2,632 | 75% | 2,391 | 68% |
| 157FH006 | 3,500 | 1,694 | 48% | 2,451 | 70% | 2,357 | 67% | 2,160 | 62% |
| 157FH017 | 3,500 | 1,308 | 37% | 1,639 | 47% | 1,589 | 45% | 1,460 | 42% |
| 157FH018 | 3,500 | 1,064 | 30% | 1,291 | 37% | 1,240 | 35% | 1,117 | 32% |
| 157FH019 | 3,500 | 896 | 26% | 1,051 | 30% | 1,007 | 29% | 901 | 26% |
| 170FH001 | 3,500 | 1,109 | 32% | 1,966 | 56% | 1,841 | 53% | 1,577 | 45% |
| 170FH002 | 3,500 | 1,354 | 39% | 2,498 | 71% | 2,342 | 67% | 2,045 | 58% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 170FH003 | 3,500 | 1,308 | 37% | 2,180 | 62% | 2,059 | 59% | 1,813 | 52% |
| 170FH004 | 3,500 | 1,399 | 40% | 2,294 | 66% | 2,176 | 62% | 1,938 | 55% |
| 170FH005 | 3,500 | 1,458 | 42% | 2,662 | 76% | 2,506 | 72% | 2,197 | 63% |
| 170FH006 | 3,500 | 1,463 | 42% | 2,397 | 68% | 2,279 | 65% | 2,032 | 58% |
| 170FH007 | 3,500 | 1,312 | 37% | 2,110 | 60% | 2,008 | 57% | 1,766 | 50% |
| 170FH008 | 3,500 | 1,519 | 43% | 2,525 | 72% | 2,401 | 69% | 2,132 | 61% |
| 171FH001 | 3,500 | 1,698 | 49% | 3,053 | 87% | 2,910 | 83% | 2,600 | 74% |
| 171FH003 | 3,500 | 1,630 | 47% | 2,871 | 82% | 2,753 | 79% | 2,444 | 70% |
| 171FH004 | 3,500 | 1,653 | 47% | 3,197 | 91% | 3,048 | 87% | 2,667 | 76% |
| 171FH005 | 3,000 | 1,213 | 40% | 1,518 | 51% | 1,492 | 50% | 1,381 | 46% |
| **2013 Available Fire Flow 50 - 75% of Fire Flow Goal** | | | | | | | | | |
| 047FH084 | 3,000 | 2,014 | 67% | 2,418 | 81% | 2,373 | 79% | 2,280 | 76% |
| 047FH114 | 1,500 | 967 | 64% | 1,577 | 100% | 1,521 | 100% | 1,402 | 93% |
| 047FH124 | 3,000 | 2,201 | 73% | 2,382 | 79% | 2,364 | 79% | 2,318 | 77% |
| 048FH011 | 1,500 | 1,075 | 72% | 1,040 | 69% | 1,017 | 68% | 969 | 65% |
| 048FH047 | 3,000 | 2,190 | 73% | 2,692 | 90% | 2,629 | 88% | 2,496 | 83% |
| 048FH048 | 3,000 | 2,005 | 67% | 2,453 | 82% | 2,398 | 80% | 2,282 | 76% |
| 048FH050 | 3,000 | 2,077 | 69% | 2,530 | 84% | 2,473 | 82% | 2,355 | 79% |
| 048FH080 | 3,500 | 2,153 | 62% | 2,669 | 76% | 2,570 | 73% | 2,361 | 67% |
| 048FH139 | 1,500 | 787 | 52% | 1,718 | 100% | 1,624 | 100% | 1,417 | 94% |
| 048FH140 | 1,500 | 1,062 | 71% | 1,707 | 100% | 1,636 | 100% | 1,481 | 99% |
| 048FH150 | 3,000 | 2,173 | 72% | 2,311 | 77% | 2,311 | 77% | 2,287 | 76% |
| 049FH001 | 3,500 | 2,562 | 73% | 2,996 | 86% | 2,900 | 83% | 2,696 | 77% |
| 049FH025 | 2,500 | 1,559 | 62% | 1,616 | 65% | 1,571 | 63% | 1,476 | 59% |
| 049FH027 | 3,500 | 2,482 | 71% | 2,907 | 83% | 2,818 | 81% | 2,628 | 75% |
| 049FH028 | 3,500 | 2,356 | 67% | 2,729 | 78% | 2,651 | 76% | 2,487 | 71% |
| 049FH029 | 3,500 | 2,510 | 72% | 2,897 | 83% | 2,810 | 80% | 2,627 | 75% |
| 049FH030 | 3,500 | 2,165 | 62% | 2,558 | 73% | 2,482 | 71% | 2,321 | 66% |
| 049FH031 | 3,500 | 2,440 | 70% | 2,873 | 82% | 2,779 | 79% | 2,580 | 74% |
| 049FH032 | 3,500 | 2,285 | 65% | 2,705 | 77% | 2,619 | 75% | 2,437 | 70% |
| 049FH033 | 3,500 | 1,773 | 51% | 2,230 | 64% | 2,158 | 62% | 2,004 | 57% |
| 049FH035 | 3,000 | 1,522 | 51% | 1,582 | 53% | 1,536 | 51% | 1,440 | 48% |
| 049FH036 | 2,500 | 1,541 | 62% | 1,606 | 64% | 1,565 | 63% | 1,480 | 59% |
| 049FH037 | 3,000 | 1,508 | 50% | 1,568 | 52% | 1,522 | 51% | 1,428 | 48% |
| 061FH019 | 3,000 | 2,098 | 70% | 2,401 | 80% | 2,364 | 79% | 2,287 | 76% |
| 061FH020 | 3,000 | 2,182 | 73% | 2,534 | 84% | 2,487 | 83% | 2,389 | 80% |
| 061FH022 | 3,000 | 2,160 | 72% | 2,470 | 82% | 2,432 | 81% | 2,353 | 78% |
| 061FH025 | 3,000 | 1,868 | 62% | 2,216 | 74% | 2,170 | 72% | 2,076 | 69% |
| 061FH029 | 2,500 | 1,783 | 71% | 2,087 | 83% | 2,043 | 82% | 1,952 | 78% |
| 061FH030 | 3,000 | 1,685 | 56% | 2,109 | 70% | 2,054 | 68% | 1,940 | 65% |
| 061FH033 | 2,500 | 1,841 | 74% | 2,135 | 85% | 2,092 | 84% | 2,003 | 80% |
| 061FH035 | 2,500 | 1,347 | 54% | 1,741 | 70% | 1,692 | 68% | 1,590 | 64% |
| 061FH040 | 2,500 | 1,370 | 55% | 1,762 | 70% | 1,713 | 69% | 1,611 | 64% |
| 061FH041 | 3,500 | 2,082 | 59% | 2,449 | 70% | 2,391 | 68% | 2,272 | 65% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 061FH044 | 3,000 | 1,781 | 59% | 2,170 | 72% | 2,114 | 70% | 1,997 | 67% |
| 061FH045 | 3,000 | 1,738 | 58% | 2,131 | 71% | 2,075 | 69% | 1,959 | 65% |
| 061FH046 | 3,000 | 1,560 | 52% | 1,976 | 66% | 1,922 | 64% | 1,809 | 60% |
| 061FH053 | 3,000 | 1,729 | 58% | 2,056 | 69% | 2,014 | 67% | 1,927 | 64% |
| 061FH055 | 3,000 | 1,763 | 59% | 1,912 | 64% | 1,880 | 63% | 1,818 | 61% |
| 061FH058 | 3,000 | 1,870 | 62% | 2,031 | 68% | 1,997 | 67% | 1,928 | 64% |
| 061FH059 | 3,500 | 2,209 | 63% | 2,391 | 68% | 2,350 | 67% | 2,269 | 65% |
| 061FH061 | 3,500 | 1,792 | 51% | 1,918 | 55% | 1,890 | 54% | 1,835 | 52% |
| 061FH062 | 3,000 | 1,714 | 57% | 1,485 | 50% | 1,463 | 49% | 1,427 | 48% |
| 061FH082 | 3,000 | 1,860 | 62% | 2,176 | 73% | 2,135 | 71% | 2,050 | 68% |
| 061FH083 | 3,000 | 1,864 | 62% | 2,180 | 73% | 2,139 | 71% | 2,054 | 68% |
| 061FH088 | 3,000 | 1,678 | 56% | 1,821 | 61% | 1,791 | 60% | 1,731 | 58% |
| 061FH089 | 3,500 | 2,603 | 74% | 2,518 | 72% | 2,481 | 71% | 2,414 | 69% |
| 061FH092 | 3,500 | 2,363 | 68% | 2,299 | 66% | 2,268 | 65% | 2,208 | 63% |
| 061FH093 | 3,500 | 1,968 | 56% | 1,981 | 57% | 1,955 | 56% | 1,905 | 54% |
| 061FH094 | 3,500 | 2,398 | 69% | 2,331 | 67% | 2,300 | 66% | 2,242 | 64% |
| 061FH095 | 3,500 | 2,102 | 60% | 1,994 | 57% | 1,968 | 56% | 1,916 | 55% |
| 061FH096 | 3,000 | 1,736 | 58% | 1,710 | 57% | 1,688 | 56% | 1,646 | 55% |
| 061FH097 | 3,000 | 1,725 | 57% | 1,713 | 57% | 1,691 | 56% | 1,648 | 55% |
| 061FH098 | 3,000 | 1,878 | 63% | 1,848 | 62% | 1,824 | 61% | 1,776 | 59% |
| 061FH099 | 3,500 | 2,183 | 62% | 2,142 | 61% | 2,114 | 60% | 2,059 | 59% |
| 061FH100 | 3,000 | 1,970 | 66% | 1,994 | 66% | 1,967 | 66% | 1,916 | 64% |
| 061FH101 | 3,000 | 1,907 | 64% | 1,808 | 60% | 1,785 | 60% | 1,740 | 58% |
| 062FH005 | 3,000 | 2,238 | 75% | 2,678 | 89% | 2,622 | 87% | 2,503 | 83% |
| 062FH095 | 3,000 | 1,544 | 51% | 1,674 | 56% | 1,638 | 55% | 1,563 | 52% |
| 062FH100 | 3,500 | 1,755 | 50% | 1,719 | 49% | 1,693 | 48% | 1,642 | 47% |
| 062FH101 | 3,500 | 1,801 | 51% | 1,766 | 50% | 1,737 | 50% | 1,681 | 48% |
| 062FH107 | 4,000 | 2,605 | 65% | 2,625 | 66% | 2,578 | 64% | 2,490 | 62% |
| 062FH108 | 4,000 | 2,121 | 53% | 2,053 | 51% | 2,022 | 51% | 1,967 | 49% |
| 062FH109 | 4,000 | 2,460 | 61% | 2,341 | 59% | 2,304 | 58% | 2,242 | 56% |
| 062FH110 | 4,000 | 2,715 | 68% | 2,616 | 65% | 2,572 | 64% | 2,498 | 62% |
| 062FH111 | 4,000 | 2,675 | 67% | 2,576 | 64% | 2,534 | 63% | 2,464 | 62% |
| 062FH112 | 4,000 | 2,988 | 75% | 2,914 | 73% | 2,863 | 72% | 2,776 | 69% |
| 062FH113 | 4,000 | 2,829 | 71% | 2,741 | 69% | 2,695 | 67% | 2,616 | 65% |
| 062FH114 | 4,000 | 2,890 | 72% | 2,807 | 70% | 2,759 | 69% | 2,678 | 67% |
| 062FH118 | 3,000 | 1,578 | 53% | 1,915 | 64% | 1,878 | 63% | 1,800 | 60% |
| 062FH136 | 3,500 | 2,479 | 71% | 3,133 | 90% | 3,064 | 88% | 2,922 | 83% |
| 062FH162 | 3,500 | 2,524 | 72% | 2,904 | 83% | 2,850 | 81% | 2,735 | 78% |
| 063FH016 | 3,500 | 2,434 | 70% | 3,099 | 89% | 3,030 | 87% | 2,887 | 82% |
| 063FH022 | 3,500 | 2,566 | 73% | 3,302 | 94% | 3,226 | 92% | 3,070 | 88% |
| 063FH024 | 3,500 | 2,560 | 73% | 3,281 | 94% | 3,209 | 92% | 3,060 | 87% |
| 064FH084 | 3,000 | 1,654 | 55% | 1,936 | 65% | 1,901 | 63% | 1,829 | 61% |
| 064FH090 | 3,000 | 2,070 | 69% | 2,455 | 82% | 2,409 | 80% | 2,316 | 77% |
| 064FH096 | 3,000 | 1,892 | 63% | 1,876 | 63% | 1,874 | 62% | 1,861 | 62% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 064FH100 | 3,000 | 1,899 | 63% | 2,221 | 74% | 2,183 | 73% | 2,104 | 70% |
| 064FH106 | 3,000 | 2,159 | 72% | 2,136 | 71% | 2,134 | 71% | 2,121 | 71% |
| 064FH134 | 3,000 | 1,848 | 62% | 1,834 | 61% | 1,833 | 61% | 1,822 | 61% |
| 065FH006 | 1,500 | 923 | 62% | 1,130 | 75% | 1,052 | 70% | 871 | 58% |
| 065FH014 | 3,500 | 2,405 | 69% | 2,351 | 67% | 2,351 | 67% | 2,322 | 66% |
| 065FH050 | 1,500 | 762 | 51% | 916 | 61% | 1,054 | 70% | 858 | 57% |
| 075FH015 | 3,000 | 1,685 | 56% | 1,317 | 44% | 1,307 | 44% | 1,295 | 43% |
| 075FH018 | 3,000 | 2,249 | 75% | 1,870 | 62% | 1,852 | 62% | 1,835 | 61% |
| 075FH019 | 3,000 | 1,754 | 58% | 1,416 | 47% | 1,405 | 47% | 1,394 | 46% |
| 075FH020 | 3,000 | 1,932 | 64% | 1,703 | 57% | 1,688 | 56% | 1,673 | 56% |
| 075FH022 | 3,000 | 2,082 | 69% | 1,656 | 55% | 1,642 | 55% | 1,628 | 54% |
| 075FH023 | 3,000 | 1,926 | 64% | 1,533 | 51% | 1,521 | 51% | 1,509 | 50% |
| 075FH031 | 3,000 | 1,720 | 57% | 1,368 | 46% | 1,358 | 45% | 1,349 | 45% |
| 075FH034 | 1,500 | 966 | 64% | 744 | 50% | 741 | 49% | 738 | 49% |
| 075FH043 | 1,500 | 1,105 | 74% | 907 | 60% | 904 | 60% | 901 | 60% |
| 075FH050 | 3,000 | 2,226 | 74% | 1,756 | 59% | 1,736 | 58% | 1,718 | 57% |
| 075FH051 | 3,000 | 1,747 | 58% | 1,376 | 46% | 1,366 | 46% | 1,355 | 45% |
| 076FH002 | 4,000 | 2,456 | 61% | 1,974 | 49% | 1,953 | 49% | 1,935 | 48% |
| 076FH003 | 4,000 | 2,130 | 53% | 1,688 | 42% | 1,670 | 42% | 1,655 | 41% |
| 076FH004 | 4,000 | 2,911 | 73% | 2,377 | 59% | 2,350 | 59% | 2,327 | 58% |
| 076FH010 | 4,000 | 2,434 | 61% | 3,181 | 80% | 3,104 | 78% | 2,946 | 74% |
| 076FH012 | 4,000 | 2,357 | 59% | 3,083 | 77% | 3,008 | 75% | 2,852 | 71% |
| 076FH016 | 4,000 | 2,226 | 56% | 2,897 | 72% | 2,826 | 71% | 2,681 | 67% |
| 076FH019 | 4,000 | 2,296 | 57% | 2,991 | 75% | 2,919 | 73% | 2,769 | 69% |
| 076FH043 | 1,500 | 996 | 66% | 814 | 54% | 809 | 54% | 804 | 54% |
| 076FH063 | 4,000 | 2,948 | 74% | 2,506 | 63% | 2,481 | 62% | 2,461 | 62% |
| 076FH064 | 4,000 | 2,279 | 57% | 1,891 | 47% | 1,874 | 47% | 1,859 | 46% |
| 077FH004 | 3,500 | 2,564 | 73% | 3,313 | 95% | 3,240 | 93% | 3,088 | 88% |
| 077FH018 | 4,000 | 2,707 | 68% | 3,514 | 88% | 3,436 | 86% | 3,276 | 82% |
| 077FH019 | 4,000 | 2,564 | 64% | 2,380 | 60% | 2,331 | 58% | 2,288 | 57% |
| 077FH020 | 4,000 | 2,798 | 70% | 2,613 | 65% | 2,555 | 64% | 2,506 | 63% |
| 077FH021 | 4,000 | 2,301 | 58% | 2,116 | 53% | 2,072 | 52% | 2,035 | 51% |
| 077FH041 | 4,000 | 2,987 | 75% | 2,829 | 71% | 2,774 | 69% | 2,727 | 68% |
| 077FH042 | 4,000 | 2,778 | 69% | 2,584 | 65% | 2,524 | 63% | 2,473 | 62% |
| 077FH045 | 4,000 | 2,319 | 58% | 2,143 | 54% | 2,100 | 52% | 2,064 | 52% |
| 077FH055 | 2,500 | 1,712 | 68% | 1,616 | 65% | 1,586 | 63% | 1,561 | 62% |
| 077FH065 | 3,000 | 2,226 | 74% | 6,649 | 100% | 6,425 | 100% | 6,298 | 100% |
| 077FH080 | 1,500 | 982 | 65% | 1,276 | 85% | 1,258 | 84% | 1,243 | 83% |
| 077FH087 | 3,000 | 1,786 | 60% | 1,912 | 64% | 1,883 | 63% | 1,859 | 62% |
| 077FH097 | 3,000 | 1,952 | 65% | 1,939 | 65% | 1,901 | 63% | 1,869 | 62% |
| 078FH005 | 3,000 | 2,113 | 70% | 2,034 | 68% | 2,010 | 67% | 1,987 | 66% |
| 081FH002 | 3,000 | 2,061 | 69% | 2,011 | 67% | 3,748 | 100% | 3,692 | 100% |
| 089FH024 | 3,500 | 2,550 | 73% | 2,171 | 62% | 2,334 | 67% | 2,329 | 67% |
| 089FH027 | 3,500 | 2,512 | 72% | 2,144 | 61% | 2,358 | 67% | 2,353 | 67% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 089FH031 | 3,500 | 2,507 | 72% | 2,149 | 61% | 2,455 | 70% | 2,450 | 70% |
| 089FH046 | 3,500 | 1,826 | 52% | 1,623 | 46% | 1,913 | 55% | 1,905 | 54% |
| 090FH009 | 1,500 | 1,066 | 71% | 895 | 60% | 892 | 59% | 889 | 59% |
| 090FH016 | 2,500 | 1,387 | 55% | 1,207 | 48% | 1,199 | 48% | 1,192 | 48% |
| 090FH022 | 3,000 | 2,142 | 71% | 1,884 | 63% | 1,873 | 62% | 1,864 | 62% |
| 090FH026 | 2,500 | 1,692 | 68% | 1,453 | 58% | 1,447 | 58% | 1,441 | 58% |
| 090FH031 | 2,500 | 1,384 | 55% | 1,196 | 48% | 1,191 | 48% | 1,186 | 47% |
| 090FH044 | 3,000 | 1,986 | 66% | 1,723 | 57% | 1,710 | 57% | 1,699 | 57% |
| 090FH045 | 3,000 | 1,584 | 53% | 1,373 | 46% | 1,360 | 45% | 1,350 | 45% |
| 090FH048 | 1,500 | 788 | 53% | 673 | 45% | 668 | 45% | 663 | 44% |
| 090FH052 | 1,500 | 884 | 59% | 771 | 51% | 765 | 51% | 761 | 51% |
| 090FH063 | 3,500 | 2,597 | 74% | 2,370 | 68% | 2,353 | 67% | 2,339 | 67% |
| 090FH064 | 1,500 | 883 | 59% | 787 | 52% | 782 | 52% | 778 | 52% |
| 090FH077 | 3,500 | 1,805 | 52% | 1,610 | 46% | 1,617 | 46% | 1,610 | 46% |
| 090FH084 | 3,500 | 2,027 | 58% | 1,846 | 53% | 1,835 | 52% | 1,826 | 52% |
| 090FH094 | 3,500 | 1,982 | 57% | 1,792 | 51% | 1,782 | 51% | 1,774 | 51% |
| 090FH112 | 2,500 | 1,568 | 63% | 1,405 | 56% | 1,396 | 56% | 1,388 | 56% |
| 090FH116 | 3,500 | 2,130 | 61% | 1,942 | 55% | 1,928 | 55% | 1,917 | 55% |
| 090FH131 | 3,500 | 2,045 | 58% | 1,880 | 54% | 1,866 | 53% | 1,855 | 53% |
| 090FH140 | 3,500 | 2,288 | 65% | 2,138 | 61% | 2,120 | 61% | 2,106 | 60% |
| 090FH154 | 3,500 | 2,301 | 66% | 2,138 | 61% | 2,122 | 61% | 2,111 | 60% |
| 091FH007 | 1,500 | 844 | 56% | 764 | 51% | 754 | 50% | 747 | 50% |
| 091FH009 | 1,500 | 1,044 | 70% | 942 | 63% | 928 | 62% | 917 | 61% |
| 091FH039 | 1,500 | 791 | 53% | 718 | 48% | 708 | 47% | 700 | 47% |
| 091FH051 | 3,000 | 2,080 | 69% | 2,800 | 93% | 2,758 | 92% | 2,726 | 91% |
| 091FH058 | 3,000 | 2,040 | 68% | 2,061 | 69% | 2,029 | 68% | 2,005 | 67% |
| 091FH059 | 3,000 | 1,851 | 62% | 1,831 | 61% | 1,797 | 60% | 1,771 | 59% |
| 091FH060 | 3,000 | 1,961 | 65% | 1,807 | 60% | 1,792 | 60% | 1,780 | 59% |
| 091FH065 | 3,000 | 2,079 | 69% | 1,912 | 64% | 1,895 | 63% | 1,881 | 63% |
| 091FH077 | 3,500 | 1,912 | 55% | 1,815 | 52% | 1,794 | 51% | 1,779 | 51% |
| 091FH081 | 3,500 | 1,942 | 55% | 1,800 | 51% | 1,786 | 51% | 1,775 | 51% |
| 091FH086 | 3,000 | 1,604 | 53% | 1,527 | 51% | 1,508 | 50% | 1,494 | 50% |
| 091FH090 | 1,500 | 834 | 56% | 808 | 54% | 797 | 53% | 788 | 53% |
| 091FH092 | 3,000 | 1,590 | 53% | 2,848 | 95% | 2,806 | 94% | 2,774 | 92% |
| 091FH096 | 3,000 | 2,086 | 70% | 3,556 | 100% | 3,500 | 100% | 3,459 | 100% |
| 091FH097 | 3,500 | 2,428 | 69% | 3,009 | 86% | 2,967 | 85% | 2,935 | 84% |
| 091FH099 | 1,500 | 1,008 | 67% | 4,235 | 100% | 4,156 | 100% | 4,099 | 100% |
| 091FH100 | 3,500 | 2,366 | 68% | 2,504 | 72% | 2,475 | 71% | 2,453 | 70% |
| 091FH101 | 3,500 | 2,138 | 61% | 2,188 | 63% | 2,164 | 62% | 2,145 | 61% |
| 091FH102 | 3,000 | 2,016 | 67% | 2,318 | 77% | 2,276 | 76% | 2,246 | 75% |
| 091FH103 | 3,500 | 2,338 | 67% | 2,459 | 70% | 2,431 | 69% | 2,410 | 69% |
| 092FH006 | 3,500 | 1,976 | 56% | 1,886 | 54% | 1,867 | 53% | 1,849 | 53% |
| 092FH009 | 3,500 | 2,419 | 69% | 2,375 | 68% | 2,348 | 67% | 2,324 | 66% |
| 092FH026 | 3,000 | 2,143 | 71% | 2,137 | 71% | 2,100 | 70% | 2,069 | 69% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 092FH035 | 3,000 | 2,098 | 70% | 2,043 | 68% | 2,024 | 67% | 2,006 | 67% |
| 092FH036 | 3,000 | 2,095 | 70% | 2,099 | 70% | 2,094 | 70% | 2,067 | 69% |
| 092FH037 | 3,000 | 2,070 | 69% | 2,072 | 69% | 2,067 | 69% | 2,037 | 68% |
| 092FH047 | 3,500 | 2,210 | 63% | 2,167 | 62% | 2,149 | 61% | 2,132 | 61% |
| 092FH048 | 3,500 | 2,117 | 60% | 2,078 | 59% | 2,062 | 59% | 2,047 | 58% |
| 092FH049 | 3,000 | 2,097 | 70% | 2,060 | 69% | 2,044 | 68% | 2,029 | 68% |
| 092FH051 | 3,000 | 1,962 | 65% | 1,927 | 64% | 1,912 | 64% | 1,899 | 63% |
| 092FH052 | 3,500 | 2,273 | 65% | 2,234 | 64% | 2,217 | 63% | 2,202 | 63% |
| 092FH053 | 3,500 | 2,086 | 60% | 2,049 | 59% | 2,034 | 58% | 2,020 | 58% |
| 092FH055 | 3,000 | 2,016 | 67% | 1,982 | 66% | 1,969 | 66% | 1,956 | 65% |
| 092FH056 | 3,000 | 1,975 | 66% | 1,941 | 65% | 1,927 | 64% | 1,915 | 64% |
| 092FH057 | 3,000 | 1,894 | 63% | 1,928 | 64% | 1,891 | 63% | 1,863 | 62% |
| 092FH058 | 3,000 | 1,705 | 57% | 1,707 | 57% | 1,675 | 56% | 1,650 | 55% |
| 092FH059 | 3,000 | 1,804 | 60% | 1,798 | 60% | 1,766 | 59% | 1,741 | 58% |
| 092FH061 | 3,000 | 1,531 | 51% | 1,527 | 51% | 1,508 | 50% | 1,493 | 50% |
| 092FH062 | 3,000 | 1,585 | 53% | 1,580 | 53% | 1,556 | 52% | 1,538 | 51% |
| 092FH063 | 1,500 | 792 | 53% | 768 | 51% | 756 | 50% | 747 | 50% |
| 092FH069 | 1,500 | 785 | 52% | 2,312 | 100% | 2,269 | 100% | 2,239 | 100% |
| 092FH072 | 3,000 | 1,871 | 62% | 1,922 | 64% | 1,895 | 63% | 1,875 | 63% |
| 092FH076 | 3,000 | 1,668 | 56% | 1,753 | 58% | 1,723 | 57% | 1,702 | 57% |
| 092FH080 | 3,500 | 1,755 | 50% | 1,818 | 52% | 1,791 | 51% | 1,771 | 51% |
| 092FH081 | 3,500 | 1,891 | 54% | 1,970 | 56% | 1,941 | 55% | 1,923 | 55% |
| 092FH109 | 3,500 | 1,847 | 53% | 1,889 | 54% | 1,882 | 54% | 1,870 | 53% |
| 092FH113 | 3,000 | 2,158 | 72% | 2,199 | 73% | 2,188 | 73% | 2,168 | 72% |
| 092FH121 | 3,000 | 1,850 | 62% | 1,784 | 59% | 1,765 | 59% | 1,747 | 58% |
| 093FH016 | 3,000 | 2,208 | 74% | 2,191 | 73% | 2,187 | 73% | 2,162 | 72% |
| 093FH020 | 3,000 | 2,153 | 72% | 2,135 | 71% | 2,130 | 71% | 2,104 | 70% |
| 093FH023 | 3,000 | 2,001 | 67% | 1,982 | 66% | 1,978 | 66% | 1,953 | 65% |
| 093FH032 | 3,000 | 1,770 | 59% | 1,770 | 59% | 1,770 | 59% | 1,769 | 59% |
| 093FH045 | 3,000 | 2,112 | 70% | 2,101 | 70% | 2,100 | 70% | 2,091 | 70% |
| 093FH081 | 3,500 | 2,517 | 72% | 2,517 | 72% | 2,519 | 72% | 2,515 | 72% |
| 093FH097 | 3,000 | 2,009 | 67% | 2,009 | 67% | 2,011 | 67% | 2,008 | 67% |
| 100FH021 | 3,500 | 2,558 | 73% | 2,264 | 65% | 2,149 | 61% | 2,030 | 58% |
| 103FH006 | 3,500 | 2,561 | 73% | 2,399 | 69% | 2,383 | 68% | 2,373 | 68% |
| 103FH008 | 3,000 | 1,892 | 63% | 1,700 | 57% | 1,695 | 57% | 1,687 | 56% |
| 103FH011 | 3,500 | 2,196 | 63% | 2,063 | 59% | 2,049 | 59% | 2,039 | 58% |
| 103FH041 | 3,500 | 2,359 | 67% | 2,311 | 66% | 2,289 | 65% | 2,269 | 65% |
| 103FH046 | 3,500 | 2,077 | 59% | 2,030 | 58% | 2,008 | 57% | 1,991 | 57% |
| 103FH051 | 3,500 | 2,325 | 66% | 2,314 | 66% | 2,288 | 65% | 2,265 | 65% |
| 103FH057 | 3,500 | 2,566 | 73% | 2,598 | 74% | 2,568 | 73% | 2,538 | 73% |
| 103FH066 | 3,500 | 2,602 | 74% | 2,497 | 71% | 3,243 | 93% | 3,133 | 90% |
| 103FH068 | 3,500 | 2,447 | 70% | 2,332 | 67% | 2,928 | 84% | 2,823 | 81% |
| 103FH069 | 3,500 | 2,093 | 60% | 1,960 | 56% | 2,314 | 66% | 2,223 | 64% |
| 103FH073 | 3,500 | 2,281 | 65% | 2,157 | 62% | 2,626 | 75% | 2,526 | 72% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 103FH074 | 3,500 | 1,954 | 56% | 1,815 | 52% | 2,101 | 60% | 2,016 | 58% |
| 103FH079 | 3,500 | 1,852 | 53% | 1,706 | 49% | 1,955 | 56% | 1,871 | 53% |
| 103FH084 | 3,500 | 1,905 | 54% | 1,760 | 50% | 2,034 | 58% | 1,947 | 56% |
| 103FH089 | 3,500 | 1,900 | 54% | 1,756 | 50% | 2,024 | 58% | 1,934 | 55% |
| 103FH090 | 3,500 | 1,832 | 52% | 1,681 | 48% | 1,929 | 55% | 1,839 | 53% |
| 103FH097 | 3,000 | 2,175 | 73% | 2,068 | 69% | 2,063 | 69% | 2,035 | 68% |
| 103FH118 | 3,500 | 1,779 | 51% | 1,639 | 47% | 1,847 | 53% | 1,772 | 51% |
| 103FH129 | 3,500 | 2,536 | 72% | 2,454 | 70% | 2,454 | 70% | 2,418 | 69% |
| 103FH144 | 3,500 | 2,525 | 72% | 2,572 | 73% | 2,539 | 73% | 2,506 | 72% |
| 104FH007 | 3,500 | 2,131 | 61% | 1,984 | 57% | 1,971 | 56% | 1,963 | 56% |
| 104FH015 | 3,500 | 2,374 | 68% | 2,300 | 66% | 2,279 | 65% | 2,264 | 65% |
| 104FH023 | 3,500 | 2,321 | 66% | 2,457 | 70% | 2,420 | 69% | 2,395 | 68% |
| 104FH024 | 1,500 | 910 | 61% | 931 | 62% | 914 | 61% | 904 | 60% |
| 104FH034 | 2,500 | 1,352 | 54% | 1,379 | 55% | 1,359 | 54% | 1,346 | 54% |
| 104FH040 | 2,500 | 1,260 | 50% | 1,343 | 54% | 1,319 | 53% | 1,303 | 52% |
| 104FH042 | 1,500 | 835 | 56% | 821 | 55% | 811 | 54% | 805 | 54% |
| 104FH053 | 1,500 | 1,101 | 73% | 1,159 | 77% | 1,140 | 76% | 1,128 | 75% |
| 104FH054 | 3,000 | 2,044 | 68% | 2,157 | 72% | 2,103 | 70% | 2,068 | 69% |
| 104FH055 | 1,500 | 922 | 61% | 941 | 63% | 926 | 62% | 917 | 61% |
| 104FH056 | 1,500 | 891 | 59% | 907 | 60% | 891 | 59% | 882 | 59% |
| 104FH059 | 1,500 | 1,000 | 67% | 1,035 | 69% | 1,018 | 68% | 1,007 | 67% |
| 104FH061 | 1,500 | 913 | 61% | 933 | 62% | 917 | 61% | 907 | 60% |
| 104FH062 | 1,500 | 888 | 59% | 905 | 60% | 888 | 59% | 878 | 59% |
| 104FH090 | 3,000 | 2,077 | 69% | 2,144 | 71% | 2,118 | 71% | 2,101 | 70% |
| 105FH001 | 1,500 | 915 | 61% | 1,082 | 72% | 1,060 | 71% | 1,046 | 70% |
| 105FH003 | 1,500 | 759 | 51% | 808 | 54% | 793 | 53% | 783 | 52% |
| 105FH004 | 3,500 | 2,494 | 71% | 2,946 | 84% | 2,878 | 82% | 2,836 | 81% |
| 105FH005 | 1,500 | 822 | 55% | 862 | 57% | 845 | 56% | 834 | 56% |
| 105FH006 | 1,500 | 1,118 | 75% | 1,293 | 86% | 1,267 | 84% | 1,250 | 83% |
| 105FH008 | 1,500 | 826 | 55% | 876 | 58% | 860 | 57% | 849 | 57% |
| 105FH009 | 1,500 | 1,037 | 69% | 1,103 | 74% | 1,079 | 72% | 1,066 | 71% |
| 105FH012 | 1,500 | 940 | 63% | 992 | 66% | 973 | 65% | 961 | 64% |
| 105FH015 | 3,500 | 1,883 | 54% | 2,084 | 60% | 2,041 | 58% | 2,014 | 58% |
| 105FH016 | 1,500 | 1,002 | 67% | 1,069 | 71% | 1,048 | 70% | 1,036 | 69% |
| 105FH024 | 3,500 | 1,893 | 54% | 2,095 | 60% | 2,053 | 59% | 2,026 | 58% |
| 105FH027 | 2,500 | 1,781 | 71% | 1,944 | 78% | 1,906 | 76% | 1,882 | 75% |
| 105FH030 | 3,000 | 2,208 | 74% | 2,518 | 84% | 2,465 | 82% | 2,433 | 81% |
| 105FH039 | 1,500 | 1,117 | 74% | 1,999 | 100% | 1,953 | 100% | 1,927 | 100% |
| 105FH041 | 1,500 | 938 | 63% | 2,396 | 100% | 2,342 | 100% | 2,309 | 100% |
| 105FH042 | 1,500 | 839 | 56% | 969 | 65% | 950 | 63% | 939 | 63% |
| 105FH052 | 3,000 | 2,170 | 72% | 2,481 | 83% | 2,428 | 81% | 2,397 | 80% |
| 105FH059 | 3,500 | 2,297 | 66% | 2,668 | 76% | 2,600 | 74% | 2,563 | 73% |
| 105FH061 | 3,500 | 2,277 | 65% | 2,649 | 76% | 2,580 | 74% | 2,543 | 73% |
| 105FH062 | 3,500 | 2,445 | 70% | 2,880 | 82% | 2,804 | 80% | 2,764 | 79% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 105FH073 | 3,500 | 2,292 | 65% | 2,658 | 76% | 2,590 | 74% | 2,554 | 73% |
| 105FH074 | 3,500 | 2,478 | 71% | 2,917 | 83% | 2,840 | 81% | 2,800 | 80% |
| 105FH078 | 3,500 | 2,083 | 60% | 2,447 | 70% | 2,364 | 68% | 2,306 | 66% |
| 105FH079 | 3,500 | 2,019 | 58% | 2,369 | 68% | 2,287 | 65% | 2,229 | 64% |
| 105FH080 | 3,500 | 1,765 | 50% | 2,038 | 58% | 1,965 | 56% | 1,912 | 55% |
| 105FH081 | 3,500 | 1,866 | 53% | 2,151 | 61% | 2,078 | 59% | 2,023 | 58% |
| 105FH083 | 3,500 | 1,811 | 52% | 2,085 | 60% | 2,012 | 57% | 1,958 | 56% |
| 105FH084 | 3,500 | 1,782 | 51% | 2,029 | 58% | 1,961 | 56% | 1,909 | 55% |
| 105FH085 | 3,500 | 1,777 | 51% | 2,051 | 59% | 1,978 | 57% | 1,924 | 55% |
| 105FH090 | 3,500 | 1,805 | 52% | 2,133 | 61% | 2,050 | 59% | 1,993 | 57% |
| 105FH091 | 3,500 | 1,959 | 56% | 2,294 | 66% | 2,214 | 63% | 2,158 | 62% |
| 105FH092 | 2,500 | 1,332 | 53% | 1,523 | 61% | 1,464 | 59% | 1,421 | 57% |
| 106FH004 | 500 | 367 | 73% | 1,276 | 100% | 1,273 | 100% | 1,268 | 100% |
| 107FH014 | 3,500 | 2,176 | 62% | 2,262 | 65% | 2,265 | 65% | 2,262 | 65% |
| 107FH021 | 3,500 | 2,026 | 58% | 3,429 | 98% | 3,430 | 98% | 3,423 | 98% |
| 117FH002 | 3,500 | 2,223 | 64% | 2,888 | 83% | 2,618 | 75% | 2,527 | 72% |
| 117FH005 | 3,500 | 2,441 | 70% | 3,364 | 96% | 3,031 | 87% | 2,926 | 84% |
| 117FH006 | 3,500 | 2,367 | 68% | 3,074 | 88% | 2,806 | 80% | 2,723 | 78% |
| 117FH007 | 3,500 | 2,269 | 65% | 3,008 | 86% | 2,714 | 78% | 2,619 | 75% |
| 118FH001 | 2,500 | 1,569 | 63% | 1,891 | 76% | 1,778 | 71% | 1,719 | 69% |
| 118FH012 | 2,500 | 1,549 | 62% | 1,829 | 73% | 1,706 | 68% | 1,641 | 66% |
| 118FH023 | 3,000 | 1,743 | 58% | 1,996 | 67% | 1,880 | 63% | 1,811 | 60% |
| 118FH032 | 3,000 | 2,141 | 71% | 2,933 | 98% | 2,672 | 89% | 2,551 | 85% |
| 118FH034 | 3,000 | 1,812 | 60% | 2,406 | 80% | 2,176 | 73% | 2,035 | 68% |
| 118FH038 | 3,000 | 1,941 | 65% | 2,597 | 87% | 2,350 | 78% | 2,199 | 73% |
| 118FH039 | 3,000 | 2,177 | 73% | 3,082 | 100% | 2,799 | 93% | 2,671 | 89% |
| 118FH040 | 3,000 | 1,833 | 61% | 2,427 | 81% | 2,198 | 73% | 2,058 | 69% |
| 118FH041 | 3,000 | 2,134 | 71% | 3,127 | 100% | 2,821 | 94% | 2,654 | 88% |
| 118FH042 | 3,000 | 2,151 | 72% | 3,221 | 100% | 2,895 | 97% | 2,750 | 92% |
| 118FH048 | 3,500 | 2,261 | 65% | 4,505 | 100% | 4,165 | 100% | 4,009 | 100% |
| 118FH049 | 3,000 | 1,789 | 60% | 3,439 | 100% | 2,986 | 100% | 2,790 | 93% |
| 118FH062 | 3,000 | 2,002 | 67% | 2,595 | 87% | 2,407 | 80% | 2,311 | 77% |
| 118FH076 | 3,000 | 2,139 | 71% | 2,923 | 97% | 2,646 | 88% | 2,460 | 82% |
| 118FH078 | 3,000 | 1,866 | 62% | 3,354 | 100% | 2,945 | 98% | 2,761 | 92% |
| 118FH079 | 3,000 | 1,742 | 58% | 2,730 | 91% | 2,432 | 81% | 2,272 | 76% |
| 118FH080 | 3,000 | 1,953 | 65% | 3,410 | 100% | 3,010 | 100% | 2,829 | 94% |
| 118FH081 | 3,000 | 1,883 | 63% | 3,247 | 100% | 2,858 | 95% | 2,672 | 89% |
| 118FH082 | 3,000 | 2,139 | 71% | 3,682 | 100% | 3,235 | 100% | 3,014 | 100% |
| 118FH084 | 3,000 | 2,181 | 73% | 3,108 | 100% | 2,805 | 94% | 2,613 | 87% |
| 118FH085 | 3,000 | 1,909 | 64% | 2,568 | 86% | 2,331 | 78% | 2,174 | 72% |
| 118FH086 | 3,000 | 1,896 | 63% | 2,516 | 84% | 2,276 | 76% | 2,102 | 70% |
| 118FH087 | 3,000 | 1,728 | 58% | 2,283 | 76% | 2,034 | 68% | 1,829 | 61% |
| 118FH088 | 3,000 | 1,770 | 59% | 2,254 | 75% | 2,025 | 67% | 1,810 | 60% |
| 118FH089 | 3,000 | 2,163 | 72% | 2,983 | 99% | 2,692 | 90% | 2,478 | 83% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 118FH091 | 3,000 | 1,701 | 57% | 2,217 | 74% | 1,998 | 67% | 1,837 | 61% |
| 130FH001 | 3,500 | 1,934 | 55% | 5,537 | 100% | 5,456 | 100% | 5,325 | 100% |
| 130FH002 | 3,500 | 1,809 | 52% | 5,621 | 100% | 5,522 | 100% | 5,369 | 100% |
| 130FH003 | 3,500 | 1,851 | 53% | 6,792 | 100% | 6,631 | 100% | 6,407 | 100% |
| 130FH004 | 3,500 | 1,920 | 55% | 7,740 | 100% | 7,542 | 100% | 7,260 | 100% |
| 130FH005 | 3,500 | 1,992 | 57% | 9,123 | 100% | 8,875 | 100% | 8,488 | 100% |
| 130FH006 | 3,500 | 1,928 | 55% | 9,667 | 100% | 9,381 | 100% | 8,916 | 100% |
| 144FH004 | 3,500 | 1,812 | 52% | 7,426 | 100% | 7,202 | 100% | 6,790 | 100% |
| 144FH005 | 3,500 | 1,765 | 50% | 8,166 | 100% | 7,912 | 100% | 7,521 | 100% |
| 144FH006 | 3,500 | 1,820 | 52% | 7,962 | 100% | 7,712 | 100% | 7,292 | 100% |
| 144FH007 | 3,500 | 1,809 | 52% | 6,749 | 100% | 6,554 | 100% | 6,229 | 100% |
| 144FH008 | 3,500 | 1,778 | 51% | 5,274 | 100% | 5,157 | 100% | 4,956 | 100% |
| 144FH009 | 3,500 | 1,888 | 54% | 5,695 | 100% | 5,597 | 100% | 5,428 | 100% |
| 144FH010 | 3,500 | 2,087 | 60% | 5,742 | 100% | 5,616 | 100% | 5,424 | 100% |
| 144FH011 | 3,500 | 2,244 | 64% | 6,992 | 100% | 6,811 | 100% | 6,548 | 100% |
| 144FH012 | 3,500 | 2,335 | 67% | 6,170 | 100% | 6,045 | 100% | 5,863 | 100% |
| 156FH001 | 3,500 | 2,532 | 72% | 3,961 | 100% | 3,863 | 100% | 3,685 | 100% |
| 157FH003 | 3,500 | 1,941 | 55% | 3,280 | 94% | 3,161 | 90% | 2,881 | 82% |
| 157FH004 | 3,500 | 1,811 | 52% | 2,667 | 76% | 2,570 | 73% | 2,363 | 68% |
| 157FH005 | 3,500 | 1,931 | 55% | 2,948 | 84% | 2,838 | 81% | 2,613 | 75% |
| 157FH007 | 3,500 | 2,009 | 57% | 3,150 | 90% | 3,023 | 86% | 2,788 | 80% |
| 157FH008 | 3,500 | 1,759 | 50% | 2,505 | 72% | 2,411 | 69% | 2,227 | 64% |
| 157FH009 | 3,500 | 2,317 | 66% | 3,555 | 100% | 3,436 | 98% | 3,207 | 92% |
| 157FH011 | 3,500 | 2,307 | 66% | 3,470 | 99% | 3,357 | 96% | 3,136 | 90% |
| 157FH021 | 3,500 | 2,138 | 61% | 3,324 | 95% | 3,198 | 91% | 2,971 | 85% |
| 171FH002 | 3,500 | 1,781 | 51% | 3,207 | 92% | 3,067 | 88% | 2,755 | 79% |
| 171FH006 | 3,000 | 1,537 | 51% | 2,025 | 68% | 1,981 | 66% | 1,847 | 62% |
| 171FH007 | 3,000 | 1,550 | 52% | 2,080 | 69% | 2,031 | 68% | 1,888 | 63% |
| **2013 Available Fire Flow 75 - 100% of Fire Flow Goal** | | | | | | | | | |
| 045FH001 | 3,500 | 2,993 | 86% | 3,479 | 99% | 3,399 | 97% | 3,306 | 94% |
| 047FH001 | 3,000 | 2,355 | 79% | 2,542 | 85% | 2,521 | 84% | 2,473 | 82% |
| 047FH004 | 3,000 | 2,288 | 76% | 2,476 | 83% | 2,455 | 82% | 2,407 | 80% |
| 047FH008 | 3,000 | 2,364 | 79% | 2,550 | 85% | 2,529 | 84% | 2,481 | 83% |
| 047FH009 | 2,500 | 2,362 | 94% | 2,548 | 100% | 2,527 | 100% | 2,479 | 99% |
| 047FH013 | 2,500 | 2,469 | 99% | 2,657 | 100% | 2,635 | 100% | 2,586 | 100% |
| 047FH051 | 3,000 | 2,677 | 89% | 3,035 | 100% | 2,875 | 96% | 2,788 | 93% |
| 047FH054 | 1,500 | 1,233 | 82% | 1,669 | 100% | 1,626 | 100% | 1,536 | 100% |
| 047FH057 | 3,000 | 2,556 | 85% | 3,398 | 100% | 3,302 | 100% | 3,104 | 100% |
| 047FH065 | 1,500 | 1,140 | 76% | 1,429 | 95% | 1,400 | 93% | 1,338 | 89% |
| 047FH099 | 3,000 | 2,368 | 79% | 2,592 | 86% | 2,573 | 86% | 2,533 | 84% |
| 047FH101 | 1,500 | 1,482 | 99% | 1,504 | 100% | 1,504 | 100% | 1,504 | 100% |
| 047FH110 | 3,500 | 2,626 | 75% | 2,838 | 81% | 2,799 | 80% | 2,723 | 78% |
| 047FH115 | 1,500 | 1,188 | 79% | 1,683 | 100% | 1,635 | 100% | 1,534 | 100% |
| 047FH117 | 3,000 | 2,355 | 79% | 2,546 | 85% | 2,524 | 84% | 2,475 | 83% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 047FH118 | 3,000 | 2,353 | 78% | 2,541 | 85% | 2,519 | 84% | 2,471 | 82% |
| 047FH119 | 3,000 | 2,356 | 79% | 2,543 | 85% | 2,522 | 84% | 2,474 | 82% |
| 048FH001 | 1,500 | 1,278 | 85% | 1,239 | 83% | 1,215 | 81% | 1,163 | 78% |
| 048FH002 | 1,500 | 1,138 | 76% | 1,099 | 73% | 1,073 | 72% | 1,021 | 68% |
| 048FH003 | 1,500 | 1,137 | 76% | 1,101 | 73% | 1,078 | 72% | 1,029 | 69% |
| 048FH004 | 1,500 | 1,241 | 83% | 1,203 | 80% | 1,178 | 79% | 1,126 | 75% |
| 048FH006 | 1,500 | 1,159 | 77% | 1,125 | 75% | 1,102 | 73% | 1,055 | 70% |
| 048FH007 | 1,500 | 1,257 | 84% | 1,220 | 81% | 1,196 | 80% | 1,147 | 76% |
| 048FH008 | 1,500 | 1,345 | 90% | 1,342 | 89% | 1,316 | 88% | 1,262 | 84% |
| 048FH014 | 1,500 | 1,395 | 93% | 1,466 | 98% | 1,423 | 95% | 1,322 | 88% |
| 048FH015 | 1,500 | 1,358 | 91% | 1,373 | 92% | 1,347 | 90% | 1,288 | 86% |
| 048FH016 | 1,500 | 1,367 | 91% | 1,398 | 93% | 1,372 | 91% | 1,297 | 86% |
| 048FH017 | 1,500 | 1,398 | 93% | 1,472 | 98% | 1,425 | 95% | 1,325 | 88% |
| 048FH018 | 1,500 | 1,422 | 95% | 1,496 | 100% | 1,448 | 97% | 1,350 | 90% |
| 048FH019 | 1,500 | 1,462 | 97% | 1,462 | 97% | 1,462 | 97% | 1,461 | 97% |
| 048FH055 | 1,500 | 1,363 | 91% | 1,366 | 91% | 1,366 | 91% | 1,365 | 91% |
| 048FH056 | 1,500 | 1,361 | 91% | 1,363 | 91% | 1,363 | 91% | 1,363 | 91% |
| 048FH068 | 3,000 | 2,425 | 81% | 2,609 | 87% | 2,588 | 86% | 2,539 | 85% |
| 048FH069 | 3,000 | 2,312 | 77% | 2,505 | 83% | 2,483 | 83% | 2,433 | 81% |
| 048FH071 | 2,500 | 2,465 | 99% | 2,651 | 100% | 2,630 | 100% | 2,580 | 100% |
| 048FH074 | 1,500 | 1,500 | 100% | 1,582 | 100% | 1,532 | 100% | 1,430 | 95% |
| 048FH088 | 1,500 | 1,467 | 98% | 1,541 | 100% | 1,493 | 100% | 1,396 | 93% |
| 048FH092 | 1,500 | 1,478 | 99% | 1,550 | 100% | 1,502 | 100% | 1,402 | 93% |
| 048FH093 | 1,500 | 1,412 | 94% | 1,486 | 99% | 1,438 | 96% | 1,339 | 89% |
| 048FH095 | 1,500 | 1,363 | 91% | 1,381 | 92% | 1,355 | 90% | 1,292 | 86% |
| 048FH096 | 1,500 | 1,329 | 89% | 1,299 | 87% | 1,276 | 85% | 1,226 | 82% |
| 048FH097 | 1,500 | 1,405 | 94% | 1,479 | 99% | 1,431 | 95% | 1,330 | 89% |
| 048FH098 | 1,500 | 1,404 | 94% | 1,477 | 98% | 1,429 | 95% | 1,330 | 89% |
| 048FH099 | 1,500 | 1,413 | 94% | 1,485 | 99% | 1,437 | 96% | 1,338 | 89% |
| 048FH100 | 1,500 | 1,411 | 94% | 1,485 | 99% | 1,436 | 96% | 1,334 | 89% |
| 048FH101 | 1,500 | 1,397 | 93% | 1,467 | 98% | 1,422 | 95% | 1,321 | 88% |
| 048FH102 | 1,500 | 1,396 | 93% | 1,462 | 97% | 1,421 | 95% | 1,321 | 88% |
| 048FH103 | 1,500 | 1,398 | 93% | 1,468 | 98% | 1,422 | 95% | 1,323 | 88% |
| 048FH104 | 1,500 | 1,416 | 94% | 1,487 | 99% | 1,439 | 96% | 1,340 | 89% |
| 048FH105 | 1,500 | 1,401 | 93% | 1,466 | 98% | 1,425 | 95% | 1,326 | 88% |
| 048FH106 | 1,500 | 1,391 | 93% | 1,442 | 96% | 1,415 | 94% | 1,317 | 88% |
| 048FH107 | 1,500 | 1,353 | 90% | 1,354 | 90% | 1,329 | 89% | 1,276 | 85% |
| 048FH108 | 1,500 | 1,378 | 92% | 1,418 | 95% | 1,390 | 93% | 1,304 | 87% |
| 048FH109 | 1,500 | 1,300 | 87% | 1,264 | 84% | 1,241 | 83% | 1,193 | 80% |
| 048FH115 | 1,500 | 1,373 | 92% | 1,398 | 93% | 1,373 | 92% | 1,302 | 87% |
| 048FH116 | 1,500 | 1,286 | 86% | 1,250 | 83% | 1,226 | 82% | 1,177 | 78% |
| 048FH117 | 1,500 | 1,186 | 79% | 1,152 | 77% | 1,130 | 75% | 1,084 | 72% |
| 048FH118 | 1,500 | 1,347 | 90% | 1,342 | 89% | 1,317 | 88% | 1,268 | 85% |
| 048FH119 | 1,500 | 1,381 | 92% | 1,417 | 94% | 1,393 | 93% | 1,311 | 87% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 048FH120 | 1,500 | 1,408 | 94% | 1,479 | 99% | 1,432 | 95% | 1,335 | 89% |
| 048FH121 | 1,500 | 1,476 | 98% | 1,542 | 100% | 1,496 | 100% | 1,401 | 93% |
| 048FH122 | 1,500 | 1,443 | 96% | 1,511 | 100% | 1,465 | 98% | 1,369 | 91% |
| 048FH123 | 1,500 | 1,490 | 99% | 1,552 | 100% | 1,508 | 100% | 1,417 | 94% |
| 048FH126 | 1,500 | 1,437 | 96% | 1,500 | 100% | 1,456 | 97% | 1,365 | 91% |
| 048FH128 | 1,500 | 1,471 | 98% | 1,535 | 100% | 1,490 | 99% | 1,396 | 93% |
| 048FH129 | 1,500 | 1,401 | 93% | 1,462 | 97% | 1,423 | 95% | 1,327 | 88% |
| 048FH130 | 1,500 | 1,421 | 95% | 1,491 | 99% | 1,444 | 96% | 1,346 | 90% |
| 048FH131 | 1,500 | 1,453 | 97% | 1,517 | 100% | 1,472 | 98% | 1,380 | 92% |
| 048FH132 | 1,500 | 1,362 | 91% | 1,376 | 92% | 1,351 | 90% | 1,291 | 86% |
| 048FH134 | 1,500 | 1,438 | 96% | 1,441 | 96% | 1,441 | 96% | 1,440 | 96% |
| 048FH138 | 1,500 | 1,453 | 97% | 1,526 | 100% | 1,477 | 98% | 1,375 | 92% |
| 048FH141 | 1,500 | 1,192 | 79% | 2,024 | 100% | 1,931 | 100% | 1,727 | 100% |
| 048FH143 | 3,000 | 2,305 | 77% | 2,489 | 83% | 2,468 | 82% | 2,420 | 81% |
| 048FH144 | 3,000 | 2,366 | 79% | 2,544 | 85% | 2,524 | 84% | 2,477 | 83% |
| 048FH145 | 3,000 | 2,389 | 80% | 2,571 | 86% | 2,550 | 85% | 2,503 | 83% |
| 048FH146 | 3,000 | 2,420 | 81% | 2,603 | 87% | 2,582 | 86% | 2,533 | 84% |
| 048FH147 | 3,000 | 2,451 | 82% | 2,629 | 88% | 2,609 | 87% | 2,561 | 85% |
| 048FH148 | 3,000 | 2,438 | 81% | 2,623 | 87% | 2,601 | 87% | 2,552 | 85% |
| 048FH149 | 3,000 | 2,383 | 79% | 2,565 | 86% | 2,544 | 85% | 2,496 | 83% |
| 048FH151 | 1,500 | 1,249 | 83% | 1,205 | 80% | 1,177 | 78% | 1,119 | 75% |
| 048FH154 | 1,500 | 1,352 | 90% | 1,356 | 90% | 1,329 | 89% | 1,272 | 85% |
| 048FH155 | 1,500 | 1,379 | 92% | 1,421 | 95% | 1,393 | 93% | 1,304 | 87% |
| 048FH156 | 1,500 | 1,365 | 91% | 1,384 | 92% | 1,358 | 91% | 1,293 | 86% |
| 048FH157 | 1,500 | 1,351 | 90% | 1,353 | 90% | 1,328 | 89% | 1,277 | 85% |
| 048FH158 | 3,000 | 2,332 | 78% | 2,524 | 84% | 2,502 | 83% | 2,452 | 82% |
| 049FH002 | 3,500 | 2,949 | 84% | 3,794 | 100% | 3,639 | 100% | 3,312 | 95% |
| 049FH004 | 1,500 | 1,476 | 98% | 1,542 | 100% | 1,495 | 100% | 1,397 | 93% |
| 049FH005 | 1,500 | 1,473 | 98% | 1,537 | 100% | 1,491 | 99% | 1,395 | 93% |
| 049FH006 | 1,500 | 1,495 | 100% | 1,558 | 100% | 1,512 | 100% | 1,418 | 95% |
| 049FH014 | 1,500 | 1,493 | 100% | 1,555 | 100% | 1,509 | 100% | 1,414 | 94% |
| 049FH015 | 1,500 | 1,481 | 99% | 1,545 | 100% | 1,499 | 100% | 1,403 | 94% |
| 049FH016 | 1,500 | 1,445 | 96% | 1,511 | 100% | 1,465 | 98% | 1,368 | 91% |
| 049FH017 | 1,500 | 1,455 | 97% | 1,519 | 100% | 1,474 | 98% | 1,379 | 92% |
| 049FH018 | 1,500 | 1,439 | 96% | 1,504 | 100% | 1,458 | 97% | 1,363 | 91% |
| 049FH020 | 1,500 | 1,494 | 100% | 1,553 | 100% | 1,509 | 100% | 1,417 | 94% |
| 049FH021 | 1,500 | 1,438 | 96% | 1,501 | 100% | 1,456 | 97% | 1,363 | 91% |
| 049FH023 | 1,500 | 1,407 | 94% | 1,475 | 98% | 1,428 | 95% | 1,330 | 89% |
| 049FH024 | 1,500 | 1,407 | 94% | 1,476 | 98% | 1,429 | 95% | 1,331 | 89% |
| 050FH013 | 3,000 | 2,851 | 95% | 3,363 | 100% | 3,112 | 100% | 2,632 | 88% |
| 050FH019 | 3,000 | 2,863 | 95% | 3,288 | 100% | 3,034 | 100% | 2,559 | 85% |
| 050FH020 | 3,000 | 2,948 | 98% | 3,370 | 100% | 3,113 | 100% | 2,636 | 88% |
| 050FH029 | 3,000 | 2,828 | 94% | 3,315 | 100% | 3,002 | 100% | 2,434 | 81% |
| 050FH030 | 3,000 | 2,821 | 94% | 3,278 | 100% | 2,970 | 99% | 2,415 | 81% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 050FH031 | 3,000 | 2,294 | 76% | 2,748 | 92% | 2,434 | 81% | 1,871 | 62% |
| 060FH001 | 3,500 | 2,982 | 85% | 3,143 | 90% | 3,103 | 89% | 3,025 | 86% |
| 061FH009 | 3,000 | 2,400 | 80% | 2,828 | 94% | 2,776 | 93% | 2,669 | 89% |
| 061FH011 | 3,000 | 2,978 | 99% | 3,477 | 100% | 3,411 | 100% | 3,274 | 100% |
| 061FH012 | 3,000 | 2,394 | 80% | 2,780 | 93% | 2,733 | 91% | 2,635 | 88% |
| 061FH014 | 3,000 | 2,475 | 82% | 2,849 | 95% | 2,800 | 93% | 2,700 | 90% |
| 061FH034 | 2,500 | 1,964 | 79% | 2,285 | 91% | 2,237 | 89% | 2,139 | 86% |
| 061FH039 | 2,500 | 1,893 | 76% | 2,224 | 89% | 2,176 | 87% | 2,075 | 83% |
| 061FH043 | 3,000 | 2,601 | 87% | 2,834 | 94% | 2,785 | 93% | 2,690 | 90% |
| 061FH051 | 1,500 | 1,352 | 90% | 1,441 | 96% | 1,423 | 95% | 1,387 | 92% |
| 061FH052 | 1,500 | 1,219 | 81% | 1,322 | 88% | 1,301 | 87% | 1,260 | 84% |
| 061FH063 | 3,000 | 2,268 | 76% | 1,905 | 63% | 1,865 | 62% | 1,805 | 60% |
| 061FH064 | 3,000 | 2,519 | 84% | 2,028 | 68% | 1,988 | 66% | 1,933 | 64% |
| 061FH080 | 3,000 | 2,734 | 91% | 2,105 | 70% | 2,063 | 69% | 2,012 | 67% |
| 061FH084 | 2,500 | 1,933 | 77% | 2,254 | 90% | 2,207 | 88% | 2,109 | 84% |
| 061FH085 | 3,000 | 2,423 | 81% | 2,815 | 94% | 2,761 | 92% | 2,650 | 88% |
| 061FH090 | 3,500 | 2,899 | 83% | 2,824 | 81% | 2,782 | 79% | 2,706 | 77% |
| 062FH006 | 3,500 | 3,453 | 99% | 4,101 | 100% | 4,005 | 100% | 3,805 | 100% |
| 062FH008 | 3,000 | 2,747 | 92% | 3,205 | 100% | 3,139 | 100% | 3,001 | 100% |
| 062FH009 | 3,500 | 3,388 | 97% | 3,928 | 100% | 3,846 | 100% | 3,675 | 100% |
| 062FH010 | 3,000 | 2,856 | 95% | 3,310 | 100% | 3,243 | 100% | 3,104 | 100% |
| 062FH013 | 3,500 | 3,290 | 94% | 3,765 | 100% | 3,691 | 100% | 3,535 | 100% |
| 062FH023 | 3,000 | 2,557 | 85% | 2,897 | 97% | 2,848 | 95% | 2,745 | 91% |
| 062FH028 | 3,000 | 2,700 | 90% | 3,054 | 100% | 3,002 | 100% | 2,892 | 96% |
| 062FH031 | 3,000 | 2,793 | 93% | 2,971 | 99% | 2,937 | 98% | 2,865 | 95% |
| 062FH032 | 3,000 | 2,889 | 96% | 3,075 | 100% | 3,039 | 100% | 2,965 | 99% |
| 062FH033 | 3,000 | 2,978 | 99% | 3,221 | 100% | 3,174 | 100% | 3,079 | 100% |
| 062FH034 | 3,000 | 2,555 | 85% | 2,900 | 97% | 2,852 | 95% | 2,751 | 92% |
| 062FH037 | 3,000 | 2,983 | 99% | 3,196 | 100% | 3,155 | 100% | 3,071 | 100% |
| 062FH081 | 3,000 | 2,615 | 87% | 2,814 | 94% | 2,770 | 92% | 2,687 | 90% |
| 062FH082 | 3,000 | 2,940 | 98% | 3,176 | 100% | 3,130 | 100% | 3,036 | 100% |
| 062FH088 | 3,000 | 2,374 | 79% | 2,596 | 87% | 2,542 | 85% | 2,436 | 81% |
| 062FH092 | 2,500 | 2,004 | 80% | 2,137 | 85% | 2,094 | 84% | 2,006 | 80% |
| 062FH093 | 1,500 | 1,456 | 97% | 1,451 | 97% | 1,433 | 96% | 1,398 | 93% |
| 062FH099 | 1,500 | 1,137 | 76% | 1,167 | 78% | 1,146 | 76% | 1,103 | 74% |
| 062FH115 | 4,000 | 3,114 | 78% | 3,053 | 76% | 3,001 | 75% | 2,910 | 73% |
| 062FH116 | 4,000 | 3,071 | 77% | 3,007 | 75% | 2,956 | 74% | 2,869 | 72% |
| 062FH123 | 3,500 | 3,201 | 91% | 4,425 | 100% | 4,308 | 100% | 4,070 | 100% |
| 062FH125 | 3,500 | 3,190 | 91% | 4,440 | 100% | 4,324 | 100% | 4,085 | 100% |
| 062FH130 | 1,500 | 1,177 | 78% | 1,239 | 83% | 1,224 | 82% | 1,191 | 79% |
| 062FH142 | 3,500 | 3,489 | 100% | 4,184 | 100% | 4,074 | 100% | 3,842 | 100% |
| 062FH148 | 3,500 | 3,240 | 93% | 3,821 | 100% | 3,733 | 100% | 3,549 | 100% |
| 062FH164 | 3,500 | 3,110 | 89% | 3,713 | 100% | 3,614 | 100% | 3,404 | 97% |
| 062FH165 | 3,500 | 2,891 | 83% | 3,427 | 98% | 3,338 | 95% | 3,148 | 90% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 062FH176 | 3,500 | 3,208 | 92% | 4,456 | 100% | 4,337 | 100% | 4,093 | 100% |
| 063FH002 | 3,500 | 3,473 | 99% | 5,052 | 100% | 4,915 | 100% | 4,637 | 100% |
| 063FH003 | 3,500 | 3,389 | 97% | 4,830 | 100% | 4,704 | 100% | 4,448 | 100% |
| 063FH004 | 3,500 | 3,442 | 98% | 5,094 | 100% | 4,959 | 100% | 4,684 | 100% |
| 063FH008 | 3,500 | 3,109 | 89% | 4,290 | 100% | 4,184 | 100% | 3,967 | 100% |
| 063FH009 | 3,500 | 3,222 | 92% | 4,479 | 100% | 4,365 | 100% | 4,135 | 100% |
| 063FH010 | 3,500 | 3,365 | 96% | 4,821 | 100% | 4,697 | 100% | 4,445 | 100% |
| 063FH011 | 3,500 | 2,999 | 86% | 4,052 | 100% | 3,959 | 100% | 3,771 | 100% |
| 063FH013 | 3,500 | 2,912 | 83% | 3,861 | 100% | 3,768 | 100% | 3,579 | 100% |
| 063FH015 | 3,500 | 2,890 | 83% | 3,908 | 100% | 3,813 | 100% | 3,618 | 100% |
| 063FH017 | 3,500 | 3,454 | 99% | 5,044 | 100% | 4,907 | 100% | 4,632 | 100% |
| 063FH018 | 3,500 | 3,484 | 100% | 5,004 | 100% | 4,877 | 100% | 4,624 | 100% |
| 063FH019 | 3,500 | 2,974 | 85% | 4,039 | 100% | 3,939 | 100% | 3,733 | 100% |
| 063FH020 | 3,500 | 3,373 | 96% | 4,821 | 100% | 4,693 | 100% | 4,434 | 100% |
| 063FH021 | 3,500 | 3,312 | 95% | 4,673 | 100% | 4,551 | 100% | 4,303 | 100% |
| 063FH025 | 3,500 | 3,402 | 97% | 4,799 | 100% | 4,681 | 100% | 4,444 | 100% |
| 063FH027 | 3,000 | 2,982 | 99% | 3,975 | 100% | 3,868 | 100% | 3,659 | 100% |
| 063FH030 | 3,000 | 2,862 | 95% | 3,682 | 100% | 3,588 | 100% | 3,405 | 100% |
| 063FH036 | 3,500 | 3,194 | 91% | 4,414 | 100% | 4,309 | 100% | 4,097 | 100% |
| 063FH039 | 3,000 | 2,622 | 87% | 3,264 | 100% | 3,190 | 100% | 3,045 | 100% |
| 063FH047 | 3,500 | 2,730 | 78% | 3,508 | 100% | 3,432 | 98% | 3,277 | 94% |
| 063FH067 | 3,000 | 2,825 | 94% | 3,604 | 100% | 3,511 | 100% | 3,330 | 100% |
| 063FH068 | 3,000 | 2,902 | 97% | 3,727 | 100% | 3,631 | 100% | 3,445 | 100% |
| 063FH069 | 3,000 | 2,930 | 98% | 3,776 | 100% | 3,681 | 100% | 3,494 | 100% |
| 063FH070 | 3,000 | 2,999 | 100% | 3,892 | 100% | 3,793 | 100% | 3,600 | 100% |
| 063FH073 | 3,000 | 2,290 | 76% | 2,968 | 99% | 2,856 | 95% | 2,614 | 87% |
| 063FH078 | 3,000 | 2,621 | 87% | 3,224 | 100% | 3,156 | 100% | 3,021 | 100% |
| 063FH079 | 3,500 | 3,238 | 93% | 4,484 | 100% | 4,374 | 100% | 4,151 | 100% |
| 063FH080 | 3,500 | 3,254 | 93% | 4,527 | 100% | 4,411 | 100% | 4,177 | 100% |
| 064FH018 | 3,000 | 2,924 | 97% | 3,399 | 100% | 3,083 | 100% | 2,514 | 84% |
| 064FH019 | 3,000 | 2,973 | 99% | 3,510 | 100% | 3,158 | 100% | 2,530 | 84% |
| 064FH048 | 2,500 | 2,452 | 98% | 2,424 | 97% | 2,422 | 97% | 2,410 | 96% |
| 064FH053 | 2,500 | 2,102 | 84% | 2,078 | 83% | 2,076 | 83% | 2,059 | 82% |
| 064FH069 | 2,500 | 1,920 | 77% | 1,919 | 77% | 1,917 | 77% | 1,909 | 76% |
| 064FH076 | 2,500 | 2,023 | 81% | 2,017 | 81% | 2,015 | 81% | 2,007 | 80% |
| 064FH095 | 3,000 | 2,655 | 88% | 2,629 | 88% | 2,628 | 88% | 2,616 | 87% |
| 064FH097 | 3,000 | 2,412 | 80% | 2,388 | 80% | 2,386 | 80% | 2,375 | 79% |
| 064FH099 | 3,000 | 2,266 | 76% | 2,703 | 90% | 2,652 | 88% | 2,550 | 85% |
| 064FH103 | 1,500 | 1,484 | 99% | 1,467 | 98% | 1,465 | 98% | 1,452 | 97% |
| 075FH016 | 3,000 | 2,369 | 79% | 1,869 | 62% | 1,850 | 62% | 1,831 | 61% |
| 075FH038 | 1,500 | 1,203 | 80% | 945 | 63% | 940 | 63% | 936 | 62% |
| 075FH052 | 3,000 | 2,352 | 78% | 1,875 | 62% | 1,856 | 62% | 1,838 | 61% |
| 076FH005 | 4,000 | 3,770 | 94% | 3,177 | 79% | 3,137 | 78% | 3,103 | 78% |
| 076FH015 | 3,000 | 2,522 | 84% | 3,330 | 100% | 3,249 | 100% | 3,079 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 076FH020 | 3,000 | 2,680 | 89% | 2,205 | 73% | 2,183 | 73% | 2,163 | 72% |
| 076FH025 | 3,000 | 2,636 | 88% | 2,157 | 72% | 2,136 | 71% | 2,117 | 71% |
| 076FH037 | 1,500 | 1,355 | 90% | 1,093 | 73% | 1,086 | 72% | 1,080 | 72% |
| 076FH039 | 1,500 | 1,363 | 91% | 1,090 | 73% | 1,083 | 72% | 1,077 | 72% |
| 076FH041 | 1,500 | 1,491 | 99% | 1,216 | 81% | 1,209 | 81% | 1,203 | 80% |
| 076FH052 | 4,000 | 3,851 | 96% | 3,747 | 94% | 3,677 | 92% | 3,615 | 90% |
| 076FH059 | 3,000 | 2,672 | 89% | 2,287 | 76% | 2,268 | 76% | 2,252 | 75% |
| 076FH062 | 4,000 | 3,018 | 75% | 2,572 | 64% | 2,546 | 64% | 2,525 | 63% |
| 077FH001 | 3,500 | 3,195 | 91% | 4,340 | 100% | 4,237 | 100% | 4,030 | 100% |
| 077FH002 | 3,500 | 3,446 | 98% | 5,027 | 100% | 4,901 | 100% | 4,648 | 100% |
| 077FH003 | 3,500 | 2,770 | 79% | 3,673 | 100% | 3,588 | 100% | 3,414 | 98% |
| 077FH005 | 3,000 | 2,766 | 92% | 3,623 | 100% | 3,540 | 100% | 3,371 | 100% |
| 077FH006 | 3,000 | 2,741 | 91% | 3,584 | 100% | 3,502 | 100% | 3,336 | 100% |
| 077FH007 | 3,000 | 2,549 | 85% | 3,258 | 100% | 3,188 | 100% | 3,044 | 100% |
| 077FH008 | 3,000 | 2,621 | 87% | 3,371 | 100% | 3,297 | 100% | 3,146 | 100% |
| 077FH011 | 3,000 | 2,654 | 88% | 3,430 | 100% | 3,355 | 100% | 3,199 | 100% |
| 077FH013 | 3,000 | 2,650 | 88% | 3,420 | 100% | 3,345 | 100% | 3,191 | 100% |
| 077FH015 | 3,500 | 2,729 | 78% | 3,557 | 100% | 3,476 | 99% | 3,310 | 95% |
| 077FH016 | 3,000 | 2,992 | 100% | 3,928 | 100% | 3,841 | 100% | 3,664 | 100% |
| 077FH022 | 4,000 | 3,726 | 93% | 3,615 | 90% | 3,549 | 89% | 3,490 | 87% |
| 077FH023 | 4,000 | 3,376 | 84% | 3,224 | 81% | 3,156 | 79% | 3,096 | 77% |
| 077FH024 | 3,500 | 3,460 | 99% | 4,877 | 100% | 4,756 | 100% | 4,516 | 100% |
| 077FH026 | 3,000 | 2,959 | 99% | 3,715 | 100% | 3,636 | 100% | 3,479 | 100% |
| 077FH030 | 3,000 | 2,919 | 97% | 3,689 | 100% | 3,614 | 100% | 3,461 | 100% |
| 077FH036 | 4,000 | 3,061 | 77% | 2,883 | 72% | 2,819 | 70% | 2,764 | 69% |
| 077FH056 | 2,500 | 2,152 | 86% | 2,097 | 84% | 2,056 | 82% | 2,020 | 81% |
| 077FH059 | 1,500 | 1,376 | 92% | 1,255 | 84% | 1,237 | 82% | 1,223 | 82% |
| 077FH062 | 4,000 | 3,816 | 95% | 3,692 | 92% | 3,639 | 91% | 3,594 | 90% |
| 077FH076 | 1,500 | 1,380 | 92% | 1,430 | 95% | 1,409 | 94% | 1,391 | 93% |
| 077FH079 | 1,500 | 1,436 | 96% | 1,350 | 90% | 1,332 | 89% | 1,316 | 88% |
| 077FH082 | 2,500 | 2,099 | 84% | 2,779 | 100% | 2,739 | 100% | 2,705 | 100% |
| 077FH096 | 3,000 | 2,352 | 78% | 2,854 | 95% | 2,801 | 93% | 2,692 | 90% |
| 077FH100 | 4,000 | 3,060 | 76% | 2,902 | 73% | 2,845 | 71% | 2,796 | 70% |
| 077FH101 | 3,000 | 2,747 | 92% | 3,575 | 100% | 3,495 | 100% | 3,331 | 100% |
| 077FH103 | 3,000 | 2,712 | 90% | 3,416 | 100% | 3,346 | 100% | 3,204 | 100% |
| 077FH104 | 4,000 | 3,570 | 89% | 3,445 | 86% | 3,379 | 84% | 3,319 | 83% |
| 077FH105 | 4,000 | 3,252 | 81% | 3,107 | 78% | 3,047 | 76% | 2,993 | 75% |
| 077FH107 | 3,000 | 2,888 | 96% | 3,632 | 100% | 3,558 | 100% | 3,408 | 100% |
| 077FH108 | 3,500 | 3,289 | 94% | 4,747 | 100% | 4,627 | 100% | 4,386 | 100% |
| 078FH006 | 3,000 | 2,402 | 80% | 2,328 | 78% | 2,301 | 77% | 2,274 | 76% |
| 078FH007 | 3,000 | 2,482 | 83% | 2,407 | 80% | 2,379 | 79% | 2,350 | 78% |
| 078FH008 | 3,000 | 2,821 | 94% | 2,752 | 92% | 2,720 | 91% | 2,685 | 89% |
| 078FH009 | 3,000 | 2,839 | 95% | 2,775 | 92% | 2,742 | 91% | 2,707 | 90% |
| 078FH011 | 3,000 | 2,978 | 99% | 2,911 | 97% | 2,878 | 96% | 2,839 | 95% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 078FH015 | 3,000 | 2,263 | 75% | 2,191 | 73% | 2,167 | 72% | 2,143 | 71% |
| 078FH026 | 3,000 | 2,652 | 88% | 2,607 | 87% | 2,605 | 87% | 2,581 | 86% |
| 079FH103 | 3,500 | 3,444 | 98% | 3,391 | 97% | 3,393 | 97% | 3,364 | 96% |
| 079FH129 | 3,000 | 2,640 | 88% | 2,589 | 86% | 2,585 | 86% | 2,557 | 85% |
| 081FH003 | 3,000 | 2,809 | 94% | 2,735 | 91% | 3,932 | 100% | 3,861 | 100% |
| 081FH004 | 2,500 | 2,249 | 90% | 2,194 | 88% | 2,693 | 100% | 2,653 | 100% |
| 089FH010 | 3,000 | 2,362 | 79% | 1,949 | 65% | 2,008 | 67% | 2,004 | 67% |
| 089FH015 | 3,000 | 2,828 | 94% | 2,360 | 79% | 2,484 | 83% | 2,478 | 83% |
| 089FH017 | 2,500 | 2,298 | 92% | 1,910 | 76% | 1,917 | 77% | 1,914 | 77% |
| 089FH019 | 3,000 | 2,564 | 85% | 2,163 | 72% | 2,278 | 76% | 2,273 | 76% |
| 089FH022 | 1,500 | 1,321 | 88% | 1,099 | 73% | 1,099 | 73% | 1,098 | 73% |
| 089FH025 | 3,500 | 2,811 | 80% | 2,401 | 69% | 2,615 | 75% | 2,609 | 75% |
| 089FH030 | 3,500 | 2,641 | 75% | 2,266 | 65% | 2,555 | 73% | 2,549 | 73% |
| 090FH001 | 1,500 | 1,433 | 96% | 1,195 | 80% | 1,189 | 79% | 1,184 | 79% |
| 090FH006 | 3,000 | 2,557 | 85% | 2,213 | 74% | 2,198 | 73% | 2,186 | 73% |
| 090FH007 | 3,000 | 2,725 | 91% | 2,395 | 80% | 2,377 | 79% | 2,363 | 79% |
| 090FH028 | 1,500 | 1,305 | 87% | 1,115 | 74% | 1,111 | 74% | 1,107 | 74% |
| 090FH030 | 3,000 | 2,580 | 86% | 2,302 | 77% | 2,288 | 76% | 2,277 | 76% |
| 090FH034 | 1,500 | 1,152 | 77% | 990 | 66% | 986 | 66% | 983 | 66% |
| 090FH039 | 3,000 | 2,465 | 82% | 2,160 | 72% | 2,137 | 71% | 2,119 | 71% |
| 090FH040 | 3,000 | 2,717 | 91% | 2,379 | 79% | 2,356 | 79% | 2,339 | 78% |
| 090FH061 | 1,500 | 1,174 | 78% | 1,046 | 70% | 1,039 | 69% | 1,033 | 69% |
| 090FH074 | 3,500 | 2,843 | 81% | 2,606 | 74% | 2,587 | 74% | 2,574 | 74% |
| 090FH078 | 3,000 | 2,868 | 96% | 2,659 | 89% | 2,639 | 88% | 2,625 | 88% |
| 090FH079 | 3,500 | 3,288 | 94% | 3,011 | 86% | 3,310 | 95% | 3,296 | 94% |
| 090FH099 | 3,500 | 3,288 | 94% | 3,098 | 89% | 3,073 | 88% | 3,057 | 87% |
| 090FH102 | 3,500 | 3,268 | 93% | 3,081 | 88% | 3,057 | 87% | 3,040 | 87% |
| 090FH117 | 2,500 | 1,882 | 75% | 7,923 | 100% | 7,836 | 100% | 7,760 | 100% |
| 090FH123 | 2,500 | 1,936 | 77% | 1,783 | 71% | 1,769 | 71% | 1,758 | 70% |
| 090FH125 | 3,500 | 2,936 | 84% | 2,757 | 79% | 2,734 | 78% | 2,716 | 78% |
| 090FH128 | 3,500 | 2,961 | 85% | 2,774 | 79% | 2,751 | 79% | 2,735 | 78% |
| 091FH003 | 3,000 | 2,584 | 86% | 2,441 | 81% | 2,394 | 80% | 2,356 | 79% |
| 091FH011 | 1,500 | 1,422 | 95% | 2,148 | 100% | 2,122 | 100% | 2,101 | 100% |
| 091FH012 | 2,500 | 2,043 | 82% | 1,894 | 76% | 1,871 | 75% | 1,853 | 74% |
| 091FH020 | 2,500 | 2,285 | 91% | 2,144 | 86% | 2,124 | 85% | 2,108 | 84% |
| 091FH025 | 3,000 | 2,960 | 99% | 2,840 | 95% | 2,810 | 94% | 2,787 | 93% |
| 091FH040 | 2,500 | 2,168 | 87% | 2,041 | 82% | 2,013 | 81% | 1,990 | 80% |
| 091FH056 | 3,000 | 2,270 | 76% | 2,221 | 74% | 2,191 | 73% | 2,168 | 72% |
| 091FH074 | 3,500 | 3,369 | 96% | 3,296 | 94% | 3,254 | 93% | 3,222 | 92% |
| 091FH089 | 3,000 | 2,403 | 80% | 2,507 | 84% | 2,469 | 82% | 2,440 | 81% |
| 091FH098 | 3,500 | 2,629 | 75% | 2,654 | 76% | 2,623 | 75% | 2,600 | 74% |
| 091FH119 | 3,000 | 2,701 | 90% | 2,558 | 85% | 2,523 | 84% | 2,495 | 83% |
| 092FH001 | 3,500 | 2,949 | 84% | 2,861 | 82% | 2,829 | 81% | 2,796 | 80% |
| 092FH025 | 1,500 | 1,258 | 84% | 1,200 | 80% | 1,183 | 79% | 1,169 | 78% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 092FH027 | 3,000 | 2,266 | 76% | 2,274 | 76% | 2,234 | 74% | 2,202 | 73% |
| 092FH029 | 3,000 | 2,624 | 87% | 2,650 | 88% | 2,606 | 87% | 2,572 | 86% |
| 092FH030 | 3,000 | 2,458 | 82% | 2,430 | 81% | 2,395 | 80% | 2,365 | 79% |
| 092FH065 | 1,500 | 1,492 | 99% | 1,484 | 99% | 1,463 | 98% | 1,447 | 96% |
| 092FH074 | 1,500 | 1,477 | 98% | 1,517 | 100% | 1,492 | 99% | 1,473 | 98% |
| 092FH079 | 3,500 | 3,408 | 97% | 3,749 | 100% | 3,695 | 100% | 3,658 | 100% |
| 092FH082 | 3,500 | 3,455 | 99% | 3,888 | 100% | 3,829 | 100% | 3,787 | 100% |
| 092FH083 | 3,500 | 3,150 | 90% | 3,578 | 100% | 3,518 | 100% | 3,477 | 99% |
| 092FH085 | 3,000 | 2,855 | 95% | 2,870 | 96% | 2,838 | 95% | 2,812 | 94% |
| 092FH086 | 3,000 | 2,759 | 92% | 2,770 | 92% | 2,740 | 91% | 2,715 | 91% |
| 092FH088 | 3,000 | 2,907 | 97% | 2,930 | 98% | 2,897 | 97% | 2,871 | 96% |
| 092FH090 | 3,000 | 2,914 | 97% | 2,943 | 98% | 2,910 | 97% | 2,883 | 96% |
| 092FH103 | 3,000 | 2,451 | 82% | 2,431 | 81% | 2,420 | 81% | 2,403 | 80% |
| 092FH105 | 3,000 | 2,536 | 85% | 2,538 | 85% | 2,527 | 84% | 2,509 | 84% |
| 092FH108 | 3,000 | 2,837 | 95% | 2,926 | 98% | 2,908 | 97% | 2,880 | 96% |
| 092FH110 | 3,000 | 2,956 | 99% | 2,997 | 100% | 2,982 | 99% | 2,957 | 99% |
| 092FH111 | 3,000 | 2,710 | 90% | 2,758 | 92% | 2,742 | 91% | 2,716 | 91% |
| 092FH114 | 3,000 | 2,395 | 80% | 2,430 | 81% | 2,388 | 80% | 2,354 | 78% |
| 093FH003 | 3,000 | 2,559 | 85% | 2,642 | 88% | 2,637 | 88% | 2,608 | 87% |
| 093FH006 | 3,000 | 2,849 | 95% | 3,115 | 100% | 3,110 | 100% | 3,076 | 100% |
| 093FH008 | 3,000 | 2,909 | 97% | 2,954 | 98% | 2,950 | 98% | 2,920 | 97% |
| 093FH018 | 3,000 | 2,765 | 92% | 2,765 | 92% | 2,760 | 92% | 2,729 | 91% |
| 093FH019 | 3,000 | 2,439 | 81% | 2,425 | 81% | 2,424 | 81% | 2,412 | 80% |
| 093FH021 | 3,000 | 2,390 | 80% | 2,377 | 79% | 2,372 | 79% | 2,343 | 78% |
| 093FH022 | 3,000 | 2,468 | 82% | 2,454 | 82% | 2,453 | 82% | 2,441 | 81% |
| 093FH024 | 3,000 | 2,437 | 81% | 2,423 | 81% | 2,422 | 81% | 2,410 | 80% |
| 093FH025 | 3,000 | 2,613 | 87% | 2,599 | 87% | 2,598 | 87% | 2,584 | 86% |
| 093FH046 | 3,000 | 2,492 | 83% | 2,476 | 83% | 2,475 | 82% | 2,460 | 82% |
| 093FH047 | 3,000 | 2,504 | 83% | 2,490 | 83% | 2,489 | 83% | 2,476 | 83% |
| 093FH048 | 3,000 | 2,725 | 91% | 2,711 | 90% | 2,709 | 90% | 2,695 | 90% |
| 093FH051 | 3,000 | 2,617 | 87% | 2,603 | 87% | 2,602 | 87% | 2,589 | 86% |
| 093FH052 | 3,000 | 2,890 | 96% | 2,875 | 96% | 2,874 | 96% | 2,854 | 95% |
| 093FH058 | 3,000 | 2,674 | 89% | 2,649 | 88% | 2,639 | 88% | 2,619 | 87% |
| 093FH069 | 1,500 | 1,293 | 86% | 1,293 | 86% | 1,294 | 86% | 1,293 | 86% |
| 093FH085 | 2,500 | 1,924 | 77% | 1,924 | 77% | 1,926 | 77% | 1,923 | 77% |
| 093FH090 | 3,000 | 2,992 | 100% | 2,991 | 100% | 2,994 | 100% | 2,990 | 100% |
| 093FH094 | 3,000 | 2,672 | 89% | 2,671 | 89% | 2,673 | 89% | 2,670 | 89% |
| 093FH099 | 3,000 | 2,294 | 76% | 2,293 | 76% | 2,296 | 77% | 2,292 | 76% |
| 093FH125 | 3,000 | 2,892 | 96% | 2,875 | 96% | 2,873 | 96% | 2,853 | 95% |
| 093FH128 | 3,000 | 2,828 | 94% | 2,812 | 94% | 2,811 | 94% | 2,792 | 93% |
| 093FH132 | 3,000 | 2,829 | 94% | 2,839 | 95% | 2,835 | 94% | 2,806 | 94% |
| 093FH133 | 3,000 | 2,457 | 82% | 2,449 | 82% | 2,444 | 81% | 2,417 | 81% |
| 093FH134 | 3,000 | 2,465 | 82% | 2,454 | 82% | 2,449 | 82% | 2,422 | 81% |
| 094FH033 | 3,500 | 3,472 | 99% | 4,757 | 100% | 4,795 | 100% | 4,845 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 096FH046 | 3,500 | 3,478 | 99% | 3,545 | 100% | 3,619 | 100% | 3,694 | 100% |
| 096FH060 | 3,500 | 3,185 | 91% | 3,249 | 93% | 3,327 | 95% | 3,395 | 97% |
| 100FH010 | 3,500 | 3,002 | 86% | 2,308 | 66% | 2,163 | 62% | 2,010 | 57% |
| 100FH011 | 3,500 | 3,290 | 94% | 2,362 | 67% | 2,212 | 63% | 2,056 | 59% |
| 100FH012 | 3,500 | 3,142 | 90% | 2,345 | 67% | 2,198 | 63% | 2,044 | 58% |
| 100FH013 | 3,500 | 3,357 | 96% | 2,386 | 68% | 2,237 | 64% | 2,080 | 59% |
| 100FH014 | 3,500 | 3,203 | 92% | 2,364 | 68% | 2,217 | 63% | 2,063 | 59% |
| 100FH015 | 3,500 | 3,065 | 88% | 2,357 | 67% | 2,221 | 63% | 2,079 | 59% |
| 100FH017 | 3,500 | 3,082 | 88% | 2,881 | 82% | 2,823 | 81% | 2,760 | 79% |
| 100FH018 | 3,500 | 3,098 | 89% | 2,916 | 83% | 2,864 | 82% | 2,806 | 80% |
| 100FH019 | 3,500 | 2,882 | 82% | 2,786 | 80% | 2,748 | 79% | 2,704 | 77% |
| 100FH020 | 3,500 | 2,667 | 76% | 2,275 | 65% | 2,144 | 61% | 2,111 | 60% |
| 100FH022 | 3,500 | 3,345 | 96% | 3,407 | 97% | 3,398 | 97% | 3,388 | 97% |
| 100FH031 | 3,500 | 3,202 | 91% | 2,575 | 74% | 2,440 | 70% | 2,299 | 66% |
| 103FH005 | 3,500 | 2,973 | 85% | 2,779 | 79% | 2,763 | 79% | 2,753 | 79% |
| 103FH014 | 3,000 | 2,922 | 97% | 2,766 | 92% | 2,756 | 92% | 2,734 | 91% |
| 103FH024 | 3,500 | 3,084 | 88% | 3,022 | 86% | 3,028 | 87% | 2,984 | 85% |
| 103FH025 | 3,500 | 3,397 | 97% | 3,377 | 96% | 3,393 | 97% | 3,336 | 95% |
| 103FH028 | 3,500 | 2,704 | 77% | 2,645 | 76% | 2,622 | 75% | 2,600 | 74% |
| 103FH037 | 3,000 | 2,563 | 85% | 2,482 | 83% | 2,483 | 83% | 2,447 | 82% |
| 103FH044 | 3,000 | 2,969 | 99% | 2,921 | 97% | 2,933 | 98% | 2,880 | 96% |
| 103FH048 | 3,000 | 2,579 | 86% | 2,486 | 83% | 2,489 | 83% | 2,449 | 82% |
| 103FH061 | 3,500 | 2,849 | 81% | 2,761 | 79% | 3,564 | 100% | 3,445 | 98% |
| 103FH063 | 3,500 | 3,048 | 87% | 3,191 | 91% | 3,147 | 90% | 3,101 | 89% |
| 103FH076 | 3,500 | 2,955 | 84% | 3,089 | 88% | 3,045 | 87% | 3,000 | 86% |
| 103FH077 | 3,500 | 3,336 | 95% | 3,564 | 100% | 3,508 | 100% | 3,450 | 99% |
| 103FH080 | 3,500 | 2,925 | 84% | 3,065 | 88% | 3,019 | 86% | 2,971 | 85% |
| 103FH085 | 3,500 | 2,841 | 81% | 2,961 | 85% | 2,917 | 83% | 2,872 | 82% |
| 103FH087 | 3,500 | 3,135 | 90% | 3,333 | 95% | 3,279 | 94% | 3,224 | 92% |
| 103FH088 | 3,500 | 3,016 | 86% | 3,185 | 91% | 3,134 | 90% | 3,085 | 88% |
| 103FH128 | 3,000 | 2,438 | 81% | 2,348 | 78% | 2,347 | 78% | 2,313 | 77% |
| 103FH141 | 3,500 | 3,309 | 95% | 3,275 | 94% | 3,316 | 95% | 3,242 | 93% |
| 103FH145 | 3,500 | 2,817 | 80% | 2,917 | 83% | 2,878 | 82% | 2,838 | 81% |
| 104FH002 | 3,500 | 3,022 | 86% | 2,867 | 82% | 2,842 | 81% | 2,827 | 81% |
| 104FH004 | 3,500 | 3,038 | 87% | 2,888 | 83% | 2,863 | 82% | 2,847 | 81% |
| 104FH021 | 3,500 | 3,211 | 92% | 3,061 | 87% | 3,035 | 87% | 3,018 | 86% |
| 104FH035 | 1,500 | 1,128 | 75% | 1,101 | 73% | 1,088 | 73% | 1,081 | 72% |
| 104FH036 | 3,000 | 2,948 | 98% | 3,192 | 100% | 3,154 | 100% | 3,121 | 100% |
| 104FH043 | 2,500 | 2,018 | 81% | 2,122 | 85% | 2,093 | 84% | 2,070 | 83% |
| 104FH044 | 2,500 | 2,197 | 88% | 2,429 | 97% | 2,392 | 96% | 2,361 | 94% |
| 104FH045 | 1,500 | 1,143 | 76% | 1,216 | 81% | 1,197 | 80% | 1,186 | 79% |
| 104FH047 | 1,500 | 1,271 | 85% | 4,352 | 100% | 4,264 | 100% | 4,198 | 100% |
| 104FH050 | 3,000 | 2,425 | 81% | 3,608 | 100% | 3,396 | 100% | 3,280 | 100% |
| 104FH057 | 3,500 | 2,824 | 81% | 3,146 | 90% | 3,046 | 87% | 2,991 | 85% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 104FH058 | 1,500 | 1,204 | 80% | 1,288 | 86% | 1,268 | 85% | 1,256 | 84% |
| 104FH103 | 3,500 | 2,734 | 78% | 3,007 | 86% | 2,919 | 83% | 2,870 | 82% |
| 104FH104 | 3,500 | 2,858 | 82% | 3,174 | 91% | 3,077 | 88% | 3,024 | 86% |
| 105FH020 | 3,000 | 2,311 | 77% | 2,648 | 88% | 2,591 | 86% | 2,555 | 85% |
| 105FH032 | 3,500 | 3,107 | 89% | 3,774 | 100% | 3,698 | 100% | 3,648 | 100% |
| 105FH033 | 1,500 | 1,162 | 77% | 2,304 | 100% | 2,250 | 100% | 2,218 | 100% |
| 105FH036 | 1,500 | 1,171 | 78% | 2,459 | 100% | 2,403 | 100% | 2,369 | 100% |
| 105FH037 | 3,500 | 3,215 | 92% | 3,976 | 100% | 3,892 | 100% | 3,838 | 100% |
| 105FH044 | 1,500 | 1,472 | 98% | 1,672 | 100% | 1,636 | 100% | 1,616 | 100% |
| 105FH058 | 3,500 | 2,887 | 82% | 3,405 | 97% | 3,330 | 95% | 3,287 | 94% |
| 105FH071 | 1,500 | 1,394 | 93% | 1,556 | 100% | 1,517 | 100% | 1,486 | 99% |
| 105FH095 | 3,000 | 2,637 | 88% | 3,938 | 100% | 3,712 | 100% | 3,587 | 100% |
| 105FH096 | 3,000 | 2,662 | 89% | 3,874 | 100% | 3,668 | 100% | 3,551 | 100% |
| 105FH098 | 3,000 | 2,531 | 84% | 3,479 | 100% | 3,324 | 100% | 3,224 | 100% |
| 107FH017 | 3,500 | 3,328 | 95% | 3,637 | 100% | 3,644 | 100% | 3,648 | 100% |
| 107FH030 | 3,500 | 3,279 | 94% | 3,641 | 100% | 3,645 | 100% | 3,643 | 100% |
| 108FH003 | 3,500 | 2,900 | 83% | 4,025 | 100% | 4,049 | 100% | 4,077 | 100% |
| 108FH022 | 3,500 | 2,859 | 82% | 2,912 | 83% | 2,925 | 84% | 2,938 | 84% |
| 108FH025 | 3,500 | 2,763 | 79% | 2,809 | 80% | 2,822 | 81% | 2,834 | 81% |
| 108FH036 | 3,500 | 3,482 | 99% | 3,709 | 100% | 3,723 | 100% | 3,750 | 100% |
| 108FH044 | 3,500 | 2,992 | 85% | 3,128 | 89% | 3,139 | 90% | 3,159 | 90% |
| 108FH110 | 3,500 | 2,651 | 76% | 3,458 | 99% | 3,475 | 99% | 3,491 | 100% |
| 108FH111 | 3,500 | 2,678 | 77% | 5,438 | 100% | 5,492 | 100% | 5,561 | 100% |
| 108FH112 | 3,500 | 3,088 | 88% | 5,279 | 100% | 5,325 | 100% | 5,388 | 100% |
| 117FH001 | 3,500 | 3,011 | 86% | 4,521 | 100% | 4,192 | 100% | 4,049 | 100% |
| 117FH003 | 3,500 | 2,648 | 76% | 3,669 | 100% | 3,342 | 95% | 3,239 | 93% |
| 117FH004 | 3,500 | 2,707 | 77% | 3,720 | 100% | 3,420 | 98% | 3,327 | 95% |
| 118FH007 | 1,500 | 1,369 | 91% | 1,578 | 100% | 1,487 | 99% | 1,441 | 96% |
| 118FH010 | 1,500 | 1,375 | 92% | 1,555 | 100% | 1,460 | 97% | 1,406 | 94% |
| 118FH027 | 3,000 | 2,364 | 79% | 3,184 | 100% | 2,919 | 97% | 2,812 | 94% |
| 118FH028 | 3,000 | 2,405 | 80% | 3,034 | 100% | 2,829 | 94% | 2,717 | 91% |
| 118FH031 | 3,000 | 2,766 | 92% | 3,806 | 100% | 3,549 | 100% | 3,456 | 100% |
| 118FH036 | 1,500 | 1,447 | 96% | 1,699 | 100% | 1,582 | 100% | 1,515 | 100% |
| 118FH052 | 1,500 | 1,433 | 96% | 1,936 | 100% | 1,759 | 100% | 1,663 | 100% |
| 118FH053 | 1,500 | 1,347 | 90% | 1,970 | 100% | 1,737 | 100% | 1,596 | 100% |
| 118FH054 | 1,500 | 1,482 | 99% | 2,092 | 100% | 1,894 | 100% | 1,784 | 100% |
| 118FH060 | 1,500 | 1,429 | 95% | 2,747 | 100% | 2,361 | 100% | 2,159 | 100% |
| 118FH066 | 3,000 | 2,270 | 76% | 3,163 | 100% | 2,862 | 95% | 2,661 | 89% |
| 118FH067 | 3,000 | 2,263 | 75% | 2,700 | 90% | 2,554 | 85% | 2,461 | 82% |
| 118FH068 | 3,000 | 2,286 | 76% | 2,895 | 96% | 2,689 | 90% | 2,550 | 85% |
| 118FH069 | 3,000 | 2,671 | 89% | 3,697 | 100% | 3,399 | 100% | 3,238 | 100% |
| 118FH070 | 2,500 | 2,336 | 93% | 3,153 | 100% | 2,889 | 100% | 2,728 | 100% |
| 118FH071 | 2,500 | 2,191 | 88% | 2,905 | 100% | 2,660 | 100% | 2,508 | 100% |
| 118FH072 | 2,500 | 1,981 | 79% | 2,514 | 100% | 2,313 | 93% | 2,183 | 87% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 118FH073 | 2,500 | 2,469 | 99% | 3,415 | 100% | 3,123 | 100% | 2,947 | 100% |
| 118FH074 | 3,000 | 2,368 | 79% | 3,367 | 100% | 3,044 | 100% | 2,835 | 94% |
| 118FH075 | 3,000 | 2,279 | 76% | 3,172 | 100% | 2,873 | 96% | 2,677 | 89% |
| 118FH083 | 3,000 | 2,347 | 78% | 3,669 | 100% | 3,299 | 100% | 3,116 | 100% |
| 118FH090 | 3,000 | 2,929 | 98% | 6,728 | 100% | 6,211 | 100% | 6,022 | 100% |
| 118FH119 | 3,000 | 2,835 | 94% | 3,718 | 100% | 3,467 | 100% | 3,343 | 100% |
| 129FH001 | 3,500 | 2,692 | 77% | 6,483 | 100% | 6,380 | 100% | 6,230 | 100% |
| 129FH002 | 3,500 | 2,953 | 84% | 9,621 | 100% | 9,421 | 100% | 9,100 | 100% |
| 129FH003 | 3,500 | 3,110 | 89% | 10,450 | 100% | 10,234 | 100% | 9,873 | 100% |
| 129FH004 | 3,500 | 2,936 | 84% | 9,397 | 100% | 9,204 | 100% | 8,900 | 100% |
| 130FH007 | 3,500 | 2,650 | 76% | 8,165 | 100% | 7,979 | 100% | 7,703 | 100% |
| 143FH001 | 3,500 | 2,988 | 85% | 7,493 | 100% | 7,384 | 100% | 7,205 | 100% |
| 143FH002 | 3,500 | 3,158 | 90% | 8,678 | 100% | 8,526 | 100% | 8,284 | 100% |
| 143FH003 | 3,500 | 3,070 | 88% | 6,775 | 100% | 6,675 | 100% | 6,531 | 100% |
| 143FH004 | 3,500 | 3,263 | 93% | 7,850 | 100% | 7,728 | 100% | 7,529 | 100% |
| 143FH005 | 3,500 | 3,221 | 92% | 6,448 | 100% | 6,359 | 100% | 6,222 | 100% |
| 143FH006 | 3,500 | 3,488 | 100% | 7,770 | 100% | 7,644 | 100% | 7,450 | 100% |
| 143FH007 | 3,500 | 3,442 | 98% | 7,268 | 100% | 7,156 | 100% | 6,984 | 100% |
| 143FH008 | 3,500 | 3,238 | 93% | 6,084 | 100% | 5,996 | 100% | 5,867 | 100% |
| 143FH009 | 3,500 | 3,346 | 96% | 6,150 | 100% | 6,059 | 100% | 5,925 | 100% |
| 157FH010 | 3,500 | 2,685 | 77% | 4,641 | 100% | 4,487 | 100% | 4,200 | 100% |
| 157FH012 | 3,500 | 3,048 | 87% | 4,284 | 100% | 4,175 | 100% | 3,975 | 100% |
| 157FH016 | 3,500 | 2,820 | 81% | 3,958 | 100% | 3,887 | 100% | 3,751 | 100% |
| **2013 Available Fire Flow >100% of Fire Flow Goal** | | | | | | | | | |
| 033FH001 | 1,500 | 2,806 | 100% | 2,777 | 100% | 2,764 | 100% | 2,736 | 100% |
| 033FH002 | 1,500 | 2,795 | 100% | 2,765 | 100% | 2,752 | 100% | 2,724 | 100% |
| 033FH003 | 1,500 | 2,697 | 100% | 2,664 | 100% | 2,652 | 100% | 2,626 | 100% |
| 033FH004 | 1,500 | 2,809 | 100% | 2,779 | 100% | 2,766 | 100% | 2,738 | 100% |
| 033FH005 | 1,500 | 2,863 | 100% | 2,836 | 100% | 2,822 | 100% | 2,795 | 100% |
| 033FH006 | 1,500 | 2,560 | 100% | 2,560 | 100% | 2,548 | 100% | 2,523 | 100% |
| 033FH007 | 1,500 | 2,671 | 100% | 2,638 | 100% | 2,625 | 100% | 2,598 | 100% |
| 033FH008 | 1,500 | 2,670 | 100% | 2,637 | 100% | 2,624 | 100% | 2,597 | 100% |
| 033FH009 | 1,500 | 2,549 | 100% | 2,549 | 100% | 2,546 | 100% | 2,519 | 100% |
| 033FH010 | 1,500 | 2,635 | 100% | 2,599 | 100% | 2,587 | 100% | 2,560 | 100% |
| 033FH011 | 1,500 | 2,643 | 100% | 2,608 | 100% | 2,595 | 100% | 2,568 | 100% |
| 033FH012 | 1,500 | 2,619 | 100% | 2,583 | 100% | 2,571 | 100% | 2,544 | 100% |
| 033FH013 | 1,500 | 2,709 | 100% | 2,676 | 100% | 2,662 | 100% | 2,635 | 100% |
| 033FH014 | 1,500 | 2,721 | 100% | 2,689 | 100% | 2,677 | 100% | 2,650 | 100% |
| 033FH015 | 1,500 | 2,696 | 100% | 2,662 | 100% | 2,649 | 100% | 2,621 | 100% |
| 033FH016 | 1,500 | 2,481 | 100% | 2,481 | 100% | 2,481 | 100% | 2,481 | 100% |
| 033FH017 | 1,500 | 2,746 | 100% | 2,715 | 100% | 2,702 | 100% | 2,674 | 100% |
| 033FH018 | 1,500 | 2,726 | 100% | 2,693 | 100% | 2,680 | 100% | 2,653 | 100% |
| 033FH019 | 1,500 | 2,638 | 100% | 2,605 | 100% | 2,593 | 100% | 2,567 | 100% |
| 033FH020 | 1,500 | 2,732 | 100% | 2,699 | 100% | 2,686 | 100% | 2,658 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 047FH002 | 1,500 | 2,388 | 100% | 2,568 | 100% | 2,547 | 100% | 2,501 | 100% |
| 047FH003 | 1,500 | 2,270 | 100% | 2,449 | 100% | 2,429 | 100% | 2,384 | 100% |
| 047FH005 | 1,500 | 2,267 | 100% | 2,449 | 100% | 2,429 | 100% | 2,383 | 100% |
| 047FH006 | 1,500 | 2,421 | 100% | 2,605 | 100% | 2,584 | 100% | 2,536 | 100% |
| 047FH007 | 1,500 | 2,379 | 100% | 2,561 | 100% | 2,541 | 100% | 2,494 | 100% |
| 047FH010 | 1,500 | 2,432 | 100% | 2,615 | 100% | 2,594 | 100% | 2,546 | 100% |
| 047FH011 | 1,500 | 2,439 | 100% | 2,626 | 100% | 2,604 | 100% | 2,556 | 100% |
| 047FH012 | 1,500 | 1,897 | 100% | 1,897 | 100% | 1,897 | 100% | 1,896 | 100% |
| 047FH014 | 1,500 | 2,771 | 100% | 2,741 | 100% | 2,728 | 100% | 2,700 | 100% |
| 047FH015 | 1,500 | 2,814 | 100% | 2,785 | 100% | 2,772 | 100% | 2,744 | 100% |
| 047FH016 | 1,500 | 2,825 | 100% | 2,797 | 100% | 2,784 | 100% | 2,756 | 100% |
| 047FH017 | 1,500 | 2,783 | 100% | 2,753 | 100% | 2,740 | 100% | 2,712 | 100% |
| 047FH018 | 1,500 | 2,749 | 100% | 2,718 | 100% | 2,704 | 100% | 2,676 | 100% |
| 047FH019 | 1,500 | 2,792 | 100% | 2,762 | 100% | 2,749 | 100% | 2,722 | 100% |
| 047FH020 | 1,500 | 2,832 | 100% | 2,804 | 100% | 2,790 | 100% | 2,762 | 100% |
| 047FH021 | 1,500 | 2,859 | 100% | 2,832 | 100% | 2,819 | 100% | 2,790 | 100% |
| 047FH022 | 1,500 | 2,811 | 100% | 2,783 | 100% | 2,770 | 100% | 2,743 | 100% |
| 047FH023 | 1,500 | 2,851 | 100% | 2,824 | 100% | 2,810 | 100% | 2,782 | 100% |
| 047FH024 | 1,500 | 2,896 | 100% | 2,870 | 100% | 2,856 | 100% | 2,828 | 100% |
| 047FH025 | 1,500 | 2,872 | 100% | 2,845 | 100% | 2,832 | 100% | 2,804 | 100% |
| 047FH026 | 1,500 | 2,872 | 100% | 2,846 | 100% | 2,833 | 100% | 2,806 | 100% |
| 047FH027 | 1,500 | 1,818 | 100% | 1,818 | 100% | 1,818 | 100% | 1,818 | 100% |
| 047FH028 | 1,500 | 2,853 | 100% | 2,826 | 100% | 2,813 | 100% | 2,785 | 100% |
| 047FH029 | 1,500 | 2,909 | 100% | 2,884 | 100% | 2,871 | 100% | 2,843 | 100% |
| 047FH030 | 1,500 | 3,009 | 100% | 2,989 | 100% | 2,975 | 100% | 2,946 | 100% |
| 047FH031 | 1,500 | 2,933 | 100% | 2,910 | 100% | 2,897 | 100% | 2,869 | 100% |
| 047FH032 | 1,500 | 2,931 | 100% | 2,908 | 100% | 2,895 | 100% | 2,868 | 100% |
| 047FH033 | 1,500 | 2,906 | 100% | 2,881 | 100% | 2,868 | 100% | 2,839 | 100% |
| 047FH034 | 1,500 | 2,894 | 100% | 2,869 | 100% | 2,856 | 100% | 2,830 | 100% |
| 047FH035 | 1,500 | 3,028 | 100% | 3,009 | 100% | 2,996 | 100% | 2,967 | 100% |
| 047FH036 | 1,500 | 2,897 | 100% | 2,872 | 100% | 2,859 | 100% | 2,831 | 100% |
| 047FH037 | 1,500 | 2,920 | 100% | 2,897 | 100% | 2,885 | 100% | 2,859 | 100% |
| 047FH038 | 1,500 | 2,925 | 100% | 2,902 | 100% | 2,889 | 100% | 2,861 | 100% |
| 047FH039 | 1,500 | 2,829 | 100% | 2,802 | 100% | 2,789 | 100% | 2,763 | 100% |
| 047FH040 | 1,500 | 2,674 | 100% | 2,644 | 100% | 2,633 | 100% | 2,609 | 100% |
| 047FH041 | 1,500 | 2,814 | 100% | 2,787 | 100% | 2,775 | 100% | 2,750 | 100% |
| 047FH042 | 1,500 | 2,816 | 100% | 2,787 | 100% | 2,774 | 100% | 2,747 | 100% |
| 047FH043 | 1,500 | 2,198 | 100% | 2,499 | 100% | 2,473 | 100% | 2,420 | 100% |
| 047FH044 | 1,500 | 2,787 | 100% | 2,759 | 100% | 2,747 | 100% | 2,721 | 100% |
| 047FH045 | 1,500 | 2,697 | 100% | 2,666 | 100% | 2,653 | 100% | 2,627 | 100% |
| 047FH046 | 1,500 | 1,750 | 100% | 1,774 | 100% | 1,774 | 100% | 1,773 | 100% |
| 047FH047 | 1,500 | 2,501 | 100% | 2,809 | 100% | 2,783 | 100% | 2,730 | 100% |
| 047FH048 | 1,500 | 1,951 | 100% | 2,071 | 100% | 2,071 | 100% | 2,071 | 100% |
| 047FH049 | 1,500 | 2,034 | 100% | 2,270 | 100% | 2,270 | 100% | 2,254 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 047FH050 | 1,500 | 2,619 | 100% | 2,585 | 100% | 2,573 | 100% | 2,548 | 100% |
| 047FH053 | 1,500 | 2,133 | 100% | 2,983 | 100% | 2,892 | 100% | 2,701 | 100% |
| 047FH055 | 1,500 | 2,252 | 100% | 3,405 | 100% | 3,281 | 100% | 3,022 | 100% |
| 047FH056 | 1,500 | 2,823 | 100% | 3,694 | 100% | 3,591 | 100% | 3,378 | 100% |
| 047FH058 | 1,500 | 2,741 | 100% | 3,661 | 100% | 3,555 | 100% | 3,333 | 100% |
| 047FH059 | 1,500 | 2,801 | 100% | 3,558 | 100% | 3,468 | 100% | 3,281 | 100% |
| 047FH060 | 1,500 | 1,865 | 100% | 2,384 | 100% | 2,329 | 100% | 2,213 | 100% |
| 047FH061 | 1,500 | 3,760 | 100% | 4,950 | 100% | 4,802 | 100% | 4,495 | 100% |
| 047FH062 | 1,500 | 2,709 | 100% | 3,420 | 100% | 3,338 | 100% | 3,166 | 100% |
| 047FH063 | 1,500 | 2,820 | 100% | 3,583 | 100% | 3,493 | 100% | 3,306 | 100% |
| 047FH064 | 1,500 | 2,822 | 100% | 3,672 | 100% | 3,572 | 100% | 3,364 | 100% |
| 047FH066 | 1,500 | 3,312 | 100% | 4,074 | 100% | 3,976 | 100% | 3,774 | 100% |
| 047FH067 | 2,500 | 4,426 | 100% | 5,718 | 100% | 5,564 | 100% | 5,243 | 100% |
| 047FH068 | 3,500 | 4,100 | 100% | 5,273 | 100% | 5,131 | 100% | 4,837 | 100% |
| 047FH069 | 1,500 | 1,530 | 100% | 1,872 | 100% | 1,835 | 100% | 1,759 | 100% |
| 047FH070 | 1,500 | 3,229 | 100% | 4,046 | 100% | 3,944 | 100% | 3,733 | 100% |
| 047FH071 | 1,500 | 3,861 | 100% | 4,737 | 100% | 4,626 | 100% | 4,397 | 100% |
| 047FH072 | 3,500 | 4,206 | 100% | 5,359 | 100% | 5,220 | 100% | 4,933 | 100% |
| 047FH073 | 1,500 | 1,559 | 100% | 1,897 | 100% | 1,861 | 100% | 1,784 | 100% |
| 047FH074 | 3,500 | 4,191 | 100% | 5,284 | 100% | 5,152 | 100% | 4,880 | 100% |
| 047FH075 | 2,500 | 4,999 | 100% | 6,461 | 100% | 6,294 | 100% | 5,943 | 100% |
| 047FH076 | 1,500 | 3,246 | 100% | 4,017 | 100% | 3,921 | 100% | 3,721 | 100% |
| 047FH077 | 1,500 | 3,810 | 100% | 4,648 | 100% | 4,542 | 100% | 4,323 | 100% |
| 047FH078 | 1,500 | 2,014 | 100% | 2,391 | 100% | 2,349 | 100% | 2,262 | 100% |
| 047FH079 | 3,000 | 5,320 | 100% | 6,876 | 100% | 6,704 | 100% | 6,339 | 100% |
| 047FH080 | 1,500 | 3,932 | 100% | 4,774 | 100% | 4,667 | 100% | 4,448 | 100% |
| 047FH081 | 2,500 | 4,888 | 100% | 6,293 | 100% | 6,133 | 100% | 5,796 | 100% |
| 047FH082 | 1,500 | 3,378 | 100% | 4,152 | 100% | 4,053 | 100% | 3,849 | 100% |
| 047FH083 | 2,500 | 4,486 | 100% | 5,633 | 100% | 5,499 | 100% | 5,219 | 100% |
| 047FH085 | 1,500 | 2,244 | 100% | 2,550 | 100% | 2,523 | 100% | 2,470 | 100% |
| 047FH086 | 1,500 | 2,255 | 100% | 2,513 | 100% | 2,491 | 100% | 2,446 | 100% |
| 047FH087 | 1,500 | 2,370 | 100% | 2,370 | 100% | 2,370 | 100% | 2,370 | 100% |
| 047FH088 | 1,500 | 1,867 | 100% | 1,867 | 100% | 1,867 | 100% | 1,867 | 100% |
| 047FH089 | 1,500 | 2,319 | 100% | 2,626 | 100% | 2,600 | 100% | 2,548 | 100% |
| 047FH090 | 1,500 | 2,044 | 100% | 2,189 | 100% | 2,189 | 100% | 2,188 | 100% |
| 047FH091 | 1,500 | 2,400 | 100% | 2,673 | 100% | 2,650 | 100% | 2,602 | 100% |
| 047FH092 | 1,500 | 1,858 | 100% | 1,942 | 100% | 1,942 | 100% | 1,942 | 100% |
| 047FH093 | 1,500 | 2,694 | 100% | 2,986 | 100% | 2,962 | 100% | 2,913 | 100% |
| 047FH094 | 1,500 | 2,032 | 100% | 2,386 | 100% | 2,368 | 100% | 2,311 | 100% |
| 047FH095 | 1,500 | 2,209 | 100% | 2,452 | 100% | 2,431 | 100% | 2,388 | 100% |
| 047FH096 | 1,500 | 2,277 | 100% | 2,628 | 100% | 2,604 | 100% | 2,554 | 100% |
| 047FH097 | 1,500 | 1,627 | 100% | 1,643 | 100% | 1,643 | 100% | 1,643 | 100% |
| 047FH098 | 1,500 | 1,580 | 100% | 1,593 | 100% | 1,593 | 100% | 1,593 | 100% |
| 047FH100 | 1,500 | 1,903 | 100% | 2,080 | 100% | 2,080 | 100% | 2,080 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 047FH102 | 1,500 | 3,313 | 100% | 3,665 | 100% | 3,639 | 100% | 3,585 | 100% |
| 047FH103 | 1,500 | 1,688 | 100% | 1,733 | 100% | 1,733 | 100% | 1,733 | 100% |
| 047FH104 | 1,500 | 1,577 | 100% | 1,593 | 100% | 1,593 | 100% | 1,593 | 100% |
| 047FH105 | 1,500 | 1,822 | 100% | 2,030 | 100% | 2,030 | 100% | 2,029 | 100% |
| 047FH106 | 1,500 | 1,573 | 100% | 2,569 | 100% | 2,549 | 100% | 2,509 | 100% |
| 047FH107 | 1,500 | 1,676 | 100% | 2,769 | 100% | 2,747 | 100% | 2,702 | 100% |
| 047FH108 | 1,500 | 1,734 | 100% | 2,021 | 100% | 2,021 | 100% | 2,021 | 100% |
| 047FH109 | 1,500 | 2,612 | 100% | 2,871 | 100% | 2,849 | 100% | 2,804 | 100% |
| 047FH111 | 1,500 | 1,763 | 100% | 2,112 | 100% | 2,074 | 100% | 1,994 | 100% |
| 047FH112 | 1,500 | 1,985 | 100% | 2,145 | 100% | 2,117 | 100% | 2,061 | 100% |
| 047FH113 | 3,500 | 6,267 | 100% | 6,706 | 100% | 6,595 | 100% | 6,362 | 100% |
| 047FH120 | 1,500 | 2,728 | 100% | 2,695 | 100% | 2,681 | 100% | 2,653 | 100% |
| 047FH121 | 1,500 | 2,700 | 100% | 2,667 | 100% | 2,654 | 100% | 2,627 | 100% |
| 047FH122 | 1,500 | 2,691 | 100% | 2,657 | 100% | 2,644 | 100% | 2,617 | 100% |
| 047FH123 | 1,500 | 2,161 | 100% | 2,418 | 100% | 2,396 | 100% | 2,350 | 100% |
| 048FH005 | 1,500 | 2,377 | 100% | 2,562 | 100% | 2,540 | 100% | 2,492 | 100% |
| 048FH009 | 1,500 | 2,252 | 100% | 2,446 | 100% | 2,424 | 100% | 2,374 | 100% |
| 048FH010 | 1,500 | 2,194 | 100% | 2,399 | 100% | 2,376 | 100% | 2,324 | 100% |
| 048FH012 | 1,500 | 2,230 | 100% | 2,438 | 100% | 2,415 | 100% | 2,362 | 100% |
| 048FH013 | 1,500 | 2,220 | 100% | 2,426 | 100% | 2,403 | 100% | 2,350 | 100% |
| 048FH020 | 1,500 | 2,228 | 100% | 2,436 | 100% | 2,412 | 100% | 2,359 | 100% |
| 048FH021 | 1,500 | 2,250 | 100% | 2,452 | 100% | 2,429 | 100% | 2,378 | 100% |
| 048FH022 | 1,500 | 2,376 | 100% | 2,569 | 100% | 2,547 | 100% | 2,496 | 100% |
| 048FH023 | 1,500 | 2,318 | 100% | 2,518 | 100% | 2,496 | 100% | 2,444 | 100% |
| 048FH024 | 1,500 | 2,322 | 100% | 2,518 | 100% | 2,496 | 100% | 2,445 | 100% |
| 048FH025 | 1,500 | 1,825 | 100% | 1,825 | 100% | 1,825 | 100% | 1,824 | 100% |
| 048FH026 | 1,500 | 2,338 | 100% | 2,528 | 100% | 2,506 | 100% | 2,457 | 100% |
| 048FH027 | 1,500 | 2,535 | 100% | 2,701 | 100% | 2,682 | 100% | 2,637 | 100% |
| 048FH028 | 1,500 | 2,607 | 100% | 3,118 | 100% | 3,010 | 100% | 2,736 | 100% |
| 048FH029 | 1,500 | 2,271 | 100% | 2,586 | 100% | 2,436 | 100% | 2,388 | 100% |
| 048FH030 | 1,500 | 3,144 | 100% | 3,802 | 100% | 3,723 | 100% | 3,548 | 100% |
| 048FH031 | 3,000 | 3,397 | 100% | 3,973 | 100% | 3,901 | 100% | 3,744 | 100% |
| 048FH032 | 3,000 | 3,770 | 100% | 4,713 | 100% | 4,597 | 100% | 4,348 | 100% |
| 048FH033 | 1,500 | 1,554 | 100% | 2,565 | 100% | 2,455 | 100% | 2,221 | 100% |
| 048FH034 | 1,500 | 1,926 | 100% | 2,399 | 100% | 2,248 | 100% | 2,231 | 100% |
| 048FH035 | 1,500 | 1,725 | 100% | 1,896 | 100% | 1,896 | 100% | 1,894 | 100% |
| 048FH036 | 1,500 | 1,962 | 100% | 2,704 | 100% | 2,617 | 100% | 2,432 | 100% |
| 048FH037 | 1,500 | 1,766 | 100% | 1,934 | 100% | 1,934 | 100% | 1,933 | 100% |
| 048FH038 | 1,500 | 2,235 | 100% | 2,819 | 100% | 2,747 | 100% | 2,594 | 100% |
| 048FH039 | 1,500 | 1,546 | 100% | 1,683 | 100% | 1,683 | 100% | 1,682 | 100% |
| 048FH040 | 1,500 | 2,980 | 100% | 3,701 | 100% | 3,599 | 100% | 3,387 | 100% |
| 048FH041 | 1,500 | 2,033 | 100% | 2,877 | 100% | 2,776 | 100% | 2,562 | 100% |
| 048FH042 | 1,500 | 2,579 | 100% | 3,311 | 100% | 3,215 | 100% | 3,014 | 100% |
| 048FH043 | 1,500 | 1,816 | 100% | 2,649 | 100% | 2,552 | 100% | 2,343 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 048FH044 | 1,500 | 2,322 | 100% | 3,091 | 100% | 2,995 | 100% | 2,793 | 100% |
| 048FH045 | 1,500 | 2,174 | 100% | 2,718 | 100% | 2,651 | 100% | 2,510 | 100% |
| 048FH046 | 1,500 | 2,335 | 100% | 3,261 | 100% | 3,143 | 100% | 2,895 | 100% |
| 048FH049 | 1,500 | 3,223 | 100% | 3,960 | 100% | 3,854 | 100% | 3,632 | 100% |
| 048FH051 | 3,500 | 3,666 | 100% | 4,513 | 100% | 4,394 | 100% | 4,146 | 100% |
| 048FH052 | 2,500 | 4,443 | 100% | 5,679 | 100% | 5,515 | 100% | 5,173 | 100% |
| 048FH053 | 3,000 | 3,819 | 100% | 4,833 | 100% | 4,690 | 100% | 4,392 | 100% |
| 048FH054 | 3,000 | 3,727 | 100% | 4,733 | 100% | 4,589 | 100% | 4,287 | 100% |
| 048FH057 | 1,500 | 1,730 | 100% | 1,735 | 100% | 1,735 | 100% | 1,734 | 100% |
| 048FH058 | 1,500 | 1,527 | 100% | 1,530 | 100% | 1,530 | 100% | 1,529 | 100% |
| 048FH059 | 1,500 | 1,721 | 100% | 1,725 | 100% | 1,725 | 100% | 1,724 | 100% |
| 048FH060 | 1,500 | 2,139 | 100% | 2,279 | 100% | 2,247 | 100% | 2,244 | 100% |
| 048FH061 | 1,500 | 1,574 | 100% | 1,578 | 100% | 1,578 | 100% | 1,577 | 100% |
| 048FH062 | 1,500 | 1,744 | 100% | 1,796 | 100% | 1,795 | 100% | 1,794 | 100% |
| 048FH063 | 1,500 | 3,226 | 100% | 4,395 | 100% | 4,216 | 100% | 3,840 | 100% |
| 048FH064 | 2,500 | 3,340 | 100% | 4,200 | 100% | 4,063 | 100% | 3,775 | 100% |
| 048FH065 | 750 | 2,557 | 100% | 3,454 | 100% | 3,323 | 100% | 3,045 | 100% |
| 048FH066 | 2,500 | 4,439 | 100% | 5,906 | 100% | 5,699 | 100% | 5,264 | 100% |
| 048FH067 | 2,500 | 4,040 | 100% | 5,144 | 100% | 4,977 | 100% | 4,626 | 100% |
| 048FH070 | 1,500 | 2,298 | 100% | 2,489 | 100% | 2,467 | 100% | 2,418 | 100% |
| 048FH072 | 1,500 | 1,545 | 100% | 1,632 | 100% | 1,574 | 100% | 1,470 | 98% |
| 048FH073 | 1,500 | 1,543 | 100% | 1,628 | 100% | 1,574 | 100% | 1,469 | 98% |
| 048FH075 | 1,500 | 1,625 | 100% | 2,151 | 100% | 2,040 | 100% | 1,788 | 100% |
| 048FH076 | 1,500 | 1,591 | 100% | 1,923 | 100% | 1,817 | 100% | 1,571 | 100% |
| 048FH077 | 1,500 | 2,398 | 100% | 2,856 | 100% | 2,763 | 100% | 2,565 | 100% |
| 048FH078 | 1,500 | 1,609 | 100% | 1,997 | 100% | 1,900 | 100% | 1,682 | 100% |
| 048FH079 | 1,500 | 2,008 | 100% | 2,598 | 100% | 2,495 | 100% | 2,273 | 100% |
| 048FH081 | 1,500 | 1,642 | 100% | 2,138 | 100% | 2,034 | 100% | 1,804 | 100% |
| 048FH082 | 1,500 | 1,608 | 100% | 1,942 | 100% | 1,838 | 100% | 1,602 | 100% |
| 048FH083 | 1,500 | 1,599 | 100% | 1,856 | 100% | 1,759 | 100% | 1,540 | 100% |
| 048FH084 | 1,500 | 1,595 | 100% | 1,851 | 100% | 1,747 | 100% | 1,516 | 100% |
| 048FH085 | 1,500 | 1,563 | 100% | 1,708 | 100% | 1,590 | 100% | 1,487 | 99% |
| 048FH086 | 1,500 | 1,521 | 100% | 1,600 | 100% | 1,550 | 100% | 1,447 | 96% |
| 048FH087 | 1,500 | 1,550 | 100% | 1,622 | 100% | 1,572 | 100% | 1,471 | 98% |
| 048FH090 | 1,500 | 1,588 | 100% | 1,780 | 100% | 1,687 | 100% | 1,507 | 100% |
| 048FH091 | 1,500 | 1,518 | 100% | 1,589 | 100% | 1,540 | 100% | 1,437 | 96% |
| 048FH110 | 1,500 | 1,631 | 100% | 2,026 | 100% | 1,926 | 100% | 1,706 | 100% |
| 048FH111 | 2,500 | 4,231 | 100% | 5,773 | 100% | 5,534 | 100% | 5,034 | 100% |
| 048FH112 | 1,500 | 2,650 | 100% | 2,914 | 100% | 2,814 | 100% | 2,753 | 100% |
| 048FH114 | 1,500 | 1,931 | 100% | 3,292 | 100% | 3,123 | 100% | 2,761 | 100% |
| 048FH124 | 1,500 | 1,504 | 100% | 1,567 | 100% | 1,522 | 100% | 1,428 | 95% |
| 048FH125 | 1,500 | 1,502 | 100% | 1,565 | 100% | 1,519 | 100% | 1,425 | 95% |
| 048FH127 | 1,500 | 1,534 | 100% | 1,595 | 100% | 1,550 | 100% | 1,456 | 97% |
| 048FH133 | 1,500 | 2,247 | 100% | 2,438 | 100% | 2,416 | 100% | 2,367 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 048FH135 | 3,000 | 3,706 | 100% | 4,369 | 100% | 4,292 | 100% | 4,125 | 100% |
| 048FH136 | 2,500 | 2,523 | 100% | 2,691 | 100% | 2,672 | 100% | 2,626 | 100% |
| 048FH137 | 2,500 | 2,594 | 100% | 2,782 | 100% | 2,747 | 100% | 2,700 | 100% |
| 049FH003 | 500 | 2,829 | 100% | 3,495 | 100% | 3,288 | 100% | 2,878 | 100% |
| 049FH007 | 1,500 | 1,574 | 100% | 1,649 | 100% | 1,587 | 100% | 1,490 | 99% |
| 049FH008 | 1,500 | 1,554 | 100% | 1,615 | 100% | 1,568 | 100% | 1,471 | 98% |
| 049FH009 | 1,500 | 1,593 | 100% | 1,706 | 100% | 1,638 | 100% | 1,510 | 100% |
| 049FH010 | 1,500 | 1,554 | 100% | 1,612 | 100% | 1,568 | 100% | 1,476 | 98% |
| 049FH011 | 1,500 | 1,558 | 100% | 1,618 | 100% | 1,573 | 100% | 1,478 | 99% |
| 049FH012 | 1,500 | 1,560 | 100% | 1,621 | 100% | 1,575 | 100% | 1,480 | 99% |
| 049FH013 | 1,500 | 1,560 | 100% | 1,620 | 100% | 1,573 | 100% | 1,476 | 98% |
| 049FH019 | 1,500 | 1,517 | 100% | 1,580 | 100% | 1,538 | 100% | 1,453 | 97% |
| 050FH001 | 500 | 2,536 | 100% | 2,928 | 100% | 2,711 | 100% | 2,296 | 100% |
| 050FH002 | 500 | 2,034 | 100% | 2,592 | 100% | 2,341 | 100% | 1,855 | 100% |
| 050FH003 | 500 | 2,273 | 100% | 2,808 | 100% | 2,548 | 100% | 2,050 | 100% |
| 050FH004 | 500 | 3,017 | 100% | 3,523 | 100% | 3,229 | 100% | 2,685 | 100% |
| 050FH005 | 500 | 1,962 | 100% | 2,468 | 100% | 2,244 | 100% | 1,808 | 100% |
| 050FH006 | 500 | 1,378 | 100% | 2,143 | 100% | 1,892 | 100% | 1,388 | 100% |
| 050FH007 | 500 | 2,965 | 100% | 3,467 | 100% | 3,185 | 100% | 2,658 | 100% |
| 050FH008 | 500 | 1,726 | 100% | 2,134 | 100% | 1,971 | 100% | 1,646 | 100% |
| 050FH009 | 500 | 755 | 100% | 1,426 | 100% | 1,262 | 100% | 904 | 100% |
| 050FH010 | 500 | 2,663 | 100% | 3,124 | 100% | 2,883 | 100% | 2,421 | 100% |
| 050FH011 | 500 | 2,414 | 100% | 2,944 | 100% | 2,695 | 100% | 2,209 | 100% |
| 050FH012 | 500 | 1,896 | 100% | 2,680 | 100% | 2,380 | 100% | 1,799 | 100% |
| 050FH014 | 500 | 2,783 | 100% | 3,369 | 100% | 3,080 | 100% | 2,530 | 100% |
| 050FH015 | 500 | 1,822 | 100% | 2,515 | 100% | 2,264 | 100% | 1,767 | 100% |
| 050FH016 | 500 | 1,562 | 100% | 1,993 | 100% | 1,858 | 100% | 1,586 | 100% |
| 050FH017 | 500 | 1,841 | 100% | 2,494 | 100% | 2,265 | 100% | 1,809 | 100% |
| 050FH018 | 500 | 2,108 | 100% | 2,612 | 100% | 2,413 | 100% | 2,019 | 100% |
| 050FH021 | 500 | 3,079 | 100% | 3,530 | 100% | 3,270 | 100% | 2,783 | 100% |
| 050FH022 | 500 | 2,431 | 100% | 2,792 | 100% | 2,601 | 100% | 2,232 | 100% |
| 050FH023 | 500 | 2,248 | 100% | 2,622 | 100% | 2,439 | 100% | 2,082 | 100% |
| 050FH024 | 500 | 1,918 | 100% | 2,279 | 100% | 2,125 | 100% | 1,819 | 100% |
| 050FH025 | 3,000 | 3,312 | 100% | 3,854 | 100% | 3,492 | 100% | 2,852 | 95% |
| 050FH026 | 3,000 | 3,247 | 100% | 3,780 | 100% | 3,437 | 100% | 2,821 | 94% |
| 050FH027 | 500 | 3,076 | 100% | 3,730 | 100% | 3,460 | 100% | 2,950 | 100% |
| 050FH028 | 1,500 | 2,580 | 100% | 3,085 | 100% | 2,792 | 100% | 2,248 | 100% |
| 060FH002 | 3,500 | 3,942 | 100% | 4,079 | 100% | 4,010 | 100% | 3,877 | 100% |
| 060FH003 | 3,500 | 3,518 | 100% | 3,480 | 99% | 3,431 | 98% | 3,336 | 95% |
| 061FH001 | 3,000 | 4,396 | 100% | 5,509 | 100% | 5,377 | 100% | 5,103 | 100% |
| 061FH002 | 3,000 | 5,028 | 100% | 6,760 | 100% | 6,589 | 100% | 6,227 | 100% |
| 061FH003 | 2,500 | 5,464 | 100% | 7,462 | 100% | 7,267 | 100% | 6,848 | 100% |
| 061FH004 | 2,500 | 2,750 | 100% | 3,344 | 100% | 3,275 | 100% | 3,132 | 100% |
| 061FH006 | 3,000 | 3,878 | 100% | 4,517 | 100% | 4,426 | 100% | 4,241 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 061FH007 | 3,000 | 4,792 | 100% | 5,732 | 100% | 5,610 | 100% | 5,357 | 100% |
| 061FH008 | 3,000 | 3,958 | 100% | 4,628 | 100% | 4,531 | 100% | 4,334 | 100% |
| 061FH010 | 2,500 | 3,417 | 100% | 4,042 | 100% | 3,959 | 100% | 3,789 | 100% |
| 061FH013 | 3,000 | 3,767 | 100% | 4,386 | 100% | 4,304 | 100% | 4,135 | 100% |
| 061FH015 | 3,000 | 3,722 | 100% | 4,287 | 100% | 4,210 | 100% | 4,052 | 100% |
| 061FH017 | 3,000 | 3,719 | 100% | 4,259 | 100% | 4,186 | 100% | 4,037 | 100% |
| 061FH018 | 2,500 | 3,585 | 100% | 4,024 | 100% | 3,958 | 100% | 3,823 | 100% |
| 061FH021 | 3,000 | 4,388 | 100% | 4,996 | 100% | 4,914 | 100% | 4,746 | 100% |
| 061FH023 | 1,500 | 3,325 | 100% | 3,696 | 100% | 3,636 | 100% | 3,515 | 100% |
| 061FH024 | 1,500 | 2,094 | 100% | 2,375 | 100% | 2,334 | 100% | 2,250 | 100% |
| 061FH031 | 1,500 | 3,091 | 100% | 3,456 | 100% | 3,397 | 100% | 3,275 | 100% |
| 061FH032 | 1,500 | 2,159 | 100% | 2,482 | 100% | 2,434 | 100% | 2,334 | 100% |
| 061FH038 | 1,500 | 2,418 | 100% | 2,748 | 100% | 2,696 | 100% | 2,588 | 100% |
| 061FH042 | 1,500 | 2,812 | 100% | 3,175 | 100% | 3,114 | 100% | 2,991 | 100% |
| 061FH047 | 1,500 | 2,363 | 100% | 2,639 | 100% | 2,600 | 100% | 2,522 | 100% |
| 061FH048 | 1,500 | 2,250 | 100% | 2,417 | 100% | 2,384 | 100% | 2,319 | 100% |
| 061FH049 | 3,500 | 8,512 | 100% | 8,727 | 100% | 8,570 | 100% | 8,227 | 100% |
| 061FH050 | 1,500 | 2,138 | 100% | 2,261 | 100% | 2,235 | 100% | 2,185 | 100% |
| 061FH079 | 3,000 | 3,068 | 100% | 2,394 | 80% | 2,344 | 78% | 2,283 | 76% |
| 061FH081 | 3,000 | 3,610 | 100% | 2,895 | 96% | 2,835 | 95% | 2,760 | 92% |
| 061FH086 | 3,000 | 5,491 | 100% | 7,192 | 100% | 7,008 | 100% | 6,614 | 100% |
| 061FH087 | 1,500 | 5,213 | 100% | 5,395 | 100% | 5,311 | 100% | 5,144 | 100% |
| 062FH001 | 3,000 | 3,569 | 100% | 4,291 | 100% | 4,187 | 100% | 3,970 | 100% |
| 062FH002 | 2,500 | 3,594 | 100% | 4,451 | 100% | 4,329 | 100% | 4,075 | 100% |
| 062FH003 | 2,500 | 3,938 | 100% | 4,946 | 100% | 4,805 | 100% | 4,514 | 100% |
| 062FH004 | 2,500 | 4,933 | 100% | 6,146 | 100% | 5,989 | 100% | 5,656 | 100% |
| 062FH007 | 1,500 | 3,621 | 100% | 4,303 | 100% | 4,202 | 100% | 3,991 | 100% |
| 062FH011 | 1,500 | 3,229 | 100% | 3,732 | 100% | 3,653 | 100% | 3,488 | 100% |
| 062FH012 | 1,500 | 4,483 | 100% | 5,334 | 100% | 5,216 | 100% | 4,969 | 100% |
| 062FH014 | 1,500 | 2,339 | 100% | 2,743 | 100% | 2,688 | 100% | 2,570 | 100% |
| 062FH015 | 1,500 | 3,513 | 100% | 4,041 | 100% | 3,958 | 100% | 3,787 | 100% |
| 062FH016 | 3,500 | 3,621 | 100% | 4,147 | 100% | 4,066 | 100% | 3,895 | 100% |
| 062FH018 | 1,500 | 4,163 | 100% | 4,861 | 100% | 4,759 | 100% | 4,546 | 100% |
| 062FH019 | 1,500 | 3,898 | 100% | 4,523 | 100% | 4,427 | 100% | 4,230 | 100% |
| 062FH020 | 1,500 | 1,612 | 100% | 2,238 | 100% | 2,200 | 100% | 2,119 | 100% |
| 062FH021 | 1,500 | 4,072 | 100% | 4,644 | 100% | 4,558 | 100% | 4,379 | 100% |
| 062FH022 | 1,500 | 3,772 | 100% | 4,271 | 100% | 4,192 | 100% | 4,028 | 100% |
| 062FH024 | 2,500 | 2,971 | 100% | 3,336 | 100% | 3,275 | 100% | 3,149 | 100% |
| 062FH025 | 2,500 | 2,782 | 100% | 3,151 | 100% | 3,092 | 100% | 2,968 | 100% |
| 062FH026 | 2,500 | 2,549 | 100% | 2,894 | 100% | 2,841 | 100% | 2,731 | 100% |
| 062FH027 | 1,500 | 3,489 | 100% | 3,899 | 100% | 3,831 | 100% | 3,690 | 100% |
| 062FH029 | 1,500 | 1,737 | 100% | 1,991 | 100% | 1,959 | 100% | 1,891 | 100% |
| 062FH030 | 1,500 | 3,039 | 100% | 3,386 | 100% | 3,328 | 100% | 3,208 | 100% |
| 062FH035 | 1,500 | 3,580 | 100% | 3,919 | 100% | 3,858 | 100% | 3,734 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 062FH036 | 3,000 | 4,157 | 100% | 4,728 | 100% | 4,655 | 100% | 4,502 | 100% |
| 062FH038 | 1,500 | 2,404 | 100% | 2,560 | 100% | 2,526 | 100% | 2,456 | 100% |
| 062FH039 | 3,000 | 5,154 | 100% | 5,966 | 100% | 5,865 | 100% | 5,647 | 100% |
| 062FH040 | 1,500 | 4,236 | 100% | 5,649 | 100% | 5,443 | 100% | 5,012 | 100% |
| 062FH041 | 1,500 | 3,319 | 100% | 4,142 | 100% | 4,015 | 100% | 3,749 | 100% |
| 062FH042 | 1,500 | 4,668 | 100% | 5,965 | 100% | 5,784 | 100% | 5,402 | 100% |
| 062FH043 | 2,500 | 4,366 | 100% | 5,464 | 100% | 5,308 | 100% | 4,980 | 100% |
| 062FH044 | 1,500 | 3,318 | 100% | 3,986 | 100% | 3,879 | 100% | 3,656 | 100% |
| 062FH045 | 1,500 | 4,573 | 100% | 5,725 | 100% | 5,565 | 100% | 5,228 | 100% |
| 062FH046 | 1,500 | 4,975 | 100% | 6,278 | 100% | 6,103 | 100% | 5,731 | 100% |
| 062FH047 | 3,500 | 6,056 | 100% | 7,792 | 100% | 7,563 | 100% | 7,072 | 100% |
| 062FH048 | 3,000 | 4,192 | 100% | 5,105 | 100% | 4,974 | 100% | 4,700 | 100% |
| 062FH049 | 3,000 | 4,272 | 100% | 5,242 | 100% | 5,106 | 100% | 4,820 | 100% |
| 062FH050 | 1,500 | 3,720 | 100% | 4,487 | 100% | 4,369 | 100% | 4,120 | 100% |
| 062FH051 | 3,500 | 4,095 | 100% | 4,947 | 100% | 4,823 | 100% | 4,565 | 100% |
| 062FH052 | 1,500 | 3,503 | 100% | 4,193 | 100% | 4,086 | 100% | 3,861 | 100% |
| 062FH053 | 3,000 | 3,952 | 100% | 4,821 | 100% | 4,703 | 100% | 4,454 | 100% |
| 062FH054 | 1,500 | 4,154 | 100% | 5,651 | 100% | 5,461 | 100% | 5,064 | 100% |
| 062FH055 | 2,500 | 3,592 | 100% | 4,245 | 100% | 4,147 | 100% | 3,942 | 100% |
| 062FH056 | 1,500 | 2,420 | 100% | 2,871 | 100% | 2,805 | 100% | 2,664 | 100% |
| 062FH057 | 3,000 | 4,511 | 100% | 5,468 | 100% | 5,339 | 100% | 5,066 | 100% |
| 062FH058 | 1,500 | 4,398 | 100% | 5,361 | 100% | 5,225 | 100% | 4,939 | 100% |
| 062FH059 | 3,000 | 4,702 | 100% | 5,963 | 100% | 5,814 | 100% | 5,500 | 100% |
| 062FH060 | 2,500 | 2,716 | 100% | 3,139 | 100% | 3,076 | 100% | 2,944 | 100% |
| 062FH061 | 1,500 | 4,070 | 100% | 5,947 | 100% | 5,752 | 100% | 5,344 | 100% |
| 062FH062 | 1,500 | 4,396 | 100% | 5,415 | 100% | 5,274 | 100% | 4,977 | 100% |
| 062FH063 | 2,500 | 4,094 | 100% | 4,803 | 100% | 4,699 | 100% | 4,482 | 100% |
| 062FH064 | 1,500 | 2,520 | 100% | 2,961 | 100% | 2,902 | 100% | 2,778 | 100% |
| 062FH065 | 1,500 | 3,631 | 100% | 5,169 | 100% | 5,052 | 100% | 4,806 | 100% |
| 062FH066 | 1,500 | 3,082 | 100% | 3,639 | 100% | 3,558 | 100% | 3,386 | 100% |
| 062FH067 | 2,500 | 2,611 | 100% | 2,973 | 100% | 2,918 | 100% | 2,802 | 100% |
| 062FH068 | 1,500 | 2,442 | 100% | 2,796 | 100% | 2,744 | 100% | 2,633 | 100% |
| 062FH069 | 1,500 | 2,559 | 100% | 2,971 | 100% | 2,914 | 100% | 2,792 | 100% |
| 062FH070 | 1,500 | 3,041 | 100% | 3,567 | 100% | 3,490 | 100% | 3,327 | 100% |
| 062FH071 | 1,500 | 3,697 | 100% | 4,743 | 100% | 4,598 | 100% | 4,302 | 100% |
| 062FH072 | 1,500 | 1,822 | 100% | 2,184 | 100% | 2,136 | 100% | 2,034 | 100% |
| 062FH073 | 2,500 | 2,553 | 100% | 2,888 | 100% | 2,836 | 100% | 2,728 | 100% |
| 062FH074 | 1,500 | 1,686 | 100% | 1,943 | 100% | 1,908 | 100% | 1,836 | 100% |
| 062FH075 | 1,500 | 2,161 | 100% | 2,553 | 100% | 2,499 | 100% | 2,383 | 100% |
| 062FH076 | 1,500 | 2,002 | 100% | 2,310 | 100% | 2,268 | 100% | 2,179 | 100% |
| 062FH077 | 1,500 | 3,676 | 100% | 4,647 | 100% | 4,511 | 100% | 4,236 | 100% |
| 062FH078 | 1,500 | 2,050 | 100% | 2,419 | 100% | 2,372 | 100% | 2,273 | 100% |
| 062FH079 | 1,500 | 2,136 | 100% | 2,588 | 100% | 2,527 | 100% | 2,397 | 100% |
| 062FH080 | 1,500 | 1,765 | 100% | 2,217 | 100% | 2,170 | 100% | 2,070 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 062FH083 | 1,500 | 3,363 | 100% | 3,645 | 100% | 3,592 | 100% | 3,485 | 100% |
| 062FH084 | 3,000 | 3,074 | 100% | 3,401 | 100% | 3,339 | 100% | 3,213 | 100% |
| 062FH085 | 1,500 | 2,902 | 100% | 3,133 | 100% | 3,090 | 100% | 3,000 | 100% |
| 062FH086 | 3,000 | 3,617 | 100% | 3,964 | 100% | 3,898 | 100% | 3,766 | 100% |
| 062FH087 | 1,500 | 2,200 | 100% | 2,362 | 100% | 2,325 | 100% | 2,249 | 100% |
| 062FH089 | 3,000 | 3,297 | 100% | 3,653 | 100% | 3,585 | 100% | 3,449 | 100% |
| 062FH090 | 1,500 | 2,425 | 100% | 2,626 | 100% | 2,581 | 100% | 2,490 | 100% |
| 062FH091 | 1,500 | 2,058 | 100% | 2,235 | 100% | 2,194 | 100% | 2,112 | 100% |
| 062FH094 | 1,500 | 2,284 | 100% | 2,394 | 100% | 2,365 | 100% | 2,306 | 100% |
| 062FH096 | 1,500 | 1,612 | 100% | 1,691 | 100% | 1,657 | 100% | 1,589 | 100% |
| 062FH097 | 1,500 | 1,748 | 100% | 1,766 | 100% | 1,746 | 100% | 1,709 | 100% |
| 062FH117 | 1,500 | 1,831 | 100% | 2,229 | 100% | 2,186 | 100% | 2,095 | 100% |
| 062FH119 | 1,500 | 2,357 | 100% | 2,894 | 100% | 2,822 | 100% | 2,672 | 100% |
| 062FH120 | 2,500 | 3,090 | 100% | 3,894 | 100% | 3,794 | 100% | 3,586 | 100% |
| 062FH121 | 1,500 | 2,253 | 100% | 2,755 | 100% | 2,692 | 100% | 2,558 | 100% |
| 062FH122 | 1,500 | 1,597 | 100% | 2,624 | 100% | 2,565 | 100% | 2,441 | 100% |
| 062FH124 | 1,500 | 3,089 | 100% | 3,940 | 100% | 3,840 | 100% | 3,634 | 100% |
| 062FH126 | 1,500 | 3,588 | 100% | 4,864 | 100% | 4,738 | 100% | 4,478 | 100% |
| 062FH127 | 1,500 | 2,563 | 100% | 3,273 | 100% | 3,194 | 100% | 3,030 | 100% |
| 062FH129 | 1,500 | 3,677 | 100% | 5,155 | 100% | 5,012 | 100% | 4,721 | 100% |
| 062FH131 | 1,500 | 2,565 | 100% | 3,150 | 100% | 3,082 | 100% | 2,939 | 100% |
| 062FH132 | 1,500 | 2,537 | 100% | 3,154 | 100% | 3,083 | 100% | 2,935 | 100% |
| 062FH133 | 1,500 | 2,381 | 100% | 3,038 | 100% | 2,966 | 100% | 2,815 | 100% |
| 062FH134 | 1,500 | 3,733 | 100% | 5,111 | 100% | 4,987 | 100% | 4,733 | 100% |
| 062FH135 | 1,500 | 2,695 | 100% | 3,355 | 100% | 3,284 | 100% | 3,137 | 100% |
| 062FH138 | 1,500 | 3,192 | 100% | 4,104 | 100% | 3,990 | 100% | 3,756 | 100% |
| 062FH141 | 3,500 | 4,489 | 100% | 5,760 | 100% | 5,571 | 100% | 5,172 | 100% |
| 062FH143 | 1,500 | 3,246 | 100% | 3,902 | 100% | 3,797 | 100% | 3,573 | 100% |
| 062FH144 | 1,500 | 1,954 | 100% | 2,294 | 100% | 2,250 | 100% | 2,156 | 100% |
| 062FH145 | 1,500 | 2,189 | 100% | 2,558 | 100% | 2,508 | 100% | 2,403 | 100% |
| 062FH146 | 1,500 | 2,506 | 100% | 2,898 | 100% | 2,842 | 100% | 2,725 | 100% |
| 062FH147 | 3,500 | 3,802 | 100% | 4,610 | 100% | 4,494 | 100% | 4,252 | 100% |
| 062FH149 | 3,500 | 3,698 | 100% | 4,532 | 100% | 4,411 | 100% | 4,159 | 100% |
| 062FH150 | 3,500 | 3,930 | 100% | 4,822 | 100% | 4,696 | 100% | 4,432 | 100% |
| 062FH151 | 3,500 | 4,303 | 100% | 5,281 | 100% | 5,147 | 100% | 4,868 | 100% |
| 062FH163 | 3,500 | 4,160 | 100% | 5,195 | 100% | 5,037 | 100% | 4,706 | 100% |
| 062FH166 | 3,500 | 3,862 | 100% | 4,700 | 100% | 4,571 | 100% | 4,297 | 100% |
| 062FH168 | 3,500 | 4,528 | 100% | 5,587 | 100% | 5,432 | 100% | 5,107 | 100% |
| 062FH170 | 2,500 | 4,549 | 100% | 5,373 | 100% | 5,255 | 100% | 5,009 | 100% |
| 062FH171 | 2,500 | 3,030 | 100% | 3,541 | 100% | 3,464 | 100% | 3,302 | 100% |
| 062FH172 | 2,500 | 4,225 | 100% | 5,056 | 100% | 4,940 | 100% | 4,699 | 100% |
| 062FH174 | 1,500 | 3,455 | 100% | 4,409 | 100% | 4,283 | 100% | 4,026 | 100% |
| 062FH175 | 3,500 | 4,466 | 100% | 5,689 | 100% | 5,509 | 100% | 5,129 | 100% |
| 063FH001 | 3,500 | 3,805 | 100% | 5,888 | 100% | 5,714 | 100% | 5,360 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 063FH005 | 3,500 | 3,910 | 100% | 6,425 | 100% | 6,235 | 100% | 5,850 | 100% |
| 063FH006 | 3,500 | 3,907 | 100% | 6,503 | 100% | 6,299 | 100% | 5,884 | 100% |
| 063FH007 | 3,500 | 3,634 | 100% | 5,647 | 100% | 5,480 | 100% | 5,141 | 100% |
| 063FH012 | 3,500 | 3,515 | 100% | 5,304 | 100% | 5,157 | 100% | 4,862 | 100% |
| 063FH014 | 3,500 | 3,754 | 100% | 5,738 | 100% | 5,588 | 100% | 5,287 | 100% |
| 063FH023 | 3,500 | 3,619 | 100% | 5,514 | 100% | 5,361 | 100% | 5,055 | 100% |
| 063FH026 | 3,500 | 3,924 | 100% | 6,224 | 100% | 6,050 | 100% | 5,699 | 100% |
| 063FH028 | 3,000 | 3,051 | 100% | 4,051 | 100% | 3,942 | 100% | 3,729 | 100% |
| 063FH031 | 3,000 | 3,231 | 100% | 4,431 | 100% | 4,314 | 100% | 4,085 | 100% |
| 063FH033 | 2,500 | 3,304 | 100% | 4,625 | 100% | 4,506 | 100% | 4,270 | 100% |
| 063FH035 | 3,000 | 3,018 | 100% | 4,009 | 100% | 3,911 | 100% | 3,715 | 100% |
| 063FH037 | 3,000 | 3,428 | 100% | 4,863 | 100% | 4,737 | 100% | 4,487 | 100% |
| 063FH038 | 3,000 | 3,277 | 100% | 4,556 | 100% | 4,443 | 100% | 4,217 | 100% |
| 063FH040 | 3,000 | 3,198 | 100% | 4,266 | 100% | 4,158 | 100% | 3,947 | 100% |
| 063FH041 | 3,000 | 3,084 | 100% | 4,011 | 100% | 3,915 | 100% | 3,726 | 100% |
| 063FH042 | 3,000 | 3,492 | 100% | 4,965 | 100% | 4,837 | 100% | 4,585 | 100% |
| 063FH043 | 3,000 | 3,525 | 100% | 5,057 | 100% | 4,927 | 100% | 4,669 | 100% |
| 063FH044 | 3,000 | 3,611 | 100% | 5,281 | 100% | 5,144 | 100% | 4,871 | 100% |
| 063FH045 | 3,500 | 3,619 | 100% | 5,345 | 100% | 5,205 | 100% | 4,926 | 100% |
| 063FH046 | 3,500 | 3,586 | 100% | 5,236 | 100% | 5,101 | 100% | 4,831 | 100% |
| 063FH048 | 3,000 | 3,029 | 100% | 3,866 | 100% | 3,779 | 100% | 3,605 | 100% |
| 063FH049 | 3,000 | 3,289 | 100% | 4,415 | 100% | 4,310 | 100% | 4,103 | 100% |
| 063FH050 | 3,500 | 3,811 | 100% | 5,671 | 100% | 5,524 | 100% | 5,231 | 100% |
| 063FH051 | 3,000 | 3,698 | 100% | 5,264 | 100% | 5,135 | 100% | 4,880 | 100% |
| 063FH052 | 3,500 | 3,716 | 100% | 5,402 | 100% | 5,266 | 100% | 4,995 | 100% |
| 063FH053 | 3,000 | 3,225 | 100% | 5,221 | 100% | 5,077 | 100% | 4,786 | 100% |
| 063FH054 | 3,000 | 3,128 | 100% | 4,997 | 100% | 4,857 | 100% | 4,574 | 100% |
| 063FH055 | 3,000 | 3,209 | 100% | 5,267 | 100% | 5,118 | 100% | 4,817 | 100% |
| 063FH056 | 3,000 | 3,235 | 100% | 5,419 | 100% | 5,264 | 100% | 4,951 | 100% |
| 063FH057 | 3,000 | 3,243 | 100% | 5,394 | 100% | 5,241 | 100% | 4,932 | 100% |
| 063FH058 | 3,000 | 3,510 | 100% | 6,222 | 100% | 6,035 | 100% | 5,655 | 100% |
| 063FH059 | 3,000 | 3,396 | 100% | 5,783 | 100% | 5,614 | 100% | 5,270 | 100% |
| 063FH060 | 3,000 | 3,434 | 100% | 5,876 | 100% | 5,702 | 100% | 5,349 | 100% |
| 063FH061 | 3,000 | 3,629 | 100% | 5,181 | 100% | 5,051 | 100% | 4,794 | 100% |
| 063FH062 | 3,500 | 3,754 | 100% | 6,139 | 100% | 5,971 | 100% | 5,630 | 100% |
| 063FH063 | 3,500 | 3,772 | 100% | 6,294 | 100% | 6,119 | 100% | 5,763 | 100% |
| 063FH064 | 3,500 | 3,688 | 100% | 6,037 | 100% | 5,872 | 100% | 5,538 | 100% |
| 063FH065 | 3,500 | 3,644 | 100% | 5,963 | 100% | 5,798 | 100% | 5,464 | 100% |
| 063FH066 | 3,500 | 3,705 | 100% | 6,185 | 100% | 6,009 | 100% | 5,652 | 100% |
| 063FH071 | 500 | 4,248 | 100% | 6,188 | 100% | 5,884 | 100% | 5,238 | 100% |
| 063FH072 | 500 | 3,182 | 100% | 4,374 | 100% | 4,173 | 100% | 3,745 | 100% |
| 063FH074 | 3,000 | 3,670 | 100% | 4,325 | 100% | 4,112 | 100% | 3,701 | 100% |
| 063FH075 | 3,000 | 7,944 | 100% | 8,314 | 100% | 8,309 | 100% | 8,231 | 100% |
| 063FH076 | 3,000 | 5,175 | 100% | 5,206 | 100% | 5,200 | 100% | 5,184 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 063FH077 | 3,000 | 3,012 | 100% | 3,917 | 100% | 3,817 | 100% | 3,623 | 100% |
| 063FH081 | 3,000 | 3,003 | 100% | 5,377 | 100% | 5,213 | 100% | 4,880 | 100% |
| 063FH082 | 3,000 | 3,160 | 100% | 5,628 | 100% | 5,469 | 100% | 5,147 | 100% |
| 063FH083 | 3,000 | 3,116 | 100% | 4,999 | 100% | 4,863 | 100% | 4,588 | 100% |
| 063FH084 | 3,000 | 3,150 | 100% | 5,100 | 100% | 4,959 | 100% | 4,673 | 100% |
| 063FH085 | 3,000 | 3,287 | 100% | 5,128 | 100% | 4,994 | 100% | 4,724 | 100% |
| 063FH086 | 3,000 | 3,503 | 100% | 5,450 | 100% | 5,307 | 100% | 5,019 | 100% |
| 063FH087 | 3,000 | 3,637 | 100% | 5,762 | 100% | 5,607 | 100% | 5,295 | 100% |
| 063FH088 | 3,500 | 3,681 | 100% | 5,746 | 100% | 5,595 | 100% | 5,291 | 100% |
| 063FH089 | 3,500 | 3,575 | 100% | 5,317 | 100% | 5,169 | 100% | 4,868 | 100% |
| 063FH090 | 3,500 | 3,791 | 100% | 6,153 | 100% | 5,963 | 100% | 5,577 | 100% |
| 064FH001 | 3,000 | 4,806 | 100% | 4,811 | 100% | 4,804 | 100% | 4,789 | 100% |
| 064FH002 | 3,000 | 3,779 | 100% | 3,769 | 100% | 3,763 | 100% | 3,751 | 100% |
| 064FH003 | 1,500 | 2,425 | 100% | 2,408 | 100% | 2,406 | 100% | 2,395 | 100% |
| 064FH004 | 3,000 | 4,392 | 100% | 4,380 | 100% | 4,374 | 100% | 4,359 | 100% |
| 064FH005 | 1,500 | 3,316 | 100% | 3,299 | 100% | 3,297 | 100% | 3,281 | 100% |
| 064FH006 | 3,000 | 3,109 | 100% | 3,106 | 100% | 3,105 | 100% | 3,101 | 100% |
| 064FH007 | 3,000 | 4,598 | 100% | 4,591 | 100% | 4,586 | 100% | 4,572 | 100% |
| 064FH008 | 3,000 | 7,884 | 100% | 8,421 | 100% | 8,370 | 100% | 8,249 | 100% |
| 064FH009 | 1,500 | 5,509 | 100% | 5,560 | 100% | 5,557 | 100% | 5,527 | 100% |
| 064FH010 | 1,500 | 5,497 | 100% | 5,529 | 100% | 5,526 | 100% | 5,498 | 100% |
| 064FH011 | 3,000 | 4,642 | 100% | 4,633 | 100% | 4,630 | 100% | 4,618 | 100% |
| 064FH012 | 1,500 | 3,007 | 100% | 2,995 | 100% | 2,994 | 100% | 2,985 | 100% |
| 064FH013 | 3,000 | 5,176 | 100% | 5,222 | 100% | 5,219 | 100% | 5,211 | 100% |
| 064FH014 | 1,500 | 7,356 | 100% | 7,573 | 100% | 7,570 | 100% | 7,470 | 100% |
| 064FH015 | 1,500 | 5,991 | 100% | 6,066 | 100% | 6,063 | 100% | 6,044 | 100% |
| 064FH016 | 2,500 | 8,151 | 100% | 8,573 | 100% | 8,538 | 100% | 8,417 | 100% |
| 064FH017 | 1,500 | 8,363 | 100% | 9,002 | 100% | 8,977 | 100% | 8,804 | 100% |
| 064FH020 | 1,500 | 2,498 | 100% | 2,943 | 100% | 2,659 | 100% | 2,140 | 100% |
| 064FH021 | 1,500 | 2,239 | 100% | 2,692 | 100% | 2,431 | 100% | 1,950 | 100% |
| 064FH022 | 1,500 | 2,725 | 100% | 3,211 | 100% | 2,895 | 100% | 2,327 | 100% |
| 064FH023 | 1,500 | 2,055 | 100% | 2,458 | 100% | 2,247 | 100% | 1,847 | 100% |
| 064FH024 | 1,500 | 1,713 | 100% | 2,143 | 100% | 1,947 | 100% | 1,571 | 100% |
| 064FH025 | 1,500 | 2,791 | 100% | 3,271 | 100% | 2,959 | 100% | 2,394 | 100% |
| 064FH026 | 1,500 | 2,186 | 100% | 2,664 | 100% | 2,397 | 100% | 1,904 | 100% |
| 064FH027 | 1,500 | 2,187 | 100% | 2,577 | 100% | 2,361 | 100% | 1,956 | 100% |
| 064FH028 | 1,500 | 2,326 | 100% | 2,807 | 100% | 2,523 | 100% | 2,001 | 100% |
| 064FH029 | 1,500 | 2,338 | 100% | 2,765 | 100% | 2,513 | 100% | 2,045 | 100% |
| 064FH030 | 1,500 | 1,866 | 100% | 2,269 | 100% | 2,074 | 100% | 1,701 | 100% |
| 064FH031 | 1,500 | 2,108 | 100% | 2,533 | 100% | 2,305 | 100% | 1,876 | 100% |
| 064FH032 | 1,500 | 1,966 | 100% | 2,372 | 100% | 2,167 | 100% | 1,778 | 100% |
| 064FH033 | 1,500 | 1,732 | 100% | 2,138 | 100% | 1,953 | 100% | 1,594 | 100% |
| 064FH034 | 1,500 | 2,073 | 100% | 2,544 | 100% | 2,295 | 100% | 1,829 | 100% |
| 064FH035 | 1,500 | 2,801 | 100% | 3,234 | 100% | 2,952 | 100% | 2,439 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 064FH036 | 1,500 | 2,680 | 100% | 3,018 | 100% | 2,800 | 100% | 2,395 | 100% |
| 064FH037 | 1,500 | 2,544 | 100% | 2,923 | 100% | 2,680 | 100% | 2,231 | 100% |
| 064FH038 | 1,500 | 1,612 | 100% | 2,033 | 100% | 1,850 | 100% | 1,494 | 100% |
| 064FH039 | 1,500 | 2,639 | 100% | 2,984 | 100% | 2,763 | 100% | 2,353 | 100% |
| 064FH040 | 1,500 | 2,369 | 100% | 2,753 | 100% | 2,523 | 100% | 2,096 | 100% |
| 064FH041 | 1,500 | 1,792 | 100% | 2,159 | 100% | 1,987 | 100% | 1,657 | 100% |
| 064FH042 | 1,500 | 4,024 | 100% | 4,263 | 100% | 4,261 | 100% | 4,235 | 100% |
| 064FH043 | 1,500 | 4,389 | 100% | 4,590 | 100% | 4,588 | 100% | 4,562 | 100% |
| 064FH044 | 1,500 | 3,636 | 100% | 3,818 | 100% | 3,817 | 100% | 3,791 | 100% |
| 064FH045 | 1,500 | 3,586 | 100% | 3,702 | 100% | 3,701 | 100% | 3,674 | 100% |
| 064FH046 | 1,500 | 2,695 | 100% | 3,025 | 100% | 2,812 | 100% | 2,418 | 100% |
| 064FH047 | 1,500 | 3,645 | 100% | 3,678 | 100% | 3,677 | 100% | 3,648 | 100% |
| 064FH049 | 2,500 | 4,575 | 100% | 4,541 | 100% | 4,539 | 100% | 4,516 | 100% |
| 064FH050 | 2,500 | 3,100 | 100% | 3,072 | 100% | 3,071 | 100% | 3,050 | 100% |
| 064FH051 | 1,500 | 1,563 | 100% | 1,781 | 100% | 1,689 | 100% | 1,507 | 100% |
| 064FH052 | 2,500 | 2,968 | 100% | 2,947 | 100% | 2,946 | 100% | 2,934 | 100% |
| 064FH054 | 1,500 | 3,467 | 100% | 3,656 | 100% | 3,652 | 100% | 3,637 | 100% |
| 064FH055 | 1,500 | 6,349 | 100% | 6,670 | 100% | 6,666 | 100% | 6,630 | 100% |
| 064FH056 | 1,500 | 3,550 | 100% | 3,678 | 100% | 3,675 | 100% | 3,662 | 100% |
| 064FH057 | 1,500 | 4,529 | 100% | 4,731 | 100% | 4,727 | 100% | 4,709 | 100% |
| 064FH058 | 1,500 | 3,382 | 100% | 3,517 | 100% | 3,514 | 100% | 3,501 | 100% |
| 064FH059 | 1,500 | 3,948 | 100% | 4,074 | 100% | 4,072 | 100% | 4,058 | 100% |
| 064FH060 | 1,500 | 5,002 | 100% | 5,021 | 100% | 5,019 | 100% | 5,000 | 100% |
| 064FH061 | 1,500 | 3,879 | 100% | 4,026 | 100% | 4,022 | 100% | 4,007 | 100% |
| 064FH062 | 1,500 | 4,239 | 100% | 4,332 | 100% | 4,329 | 100% | 4,314 | 100% |
| 064FH063 | 1,500 | 6,923 | 100% | 7,020 | 100% | 7,016 | 100% | 6,959 | 100% |
| 064FH064 | 1,500 | 3,607 | 100% | 3,698 | 100% | 3,695 | 100% | 3,683 | 100% |
| 064FH065 | 1,500 | 3,380 | 100% | 3,377 | 100% | 3,376 | 100% | 3,365 | 100% |
| 064FH066 | 1,500 | 2,578 | 100% | 2,577 | 100% | 2,576 | 100% | 2,569 | 100% |
| 064FH067 | 1,500 | 3,466 | 100% | 3,537 | 100% | 3,534 | 100% | 3,523 | 100% |
| 064FH068 | 1,500 | 3,835 | 100% | 3,915 | 100% | 3,912 | 100% | 3,899 | 100% |
| 064FH070 | 1,500 | 5,016 | 100% | 5,031 | 100% | 5,029 | 100% | 5,010 | 100% |
| 064FH071 | 2,500 | 5,091 | 100% | 5,233 | 100% | 5,229 | 100% | 5,211 | 100% |
| 064FH073 | 1,500 | 4,839 | 100% | 4,804 | 100% | 4,801 | 100% | 4,778 | 100% |
| 064FH074 | 1,500 | 3,133 | 100% | 3,177 | 100% | 3,175 | 100% | 3,165 | 100% |
| 064FH075 | 1,500 | 3,666 | 100% | 3,717 | 100% | 3,714 | 100% | 3,703 | 100% |
| 064FH077 | 3,000 | 3,294 | 100% | 3,312 | 100% | 3,311 | 100% | 3,303 | 100% |
| 064FH078 | 2,500 | 3,708 | 100% | 3,711 | 100% | 3,709 | 100% | 3,699 | 100% |
| 064FH079 | 3,000 | 5,317 | 100% | 5,424 | 100% | 5,420 | 100% | 5,404 | 100% |
| 064FH080 | 2,500 | 3,292 | 100% | 3,303 | 100% | 3,301 | 100% | 3,292 | 100% |
| 064FH081 | 2,500 | 5,789 | 100% | 5,856 | 100% | 5,853 | 100% | 5,832 | 100% |
| 064FH082 | 2,500 | 4,356 | 100% | 4,372 | 100% | 4,370 | 100% | 4,356 | 100% |
| 064FH083 | 3,000 | 6,584 | 100% | 6,604 | 100% | 6,602 | 100% | 6,584 | 100% |
| 064FH085 | 3,000 | 5,618 | 100% | 5,651 | 100% | 5,649 | 100% | 5,641 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 064FH086 | 1,500 | 4,922 | 100% | 4,891 | 100% | 4,889 | 100% | 4,867 | 100% |
| 064FH087 | 2,500 | 3,314 | 100% | 3,304 | 100% | 3,303 | 100% | 3,293 | 100% |
| 064FH088 | 2,500 | 5,569 | 100% | 5,607 | 100% | 5,605 | 100% | 5,585 | 100% |
| 064FH089 | 3,000 | 6,317 | 100% | 6,363 | 100% | 6,361 | 100% | 6,352 | 100% |
| 064FH091 | 2,500 | 8,535 | 100% | 9,001 | 100% | 8,970 | 100% | 8,798 | 100% |
| 064FH092 | 2,500 | 6,027 | 100% | 6,065 | 100% | 6,062 | 100% | 6,035 | 100% |
| 064FH093 | 2,500 | 6,381 | 100% | 6,429 | 100% | 6,426 | 100% | 6,402 | 100% |
| 064FH094 | 3,000 | 6,044 | 100% | 6,054 | 100% | 6,053 | 100% | 6,042 | 100% |
| 064FH098 | 2,500 | 2,646 | 100% | 3,224 | 100% | 3,159 | 100% | 3,029 | 100% |
| 064FH101 | 3,000 | 3,994 | 100% | 3,965 | 100% | 3,964 | 100% | 3,945 | 100% |
| 064FH102 | 1,500 | 2,464 | 100% | 2,423 | 100% | 2,422 | 100% | 2,400 | 100% |
| 064FH104 | 1,500 | 3,457 | 100% | 3,415 | 100% | 3,413 | 100% | 3,388 | 100% |
| 064FH105 | 1,500 | 3,882 | 100% | 3,854 | 100% | 3,852 | 100% | 3,834 | 100% |
| 064FH107 | 1,500 | 5,229 | 100% | 5,206 | 100% | 5,204 | 100% | 5,177 | 100% |
| 064FH108 | 1,500 | 1,624 | 100% | 1,605 | 100% | 1,604 | 100% | 1,590 | 100% |
| 064FH109 | 1,500 | 2,649 | 100% | 2,614 | 100% | 2,613 | 100% | 2,596 | 100% |
| 064FH110 | 1,500 | 2,764 | 100% | 2,713 | 100% | 2,713 | 100% | 2,689 | 100% |
| 064FH111 | 1,500 | 2,146 | 100% | 2,125 | 100% | 2,123 | 100% | 2,111 | 100% |
| 064FH112 | 1,500 | 2,393 | 100% | 2,371 | 100% | 2,369 | 100% | 2,360 | 100% |
| 064FH113 | 1,500 | 4,656 | 100% | 4,619 | 100% | 4,617 | 100% | 4,594 | 100% |
| 064FH114 | 1,500 | 4,775 | 100% | 4,738 | 100% | 4,736 | 100% | 4,713 | 100% |
| 064FH115 | 1,500 | 1,678 | 100% | 1,660 | 100% | 1,658 | 100% | 1,645 | 100% |
| 064FH116 | 1,500 | 4,359 | 100% | 4,292 | 100% | 4,294 | 100% | 4,252 | 100% |
| 064FH117 | 1,500 | 2,772 | 100% | 2,737 | 100% | 2,736 | 100% | 2,719 | 100% |
| 064FH118 | 1,500 | 1,740 | 100% | 1,726 | 100% | 1,725 | 100% | 1,714 | 100% |
| 064FH119 | 1,500 | 3,063 | 100% | 3,042 | 100% | 3,041 | 100% | 3,028 | 100% |
| 064FH120 | 1,500 | 4,385 | 100% | 4,352 | 100% | 4,350 | 100% | 4,330 | 100% |
| 064FH121 | 1,500 | 4,662 | 100% | 4,626 | 100% | 4,624 | 100% | 4,602 | 100% |
| 064FH122 | 1,500 | 2,434 | 100% | 2,413 | 100% | 2,411 | 100% | 2,403 | 100% |
| 064FH123 | 1,500 | 1,947 | 100% | 1,932 | 100% | 1,930 | 100% | 1,919 | 100% |
| 064FH124 | 1,500 | 1,936 | 100% | 1,915 | 100% | 1,913 | 100% | 1,898 | 100% |
| 064FH125 | 1,500 | 4,528 | 100% | 4,465 | 100% | 4,467 | 100% | 4,427 | 100% |
| 064FH126 | 1,500 | 2,853 | 100% | 2,832 | 100% | 2,831 | 100% | 2,820 | 100% |
| 064FH127 | 2,500 | 5,259 | 100% | 5,235 | 100% | 5,232 | 100% | 5,204 | 100% |
| 064FH128 | 2,500 | 5,536 | 100% | 5,537 | 100% | 5,534 | 100% | 5,506 | 100% |
| 064FH129 | 2,500 | 4,685 | 100% | 4,634 | 100% | 4,633 | 100% | 4,598 | 100% |
| 064FH130 | 2,500 | 4,838 | 100% | 4,804 | 100% | 4,801 | 100% | 4,778 | 100% |
| 064FH131 | 2,500 | 3,246 | 100% | 3,226 | 100% | 3,225 | 100% | 3,212 | 100% |
| 064FH132 | 3,000 | 4,749 | 100% | 4,702 | 100% | 4,700 | 100% | 4,670 | 100% |
| 064FH133 | 3,000 | 5,124 | 100% | 5,083 | 100% | 5,080 | 100% | 5,046 | 100% |
| 064FH135 | 3,000 | 5,057 | 100% | 5,002 | 100% | 5,000 | 100% | 4,958 | 100% |
| 064FH136 | 3,000 | 4,902 | 100% | 4,858 | 100% | 4,855 | 100% | 4,825 | 100% |
| 064FH137 | 3,000 | 3,198 | 100% | 3,157 | 100% | 3,156 | 100% | 3,134 | 100% |
| 064FH138 | 3,000 | 3,776 | 100% | 3,729 | 100% | 3,728 | 100% | 3,699 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 064FH139 | 1,500 | 2,463 | 100% | 3,062 | 100% | 2,756 | 100% | 2,186 | 100% |
| 064FH140 | 1,500 | 4,067 | 100% | 4,023 | 100% | 4,022 | 100% | 3,994 | 100% |
| 064FH141 | 1,500 | 6,567 | 100% | 6,711 | 100% | 6,709 | 100% | 6,665 | 100% |
| 064FH142 | 1,500 | 4,760 | 100% | 4,724 | 100% | 4,722 | 100% | 4,699 | 100% |
| 065FH001 | 500 | 2,300 | 100% | 2,698 | 100% | 2,391 | 100% | 1,845 | 100% |
| 065FH002 | 500 | 2,282 | 100% | 2,716 | 100% | 2,392 | 100% | 1,793 | 100% |
| 065FH003 | 500 | 1,975 | 100% | 2,444 | 100% | 2,157 | 100% | 1,563 | 100% |
| 065FH004 | 750 | 1,908 | 100% | 2,360 | 100% | 2,113 | 100% | 1,538 | 100% |
| 065FH005 | 1,500 | 1,906 | 100% | 2,329 | 100% | 2,097 | 100% | 1,555 | 100% |
| 065FH007 | 1,500 | 2,312 | 100% | 2,643 | 100% | 2,436 | 100% | 1,935 | 100% |
| 065FH008 | 1,500 | 3,779 | 100% | 3,691 | 100% | 3,694 | 100% | 3,642 | 100% |
| 065FH009 | 1,500 | 4,491 | 100% | 4,390 | 100% | 4,396 | 100% | 4,332 | 100% |
| 065FH010 | 1,500 | 5,071 | 100% | 4,979 | 100% | 4,988 | 100% | 4,922 | 100% |
| 065FH011 | 1,500 | 4,599 | 100% | 4,524 | 100% | 4,528 | 100% | 4,479 | 100% |
| 065FH012 | 1,500 | 4,044 | 100% | 3,964 | 100% | 3,968 | 100% | 3,919 | 100% |
| 065FH013 | 1,500 | 3,966 | 100% | 3,889 | 100% | 3,892 | 100% | 3,845 | 100% |
| 065FH015 | 2,500 | 5,933 | 100% | 5,912 | 100% | 5,923 | 100% | 5,847 | 100% |
| 065FH016 | 750 | 4,514 | 100% | 4,438 | 100% | 4,444 | 100% | 4,396 | 100% |
| 065FH017 | 750 | 4,233 | 100% | 4,160 | 100% | 4,164 | 100% | 4,119 | 100% |
| 065FH018 | 1,500 | 3,512 | 100% | 3,445 | 100% | 3,448 | 100% | 3,409 | 100% |
| 065FH019 | 2,500 | 4,179 | 100% | 4,107 | 100% | 4,110 | 100% | 4,067 | 100% |
| 065FH020 | 1,500 | 2,664 | 100% | 2,607 | 100% | 2,608 | 100% | 2,582 | 100% |
| 065FH021 | 2,500 | 6,335 | 100% | 6,332 | 100% | 6,347 | 100% | 6,271 | 100% |
| 065FH022 | 1,500 | 4,663 | 100% | 4,586 | 100% | 4,593 | 100% | 4,545 | 100% |
| 065FH023 | 2,500 | 5,656 | 100% | 5,583 | 100% | 5,602 | 100% | 5,533 | 100% |
| 065FH024 | 1,500 | 4,681 | 100% | 4,605 | 100% | 4,613 | 100% | 4,565 | 100% |
| 065FH025 | 2,500 | 2,668 | 100% | 2,619 | 100% | 2,619 | 100% | 2,597 | 100% |
| 065FH026 | 1,500 | 2,802 | 100% | 2,750 | 100% | 2,752 | 100% | 2,728 | 100% |
| 065FH027 | 1,500 | 6,438 | 100% | 6,438 | 100% | 6,454 | 100% | 6,380 | 100% |
| 065FH028 | 2,500 | 5,972 | 100% | 5,952 | 100% | 5,962 | 100% | 5,900 | 100% |
| 065FH029 | 2,500 | 5,763 | 100% | 5,712 | 100% | 5,721 | 100% | 5,663 | 100% |
| 065FH030 | 2,500 | 5,954 | 100% | 5,934 | 100% | 5,944 | 100% | 5,882 | 100% |
| 065FH031 | 2,500 | 6,160 | 100% | 6,143 | 100% | 6,159 | 100% | 6,089 | 100% |
| 065FH032 | 3,500 | 6,549 | 100% | 6,528 | 100% | 6,563 | 100% | 6,476 | 100% |
| 065FH033 | 2,500 | 4,825 | 100% | 4,759 | 100% | 4,762 | 100% | 4,719 | 100% |
| 065FH034 | 2,500 | 4,252 | 100% | 4,191 | 100% | 4,195 | 100% | 4,158 | 100% |
| 065FH035 | 3,000 | 6,328 | 100% | 6,323 | 100% | 6,335 | 100% | 6,269 | 100% |
| 065FH036 | 2,500 | 6,686 | 100% | 6,674 | 100% | 6,708 | 100% | 6,622 | 100% |
| 065FH037 | 2,500 | 7,138 | 100% | 7,158 | 100% | 7,191 | 100% | 7,104 | 100% |
| 065FH042 | 1,500 | 1,940 | 100% | 1,882 | 100% | 1,884 | 100% | 1,849 | 100% |
| 065FH043 | 1,500 | 2,685 | 100% | 2,586 | 100% | 2,591 | 100% | 2,546 | 100% |
| 065FH046 | 1,500 | 2,159 | 100% | 2,073 | 100% | 2,076 | 100% | 2,026 | 100% |
| 065FH047 | 1,500 | 3,659 | 100% | 3,566 | 100% | 3,580 | 100% | 3,528 | 100% |
| 065FH048 | 1,500 | 2,732 | 100% | 2,657 | 100% | 2,662 | 100% | 2,629 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 065FH049 | 1,500 | 3,463 | 100% | 3,363 | 100% | 3,376 | 100% | 3,323 | 100% |
| 065FH051 | 1,500 | 1,754 | 100% | 1,692 | 100% | 1,694 | 100% | 1,658 | 100% |
| 065FH052 | 1,500 | 3,751 | 100% | 3,668 | 100% | 3,681 | 100% | 3,634 | 100% |
| 065FH053 | 1,500 | 2,336 | 100% | 2,247 | 100% | 2,250 | 100% | 2,201 | 100% |
| 065FH054 | 1,500 | 3,896 | 100% | 3,800 | 100% | 3,817 | 100% | 3,758 | 100% |
| 065FH055 | 1,500 | 2,334 | 100% | 2,262 | 100% | 2,267 | 100% | 2,230 | 100% |
| 065FH056 | 1,500 | 2,324 | 100% | 2,248 | 100% | 2,254 | 100% | 2,215 | 100% |
| 065FH057 | 1,500 | 2,663 | 100% | 2,577 | 100% | 2,584 | 100% | 2,550 | 100% |
| 065FH058 | 1,500 | 4,976 | 100% | 4,879 | 100% | 4,902 | 100% | 4,839 | 100% |
| 065FH059 | 1,500 | 4,765 | 100% | 4,681 | 100% | 4,697 | 100% | 4,643 | 100% |
| 065FH060 | 1,500 | 5,300 | 100% | 5,197 | 100% | 5,231 | 100% | 5,158 | 100% |
| 065FH061 | 1,500 | 4,902 | 100% | 4,783 | 100% | 4,828 | 100% | 4,756 | 100% |
| 065FH062 | 1,500 | 4,520 | 100% | 4,426 | 100% | 4,452 | 100% | 4,395 | 100% |
| 065FH063 | 1,500 | 4,772 | 100% | 4,646 | 100% | 4,703 | 100% | 4,633 | 100% |
| 065FH064 | 2,500 | 5,691 | 100% | 5,608 | 100% | 5,644 | 100% | 5,572 | 100% |
| 065FH065 | 1,500 | 5,389 | 100% | 5,288 | 100% | 5,330 | 100% | 5,259 | 100% |
| 065FH066 | 1,500 | 5,216 | 100% | 5,120 | 100% | 5,151 | 100% | 5,084 | 100% |
| 065FH067 | 1,500 | 4,776 | 100% | 4,675 | 100% | 4,711 | 100% | 4,649 | 100% |
| 065FH068 | 1,500 | 4,409 | 100% | 4,332 | 100% | 4,346 | 100% | 4,300 | 100% |
| 065FH069 | 1,500 | 5,881 | 100% | 5,819 | 100% | 5,860 | 100% | 5,786 | 100% |
| 065FH070 | 1,500 | 5,900 | 100% | 5,837 | 100% | 5,882 | 100% | 5,803 | 100% |
| 065FH071 | 2,500 | 5,292 | 100% | 5,190 | 100% | 5,236 | 100% | 5,169 | 100% |
| 065FH072 | 1,500 | 4,566 | 100% | 4,472 | 100% | 4,511 | 100% | 4,459 | 100% |
| 065FH073 | 1,500 | 5,067 | 100% | 4,970 | 100% | 5,014 | 100% | 4,953 | 100% |
| 065FH074 | 1,500 | 4,608 | 100% | 4,533 | 100% | 4,548 | 100% | 4,500 | 100% |
| 065FH075 | 2,500 | 4,855 | 100% | 4,765 | 100% | 4,798 | 100% | 4,743 | 100% |
| 065FH076 | 3,500 | 4,441 | 100% | 4,369 | 100% | 4,390 | 100% | 4,346 | 100% |
| 065FH077 | 2,500 | 5,143 | 100% | 5,070 | 100% | 5,077 | 100% | 5,028 | 100% |
| 065FH078 | 2,500 | 7,006 | 100% | 7,035 | 100% | 7,061 | 100% | 6,979 | 100% |
| 065FH079 | 2,500 | 6,764 | 100% | 6,777 | 100% | 6,800 | 100% | 6,719 | 100% |
| 065FH080 | 2,500 | 6,433 | 100% | 6,428 | 100% | 6,447 | 100% | 6,372 | 100% |
| 065FH081 | 2,500 | 3,727 | 100% | 3,668 | 100% | 3,672 | 100% | 3,639 | 100% |
| 065FH082 | 2,500 | 5,973 | 100% | 5,938 | 100% | 5,963 | 100% | 5,898 | 100% |
| 065FH083 | 2,500 | 6,747 | 100% | 6,760 | 100% | 6,783 | 100% | 6,701 | 100% |
| 065FH084 | 2,500 | 2,687 | 100% | 2,640 | 100% | 2,641 | 100% | 2,620 | 100% |
| 065FH085 | 2,500 | 4,128 | 100% | 4,066 | 100% | 4,070 | 100% | 4,034 | 100% |
| 065FH086 | 2,500 | 8,052 | 100% | 8,277 | 100% | 8,302 | 100% | 8,214 | 100% |
| 065FH087 | 1,500 | 3,247 | 100% | 3,168 | 100% | 3,170 | 100% | 3,129 | 100% |
| 065FH088 | 1,500 | 3,033 | 100% | 2,958 | 100% | 2,960 | 100% | 2,922 | 100% |
| 065FH089 | 2,500 | 5,034 | 100% | 4,957 | 100% | 4,965 | 100% | 4,916 | 100% |
| 065FH090 | 2,500 | 5,169 | 100% | 5,091 | 100% | 5,103 | 100% | 5,046 | 100% |
| 065FH091 | 2,500 | 4,142 | 100% | 4,072 | 100% | 4,079 | 100% | 4,039 | 100% |
| 065FH092 | 2,500 | 5,473 | 100% | 5,411 | 100% | 5,420 | 100% | 5,364 | 100% |
| 065FH093 | 3,500 | 6,150 | 100% | 6,108 | 100% | 6,151 | 100% | 6,072 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 065FH094 | 3,500 | 5,687 | 100% | 5,605 | 100% | 5,641 | 100% | 5,572 | 100% |
| 065FH095 | 1,500 | 5,651 | 100% | 5,590 | 100% | 5,600 | 100% | 5,540 | 100% |
| 065FH096 | 2,500 | 6,251 | 100% | 6,214 | 100% | 6,257 | 100% | 6,174 | 100% |
| 065FH097 | 1,500 | 2,246 | 100% | 2,165 | 100% | 2,165 | 100% | 2,116 | 100% |
| 065FH098 | 1,500 | 2,630 | 100% | 2,538 | 100% | 2,538 | 100% | 2,493 | 100% |
| 065FH099 | 1,500 | 2,412 | 100% | 2,323 | 100% | 2,322 | 100% | 2,275 | 100% |
| 065FH100 | 1,500 | 2,653 | 100% | 2,559 | 100% | 2,559 | 100% | 2,515 | 100% |
| 065FH101 | 1,500 | 2,307 | 100% | 2,226 | 100% | 2,225 | 100% | 2,177 | 100% |
| 065FH102 | 1,500 | 3,284 | 100% | 3,201 | 100% | 3,204 | 100% | 3,157 | 100% |
| 065FH103 | 1,500 | 4,057 | 100% | 3,977 | 100% | 3,981 | 100% | 3,932 | 100% |
| 065FH104 | 1,500 | 4,074 | 100% | 3,995 | 100% | 3,999 | 100% | 3,950 | 100% |
| 065FH105 | 1,500 | 3,408 | 100% | 3,332 | 100% | 3,335 | 100% | 3,290 | 100% |
| 065FH106 | 1,500 | 3,683 | 100% | 3,605 | 100% | 3,608 | 100% | 3,561 | 100% |
| 065FH107 | 1,500 | 3,071 | 100% | 2,987 | 100% | 2,989 | 100% | 2,945 | 100% |
| 065FH109 | 500 | 1,072 | 100% | 1,285 | 100% | 1,944 | 100% | 1,463 | 100% |
| 066FH001 | 1,500 | 3,915 | 100% | 3,839 | 100% | 3,865 | 100% | 3,825 | 100% |
| 066FH002 | 1,500 | 6,113 | 100% | 6,021 | 100% | 6,093 | 100% | 6,006 | 100% |
| 066FH003 | 1,500 | 5,140 | 100% | 5,010 | 100% | 5,076 | 100% | 5,008 | 100% |
| 066FH004 | 1,500 | 4,823 | 100% | 4,691 | 100% | 4,764 | 100% | 4,699 | 100% |
| 066FH005 | 1,500 | 4,367 | 100% | 4,241 | 100% | 4,301 | 100% | 4,241 | 100% |
| 066FH006 | 1,500 | 4,968 | 100% | 4,827 | 100% | 4,907 | 100% | 4,835 | 100% |
| 066FH007 | 1,500 | 5,191 | 100% | 5,053 | 100% | 5,124 | 100% | 5,050 | 100% |
| 066FH008 | 1,500 | 5,181 | 100% | 5,044 | 100% | 5,107 | 100% | 5,039 | 100% |
| 066FH009 | 1,500 | 5,538 | 100% | 5,376 | 100% | 5,457 | 100% | 5,376 | 100% |
| 066FH010 | 1,500 | 4,492 | 100% | 4,364 | 100% | 4,419 | 100% | 4,352 | 100% |
| 066FH011 | 1,500 | 4,528 | 100% | 4,417 | 100% | 4,465 | 100% | 4,407 | 100% |
| 066FH012 | 1,500 | 3,570 | 100% | 3,473 | 100% | 3,501 | 100% | 3,454 | 100% |
| 066FH013 | 1,500 | 3,515 | 100% | 3,424 | 100% | 3,453 | 100% | 3,411 | 100% |
| 075FH001 | 3,000 | 3,246 | 100% | 2,651 | 88% | 2,604 | 87% | 2,542 | 85% |
| 075FH002 | 3,000 | 4,003 | 100% | 3,291 | 100% | 3,229 | 100% | 3,144 | 100% |
| 075FH009 | 3,000 | 4,051 | 100% | 3,421 | 100% | 3,366 | 100% | 3,297 | 100% |
| 075FH013 | 3,000 | 4,270 | 100% | 3,698 | 100% | 3,649 | 100% | 3,591 | 100% |
| 075FH021 | 3,000 | 3,028 | 100% | 2,489 | 83% | 2,462 | 82% | 2,437 | 81% |
| 075FH025 | 1,500 | 2,498 | 100% | 2,473 | 100% | 2,445 | 100% | 2,419 | 100% |
| 075FH026 | 1,500 | 3,175 | 100% | 2,660 | 100% | 2,633 | 100% | 2,609 | 100% |
| 075FH027 | 1,500 | 1,906 | 100% | 1,572 | 100% | 1,560 | 100% | 1,549 | 100% |
| 075FH028 | 1,500 | 2,974 | 100% | 2,445 | 100% | 2,421 | 100% | 2,398 | 100% |
| 075FH029 | 1,500 | 2,282 | 100% | 1,842 | 100% | 1,828 | 100% | 1,813 | 100% |
| 075FH030 | 1,500 | 2,254 | 100% | 1,822 | 100% | 1,808 | 100% | 1,794 | 100% |
| 075FH032 | 3,000 | 3,015 | 100% | 2,483 | 83% | 2,460 | 82% | 2,438 | 81% |
| 075FH035 | 1,500 | 1,608 | 100% | 1,645 | 100% | 1,629 | 100% | 1,615 | 100% |
| 075FH036 | 1,500 | 1,810 | 100% | 1,514 | 100% | 1,507 | 100% | 1,499 | 100% |
| 075FH039 | 1,500 | 1,538 | 100% | 2,248 | 100% | 2,235 | 100% | 2,223 | 100% |
| 075FH040 | 1,500 | 1,979 | 100% | 1,655 | 100% | 1,647 | 100% | 1,638 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 075FH041 | 1,500 | 1,554 | 100% | 1,283 | 86% | 1,278 | 85% | 1,272 | 85% |
| 075FH042 | 1,500 | 1,696 | 100% | 1,411 | 94% | 1,404 | 94% | 1,398 | 93% |
| 075FH044 | 1,500 | 3,401 | 100% | 2,997 | 100% | 2,982 | 100% | 2,966 | 100% |
| 075FH045 | 1,500 | 7,744 | 100% | 7,791 | 100% | 7,729 | 100% | 7,675 | 100% |
| 075FH046 | 2,500 | 6,861 | 100% | 6,674 | 100% | 6,621 | 100% | 6,576 | 100% |
| 075FH047 | 1,500 | 4,664 | 100% | 5,147 | 100% | 5,048 | 100% | 4,956 | 100% |
| 075FH053 | 2,500 | 7,331 | 100% | 7,420 | 100% | 7,361 | 100% | 7,310 | 100% |
| 075FH054 | 1,500 | 8,592 | 100% | 9,003 | 100% | 8,928 | 100% | 8,860 | 100% |
| 076FH001 | 3,000 | 4,480 | 100% | 3,914 | 100% | 3,863 | 100% | 3,805 | 100% |
| 076FH006 | 3,000 | 4,101 | 100% | 3,496 | 100% | 3,452 | 100% | 3,414 | 100% |
| 076FH022 | 4,000 | 4,610 | 100% | 4,014 | 100% | 3,961 | 99% | 3,916 | 98% |
| 076FH023 | 1,500 | 3,043 | 100% | 2,526 | 100% | 2,501 | 100% | 2,478 | 100% |
| 076FH024 | 1,500 | 1,712 | 100% | 1,375 | 92% | 1,364 | 91% | 1,355 | 90% |
| 076FH027 | 1,500 | 2,201 | 100% | 1,768 | 100% | 1,752 | 100% | 1,737 | 100% |
| 076FH028 | 3,000 | 4,021 | 100% | 3,480 | 100% | 3,442 | 100% | 3,409 | 100% |
| 076FH029 | 3,000 | 3,445 | 100% | 2,912 | 97% | 2,881 | 96% | 2,855 | 95% |
| 076FH030 | 1,500 | 1,597 | 100% | 1,267 | 84% | 1,257 | 84% | 1,249 | 83% |
| 076FH031 | 1,500 | 2,398 | 100% | 1,982 | 100% | 1,963 | 100% | 1,948 | 100% |
| 076FH032 | 1,500 | 2,336 | 100% | 1,914 | 100% | 1,898 | 100% | 1,883 | 100% |
| 076FH033 | 1,500 | 4,149 | 100% | 3,610 | 100% | 3,571 | 100% | 3,539 | 100% |
| 076FH034 | 1,500 | 2,329 | 100% | 1,894 | 100% | 1,877 | 100% | 1,863 | 100% |
| 076FH035 | 1,500 | 1,719 | 100% | 1,389 | 93% | 1,378 | 92% | 1,369 | 91% |
| 076FH036 | 1,500 | 1,799 | 100% | 1,462 | 97% | 1,450 | 97% | 1,440 | 96% |
| 076FH038 | 1,500 | 1,796 | 100% | 1,486 | 99% | 1,473 | 98% | 1,463 | 98% |
| 076FH040 | 1,500 | 2,528 | 100% | 2,108 | 100% | 2,092 | 100% | 2,078 | 100% |
| 076FH042 | 1,500 | 3,749 | 100% | 3,192 | 100% | 3,162 | 100% | 3,136 | 100% |
| 076FH044 | 1,500 | 1,652 | 100% | 1,367 | 91% | 1,359 | 91% | 1,352 | 90% |
| 076FH045 | 1,500 | 3,938 | 100% | 3,428 | 100% | 3,399 | 100% | 3,373 | 100% |
| 076FH046 | 2,500 | 5,167 | 100% | 4,685 | 100% | 4,638 | 100% | 4,601 | 100% |
| 076FH047 | 1,500 | 6,761 | 100% | 6,413 | 100% | 6,353 | 100% | 6,305 | 100% |
| 076FH048 | 2,500 | 7,944 | 100% | 7,747 | 100% | 7,663 | 100% | 7,593 | 100% |
| 076FH049 | 1,500 | 6,794 | 100% | 6,506 | 100% | 6,451 | 100% | 6,406 | 100% |
| 076FH050 | 3,000 | 4,981 | 100% | 4,533 | 100% | 4,487 | 100% | 4,450 | 100% |
| 076FH053 | 4,000 | 4,506 | 100% | 3,938 | 98% | 3,887 | 97% | 3,845 | 96% |
| 076FH054 | 4,000 | 4,119 | 100% | 3,566 | 89% | 3,522 | 88% | 3,485 | 87% |
| 076FH055 | 4,000 | 4,742 | 100% | 4,185 | 100% | 4,131 | 100% | 4,085 | 100% |
| 076FH056 | 4,000 | 4,239 | 100% | 3,742 | 94% | 3,700 | 92% | 3,665 | 92% |
| 076FH057 | 4,000 | 5,313 | 100% | 4,851 | 100% | 4,788 | 100% | 4,736 | 100% |
| 076FH060 | 3,000 | 3,978 | 100% | 3,418 | 100% | 3,378 | 100% | 3,344 | 100% |
| 076FH061 | 4,000 | 5,276 | 100% | 4,826 | 100% | 4,765 | 100% | 4,715 | 100% |
| 076FH065 | 4,000 | 5,154 | 100% | 4,626 | 100% | 4,564 | 100% | 4,513 | 100% |
| 076FH066 | 4,000 | 5,552 | 100% | 5,119 | 100% | 5,056 | 100% | 5,004 | 100% |
| 076FH067 | 3,000 | 5,593 | 100% | 5,184 | 100% | 5,124 | 100% | 5,074 | 100% |
| 076FH068 | 3,000 | 5,495 | 100% | 5,069 | 100% | 5,009 | 100% | 4,959 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 076FH069 | 4,000 | 4,257 | 100% | 3,665 | 92% | 3,618 | 90% | 3,578 | 89% |
| 076FH070 | 3,000 | 3,886 | 100% | 3,336 | 100% | 3,299 | 100% | 3,267 | 100% |
| 076FH071 | 3,000 | 5,798 | 100% | 5,513 | 100% | 5,441 | 100% | 5,381 | 100% |
| 076FH072 | 3,000 | 4,569 | 100% | 4,189 | 100% | 4,136 | 100% | 4,092 | 100% |
| 076FH073 | 3,000 | 3,592 | 100% | 3,200 | 100% | 3,160 | 100% | 3,129 | 100% |
| 076FH074 | 3,000 | 3,814 | 100% | 3,398 | 100% | 3,355 | 100% | 3,321 | 100% |
| 077FH009 | 3,000 | 3,146 | 100% | 4,299 | 100% | 4,197 | 100% | 3,991 | 100% |
| 077FH010 | 3,000 | 3,264 | 100% | 4,510 | 100% | 4,402 | 100% | 4,185 | 100% |
| 077FH012 | 3,000 | 3,020 | 100% | 3,999 | 100% | 3,909 | 100% | 3,727 | 100% |
| 077FH014 | 3,000 | 3,261 | 100% | 4,464 | 100% | 4,360 | 100% | 4,150 | 100% |
| 077FH017 | 3,000 | 3,400 | 100% | 4,708 | 100% | 4,597 | 100% | 4,374 | 100% |
| 077FH025 | 3,000 | 3,213 | 100% | 4,172 | 100% | 4,080 | 100% | 3,897 | 100% |
| 077FH027 | 3,000 | 3,874 | 100% | 5,632 | 100% | 5,492 | 100% | 5,216 | 100% |
| 077FH028 | 3,000 | 3,182 | 100% | 4,163 | 100% | 4,072 | 100% | 3,891 | 100% |
| 077FH029 | 3,000 | 3,159 | 100% | 4,143 | 100% | 4,053 | 100% | 3,871 | 100% |
| 077FH031 | 3,000 | 3,514 | 100% | 4,874 | 100% | 4,759 | 100% | 4,530 | 100% |
| 077FH032 | 3,000 | 3,046 | 100% | 3,877 | 100% | 3,796 | 100% | 3,635 | 100% |
| 077FH033 | 3,000 | 3,496 | 100% | 4,793 | 100% | 4,682 | 100% | 4,463 | 100% |
| 077FH034 | 3,000 | 3,542 | 100% | 4,856 | 100% | 4,745 | 100% | 4,525 | 100% |
| 077FH035 | 2,500 | 3,235 | 100% | 4,277 | 100% | 4,183 | 100% | 3,995 | 100% |
| 077FH037 | 4,000 | 4,855 | 100% | 4,898 | 100% | 4,757 | 100% | 4,665 | 100% |
| 077FH038 | 4,000 | 5,264 | 100% | 5,479 | 100% | 5,313 | 100% | 5,210 | 100% |
| 077FH039 | 4,000 | 5,276 | 100% | 5,486 | 100% | 5,325 | 100% | 5,225 | 100% |
| 077FH040 | 4,000 | 5,151 | 100% | 5,314 | 100% | 5,157 | 100% | 5,059 | 100% |
| 077FH043 | 1,500 | 1,728 | 100% | 1,592 | 100% | 1,567 | 100% | 1,547 | 100% |
| 077FH044 | 1,500 | 2,669 | 100% | 2,522 | 100% | 2,479 | 100% | 2,440 | 100% |
| 077FH046 | 4,000 | 4,127 | 100% | 4,038 | 100% | 3,966 | 99% | 3,902 | 98% |
| 077FH047 | 1,500 | 1,854 | 100% | 1,681 | 100% | 1,647 | 100% | 1,618 | 100% |
| 077FH048 | 1,500 | 4,425 | 100% | 4,370 | 100% | 4,300 | 100% | 4,238 | 100% |
| 077FH049 | 1,500 | 4,495 | 100% | 4,450 | 100% | 4,377 | 100% | 4,311 | 100% |
| 077FH050 | 1,500 | 1,620 | 100% | 1,481 | 99% | 1,457 | 97% | 1,438 | 96% |
| 077FH051 | 1,500 | 3,332 | 100% | 3,248 | 100% | 3,200 | 100% | 3,157 | 100% |
| 077FH052 | 1,500 | 4,030 | 100% | 3,951 | 100% | 3,890 | 100% | 3,838 | 100% |
| 077FH054 | 1,500 | 1,618 | 100% | 1,955 | 100% | 1,925 | 100% | 1,900 | 100% |
| 077FH057 | 1,500 | 4,810 | 100% | 4,771 | 100% | 4,703 | 100% | 4,642 | 100% |
| 077FH058 | 1,500 | 4,695 | 100% | 4,648 | 100% | 4,579 | 100% | 4,518 | 100% |
| 077FH063 | 1,500 | 4,441 | 100% | 4,371 | 100% | 4,306 | 100% | 4,250 | 100% |
| 077FH064 | 2,500 | 3,595 | 100% | 3,498 | 100% | 3,446 | 100% | 3,402 | 100% |
| 077FH066 | 3,000 | 6,119 | 100% | 7,067 | 100% | 6,829 | 100% | 6,692 | 100% |
| 077FH067 | 4,000 | 5,278 | 100% | 5,478 | 100% | 5,322 | 100% | 5,224 | 100% |
| 077FH068 | 4,000 | 5,541 | 100% | 5,816 | 100% | 5,655 | 100% | 5,554 | 100% |
| 077FH069 | 4,000 | 5,570 | 100% | 5,844 | 100% | 5,686 | 100% | 5,588 | 100% |
| 077FH070 | 4,000 | 5,706 | 100% | 6,015 | 100% | 5,854 | 100% | 5,758 | 100% |
| 077FH071 | 4,000 | 6,076 | 100% | 6,502 | 100% | 6,333 | 100% | 6,234 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 077FH072 | 4,000 | 6,876 | 100% | 7,610 | 100% | 7,409 | 100% | 7,292 | 100% |
| 077FH073 | 1,500 | 1,705 | 100% | 1,577 | 100% | 1,553 | 100% | 1,532 | 100% |
| 077FH074 | 1,500 | 2,017 | 100% | 1,885 | 100% | 1,854 | 100% | 1,827 | 100% |
| 077FH075 | 1,500 | 1,893 | 100% | 1,768 | 100% | 1,742 | 100% | 1,719 | 100% |
| 077FH077 | 1,500 | 1,559 | 100% | 1,487 | 99% | 1,467 | 98% | 1,450 | 97% |
| 077FH078 | 1,500 | 1,990 | 100% | 1,881 | 100% | 1,858 | 100% | 1,837 | 100% |
| 077FH081 | 1,500 | 1,570 | 100% | 1,453 | 97% | 1,433 | 96% | 1,416 | 94% |
| 077FH083 | 1,500 | 3,113 | 100% | 3,026 | 100% | 2,988 | 100% | 2,955 | 100% |
| 077FH084 | 1,500 | 2,343 | 100% | 2,252 | 100% | 2,225 | 100% | 2,201 | 100% |
| 077FH085 | 1,500 | 4,343 | 100% | 4,325 | 100% | 4,263 | 100% | 4,217 | 100% |
| 077FH086 | 1,500 | 3,182 | 100% | 3,119 | 100% | 3,081 | 100% | 3,046 | 100% |
| 077FH088 | 3,000 | 3,210 | 100% | 3,133 | 100% | 3,068 | 100% | 3,013 | 100% |
| 077FH089 | 2,500 | 3,177 | 100% | 3,102 | 100% | 3,053 | 100% | 3,010 | 100% |
| 077FH090 | 3,000 | 6,548 | 100% | 7,031 | 100% | 6,891 | 100% | 6,809 | 100% |
| 077FH091 | 2,500 | 2,697 | 100% | 2,608 | 100% | 2,578 | 100% | 2,551 | 100% |
| 077FH092 | 3,000 | 3,145 | 100% | 4,172 | 100% | 4,079 | 100% | 3,890 | 100% |
| 077FH093 | 3,000 | 3,381 | 100% | 4,510 | 100% | 4,410 | 100% | 4,210 | 100% |
| 077FH094 | 3,000 | 3,073 | 100% | 3,937 | 100% | 3,854 | 100% | 3,689 | 100% |
| 077FH098 | 3,000 | 3,395 | 100% | 4,504 | 100% | 4,405 | 100% | 4,209 | 100% |
| 077FH099 | 3,000 | 3,198 | 100% | 4,131 | 100% | 4,044 | 100% | 3,871 | 100% |
| 077FH106 | 2,500 | 3,440 | 100% | 4,723 | 100% | 4,613 | 100% | 4,393 | 100% |
| 077FH109 | 3,000 | 3,324 | 100% | 4,660 | 100% | 4,547 | 100% | 4,318 | 100% |
| 078FH003 | 3,000 | 4,805 | 100% | 4,856 | 100% | 4,748 | 100% | 4,681 | 100% |
| 078FH010 | 3,000 | 5,059 | 100% | 5,130 | 100% | 5,060 | 100% | 5,020 | 100% |
| 078FH013 | 3,000 | 4,635 | 100% | 4,592 | 100% | 4,589 | 100% | 4,562 | 100% |
| 078FH014 | 3,000 | 3,842 | 100% | 3,810 | 100% | 3,808 | 100% | 3,786 | 100% |
| 078FH016 | 4,000 | 10,092 | 100% | 11,140 | 100% | 11,083 | 100% | 10,866 | 100% |
| 078FH017 | 3,000 | 8,417 | 100% | 9,010 | 100% | 8,980 | 100% | 8,719 | 100% |
| 078FH018 | 3,000 | 6,049 | 100% | 6,074 | 100% | 6,069 | 100% | 6,016 | 100% |
| 078FH019 | 3,000 | 8,060 | 100% | 8,429 | 100% | 8,422 | 100% | 8,258 | 100% |
| 078FH020 | 3,000 | 6,346 | 100% | 6,384 | 100% | 6,379 | 100% | 6,321 | 100% |
| 078FH021 | 3,000 | 4,577 | 100% | 4,519 | 100% | 4,515 | 100% | 4,477 | 100% |
| 078FH022 | 3,000 | 5,910 | 100% | 5,928 | 100% | 5,923 | 100% | 5,866 | 100% |
| 078FH023 | 3,000 | 4,790 | 100% | 4,715 | 100% | 4,710 | 100% | 4,659 | 100% |
| 078FH024 | 3,000 | 4,834 | 100% | 4,761 | 100% | 4,756 | 100% | 4,705 | 100% |
| 078FH025 | 3,000 | 4,107 | 100% | 4,043 | 100% | 4,038 | 100% | 3,993 | 100% |
| 078FH027 | 3,000 | 3,910 | 100% | 3,847 | 100% | 3,843 | 100% | 3,807 | 100% |
| 078FH028 | 3,000 | 7,436 | 100% | 7,628 | 100% | 7,620 | 100% | 7,494 | 100% |
| 079FH001 | 2,500 | 4,872 | 100% | 5,302 | 100% | 5,300 | 100% | 5,251 | 100% |
| 079FH002 | 2,500 | 4,997 | 100% | 4,926 | 100% | 4,934 | 100% | 4,888 | 100% |
| 079FH003 | 2,500 | 4,907 | 100% | 4,838 | 100% | 4,848 | 100% | 4,803 | 100% |
| 079FH004 | 2,500 | 4,446 | 100% | 4,379 | 100% | 4,387 | 100% | 4,344 | 100% |
| 079FH005 | 1,500 | 3,285 | 100% | 3,230 | 100% | 3,234 | 100% | 3,208 | 100% |
| 079FH006 | 2,500 | 3,948 | 100% | 3,889 | 100% | 3,894 | 100% | 3,860 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 079FH007 | 1,500 | 3,174 | 100% | 3,119 | 100% | 3,123 | 100% | 3,098 | 100% |
| 079FH008 | 3,500 | 5,832 | 100% | 5,783 | 100% | 5,787 | 100% | 5,727 | 100% |
| 079FH009 | 3,500 | 5,156 | 100% | 5,088 | 100% | 5,092 | 100% | 5,040 | 100% |
| 079FH010 | 2,500 | 6,777 | 100% | 6,832 | 100% | 6,828 | 100% | 6,748 | 100% |
| 079FH011 | 3,500 | 6,869 | 100% | 6,892 | 100% | 6,894 | 100% | 6,820 | 100% |
| 079FH012 | 1,500 | 5,858 | 100% | 5,815 | 100% | 5,809 | 100% | 5,740 | 100% |
| 079FH013 | 3,500 | 4,872 | 100% | 4,805 | 100% | 4,807 | 100% | 4,762 | 100% |
| 079FH014 | 1,500 | 7,091 | 100% | 7,153 | 100% | 7,148 | 100% | 7,063 | 100% |
| 079FH015 | 1,500 | 7,673 | 100% | 7,830 | 100% | 7,825 | 100% | 7,736 | 100% |
| 079FH016 | 1,500 | 6,944 | 100% | 6,972 | 100% | 6,971 | 100% | 6,886 | 100% |
| 079FH017 | 2,500 | 5,763 | 100% | 5,713 | 100% | 5,712 | 100% | 5,649 | 100% |
| 079FH018 | 2,500 | 5,123 | 100% | 5,055 | 100% | 5,055 | 100% | 5,002 | 100% |
| 079FH019 | 1,500 | 3,480 | 100% | 3,425 | 100% | 3,421 | 100% | 3,390 | 100% |
| 079FH020 | 3,000 | 5,716 | 100% | 5,655 | 100% | 5,648 | 100% | 5,578 | 100% |
| 079FH021 | 1,500 | 4,648 | 100% | 4,578 | 100% | 4,573 | 100% | 4,523 | 100% |
| 079FH022 | 1,500 | 2,917 | 100% | 2,863 | 100% | 2,860 | 100% | 2,836 | 100% |
| 079FH023 | 3,000 | 4,128 | 100% | 4,060 | 100% | 4,055 | 100% | 4,013 | 100% |
| 079FH024 | 3,000 | 3,392 | 100% | 3,328 | 100% | 3,323 | 100% | 3,291 | 100% |
| 079FH025 | 1,500 | 3,394 | 100% | 3,337 | 100% | 3,333 | 100% | 3,302 | 100% |
| 079FH026 | 1,500 | 6,755 | 100% | 6,773 | 100% | 6,769 | 100% | 6,678 | 100% |
| 079FH027 | 2,500 | 5,794 | 100% | 5,738 | 100% | 5,734 | 100% | 5,659 | 100% |
| 079FH028 | 1,500 | 5,602 | 100% | 5,538 | 100% | 5,533 | 100% | 5,464 | 100% |
| 079FH029 | 1,500 | 5,117 | 100% | 5,038 | 100% | 5,060 | 100% | 5,008 | 100% |
| 079FH030 | 1,500 | 4,943 | 100% | 4,866 | 100% | 4,886 | 100% | 4,838 | 100% |
| 079FH031 | 3,500 | 6,369 | 100% | 6,326 | 100% | 6,365 | 100% | 6,284 | 100% |
| 079FH032 | 3,500 | 4,911 | 100% | 4,819 | 100% | 4,851 | 100% | 4,798 | 100% |
| 079FH033 | 1,500 | 4,786 | 100% | 4,706 | 100% | 4,748 | 100% | 4,695 | 100% |
| 079FH034 | 1,500 | 6,328 | 100% | 6,503 | 100% | 6,558 | 100% | 6,470 | 100% |
| 079FH035 | 3,500 | 4,655 | 100% | 4,586 | 100% | 4,617 | 100% | 4,567 | 100% |
| 079FH036 | 1,500 | 3,874 | 100% | 3,818 | 100% | 3,829 | 100% | 3,797 | 100% |
| 079FH037 | 1,500 | 4,478 | 100% | 4,625 | 100% | 4,658 | 100% | 4,610 | 100% |
| 079FH038 | 1,500 | 2,972 | 100% | 2,958 | 100% | 2,966 | 100% | 2,942 | 100% |
| 079FH039 | 1,500 | 4,170 | 100% | 4,106 | 100% | 4,115 | 100% | 4,081 | 100% |
| 079FH040 | 1,500 | 5,026 | 100% | 4,958 | 100% | 4,970 | 100% | 4,925 | 100% |
| 079FH041 | 1,500 | 5,449 | 100% | 5,369 | 100% | 5,403 | 100% | 5,346 | 100% |
| 079FH042 | 1,500 | 3,090 | 100% | 3,040 | 100% | 3,050 | 100% | 3,025 | 100% |
| 079FH043 | 1,500 | 5,121 | 100% | 5,074 | 100% | 5,103 | 100% | 5,052 | 100% |
| 079FH044 | 1,500 | 4,916 | 100% | 4,863 | 100% | 4,887 | 100% | 4,839 | 100% |
| 079FH045 | 1,500 | 5,670 | 100% | 6,328 | 100% | 6,370 | 100% | 6,294 | 100% |
| 079FH046 | 1,500 | 6,334 | 100% | 6,316 | 100% | 6,346 | 100% | 6,273 | 100% |
| 079FH047 | 2,500 | 5,457 | 100% | 5,396 | 100% | 5,395 | 100% | 5,337 | 100% |
| 079FH048 | 1,500 | 5,425 | 100% | 5,364 | 100% | 5,366 | 100% | 5,309 | 100% |
| 079FH049 | 3,000 | 5,132 | 100% | 5,075 | 100% | 5,085 | 100% | 5,037 | 100% |
| 079FH050 | 2,500 | 6,345 | 100% | 6,341 | 100% | 6,337 | 100% | 6,257 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 079FH051 | 1,500 | 7,201 | 100% | 7,376 | 100% | 7,383 | 100% | 7,368 | 100% |
| 079FH052 | 1,500 | 7,115 | 100% | 7,185 | 100% | 7,183 | 100% | 7,163 | 100% |
| 079FH053 | 3,000 | 7,929 | 100% | 8,472 | 100% | 8,472 | 100% | 8,494 | 100% |
| 079FH054 | 1,500 | 8,634 | 100% | 9,310 | 100% | 9,308 | 100% | 9,322 | 100% |
| 079FH055 | 1,500 | 6,504 | 100% | 6,507 | 100% | 6,502 | 100% | 6,412 | 100% |
| 079FH056 | 1,500 | 5,019 | 100% | 4,943 | 100% | 4,939 | 100% | 4,879 | 100% |
| 079FH057 | 3,000 | 6,269 | 100% | 6,246 | 100% | 6,234 | 100% | 6,147 | 100% |
| 079FH058 | 1,500 | 3,085 | 100% | 3,024 | 100% | 3,020 | 100% | 2,991 | 100% |
| 079FH059 | 3,500 | 5,158 | 100% | 5,087 | 100% | 5,084 | 100% | 5,026 | 100% |
| 079FH060 | 1,500 | 7,165 | 100% | 7,216 | 100% | 7,208 | 100% | 7,108 | 100% |
| 079FH061 | 1,500 | 4,707 | 100% | 4,631 | 100% | 4,627 | 100% | 4,570 | 100% |
| 079FH062 | 3,500 | 5,624 | 100% | 5,562 | 100% | 5,558 | 100% | 5,491 | 100% |
| 079FH063 | 1,500 | 2,482 | 100% | 2,429 | 100% | 2,424 | 100% | 2,398 | 100% |
| 079FH064 | 1,500 | 4,307 | 100% | 4,232 | 100% | 4,228 | 100% | 4,174 | 100% |
| 079FH065 | 3,000 | 4,798 | 100% | 4,729 | 100% | 4,725 | 100% | 4,673 | 100% |
| 079FH066 | 3,000 | 5,540 | 100% | 5,452 | 100% | 5,437 | 100% | 5,384 | 100% |
| 079FH067 | 2,500 | 4,916 | 100% | 4,838 | 100% | 4,828 | 100% | 4,774 | 100% |
| 079FH068 | 3,000 | 3,262 | 100% | 3,201 | 100% | 3,196 | 100% | 3,164 | 100% |
| 079FH069 | 1,500 | 7,952 | 100% | 8,368 | 100% | 8,366 | 100% | 8,378 | 100% |
| 079FH070 | 2,500 | 7,959 | 100% | 8,378 | 100% | 8,375 | 100% | 8,394 | 100% |
| 079FH071 | 3,000 | 7,994 | 100% | 8,459 | 100% | 8,459 | 100% | 8,485 | 100% |
| 079FH072 | 2,500 | 6,822 | 100% | 6,836 | 100% | 6,830 | 100% | 6,763 | 100% |
| 079FH073 | 2,500 | 3,885 | 100% | 3,827 | 100% | 3,824 | 100% | 3,781 | 100% |
| 079FH074 | 1,500 | 5,374 | 100% | 5,296 | 100% | 5,289 | 100% | 5,218 | 100% |
| 079FH075 | 2,500 | 4,981 | 100% | 4,905 | 100% | 4,898 | 100% | 4,834 | 100% |
| 079FH076 | 3,000 | 4,241 | 100% | 4,177 | 100% | 4,171 | 100% | 4,116 | 100% |
| 079FH077 | 3,500 | 5,004 | 100% | 4,942 | 100% | 4,936 | 100% | 4,871 | 100% |
| 079FH078 | 1,500 | 2,479 | 100% | 2,430 | 100% | 2,425 | 100% | 2,400 | 100% |
| 079FH079 | 3,000 | 4,655 | 100% | 4,592 | 100% | 4,585 | 100% | 4,524 | 100% |
| 079FH080 | 3,000 | 4,326 | 100% | 4,271 | 100% | 4,264 | 100% | 4,209 | 100% |
| 079FH081 | 2,500 | 4,953 | 100% | 4,894 | 100% | 4,884 | 100% | 4,827 | 100% |
| 079FH082 | 3,000 | 3,912 | 100% | 3,847 | 100% | 3,839 | 100% | 3,798 | 100% |
| 079FH083 | 3,000 | 4,423 | 100% | 4,360 | 100% | 4,351 | 100% | 4,303 | 100% |
| 079FH084 | 2,500 | 4,256 | 100% | 4,201 | 100% | 4,194 | 100% | 4,139 | 100% |
| 079FH085 | 2,500 | 3,305 | 100% | 3,252 | 100% | 3,246 | 100% | 3,215 | 100% |
| 079FH086 | 3,000 | 7,139 | 100% | 7,136 | 100% | 7,169 | 100% | 7,152 | 100% |
| 079FH087 | 1,500 | 8,198 | 100% | 8,727 | 100% | 8,727 | 100% | 8,762 | 100% |
| 079FH088 | 3,500 | 7,066 | 100% | 7,106 | 100% | 7,111 | 100% | 7,097 | 100% |
| 079FH089 | 3,500 | 7,533 | 100% | 7,744 | 100% | 7,745 | 100% | 7,742 | 100% |
| 079FH090 | 2,500 | 7,736 | 100% | 7,985 | 100% | 8,012 | 100% | 8,017 | 100% |
| 079FH091 | 2,500 | 8,190 | 100% | 8,727 | 100% | 8,727 | 100% | 8,766 | 100% |
| 079FH092 | 1,500 | 4,064 | 100% | 4,013 | 100% | 4,016 | 100% | 3,981 | 100% |
| 079FH093 | 2,500 | 9,349 | 100% | 10,542 | 100% | 10,562 | 100% | 10,555 | 100% |
| 079FH094 | 2,500 | 7,206 | 100% | 7,311 | 100% | 7,327 | 100% | 7,314 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 079FH095 | 2,500 | 5,095 | 100% | 5,027 | 100% | 5,021 | 100% | 4,957 | 100% |
| 079FH096 | 2,500 | 8,590 | 100% | 9,365 | 100% | 9,346 | 100% | 9,366 | 100% |
| 079FH097 | 2,500 | 5,033 | 100% | 4,969 | 100% | 4,964 | 100% | 4,903 | 100% |
| 079FH098 | 2,500 | 4,337 | 100% | 4,278 | 100% | 4,273 | 100% | 4,222 | 100% |
| 079FH099 | 2,500 | 2,926 | 100% | 2,878 | 100% | 2,876 | 100% | 2,848 | 100% |
| 079FH100 | 2,500 | 6,329 | 100% | 6,337 | 100% | 6,335 | 100% | 6,325 | 100% |
| 079FH101 | 2,500 | 4,979 | 100% | 4,977 | 100% | 4,977 | 100% | 4,972 | 100% |
| 079FH102 | 2,500 | 2,693 | 100% | 2,737 | 100% | 2,735 | 100% | 2,717 | 100% |
| 079FH104 | 2,500 | 4,053 | 100% | 3,997 | 100% | 3,991 | 100% | 3,943 | 100% |
| 079FH105 | 3,000 | 6,102 | 100% | 6,089 | 100% | 6,119 | 100% | 6,050 | 100% |
| 079FH106 | 3,000 | 5,568 | 100% | 5,523 | 100% | 5,554 | 100% | 5,496 | 100% |
| 079FH108 | 2,500 | 3,243 | 100% | 3,182 | 100% | 3,177 | 100% | 3,144 | 100% |
| 079FH109 | 3,500 | 4,983 | 100% | 4,920 | 100% | 4,914 | 100% | 4,851 | 100% |
| 079FH110 | 3,500 | 3,794 | 100% | 3,743 | 100% | 3,739 | 100% | 3,695 | 100% |
| 079FH111 | 2,500 | 6,577 | 100% | 6,573 | 100% | 6,569 | 100% | 6,558 | 100% |
| 079FH112 | 2,500 | 4,072 | 100% | 4,010 | 100% | 4,006 | 100% | 3,957 | 100% |
| 079FH113 | 2,500 | 3,623 | 100% | 3,573 | 100% | 3,569 | 100% | 3,535 | 100% |
| 079FH114 | 2,500 | 4,311 | 100% | 4,272 | 100% | 4,283 | 100% | 4,246 | 100% |
| 079FH115 | 1,500 | 5,034 | 100% | 4,987 | 100% | 5,010 | 100% | 4,961 | 100% |
| 079FH116 | 2,500 | 5,279 | 100% | 5,234 | 100% | 5,261 | 100% | 5,208 | 100% |
| 079FH117 | 3,500 | 6,764 | 100% | 6,777 | 100% | 6,773 | 100% | 6,718 | 100% |
| 079FH118 | 3,500 | 6,477 | 100% | 6,474 | 100% | 6,470 | 100% | 6,386 | 100% |
| 079FH119 | 3,500 | 4,707 | 100% | 4,635 | 100% | 4,632 | 100% | 4,575 | 100% |
| 079FH120 | 3,500 | 7,015 | 100% | 7,039 | 100% | 7,043 | 100% | 7,029 | 100% |
| 079FH121 | 3,500 | 6,594 | 100% | 6,603 | 100% | 6,601 | 100% | 6,524 | 100% |
| 079FH122 | 1,500 | 4,931 | 100% | 4,857 | 100% | 4,856 | 100% | 4,802 | 100% |
| 079FH123 | 1,500 | 5,965 | 100% | 5,939 | 100% | 5,936 | 100% | 5,864 | 100% |
| 079FH124 | 1,500 | 6,491 | 100% | 6,495 | 100% | 6,492 | 100% | 6,411 | 100% |
| 079FH125 | 1,500 | 4,171 | 100% | 4,106 | 100% | 4,116 | 100% | 4,081 | 100% |
| 079FH126 | 1,500 | 3,235 | 100% | 3,179 | 100% | 3,187 | 100% | 3,161 | 100% |
| 079FH127 | 3,500 | 6,803 | 100% | 6,905 | 100% | 6,980 | 100% | 6,973 | 100% |
| 079FH128 | 3,000 | 7,191 | 100% | 7,399 | 100% | 7,442 | 100% | 7,455 | 100% |
| 079FH130 | 2,500 | 4,040 | 100% | 3,976 | 100% | 3,970 | 100% | 3,922 | 100% |
| 079FH131 | 2,500 | 4,220 | 100% | 4,182 | 100% | 4,191 | 100% | 4,157 | 100% |
| 079FH132 | 2,500 | 4,857 | 100% | 4,815 | 100% | 4,835 | 100% | 4,788 | 100% |
| 079FH133 | 2,500 | 4,339 | 100% | 4,301 | 100% | 4,312 | 100% | 4,274 | 100% |
| 079FH134 | 1,500 | 4,408 | 100% | 5,300 | 100% | 5,298 | 100% | 5,247 | 100% |
| 079FH135 | 1,500 | 6,068 | 100% | 6,457 | 100% | 6,454 | 100% | 6,371 | 100% |
| 079FH136 | 1,500 | 6,588 | 100% | 6,592 | 100% | 6,587 | 100% | 6,493 | 100% |
| 079FH137 | 3,000 | 4,601 | 100% | 4,521 | 100% | 4,515 | 100% | 4,458 | 100% |
| 079FH138 | 2,500 | 5,625 | 100% | 5,668 | 100% | 5,665 | 100% | 5,603 | 100% |
| 079FH139 | 1,500 | 5,236 | 100% | 5,167 | 100% | 5,164 | 100% | 5,108 | 100% |
| 079FH140 | 1,500 | 4,147 | 100% | 4,087 | 100% | 4,085 | 100% | 4,043 | 100% |
| 079FH141 | 2,500 | 6,417 | 100% | 6,415 | 100% | 6,412 | 100% | 6,328 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 079FH142 | 3,500 | 6,623 | 100% | 6,632 | 100% | 6,628 | 100% | 6,541 | 100% |
| 079FH143 | 1,500 | 5,263 | 100% | 5,176 | 100% | 5,209 | 100% | 5,154 | 100% |
| 079FH145 | 1,500 | 4,813 | 100% | 4,750 | 100% | 4,754 | 100% | 4,707 | 100% |
| 079FH146 | 3,500 | 4,682 | 100% | 4,617 | 100% | 4,620 | 100% | 4,577 | 100% |
| 079FH147 | 2,500 | 4,749 | 100% | 4,682 | 100% | 4,686 | 100% | 4,641 | 100% |
| 079FH148 | 1,500 | 6,436 | 100% | 6,449 | 100% | 6,447 | 100% | 6,375 | 100% |
| 079FH149 | 3,000 | 9,012 | 100% | 10,002 | 100% | 10,002 | 100% | 10,013 | 100% |
| 079FH150 | 3,000 | 8,771 | 100% | 9,677 | 100% | 9,664 | 100% | 9,683 | 100% |
| 080FH001 | 1,500 | 4,178 | 100% | 4,071 | 100% | 4,121 | 100% | 4,072 | 100% |
| 080FH002 | 1,500 | 4,480 | 100% | 4,382 | 100% | 4,426 | 100% | 4,375 | 100% |
| 080FH003 | 1,500 | 4,474 | 100% | 4,334 | 100% | 4,437 | 100% | 4,377 | 100% |
| 080FH004 | 1,500 | 2,926 | 100% | 2,867 | 100% | 2,878 | 100% | 2,854 | 100% |
| 080FH005 | 1,500 | 3,488 | 100% | 3,430 | 100% | 3,443 | 100% | 3,413 | 100% |
| 080FH006 | 1,500 | 4,426 | 100% | 4,317 | 100% | 4,416 | 100% | 4,357 | 100% |
| 080FH007 | 3,000 | 5,358 | 100% | 5,225 | 100% | 5,280 | 100% | 5,210 | 100% |
| 080FH008 | 1,500 | 5,612 | 100% | 5,492 | 100% | 5,634 | 100% | 5,554 | 100% |
| 080FH009 | 1,500 | 4,493 | 100% | 4,385 | 100% | 4,483 | 100% | 4,424 | 100% |
| 080FH010 | 3,000 | 5,418 | 100% | 5,291 | 100% | 5,344 | 100% | 5,275 | 100% |
| 080FH011 | 3,000 | 3,099 | 100% | 3,039 | 100% | 3,052 | 100% | 3,023 | 100% |
| 080FH012 | 1,500 | 4,912 | 100% | 4,804 | 100% | 4,897 | 100% | 4,835 | 100% |
| 080FH013 | 3,000 | 4,786 | 100% | 4,718 | 100% | 4,761 | 100% | 4,709 | 100% |
| 080FH014 | 3,000 | 5,045 | 100% | 4,954 | 100% | 4,987 | 100% | 4,928 | 100% |
| 080FH015 | 3,000 | 5,294 | 100% | 5,179 | 100% | 5,220 | 100% | 5,155 | 100% |
| 080FH016 | 3,000 | 5,689 | 100% | 5,577 | 100% | 5,627 | 100% | 5,556 | 100% |
| 080FH017 | 1,500 | 5,119 | 100% | 4,999 | 100% | 5,190 | 100% | 5,118 | 100% |
| 080FH018 | 1,500 | 3,291 | 100% | 3,249 | 100% | 3,278 | 100% | 3,252 | 100% |
| 080FH019 | 1,500 | 4,214 | 100% | 4,133 | 100% | 4,196 | 100% | 4,142 | 100% |
| 080FH020 | 2,500 | 5,102 | 100% | 4,990 | 100% | 5,028 | 100% | 4,967 | 100% |
| 080FH021 | 1,500 | 3,034 | 100% | 3,002 | 100% | 3,044 | 100% | 3,026 | 100% |
| 080FH022 | 1,500 | 3,312 | 100% | 3,268 | 100% | 3,294 | 100% | 3,269 | 100% |
| 080FH023 | 1,500 | 4,447 | 100% | 4,361 | 100% | 4,499 | 100% | 4,443 | 100% |
| 080FH024 | 1,500 | 5,022 | 100% | 4,909 | 100% | 5,135 | 100% | 5,062 | 100% |
| 080FH025 | 1,500 | 6,196 | 100% | 6,133 | 100% | 6,180 | 100% | 6,105 | 100% |
| 080FH026 | 3,000 | 5,364 | 100% | 5,255 | 100% | 5,469 | 100% | 5,402 | 100% |
| 080FH027 | 2,500 | 4,997 | 100% | 4,883 | 100% | 5,117 | 100% | 5,042 | 100% |
| 080FH028 | 1,500 | 5,948 | 100% | 5,879 | 100% | 5,918 | 100% | 5,849 | 100% |
| 080FH029 | 3,000 | 5,653 | 100% | 5,547 | 100% | 5,722 | 100% | 5,651 | 100% |
| 080FH030 | 1,500 | 5,333 | 100% | 5,240 | 100% | 5,269 | 100% | 5,210 | 100% |
| 080FH031 | 2,500 | 4,557 | 100% | 4,464 | 100% | 4,629 | 100% | 4,568 | 100% |
| 080FH032 | 2,500 | 4,930 | 100% | 4,816 | 100% | 5,064 | 100% | 4,989 | 100% |
| 080FH033 | 1,500 | 6,878 | 100% | 6,855 | 100% | 6,895 | 100% | 6,828 | 100% |
| 080FH034 | 3,000 | 5,282 | 100% | 5,188 | 100% | 5,217 | 100% | 5,160 | 100% |
| 080FH035 | 3,000 | 3,768 | 100% | 3,709 | 100% | 3,924 | 100% | 3,879 | 100% |
| 080FH036 | 1,500 | 3,003 | 100% | 2,972 | 100% | 3,008 | 100% | 2,991 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 080FH037 | 1,500 | 4,112 | 100% | 4,042 | 100% | 4,253 | 100% | 4,196 | 100% |
| 080FH038 | 1,500 | 4,638 | 100% | 4,533 | 100% | 4,720 | 100% | 4,655 | 100% |
| 080FH039 | 1,500 | 4,452 | 100% | 4,369 | 100% | 4,632 | 100% | 4,568 | 100% |
| 080FH040 | 1,500 | 4,947 | 100% | 4,832 | 100% | 5,265 | 100% | 5,191 | 100% |
| 080FH041 | 1,500 | 4,107 | 100% | 4,038 | 100% | 4,258 | 100% | 4,204 | 100% |
| 080FH042 | 1,500 | 6,524 | 100% | 6,504 | 100% | 6,519 | 100% | 6,453 | 100% |
| 080FH043 | 1,500 | 3,371 | 100% | 3,333 | 100% | 3,414 | 100% | 3,388 | 100% |
| 080FH044 | 1,500 | 3,603 | 100% | 3,549 | 100% | 3,562 | 100% | 3,531 | 100% |
| 080FH045 | 3,000 | 4,517 | 100% | 4,432 | 100% | 4,464 | 100% | 4,415 | 100% |
| 080FH046 | 3,000 | 3,824 | 100% | 3,764 | 100% | 3,998 | 100% | 3,952 | 100% |
| 080FH047 | 3,000 | 4,986 | 100% | 4,864 | 100% | 5,377 | 100% | 5,301 | 100% |
| 080FH050 | 3,000 | 4,920 | 100% | 4,799 | 100% | 5,510 | 100% | 5,432 | 100% |
| 080FH051 | 3,000 | 4,752 | 100% | 4,643 | 100% | 5,464 | 100% | 5,385 | 100% |
| 080FH052 | 3,000 | 4,094 | 100% | 4,013 | 100% | 4,677 | 100% | 4,595 | 100% |
| 080FH054 | 1,500 | 2,990 | 100% | 2,953 | 100% | 3,040 | 100% | 3,013 | 100% |
| 080FH055 | 1,500 | 3,414 | 100% | 3,374 | 100% | 3,500 | 100% | 3,468 | 100% |
| 080FH056 | 1,500 | 3,760 | 100% | 3,705 | 100% | 3,885 | 100% | 3,839 | 100% |
| 080FH057 | 1,500 | 3,714 | 100% | 3,665 | 100% | 3,821 | 100% | 3,780 | 100% |
| 080FH058 | 1,500 | 3,766 | 100% | 3,717 | 100% | 3,870 | 100% | 3,829 | 100% |
| 080FH059 | 1,500 | 3,169 | 100% | 3,137 | 100% | 3,228 | 100% | 3,203 | 100% |
| 080FH060 | 1,500 | 3,757 | 100% | 3,706 | 100% | 3,863 | 100% | 3,821 | 100% |
| 080FH061 | 1,500 | 3,861 | 100% | 3,809 | 100% | 3,965 | 100% | 3,924 | 100% |
| 080FH062 | 1,500 | 3,955 | 100% | 3,898 | 100% | 4,063 | 100% | 4,020 | 100% |
| 080FH063 | 1,500 | 3,806 | 100% | 3,759 | 100% | 3,904 | 100% | 3,866 | 100% |
| 080FH064 | 1,500 | 3,911 | 100% | 3,859 | 100% | 4,014 | 100% | 3,973 | 100% |
| 080FH065 | 1,500 | 3,732 | 100% | 3,688 | 100% | 3,824 | 100% | 3,787 | 100% |
| 080FH066 | 1,500 | 3,729 | 100% | 3,686 | 100% | 3,819 | 100% | 3,783 | 100% |
| 080FH067 | 1,500 | 3,743 | 100% | 3,700 | 100% | 3,834 | 100% | 3,797 | 100% |
| 080FH068 | 1,500 | 3,684 | 100% | 3,642 | 100% | 3,770 | 100% | 3,735 | 100% |
| 080FH069 | 1,500 | 4,495 | 100% | 4,410 | 100% | 4,611 | 100% | 4,549 | 100% |
| 080FH070 | 1,500 | 4,446 | 100% | 4,362 | 100% | 4,551 | 100% | 4,490 | 100% |
| 080FH071 | 1,500 | 3,611 | 100% | 3,562 | 100% | 3,672 | 100% | 3,636 | 100% |
| 080FH072 | 1,500 | 3,212 | 100% | 3,181 | 100% | 3,267 | 100% | 3,244 | 100% |
| 080FH073 | 1,500 | 3,090 | 100% | 3,056 | 100% | 3,145 | 100% | 3,118 | 100% |
| 080FH074 | 1,500 | 3,573 | 100% | 3,531 | 100% | 3,665 | 100% | 3,629 | 100% |
| 080FH075 | 1,500 | 4,115 | 100% | 4,050 | 100% | 4,241 | 100% | 4,186 | 100% |
| 080FH076 | 1,500 | 4,415 | 100% | 4,334 | 100% | 4,367 | 100% | 4,314 | 100% |
| 080FH077 | 1,500 | 7,005 | 100% | 7,140 | 100% | 7,268 | 100% | 7,267 | 100% |
| 080FH078 | 3,000 | 4,644 | 100% | 4,560 | 100% | 4,593 | 100% | 4,542 | 100% |
| 080FH081 | 1,500 | 7,689 | 100% | 7,990 | 100% | 8,399 | 100% | 8,427 | 100% |
| 081FH001 | 3,000 | 4,314 | 100% | 4,219 | 100% | 5,060 | 100% | 4,978 | 100% |
| 081FH005 | 1,500 | 2,645 | 100% | 2,577 | 100% | 3,400 | 100% | 3,346 | 100% |
| 081FH006 | 1,500 | 2,332 | 100% | 2,278 | 100% | 2,717 | 100% | 2,679 | 100% |
| 081FH007 | 1,500 | 2,575 | 100% | 2,511 | 100% | 3,159 | 100% | 3,103 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 081FH008 | 1,500 | 3,122 | 100% | 3,052 | 100% | 3,992 | 100% | 3,925 | 100% |
| 081FH009 | 1,500 | 2,981 | 100% | 2,905 | 100% | 3,799 | 100% | 3,733 | 100% |
| 081FH010 | 1,500 | 3,202 | 100% | 3,138 | 100% | 3,955 | 100% | 3,895 | 100% |
| 081FH011 | 3,000 | 3,776 | 100% | 3,688 | 100% | 4,905 | 100% | 4,810 | 100% |
| 081FH012 | 3,000 | 4,110 | 100% | 4,032 | 100% | 5,143 | 100% | 5,063 | 100% |
| 081FH013 | 1,500 | 3,884 | 100% | 3,811 | 100% | 4,573 | 100% | 4,516 | 100% |
| 081FH014 | 1,500 | 3,949 | 100% | 3,880 | 100% | 4,533 | 100% | 4,475 | 100% |
| 081FH015 | 1,500 | 4,484 | 100% | 4,413 | 100% | 5,163 | 100% | 5,101 | 100% |
| 081FH016 | 1,500 | 4,428 | 100% | 4,361 | 100% | 5,048 | 100% | 4,995 | 100% |
| 081FH017 | 1,500 | 3,453 | 100% | 3,402 | 100% | 3,737 | 100% | 3,702 | 100% |
| 081FH018 | 1,500 | 3,563 | 100% | 3,514 | 100% | 3,856 | 100% | 3,823 | 100% |
| 081FH019 | 1,500 | 3,814 | 100% | 3,760 | 100% | 4,179 | 100% | 4,141 | 100% |
| 081FH020 | 1,500 | 4,402 | 100% | 4,338 | 100% | 4,968 | 100% | 4,922 | 100% |
| 081FH021 | 1,500 | 4,335 | 100% | 4,274 | 100% | 4,852 | 100% | 4,808 | 100% |
| 081FH022 | 1,500 | 4,166 | 100% | 4,108 | 100% | 4,589 | 100% | 4,545 | 100% |
| 081FH023 | 1,500 | 3,818 | 100% | 3,761 | 100% | 4,207 | 100% | 4,166 | 100% |
| 081FH024 | 1,500 | 4,266 | 100% | 4,208 | 100% | 4,712 | 100% | 4,669 | 100% |
| 081FH025 | 3,000 | 3,564 | 100% | 3,504 | 100% | 4,053 | 100% | 4,004 | 100% |
| 081FH027 | 3,000 | 3,606 | 100% | 3,535 | 100% | 4,356 | 100% | 4,295 | 100% |
| 081FH029 | 3,000 | 3,384 | 100% | 3,318 | 100% | 4,060 | 100% | 3,998 | 100% |
| 081FH089 | 3,000 | 3,610 | 100% | 3,537 | 100% | 4,385 | 100% | 4,324 | 100% |
| 081FH090 | 1,500 | 4,574 | 100% | 4,502 | 100% | 5,264 | 100% | 5,201 | 100% |
| 081FH091 | 1,500 | 4,596 | 100% | 4,523 | 100% | 5,292 | 100% | 5,229 | 100% |
| 081FH092 | 3,000 | 4,368 | 100% | 4,270 | 100% | 5,328 | 100% | 5,245 | 100% |
| 081FH093 | 3,000 | 4,033 | 100% | 3,950 | 100% | 5,088 | 100% | 5,004 | 100% |
| 081FH094 | 3,000 | 3,877 | 100% | 3,796 | 100% | 4,992 | 100% | 4,901 | 100% |
| 081FH095 | 1,500 | 3,192 | 100% | 3,122 | 100% | 3,985 | 100% | 3,916 | 100% |
| 081FH096 | 1,500 | 3,589 | 100% | 3,503 | 100% | 4,571 | 100% | 4,474 | 100% |
| 081FH097 | 1,500 | 3,744 | 100% | 3,653 | 100% | 4,840 | 100% | 4,739 | 100% |
| 081FH098 | 1,500 | 3,458 | 100% | 3,392 | 100% | 4,103 | 100% | 4,043 | 100% |
| 081FH099 | 1,500 | 3,686 | 100% | 3,616 | 100% | 4,375 | 100% | 4,314 | 100% |
| 081FH100 | 1,500 | 3,645 | 100% | 3,569 | 100% | 4,478 | 100% | 4,409 | 100% |
| 081FH101 | 3,000 | 3,915 | 100% | 3,832 | 100% | 5,078 | 100% | 4,988 | 100% |
| 081FH102 | 1,500 | 4,234 | 100% | 4,170 | 100% | 4,713 | 100% | 4,666 | 100% |
| 081FH103 | 1,500 | 3,952 | 100% | 3,893 | 100% | 4,352 | 100% | 4,309 | 100% |
| 081FH104 | 1,500 | 4,308 | 100% | 4,242 | 100% | 4,825 | 100% | 4,777 | 100% |
| 081FH105 | 1,500 | 4,704 | 100% | 4,629 | 100% | 5,402 | 100% | 5,342 | 100% |
| 081FH106 | 1,500 | 4,180 | 100% | 4,107 | 100% | 4,738 | 100% | 4,684 | 100% |
| 081FH107 | 1,500 | 4,231 | 100% | 4,159 | 100% | 4,810 | 100% | 4,758 | 100% |
| 081FH108 | 1,500 | 3,931 | 100% | 3,862 | 100% | 4,443 | 100% | 4,388 | 100% |
| 081FH109 | 1,500 | 3,489 | 100% | 3,434 | 100% | 3,899 | 100% | 3,856 | 100% |
| 081FH110 | 1,500 | 3,717 | 100% | 3,652 | 100% | 4,188 | 100% | 4,138 | 100% |
| 081FH111 | 1,500 | 3,596 | 100% | 3,540 | 100% | 3,988 | 100% | 3,946 | 100% |
| 081FH112 | 1,500 | 3,741 | 100% | 3,675 | 100% | 4,208 | 100% | 4,158 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 081FH113 | 1,500 | 3,004 | 100% | 2,934 | 100% | 3,662 | 100% | 3,607 | 100% |
| 081FH114 | 1,500 | 2,962 | 100% | 2,892 | 100% | 3,660 | 100% | 3,606 | 100% |
| 082FH001 | 3,500 | 4,797 | 100% | 5,018 | 100% | 5,315 | 100% | 5,588 | 100% |
| 082FH002 | 3,500 | 5,428 | 100% | 5,755 | 100% | 6,210 | 100% | 6,656 | 100% |
| 082FH003 | 3,500 | 5,391 | 100% | 5,711 | 100% | 6,156 | 100% | 6,590 | 100% |
| 082FH004 | 3,500 | 5,522 | 100% | 5,866 | 100% | 6,349 | 100% | 6,827 | 100% |
| 088FH001 | 3,500 | 3,529 | 100% | 4,134 | 100% | 3,923 | 100% | 3,648 | 100% |
| 088FH002 | 1,500 | 4,054 | 100% | 4,771 | 100% | 4,498 | 100% | 4,148 | 100% |
| 088FH003 | 1,500 | 3,944 | 100% | 4,669 | 100% | 4,398 | 100% | 4,050 | 100% |
| 088FH004 | 3,500 | 3,862 | 100% | 4,864 | 100% | 4,493 | 100% | 4,020 | 100% |
| 089FH001 | 1,500 | 8,534 | 100% | 8,144 | 100% | 8,138 | 100% | 8,133 | 100% |
| 089FH002 | 1,500 | 1,907 | 100% | 1,554 | 100% | 1,552 | 100% | 1,550 | 100% |
| 089FH003 | 1,500 | 5,379 | 100% | 4,729 | 100% | 4,760 | 100% | 4,752 | 100% |
| 089FH004 | 1,500 | 2,193 | 100% | 1,804 | 100% | 1,822 | 100% | 1,818 | 100% |
| 089FH005 | 1,500 | 3,307 | 100% | 2,834 | 100% | 2,825 | 100% | 2,817 | 100% |
| 089FH006 | 2,500 | 3,851 | 100% | 4,097 | 100% | 4,086 | 100% | 4,076 | 100% |
| 089FH007 | 1,500 | 2,296 | 100% | 1,963 | 100% | 1,958 | 100% | 1,954 | 100% |
| 089FH008 | 1,500 | 2,073 | 100% | 1,694 | 100% | 1,714 | 100% | 1,711 | 100% |
| 089FH009 | 1,500 | 3,002 | 100% | 2,632 | 100% | 2,625 | 100% | 2,620 | 100% |
| 089FH011 | 2,500 | 3,515 | 100% | 2,993 | 100% | 3,023 | 100% | 3,018 | 100% |
| 089FH012 | 2,500 | 4,670 | 100% | 4,412 | 100% | 4,399 | 100% | 4,387 | 100% |
| 089FH014 | 1,500 | 3,064 | 100% | 2,732 | 100% | 2,726 | 100% | 2,720 | 100% |
| 089FH016 | 1,500 | 4,634 | 100% | 5,696 | 100% | 5,683 | 100% | 5,668 | 100% |
| 089FH018 | 1,500 | 2,722 | 100% | 2,297 | 100% | 2,407 | 100% | 2,403 | 100% |
| 089FH020 | 1,500 | 1,668 | 100% | 5,761 | 100% | 5,757 | 100% | 5,741 | 100% |
| 089FH021 | 1,500 | 4,738 | 100% | 4,893 | 100% | 4,878 | 100% | 4,864 | 100% |
| 089FH023 | 1,500 | 2,900 | 100% | 2,916 | 100% | 2,931 | 100% | 2,924 | 100% |
| 089FH028 | 1,500 | 2,544 | 100% | 2,201 | 100% | 2,429 | 100% | 2,424 | 100% |
| 089FH057 | 3,500 | 4,425 | 100% | 4,183 | 100% | 4,177 | 100% | 4,171 | 100% |
| 089FH059 | 3,500 | 4,872 | 100% | 4,736 | 100% | 4,715 | 100% | 4,699 | 100% |
| 089FH088 | 1,500 | 4,242 | 100% | 5,114 | 100% | 4,770 | 100% | 4,336 | 100% |
| 090FH002 | 1,500 | 5,003 | 100% | 4,546 | 100% | 4,515 | 100% | 4,489 | 100% |
| 090FH003 | 3,000 | 5,108 | 100% | 4,710 | 100% | 4,667 | 100% | 4,634 | 100% |
| 090FH004 | 1,500 | 2,551 | 100% | 2,175 | 100% | 2,161 | 100% | 2,149 | 100% |
| 090FH005 | 1,500 | 4,712 | 100% | 4,235 | 100% | 4,208 | 100% | 4,185 | 100% |
| 090FH008 | 1,500 | 4,093 | 100% | 3,642 | 100% | 3,620 | 100% | 3,603 | 100% |
| 090FH010 | 3,000 | 6,578 | 100% | 6,254 | 100% | 6,204 | 100% | 6,165 | 100% |
| 090FH011 | 2,500 | 4,427 | 100% | 3,906 | 100% | 3,889 | 100% | 3,876 | 100% |
| 090FH012 | 2,500 | 4,265 | 100% | 3,788 | 100% | 3,766 | 100% | 3,748 | 100% |
| 090FH013 | 1,500 | 1,972 | 100% | 1,687 | 100% | 1,679 | 100% | 1,672 | 100% |
| 090FH014 | 1,500 | 2,668 | 100% | 2,349 | 100% | 2,334 | 100% | 2,322 | 100% |
| 090FH015 | 1,500 | 2,483 | 100% | 2,180 | 100% | 2,168 | 100% | 2,159 | 100% |
| 090FH017 | 2,500 | 2,564 | 100% | 2,193 | 88% | 2,183 | 87% | 2,176 | 87% |
| 090FH018 | 2,500 | 2,944 | 100% | 2,523 | 100% | 2,516 | 100% | 2,511 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 090FH019 | 3,000 | 9,135 | 100% | 9,367 | 100% | 9,271 | 100% | 9,187 | 100% |
| 090FH020 | 2,500 | 3,203 | 100% | 2,822 | 100% | 2,806 | 100% | 2,794 | 100% |
| 090FH021 | 3,000 | 5,821 | 100% | 5,518 | 100% | 5,470 | 100% | 5,434 | 100% |
| 090FH023 | 3,500 | 7,875 | 100% | 7,815 | 100% | 7,739 | 100% | 7,675 | 100% |
| 090FH024 | 3,000 | 5,479 | 100% | 5,163 | 100% | 5,120 | 100% | 5,087 | 100% |
| 090FH029 | 3,000 | 5,879 | 100% | 5,743 | 100% | 5,686 | 100% | 5,640 | 100% |
| 090FH032 | 1,500 | 7,038 | 100% | 6,759 | 100% | 6,726 | 100% | 6,699 | 100% |
| 090FH033 | 3,000 | 5,368 | 100% | 5,151 | 100% | 5,104 | 100% | 5,068 | 100% |
| 090FH035 | 3,000 | 3,624 | 100% | 3,377 | 100% | 3,348 | 100% | 3,327 | 100% |
| 090FH036 | 3,000 | 5,111 | 100% | 4,701 | 100% | 4,647 | 100% | 4,605 | 100% |
| 090FH037 | 3,000 | 4,938 | 100% | 4,665 | 100% | 4,597 | 100% | 4,542 | 100% |
| 090FH038 | 2,500 | 6,336 | 100% | 6,106 | 100% | 6,028 | 100% | 5,962 | 100% |
| 090FH041 | 1,500 | 6,028 | 100% | 5,783 | 100% | 5,707 | 100% | 5,644 | 100% |
| 090FH042 | 3,000 | 5,164 | 100% | 4,877 | 100% | 4,813 | 100% | 4,764 | 100% |
| 090FH046 | 1,500 | 6,323 | 100% | 6,100 | 100% | 6,030 | 100% | 5,973 | 100% |
| 090FH049 | 3,000 | 5,712 | 100% | 5,531 | 100% | 5,462 | 100% | 5,407 | 100% |
| 090FH050 | 3,500 | 4,555 | 100% | 4,276 | 100% | 4,237 | 100% | 4,209 | 100% |
| 090FH051 | 3,500 | 7,559 | 100% | 7,535 | 100% | 7,455 | 100% | 7,386 | 100% |
| 090FH053 | 1,500 | 2,784 | 100% | 2,545 | 100% | 2,520 | 100% | 2,500 | 100% |
| 090FH054 | 3,500 | 8,372 | 100% | 8,549 | 100% | 8,459 | 100% | 8,380 | 100% |
| 090FH055 | 3,500 | 9,449 | 100% | 10,008 | 100% | 9,901 | 100% | 9,802 | 100% |
| 090FH056 | 3,500 | 7,054 | 100% | 6,970 | 100% | 6,902 | 100% | 6,844 | 100% |
| 090FH057 | 3,500 | 4,972 | 100% | 4,762 | 100% | 4,718 | 100% | 4,684 | 100% |
| 090FH058 | 3,500 | 6,298 | 100% | 6,178 | 100% | 6,116 | 100% | 6,065 | 100% |
| 090FH059 | 3,500 | 6,783 | 100% | 6,732 | 100% | 6,663 | 100% | 6,605 | 100% |
| 090FH060 | 3,500 | 5,105 | 100% | 4,910 | 100% | 4,863 | 100% | 4,827 | 100% |
| 090FH062 | 1,500 | 2,955 | 100% | 2,771 | 100% | 2,745 | 100% | 2,725 | 100% |
| 090FH065 | 2,500 | 8,416 | 100% | 8,910 | 100% | 8,809 | 100% | 8,714 | 100% |
| 090FH067 | 3,000 | 5,624 | 100% | 5,441 | 100% | 5,392 | 100% | 5,353 | 100% |
| 090FH068 | 1,500 | 3,244 | 100% | 2,951 | 100% | 2,939 | 100% | 2,930 | 100% |
| 090FH069 | 3,500 | 3,624 | 100% | 3,387 | 97% | 3,358 | 96% | 3,338 | 95% |
| 090FH070 | 3,000 | 4,119 | 100% | 3,869 | 100% | 3,840 | 100% | 3,819 | 100% |
| 090FH072 | 2,500 | 4,657 | 100% | 4,343 | 100% | 4,325 | 100% | 4,309 | 100% |
| 090FH080 | 3,500 | 4,674 | 100% | 4,491 | 100% | 4,453 | 100% | 4,425 | 100% |
| 090FH081 | 3,500 | 9,167 | 100% | 9,501 | 100% | 9,496 | 100% | 9,429 | 100% |
| 090FH082 | 3,000 | 4,200 | 100% | 4,003 | 100% | 3,970 | 100% | 3,946 | 100% |
| 090FH083 | 3,000 | 6,946 | 100% | 6,998 | 100% | 6,934 | 100% | 6,877 | 100% |
| 090FH085 | 3,000 | 7,230 | 100% | 7,323 | 100% | 7,255 | 100% | 7,194 | 100% |
| 090FH088 | 3,000 | 4,802 | 100% | 4,640 | 100% | 4,601 | 100% | 4,571 | 100% |
| 090FH089 | 3,500 | 8,167 | 100% | 7,679 | 100% | 7,608 | 100% | 7,543 | 100% |
| 090FH091 | 3,500 | 6,242 | 100% | 5,749 | 100% | 5,699 | 100% | 5,658 | 100% |
| 090FH093 | 3,500 | 4,467 | 100% | 4,257 | 100% | 4,228 | 100% | 4,204 | 100% |
| 090FH096 | 3,500 | 10,098 | 100% | 11,199 | 100% | 11,080 | 100% | 10,969 | 100% |
| 090FH098 | 3,500 | 8,030 | 100% | 8,298 | 100% | 8,224 | 100% | 8,152 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 090FH101 | 3,500 | 6,711 | 100% | 7,166 | 100% | 7,101 | 100% | 7,041 | 100% |
| 090FH104 | 3,500 | 6,485 | 100% | 6,541 | 100% | 6,481 | 100% | 6,428 | 100% |
| 090FH106 | 3,500 | 7,222 | 100% | 7,334 | 100% | 7,273 | 100% | 7,217 | 100% |
| 090FH108 | 3,500 | 6,742 | 100% | 6,803 | 100% | 6,750 | 100% | 6,702 | 100% |
| 090FH109 | 3,500 | 5,543 | 100% | 5,463 | 100% | 5,422 | 100% | 5,387 | 100% |
| 090FH110 | 3,500 | 10,556 | 100% | 11,999 | 100% | 11,852 | 100% | 11,727 | 100% |
| 090FH111 | 3,500 | 7,056 | 100% | 7,039 | 100% | 6,969 | 100% | 6,909 | 100% |
| 090FH113 | 2,500 | 5,500 | 100% | 5,613 | 100% | 5,557 | 100% | 5,511 | 100% |
| 090FH115 | 3,500 | 7,646 | 100% | 7,777 | 100% | 7,696 | 100% | 7,624 | 100% |
| 090FH119 | 3,500 | 5,466 | 100% | 5,356 | 100% | 5,305 | 100% | 5,265 | 100% |
| 090FH120 | 2,500 | 2,911 | 100% | 2,740 | 100% | 2,716 | 100% | 2,698 | 100% |
| 090FH121 | 2,500 | 4,632 | 100% | 4,587 | 100% | 4,542 | 100% | 4,507 | 100% |
| 090FH122 | 3,500 | 3,816 | 100% | 3,609 | 100% | 3,579 | 100% | 3,558 | 100% |
| 090FH124 | 3,500 | 6,229 | 100% | 6,168 | 100% | 6,112 | 100% | 6,065 | 100% |
| 090FH126 | 3,500 | 5,101 | 100% | 7,409 | 100% | 7,336 | 100% | 7,272 | 100% |
| 090FH127 | 3,500 | 5,909 | 100% | 8,236 | 100% | 8,156 | 100% | 8,085 | 100% |
| 090FH129 | 2,500 | 6,540 | 100% | 6,692 | 100% | 6,615 | 100% | 6,552 | 100% |
| 090FH130 | 3,500 | 8,961 | 100% | 8,819 | 100% | 8,734 | 100% | 8,656 | 100% |
| 090FH132 | 3,000 | 6,722 | 100% | 6,906 | 100% | 6,827 | 100% | 6,763 | 100% |
| 090FH133 | 3,500 | 8,017 | 100% | 8,386 | 100% | 8,303 | 100% | 8,228 | 100% |
| 090FH134 | 3,500 | 5,635 | 100% | 5,558 | 100% | 5,508 | 100% | 5,468 | 100% |
| 090FH135 | 3,000 | 6,893 | 100% | 7,119 | 100% | 7,037 | 100% | 6,970 | 100% |
| 090FH136 | 3,500 | 7,257 | 100% | 7,395 | 100% | 7,323 | 100% | 7,262 | 100% |
| 090FH137 | 3,000 | 7,406 | 100% | 7,759 | 100% | 7,671 | 100% | 7,599 | 100% |
| 090FH138 | 3,500 | 7,962 | 100% | 8,261 | 100% | 8,181 | 100% | 8,109 | 100% |
| 090FH139 | 3,500 | 7,731 | 100% | 7,919 | 100% | 7,844 | 100% | 7,778 | 100% |
| 090FH141 | 3,500 | 7,693 | 100% | 7,920 | 100% | 7,843 | 100% | 7,775 | 100% |
| 090FH142 | 3,500 | 6,671 | 100% | 6,659 | 100% | 6,598 | 100% | 6,546 | 100% |
| 090FH143 | 3,500 | 7,188 | 100% | 7,426 | 100% | 7,346 | 100% | 7,279 | 100% |
| 090FH145 | 3,500 | 8,458 | 100% | 8,953 | 100% | 8,858 | 100% | 8,775 | 100% |
| 090FH146 | 3,500 | 9,319 | 100% | 10,041 | 100% | 9,938 | 100% | 9,845 | 100% |
| 090FH147 | 3,500 | 6,559 | 100% | 6,633 | 100% | 6,566 | 100% | 6,511 | 100% |
| 090FH148 | 3,500 | 9,981 | 100% | 11,039 | 100% | 10,914 | 100% | 10,808 | 100% |
| 090FH149 | 3,500 | 5,925 | 100% | 6,171 | 100% | 6,084 | 100% | 6,023 | 100% |
| 090FH150 | 3,500 | 7,891 | 100% | 8,171 | 100% | 8,092 | 100% | 8,021 | 100% |
| 090FH151 | 3,500 | 8,662 | 100% | 9,209 | 100% | 9,114 | 100% | 9,028 | 100% |
| 090FH152 | 3,500 | 8,891 | 100% | 9,496 | 100% | 9,400 | 100% | 9,313 | 100% |
| 090FH155 | 3,500 | 10,422 | 100% | 11,722 | 100% | 11,578 | 100% | 11,467 | 100% |
| 090FH156 | 3,500 | 7,581 | 100% | 7,873 | 100% | 7,795 | 100% | 7,726 | 100% |
| 090FH159 | 3,500 | 7,509 | 100% | 7,769 | 100% | 7,693 | 100% | 7,627 | 100% |
| 090FH160 | 2,500 | 4,077 | 100% | 3,761 | 100% | 3,726 | 100% | 3,700 | 100% |
| 090FH161 | 3,500 | 5,342 | 100% | 5,133 | 100% | 5,084 | 100% | 5,046 | 100% |
| 090FH162 | 2,500 | 4,755 | 100% | 4,232 | 100% | 4,213 | 100% | 4,198 | 100% |
| 090FH163 | 2,500 | 6,776 | 100% | 6,343 | 100% | 6,308 | 100% | 6,280 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 090FH164 | 2,500 | 4,870 | 100% | 4,733 | 100% | 4,672 | 100% | 4,622 | 100% |
| 090FH165 | 3,500 | 8,149 | 100% | 8,457 | 100% | 8,372 | 100% | 8,294 | 100% |
| 090FH166 | 3,000 | 4,946 | 100% | 4,746 | 100% | 4,701 | 100% | 4,667 | 100% |
| 090FH167 | 3,000 | 3,245 | 100% | 2,955 | 99% | 2,934 | 98% | 2,919 | 97% |
| 090FH168 | 3,500 | 6,253 | 100% | 6,465 | 100% | 6,434 | 100% | 6,410 | 100% |
| 090FH169 | 1,500 | 7,396 | 100% | 7,331 | 100% | 7,299 | 100% | 7,268 | 100% |
| 090FH170 | 2,500 | 4,021 | 100% | 3,772 | 100% | 3,748 | 100% | 3,729 | 100% |
| 090FH171 | 3,500 | 8,839 | 100% | 9,337 | 100% | 9,259 | 100% | 9,182 | 100% |
| 090FH172 | 3,500 | 5,096 | 100% | 4,843 | 100% | 4,824 | 100% | 4,801 | 100% |
| 090FH173 | 3,500 | 4,394 | 100% | 4,140 | 100% | 4,116 | 100% | 4,097 | 100% |
| 090FH174 | 3,500 | 7,607 | 100% | 7,646 | 100% | 7,574 | 100% | 7,510 | 100% |
| 090FH175 | 3,500 | 6,438 | 100% | 6,379 | 100% | 6,320 | 100% | 6,271 | 100% |
| 090FH176 | 3,500 | 5,839 | 100% | 5,696 | 100% | 5,644 | 100% | 5,602 | 100% |
| 090FH177 | 3,500 | 3,787 | 100% | 3,503 | 100% | 3,474 | 99% | 3,452 | 99% |
| 091FH001 | 3,000 | 5,281 | 100% | 5,262 | 100% | 5,195 | 100% | 5,134 | 100% |
| 091FH002 | 3,000 | 6,432 | 100% | 6,778 | 100% | 6,649 | 100% | 6,571 | 100% |
| 091FH004 | 2,500 | 4,928 | 100% | 4,902 | 100% | 4,834 | 100% | 4,773 | 100% |
| 091FH006 | 3,000 | 5,723 | 100% | 5,830 | 100% | 5,739 | 100% | 5,673 | 100% |
| 091FH008 | 1,500 | 4,687 | 100% | 4,622 | 100% | 4,565 | 100% | 4,516 | 100% |
| 091FH010 | 1,500 | 5,760 | 100% | 5,951 | 100% | 5,804 | 100% | 5,711 | 100% |
| 091FH013 | 1,500 | 3,267 | 100% | 3,123 | 100% | 3,087 | 100% | 3,058 | 100% |
| 091FH015 | 1,500 | 2,712 | 100% | 2,524 | 100% | 2,486 | 100% | 2,455 | 100% |
| 091FH016 | 2,500 | 4,681 | 100% | 4,595 | 100% | 4,545 | 100% | 4,502 | 100% |
| 091FH017 | 2,500 | 6,890 | 100% | 7,214 | 100% | 7,090 | 100% | 7,011 | 100% |
| 091FH018 | 2,500 | 3,304 | 100% | 3,166 | 100% | 3,129 | 100% | 3,100 | 100% |
| 091FH019 | 1,500 | 1,613 | 100% | 1,522 | 100% | 1,508 | 100% | 1,496 | 100% |
| 091FH021 | 2,500 | 3,247 | 100% | 3,115 | 100% | 3,081 | 100% | 3,054 | 100% |
| 091FH022 | 2,500 | 3,024 | 100% | 2,866 | 100% | 2,821 | 100% | 2,785 | 100% |
| 091FH023 | 2,500 | 7,999 | 100% | 8,668 | 100% | 8,510 | 100% | 8,418 | 100% |
| 091FH026 | 2,500 | 2,837 | 100% | 2,721 | 100% | 2,692 | 100% | 2,669 | 100% |
| 091FH028 | 3,000 | 6,742 | 100% | 7,256 | 100% | 7,155 | 100% | 7,084 | 100% |
| 091FH030 | 1,500 | 2,986 | 100% | 3,033 | 100% | 3,001 | 100% | 2,977 | 100% |
| 091FH031 | 2,500 | 5,444 | 100% | 5,635 | 100% | 5,527 | 100% | 5,460 | 100% |
| 091FH033 | 2,500 | 5,850 | 100% | 6,070 | 100% | 5,959 | 100% | 5,893 | 100% |
| 091FH034 | 3,500 | 4,747 | 100% | 4,818 | 100% | 4,739 | 100% | 4,689 | 100% |
| 091FH035 | 1,500 | 3,209 | 100% | 3,052 | 100% | 3,002 | 100% | 2,958 | 100% |
| 091FH038 | 1,500 | 2,257 | 100% | 2,651 | 100% | 2,619 | 100% | 2,591 | 100% |
| 091FH042 | 3,000 | 3,137 | 100% | 3,015 | 100% | 2,972 | 99% | 2,938 | 98% |
| 091FH048 | 3,000 | 4,079 | 100% | 4,192 | 100% | 4,132 | 100% | 4,083 | 100% |
| 091FH052 | 3,000 | 4,127 | 100% | 4,327 | 100% | 4,264 | 100% | 4,214 | 100% |
| 091FH057 | 2,500 | 3,059 | 100% | 3,103 | 100% | 3,059 | 100% | 3,026 | 100% |
| 091FH062 | 3,000 | 3,237 | 100% | 3,107 | 100% | 3,073 | 100% | 3,047 | 100% |
| 091FH064 | 1,500 | 8,623 | 100% | 9,631 | 100% | 9,484 | 100% | 9,385 | 100% |
| 091FH066 | 3,000 | 5,150 | 100% | 5,169 | 100% | 5,105 | 100% | 5,052 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 091FH068 | 3,500 | 5,828 | 100% | 5,964 | 100% | 5,885 | 100% | 5,820 | 100% |
| 091FH069 | 3,000 | 4,947 | 100% | 5,089 | 100% | 5,026 | 100% | 4,975 | 100% |
| 091FH070 | 3,000 | 4,484 | 100% | 4,421 | 100% | 4,369 | 100% | 4,330 | 100% |
| 091FH071 | 3,500 | 3,867 | 100% | 3,803 | 100% | 3,754 | 100% | 3,718 | 100% |
| 091FH073 | 3,000 | 4,498 | 100% | 4,423 | 100% | 4,373 | 100% | 4,336 | 100% |
| 091FH075 | 3,500 | 4,680 | 100% | 4,661 | 100% | 4,606 | 100% | 4,565 | 100% |
| 091FH076 | 3,000 | 7,030 | 100% | 7,293 | 100% | 7,210 | 100% | 7,140 | 100% |
| 091FH078 | 3,000 | 7,421 | 100% | 7,797 | 100% | 7,707 | 100% | 7,631 | 100% |
| 091FH079 | 3,500 | 3,797 | 100% | 3,685 | 100% | 3,646 | 100% | 3,617 | 100% |
| 091FH082 | 3,000 | 3,549 | 100% | 3,584 | 100% | 3,537 | 100% | 3,501 | 100% |
| 091FH083 | 3,000 | 3,929 | 100% | 4,124 | 100% | 4,056 | 100% | 4,003 | 100% |
| 091FH084 | 3,000 | 3,546 | 100% | 4,528 | 100% | 4,456 | 100% | 4,400 | 100% |
| 091FH085 | 3,000 | 3,172 | 100% | 3,587 | 100% | 3,510 | 100% | 3,452 | 100% |
| 091FH088 | 3,000 | 3,091 | 100% | 3,227 | 100% | 3,177 | 100% | 3,138 | 100% |
| 091FH094 | 1,500 | 2,999 | 100% | 3,730 | 100% | 3,661 | 100% | 3,610 | 100% |
| 091FH105 | 3,500 | 4,615 | 100% | 6,498 | 100% | 6,356 | 100% | 6,267 | 100% |
| 091FH106 | 1,500 | 7,584 | 100% | 8,221 | 100% | 8,060 | 100% | 7,965 | 100% |
| 091FH107 | 3,000 | 4,222 | 100% | 4,175 | 100% | 4,122 | 100% | 4,083 | 100% |
| 091FH108 | 3,000 | 3,157 | 100% | 3,000 | 100% | 2,957 | 99% | 2,921 | 97% |
| 091FH109 | 1,500 | 5,451 | 100% | 5,468 | 100% | 5,398 | 100% | 5,336 | 100% |
| 091FH110 | 2,500 | 4,370 | 100% | 4,293 | 100% | 4,239 | 100% | 4,193 | 100% |
| 091FH111 | 3,000 | 5,130 | 100% | 5,201 | 100% | 5,118 | 100% | 5,053 | 100% |
| 091FH112 | 2,500 | 4,749 | 100% | 4,682 | 100% | 4,623 | 100% | 4,572 | 100% |
| 091FH113 | 3,000 | 3,438 | 100% | 3,301 | 100% | 3,255 | 100% | 3,217 | 100% |
| 091FH114 | 2,500 | 4,275 | 100% | 4,181 | 100% | 4,132 | 100% | 4,091 | 100% |
| 091FH115 | 2,500 | 2,797 | 100% | 2,614 | 100% | 2,576 | 100% | 2,546 | 100% |
| 091FH116 | 1,500 | 3,425 | 100% | 3,297 | 100% | 3,262 | 100% | 3,234 | 100% |
| 091FH117 | 3,000 | 4,147 | 100% | 4,104 | 100% | 4,057 | 100% | 4,021 | 100% |
| 091FH118 | 2,500 | 4,148 | 100% | 4,100 | 100% | 4,052 | 100% | 4,014 | 100% |
| 091FH120 | 3,000 | 4,796 | 100% | 4,838 | 100% | 4,777 | 100% | 4,729 | 100% |
| 091FH121 | 3,500 | 4,773 | 100% | 7,736 | 100% | 7,517 | 100% | 7,407 | 100% |
| 091FH122 | 3,500 | 4,040 | 100% | 6,149 | 100% | 5,995 | 100% | 5,909 | 100% |
| 092FH002 | 1,500 | 3,131 | 100% | 3,088 | 100% | 3,050 | 100% | 3,009 | 100% |
| 092FH003 | 1,500 | 5,407 | 100% | 5,588 | 100% | 5,488 | 100% | 5,426 | 100% |
| 092FH004 | 1,500 | 1,613 | 100% | 1,539 | 100% | 1,520 | 100% | 1,503 | 100% |
| 092FH005 | 1,500 | 1,601 | 100% | 1,533 | 100% | 1,515 | 100% | 1,500 | 100% |
| 092FH007 | 1,500 | 7,270 | 100% | 7,941 | 100% | 7,811 | 100% | 7,735 | 100% |
| 092FH008 | 1,500 | 1,762 | 100% | 1,706 | 100% | 1,688 | 100% | 1,672 | 100% |
| 092FH010 | 1,500 | 2,398 | 100% | 2,359 | 100% | 2,334 | 100% | 2,311 | 100% |
| 092FH012 | 3,000 | 7,088 | 100% | 7,692 | 100% | 7,573 | 100% | 7,503 | 100% |
| 092FH013 | 1,500 | 6,667 | 100% | 7,154 | 100% | 7,034 | 100% | 6,963 | 100% |
| 092FH014 | 1,500 | 2,749 | 100% | 2,725 | 100% | 2,688 | 100% | 2,655 | 100% |
| 092FH015 | 3,000 | 3,838 | 100% | 3,856 | 100% | 3,819 | 100% | 3,783 | 100% |
| 092FH016 | 1,500 | 5,629 | 100% | 5,957 | 100% | 5,842 | 100% | 5,772 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 092FH017 | 1,500 | 6,871 | 100% | 7,542 | 100% | 7,406 | 100% | 7,328 | 100% |
| 092FH018 | 1,500 | 3,318 | 100% | 3,370 | 100% | 3,324 | 100% | 3,284 | 100% |
| 092FH019 | 1,500 | 6,426 | 100% | 6,999 | 100% | 6,842 | 100% | 6,751 | 100% |
| 092FH020 | 1,500 | 3,194 | 100% | 3,228 | 100% | 3,186 | 100% | 3,149 | 100% |
| 092FH021 | 1,500 | 2,945 | 100% | 2,940 | 100% | 2,905 | 100% | 2,873 | 100% |
| 092FH022 | 1,500 | 1,909 | 100% | 1,869 | 100% | 1,840 | 100% | 1,817 | 100% |
| 092FH023 | 1,500 | 2,275 | 100% | 2,249 | 100% | 2,210 | 100% | 2,177 | 100% |
| 092FH024 | 1,500 | 3,345 | 100% | 3,363 | 100% | 3,321 | 100% | 3,282 | 100% |
| 092FH028 | 1,500 | 2,425 | 100% | 2,396 | 100% | 2,364 | 100% | 2,338 | 100% |
| 092FH031 | 3,000 | 3,132 | 100% | 3,026 | 100% | 2,990 | 100% | 2,967 | 99% |
| 092FH032 | 1,500 | 2,079 | 100% | 2,006 | 100% | 1,981 | 100% | 1,958 | 100% |
| 092FH033 | 1,500 | 2,065 | 100% | 1,995 | 100% | 1,972 | 100% | 1,949 | 100% |
| 092FH034 | 1,500 | 2,190 | 100% | 2,123 | 100% | 2,099 | 100% | 2,075 | 100% |
| 092FH038 | 1,500 | 1,977 | 100% | 1,906 | 100% | 1,883 | 100% | 1,862 | 100% |
| 092FH039 | 1,500 | 1,920 | 100% | 1,853 | 100% | 1,832 | 100% | 1,812 | 100% |
| 092FH040 | 1,500 | 2,365 | 100% | 2,381 | 100% | 2,375 | 100% | 2,342 | 100% |
| 092FH041 | 1,500 | 1,529 | 100% | 1,487 | 99% | 1,473 | 98% | 1,461 | 97% |
| 092FH043 | 1,500 | 1,943 | 100% | 1,901 | 100% | 1,883 | 100% | 1,868 | 100% |
| 092FH044 | 1,500 | 2,059 | 100% | 2,018 | 100% | 2,002 | 100% | 1,986 | 100% |
| 092FH045 | 1,500 | 2,468 | 100% | 2,413 | 100% | 2,386 | 100% | 2,360 | 100% |
| 092FH046 | 1,500 | 2,028 | 100% | 1,985 | 100% | 1,967 | 100% | 1,951 | 100% |
| 092FH050 | 1,500 | 3,725 | 100% | 3,715 | 100% | 3,684 | 100% | 3,654 | 100% |
| 092FH064 | 1,500 | 1,673 | 100% | 1,683 | 100% | 1,654 | 100% | 1,635 | 100% |
| 092FH067 | 1,500 | 1,541 | 100% | 1,547 | 100% | 1,525 | 100% | 1,508 | 100% |
| 092FH068 | 1,500 | 1,580 | 100% | 1,583 | 100% | 1,565 | 100% | 1,550 | 100% |
| 092FH070 | 1,500 | 1,518 | 100% | 1,545 | 100% | 1,517 | 100% | 1,497 | 100% |
| 092FH073 | 1,500 | 1,804 | 100% | 1,854 | 100% | 1,826 | 100% | 1,805 | 100% |
| 092FH075 | 1,500 | 1,786 | 100% | 1,831 | 100% | 1,806 | 100% | 1,788 | 100% |
| 092FH077 | 1,500 | 1,975 | 100% | 2,051 | 100% | 2,024 | 100% | 2,003 | 100% |
| 092FH078 | 3,500 | 3,948 | 100% | 4,784 | 100% | 4,698 | 100% | 4,636 | 100% |
| 092FH084 | 3,500 | 3,562 | 100% | 4,401 | 100% | 4,315 | 100% | 4,256 | 100% |
| 092FH087 | 1,500 | 2,367 | 100% | 2,400 | 100% | 2,379 | 100% | 2,362 | 100% |
| 092FH089 | 1,500 | 2,625 | 100% | 2,671 | 100% | 2,639 | 100% | 2,616 | 100% |
| 092FH091 | 1,500 | 2,277 | 100% | 2,297 | 100% | 2,282 | 100% | 2,269 | 100% |
| 092FH092 | 1,500 | 2,540 | 100% | 2,595 | 100% | 2,566 | 100% | 2,542 | 100% |
| 092FH093 | 1,500 | 1,847 | 100% | 1,856 | 100% | 1,837 | 100% | 1,821 | 100% |
| 092FH094 | 1,500 | 2,474 | 100% | 2,515 | 100% | 2,480 | 100% | 2,452 | 100% |
| 092FH095 | 3,000 | 3,113 | 100% | 3,165 | 100% | 3,130 | 100% | 3,103 | 100% |
| 092FH096 | 1,500 | 2,842 | 100% | 2,902 | 100% | 2,868 | 100% | 2,843 | 100% |
| 092FH097 | 1,500 | 1,887 | 100% | 1,895 | 100% | 1,878 | 100% | 1,865 | 100% |
| 092FH098 | 2,500 | 3,260 | 100% | 3,352 | 100% | 3,313 | 100% | 3,283 | 100% |
| 092FH099 | 1,500 | 3,273 | 100% | 3,379 | 100% | 3,337 | 100% | 3,305 | 100% |
| 092FH100 | 1,500 | 1,975 | 100% | 1,988 | 100% | 1,972 | 100% | 1,959 | 100% |
| 092FH101 | 1,500 | 1,949 | 100% | 1,969 | 100% | 1,947 | 100% | 1,930 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 092FH102 | 1,500 | 3,316 | 100% | 3,441 | 100% | 3,396 | 100% | 3,362 | 100% |
| 092FH104 | 1,500 | 1,998 | 100% | 2,023 | 100% | 2,001 | 100% | 1,984 | 100% |
| 092FH106 | 1,500 | 3,088 | 100% | 3,214 | 100% | 3,197 | 100% | 3,168 | 100% |
| 092FH107 | 3,000 | 3,102 | 100% | 3,202 | 100% | 3,185 | 100% | 3,158 | 100% |
| 092FH112 | 3,000 | 3,018 | 100% | 3,040 | 100% | 3,025 | 100% | 3,001 | 100% |
| 092FH115 | 3,000 | 3,001 | 100% | 3,150 | 100% | 3,094 | 100% | 3,049 | 100% |
| 092FH116 | 1,500 | 2,682 | 100% | 2,803 | 100% | 2,767 | 100% | 2,740 | 100% |
| 092FH117 | 1,500 | 2,480 | 100% | 2,535 | 100% | 2,505 | 100% | 2,481 | 100% |
| 092FH118 | 1,500 | 2,429 | 100% | 2,364 | 100% | 2,335 | 100% | 2,307 | 100% |
| 092FH119 | 1,500 | 2,587 | 100% | 2,526 | 100% | 2,495 | 100% | 2,464 | 100% |
| 092FH120 | 1,500 | 2,101 | 100% | 2,029 | 100% | 2,004 | 100% | 1,980 | 100% |
| 093FH001 | 2,500 | 4,015 | 100% | 3,963 | 100% | 3,957 | 100% | 3,905 | 100% |
| 093FH002 | 2,500 | 4,341 | 100% | 4,302 | 100% | 4,295 | 100% | 4,241 | 100% |
| 093FH004 | 3,000 | 3,116 | 100% | 3,415 | 100% | 3,410 | 100% | 3,373 | 100% |
| 093FH005 | 2,500 | 3,751 | 100% | 3,728 | 100% | 3,722 | 100% | 3,676 | 100% |
| 093FH007 | 2,500 | 2,940 | 100% | 3,374 | 100% | 3,368 | 100% | 3,333 | 100% |
| 093FH009 | 2,500 | 3,209 | 100% | 3,189 | 100% | 3,184 | 100% | 3,150 | 100% |
| 093FH010 | 1,500 | 2,937 | 100% | 2,926 | 100% | 2,921 | 100% | 2,892 | 100% |
| 093FH011 | 1,500 | 3,452 | 100% | 3,747 | 100% | 3,742 | 100% | 3,699 | 100% |
| 093FH012 | 1,500 | 3,500 | 100% | 3,879 | 100% | 3,873 | 100% | 3,828 | 100% |
| 093FH013 | 2,500 | 2,889 | 100% | 2,906 | 100% | 2,901 | 100% | 2,868 | 100% |
| 093FH014 | 2,500 | 2,582 | 100% | 2,562 | 100% | 2,557 | 100% | 2,529 | 100% |
| 093FH015 | 3,000 | 3,527 | 100% | 4,030 | 100% | 4,024 | 100% | 3,977 | 100% |
| 093FH017 | 2,500 | 2,639 | 100% | 2,643 | 100% | 2,637 | 100% | 2,601 | 100% |
| 093FH026 | 2,500 | 2,795 | 100% | 2,756 | 100% | 2,751 | 100% | 2,719 | 100% |
| 093FH027 | 2,500 | 2,987 | 100% | 2,951 | 100% | 2,946 | 100% | 2,913 | 100% |
| 093FH028 | 2,500 | 2,864 | 100% | 2,824 | 100% | 2,819 | 100% | 2,786 | 100% |
| 093FH029 | 2,500 | 2,645 | 100% | 2,605 | 100% | 2,599 | 100% | 2,565 | 100% |
| 093FH030 | 2,500 | 3,018 | 100% | 2,983 | 100% | 2,978 | 100% | 2,943 | 100% |
| 093FH031 | 3,000 | 3,156 | 100% | 3,127 | 100% | 3,123 | 100% | 3,087 | 100% |
| 093FH033 | 1,500 | 5,589 | 100% | 5,606 | 100% | 5,607 | 100% | 5,608 | 100% |
| 093FH034 | 1,500 | 2,869 | 100% | 2,868 | 100% | 2,871 | 100% | 2,864 | 100% |
| 093FH035 | 1,500 | 2,930 | 100% | 2,930 | 100% | 2,933 | 100% | 2,926 | 100% |
| 093FH036 | 1,500 | 3,261 | 100% | 3,260 | 100% | 3,263 | 100% | 3,258 | 100% |
| 093FH037 | 1,500 | 2,048 | 100% | 2,048 | 100% | 2,050 | 100% | 2,047 | 100% |
| 093FH038 | 1,500 | 5,483 | 100% | 5,502 | 100% | 5,504 | 100% | 5,505 | 100% |
| 093FH039 | 1,500 | 3,741 | 100% | 3,743 | 100% | 3,744 | 100% | 3,742 | 100% |
| 093FH040 | 1,500 | 4,605 | 100% | 4,619 | 100% | 4,622 | 100% | 4,622 | 100% |
| 093FH041 | 1,500 | 5,446 | 100% | 5,480 | 100% | 5,484 | 100% | 5,489 | 100% |
| 093FH042 | 1,500 | 4,803 | 100% | 4,821 | 100% | 4,823 | 100% | 4,824 | 100% |
| 093FH043 | 2,500 | 5,268 | 100% | 5,296 | 100% | 5,300 | 100% | 5,303 | 100% |
| 093FH044 | 2,500 | 2,887 | 100% | 2,886 | 100% | 2,889 | 100% | 2,884 | 100% |
| 093FH049 | 3,000 | 3,039 | 100% | 3,023 | 100% | 3,017 | 100% | 2,995 | 100% |
| 093FH050 | 3,000 | 3,326 | 100% | 3,301 | 100% | 3,291 | 100% | 3,268 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 093FH053 | 3,000 | 3,237 | 100% | 3,216 | 100% | 3,207 | 100% | 3,184 | 100% |
| 093FH055 | 1,500 | 2,443 | 100% | 2,443 | 100% | 2,444 | 100% | 2,441 | 100% |
| 093FH056 | 1,500 | 4,053 | 100% | 4,030 | 100% | 4,019 | 100% | 3,993 | 100% |
| 093FH057 | 1,500 | 4,173 | 100% | 4,152 | 100% | 4,137 | 100% | 4,104 | 100% |
| 093FH059 | 1,500 | 3,702 | 100% | 3,700 | 100% | 3,700 | 100% | 3,694 | 100% |
| 093FH060 | 1,500 | 2,384 | 100% | 2,375 | 100% | 2,375 | 100% | 2,366 | 100% |
| 093FH061 | 1,500 | 3,063 | 100% | 3,030 | 100% | 3,018 | 100% | 2,993 | 100% |
| 093FH062 | 1,500 | 4,077 | 100% | 4,061 | 100% | 4,042 | 100% | 4,009 | 100% |
| 093FH063 | 1,500 | 2,216 | 100% | 2,213 | 100% | 2,213 | 100% | 2,206 | 100% |
| 093FH064 | 1,500 | 2,322 | 100% | 2,316 | 100% | 2,317 | 100% | 2,310 | 100% |
| 093FH065 | 1,500 | 2,666 | 100% | 2,665 | 100% | 2,667 | 100% | 2,664 | 100% |
| 093FH066 | 1,500 | 3,587 | 100% | 3,562 | 100% | 3,548 | 100% | 3,522 | 100% |
| 093FH067 | 1,500 | 3,280 | 100% | 3,253 | 100% | 3,242 | 100% | 3,220 | 100% |
| 093FH068 | 1,500 | 2,281 | 100% | 2,281 | 100% | 2,283 | 100% | 2,280 | 100% |
| 093FH070 | 1,500 | 2,269 | 100% | 2,261 | 100% | 2,261 | 100% | 2,254 | 100% |
| 093FH071 | 1,500 | 2,452 | 100% | 2,452 | 100% | 2,454 | 100% | 2,450 | 100% |
| 093FH072 | 1,500 | 3,164 | 100% | 3,138 | 100% | 3,128 | 100% | 3,107 | 100% |
| 093FH073 | 1,500 | 2,626 | 100% | 2,626 | 100% | 2,628 | 100% | 2,625 | 100% |
| 093FH074 | 1,500 | 2,321 | 100% | 2,313 | 100% | 2,313 | 100% | 2,306 | 100% |
| 093FH075 | 1,500 | 3,544 | 100% | 3,518 | 100% | 3,507 | 100% | 3,483 | 100% |
| 093FH076 | 1,500 | 3,928 | 100% | 3,932 | 100% | 3,931 | 100% | 3,927 | 100% |
| 093FH077 | 1,500 | 4,450 | 100% | 4,457 | 100% | 4,458 | 100% | 4,455 | 100% |
| 093FH078 | 2,500 | 4,763 | 100% | 4,793 | 100% | 4,797 | 100% | 4,800 | 100% |
| 093FH079 | 2,500 | 3,866 | 100% | 3,878 | 100% | 3,881 | 100% | 3,880 | 100% |
| 093FH080 | 1,500 | 4,111 | 100% | 4,113 | 100% | 4,113 | 100% | 4,108 | 100% |
| 093FH082 | 1,500 | 2,773 | 100% | 2,772 | 100% | 2,775 | 100% | 2,771 | 100% |
| 093FH083 | 2,500 | 5,286 | 100% | 5,326 | 100% | 5,330 | 100% | 5,335 | 100% |
| 093FH084 | 1,500 | 2,717 | 100% | 2,716 | 100% | 2,719 | 100% | 2,715 | 100% |
| 093FH086 | 2,500 | 5,017 | 100% | 5,055 | 100% | 5,060 | 100% | 5,065 | 100% |
| 093FH087 | 1,500 | 5,250 | 100% | 5,302 | 100% | 5,308 | 100% | 5,316 | 100% |
| 093FH088 | 1,500 | 2,189 | 100% | 2,188 | 100% | 2,191 | 100% | 2,187 | 100% |
| 093FH089 | 1,500 | 3,787 | 100% | 3,801 | 100% | 3,803 | 100% | 3,803 | 100% |
| 093FH091 | 3,000 | 3,097 | 100% | 3,097 | 100% | 3,100 | 100% | 3,095 | 100% |
| 093FH092 | 1,500 | 5,576 | 100% | 5,619 | 100% | 5,622 | 100% | 5,627 | 100% |
| 093FH093 | 3,000 | 3,286 | 100% | 3,286 | 100% | 3,288 | 100% | 3,284 | 100% |
| 093FH095 | 1,500 | 3,682 | 100% | 3,696 | 100% | 3,699 | 100% | 3,698 | 100% |
| 093FH096 | 1,500 | 2,097 | 100% | 2,097 | 100% | 2,100 | 100% | 2,096 | 100% |
| 093FH098 | 3,000 | 4,268 | 100% | 4,274 | 100% | 4,275 | 100% | 4,272 | 100% |
| 093FH100 | 1,500 | 4,898 | 100% | 4,914 | 100% | 4,915 | 100% | 4,914 | 100% |
| 093FH101 | 1,500 | 3,633 | 100% | 3,641 | 100% | 3,643 | 100% | 3,641 | 100% |
| 093FH102 | 1,500 | 2,018 | 100% | 2,018 | 100% | 2,020 | 100% | 2,017 | 100% |
| 093FH103 | 1,500 | 3,284 | 100% | 3,286 | 100% | 3,287 | 100% | 3,285 | 100% |
| 093FH104 | 1,500 | 4,059 | 100% | 4,080 | 100% | 4,083 | 100% | 4,084 | 100% |
| 093FH105 | 1,500 | 2,893 | 100% | 2,893 | 100% | 2,895 | 100% | 2,891 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 093FH107 | 1,500 | 2,676 | 100% | 2,676 | 100% | 2,678 | 100% | 2,674 | 100% |
| 093FH108 | 1,500 | 2,709 | 100% | 2,709 | 100% | 2,712 | 100% | 2,707 | 100% |
| 093FH109 | 1,500 | 4,980 | 100% | 4,998 | 100% | 5,000 | 100% | 4,999 | 100% |
| 093FH110 | 3,000 | 3,216 | 100% | 3,716 | 100% | 3,711 | 100% | 3,669 | 100% |
| 093FH111 | 1,500 | 6,897 | 100% | 7,124 | 100% | 7,118 | 100% | 7,127 | 100% |
| 093FH112 | 3,000 | 5,678 | 100% | 5,684 | 100% | 5,684 | 100% | 5,683 | 100% |
| 093FH113 | 1,500 | 3,875 | 100% | 3,875 | 100% | 3,876 | 100% | 3,872 | 100% |
| 093FH114 | 1,500 | 5,620 | 100% | 5,631 | 100% | 5,631 | 100% | 5,630 | 100% |
| 093FH115 | 1,500 | 5,834 | 100% | 5,847 | 100% | 5,847 | 100% | 5,847 | 100% |
| 093FH117 | 1,500 | 6,290 | 100% | 6,343 | 100% | 6,343 | 100% | 6,346 | 100% |
| 093FH118 | 1,500 | 5,974 | 100% | 5,991 | 100% | 5,991 | 100% | 5,993 | 100% |
| 093FH119 | 1,500 | 6,279 | 100% | 6,324 | 100% | 6,325 | 100% | 6,327 | 100% |
| 093FH120 | 3,000 | 3,904 | 100% | 3,873 | 100% | 3,866 | 100% | 3,824 | 100% |
| 093FH121 | 3,000 | 4,188 | 100% | 4,187 | 100% | 4,189 | 100% | 4,183 | 100% |
| 093FH122 | 3,000 | 4,810 | 100% | 4,809 | 100% | 4,810 | 100% | 4,802 | 100% |
| 093FH123 | 3,000 | 5,442 | 100% | 5,441 | 100% | 5,441 | 100% | 5,439 | 100% |
| 093FH124 | 3,000 | 3,463 | 100% | 3,435 | 100% | 3,424 | 100% | 3,397 | 100% |
| 093FH126 | 1,500 | 5,031 | 100% | 5,037 | 100% | 5,037 | 100% | 5,036 | 100% |
| 093FH129 | 2,500 | 2,711 | 100% | 2,675 | 100% | 2,670 | 100% | 2,639 | 100% |
| 093FH130 | 2,500 | 2,678 | 100% | 2,641 | 100% | 2,636 | 100% | 2,604 | 100% |
| 093FH131 | 2,500 | 2,968 | 100% | 2,933 | 100% | 2,928 | 100% | 2,895 | 100% |
| 093FH135 | 2,500 | 2,881 | 100% | 2,845 | 100% | 2,840 | 100% | 2,808 | 100% |
| 093FH136 | 2,500 | 2,572 | 100% | 2,543 | 100% | 2,538 | 100% | 2,508 | 100% |
| 093FH137 | 3,000 | 7,250 | 100% | 7,672 | 100% | 7,665 | 100% | 7,695 | 100% |
| 093FH138 | 1,500 | 3,041 | 100% | 3,021 | 100% | 3,017 | 100% | 2,987 | 100% |
| 093FH139 | 2,500 | 2,810 | 100% | 2,773 | 100% | 2,768 | 100% | 2,735 | 100% |
| 093FH140 | 2,500 | 2,691 | 100% | 2,654 | 100% | 2,649 | 100% | 2,618 | 100% |
| 094FH001 | 1,500 | 4,053 | 100% | 4,057 | 100% | 4,056 | 100% | 4,054 | 100% |
| 094FH002 | 1,500 | 4,462 | 100% | 4,470 | 100% | 4,469 | 100% | 4,468 | 100% |
| 094FH003 | 1,500 | 4,757 | 100% | 4,768 | 100% | 4,767 | 100% | 4,766 | 100% |
| 094FH004 | 1,500 | 5,316 | 100% | 5,335 | 100% | 5,333 | 100% | 5,335 | 100% |
| 094FH005 | 1,500 | 6,379 | 100% | 6,465 | 100% | 6,463 | 100% | 6,470 | 100% |
| 094FH006 | 2,500 | 6,254 | 100% | 6,302 | 100% | 6,301 | 100% | 6,308 | 100% |
| 094FH007 | 2,500 | 2,835 | 100% | 2,834 | 100% | 2,834 | 100% | 2,828 | 100% |
| 094FH008 | 2,500 | 5,091 | 100% | 5,116 | 100% | 5,111 | 100% | 5,112 | 100% |
| 094FH009 | 2,500 | 5,082 | 100% | 5,102 | 100% | 5,097 | 100% | 5,098 | 100% |
| 094FH010 | 2,500 | 2,774 | 100% | 2,773 | 100% | 2,773 | 100% | 2,766 | 100% |
| 094FH011 | 3,000 | 4,518 | 100% | 4,532 | 100% | 4,528 | 100% | 4,527 | 100% |
| 094FH012 | 2,500 | 5,665 | 100% | 5,713 | 100% | 5,709 | 100% | 5,717 | 100% |
| 094FH013 | 2,500 | 6,880 | 100% | 7,264 | 100% | 7,271 | 100% | 7,306 | 100% |
| 094FH014 | 1,500 | 5,434 | 100% | 5,480 | 100% | 5,482 | 100% | 5,490 | 100% |
| 094FH015 | 1,500 | 5,547 | 100% | 5,597 | 100% | 5,599 | 100% | 5,609 | 100% |
| 094FH016 | 1,500 | 4,486 | 100% | 4,510 | 100% | 4,512 | 100% | 4,515 | 100% |
| 094FH017 | 1,500 | 6,320 | 100% | 6,419 | 100% | 6,422 | 100% | 6,440 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 094FH018 | 1,500 | 6,211 | 100% | 6,293 | 100% | 6,296 | 100% | 6,314 | 100% |
| 094FH019 | 1,500 | 6,017 | 100% | 6,090 | 100% | 6,094 | 100% | 6,110 | 100% |
| 094FH021 | 1,500 | 4,510 | 100% | 4,538 | 100% | 4,541 | 100% | 4,545 | 100% |
| 094FH022 | 1,500 | 5,674 | 100% | 5,734 | 100% | 5,738 | 100% | 5,751 | 100% |
| 094FH023 | 1,500 | 6,435 | 100% | 6,573 | 100% | 6,579 | 100% | 6,599 | 100% |
| 094FH024 | 1,500 | 6,022 | 100% | 6,105 | 100% | 6,110 | 100% | 6,128 | 100% |
| 094FH025 | 3,500 | 6,452 | 100% | 6,879 | 100% | 7,052 | 100% | 7,229 | 100% |
| 094FH026 | 1,500 | 6,546 | 100% | 6,719 | 100% | 6,727 | 100% | 6,748 | 100% |
| 094FH027 | 3,500 | 5,416 | 100% | 5,632 | 100% | 5,712 | 100% | 5,795 | 100% |
| 094FH029 | 3,500 | 6,499 | 100% | 6,901 | 100% | 7,016 | 100% | 7,145 | 100% |
| 094FH030 | 3,500 | 4,261 | 100% | 5,005 | 100% | 5,059 | 100% | 5,122 | 100% |
| 094FH032 | 3,500 | 8,198 | 100% | 9,760 | 100% | 9,953 | 100% | 10,398 | 100% |
| 094FH034 | 2,500 | 6,873 | 100% | 7,230 | 100% | 7,239 | 100% | 7,272 | 100% |
| 094FH035 | 1,500 | 5,511 | 100% | 5,557 | 100% | 5,558 | 100% | 5,566 | 100% |
| 094FH036 | 1,500 | 6,413 | 100% | 6,534 | 100% | 6,538 | 100% | 6,553 | 100% |
| 094FH037 | 1,500 | 6,980 | 100% | 7,305 | 100% | 7,316 | 100% | 7,343 | 100% |
| 094FH038 | 3,000 | 6,844 | 100% | 7,144 | 100% | 7,155 | 100% | 7,184 | 100% |
| 094FH039 | 3,000 | 6,002 | 100% | 6,124 | 100% | 6,135 | 100% | 6,160 | 100% |
| 094FH040 | 3,000 | 7,176 | 100% | 7,690 | 100% | 7,705 | 100% | 7,766 | 100% |
| 094FH041 | 3,000 | 5,825 | 100% | 5,938 | 100% | 5,948 | 100% | 5,970 | 100% |
| 094FH042 | 2,500 | 6,213 | 100% | 6,330 | 100% | 6,338 | 100% | 6,360 | 100% |
| 094FH043 | 1,500 | 6,986 | 100% | 7,351 | 100% | 7,365 | 100% | 7,398 | 100% |
| 094FH045 | 1,500 | 6,855 | 100% | 7,184 | 100% | 7,199 | 100% | 7,233 | 100% |
| 094FH046 | 1,500 | 2,815 | 100% | 2,823 | 100% | 2,825 | 100% | 2,824 | 100% |
| 094FH047 | 1,500 | 5,374 | 100% | 5,485 | 100% | 5,498 | 100% | 5,519 | 100% |
| 094FH048 | 1,500 | 6,806 | 100% | 7,147 | 100% | 7,167 | 100% | 7,207 | 100% |
| 094FH049 | 1,500 | 6,462 | 100% | 6,636 | 100% | 6,646 | 100% | 6,674 | 100% |
| 094FH050 | 1,500 | 4,666 | 100% | 4,726 | 100% | 4,734 | 100% | 4,743 | 100% |
| 094FH051 | 1,500 | 6,556 | 100% | 6,819 | 100% | 6,837 | 100% | 6,876 | 100% |
| 094FH052 | 1,500 | 4,185 | 100% | 4,237 | 100% | 4,245 | 100% | 4,252 | 100% |
| 094FH053 | 1,500 | 4,770 | 100% | 4,857 | 100% | 4,868 | 100% | 4,882 | 100% |
| 094FH054 | 1,500 | 3,109 | 100% | 3,126 | 100% | 3,129 | 100% | 3,128 | 100% |
| 094FH055 | 1,500 | 5,735 | 100% | 5,846 | 100% | 5,858 | 100% | 5,882 | 100% |
| 094FH056 | 1,500 | 7,466 | 100% | 8,046 | 100% | 8,062 | 100% | 8,145 | 100% |
| 094FH057 | 1,500 | 5,061 | 100% | 5,157 | 100% | 5,169 | 100% | 5,187 | 100% |
| 094FH058 | 1,500 | 8,604 | 100% | 10,082 | 100% | 10,139 | 100% | 10,405 | 100% |
| 094FH059 | 1,500 | 7,124 | 100% | 7,612 | 100% | 7,639 | 100% | 7,690 | 100% |
| 094FH060 | 1,500 | 4,300 | 100% | 4,359 | 100% | 4,366 | 100% | 4,374 | 100% |
| 094FH061 | 1,500 | 6,166 | 100% | 6,349 | 100% | 6,365 | 100% | 6,402 | 100% |
| 094FH062 | 1,500 | 6,302 | 100% | 6,514 | 100% | 6,532 | 100% | 6,574 | 100% |
| 094FH063 | 1,500 | 1,805 | 100% | 1,805 | 100% | 1,809 | 100% | 1,804 | 100% |
| 094FH064 | 1,500 | 6,228 | 100% | 6,384 | 100% | 6,399 | 100% | 6,433 | 100% |
| 094FH065 | 1,500 | 6,763 | 100% | 7,151 | 100% | 7,174 | 100% | 7,223 | 100% |
| 094FH066 | 1,500 | 5,445 | 100% | 5,566 | 100% | 5,579 | 100% | 5,603 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 094FH067 | 1,500 | 6,120 | 100% | 6,296 | 100% | 6,312 | 100% | 6,348 | 100% |
| 094FH068 | 1,500 | 4,817 | 100% | 4,830 | 100% | 4,829 | 100% | 4,829 | 100% |
| 094FH070 | 1,500 | 7,111 | 100% | 7,300 | 100% | 7,383 | 100% | 7,394 | 100% |
| 094FH071 | 1,500 | 5,047 | 100% | 5,049 | 100% | 5,048 | 100% | 5,046 | 100% |
| 094FH072 | 1,500 | 4,679 | 100% | 4,682 | 100% | 4,677 | 100% | 4,676 | 100% |
| 094FH073 | 1,500 | 5,084 | 100% | 5,094 | 100% | 5,089 | 100% | 5,090 | 100% |
| 094FH074 | 1,500 | 3,089 | 100% | 3,087 | 100% | 3,086 | 100% | 3,080 | 100% |
| 094FH075 | 1,500 | 3,995 | 100% | 3,998 | 100% | 3,994 | 100% | 3,992 | 100% |
| 094FH076 | 1,500 | 6,059 | 100% | 6,093 | 100% | 6,091 | 100% | 6,096 | 100% |
| 094FH077 | 1,500 | 4,006 | 100% | 4,010 | 100% | 4,007 | 100% | 4,004 | 100% |
| 094FH078 | 1,500 | 6,567 | 100% | 6,710 | 100% | 6,714 | 100% | 6,723 | 100% |
| 094FH079 | 1,500 | 6,449 | 100% | 6,558 | 100% | 6,560 | 100% | 6,569 | 100% |
| 094FH080 | 1,500 | 5,499 | 100% | 5,522 | 100% | 5,517 | 100% | 5,521 | 100% |
| 094FH081 | 1,500 | 6,696 | 100% | 6,907 | 100% | 6,907 | 100% | 6,923 | 100% |
| 094FH082 | 1,500 | 8,856 | 100% | 10,403 | 100% | 10,426 | 100% | 10,681 | 100% |
| 094FH084 | 1,500 | 4,814 | 100% | 4,839 | 100% | 4,839 | 100% | 4,842 | 100% |
| 094FH085 | 1,500 | 5,731 | 100% | 5,779 | 100% | 5,778 | 100% | 5,788 | 100% |
| 094FH086 | 1,500 | 6,055 | 100% | 6,114 | 100% | 6,113 | 100% | 6,125 | 100% |
| 094FH087 | 1,500 | 6,075 | 100% | 6,141 | 100% | 6,141 | 100% | 6,155 | 100% |
| 094FH088 | 1,500 | 6,798 | 100% | 7,028 | 100% | 7,034 | 100% | 7,051 | 100% |
| 094FH090 | 1,500 | 5,738 | 100% | 5,784 | 100% | 5,782 | 100% | 5,790 | 100% |
| 094FH091 | 1,500 | 4,591 | 100% | 4,613 | 100% | 4,611 | 100% | 4,613 | 100% |
| 094FH092 | 1,500 | 4,890 | 100% | 4,912 | 100% | 4,910 | 100% | 4,912 | 100% |
| 094FH093 | 1,500 | 4,755 | 100% | 4,773 | 100% | 4,771 | 100% | 4,772 | 100% |
| 094FH094 | 1,500 | 5,818 | 100% | 5,853 | 100% | 5,849 | 100% | 5,856 | 100% |
| 094FH095 | 1,500 | 6,129 | 100% | 6,171 | 100% | 6,170 | 100% | 6,177 | 100% |
| 094FH096 | 1,500 | 5,784 | 100% | 5,824 | 100% | 5,821 | 100% | 5,829 | 100% |
| 094FH097 | 1,500 | 4,275 | 100% | 4,287 | 100% | 4,286 | 100% | 4,286 | 100% |
| 094FH098 | 1,500 | 5,181 | 100% | 5,201 | 100% | 5,197 | 100% | 5,199 | 100% |
| 094FH101 | 2,500 | 6,039 | 100% | 6,123 | 100% | 6,130 | 100% | 6,147 | 100% |
| 094FH102 | 2,500 | 5,262 | 100% | 5,318 | 100% | 5,324 | 100% | 5,333 | 100% |
| 094FH103 | 1,500 | 4,093 | 100% | 4,100 | 100% | 4,097 | 100% | 4,096 | 100% |
| 094FH104 | 1,500 | 5,996 | 100% | 6,037 | 100% | 6,033 | 100% | 6,041 | 100% |
| 094FH105 | 1,500 | 6,717 | 100% | 6,910 | 100% | 6,916 | 100% | 6,928 | 100% |
| 094FH106 | 1,500 | 6,494 | 100% | 6,623 | 100% | 6,625 | 100% | 6,636 | 100% |
| 094FH107 | 1,500 | 5,237 | 100% | 5,264 | 100% | 5,259 | 100% | 5,262 | 100% |
| 094FH108 | 1,500 | 4,931 | 100% | 4,953 | 100% | 4,949 | 100% | 4,950 | 100% |
| 094FH109 | 1,500 | 6,551 | 100% | 6,694 | 100% | 6,697 | 100% | 6,708 | 100% |
| 094FH110 | 1,500 | 5,998 | 100% | 6,042 | 100% | 6,038 | 100% | 6,047 | 100% |
| 094FH111 | 1,500 | 6,925 | 100% | 7,188 | 100% | 7,192 | 100% | 7,211 | 100% |
| 094FH112 | 1,500 | 6,487 | 100% | 6,616 | 100% | 6,618 | 100% | 6,628 | 100% |
| 094FH113 | 1,500 | 3,582 | 100% | 3,585 | 100% | 3,582 | 100% | 3,579 | 100% |
| 094FH118 | 500 | 7,129 | 100% | 7,226 | 100% | 7,722 | 100% | 7,713 | 100% |
| 094FH119 | 1,500 | 5,808 | 100% | 5,731 | 100% | 6,542 | 100% | 6,490 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 094FH127 | 2,500 | 5,301 | 100% | 5,353 | 100% | 5,359 | 100% | 5,368 | 100% |
| 094FH242 | 3,000 | 5,570 | 100% | 5,657 | 100% | 5,666 | 100% | 5,683 | 100% |
| 094FH243 | 3,000 | 5,170 | 100% | 5,234 | 100% | 5,242 | 100% | 5,254 | 100% |
| 094FH244 | 3,000 | 4,547 | 100% | 4,585 | 100% | 4,591 | 100% | 4,597 | 100% |
| 094FH245 | 3,500 | 4,417 | 100% | 5,226 | 100% | 5,281 | 100% | 5,347 | 100% |
| 094FH246 | 1,500 | 6,164 | 100% | 6,290 | 100% | 6,303 | 100% | 6,331 | 100% |
| 094FH247 | 3,500 | 3,573 | 100% | 3,794 | 100% | 3,819 | 100% | 3,845 | 100% |
| 094FH248 | 3,500 | 5,014 | 100% | 5,360 | 100% | 5,427 | 100% | 5,501 | 100% |
| 094FH249 | 3,500 | 3,763 | 100% | 3,837 | 100% | 3,866 | 100% | 3,894 | 100% |
| 095FH001 | 3,500 | 8,333 | 100% | 10,180 | 100% | 10,774 | 100% | 11,780 | 100% |
| 095FH002 | 3,500 | 8,235 | 100% | 10,032 | 100% | 10,690 | 100% | 11,783 | 100% |
| 095FH003 | 3,500 | 8,976 | 100% | 11,774 | 100% | 12,850 | 100% | 14,944 | 100% |
| 095FH004 | 3,500 | 5,013 | 100% | 5,379 | 100% | 5,472 | 100% | 5,566 | 100% |
| 095FH005 | 3,500 | 8,700 | 100% | 11,121 | 100% | 12,011 | 100% | 13,656 | 100% |
| 095FH006 | 3,500 | 7,032 | 100% | 7,781 | 100% | 8,195 | 100% | 8,620 | 100% |
| 095FH007 | 3,500 | 5,284 | 100% | 5,511 | 100% | 5,646 | 100% | 5,776 | 100% |
| 095FH008 | 3,500 | 8,493 | 100% | 10,632 | 100% | 11,382 | 100% | 12,736 | 100% |
| 095FH009 | 3,500 | 5,756 | 100% | 6,056 | 100% | 6,229 | 100% | 6,402 | 100% |
| 095FH010 | 3,500 | 8,053 | 100% | 9,659 | 100% | 10,549 | 100% | 11,900 | 100% |
| 095FH011 | 3,500 | 5,573 | 100% | 5,856 | 100% | 6,152 | 100% | 6,431 | 100% |
| 095FH012 | 3,500 | 6,957 | 100% | 7,723 | 100% | 8,419 | 100% | 9,151 | 100% |
| 095FH013 | 3,500 | 5,367 | 100% | 5,631 | 100% | 5,921 | 100% | 6,189 | 100% |
| 095FH014 | 3,500 | 6,579 | 100% | 7,165 | 100% | 7,799 | 100% | 8,445 | 100% |
| 095FH015 | 3,500 | 5,407 | 100% | 5,690 | 100% | 6,027 | 100% | 6,332 | 100% |
| 095FH016 | 3,500 | 6,266 | 100% | 6,730 | 100% | 7,350 | 100% | 7,940 | 100% |
| 095FH017 | 3,500 | 5,175 | 100% | 5,436 | 100% | 5,789 | 100% | 6,087 | 100% |
| 095FH018 | 3,500 | 5,382 | 100% | 5,649 | 100% | 5,900 | 100% | 6,133 | 100% |
| 095FH019 | 3,500 | 6,271 | 100% | 6,679 | 100% | 7,123 | 100% | 7,576 | 100% |
| 095FH020 | 3,500 | 6,231 | 100% | 6,637 | 100% | 7,093 | 100% | 7,570 | 100% |
| 095FH021 | 3,500 | 6,314 | 100% | 6,767 | 100% | 7,293 | 100% | 7,861 | 100% |
| 095FH022 | 3,500 | 5,151 | 100% | 5,521 | 100% | 5,625 | 100% | 5,729 | 100% |
| 095FH023 | 3,500 | 5,178 | 100% | 5,499 | 100% | 5,609 | 100% | 5,716 | 100% |
| 095FH024 | 3,500 | 6,377 | 100% | 6,901 | 100% | 7,136 | 100% | 7,375 | 100% |
| 095FH025 | 3,500 | 5,580 | 100% | 5,865 | 100% | 6,021 | 100% | 6,174 | 100% |
| 095FH026 | 3,500 | 3,507 | 100% | 3,609 | 100% | 3,641 | 100% | 3,671 | 100% |
| 095FH027 | 3,500 | 5,064 | 100% | 5,315 | 100% | 5,601 | 100% | 5,861 | 100% |
| 095FH028 | 3,500 | 5,207 | 100% | 5,483 | 100% | 5,801 | 100% | 6,094 | 100% |
| 095FH029 | 3,500 | 4,479 | 100% | 4,655 | 100% | 4,849 | 100% | 5,020 | 100% |
| 095FH030 | 3,500 | 4,732 | 100% | 4,942 | 100% | 5,178 | 100% | 5,387 | 100% |
| 095FH031 | 3,500 | 5,243 | 100% | 5,528 | 100% | 5,855 | 100% | 6,158 | 100% |
| 095FH032 | 3,500 | 5,067 | 100% | 5,318 | 100% | 5,605 | 100% | 5,866 | 100% |
| 095FH033 | 3,500 | 5,298 | 100% | 5,578 | 100% | 5,900 | 100% | 6,196 | 100% |
| 095FH034 | 3,500 | 4,750 | 100% | 4,929 | 100% | 5,114 | 100% | 5,280 | 100% |
| 095FH035 | 3,500 | 5,152 | 100% | 5,388 | 100% | 5,653 | 100% | 5,893 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 095FH036 | 3,500 | 5,104 | 100% | 5,332 | 100% | 5,590 | 100% | 5,822 | 100% |
| 095FH037 | 3,500 | 5,342 | 100% | 5,607 | 100% | 5,909 | 100% | 6,185 | 100% |
| 095FH038 | 3,500 | 5,754 | 100% | 6,085 | 100% | 6,460 | 100% | 6,817 | 100% |
| 095FH039 | 3,500 | 5,217 | 100% | 5,460 | 100% | 5,723 | 100% | 5,965 | 100% |
| 095FH040 | 3,500 | 5,286 | 100% | 5,533 | 100% | 5,798 | 100% | 6,042 | 100% |
| 095FH041 | 3,500 | 4,532 | 100% | 4,690 | 100% | 4,851 | 100% | 4,995 | 100% |
| 095FH042 | 3,500 | 4,505 | 100% | 4,659 | 100% | 4,809 | 100% | 4,942 | 100% |
| 095FH043 | 3,500 | 6,205 | 100% | 6,612 | 100% | 7,039 | 100% | 7,458 | 100% |
| 095FH044 | 3,500 | 5,301 | 100% | 5,548 | 100% | 5,795 | 100% | 6,021 | 100% |
| 096FH001 | 3,500 | 6,199 | 100% | 6,640 | 100% | 7,187 | 100% | 7,794 | 100% |
| 096FH002 | 3,500 | 7,531 | 100% | 8,755 | 100% | 9,884 | 100% | 11,747 | 100% |
| 096FH003 | 3,500 | 4,074 | 100% | 4,193 | 100% | 4,340 | 100% | 4,474 | 100% |
| 096FH004 | 3,500 | 4,141 | 100% | 4,270 | 100% | 4,436 | 100% | 4,577 | 100% |
| 096FH005 | 3,500 | 6,073 | 100% | 6,503 | 100% | 7,160 | 100% | 7,754 | 100% |
| 096FH007 | 3,500 | 6,515 | 100% | 7,087 | 100% | 7,803 | 100% | 8,656 | 100% |
| 096FH008 | 3,500 | 7,599 | 100% | 8,914 | 100% | 10,144 | 100% | 12,411 | 100% |
| 096FH009 | 3,500 | 6,363 | 100% | 6,831 | 100% | 7,395 | 100% | 8,155 | 100% |
| 096FH010 | 3,500 | 6,615 | 100% | 7,186 | 100% | 7,836 | 100% | 8,659 | 100% |
| 096FH011 | 3,500 | 6,169 | 100% | 6,558 | 100% | 7,047 | 100% | 7,613 | 100% |
| 096FH012 | 3,500 | 6,166 | 100% | 6,568 | 100% | 7,074 | 100% | 7,643 | 100% |
| 096FH026 | 3,500 | 5,880 | 100% | 6,237 | 100% | 6,676 | 100% | 7,252 | 100% |
| 096FH027 | 1,000 | 5,371 | 100% | 5,654 | 100% | 5,931 | 100% | 6,635 | 100% |
| 096FH028 | 3,500 | 5,692 | 100% | 6,006 | 100% | 6,385 | 100% | 6,876 | 100% |
| 096FH029 | 3,500 | 6,874 | 100% | 7,595 | 100% | 8,375 | 100% | 9,474 | 100% |
| 096FH030 | 3,500 | 6,777 | 100% | 7,442 | 100% | 8,170 | 100% | 9,170 | 100% |
| 096FH031 | 3,500 | 5,330 | 100% | 5,579 | 100% | 5,875 | 100% | 6,223 | 100% |
| 096FH032 | 3,500 | 5,532 | 100% | 5,812 | 100% | 6,153 | 100% | 6,541 | 100% |
| 096FH033 | 3,500 | 5,288 | 100% | 5,538 | 100% | 5,848 | 100% | 6,186 | 100% |
| 096FH034 | 3,500 | 6,907 | 100% | 7,671 | 100% | 8,511 | 100% | 9,703 | 100% |
| 096FH035 | 3,500 | 6,705 | 100% | 7,340 | 100% | 8,071 | 100% | 9,015 | 100% |
| 096FH036 | 3,500 | 6,433 | 100% | 6,950 | 100% | 7,602 | 100% | 8,387 | 100% |
| 096FH037 | 3,500 | 5,973 | 100% | 6,359 | 100% | 6,867 | 100% | 7,449 | 100% |
| 096FH038 | 3,500 | 6,003 | 100% | 6,402 | 100% | 6,931 | 100% | 7,537 | 100% |
| 096FH039 | 3,500 | 6,277 | 100% | 6,731 | 100% | 7,340 | 100% | 8,050 | 100% |
| 096FH040 | 3,500 | 6,280 | 100% | 6,730 | 100% | 7,332 | 100% | 8,028 | 100% |
| 096FH041 | 3,500 | 5,894 | 100% | 6,273 | 100% | 6,773 | 100% | 7,340 | 100% |
| 096FH042 | 3,500 | 5,049 | 100% | 5,280 | 100% | 5,568 | 100% | 5,872 | 100% |
| 096FH043 | 3,500 | 6,460 | 100% | 7,020 | 100% | 7,731 | 100% | 8,600 | 100% |
| 096FH044 | 3,500 | 5,949 | 100% | 6,348 | 100% | 6,879 | 100% | 7,489 | 100% |
| 096FH045 | 3,000 | 5,573 | 100% | 5,872 | 100% | 6,236 | 100% | 6,685 | 100% |
| 096FH047 | 3,500 | 4,461 | 100% | 4,624 | 100% | 4,824 | 100% | 5,027 | 100% |
| 096FH048 | 3,500 | 6,071 | 100% | 6,535 | 100% | 7,210 | 100% | 7,921 | 100% |
| 096FH049 | 3,500 | 4,586 | 100% | 4,782 | 100% | 5,040 | 100% | 5,276 | 100% |
| 096FH050 | 3,500 | 4,614 | 100% | 4,814 | 100% | 5,077 | 100% | 5,319 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 096FH051 | 3,500 | 5,168 | 100% | 5,450 | 100% | 5,834 | 100% | 6,203 | 100% |
| 096FH052 | 3,500 | 5,715 | 100% | 6,099 | 100% | 6,642 | 100% | 7,193 | 100% |
| 096FH053 | 3,500 | 5,416 | 100% | 5,741 | 100% | 6,192 | 100% | 6,636 | 100% |
| 096FH054 | 3,500 | 5,608 | 100% | 5,970 | 100% | 6,479 | 100% | 6,988 | 100% |
| 096FH055 | 3,500 | 5,493 | 100% | 5,832 | 100% | 6,307 | 100% | 6,775 | 100% |
| 096FH056 | 3,500 | 5,245 | 100% | 5,537 | 100% | 5,940 | 100% | 6,326 | 100% |
| 096FH057 | 3,500 | 5,669 | 100% | 6,038 | 100% | 6,560 | 100% | 7,081 | 100% |
| 096FH058 | 3,500 | 5,427 | 100% | 5,753 | 100% | 6,210 | 100% | 6,655 | 100% |
| 096FH059 | 3,500 | 6,264 | 100% | 6,773 | 100% | 7,530 | 100% | 8,331 | 100% |
| 096FH061 | 3,500 | 6,576 | 100% | 7,187 | 100% | 7,941 | 100% | 8,865 | 100% |
| 096FH062 | 3,500 | 6,313 | 100% | 6,797 | 100% | 7,524 | 100% | 8,216 | 100% |
| 096FH063 | 3,500 | 4,678 | 100% | 4,868 | 100% | 5,104 | 100% | 5,346 | 100% |
| 096FH064 | 3,500 | 5,273 | 100% | 5,512 | 100% | 5,800 | 100% | 6,108 | 100% |
| 096FH065 | 3,500 | 4,567 | 100% | 4,724 | 100% | 4,906 | 100% | 5,093 | 100% |
| 096FH066 | 3,500 | 3,687 | 100% | 3,767 | 100% | 3,855 | 100% | 3,943 | 100% |
| 096FH067 | 3,500 | 6,557 | 100% | 7,199 | 100% | 8,009 | 100% | 9,032 | 100% |
| 096FH068 | 3,500 | 6,084 | 100% | 6,549 | 100% | 7,184 | 100% | 7,944 | 100% |
| 096FH069 | 3,500 | 5,983 | 100% | 6,423 | 100% | 7,021 | 100% | 7,726 | 100% |
| 096FH070 | 3,500 | 5,741 | 100% | 6,140 | 100% | 6,677 | 100% | 7,299 | 100% |
| 096FH071 | 3,500 | 5,987 | 100% | 6,433 | 100% | 7,036 | 100% | 7,755 | 100% |
| 096FH072 | 3,500 | 6,309 | 100% | 6,826 | 100% | 7,525 | 100% | 8,376 | 100% |
| 096FH073 | 3,500 | 5,861 | 100% | 6,291 | 100% | 6,874 | 100% | 7,563 | 100% |
| 096FH074 | 3,500 | 5,802 | 100% | 6,220 | 100% | 6,788 | 100% | 7,454 | 100% |
| 096FH075 | 3,500 | 5,643 | 100% | 6,038 | 100% | 6,571 | 100% | 7,189 | 100% |
| 096FH076 | 500 | 7,024 | 100% | 7,891 | 100% | 8,472 | 100% | 10,605 | 100% |
| 096FH077 | 500 | 6,741 | 100% | 7,494 | 100% | 7,902 | 100% | 9,682 | 100% |
| 096FH078 | 500 | 6,514 | 100% | 7,204 | 100% | 7,513 | 100% | 9,353 | 100% |
| 100FH001 | 3,500 | 4,913 | 100% | 2,741 | 78% | 2,580 | 74% | 2,412 | 69% |
| 100FH002 | 3,500 | 4,945 | 100% | 2,754 | 79% | 2,561 | 73% | 2,390 | 68% |
| 100FH003 | 3,500 | 4,833 | 100% | 2,673 | 76% | 2,508 | 72% | 2,336 | 67% |
| 100FH004 | 3,500 | 4,745 | 100% | 2,632 | 75% | 2,467 | 70% | 2,294 | 66% |
| 100FH005 | 3,500 | 4,500 | 100% | 2,591 | 74% | 2,431 | 69% | 2,264 | 65% |
| 100FH006 | 3,500 | 4,390 | 100% | 2,556 | 73% | 2,398 | 69% | 2,232 | 64% |
| 100FH007 | 3,500 | 4,420 | 100% | 2,566 | 73% | 2,406 | 69% | 2,239 | 64% |
| 100FH008 | 3,500 | 3,979 | 100% | 2,515 | 72% | 2,376 | 68% | 2,232 | 64% |
| 100FH009 | 3,500 | 3,846 | 100% | 2,404 | 69% | 2,247 | 64% | 2,082 | 59% |
| 100FH023 | 3,500 | 4,406 | 100% | 2,575 | 74% | 2,420 | 69% | 2,257 | 64% |
| 100FH024 | 3,500 | 4,423 | 100% | 2,611 | 75% | 2,458 | 70% | 2,297 | 66% |
| 100FH025 | 3,500 | 4,301 | 100% | 2,598 | 74% | 2,449 | 70% | 2,293 | 66% |
| 100FH026 | 3,500 | 4,351 | 100% | 2,600 | 74% | 2,449 | 70% | 2,291 | 65% |
| 100FH027 | 3,500 | 4,592 | 100% | 2,618 | 75% | 2,457 | 70% | 2,288 | 65% |
| 100FH028 | 3,500 | 5,698 | 100% | 4,014 | 100% | 2,523 | 72% | 2,358 | 67% |
| 100FH029 | 3,500 | 6,398 | 100% | 4,513 | 100% | 2,519 | 72% | 2,357 | 67% |
| 100FH030 | 3,500 | 4,343 | 100% | 2,610 | 75% | 2,460 | 70% | 2,303 | 66% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 100FH032 | 3,500 | 4,726 | 100% | 2,614 | 75% | 2,450 | 70% | 2,278 | 65% |
| 100FH033 | 3,500 | 3,995 | 100% | 2,465 | 70% | 2,332 | 67% | 2,199 | 63% |
| 100FH034 | 3,500 | 4,202 | 100% | 2,473 | 71% | 2,314 | 66% | 2,146 | 61% |
| 100FH035 | 3,500 | 4,329 | 100% | 2,503 | 72% | 2,342 | 67% | 2,173 | 62% |
| 102FH001 | 3,000 | 3,636 | 100% | 3,659 | 100% | 3,712 | 100% | 3,620 | 100% |
| 102FH002 | 3,000 | 4,232 | 100% | 4,351 | 100% | 4,462 | 100% | 4,336 | 100% |
| 102FH005 | 500 | 1,261 | 100% | 1,162 | 100% | 1,151 | 100% | 1,135 | 100% |
| 102FH006 | 3,000 | 4,559 | 100% | 4,735 | 100% | 4,852 | 100% | 4,720 | 100% |
| 103FH001 | 3,500 | 7,867 | 100% | 8,193 | 100% | 8,128 | 100% | 8,061 | 100% |
| 103FH002 | 3,500 | 6,836 | 100% | 6,930 | 100% | 6,904 | 100% | 6,864 | 100% |
| 103FH003 | 3,500 | 8,703 | 100% | 9,368 | 100% | 9,232 | 100% | 9,020 | 100% |
| 103FH004 | 3,500 | 5,900 | 100% | 5,794 | 100% | 5,784 | 100% | 5,776 | 100% |
| 103FH007 | 3,000 | 5,379 | 100% | 5,241 | 100% | 5,220 | 100% | 5,204 | 100% |
| 103FH009 | 3,000 | 3,217 | 100% | 2,965 | 99% | 2,957 | 99% | 2,948 | 98% |
| 103FH010 | 3,000 | 4,566 | 100% | 4,418 | 100% | 4,402 | 100% | 4,376 | 100% |
| 103FH013 | 3,000 | 4,916 | 100% | 4,866 | 100% | 4,862 | 100% | 4,813 | 100% |
| 103FH015 | 3,000 | 4,821 | 100% | 4,826 | 100% | 4,843 | 100% | 4,775 | 100% |
| 103FH016 | 3,000 | 4,828 | 100% | 4,923 | 100% | 4,984 | 100% | 4,889 | 100% |
| 103FH017 | 3,500 | 7,313 | 100% | 8,382 | 100% | 8,259 | 100% | 8,148 | 100% |
| 103FH019 | 3,000 | 5,118 | 100% | 5,303 | 100% | 5,261 | 100% | 5,202 | 100% |
| 103FH020 | 3,500 | 6,312 | 100% | 6,948 | 100% | 6,890 | 100% | 6,792 | 100% |
| 103FH021 | 3,500 | 4,046 | 100% | 4,139 | 100% | 4,164 | 100% | 4,071 | 100% |
| 103FH022 | 3,500 | 4,041 | 100% | 4,155 | 100% | 4,174 | 100% | 4,076 | 100% |
| 103FH023 | 3,000 | 4,707 | 100% | 4,832 | 100% | 4,805 | 100% | 4,747 | 100% |
| 103FH026 | 3,000 | 3,796 | 100% | 3,800 | 100% | 3,782 | 100% | 3,739 | 100% |
| 103FH027 | 3,500 | 4,390 | 100% | 4,550 | 100% | 4,592 | 100% | 4,478 | 100% |
| 103FH029 | 3,500 | 3,614 | 100% | 3,647 | 100% | 3,660 | 100% | 3,588 | 100% |
| 103FH030 | 3,000 | 3,925 | 100% | 3,951 | 100% | 3,943 | 100% | 3,891 | 100% |
| 103FH032 | 3,000 | 3,228 | 100% | 3,168 | 100% | 3,187 | 100% | 3,138 | 100% |
| 103FH033 | 3,000 | 4,668 | 100% | 4,786 | 100% | 4,886 | 100% | 4,786 | 100% |
| 103FH035 | 3,000 | 3,393 | 100% | 3,360 | 100% | 3,350 | 100% | 3,310 | 100% |
| 103FH036 | 3,000 | 5,327 | 100% | 5,619 | 100% | 5,886 | 100% | 5,738 | 100% |
| 103FH038 | 3,500 | 6,204 | 100% | 7,701 | 100% | 7,499 | 100% | 7,378 | 100% |
| 103FH040 | 3,000 | 4,196 | 100% | 4,275 | 100% | 4,387 | 100% | 4,290 | 100% |
| 103FH043 | 3,000 | 3,833 | 100% | 3,888 | 100% | 3,936 | 100% | 3,847 | 100% |
| 103FH047 | 3,500 | 4,742 | 100% | 5,432 | 100% | 5,327 | 100% | 5,241 | 100% |
| 103FH050 | 3,500 | 7,063 | 100% | 9,633 | 100% | 9,338 | 100% | 9,170 | 100% |
| 103FH052 | 3,000 | 3,158 | 100% | 3,118 | 100% | 3,141 | 100% | 3,075 | 100% |
| 103FH053 | 3,500 | 3,955 | 100% | 4,539 | 100% | 4,425 | 100% | 4,341 | 100% |
| 103FH054 | 3,500 | 3,788 | 100% | 4,122 | 100% | 4,058 | 100% | 3,997 | 100% |
| 103FH056 | 3,000 | 3,950 | 100% | 4,025 | 100% | 4,100 | 100% | 3,990 | 100% |
| 103FH059 | 3,500 | 3,865 | 100% | 4,220 | 100% | 4,153 | 100% | 4,089 | 100% |
| 103FH062 | 3,500 | 5,839 | 100% | 7,736 | 100% | 7,473 | 100% | 7,313 | 100% |
| 103FH064 | 3,500 | 3,864 | 100% | 4,221 | 100% | 4,152 | 100% | 4,087 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 103FH067 | 3,500 | 3,638 | 100% | 3,923 | 100% | 3,858 | 100% | 3,797 | 100% |
| 103FH070 | 3,500 | 3,553 | 100% | 3,825 | 100% | 3,763 | 100% | 3,703 | 100% |
| 103FH071 | 3,500 | 3,750 | 100% | 4,079 | 100% | 4,008 | 100% | 3,943 | 100% |
| 103FH075 | 3,500 | 5,187 | 100% | 6,634 | 100% | 6,418 | 100% | 6,281 | 100% |
| 103FH078 | 3,500 | 4,601 | 100% | 5,499 | 100% | 5,342 | 100% | 5,238 | 100% |
| 103FH082 | 3,500 | 3,769 | 100% | 4,135 | 100% | 4,058 | 100% | 3,988 | 100% |
| 103FH083 | 3,500 | 3,912 | 100% | 4,403 | 100% | 4,300 | 100% | 4,223 | 100% |
| 103FH086 | 3,500 | 3,865 | 100% | 4,285 | 100% | 4,197 | 100% | 4,122 | 100% |
| 103FH091 | 3,000 | 4,380 | 100% | 4,530 | 100% | 4,597 | 100% | 4,480 | 100% |
| 103FH092 | 3,000 | 3,739 | 100% | 3,792 | 100% | 3,828 | 100% | 3,741 | 100% |
| 103FH093 | 3,000 | 3,801 | 100% | 3,861 | 100% | 3,903 | 100% | 3,812 | 100% |
| 103FH094 | 3,000 | 3,640 | 100% | 3,676 | 100% | 3,712 | 100% | 3,628 | 100% |
| 103FH095 | 3,000 | 3,871 | 100% | 3,935 | 100% | 3,985 | 100% | 3,892 | 100% |
| 103FH096 | 3,000 | 3,568 | 100% | 3,592 | 100% | 3,627 | 100% | 3,548 | 100% |
| 103FH098 | 3,000 | 3,704 | 100% | 3,745 | 100% | 3,786 | 100% | 3,701 | 100% |
| 103FH099 | 3,000 | 3,495 | 100% | 3,512 | 100% | 3,541 | 100% | 3,467 | 100% |
| 103FH108 | 3,000 | 5,973 | 100% | 6,304 | 100% | 6,248 | 100% | 6,181 | 100% |
| 103FH109 | 3,000 | 5,517 | 100% | 5,733 | 100% | 5,682 | 100% | 5,625 | 100% |
| 103FH110 | 3,500 | 5,465 | 100% | 5,650 | 100% | 5,602 | 100% | 5,548 | 100% |
| 103FH111 | 3,500 | 7,398 | 100% | 8,033 | 100% | 7,945 | 100% | 7,862 | 100% |
| 103FH112 | 3,500 | 6,650 | 100% | 7,391 | 100% | 7,361 | 100% | 7,244 | 100% |
| 103FH113 | 3,500 | 6,185 | 100% | 6,749 | 100% | 6,795 | 100% | 6,674 | 100% |
| 103FH114 | 3,500 | 7,077 | 100% | 8,001 | 100% | 8,093 | 100% | 7,931 | 100% |
| 103FH115 | 3,500 | 6,511 | 100% | 7,175 | 100% | 7,337 | 100% | 7,182 | 100% |
| 103FH116 | 3,500 | 5,884 | 100% | 6,339 | 100% | 6,571 | 100% | 6,422 | 100% |
| 103FH117 | 3,500 | 5,069 | 100% | 5,317 | 100% | 5,568 | 100% | 5,432 | 100% |
| 103FH119 | 3,000 | 3,960 | 100% | 4,036 | 100% | 4,096 | 100% | 3,996 | 100% |
| 103FH120 | 3,000 | 3,498 | 100% | 3,512 | 100% | 3,545 | 100% | 3,467 | 100% |
| 103FH121 | 3,000 | 4,116 | 100% | 4,224 | 100% | 4,271 | 100% | 4,169 | 100% |
| 103FH122 | 3,000 | 4,074 | 100% | 4,174 | 100% | 4,216 | 100% | 4,119 | 100% |
| 103FH123 | 3,000 | 4,055 | 100% | 4,153 | 100% | 4,196 | 100% | 4,097 | 100% |
| 103FH124 | 3,500 | 4,422 | 100% | 4,579 | 100% | 4,635 | 100% | 4,520 | 100% |
| 103FH125 | 3,500 | 4,743 | 100% | 5,833 | 100% | 5,652 | 100% | 5,536 | 100% |
| 103FH126 | 3,500 | 5,591 | 100% | 7,654 | 100% | 7,379 | 100% | 7,212 | 100% |
| 103FH130 | 3,500 | 4,897 | 100% | 5,199 | 100% | 5,142 | 100% | 5,082 | 100% |
| 103FH131 | 3,000 | 4,380 | 100% | 4,414 | 100% | 4,448 | 100% | 4,371 | 100% |
| 103FH133 | 3,500 | 3,879 | 100% | 3,638 | 100% | 3,628 | 100% | 3,617 | 100% |
| 103FH135 | 3,000 | 3,573 | 100% | 3,595 | 100% | 3,628 | 100% | 3,554 | 100% |
| 103FH136 | 3,000 | 3,759 | 100% | 3,804 | 100% | 3,843 | 100% | 3,760 | 100% |
| 103FH137 | 3,000 | 6,600 | 100% | 7,181 | 100% | 7,102 | 100% | 7,024 | 100% |
| 103FH138 | 3,000 | 3,458 | 100% | 3,468 | 100% | 3,498 | 100% | 3,425 | 100% |
| 103FH139 | 3,000 | 5,214 | 100% | 5,505 | 100% | 5,765 | 100% | 5,611 | 100% |
| 103FH140 | 3,000 | 4,688 | 100% | 4,867 | 100% | 5,037 | 100% | 4,909 | 100% |
| 103FH142 | 3,500 | 5,354 | 100% | 5,673 | 100% | 5,985 | 100% | 5,826 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 103FH143 | 3,500 | 4,314 | 100% | 4,414 | 100% | 4,546 | 100% | 4,442 | 100% |
| 103FH149 | 3,500 | 5,014 | 100% | 5,253 | 100% | 5,482 | 100% | 5,343 | 100% |
| 103FH150 | 3,000 | 3,843 | 100% | 3,847 | 100% | 3,823 | 100% | 3,780 | 100% |
| 103FH151 | 3,000 | 3,930 | 100% | 3,949 | 100% | 3,928 | 100% | 3,886 | 100% |
| 104FH003 | 3,500 | 4,276 | 100% | 4,124 | 100% | 4,095 | 100% | 4,073 | 100% |
| 104FH005 | 3,500 | 7,199 | 100% | 7,505 | 100% | 7,427 | 100% | 7,358 | 100% |
| 104FH006 | 3,500 | 6,687 | 100% | 6,958 | 100% | 6,885 | 100% | 6,821 | 100% |
| 104FH008 | 3,000 | 4,672 | 100% | 4,618 | 100% | 4,580 | 100% | 4,551 | 100% |
| 104FH009 | 3,000 | 4,497 | 100% | 4,430 | 100% | 4,394 | 100% | 4,368 | 100% |
| 104FH011 | 3,000 | 4,990 | 100% | 4,962 | 100% | 4,921 | 100% | 4,888 | 100% |
| 104FH012 | 3,500 | 6,210 | 100% | 6,649 | 100% | 6,576 | 100% | 6,510 | 100% |
| 104FH013 | 3,500 | 5,088 | 100% | 5,076 | 100% | 5,033 | 100% | 4,998 | 100% |
| 104FH014 | 3,500 | 6,232 | 100% | 6,848 | 100% | 6,753 | 100% | 6,676 | 100% |
| 104FH016 | 3,000 | 4,677 | 100% | 5,084 | 100% | 5,018 | 100% | 4,960 | 100% |
| 104FH017 | 2,500 | 7,731 | 100% | 9,553 | 100% | 9,352 | 100% | 9,236 | 100% |
| 104FH018 | 3,000 | 9,754 | 100% | 14,439 | 100% | 14,128 | 100% | 13,929 | 100% |
| 104FH019 | 1,500 | 8,312 | 100% | 11,147 | 100% | 10,883 | 100% | 10,738 | 100% |
| 104FH020 | 3,500 | 11,194 | 100% | 19,871 | 100% | 19,597 | 100% | 19,079 | 100% |
| 104FH022 | 3,500 | 5,974 | 100% | 6,042 | 100% | 5,985 | 100% | 5,938 | 100% |
| 104FH026 | 2,500 | 3,188 | 100% | 3,518 | 100% | 3,467 | 100% | 3,427 | 100% |
| 104FH027 | 2,500 | 3,104 | 100% | 3,417 | 100% | 3,367 | 100% | 3,328 | 100% |
| 104FH028 | 2,500 | 3,063 | 100% | 3,350 | 100% | 3,303 | 100% | 3,266 | 100% |
| 104FH030 | 3,000 | 3,510 | 100% | 3,922 | 100% | 3,865 | 100% | 3,820 | 100% |
| 104FH032 | 3,000 | 4,854 | 100% | 5,958 | 100% | 5,847 | 100% | 5,773 | 100% |
| 104FH033 | 3,000 | 3,761 | 100% | 3,965 | 100% | 3,919 | 100% | 3,878 | 100% |
| 104FH039 | 3,000 | 3,876 | 100% | 4,428 | 100% | 4,362 | 100% | 4,309 | 100% |
| 104FH046 | 1,500 | 1,964 | 100% | 2,075 | 100% | 2,041 | 100% | 2,015 | 100% |
| 104FH048 | 1,500 | 4,910 | 100% | 6,613 | 100% | 6,395 | 100% | 6,284 | 100% |
| 104FH049 | 3,000 | 3,928 | 100% | 5,004 | 100% | 4,865 | 100% | 4,789 | 100% |
| 104FH051 | 2,500 | 2,978 | 100% | 4,636 | 100% | 4,332 | 100% | 4,184 | 100% |
| 104FH052 | 3,500 | 3,821 | 100% | 4,146 | 100% | 4,094 | 100% | 4,036 | 100% |
| 104FH063 | 1,500 | 3,620 | 100% | 4,313 | 100% | 4,159 | 100% | 4,076 | 100% |
| 104FH064 | 1,500 | 2,716 | 100% | 3,007 | 100% | 2,910 | 100% | 2,857 | 100% |
| 104FH065 | 1,500 | 2,627 | 100% | 2,910 | 100% | 2,815 | 100% | 2,762 | 100% |
| 104FH066 | 1,500 | 1,569 | 100% | 1,627 | 100% | 1,586 | 100% | 1,558 | 100% |
| 104FH067 | 1,500 | 1,606 | 100% | 1,670 | 100% | 1,623 | 100% | 1,592 | 100% |
| 104FH068 | 1,500 | 2,034 | 100% | 2,195 | 100% | 2,122 | 100% | 2,078 | 100% |
| 104FH069 | 1,500 | 1,797 | 100% | 1,893 | 100% | 1,831 | 100% | 1,793 | 100% |
| 104FH070 | 1,500 | 7,775 | 100% | 10,563 | 100% | 10,305 | 100% | 10,166 | 100% |
| 104FH071 | 3,500 | 6,597 | 100% | 7,277 | 100% | 7,184 | 100% | 7,098 | 100% |
| 104FH072 | 3,500 | 6,094 | 100% | 6,564 | 100% | 6,490 | 100% | 6,420 | 100% |
| 104FH073 | 3,500 | 5,448 | 100% | 5,475 | 100% | 5,422 | 100% | 5,380 | 100% |
| 104FH074 | 1,500 | 5,389 | 100% | 7,420 | 100% | 7,198 | 100% | 7,083 | 100% |
| 104FH075 | 1,500 | 4,197 | 100% | 5,140 | 100% | 5,012 | 100% | 4,935 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 104FH077 | 1,500 | 4,141 | 100% | 5,062 | 100% | 4,890 | 100% | 4,795 | 100% |
| 104FH079 | 1,500 | 3,317 | 100% | 3,850 | 100% | 3,727 | 100% | 3,655 | 100% |
| 104FH080 | 1,500 | 3,407 | 100% | 3,942 | 100% | 3,826 | 100% | 3,755 | 100% |
| 104FH081 | 1,500 | 4,727 | 100% | 6,023 | 100% | 5,817 | 100% | 5,703 | 100% |
| 104FH082 | 1,500 | 4,603 | 100% | 5,851 | 100% | 5,646 | 100% | 5,533 | 100% |
| 104FH083 | 1,500 | 4,644 | 100% | 6,013 | 100% | 5,790 | 100% | 5,667 | 100% |
| 104FH084 | 1,500 | 4,661 | 100% | 5,988 | 100% | 5,772 | 100% | 5,655 | 100% |
| 104FH085 | 1,500 | 3,811 | 100% | 4,821 | 100% | 4,606 | 100% | 4,499 | 100% |
| 104FH086 | 1,500 | 2,705 | 100% | 3,103 | 100% | 2,991 | 100% | 2,920 | 100% |
| 104FH087 | 1,500 | 3,737 | 100% | 4,569 | 100% | 4,405 | 100% | 4,307 | 100% |
| 104FH088 | 1,500 | 3,938 | 100% | 4,820 | 100% | 4,655 | 100% | 4,556 | 100% |
| 104FH089 | 3,500 | 8,264 | 100% | 11,000 | 100% | 10,728 | 100% | 10,575 | 100% |
| 104FH091 | 1,500 | 4,173 | 100% | 5,222 | 100% | 5,054 | 100% | 4,953 | 100% |
| 104FH092 | 1,500 | 4,392 | 100% | 6,028 | 100% | 5,777 | 100% | 5,641 | 100% |
| 104FH093 | 1,500 | 4,215 | 100% | 5,350 | 100% | 5,178 | 100% | 5,076 | 100% |
| 104FH094 | 1,500 | 2,782 | 100% | 3,272 | 100% | 3,169 | 100% | 3,102 | 100% |
| 104FH095 | 1,500 | 4,070 | 100% | 5,565 | 100% | 5,327 | 100% | 5,201 | 100% |
| 104FH096 | 3,000 | 4,695 | 100% | 6,847 | 100% | 6,550 | 100% | 6,401 | 100% |
| 104FH097 | 3,000 | 4,738 | 100% | 6,809 | 100% | 6,526 | 100% | 6,384 | 100% |
| 104FH098 | 1,500 | 3,614 | 100% | 4,798 | 100% | 4,585 | 100% | 4,473 | 100% |
| 104FH099 | 1,500 | 3,609 | 100% | 4,688 | 100% | 4,500 | 100% | 4,390 | 100% |
| 104FH100 | 1,500 | 2,698 | 100% | 3,145 | 100% | 3,048 | 100% | 2,984 | 100% |
| 104FH101 | 1,500 | 5,730 | 100% | 7,628 | 100% | 7,382 | 100% | 7,250 | 100% |
| 104FH102 | 1,500 | 2,693 | 100% | 2,962 | 100% | 2,911 | 100% | 2,872 | 100% |
| 104FH105 | 1,500 | 2,969 | 100% | 3,489 | 100% | 3,335 | 100% | 3,261 | 100% |
| 104FH106 | 3,500 | 5,178 | 100% | 5,095 | 100% | 5,049 | 100% | 5,013 | 100% |
| 104FH107 | 3,500 | 7,904 | 100% | 8,301 | 100% | 8,216 | 100% | 8,139 | 100% |
| 104FH108 | 3,000 | 3,068 | 100% | 3,165 | 100% | 3,131 | 100% | 3,101 | 100% |
| 104FH109 | 2,500 | 7,129 | 100% | 11,107 | 100% | 10,820 | 100% | 10,671 | 100% |
| 104FH110 | 2,500 | 7,090 | 100% | 11,024 | 100% | 10,739 | 100% | 10,592 | 100% |
| 104FH111 | 3,000 | 5,288 | 100% | 9,124 | 100% | 8,770 | 100% | 8,593 | 100% |
| 104FH112 | 3,000 | 6,560 | 100% | 10,318 | 100% | 10,031 | 100% | 9,883 | 100% |
| 104FH113 | 3,500 | 5,417 | 100% | 5,332 | 100% | 5,292 | 100% | 5,259 | 100% |
| 104FH114 | 3,000 | 4,403 | 100% | 7,470 | 100% | 7,116 | 100% | 6,946 | 100% |
| 104FH115 | 3,000 | 5,173 | 100% | 6,589 | 100% | 6,459 | 100% | 6,376 | 100% |
| 105FH007 | 1,500 | 2,860 | 100% | 3,460 | 100% | 3,378 | 100% | 3,329 | 100% |
| 105FH010 | 1,500 | 3,129 | 100% | 3,847 | 100% | 3,755 | 100% | 3,702 | 100% |
| 105FH011 | 1,500 | 1,711 | 100% | 3,661 | 100% | 3,575 | 100% | 3,524 | 100% |
| 105FH013 | 1,500 | 3,183 | 100% | 3,812 | 100% | 3,726 | 100% | 3,674 | 100% |
| 105FH014 | 1,500 | 3,762 | 100% | 4,869 | 100% | 4,743 | 100% | 4,677 | 100% |
| 105FH017 | 3,500 | 3,785 | 100% | 4,717 | 100% | 4,604 | 100% | 4,541 | 100% |
| 105FH019 | 1,500 | 4,098 | 100% | 5,447 | 100% | 5,304 | 100% | 5,231 | 100% |
| 105FH021 | 3,000 | 4,885 | 100% | 7,111 | 100% | 6,899 | 100% | 6,807 | 100% |
| 105FH022 | 3,500 | 4,237 | 100% | 5,483 | 100% | 5,343 | 100% | 5,270 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 105FH025 | 1,500 | 5,296 | 100% | 8,019 | 100% | 7,776 | 100% | 7,670 | 100% |
| 105FH026 | 1,500 | 1,789 | 100% | 1,979 | 100% | 1,938 | 100% | 1,914 | 100% |
| 105FH028 | 2,500 | 5,347 | 100% | 7,738 | 100% | 7,516 | 100% | 7,416 | 100% |
| 105FH029 | 2,500 | 2,517 | 100% | 2,924 | 100% | 2,861 | 100% | 2,822 | 100% |
| 105FH034 | 3,500 | 4,251 | 100% | 5,749 | 100% | 5,611 | 100% | 5,530 | 100% |
| 105FH040 | 3,500 | 5,952 | 100% | 10,197 | 100% | 9,876 | 100% | 9,751 | 100% |
| 105FH043 | 3,500 | 5,141 | 100% | 7,799 | 100% | 7,570 | 100% | 7,470 | 100% |
| 105FH045 | 3,500 | 4,058 | 100% | 5,551 | 100% | 5,402 | 100% | 5,327 | 100% |
| 105FH047 | 3,500 | 4,614 | 100% | 6,622 | 100% | 6,431 | 100% | 6,344 | 100% |
| 105FH049 | 3,500 | 4,051 | 100% | 5,441 | 100% | 5,300 | 100% | 5,229 | 100% |
| 105FH054 | 1,500 | 3,700 | 100% | 4,609 | 100% | 4,503 | 100% | 4,445 | 100% |
| 105FH055 | 1,500 | 2,196 | 100% | 2,496 | 100% | 2,443 | 100% | 2,412 | 100% |
| 105FH056 | 3,000 | 4,296 | 100% | 5,546 | 100% | 5,408 | 100% | 5,338 | 100% |
| 105FH057 | 1,500 | 2,090 | 100% | 2,334 | 100% | 2,291 | 100% | 2,261 | 100% |
| 105FH063 | 3,500 | 4,108 | 100% | 5,129 | 100% | 5,003 | 100% | 4,937 | 100% |
| 105FH064 | 3,500 | 3,962 | 100% | 4,918 | 100% | 4,796 | 100% | 4,731 | 100% |
| 105FH065 | 2,500 | 3,149 | 100% | 3,727 | 100% | 3,646 | 100% | 3,594 | 100% |
| 105FH066 | 2,500 | 2,638 | 100% | 3,154 | 100% | 3,077 | 100% | 3,021 | 100% |
| 105FH067 | 2,500 | 2,683 | 100% | 3,237 | 100% | 3,156 | 100% | 3,096 | 100% |
| 105FH068 | 2,500 | 3,677 | 100% | 5,339 | 100% | 5,092 | 100% | 4,977 | 100% |
| 105FH069 | 1,500 | 1,584 | 100% | 1,798 | 100% | 1,752 | 100% | 1,715 | 100% |
| 105FH075 | 1,500 | 5,626 | 100% | 9,529 | 100% | 9,257 | 100% | 9,138 | 100% |
| 105FH076 | 1,500 | 3,342 | 100% | 4,211 | 100% | 4,094 | 100% | 4,037 | 100% |
| 105FH077 | 1,500 | 2,432 | 100% | 2,872 | 100% | 2,794 | 100% | 2,754 | 100% |
| 105FH087 | 1,500 | 2,660 | 100% | 3,086 | 100% | 3,022 | 100% | 2,981 | 100% |
| 105FH088 | 2,500 | 3,900 | 100% | 4,824 | 100% | 4,702 | 100% | 4,637 | 100% |
| 105FH089 | 2,500 | 4,012 | 100% | 5,225 | 100% | 5,094 | 100% | 5,027 | 100% |
| 105FH094 | 3,000 | 3,184 | 100% | 5,704 | 100% | 5,307 | 100% | 5,120 | 100% |
| 105FH097 | 3,000 | 3,085 | 100% | 5,157 | 100% | 4,818 | 100% | 4,657 | 100% |
| 105FH099 | 1,500 | 3,595 | 100% | 4,458 | 100% | 4,354 | 100% | 4,297 | 100% |
| 105FH100 | 2,500 | 3,248 | 100% | 3,991 | 100% | 3,898 | 100% | 3,846 | 100% |
| 105FH101 | 3,000 | 4,671 | 100% | 6,628 | 100% | 6,437 | 100% | 6,350 | 100% |
| 105FH102 | 1,500 | 5,317 | 100% | 8,396 | 100% | 8,135 | 100% | 8,035 | 100% |
| 105FH103 | 3,500 | 4,469 | 100% | 6,245 | 100% | 6,083 | 100% | 6,001 | 100% |
| 105FH104 | 3,500 | 5,328 | 100% | 8,440 | 100% | 8,177 | 100% | 8,075 | 100% |
| 105FH105 | 3,500 | 6,008 | 100% | 10,533 | 100% | 10,218 | 100% | 10,096 | 100% |
| 105FH106 | 3,500 | 6,357 | 100% | 12,031 | 100% | 11,710 | 100% | 11,566 | 100% |
| 105FH107 | 3,500 | 6,694 | 100% | 13,220 | 100% | 12,924 | 100% | 12,763 | 100% |
| 105FH108 | 3,500 | 6,533 | 100% | 12,574 | 100% | 12,288 | 100% | 12,141 | 100% |
| 105FH109 | 3,000 | 6,078 | 100% | 10,450 | 100% | 10,131 | 100% | 10,005 | 100% |
| 105FH110 | 3,500 | 3,931 | 100% | 5,367 | 100% | 5,240 | 100% | 5,167 | 100% |
| 106FH001 | 1,500 | 2,733 | 100% | 2,755 | 100% | 2,742 | 100% | 2,720 | 100% |
| 106FH002 | 1,500 | 2,051 | 100% | 2,104 | 100% | 2,095 | 100% | 2,078 | 100% |
| 106FH003 | 1,500 | 2,054 | 100% | 2,159 | 100% | 2,149 | 100% | 2,131 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 107FH001 | 1,500 | 2,455 | 100% | 2,447 | 100% | 2,447 | 100% | 2,433 | 100% |
| 107FH002 | 1,500 | 2,996 | 100% | 2,971 | 100% | 2,962 | 100% | 2,943 | 100% |
| 107FH003 | 1,500 | 2,646 | 100% | 2,637 | 100% | 2,631 | 100% | 2,615 | 100% |
| 107FH004 | 3,000 | 4,195 | 100% | 4,274 | 100% | 4,283 | 100% | 4,293 | 100% |
| 107FH005 | 1,500 | 2,179 | 100% | 2,173 | 100% | 2,173 | 100% | 2,166 | 100% |
| 107FH006 | 1,500 | 4,374 | 100% | 4,457 | 100% | 4,466 | 100% | 4,478 | 100% |
| 107FH007 | 3,500 | 5,159 | 100% | 6,456 | 100% | 6,479 | 100% | 6,526 | 100% |
| 107FH008 | 3,500 | 5,812 | 100% | 7,907 | 100% | 7,950 | 100% | 8,050 | 100% |
| 107FH009 | 3,500 | 5,964 | 100% | 8,293 | 100% | 8,327 | 100% | 8,405 | 100% |
| 107FH010 | 3,500 | 4,370 | 100% | 5,141 | 100% | 5,156 | 100% | 5,180 | 100% |
| 107FH011 | 3,500 | 3,792 | 100% | 4,265 | 100% | 4,274 | 100% | 4,285 | 100% |
| 107FH012 | 3,500 | 4,218 | 100% | 4,898 | 100% | 4,911 | 100% | 4,931 | 100% |
| 107FH013 | 3,500 | 4,874 | 100% | 6,197 | 100% | 6,210 | 100% | 6,232 | 100% |
| 107FH015 | 3,500 | 4,418 | 100% | 5,852 | 100% | 5,862 | 100% | 5,872 | 100% |
| 107FH016 | 3,500 | 3,604 | 100% | 4,006 | 100% | 4,014 | 100% | 4,022 | 100% |
| 107FH027 | 3,500 | 5,838 | 100% | 7,804 | 100% | 7,835 | 100% | 7,912 | 100% |
| 107FH028 | 3,500 | 4,762 | 100% | 6,406 | 100% | 6,418 | 100% | 6,437 | 100% |
| 107FH029 | 3,500 | 5,506 | 100% | 7,607 | 100% | 7,630 | 100% | 7,680 | 100% |
| 107FH031 | 3,500 | 3,513 | 100% | 3,966 | 100% | 3,971 | 100% | 3,970 | 100% |
| 107FH032 | 3,500 | 3,724 | 100% | 4,187 | 100% | 4,197 | 100% | 4,207 | 100% |
| 107FH033 | 3,500 | 4,258 | 100% | 4,977 | 100% | 4,991 | 100% | 5,012 | 100% |
| 108FH001 | 3,500 | 4,418 | 100% | 5,121 | 100% | 5,157 | 100% | 5,211 | 100% |
| 108FH002 | 1,500 | 4,422 | 100% | 4,501 | 100% | 4,510 | 100% | 4,522 | 100% |
| 108FH004 | 3,000 | 4,596 | 100% | 4,734 | 100% | 4,761 | 100% | 4,796 | 100% |
| 108FH006 | 1,500 | 6,295 | 100% | 6,582 | 100% | 6,602 | 100% | 6,655 | 100% |
| 108FH007 | 1,500 | 5,146 | 100% | 5,251 | 100% | 5,263 | 100% | 5,281 | 100% |
| 108FH008 | 3,500 | 5,770 | 100% | 6,289 | 100% | 6,353 | 100% | 6,447 | 100% |
| 108FH009 | 3,500 | 4,287 | 100% | 5,095 | 100% | 5,132 | 100% | 5,187 | 100% |
| 108FH010 | 1,500 | 4,593 | 100% | 4,674 | 100% | 4,684 | 100% | 4,697 | 100% |
| 108FH011 | 1,500 | 5,646 | 100% | 5,818 | 100% | 5,833 | 100% | 5,864 | 100% |
| 108FH012 | 3,000 | 4,053 | 100% | 4,166 | 100% | 4,186 | 100% | 4,210 | 100% |
| 108FH013 | 3,500 | 5,255 | 100% | 5,640 | 100% | 5,686 | 100% | 5,762 | 100% |
| 108FH014 | 3,500 | 4,412 | 100% | 4,598 | 100% | 4,641 | 100% | 4,702 | 100% |
| 108FH015 | 3,500 | 5,010 | 100% | 5,129 | 100% | 5,141 | 100% | 5,160 | 100% |
| 108FH016 | 3,500 | 4,729 | 100% | 5,351 | 100% | 5,393 | 100% | 5,461 | 100% |
| 108FH017 | 3,500 | 5,091 | 100% | 5,381 | 100% | 5,451 | 100% | 5,549 | 100% |
| 108FH018 | 3,000 | 5,511 | 100% | 5,960 | 100% | 6,018 | 100% | 6,113 | 100% |
| 108FH019 | 3,500 | 6,107 | 100% | 6,682 | 100% | 6,797 | 100% | 6,981 | 100% |
| 108FH020 | 3,000 | 4,642 | 100% | 4,848 | 100% | 4,877 | 100% | 4,922 | 100% |
| 108FH021 | 3,500 | 6,133 | 100% | 6,806 | 100% | 6,916 | 100% | 7,111 | 100% |
| 108FH023 | 3,000 | 3,974 | 100% | 4,090 | 100% | 4,109 | 100% | 4,130 | 100% |
| 108FH024 | 3,500 | 6,435 | 100% | 7,420 | 100% | 7,547 | 100% | 7,799 | 100% |
| 108FH026 | 3,500 | 4,341 | 100% | 4,757 | 100% | 4,789 | 100% | 4,924 | 100% |
| 108FH027 | 3,500 | 6,076 | 100% | 7,621 | 100% | 7,719 | 100% | 7,998 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 108FH028 | 3,500 | 4,679 | 100% | 5,572 | 100% | 5,600 | 100% | 5,675 | 100% |
| 108FH029 | 3,500 | 5,142 | 100% | 5,804 | 100% | 5,859 | 100% | 6,064 | 100% |
| 108FH030 | 3,500 | 4,862 | 100% | 5,750 | 100% | 5,784 | 100% | 5,882 | 100% |
| 108FH031 | 3,500 | 6,028 | 100% | 7,668 | 100% | 7,760 | 100% | 8,028 | 100% |
| 108FH032 | 3,500 | 4,954 | 100% | 5,668 | 100% | 5,712 | 100% | 5,832 | 100% |
| 108FH033 | 3,500 | 4,437 | 100% | 4,923 | 100% | 4,958 | 100% | 5,132 | 100% |
| 108FH034 | 3,500 | 5,245 | 100% | 6,134 | 100% | 6,185 | 100% | 6,336 | 100% |
| 108FH035 | 3,500 | 4,673 | 100% | 5,210 | 100% | 5,254 | 100% | 5,411 | 100% |
| 108FH037 | 3,500 | 4,223 | 100% | 4,640 | 100% | 4,663 | 100% | 4,718 | 100% |
| 108FH038 | 3,500 | 5,510 | 100% | 6,699 | 100% | 6,789 | 100% | 7,411 | 100% |
| 108FH039 | 3,500 | 5,333 | 100% | 6,224 | 100% | 6,294 | 100% | 6,574 | 100% |
| 108FH040 | 3,500 | 6,430 | 100% | 6,895 | 100% | 6,980 | 100% | 7,097 | 100% |
| 108FH041 | 3,500 | 6,372 | 100% | 6,748 | 100% | 6,823 | 100% | 6,925 | 100% |
| 108FH042 | 3,500 | 6,181 | 100% | 6,479 | 100% | 6,544 | 100% | 6,631 | 100% |
| 108FH043 | 3,500 | 5,371 | 100% | 6,241 | 100% | 6,306 | 100% | 6,491 | 100% |
| 108FH045 | 3,500 | 6,315 | 100% | 7,810 | 100% | 7,941 | 100% | 8,331 | 100% |
| 108FH046 | 3,500 | 5,129 | 100% | 5,916 | 100% | 5,974 | 100% | 6,176 | 100% |
| 108FH047 | 3,000 | 5,295 | 100% | 5,624 | 100% | 5,669 | 100% | 5,745 | 100% |
| 108FH048 | 3,500 | 6,109 | 100% | 7,444 | 100% | 7,559 | 100% | 7,916 | 100% |
| 108FH049 | 3,500 | 5,131 | 100% | 5,981 | 100% | 6,048 | 100% | 6,947 | 100% |
| 108FH050 | 3,500 | 4,523 | 100% | 5,085 | 100% | 5,124 | 100% | 5,585 | 100% |
| 108FH051 | 3,500 | 4,232 | 100% | 4,716 | 100% | 4,749 | 100% | 5,107 | 100% |
| 108FH052 | 3,500 | 4,201 | 100% | 4,699 | 100% | 4,732 | 100% | 5,077 | 100% |
| 108FH053 | 3,500 | 4,563 | 100% | 5,218 | 100% | 5,259 | 100% | 5,703 | 100% |
| 108FH054 | 3,500 | 3,995 | 100% | 4,423 | 100% | 4,450 | 100% | 4,712 | 100% |
| 108FH055 | 3,500 | 5,186 | 100% | 6,257 | 100% | 6,349 | 100% | 7,692 | 100% |
| 108FH056 | 3,500 | 4,455 | 100% | 5,071 | 100% | 5,115 | 100% | 5,638 | 100% |
| 108FH057 | 3,500 | 4,308 | 100% | 4,834 | 100% | 4,870 | 100% | 5,258 | 100% |
| 108FH058 | 3,500 | 4,374 | 100% | 4,953 | 100% | 4,991 | 100% | 5,390 | 100% |
| 108FH059 | 3,500 | 5,069 | 100% | 6,022 | 100% | 6,082 | 100% | 6,746 | 100% |
| 108FH060 | 3,500 | 5,096 | 100% | 6,069 | 100% | 6,131 | 100% | 6,753 | 100% |
| 108FH061 | 3,500 | 4,349 | 100% | 4,988 | 100% | 5,033 | 100% | 5,522 | 100% |
| 108FH062 | 3,500 | 4,812 | 100% | 5,600 | 100% | 5,663 | 100% | 6,562 | 100% |
| 108FH063 | 3,000 | 5,187 | 100% | 6,021 | 100% | 6,108 | 100% | 8,865 | 100% |
| 108FH064 | 3,500 | 5,012 | 100% | 6,149 | 100% | 6,199 | 100% | 6,613 | 100% |
| 108FH065 | 3,500 | 5,066 | 100% | 6,349 | 100% | 6,393 | 100% | 6,702 | 100% |
| 108FH066 | 3,500 | 5,098 | 100% | 6,652 | 100% | 6,692 | 100% | 6,917 | 100% |
| 108FH067 | 3,500 | 4,284 | 100% | 8,256 | 100% | 8,276 | 100% | 8,295 | 100% |
| 108FH068 | 3,500 | 4,543 | 100% | 7,033 | 100% | 7,055 | 100% | 7,089 | 100% |
| 108FH069 | 3,500 | 4,925 | 100% | 6,994 | 100% | 7,022 | 100% | 7,078 | 100% |
| 108FH070 | 3,500 | 5,715 | 100% | 8,197 | 100% | 8,256 | 100% | 8,390 | 100% |
| 108FH071 | 3,500 | 5,034 | 100% | 6,040 | 100% | 6,096 | 100% | 6,640 | 100% |
| 108FH072 | 3,500 | 4,470 | 100% | 5,179 | 100% | 5,218 | 100% | 5,277 | 100% |
| 108FH073 | 3,500 | 4,145 | 100% | 4,747 | 100% | 4,772 | 100% | 4,952 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 109FH001 | 3,500 | 6,384 | 100% | 6,875 | 100% | 7,098 | 100% | 7,340 | 100% |
| 109FH002 | 3,500 | 4,654 | 100% | 4,808 | 100% | 4,895 | 100% | 4,978 | 100% |
| 109FH003 | 3,500 | 5,617 | 100% | 5,980 | 100% | 6,113 | 100% | 6,265 | 100% |
| 109FH004 | 3,500 | 4,899 | 100% | 5,079 | 100% | 5,179 | 100% | 5,277 | 100% |
| 109FH005 | 3,500 | 5,895 | 100% | 6,337 | 100% | 6,470 | 100% | 6,639 | 100% |
| 109FH006 | 3,500 | 4,927 | 100% | 5,108 | 100% | 5,210 | 100% | 5,309 | 100% |
| 109FH007 | 3,500 | 4,945 | 100% | 5,128 | 100% | 5,232 | 100% | 5,333 | 100% |
| 109FH008 | 3,500 | 6,073 | 100% | 7,086 | 100% | 7,243 | 100% | 9,494 | 100% |
| 109FH009 | 3,500 | 6,318 | 100% | 7,202 | 100% | 7,374 | 100% | 9,526 | 100% |
| 109FH010 | 3,500 | 6,308 | 100% | 7,080 | 100% | 7,266 | 100% | 9,653 | 100% |
| 109FH011 | 3,500 | 6,315 | 100% | 7,019 | 100% | 7,230 | 100% | 10,340 | 100% |
| 109FH012 | 500 | 6,418 | 100% | 7,107 | 100% | 7,358 | 100% | 9,590 | 100% |
| 118FH002 | 1,500 | 1,934 | 100% | 2,296 | 100% | 2,182 | 100% | 2,117 | 100% |
| 118FH004 | 1,500 | 1,728 | 100% | 2,016 | 100% | 1,900 | 100% | 1,827 | 100% |
| 118FH005 | 1,500 | 1,705 | 100% | 1,977 | 100% | 1,863 | 100% | 1,791 | 100% |
| 118FH006 | 1,500 | 1,776 | 100% | 2,039 | 100% | 1,927 | 100% | 1,860 | 100% |
| 118FH008 | 1,500 | 1,673 | 100% | 2,028 | 100% | 1,898 | 100% | 1,838 | 100% |
| 118FH009 | 1,500 | 2,027 | 100% | 2,479 | 100% | 2,316 | 100% | 2,219 | 100% |
| 118FH011 | 1,500 | 1,732 | 100% | 2,041 | 100% | 1,913 | 100% | 1,834 | 100% |
| 118FH013 | 1,500 | 1,721 | 100% | 2,091 | 100% | 1,953 | 100% | 1,885 | 100% |
| 118FH014 | 1,500 | 2,588 | 100% | 3,464 | 100% | 3,208 | 100% | 3,071 | 100% |
| 118FH015 | 1,500 | 2,698 | 100% | 3,726 | 100% | 3,433 | 100% | 3,280 | 100% |
| 118FH016 | 1,500 | 2,533 | 100% | 3,373 | 100% | 3,124 | 100% | 2,987 | 100% |
| 118FH017 | 1,500 | 1,593 | 100% | 1,859 | 100% | 1,740 | 100% | 1,667 | 100% |
| 118FH018 | 1,500 | 1,604 | 100% | 1,692 | 100% | 1,642 | 100% | 1,606 | 100% |
| 118FH019 | 1,500 | 2,424 | 100% | 3,006 | 100% | 2,823 | 100% | 2,720 | 100% |
| 118FH020 | 1,500 | 2,432 | 100% | 3,012 | 100% | 2,828 | 100% | 2,726 | 100% |
| 118FH021 | 1,500 | 2,400 | 100% | 2,954 | 100% | 2,773 | 100% | 2,674 | 100% |
| 118FH022 | 1,500 | 1,794 | 100% | 2,005 | 100% | 1,906 | 100% | 1,852 | 100% |
| 118FH024 | 1,500 | 2,274 | 100% | 2,885 | 100% | 2,678 | 100% | 2,562 | 100% |
| 118FH025 | 1,500 | 2,296 | 100% | 2,945 | 100% | 2,731 | 100% | 2,609 | 100% |
| 118FH026 | 1,500 | 2,027 | 100% | 2,400 | 100% | 2,265 | 100% | 2,198 | 100% |
| 118FH029 | 1,500 | 1,544 | 100% | 1,848 | 100% | 1,704 | 100% | 1,612 | 100% |
| 118FH030 | 1,500 | 1,813 | 100% | 2,154 | 100% | 2,021 | 100% | 1,952 | 100% |
| 118FH033 | 1,500 | 1,760 | 100% | 2,200 | 100% | 2,036 | 100% | 1,935 | 100% |
| 118FH035 | 1,500 | 1,790 | 100% | 2,183 | 100% | 2,040 | 100% | 1,952 | 100% |
| 118FH037 | 1,500 | 2,487 | 100% | 3,432 | 100% | 3,178 | 100% | 3,086 | 100% |
| 118FH043 | 1,500 | 2,489 | 100% | 3,745 | 100% | 3,441 | 100% | 3,328 | 100% |
| 118FH044 | 1,500 | 2,038 | 100% | 2,991 | 100% | 2,700 | 100% | 2,563 | 100% |
| 118FH045 | 1,500 | 2,489 | 100% | 4,050 | 100% | 3,721 | 100% | 3,593 | 100% |
| 118FH046 | 1,500 | 1,928 | 100% | 3,391 | 100% | 3,013 | 100% | 2,863 | 100% |
| 118FH047 | 1,500 | 2,313 | 100% | 4,118 | 100% | 3,764 | 100% | 3,624 | 100% |
| 118FH050 | 1,500 | 1,922 | 100% | 3,569 | 100% | 3,165 | 100% | 3,006 | 100% |
| 118FH051 | 1,500 | 2,232 | 100% | 4,535 | 100% | 4,169 | 100% | 4,010 | 100% |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 118FH055 | 1,500 | 1,737 | 100% | 3,734 | 100% | 3,364 | 100% | 3,219 | 100% |
| 118FH056 | 1,500 | 1,618 | 100% | 2,829 | 100% | 2,550 | 100% | 2,426 | 100% |
| 118FH057 | 1,500 | 1,697 | 100% | 3,488 | 100% | 3,115 | 100% | 2,973 | 100% |
| 118FH058 | 1,500 | 1,729 | 100% | 3,363 | 100% | 3,020 | 100% | 2,893 | 100% |
| 118FH059 | 1,500 | 1,621 | 100% | 3,260 | 100% | 2,877 | 100% | 2,724 | 100% |
| 118FH061 | 1,500 | 2,298 | 100% | 3,042 | 100% | 2,829 | 100% | 2,725 | 100% |
| 118FH063 | 2,500 | 2,563 | 100% | 3,524 | 100% | 3,235 | 100% | 3,068 | 100% |
| 118FH064 | 2,500 | 2,509 | 100% | 3,513 | 100% | 3,205 | 100% | 3,014 | 100% |
| 118FH065 | 1,500 | 2,000 | 100% | 2,575 | 100% | 2,358 | 100% | 2,212 | 100% |
| 118FH077 | 1,500 | 2,235 | 100% | 2,895 | 100% | 2,674 | 100% | 2,540 | 100% |
| 143FH010 | 3,500 | 3,656 | 100% | 7,183 | 100% | 7,066 | 100% | 6,891 | 100% |
| 143FH011 | 3,500 | 3,511 | 100% | 5,977 | 100% | 5,885 | 100% | 5,752 | 100% |
| 143FH012 | 3,500 | 3,904 | 100% | 7,279 | 100% | 7,148 | 100% | 6,956 | 100% |
| 143FH013 | 3,500 | 3,619 | 100% | 5,758 | 100% | 5,663 | 100% | 5,527 | 100% |
| 143FH014 | 3,500 | 4,113 | 100% | 7,144 | 100% | 7,004 | 100% | 6,800 | 100% |
| 157FH013 | 3,500 | 3,946 | 100% | 5,290 | 100% | 5,186 | 100% | 5,002 | 100% |
| 157FH014 | 3,500 | 4,079 | 100% | 5,576 | 100% | 5,485 | 100% | 5,306 | 100% |
| 157FH015 | 3,500 | 3,563 | 100% | 4,789 | 100% | 4,715 | 100% | 4,577 | 100% |
| 157FH022 | 3,500 | 8,615 | 100% | 9,036 | 100% | 8,842 | 100% | 8,603 | 100% |
| 157FH023 | 3,500 | 3,904 | 100% | 5,912 | 100% | 5,810 | 100% | 5,658 | 100% |
| 157FH024 | 3,500 | 4,500 | 100% | 7,409 | 100% | 7,252 | 100% | 7,018 | 100% |
| 157FH025 | 3,500 | 3,980 | 100% | 5,796 | 100% | 5,685 | 100% | 5,512 | 100% |

# Appendix 5-E
# Distribution System Assessment Method
# Additional Information

- Assessment Means – Asset Attributes and Performance Parameters
- Assessment Method – Scoring Matrix
- Assessment Method - Data Structure Schematic

**REVISED** **8/22/13**

**Water Main Facility ID** Use this GIS field to link together all sources of data

**Asset Attributes**

| Name | Type (LoF/CoF) | GIS Feature Type | Phase | GIS Source | Unit | Data Quality | Obtain From | Comments |
|---|---|---|---|---|---|---|---|---|
| Pipe Material | LoF | Polyline | 1 | Mains | N/A | Good | As-builts, specs, field inspection | Confirm in field |
| Pipe Diameter | LoF | Polyline | 1 | Mains | inches | Good | As-builts, field inspection | Confirm in field |
| Pipe Age | LoF | Polyline | 1 | Mains | years | Fair | Pipe installed date | Convert from year to age by subtracting current year by pipe installed date |
| Surface Conditions | LoF | Polyline | 1 | Mains | N/A | Fair | Aerial, right-of-way, etc. | Assign based on surface - high traffic road, light traffic road, sidewalk, open space, etc. |
| Soil Type | LoF | Polygon | 1 | Soil Types | N/A | Good | USDA SSURGO data | Assign based on USDA SSURGO soil types |
| Pipe Depth | LoF | Polyline | 2 | Mains | feet | None | As-builts, field inspection | Pipe depth is currently not being tracked in GIS but should be collected while in the field and added |
| Pipe Pressure Class | LoF | Polyline | 2 | Mains | N/A | None | As-builts, specs, field inspection | Assign based on as-builts, field inspection, or pipe material |
| Pipe Joint Type | LoF | Polyline | 2 | Mains | N/A | None | As-builts, specs, field inspection | Assign based on as-builts, field inspection, or pipe material |
| Pipe Bedding | LoF | Polyline | 2 | Mains | N/A | None | As-builts, specs, field inspection | Assign based on as-builts or field inspection |
| Trench Backfill | LoF | Polyline | 2 | Mains | N/A | None | As-builts, specs, field inspection | Assign based on as-builts or field inspection |
| Pipe Protection | LoF | Polyline | 2 | Mains | N/A | None | As-builts, specs, field inspection | Assign based on poly wrap, cathodic protection, etc. |
| Pipe Condition | LoF | Polyline | 2 | Mains | N/A | None | Field inspection | Document from field inspection (excellent, good, fair, poor) |
| Pipe Manufacturer | LoF | Polyline | 2 | Mains | N/A | None | Field inspection, submittals | Confirm in field |
| Installation Contractor | LoF | Polyline | 2 | Mains | N/A | None | As-builts, submittals | |
| Soil Corrosivity | LoF | Point | 2 | Soil Points | ohm cm | None | Field soils testing | Assign based on nearest soil inspection point |
| Soil Resistivity | LoF | Point | 2 | Soil Points | ohm cm | None | Field soils testing | Assign based on nearest soil inspection point |
| Redox Potential | LoF | Point | 2 | Soil Points | mV | None | Field soils testing | Assign based on nearest soil inspection point |
| Soil pH | LoF | Point | 2 | Soil Points | pH | None | Field soils testing | Assign based on nearest soil inspection point |
| Soil Moisture Content | LoF | Point | 2 | Soil Points | % | None | Field soils testing | Assign based on nearest soil inspection point |
| Groundwater Table | LoF | Polygon | 2 | Groundwater Table | feet | None | Field inspection | Groundwater table layers may be available in GIS format |

**Performance Parameters**

| Name | Type (LoF/CoF) | GIS Feature Type | Phase | GIS Source | Unit | Data Quality | Obtain From | Comments |
|---|---|---|---|---|---|---|---|---|
| Pipe Function | CoF | Polyline | 1 | Mains | N/A | Good | Pipe diameter | Assign from diameter - Transmission > 12", Distribution ≤ 12-inch", Fire Hydrant Lateral, Service Line |
| Operating Pressure | LoF | Polyline | 1 | Model Results | psi | Good | Hydraulic model | Assign based on average of two end point junction pressure model results |
| Operating Velocity | LoF | Polyline | 1 | Model Results | ft/s | Good | Hydraulic model | Assign based on average velocity model results |
| Surge Potential | LoF | Polyline | 1 | Model Results | psi | Good | Hydraulic model | Assign based on peak hour model velocity and pressure results and pipe material |
| Fire Flow Deficiency | LoF | Point | 1 | Model Results | gpm | Good | Hydraulic model | Assign to nearest main based on model results |
| Main Criticality | CoF | Polyline | 1 | Model Results | inch-gpm | Good | Hydraulic model | Assign based on diameter x flow based on model results |
| Critical Facility | CoF | Polyline | 1 | Mains | N/A | Good | Parcels, land use, zoning | Hospitals, schools, dialysis, data centers, etc. |
| Main Breaks | LoF | Point | 1 | Main Breaks | N/A | Fair | Main break data | Obtain points from field collection and link to nearest pipe |
| Failure Impact | CoF | Polyline | 1 | Mains | N/A | Fair | Various GIS layers | Ditches, creeks, wetlands, bridges, roads, etc. |
| Isolation Ability | LoF | Point | 1 | Valves | N/A | Good | Valves and hydraulic model | Assign based on the ability to isolate a main break |
| Remaining Life of Pipe | LoF | Polyline | 2 | GIS Main Data | N/A | None | Main break data | Assign based on standard material values or derived from main break data |
| Valve Condition | LoF | Point | 2 | Valves | N/A | None | Valve field inspection | Assign based on valve inspection and exercising data collection |
| Hydrant Condition | LoF | Point | 2 | Hydrants | N/A | None | Hydrant field inspection | Assign based on hydrant inspection and flushing data collection |
| Customer Complaints | LoF | Point | 2 | Customer Complaints | N/A | None | Customer complaint database | Quality, pressure, etc. |
| Main Leaks | LoF | Point | 2 | Leaks | N/A | None | Leak data | Assign to nearest main based on leak locations |
| Main Repairs | LoF | Point | 2 | Repairs | N/A | None | Repair data | Assign to nearest main based on repair locations |
| Last Inspected | LoF | Polyline | 2 | Mains | Date | None | Field inspection | Assign based on last field inspection date |

**REVISED** **8/22/13**

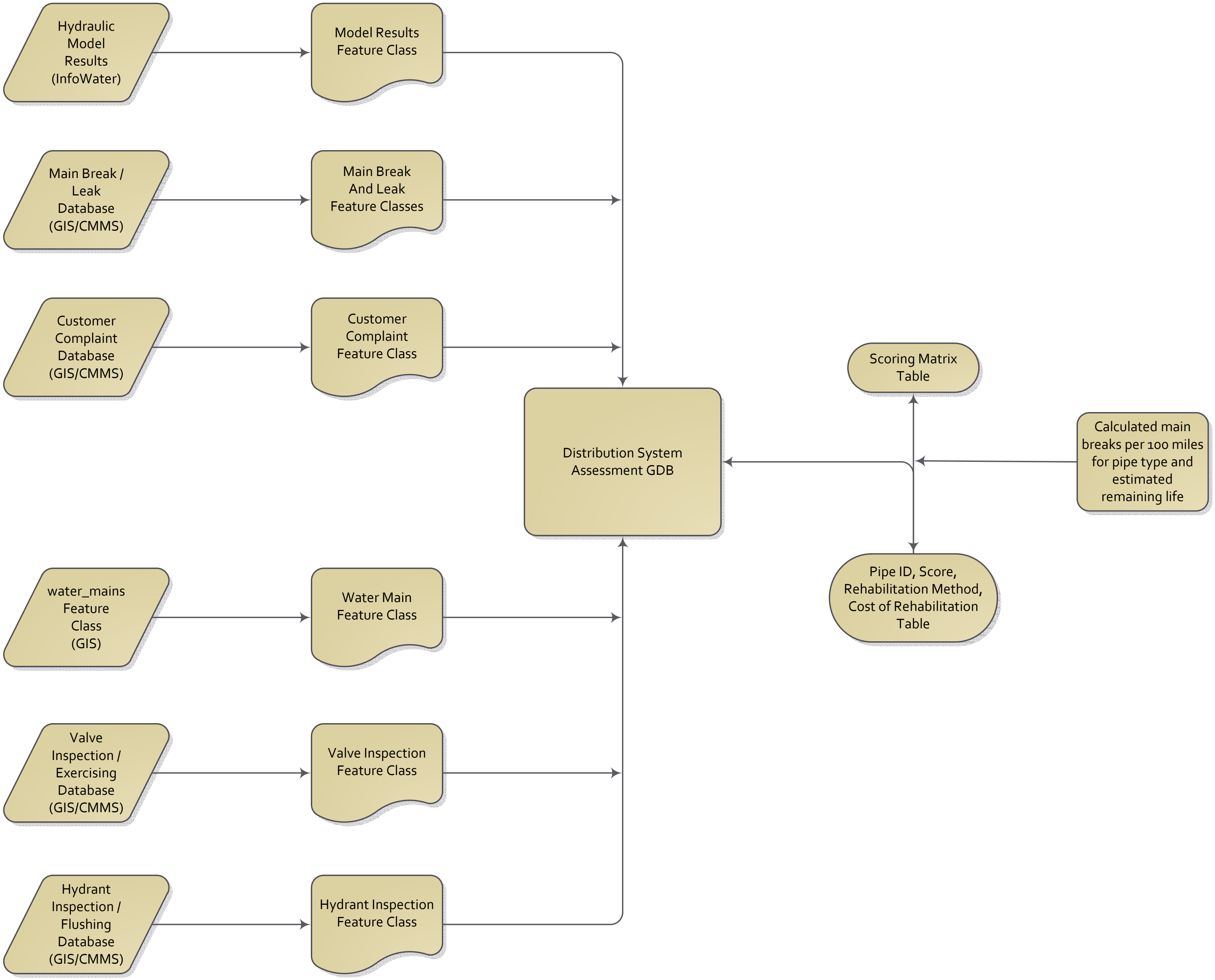
**Water Main Facility ID** Use this GIS field to link together all sources of data

**Asset Attributes**

| Name | Asset Attributes/Scoring | | | | | | | | | | | | | | | | | Category Factor | Maximum Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pipe Material Attributes | CIPL | CIPU | DIP | SP | Cementitious (ACP, PCCP, Transite) | Plastic (HDPE, PVC) | | | | | | | | | | | | - | - |
| **Pipe Material Score** | 5 | 4 | 3 | 3 | 2 | 1 | | | | | | | | | | | | 3 | 15 |
| Pipe Diameter Range (inches) | 4 | 6 | 8 | 10-12 | 14-24 | 30+ | | | | | | | | | | | | - | - |
| **Pipe Diameter Score** | 5 | 5 | 3 | 2 | 1 | 1 | | | | | | | | | | | | 3 | 15 |
| Pipe Age (years) | 70+ | 60 | 50 | 40 | 30 | 20 | 10 | | | | | | | | | | | - | - |
| **Pipe Age Score** | 4 | 5 | 5 | 5 | 3 | 2 | 1 | | | | | | | | | | | 4 | 20 |
| Surface Condition Attributes | Heavy Traffic | Medium Traffic | Light Traffic | Parking Lot | Sidewalk | Open Space/Park | | | | | | | | | | | | - | - |
| **Surface Condition Score** | 5 | 4 | 3 | 2 | 2 | 1 | | | | | | | | | | | | 3 | 15 |
| Soil Type (USDA SSURGO) | 101 | 102 | 104 | 131 | 138 | 142 | 145 | 158 | 162 | 171 | 182 | 183 | 184 | 186 | 187 | 188 | 189 | - | - |
| **Soil Type Score** | 1 | 1 | 2 | 2 | 1 | 1 | 5 | 1 | 2 | 1 | 5 | 2 | 3 | 5 | 5 | 4 | 3 | 1 | 5 |
| **Max Asset Attribute Score** | | | | | | | | | | | | | | | | | | | **70** |

**Performance Parameters**

| Name | Performance Parameters/Scoring | | | | | | | | | | | | | | | | | Category Factor | Maximum Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pipe Function Attributes | Transmission | Distribution | Hydrant Lateral | Service Lateral | | | | | | | | | | | | | | - | - |
| **Pipe Function Score** | 5 | 4 | 3 | 2 | | | | | | | | | | | | | | 2 | 10 |
| Operating Pressure Range (psi) | 0-80 | 80-100 | 100-120 | 120-150 | 150+ | | | | | | | | | | | | | - | - |
| **Operating Pressure Score** | 1 | 3 | 3 | 3 | 5 | | | | | | | | | | | | | 4 | 20 |
| Operating Velocity Range (ft/s) | 0-2 | 2-4 | 4-7 | 7-10 | > 10 | | | | | | | | | | | | | - | - |
| **Operating Velocity Score** | 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | 3 | 15 |
| Surge Pressure Range (psi) | 0-100 | 100-150 | 150-200 | 200-350 | 350+ | | | | | | | | | | | | | - | - |
| **Surge Potential Score** | 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | 1 | 5 |
| Fire Flow Deficiency Range (gpm) | 250 | 250-500 | 500-1000 | 1000-2000 | 2000+ | | | | | | | | | | | | | - | - |
| **Fire Flow Deficiency Score** | 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | 2 | 10 |
| Criticality Range (inches x gpm) | 0-100 | 100-1000 | 1000-10000 | 10000-50000 | 50000+ | | | | | | | | | | | | | - | - |
| **Main Criticality Score** | 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | | 3 | 15 |
| Critical Facility Types | Hospital | Dialysis Center | School | Data Center | | | | | | | | | | | | | | - | - |
| **Critical Facility Score** | 5 | 5 | 3 | 2 | | | | | | | | | | | | | | 2 | 10 |
| Number of Main Breaks | > 3 | 3 | 2 | 1 | 0 | | | | | | | | | | | | | - | - |
| **Main Break Score** | 5 | 4 | 3 | 2 | 0 | | | | | | | | | | | | | 5 | 25 |
| Failure Impact | Interstate | Roadway | Bridge | Park | Wetland | Ditch | Stream | | | | | | | | | | | - | - |
| **Failure Impact Score** | 4 | 2 | 5 | 2 | 4 | 3 | 5 | | | | | | | | | | | 2 | 10 |
| Isolation Ability | None | Poor | Fair | Good | Excellent | | | | | | | | | | | | | - | - |
| **Isolation Ability Score** | 5 | 4 | 2 | 1 | 0 | | | | | | | | | | | | | 2 | 10 |
| **Max Performance Parameter Score** | | | | | | | | | | | | | | | | | | | **130** |
| **Total Max Score** | | | | | | | | | | | | | | | | | | | **200** |


Hydraulic Model Results (InfoWater)
Model Results Feature Class
Main Break / Leak Database (GIS/CMMS)
Main Break And Leak Feature Classes
Customer Complaint Database (GIS/CMMS)
Customer Complaint Feature Class
Scoring Matrix Table
Distribution System Assessment GDB
Calculated main breaks per 100 miles for pipe type and estimated remaining life
Pipe ID, Score, Rehabilitation Method, Cost of Rehabilitation Table
water_mains Feature Class (GIS)
Water Main Feature Class
Valve Inspection / Exercising Database (GIS/CMMS)
Valve Inspection Feature Class
Hydrant Inspection / Flushing Database (GIS/CMMS)
Hydrant Inspection Feature Class

# Appendix 5-F
# Preventative Maintenance Recommendations
# Additional Information

- Example Performance Indicators for Water Systems
- The 2012 Comparative Review of Municipal Maintenance and Infrastructure Asset Management Systems (Water Finance Research Foundation)
- Excerpt on Cheyenne BOPU from DRAFT "Legacy of Manganese Accumulation in Water Systems: Assessment, Consequence and Prevention", Water Research Foundation (WRF), 2013.
- Preventative Maintenance Practices Summary and Data Collection Recommendations

# TEMPLATE FOR PERFORMANCE INDICATORS FOR DRINKING WATER ASSETS

## Contents



## General Assets

| PERFORMANCE INDICATOR: **Regulatory Compliance Rate** | | |
|---|---|---|
| Level 1 Asset: General | Tier 1 | Goal Area: Reliability |
| DEFINITION: The percentage of time each year that a water utility meets all the health-related drinking water standards. | | |
| USE: The compliance rate is a broad measure of the quality of water and treatment technique requirements in the National Primary Drinking Water Regulations. | | |
| ASSUMPTIONS/CHALLENGES: The compliance rate measures compliance with all water quality and treatment technique requirements for public water systems. The compliance rate does not consider secondary maximum contaminant levels (MCLs) or monitoring requirements. | | |
| CALCULATION: $$\left(\frac{\text{Times of measurement in one year}}{\text{Times of compliance in one year}}\right)\times 100$$ Where: *out of compliance* is defined by federal and state requirements for public water systems.<br><br>Data needed: The number of calendar days where the water utility is in compliance with the applicable health-related drinking water requirements. | | |
| RELATED INDICATORS: Source water quality, treatment effectiveness. | | |
| REPORTED VALUES IN INDUSTRY: A compliance rate of 100% is the goal for all public water utilities. | | |

| PERFORMANCE INDICATOR: **Operations and Maintenance (O&M) Cost Ratio** | | |
|---|---|---|
| Level 1 Asset: General | Tier 1 | Goal Area: Efficiency |
| DEFINITION: The total O&M cost per million gallons (MG) of water produced in dollars per million gallons. | | |
| USE: This indicator is a useful measure of the economic efficiency of the water utility. | | |
| ASSUMPTIONS/CHALLENGES: Depreciation is excluded from the total O&M costs. | | |
| CALCULATION: $$\text{O\&M cost per MG prcessed} = \left( \frac{\text{Total O\&M costs}}{\text{Volume produced during reporting period (MG)}} \right)$$ Where: total O&M costs are compiled in accordance with Governmental Accounting Standards Board (GASB) or Financial Accounting Standards Board (FASB) statements of accounting practice.<br><br>Data needed: Total O&M costs, total volume of produced water. | | |
| RELATED INDICATORS: Human resources efficiency, source water quality, treatment efficiency, main break rate. | | |
| REPORTED VALUES IN INDUSTRY: None provided. | | |

| PERFORMANCE INDICATOR: **Customer Water Quality Complaints** | | |
|---|---|---|
| Level 1 Asset: General | Tier 1 | Goal Area: Water quality |
| DEFINITION: Total number of customer complaints received at the customer service center/plant/public works yard per year per 1,000 customers. Include all complaints related to water quality (i.e., taste and odor, color and temperature, and other or unknown quality related issues). | | |
| USE: This performance indicator is a specific measure of customer satisfaction with the quality of water received from the service provider. | | |
| ASSUMPTIONS/CHALLENGES: It is important to log all customer complaints and make a distinction between water quality and other complaints. An added benefit would be to make a distinction between water quality complaints related to taste, odor, color, or temperature. A complaint requires followup action and should not include general inquiries. | | |
| CALCULATION: $$\frac{\text{Total number of water quality customer complaints in one year}}{\text{1,000 customers served}}$$ Data needed: Total number of water quality complaints; service population. | | |
| RELATED INDICATORS: Disinfectant residual concentration; total coliform positives. | | |
| REPORTED VALUES IN INDUSTRY: None provided. | | |

| PERFORMANCE INDICATOR: **Energy Usage** | | |
|---|---|---|
| Level 1 Asset: General | Tier 1 | Goal Area: Efficiency |
| DEFINITION: The annual energy usage per million gallons (MG) of water delivered to the distribution system. This indicator can also be evaluated on a process basis (i.e., raw water transmission, treatment, distribution). | | |
| USE: This indicator assesses the energy efficiency of the distribution system. | | |
| ASSUMPTIONS/CHALLENGES: This is a portion of the total energy cost for the water system. The energy usage for this portion of water operations may not be readily available or may take some effort to estimate. | | |
| CALCULATION: $\frac{\text{Total energy usage } (k \cdot Wh)}{\text{Total volume of water MG put into the distribution system on an annual basis}}$ Where: the total energy usage applies to the total amount of energy used by a water system.<br><br>Data needed: The total annual energy usage for the water system and the total volume of treated water put into the distribution system. | | |
| RELATED INDICATORS: Cost per million gallons to deliver water. | | |
| REPORTED VALUES IN INDUSTRY: None provided. | | |

| PERFORMANCE INDICATOR: **Outages/Interruptions of Service** | | |
|---|---|---|
| Level 1 Asset: General | Tier 1 | Goal Area: Reliability |
| DEFINITION: Number and duration (hours) of water supply per year. This indicator tracks two items, the first being the number of times per year that an interruption occurs and the second is the aggregate in hours per year that supply is unavailable in adequate quantity. | | |
| USE: This indicator assesses reliability of water service to the customer. Alternatives for more expensive or emergency sources of water supply can be evaluated with this data. Lengthy interruptions can be catastrophic and this indicator may provide an alert to future risks. This indicator can be based on reliable supply to the consumer and can also be applied to specific processes. | | |
| ASSUMPTIONS/CHALLENGES: Neither the number of interruptions nor the duration may capture the character of the indicator. Twenty-four interruptions of 1-hour duration is a different measure than a single 24-hour interruption. | | |
| CALCULATION:<br><br>Number of interruptions of water supply per year, and total hours of water supply interruption per year.<br><br>Where: interruption events are counted when water supply is unavailable or significantly below needed requirements or expectations.<br><br>Data needed: Number of interruptions and duration of each interruption. Can be calculated for the system as a whole, or can be measured by each major asset group. | | |
| RELATED INDICATORS: The number and duration of interruptions in source water, raw water transmission, water treatment, and distribution that help make up the total interruptions. Storage capacity adequacy in transmission, treatment, and distribution are closely related as they can offset this factor. | | |
| REPORTED VALUES IN INDUSTRY: The desired indicator value is zero interruptions with zero hours of interruption per year. As noted above, storage can offset some level of interruptions; consequently, the acceptable values will vary from system to system. | | |

| PERFORMANCE INDICATOR: **Human Resources (HR) Efficiency** | | |
|---|---|---|
| Level 1 Asset: General | Tier 2 | Goal Area: Efficiency |
| DEFINITION: Total annual volume of water in million gallons (MG) produced per number of full-time equivalent (FTE) employees in MG/FTE. | | |
| USE: This performance indicator is a measure of the company's staffing efficiency. | | |
| ASSUMPTIONS/CHALLENGES: This indicator should be evaluated on a process basis (i.e., raw water transmission, treatment, distribution) and should include all field, technical/engineering, supervisor/support and laboratory staff. | | |
| CALCULATION: $$\text{HR efficiency} = \frac{\text{Annual volume of water produced (MG per year)}}{\text{Number of FTE employees}}$$ Where: the average number of FTE employees is the number of FTE employees over the reporting period.<br><br>Data needed: Annual volume of water produced and the average number of FTE employees over the reporting period. | | |
| RELATED INDICATORS: None. | | |
| REPORTED VALUES IN INDUSTRY: None provided. | | |

| PERFORMANCE INDICATOR: **Employee Training** | | |
|---|---|---|
| Level 1 Asset: General | Tier 2 | Goal Area: Efficiency |
| DEFINITION: The number of training hours per employee per year. | | |
| USE: This performance indicator is a measure of the investment by the company in maintaining the skills and service levels of the employees. | | |
| ASSUMPTIONS/CHALLENGES: This performance indicator includes all training hours for the company, both internal and external. All categories of training (e.g., safety, maintenance, and best practices) are included in this indicator. This indicator does not differentiate between job functions within the company. | | |

CALCULATION:

$$\text{Annual training hours per employee} = \frac{\text{Total annual training hours for employees}}{\text{Average number of FTE employees}}$$

For reporting periods other than one year, the performance indicator may be calculated as follows:

$$\text{Annual training hours per employee} = \frac{\text{Number of days in reporting period (365)}}{\text{(Number of days in reporting period)} \times \text{(Number of FTE employees)}}$$

Where:

The total annual training hours includes all training hours for the reporting period, including all types of training and all job functions.
The total average number of FTE employees is the average number of FTE employees over the reporting period.

Data needed: The total annual training hours provided and the average number of FTE employees during the reporting period.

| RELATED INDICATORS: None. |
|---|
| REPORTED VALUES IN INDUSTRY: None provided. |

## WATER DISTRIBUTION ASSETS

<table>
<tr><td colspan="3">PERFORMANCE INDICATOR: Pressure Adequacy</td></tr>
<tr><td>Level 1 Asset: Water Distribution</td><td>Tier 1</td><td>Goal Area: Adequacy</td></tr>
<tr><td colspan="3">DEFINITION: The ability to maintain pressure in the water distribution system within established minimum and maximum limits.</td></tr>
<tr><td colspan="3">USE: This indicator assesses whether the pressures are controlled within acceptable limits in the distribution system.</td></tr>
<tr><td colspan="3">ASSUMPTIONS/CHALLENGES: System pressures are affected by the topography of the system, tank elevations, pump operation, leakage, and water demand. System pressure data throughout the system may be difficult to obtain. Customer complaints and extended time hydraulic modeling may be used to evaluate working pressure ranges. Transient high and low pressures may be difficult to detect and record.</td></tr>
<tr><td colspan="3">CALCULATION:<br><br>Number of events per year where system pressures are either higher or lower than established minimum and maximum limits<br><br>Where:<br><br>Pressures are measured at ground level.<br>Events can be expressed as are the number of instances, days, number of customers affected, or duration of the pressure deficiency.<br><br>Data needed: Measured and monitored system pressures, including hydrant static pressure measurements or in absence of actual pressure data; users can use hydraulic model of the distribution system to determine pressures under various demand conditions.</td></tr>
<tr><td colspan="3">RELATED INDICATORS: Water demand.</td></tr>
<tr><td colspan="3">REPORTED VALUES IN INDUSTRY: Water Research Foundation project 4109 (Friedman et al. 2010) recommends the following guidance on pressure:<br><br>Within +10 psi of average pressures at each customer’s service location.<br>Above 35 psi under normal conditions at each customer’s service location.<br>Above 20 psi under peak and fire-flow conditions throughout the system.<br>Above 0 psi during emergencies such as main breaks and power outages throughout the distribution system.<br>Desired maximum pressure of no more than 100 psi.</td></tr>
</table>

| PERFORMANCE INDICATOR: **Disinfectant Residual Concentration** | | |
|---|---|---|
| Level 1 Asset: Water Distribution | Tier 1 | Goal Area: Water quality |
| DEFINITION: The number of occurrences over a year where measured disinfectant residual concentrations were less than the minimum required concentration. | | |
| USE: This indicator assesses whether the disinfectant residual concentrations are maintained above minimum regulatory limits in the distribution system. A minimum disinfectant residual concentration is needed to control microbial growth in the water distribution system and is a general indicator of water quality. | | |
| ASSUMPTIONS/CHALLENGES: None. | | |
| CALCULATION:<br><br>Number of occurrences per sample per reporting period where the measured disinfectant residual concentration is less than the regulatory minimum concentration<br><br>Where: disinfectant residual concentrations are measured as a minimum at all locations as required within the distribution and storage systems, with emphasis on dead-end, low flow, or other locations where the water age is highest.<br><br>Data needed: Measured disinfectant residual concentrations. | | |
| RELATED INDICATORS: Water age and water demand. | | |
| REPORTED VALUES IN INDUSTRY: The Safe Drinking Water Act specifies that the residual disinfectant concentration in the distribution system—measured as total chlorine, free chlorine, or chlorine dioxide—cannot be undetectable in more than 5% of the samples taken each month, for any two months that the system serves water to the public.<br><br>Water Research Foundation project 4109 (Friedman et al. 2010) recommends the following disinfectant residual goals for an optimized distribution system:<br><br>Minimum 0.2 mg/L free chlorine or 0.5 mg/L chloramines residual should be maintained in the distribution system.<br>This performance goal should be met in 95% of distribution system samples.<br>There should be no two consecutive months with any readings of zero disinfection residual. | | |

| PERFORMANCE INDICATOR: **Water Main Break Rate** | | |
|---|---|---|
| Level 1 Asset: Water Distribution | Tier 1 | Goal Area: Reliability |
| DEFINITION: The rate of water main breaks in the distribution system in breaks per 100 miles per year. | | |
| USE: This indicator is widely used to characterize structural conditions of the distribution system. A high frequency of water breaks translates to frequent interruption of service. This indicator helps water utilities identify the need for a water main renewal plan. Water main break data in details may be effectively used to develop a water main renewal plan. | | |
| ASSUMPTIONS/CHALLENGES: There are controversies about the definition of a water main break. This project defines a water main break as any point of loss of structural integrity along the main (including fittings, hydrants, valves, and joints) that results in measureable ongoing loss of water to the surrounding area. This would not include weeps and seeps that are acoustically difficult to find and considered unavoidable water loss. This would also not include service lines (utilities may want to consider a secondary indicator for service line breaks).<br><br>In calculation of this indicator, it is assumed that impacts of all water main breaks are equal as a result. It provides a general condition of the distribution system and would not provide any specific information. Most water utilities keep a computerized track of water main breaks in some form. From this data, the number of water main breaks of individual pipe segments should be considered as an indicator for selecting pipes for renewal. Water main breaks due to a third party fault should be excluded. Water utilities are challenged to keep an accurate count of miles of main.<br><br>Making a distinction between major and minor breaks will make it very complicated. Definition of a break, however, is when the utility needs to dig up the pavement to repair the break. | | |
| CALCULATION:<br>$\dfrac{\text{Number of water main breaks per year}}{\text{Number of miles in the distribution system} \div 100}$<br>Where: all main breaks within the distribution system should be counted except for those caused by a third party.<br><br>Data needed: Total number of leaks during the reporting period, total number of breaks during the reporting period, and total miles of distribution piping. | | |
| RELATED INDICATORS: Number of outages, customer complaints, and pressure adequacy. | | |
| REPORTED VALUES IN INDUSTRY: Deb, Hasit, and Grablutz (1995) recommended an average value of this performance indicator for North American Water Utilities of 20 breaks per 100 miles per year.<br><br>Water Research Foundation project 4109 (Friedman et al. 2010) did not recommend any specific number of main breaks per 100 miles, instead offering guidance on data that should be collected. The data should include<br><br>Identity, time, and physical location of the break;<br>Control data such as the simple metric time water off and water restored time; and<br>Cost of repair data. | | |

| PERFORMANCE INDICATOR: **Infrastructure Leakage Index (ILI)** | | |
|---|---|---|
| Level 1 Asset: Water Distribution | Tier 1 | Goal Area: Efficiency |
| DEFINITION: The Infrastructure Leakage Index (ILI) is the ratio of the current annual real losses (CARL, calculated from the International Water Balance) to the unavoidable annual real losses (UARL, calculated from an equation developed by the International Water Association's Water Losses Task Force). | | |
| USE: These indicators assess water loss due to leakage, breaks, fire demand, meter inefficiencies, and any unauthorized water usage. These performance indicators are a measure of the condition and efficiency of the distribution system. | | |
| ASSUMPTIONS/CHALLENGES: Real water losses consist of leakage from distribution and transmission mains, overflow from storage tanks, and leakage from service connections, all of which must be estimated. Apparent losses consist of unauthorized consumption, customer metering inaccuracies, and systematic data handling errors, which may be difficult to estimate. | | |
| CALCULATION: $\frac{\text{Real and apparent loss volume over the reporting period}}{\text{Number of service connections}} \div \text{Number of days in the reporting period}$ <br> The reporting period is usually one year. The method described in AWWA Manual M36 (AWWA 2009) should be used. Free water audit software is available from AWWA that performs the calculations described in Manual M36. <br><br> Where: produced water volume, metered consumption, and the number of service connections are obtained from company records. The other parameters must be estimated. <br><br> Data needed: Volume of water produced, authorized consumption volume, real loss volume, apparent loss volume, and the number of service connections. | | |
| RELATED INDICATORS: Water main breaks. | | |
| REPORTED VALUES IN INDUSTRY: Water Research Foundation project 4109 (Friedman et al. 2010) provides the following information on water loss: <br><br> A water utility that has real losses close to its UARL value has an ILI value approaching 1.0. A number of water utilities with constrained water resources have established world-class leakage management and have ILI values just over 1.0. It is likely that many North American water utilities operate with ILI values several times their UARL value, and some have high losses with ILI values over 10.0 or ten times the amount of unavoidable leakage. | | |

| PERFORMANCE INDICATOR: **Water Distribution Cost** | | |
|---|---|---|
| Level 1 Asset: Water Distribution | Tier 2 | Goal Area: Efficiency |
| DEFINITION: The cost to distribute treated water from the treatment plant to the customers per million gallons. | | |
| USE: This indicator assesses the cost to deliver treated water to customers and is a measure of the cost efficiency of the distribution system. | | |
| ASSUMPTIONS/CHALLENGES: The costs to deliver treated water to the customers involves pumping equipment, water storage facilities, pipe maintenance supplies, equipment, and personnel that may be involved in other functions within the water operation. In smaller operations where multiple job functions are performed, the costs for equipment and personnel working on the distribution system may not be accounted for separately from other water system functions. The total direct operations and maintenance (O&M) cost for water distribution is the total costs for salaries, direct benefits, and direct O&M costs associated with water distribution. Those water utilities that do not follow Governmental Accounting Standards Board (GASB) or Financial Accounting Standards Board (FASB) practices may find it difficult to determine accurate O&M costs. | | |
| CALCULATION: $\dfrac{\text{Total direct cost for O\&M of a distribution system}}{\text{Volume of water put into the distribution system during the reporting period (MG)}}$<br>This calculation would not include changes in the assets of the system. Labor, equipment, materials spent on repairs, and energy cost would be included but not those spent on new main replacements.<br><br>Where: Distribution system cost = total direct O&M costs to deliver treated water to customers through the distribution and storage systems.<br><br>Data needed: Total direct O&M costs for the distribution system and total volume of water put into the distribution system. | | |
| RELATED INDICATORS: None. | | |
| REPORTED VALUES IN INDUSTRY: None provided. | | |

| PERFORMANCE INDICATOR: **Water Storage** | | |
|---|---|---|
| Level 1 Asset: Water Distribution | Tier 2 | Goal Area: Reliability |
| DEFINITION: Number of hours that water can be supplied from the storage. | | |
| USE: This indicator assesses the adequacy of water storage and is an indirect measure of the ability to maintain pressure in the distribution system and to continue to maintain service during brief outages. | | |
| ASSUMPTIONS/CHALLENGES: The impact of storage on the ability to maintain service and on water age is specific to the configuration and water use patterns of each distribution system. A general statement about what volume of treated water storage is optimal cannot be made. This indicator does not include bulk purchased water supplies that may be available to the water utility. This indicator does not address the problems associated with the spatial variation in storage. There may be pressure zones/service areas that are harder to serve with stored water. | | |
| CALCULATION: $$\frac{\text{Volume of treated water storage (MG)}}{\text{Water pumpage per day (MG)}} \times 24 \text{ hours}$$ Where: the volume of treated water is the sum of all storage facilities in the distribution system.<br><br>Data needed: The total volume of treated water storage and average water pumpage per day. | | |
| RELATED INDICATORS: Water age, disinfectant residual. | | |
| REPORTED VALUES IN INDUSTRY: None provided. | | |

| PERFORMANCE INDICATOR: **Outages/Interruptions of Service (directly attributed to the distribution system)** | | |
|---|---|---|
| Level 1 Asset: Distribution System | Tier 2 | Goal Area: Reliability |
| DEFINITION: See Outages/Interruptions of Service in the General Tier 1 indicators. | | |

| PERFORMANCE INDICATOR: **Energy Usage (directly attributed to the distribution system)** | | |
|---|---|---|
| Level 1 Asset: Distribution System | Tier 2 | Goal Area: Efficiency |
| DEFINITION: See Energy Usage in the General Tier 1 indicators.<br>Energy consumed in kW·h in distribution system pumpage per MG of pumpage. | | |

<table>
<tr><td colspan="3">PERFORMANCE INDICATOR: Effective Hydrants</td></tr>
<tr><td>Level 1 Asset: Water Distribution</td><td>Tier 2</td><td>Goal Area: Reliability</td></tr>
<tr><td colspan="3">DEFINITION: The number of effective hydrants versus the total number hydrants in the distribution system. Effective is defined by ISO (International Organization for Standardization) criteria to deliver adequate flow and pressure.</td></tr>
<tr><td colspan="3">USE: This indicator assesses the performance and reliability of the distribution system to provide water for fire fighting.</td></tr>
<tr><td colspan="3">ASSUMPTIONS/CHALLENGES: None.</td></tr>
<tr><td colspan="3">CALCULATION:<br>$$\frac{\text{Total number of effective hydrants in the distribution system}}{\text{Total number of fire hydrants in the distribution system}}$$<br>Data needed: The number of effective hydrants in the distribution system and the total number of fire hydrants in the distribution system.</td></tr>
<tr><td colspan="3">RELATED INDICATORS: Pressure adequacy.</td></tr>
<tr><td colspan="3">REPORTED VALUES IN INDUSTRY: None provided.</td></tr>
</table>

<table>
<tr><td colspan="3">PERFORMANCE INDICATOR: Valve Operations</td></tr>
<tr><td>Level 1 Asset: Water Distribution</td><td>Tier 2</td><td>Goal Area: Reliability</td></tr>
<tr><td colspan="3">DEFINITION: The number of fully functional valves divided by the total number of valves.</td></tr>
<tr><td colspan="3">USE: This indicator assesses the ability to efficiently isolate portions of the distribution system for repairs.</td></tr>
<tr><td colspan="3">ASSUMPTIONS/CHALLENGES: This indicator requires a thorough knowledge of the distribution system layout and the locations of all control valves.</td></tr>
<tr><td colspan="3">CALCULATION:<br>$$\frac{\text{Total number of fully functional valves in the distribution system}}{\text{Total number of valves}}$$<br>Where: a fully functional valve is defined as a valve that is fully operational and with the ability to isolate mains and control the flow of water in the distribution system.<br><br>Data needed: The total number of fully functional valves and the total number of valves. Ancillary valves such as shutoff valves on hydrant tees and service lines are not included in this indicator.</td></tr>
<tr><td colspan="3">RELATED INDICATORS: Downtime per repair, customer complaints.</td></tr>
<tr><td colspan="3">REPORTED VALUES IN INDUSTRY: None provided.</td></tr>
</table>

| PERFORMANCE INDICATOR: **Distribution Coliform Violations** | | |
|---|---|---|
| Level 1 Asset: Water Distribution | Tier 2 | Goal Area: Water quality |
| DEFINITION: The number of times when there is a violation of the Total Coliform Rule over the reporting period. | | |
| USE: This indicator assesses the quality of water in the distribution and storage system as well as compliance with the Total Coliform Rule. | | |
| ASSUMPTIONS/CHALLENGES: The number of minimum samples is in compliance with the Total Coliform Rule and related to the number of customers served by the distribution system. The location of the monitoring points is somewhat arbitrary but should be in areas of concern: dead ends, for example. There are three levels (tiers) of public health risk defined in the regulation. These require different responses to the occurrence of positive coliform samples. The indicator does not distinguish between Tier 1, 2, or 3 violations. | | |
| CALCULATION:<br><br>Number of positive total coliform samples collected during the reporting period.<br>This could also be expressed as a percentage.<br><br>Where: samples are collected at the locations specified by the written Sample Siting Plan for the system.<br><br>Data needed: Total coliform sample results taken at the required frequency and locations. | | |
| RELATED INDICATORS: Regulatory compliance rate and percentage of time that regulated water quality parameters meet regulatory requirements | | |
| REPORTED VALUES IN INDUSTRY: None provided. The goal is for no violations of the Total Coliform Rule requirements. | | |
| RELATED INDICATORS: Disinfectant residual. | | |
| REPORTED VALUES IN INDUSTRY: The Safe Drinking Water Act defines violations of the Total Coliform Rule as<br><br>Any fecal coliform positive or *E. coli* positive followed by a total-coliform positive,<br>Any repeat sample that is fecal coliform positive,<br>More than one routine or repeat sample per month that is total coliform positive for systems collecting fewer than 40 samples per month, or<br>More than 5% of routine and repeat samples in a month that are total coliform positive in systems collecting at least 40 samples per month. | | |

| PERFORMANCE INDICATOR: **Unplanned Maintenance Hours (as a percentage of total maintenance hours)** | | |
|---|---|---|
| Level 1 Asset: Water Distribution | Tier 2 | Goal Area: Reliability |

DEFINITION: Unplanned (breakdown) hours = number of hours spent by maintenance staff on high and low emergency work (time spent repairing equipment after it has broken down). High emergency work covers breakdowns that may result in loss of service or other severe detriment to the utility (e.g., a spill), where maintenance must be deployed as soon as possible. Low emergency work covers breakdowns that may not result in loss of service or are protected by equipment redundancy, where maintenance shall be deployed at the earliest convenience. Include both internal and external maintenance hours (e.g., some systems outsource all breakdown work; therefore, they should estimate all maintenance hours, both internal and external).

USE: One of the primary objectives of most maintenance programs is to improve the ratio of scheduled to unscheduled work. The underlying assumption is that scheduled and planned maintenance work can be accomplished more efficiently and productively than unscheduled or unplanned work. When work is scheduled and planned, productivity and efficiency can be ensured. The fact is, however, that breakdowns and emergencies do happen from time to time, and utilities must be prepared to respond. In these events, the benefit of planning and scheduling may be suspended, and work proceeds regardless. The objective of a good maintenance system is to ensure that only true emergency work is conducted in an unscheduled and/or unplanned manner. It is therefore important to plan for unscheduled maintenance. This in effect allocates a certain percentage of time and resources to unspecified emergency work so that the remaining corrective and preventive maintenance can be accurately scheduled.

ASSUMPTIONS/CHALLENGES: The data needed for this performance indicator requires that a well-defined system of work-order (WO) priorities be utilized within the maintenance planning function. Typical WO classification systems usually include emergency (unplanned) WOs, preventive maintenance WOs (planned), and routine corrective WOs (planned), as well as other maintenance WOs for maintenance that do not fall in any of the other three categories.

This indicator should preferably be evaluated on a process basis (i.e., raw water transmission, treatment, distribution).

CALCULATION:

$$\frac{\text{Unplanned maintenance hours}}{\text{Total maintenance hours (\%)}}$$

There is no direct calculation of unplanned maintenance hours other than that the total maintenance hours for the year is made up of the sum of unplanned, preventive, planned/scheduled, and other hours, as follows:

Total maintenance hours = Unplanned maintenance hours + Preventive maintenance hours
+ Planned (scheduled) hours + Other maintenance hours

Data needed:

Unplanned (breakdown) hours = number of hours spent by maintenance staff on high and low emergency work (time spent repairing equipment after it has broken down). High emergency work covers breakdowns that may result in loss of service or other severe detriment to the utility (e.g., spill), where maintenance must be deployed as soon as possible. Low emergency work covers breakdowns that may not result in loss of service or are protected by equipment redundancy, where maintenance shall be deployed at the earliest convenience. Include both internal and external

| |
|---|
| maintenance hours (e.g., some systems outsource all breakdown work; therefore, they should estimate all maintenance hours, both internal and external).<br>Preventive maintenance hours = number of hours spent on regularly scheduled and periodic maintenance as directed by vendor (time spent preventing equipment breaking down as specified by the vendor). Include both internal and external maintenance hours (e.g., some systems outsource all breakdown work; therefore, they should estimate all maintenance hours, both internal and external).<br>Planned (scheduled) hours = number of hours spent by maintenance staff on routine maintenance tasks that are identified through observation, etc. (time spent maintaining equipment after it is observed that the equipment is at risk of breaking down). Include both internal and external maintenance hours (e.g., some systems outsource all breakdown work; therefore, they should estimate all maintenance hours, both internal and external).<br>Other hours = number of hours spent by maintenance staff on minor, low-priority tasks that can be assigned during slow periods and any work that does not fit into the other maintenance work categories (time spent on fill in maintenance work). Include both internal and external maintenance hours (e.g., some systems outsource all breakdown work; therefore, they should estimate all maintenance hours, both internal and external). |
| RELATED INDICATORS: None. |
| REPORTED VALUES IN INDUSTRY: None. |

| PERFORMANCE INDICATOR: **Emergency Service Line Repairs and Replacements per Service Connection** | | |
|---|---|---|
| Level 1 Asset: Water Distribution | Tier 2 | Goal Area: Reliability |
| DEFINITION: Repairs to service connections due to breakdowns (either high or low emergency). High emergency breakdowns may result in loss of service or other severe detriment to the utility (e.g., spill), where maintenance must be deployed as soon as possible. Low emergency breakdowns may not result in loss of service or are protected by equipment redundancy; where maintenance shall be deployed at the earliest convenience. Only includes repairs to the service connections for which the municipality is responsible.<br>*Service connections* is defined as the pipe between the main and the property line. | | |
| USE: This performance indicator is a measure of the frequency that service connections need to be repaired or replaced and is also an indicator of the general condition of service connections. | | |
| ASSUMPTIONS/CHALLENGES: Some municipalities are legally responsible for maintaining the entire length of the service connection from the water main to the house, whereas others are only responsible for maintaining the service connection from the water main to the property line. | | |
| CALCULATION:<br>$$\frac{\text{Number of emergency service connection repairs and replacements}}{\text{Total number of service connections}}$$<br>Data needed:<br>Number of emergency service connection repairs and replacements due to breakdowns (either high or low emergency).<br>Total number of service connections = number of residential service connections + number of institutional, commercial, and industrial service connections. Service connections are the pipes that lead from the distribution water main to the customer's plumbing. | | |
| RELATED INDICATORS: Unplanned maintenance hours; number of customer complaints. | | |
| REPORTED VALUES IN INDUSTRY: None. | | |

# Water Finance

RESEARCH FOUNDATION

## The 2012 Comparative Review

# Municipal Maintenance and Infrastructure Asset Management Systems

This study includes a comparative review of Accela, Agile Assets, Azteca System's Cityworks, Cartegraph, Cityview, Energov, IBM's Maximo, Infor/Hansen, Lucity/GBA, Maintenance Connection, Novotx's Elements, Oracle, Pubworks and Vueworks.

# The 2012 Comparative Review of Municipal Maintenance and Infrastructure Asset Management Systems

**ABSTRACT:** The United States and Canada face tremendous capital outlays to repair and replace aging municipal and utility infrastructure. Technology is required to better manage the complex decision making process for maintenance, operational and capital investments and resource allocation. This study conducted in 2012 comprises a comparative review of the major computerized maintenance management and infrastructure asset management systems used by municipal governments and water and wastewater utilities in the United States and Canada. The objective of this study is to provide municipal elected officials, public works directors, infrastructure asset managers, maintenance managers, information technology managers, finance directors and procurement staff an overview of municipal maintenance management and infrastructure asset management software in a comparative format in preparation for a request for qualifications or proposals. The comparative criteria includes software costs, vendor services, support, specialization, work orders, inventory control, licensing and permitting, condition assessment, risk management, asset inventory, GIS mapping, Esri GIS integration, 311 systems, mobile devices, Esri GIS ROI and future industry trends. The comparative analysis of core maintenance management and infrastructure asset management functions was completed for the following 14 software systems in alphabetic order: Accela, Agile Assets, Azteca System's Cityworks, Cartegraph, Cityview, Energov, IBM's Maximo, Infor/Hansen, Lucity/GBA, Maintenance Connection, Novotx's Elements, Oracle, Pubworks and Vueworks. Also included in this study, but not in a comparative format is a discussion on Esri GIS as the recommended platform for municipal mapping applications; and Innovyze software offerings for an advanced wet infrastructure/underground network hydraulic modeling decision analytics approach.

**Water Finance Research Foundation WFRF**

**www.waterfinanceRF.org**

## 1. SUMMARY RESULTS

The summary results of the 2012 comprehensive comparative review and study ranks Azteca System's Cityworks maintenance management and infrastructure asset management system as the top selection for municipal and utility use. Cityworks has demonstrated strength and longevity in the municipal and utility market place for the last 15 years with a highly developed work order management system, and can fully leverage an organization's (ROI) investment in the Esri GIS and the ArcGIS geodatabase as the asset repository reducing implementation and long-term maintenance cost of ownership issues. Cityworks maintains some of the most advanced LGT (Local Government Templates) with over 630 work order templates, 150 service requests with detailed condition assessment inspections. The licensing and permitting functionality is further enhanced by the Esri GIS Centric approach in developing connectivity of all public assets, infrastructure and activities.

| Software | Functional Score | Price Score* |
|---|---|---|
| **Cityworks** | 99 | 91 |
| **Oracle** | 94 | 79 |
| **Maximo** | 93 | 78 |
| **Accela** | 92 | 82 |
| **Infor/Hansen** | 89 | 79 |
| **Energov** | 88 | 82 |
| **Cartegraph** | 87 | 81 |
| **Lucity (GBA)** | 82 | 78 |
| **Pubworks** | 65 | 68 |
| **Maintenance** | 61 | 61 |
| **Vueworks** | 61 | 61 |
| **Agile Assets** | 52 | 58 |
| **Elements** | 50 | 56 |
| **Cityview** | 33 | 42 |

*Adjusted Price Score weighted 20%

## 2. INTRODUCTION

In recent years municipalities and water and wastewater systems have struggled significantly in managing the complex and diverse assets that are within their jurisdictions for which they are accountable. Great strides have been made to develop programs and systems to improve cost efficiencies but core work order management software system functionality by itself did not address the growing needs of infrastructure asset management practices. During the most recent five years since the worldwide economic decline, which in part continues today, municipalities and utilities at all levels have faced severe revenue short falls. The actions taken to maintain baseline services involved delaying hundreds of millions of dollars a year in needed maintenance activities and deferring critical capital projects. Efforts made at the state, regional, county, and local levels to better manage assets and allocate limited resources to high profile failing assets were met with a high degree of frustration due to inconsistent and outdated practices, neglected data tracking and storing, and a lack of data integration abilities with silo/stranded data throughout many departments.

### Asset Management

Infrastructure asset management programs, offered by different consulting firms, should still be focused on managing assets in a way in which the investment for each asset can be optimized producing a reduction in capital budgets and operating expenditures, an efficient and cost effective maintenance program based on risk and an overall reduction in the cost of capital. One common problem has been when engineering drives the capital agenda and the needs of operations and maintenance are overlooked. Likewise, when the financial tracking and planning functions are also neglected, true enterprise asset management decision making cannot occur. A multidisciplinary approach at a corporate level is highly recommended to create a consistent management-wide effort to guide investments and resource allocation.

Comprehensive asset management professionals understand these concepts and have a global perspective and the ability to customize solutions to each municipality. These professionals possess the expertise in and understanding of the International Infrastructure Management Manual (IIMM), which is essentially the bible of asset management. This training is critical in establishing the foundational knowledge of the comprehensive process of modern asset management. The basic foundation as well as the expectations should be that asset management as a philosophy is a process of continuous improvement and change.

In the United States and Canada, the definition of asset management will continue to be defined by the software tools each organization selects as a means to improve asset performance and manage costs. A reduction of cost can be defined as either a short-term gain or a long-term gain or both. The logic entails that if an asset is not maintained correctly it can fail prematurely. Likewise, an asset replaced prematurely wastes a useful asset and as a result improved performance and investment decision making does not occur. Informed decision making can reduce the overall cost of the asset and function to the benefit of the taxpayers. This process is data intensive and requires the necessary policies, leadership, and structure to meet sustainable infrastructure objectives. The goal to achieve a sense of sustainable infrastructure requires an overall plan including asset management planning, which in turn also requires a financial plan, a technology plan, a service delivery plan, and integration with community planning efforts.

## Public Asset Management

The concept of public asset management strives to combine all infrastructure assets and land-based assets and functions to effectively manage the social and environmental goals of the community while offering an improved management decision making process with public review, approval and justification. The current trend is that municipal utilities as capital-intensive enterprise funds will initiate asset management programs during the economic decline and will lead their general city management counterparts of public works, streets, facilities, fleet, parks, signage, bridges, cemeteries, ports and marinas, into an era of sustainability and infrastructure asset management. The expansive nature of the process places a high level of importance on the technology which needs to be applied in a way to gain the greatest benefit overall.

Computerized Maintenance Management Systems (CMMS) and Infrastructure Asset Management Software implementation trends for municipalities demonstrate initial progress in business enterprise funds like water, wastewater, and storm drains migrating efficiencies and practices to other municipal departments. This system functionality migration trend will continue and can be more readily managed with a GIS centered strategy.

## 3. METHODOLOGY

The comparative analysis of core maintenance management and infrastructure asset management functions was completed for the following 14 software systems in alphabetic order: Accela, Agile Assets, Azteca System's Cityworks, Cartegraph, Cityview, Energov, IBM's Maximo, Infor/Hansen, Lucity/GBA, Maintenance Connection, Novotx's Elements, Oracle, Pubworks and Vueworks.

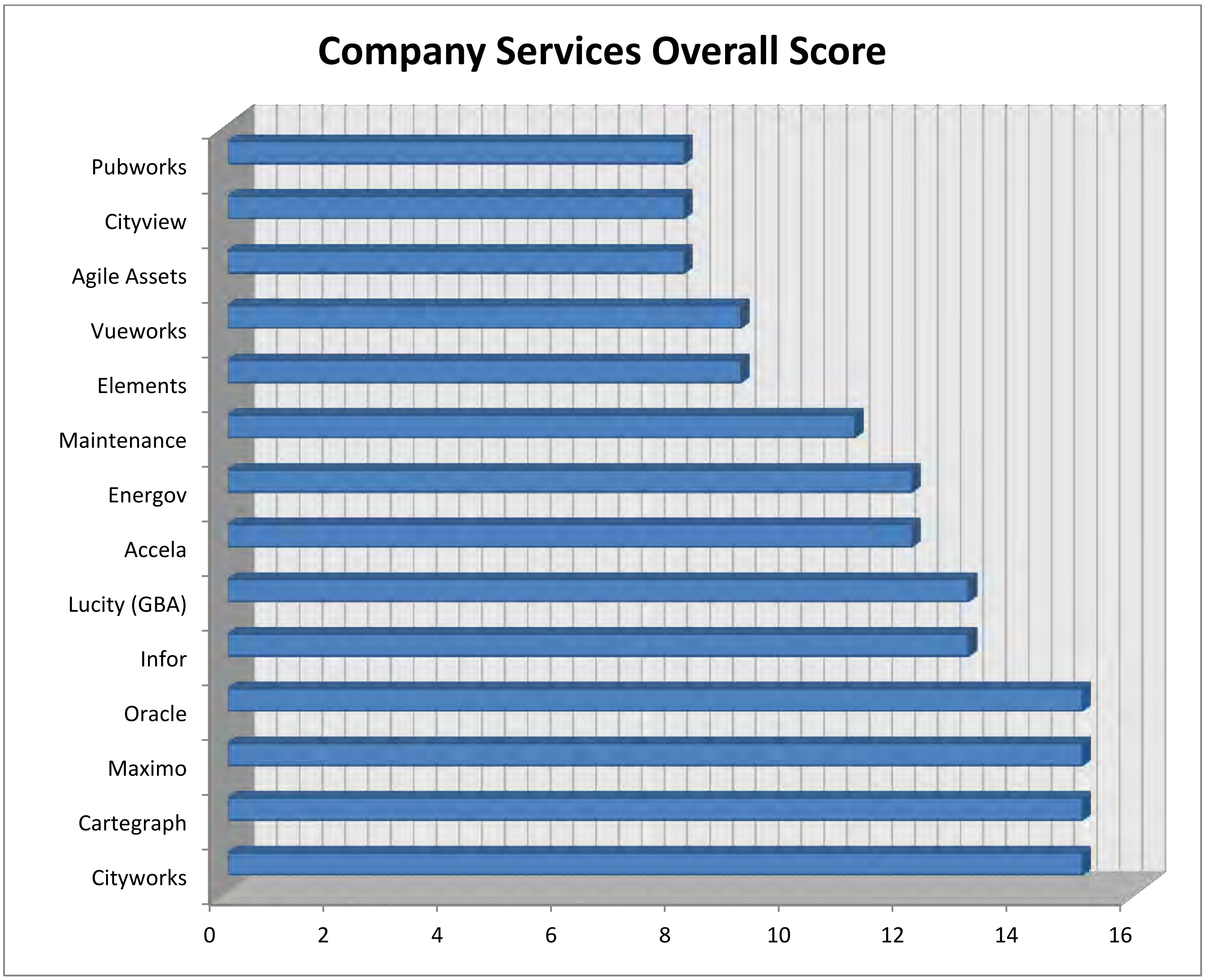
The comparative criteria includes software costs, vendor services, support, specialization, work orders, inventory, licensing and permitting, condition assessment, risk management, asset inventory, GIS mapping, Esri GIS integration, 311 systems, mobile devices and Esri GIS ROI taking into consideration future industry trends. The four major functional categories include 1) Company/Service, 2) Work Management, 3) Asset Management, and 4) GIS.

Each major component is ranked 1-5 with a 5 as the highest score. A zero represents a function not contained in the software. The Overall Functional Score assumes an even weighting of the four major functional areas.

| COMPANY SERVICES | | ASSET MANAGEMENT |
|---|---|---|
| SERVICES/IMPLEMENTATION | | CONDITION ASSESSMENT |
| SUPPORT/TRAINING | | RISK MANAGEMENT |
| SPECIALIZATION | | ASSET INVENTORY/HIERARCHY |
| | | |
| **WORK ORDERS** | | **GIS** |
| WORK ORDERS AND WORK FLOW | | GIS MAPPING |
| INVENTORY | | Esri GIS INTEGRATION |
| LICENSING AND PERMITS | | 311 SYSTEMS |
| | | MOBILE DEVICES |
| | | Esri GIS ROI |

## 4. REVIEW OF SERVICES

The functionality of the core components of a software application is very important, however, the actual success and level of benefit gained is a direct result of the work and support around the planning, implementation, testing and training. The ability for the software vendor to provide enhanced support and training to ensure the successful implementation is critical. In the area of asset management, data conversion and a specialization in specific infrastructure types can ensure a higher degree of utilization of software capabilities.



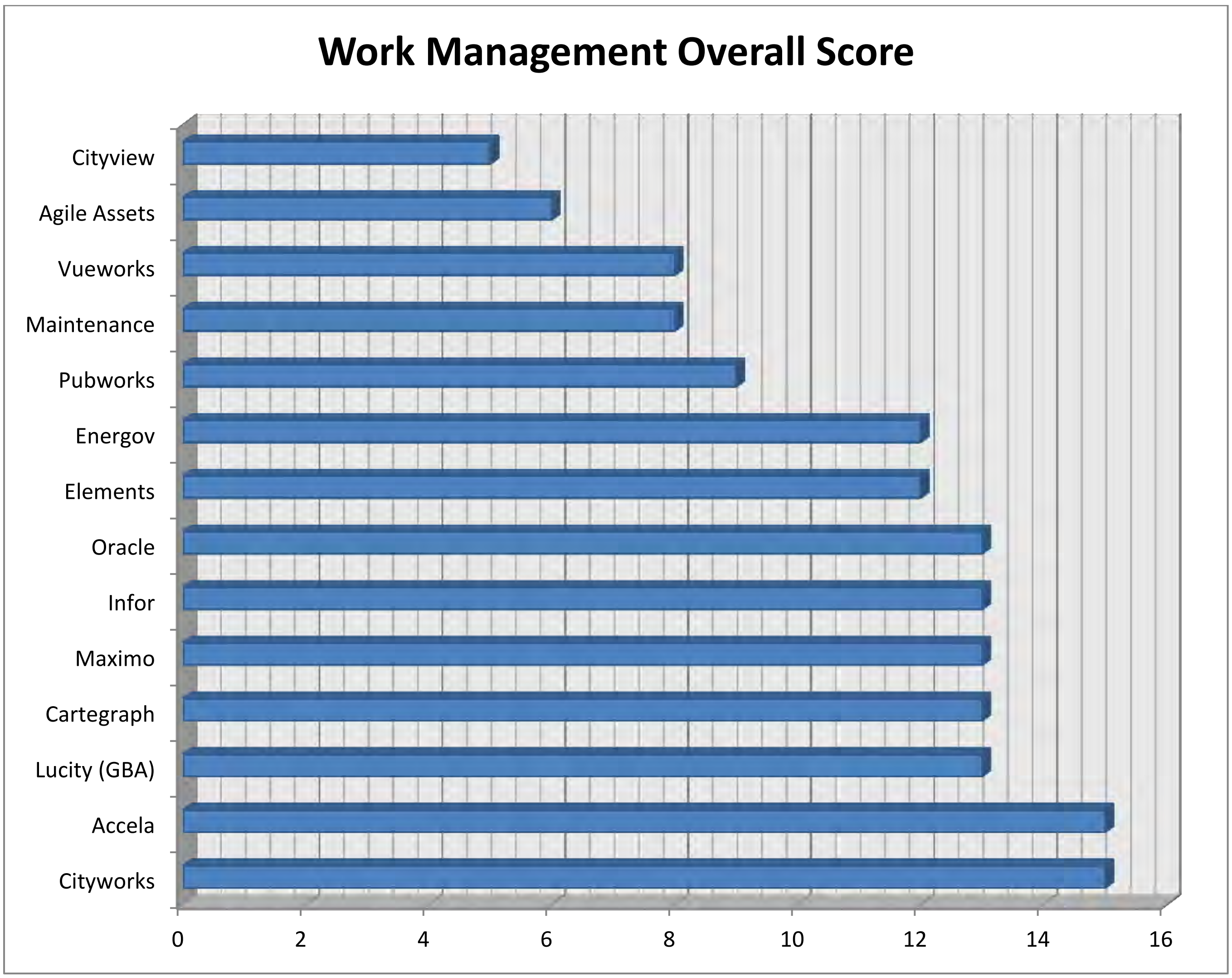
## Company/Services

The Company/Service functional category includes Vendor Services and Implementation, Support and Training Services and Company Strength and Specialization. A ranking score ranging from 1-5 was assigned to software for each of the 3 areas. A "5" score represents the highest functionality, while a low score represents a marginal level of functionality. If software did not have functionality in a given area then a zero was assigned and calculated into the overall scoring.

| Services | | Support | | Specialization | |
|---|---|---|---|---|---|
| Cityworks | 5 | Cityworks | 5 | Cityworks | 5 |
| Cartegraph | 5 | Cartegraph | 5 | Cartegraph | 5 |
| Maximo | 5 | Maximo | 5 | Maximo | 5 |
| Oracle | 5 | Infor/Hansen | 5 | Oracle | 5 |
| Accela | 4 | Lucity (GBA) | 5 | Accela | 4 |
| Energov | 4 | Oracle | 5 | Energov | 4 |
| Infor/Hansen | 4 | Accela | 4 | Infor/Hansen | 4 |
| Lucity (GBA) | 4 | Energov | 4 | Lucity (GBA) | 4 |
| Elements | 3 | Maintenance | 4 | Maintenance | 4 |
| Maintenance | 3 | Agile Assets | 3 | Agile Assets | 3 |
| Vueworks | 3 | Cityview | 3 | Cityview | 3 |
| Agile Assets | 2 | Elements | 3 | Elements | 3 |
| Cityview | 2 | Pubworks | 3 | Pubworks | 3 |
| Pubworks | 2 | Vueworks | 3 | Vueworks | 3 |

## 5. REVIEW OF WORK MANAGEMENT

A robust Computerized Maintenance Management System (CMMS) with work orders providing the ability to separate planned or unplanned maintenance costs, builds life cycle cost history, records actual direct costs of the activity, documents the procedures followed, notes the failure mode and primary cause of failure with comments on indirect costs and impacts to customers and possible unproductive time. A basic CMMS alone is not an asset management system. All of this data enables additional possibilities of failure, causal, consequence and efficiency analysis.



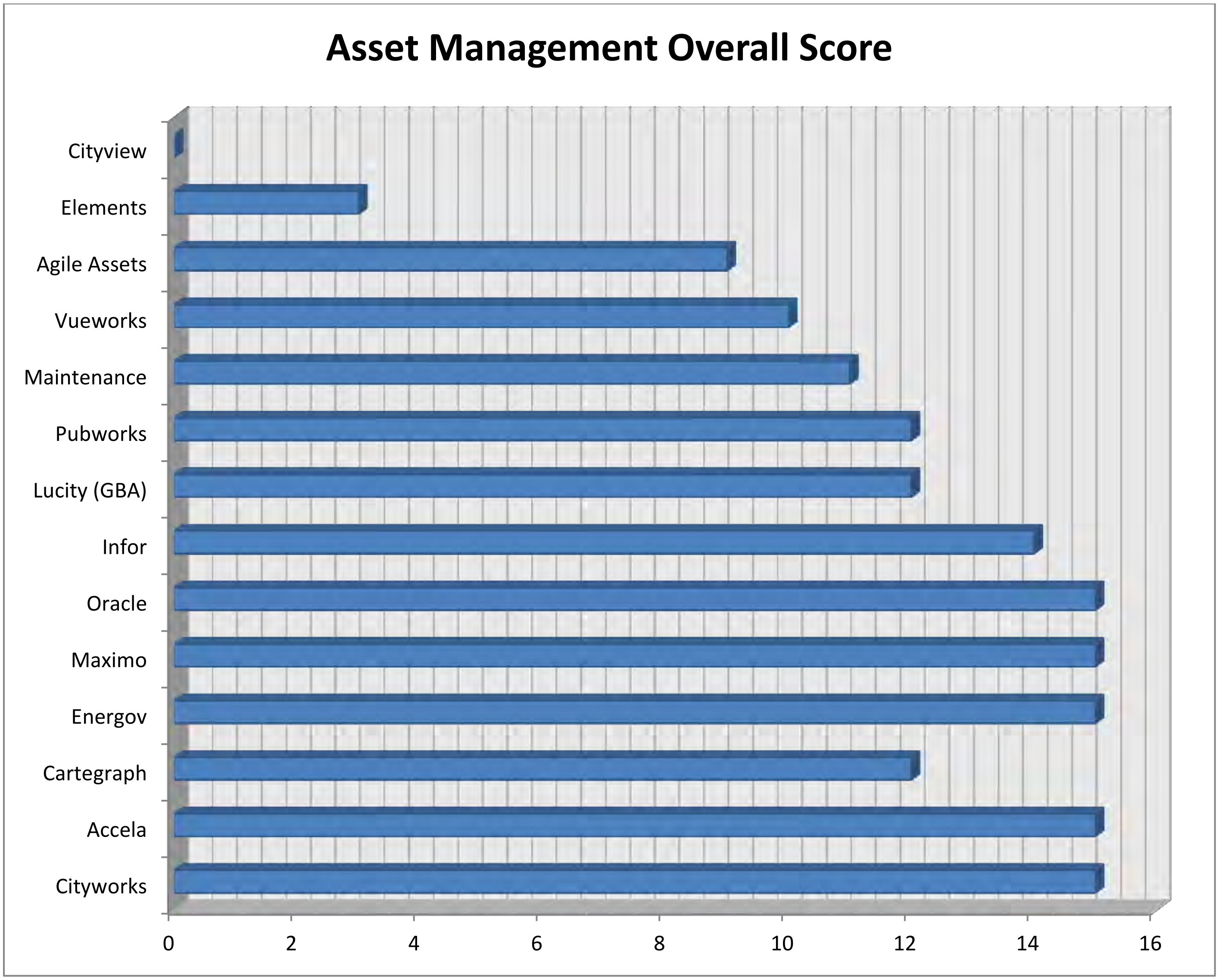
## Work Management

The Work Management functional category consisted of Work Orders and Work Flow, Inventory Control, and Licensing and Permitting. A ranking score ranging from 1-5 was assigned to software for each of the 3 areas. A "5" score represents the highest functionality, while a low score represents a marginal level of functionality. If software did not have functionality in a given area then a zero was assigned and calculated into the overall scoring.

| Work Orders | | Inventory | | License/Permits | |
|---|---|---|---|---|---|
| Cityworks | 5 | Cityworks | 5 | Cityworks | 5 |
| Accela | 5 | Accela | 5 | Accela | 5 |
| Energov | 4 | Maximo | 5 | Cityview | 5 |
| Infor/Hansen | 4 | Lucity (GBA) | 5 | Energov | 5 |
| Maintenance | 4 | Pubworks | 5 | Cartegraph | 4 |
| Maximo | 4 | Infor/Hansen | 5 | Lucity (GBA) | 4 |
| Lucity (GBA) | 4 | Oracle | 5 | Maximo | 4 |
| Cartegraph | 4 | Cartegraph | 5 | Infor/Hansen | 4 |
| Elements | 4 | Elements | 5 | Oracle | 4 |
| Oracle | 4 | Energov | 4 | Elements | 3 |
| Pubworks | 4 | Maintenance | 4 | Pubworks | 0 |
| Vueworks | 4 | Vueworks | 4 | Maintenance | 0 |
| Agile Assets | 3 | Agile Assets | 3 | Vueworks | 0 |
| Cityview | 0 | Cityview | 0 | Agile Assets | 0 |

## 6. REVIEW OF ASSET MANAGEMENT

Condition assessment can be defined as a method that establishes the current condition of assets as a means of prioritizing and forecasting maintenance and rehabilitation efforts. Condition assessment can help managers understand the level of asset deterioration and the risk management impact on the probability and consequence of failure. The Asset Inventory or Registry is central to any asset management program or strategy. An asset register is a systematic recording of all assets an organization owns or for which it has responsibility.



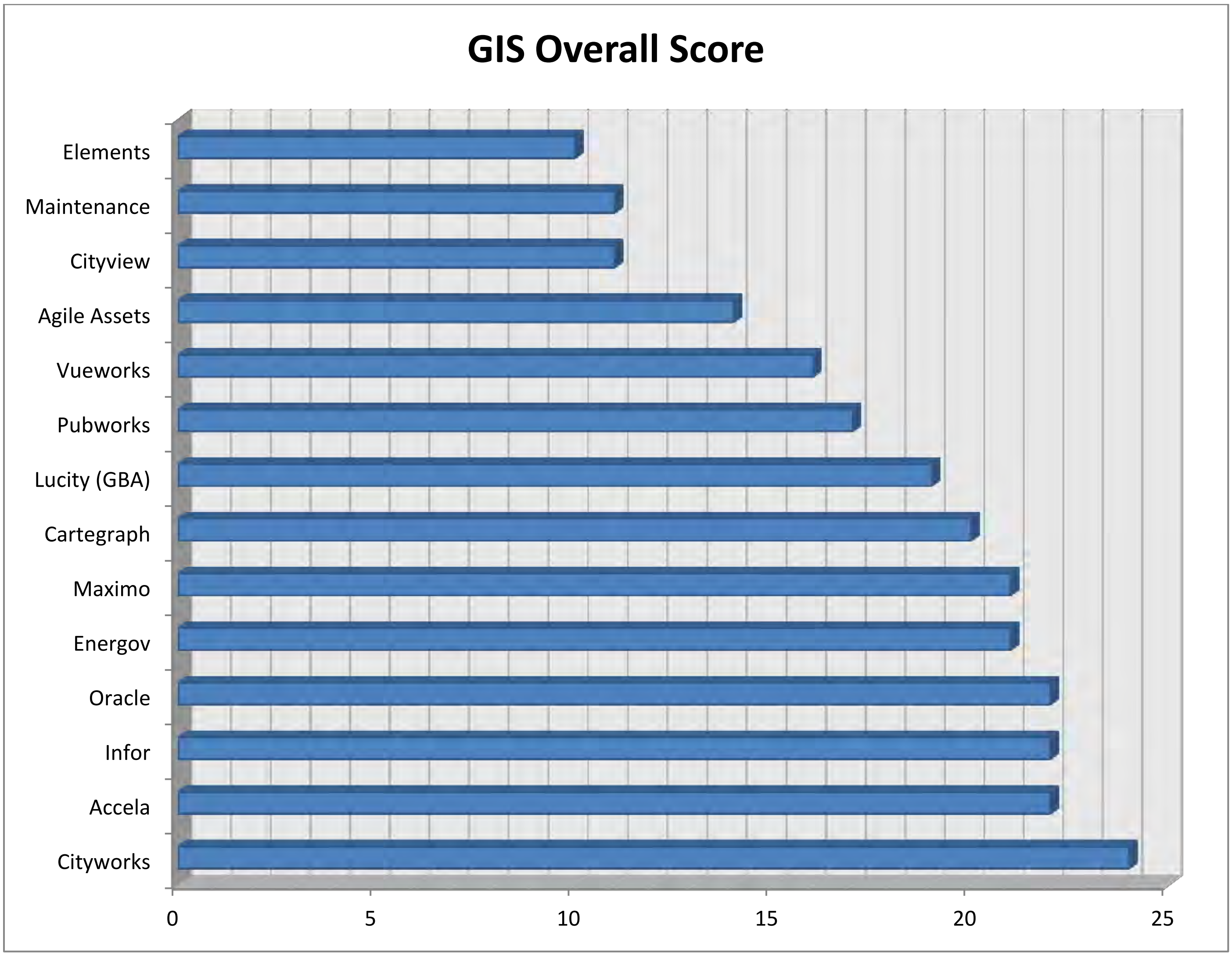
## Asset Management

Asset Management functional category includes Condition Assessment capabilities, Risk Management, and Asset Inventory and Hierarchy. A ranking score ranging from 1-5 was assigned to software for each of the 3 areas. A "5" score represents the highest functionality, while a low score represents a marginal level of functionality. If software did not have functionality in a given area then a zero was assigned and calculated into the overall scoring.

| Condition Assessment | | Risk Management | | Asset Inventory | |
|---|---|---|---|---|---|
| Cityworks | 5 | Cityworks | 5 | Cityworks | 5 |
| Cityview | 0 | Cityview | 0 | Cityview | 0 |
| Elements | 0 | Elements | 0 | Accela | 5 |
| Accela | 5 | Accela | 5 | Cartegraph | 4 |
| Cartegraph | 4 | Cartegraph | 4 | Energov | 5 |
| Energov | 5 | Energov | 5 | Maximo | 5 |
| Maximo | 5 | Maximo | 5 | Oracle | 5 |
| Infor | 5 | Infor | 5 | Infor | 4 |
| Oracle | 5 | Oracle | 5 | Lucity (GBA) | 4 |
| Lucity (GBA) | 4 | Lucity (GBA) | 4 | Pubworks | 4 |
| Maintenance | 4 | Maintenance | 4 | Agile Assets | 3 |
| Pubworks | 4 | Pubworks | 4 | Elements | 3 |
| Agile Assets | 3 | Vueworks | 4 | Maintenance | 3 |
| Vueworks | 3 | Agile Assets | 3 | Vueworks | 3 |

## 7. REVIEW OF GIS

Investing in a complete GIS system with full functionality produces an overall reduction in operating and maintenance costs and can become the foundation of a lower cost asset management system. Technology has increased the operating efficiencies of municipalities and utilities by converting manual office process from paper to an intelligent automation system. GIS is a unique system of hardware, software and data used to create, store, edit, organize, manipulate and analyze information within a geographic area. GIS offers the ability to visualize models of the physical infrastructure and related activities in a map view.



## GIS

The GIS (Geographical Information System) functional category consists of GIS Mapping features, Esri GIS integration, 311 System Abilities, Mobile Devices Enhancements, and Esri GIS ROI (Return on Investment) considerations. A "5" score represents the highest functionality, while a low score represents a marginal level of functionality. If software did not have functionality in a given area then a zero was assigned and calculated into the overall scoring.

| GIS Mapping | | Esri Integration | | 311 System | | Mobile Devices | |
|---|---|---|---|---|---|---|---|
| Cityworks | 5 | Cityworks | 5 | Accela | 5 | Accela | 5 |
| Accela | 5 | Accela | 4 | Cartegraph | 5 | Maximo | 5 |
| Cartegraph | 5 | Cartegraph | 4 | Energov | 5 | Infor/Hansen | 5 |
| Elements | 5 | Energov | 4 | Infor/Hansen | 5 | Oracle | 5 |
| Energov | 5 | Maximo | 4 | Oracle | 5 | Cityworks | 4 |
| Maximo | 5 | Infor/Hansen | 4 | Pubworks | 5 | Agile Assets | 4 |
| Infor/Hansen | 5 | Lucity (GBA) | 4 | Cityworks | 4 | Energov | 4 |
| Lucity (GBA) | 5 | Oracle | 4 | Maximo | 4 | Cartegraph | 3 |
| Oracle | 5 | Agile Assets | 3 | Lucity (GBA) | 4 | Cityview | 3 |
| Vueworks | 5 | Elements | 3 | Vueworks | 4 | Lucity (GBA) | 3 |
| Agile Assets | 4 | Maintenance | 3 | Cityview | 3 | Maintenance | 3 |
| Cityview | 4 | Pubworks | 3 | Agile Assets | 2 | Pubworks | 3 |
| Pubworks | 4 | Vueworks | 3 | Elements | 0 | Vueworks | 2 |
| Maintenance | 3 | Cityview | 0 | Maintenance | 0 | Elements | 0 |

GIS has been able to meet the increased demand for mobility and information sharing. Many applications for asset maintenance and management purposes have been developed by software companies in order to improve the transactional cost of public accountability. Some of these features can also be accessed through 3rd party vendors. Municipalities and utilities have benefited from 311 citizen information, request and tracking systems as well as mobile remote business functionality via handheld mobile devices. 311 capabilities and mobile device initiatives are continually improving for top vendors.

## Esri GIS ROI

GIS offers a return on investment (ROI) and these operational savings will continue almost indefinitely. Municipalities and utilities in the United States and Canada rely on the industry leader Esri (Environmental Systems Research Institute) GIS for their GIS software. Local governments and utilities benefit overall with standardization and common open standards for consistency which helps achieves lower-costs with the economies of scale. Under this GIS Centric approach, the Esri GIS ArcGIS geodatabase is the feature database for storing the all asset attributes. Additionally, there is no redundancy for data storage (no reliance on views, data mapping, database triggers, or "transparent" links). All feature (asset) data is fully user-definable and customizable without vendor support. This would include common standardization absent expensive non-proprietary feature data model format, including data names, fields, tables, relationships, and other data design elements.

| Esri GIS ROI | | Esri PARTNER LEVEL |
|---|---|---|
| Cityworks | 5 | Platinum |
| Accela | 3 | Gold |
| Cartegraph | 3 | Silver |
| Energov | 3 | Gold |
| Maximo | 3 | - |
| Infor/Hansen | 3 | member- |
| Lucity (GBA) | 3 | Gold |
| Oracle | 3 | - |
| Elements | 2 | - |
| Maintenance | 2 | - |
| Pubworks | 2 | - |
| Vueworks | 2 | -member |
| Agile Assets | 1 | - |
| Cityview | 1 | - |

## 8. REVIEW OF COST FACTORS

Overall Scores and Rankings normally are based on the functional categories scores and averages. Under this review, the four major functional categories were weighted evenly. The element of cost adds additional complexity to the analysis. Most municipalities and utilities will normally focus on the core functionality of the software in order to meet all current and future business needs before reviewing bids or prices. The price component can be challenging considering there are the basic user licenses, software and maintenance costs and agreements combined with phased implementations, modular selections, data clean up, data conversion, systems integrations, testing and training. This study focuses on the common costs; however, it is very important to note that if various modules are selected and integrated, the costs of implementation are normally significant higher.

| Cost Factors | (5 is a high cost) | |
|---|---|---|
| Agile Assets | 2 | Low |
| Cityview | 2 | Low |
| Elements | 2 | Low |
| Pubworks | 2 | Low |
| Cityworks | 3 | Average |
| Cartegraph | 3 | Average |
| Energov | 3 | Average |
| Lucity (GBA) | 3 | Average |
| Maintenance | 3 | Average |
| Vueworks | 3 | Average |
| Accela | 4 | High |
| Infor/Hansen | 4 | High |
| Maximo | 5 | High |
| Oracle | 5 | High |

## Cost Factors

Likewise, when system integration and conversion is required for many different systems and several modules, the initial implementation and long-term system synchronization and maintenance of redundant databases can raise the total cost of ownership significantly. This is very true in the area of licensing and permitting. Every municipality and utility has a degree of data clean up due to neglect or inconsistent policies and practices concerning work order histories and inspection recording and asset data collection. One specific area of concern has been the development of the asset inventory and the connectivity and integration with GIS software.

## 9. Esri GIS ArcGIS: Geodatabase management

ArcGIS for Desktop includes comprehensive professional GIS applications that support a number of GIS tasks, including mapping, data compilation, analysis, geodata and image management, and geographic information sharing. ArcGIS for Desktop is the platform that GIS professionals use to manage their GIS workflows and projects and to build data, maps, models, and applications. It is also the starting point and the foundation for deploying GIS across organizations and onto the web. It is used to publish and share geographic information with others.

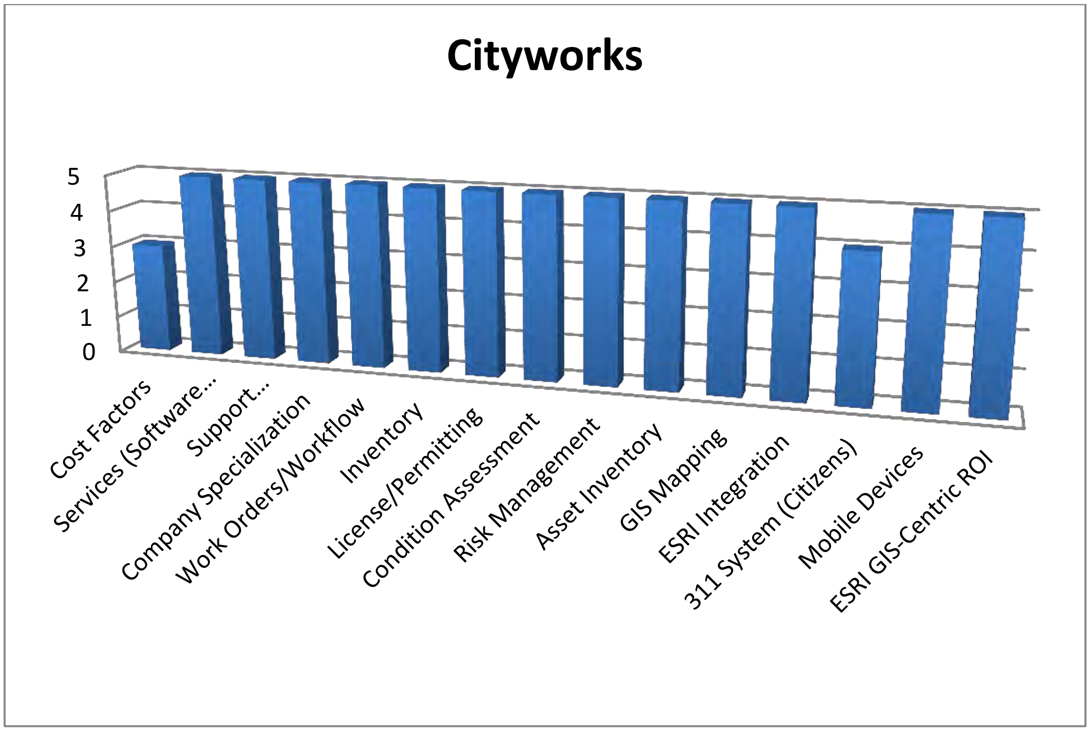
ArcGIS for Server includes capabilities for managing multiuser geodatabases in a number of DBMSs. When you need a large multiuser geodatabase that can be edited and used simultaneously by many users or that can be synchronized across many copies (replicas) of the database, the geodatabase provides a good solution.

ArcGIS for Server adds the ability to manage shared, multiuser geodatabases as well as support for a number of critical multiuser database workflows. The ability to leverage your organization's enterprise relational database is a key advantage. Multiuser, transactional geodatabases work with a variety of DBMS storage models (for example, IBM DB2, Informix, Oracle, PostgreSQL, and SQL Server). Geodatabases take full advantage of underlying DBMS architectures to support the following:

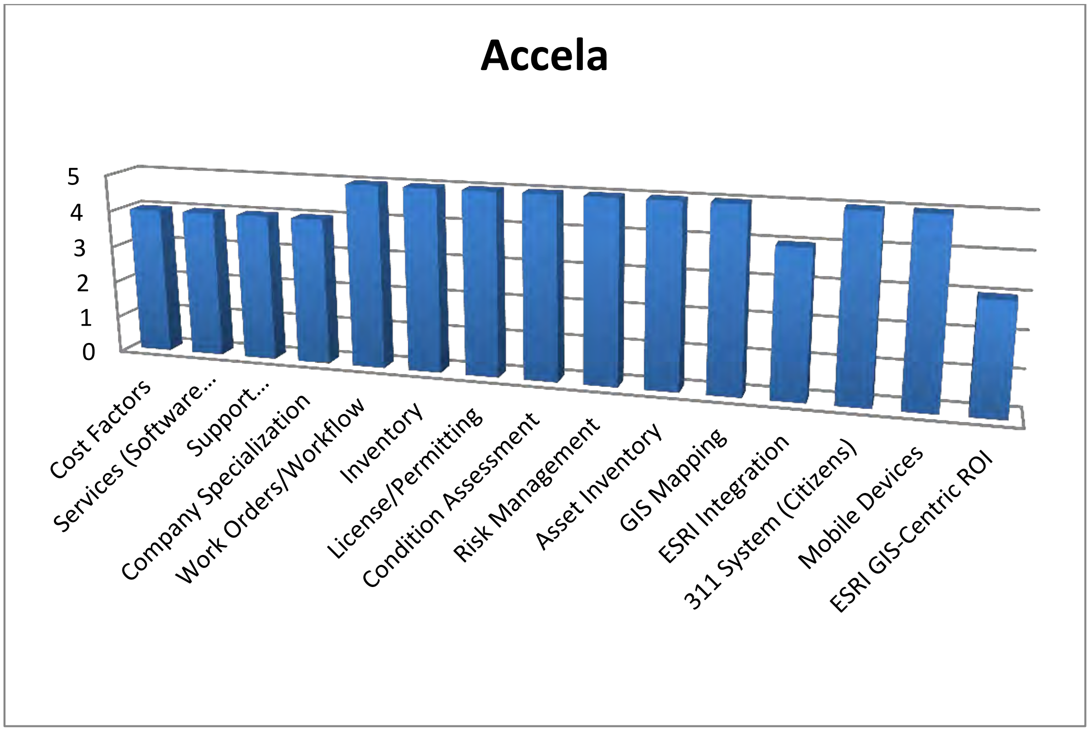
- Extremely large, continuous GIS databases
- Many simultaneous users
- Long transactions and versioned workflows
- Relational database support for GIS data management (providing the benefits of a relational database for scalability, reliability, security, backup, integrity, and so forth)
- SQL types for spatial in all supported DBMSs (Oracle, SQL Server, PostgreSQL, Informix, and DB2)
- High performance that can scale to a very large number of users

DBMSs are efficient at retrieving and working with records containing the type of large geometry elements required for GIS data. In addition, GIS database sizes can be much larger, and the number of supported users greater, than with file-based GIS datasets.

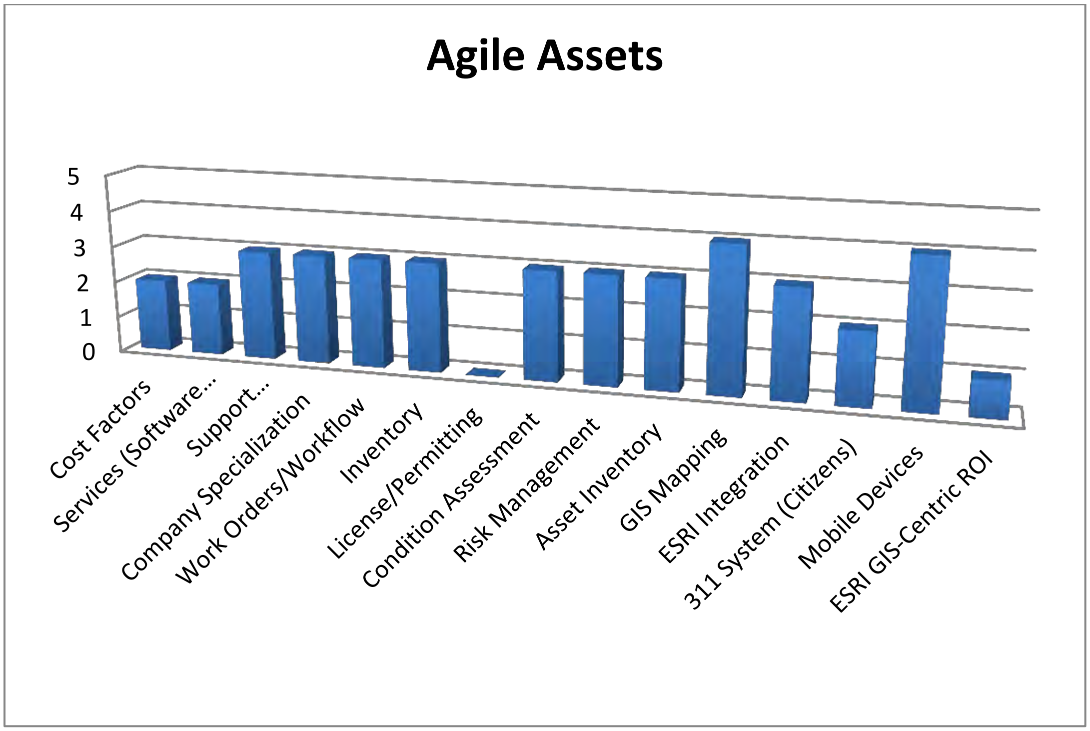
## 10. PROFILE: Azteca Systems CITYWORKS



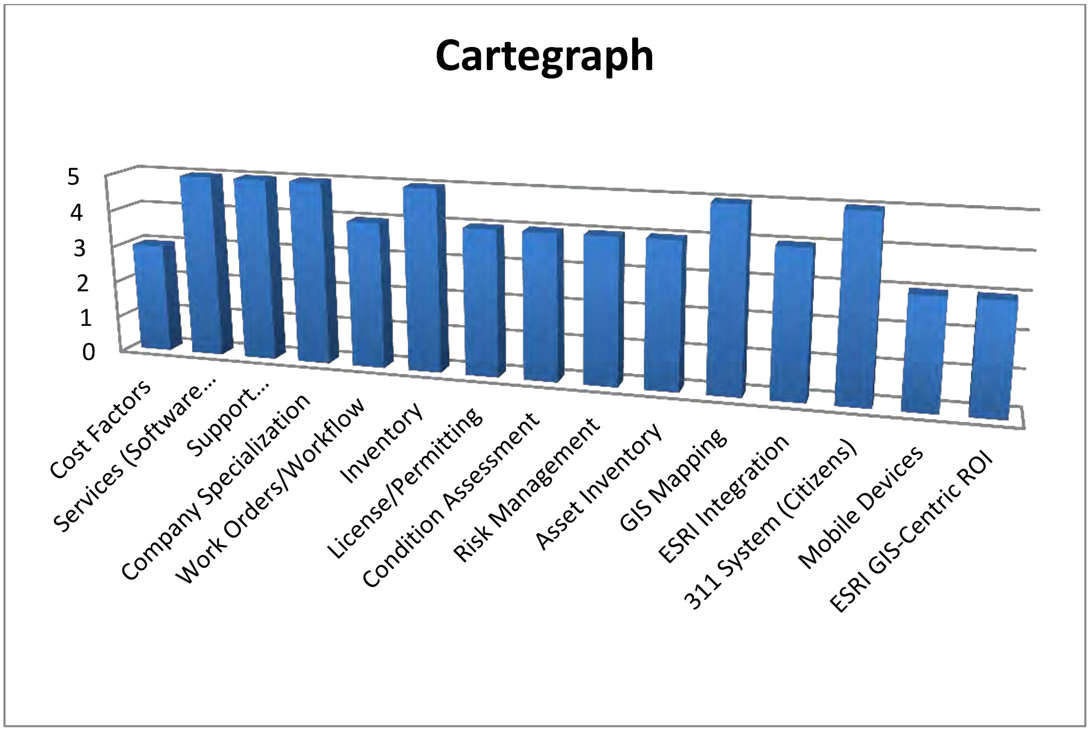
# 10. PROFILE: ACCELA



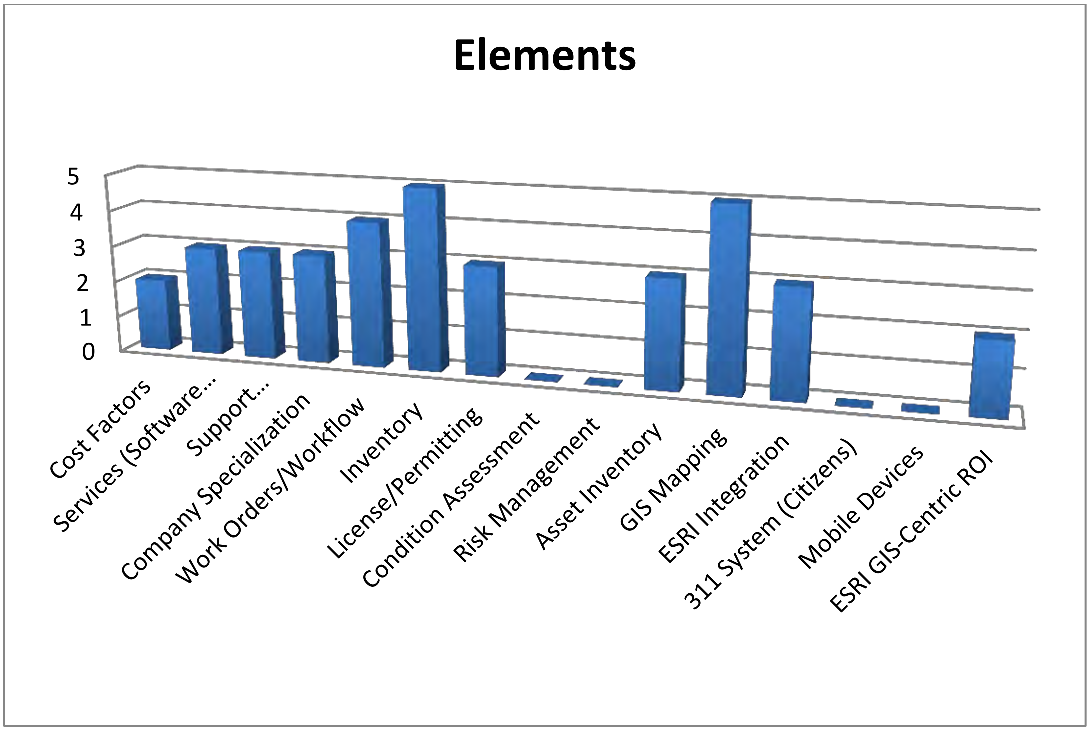
## 10. PROFILE: AGILE ASSETS



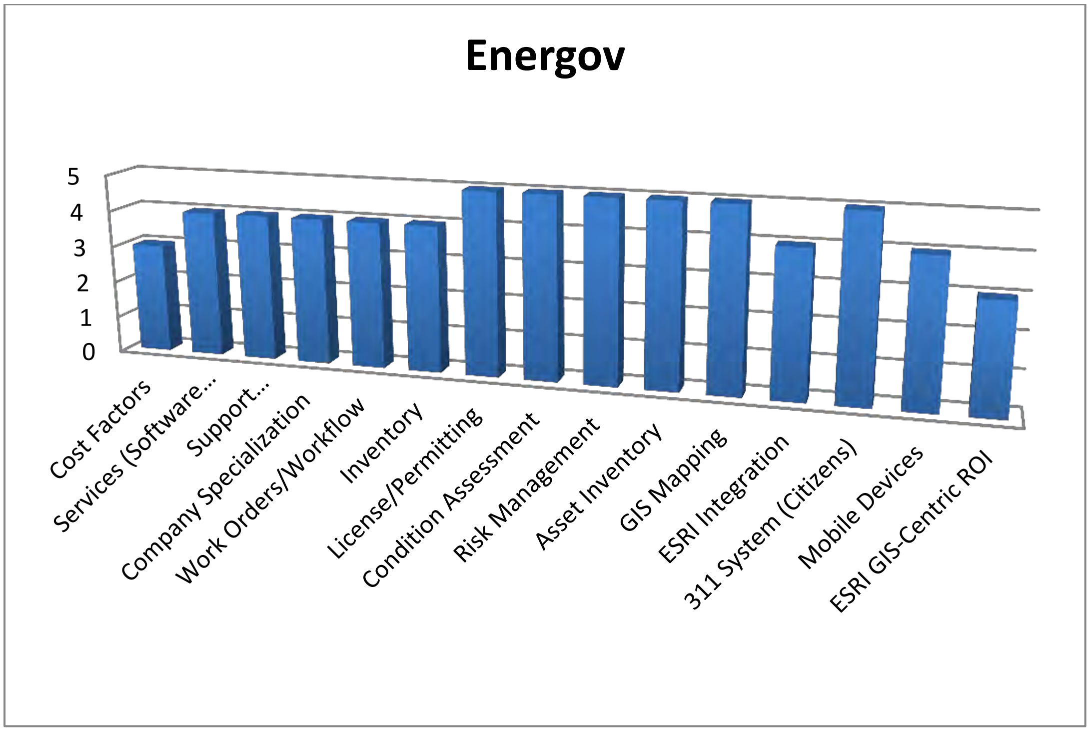
## 10. PROFILE: CARTEGRAPH



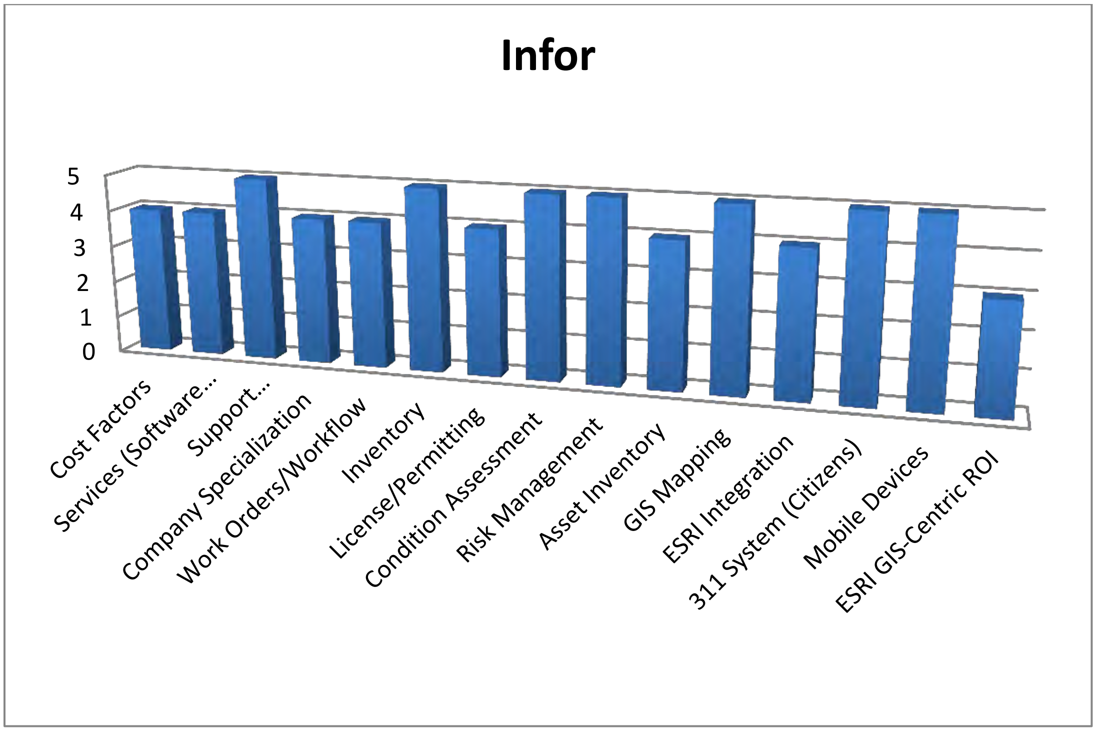
# 10. PROFILE: ELEMENTS



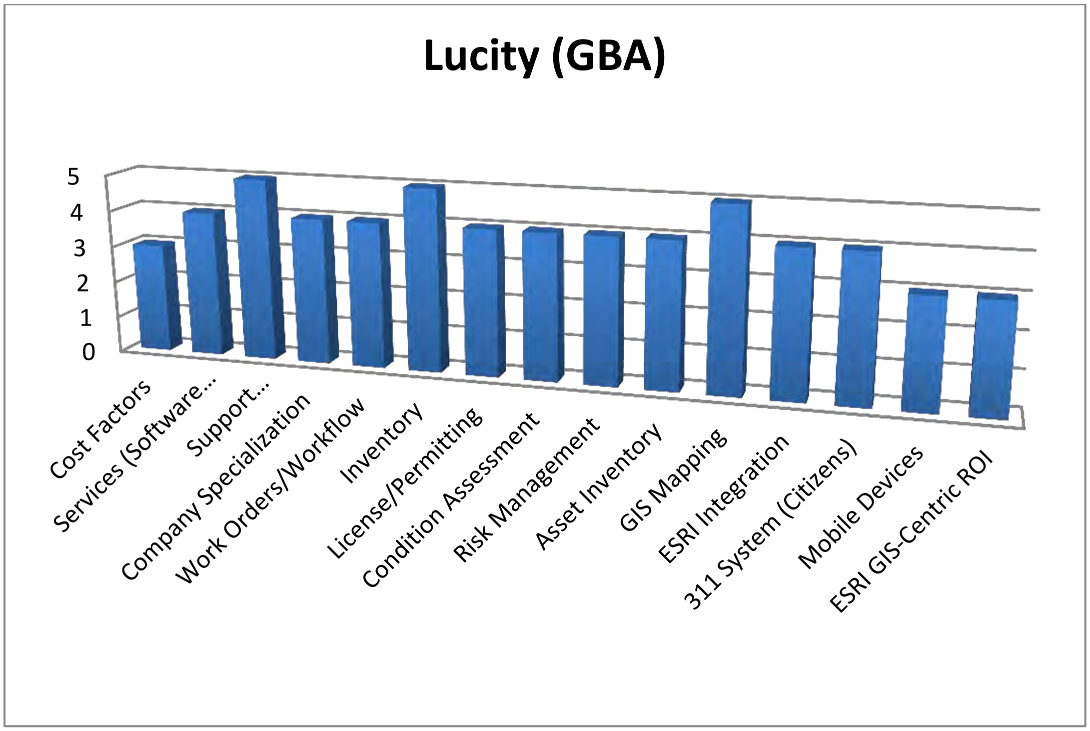
## 10. PROFILE: ENERGOV



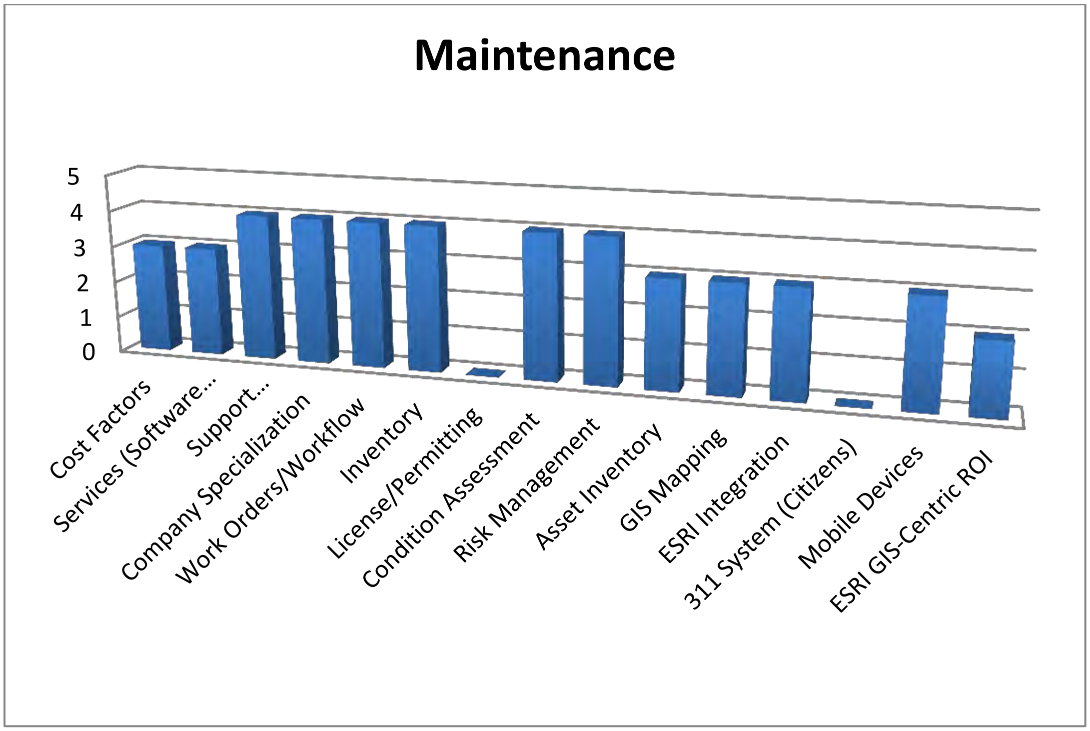
# 10. PROFILE: INFOR/HANSEN



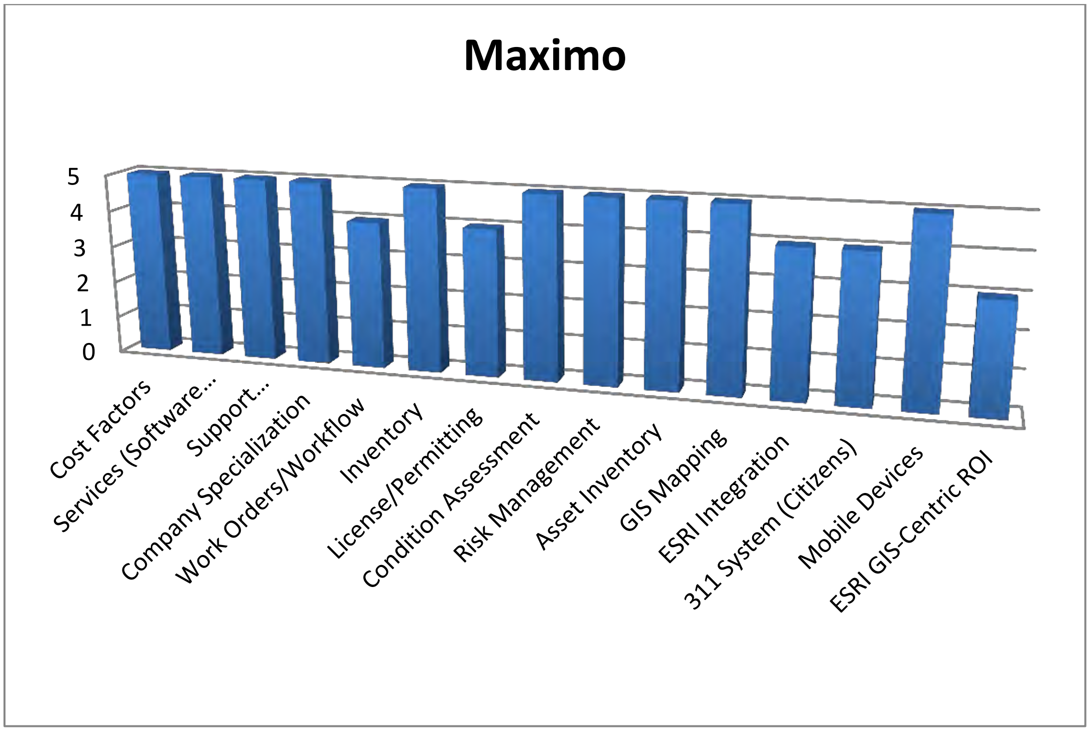
## 10. PROFILE: LUCITY (GBR)



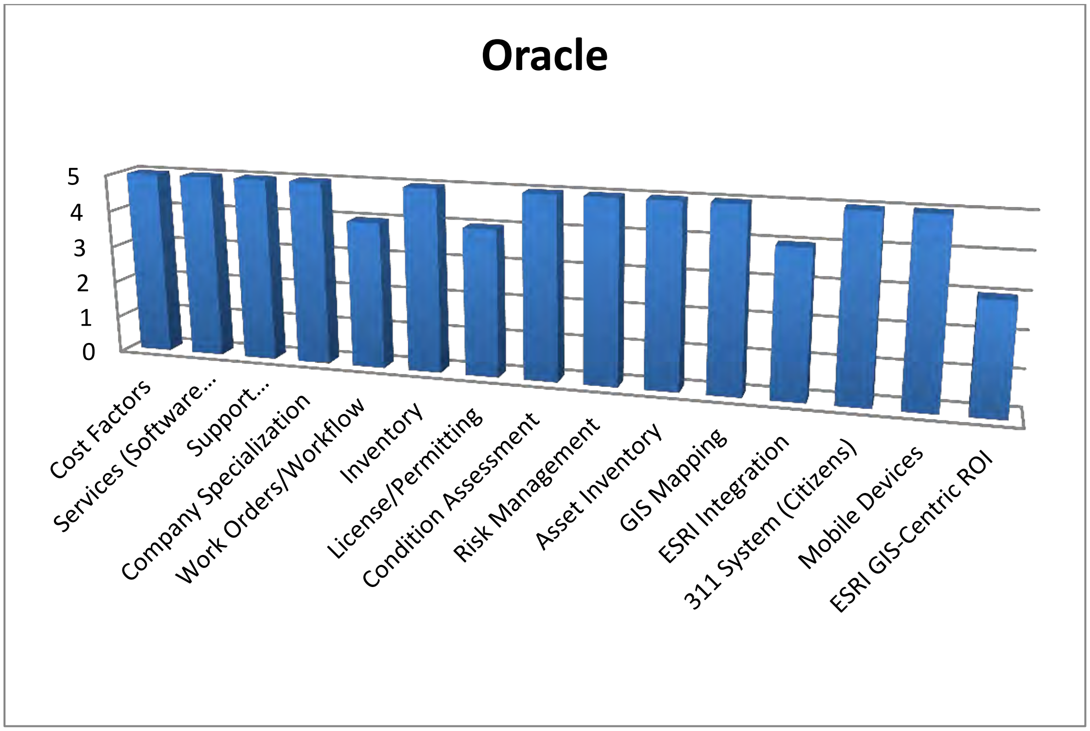
## 10. PROFILE: MAINTENANCE CONNECTION



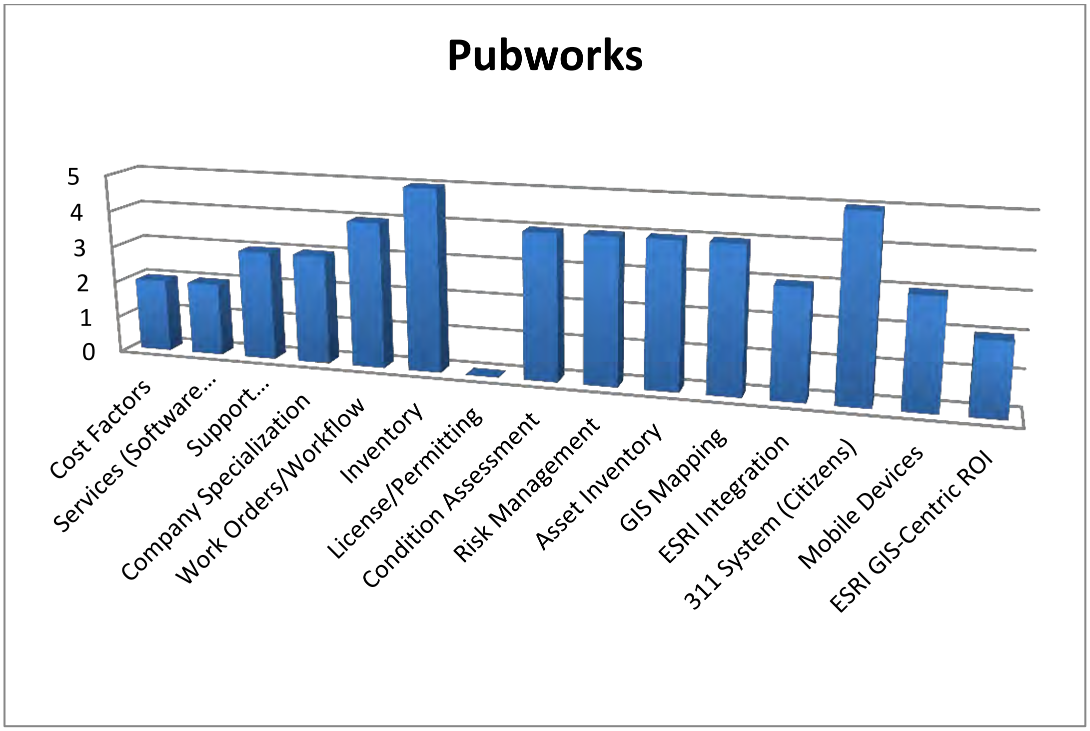
## 10. PROFILE: IBM MAXIMO



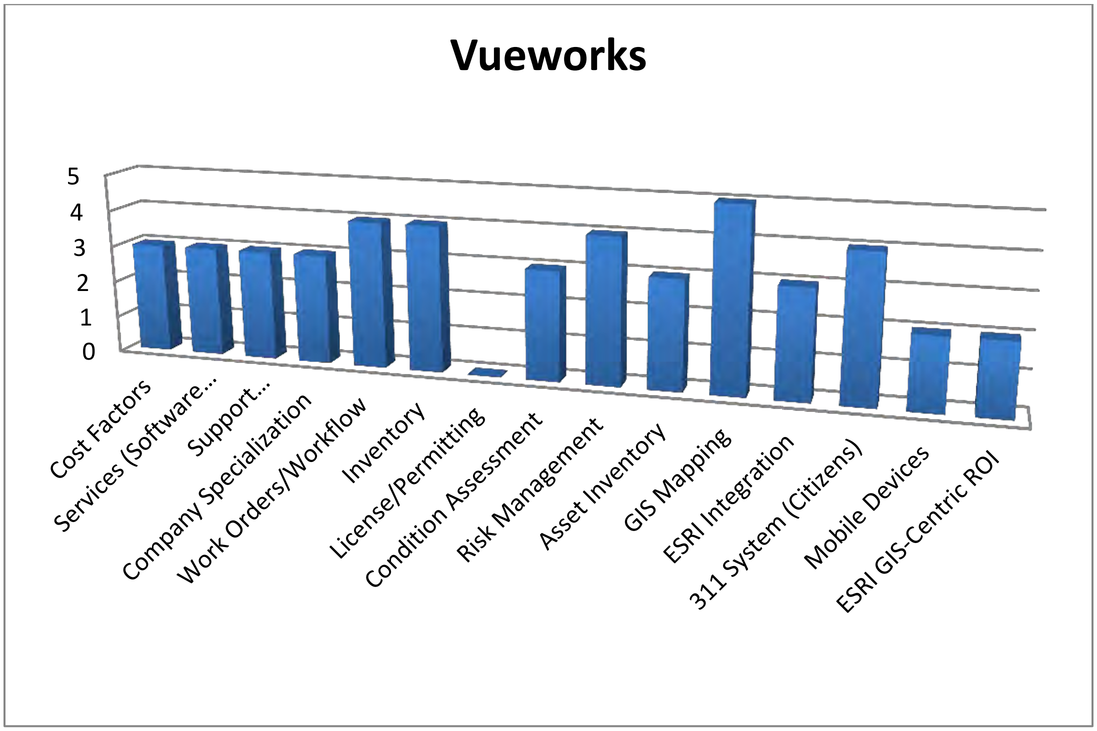
## 10. PROFILE: ORACLE



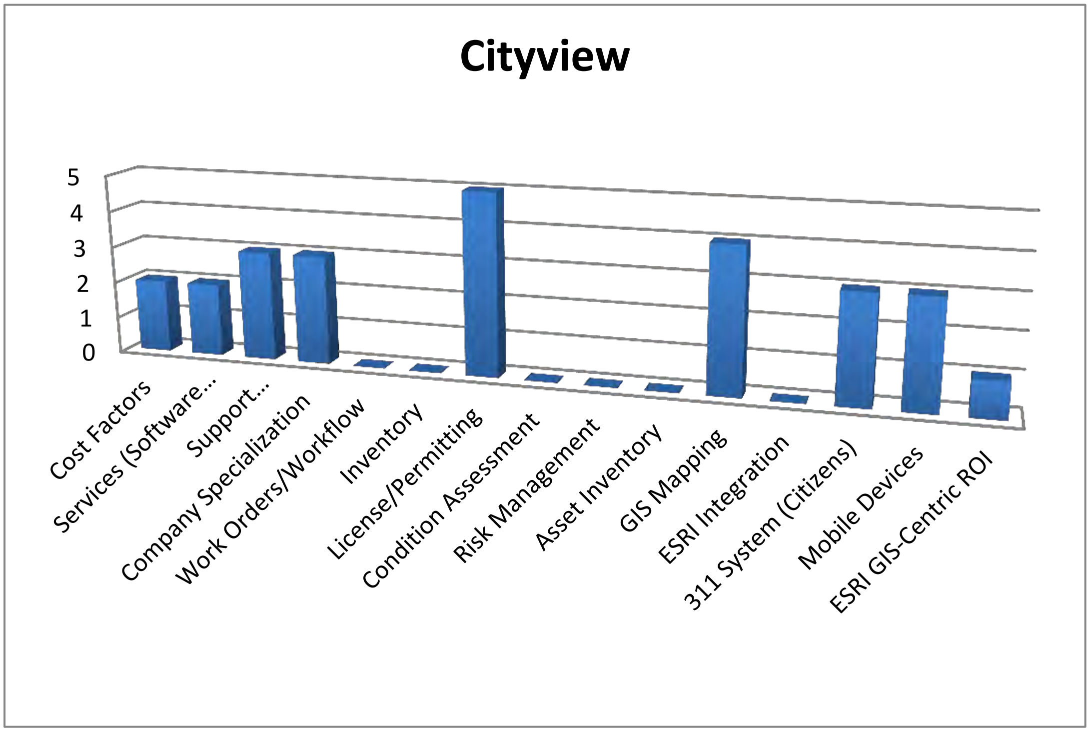
# 10. PROFILE: PUBWORKS



# 10. PROFILE: VUEWORKS



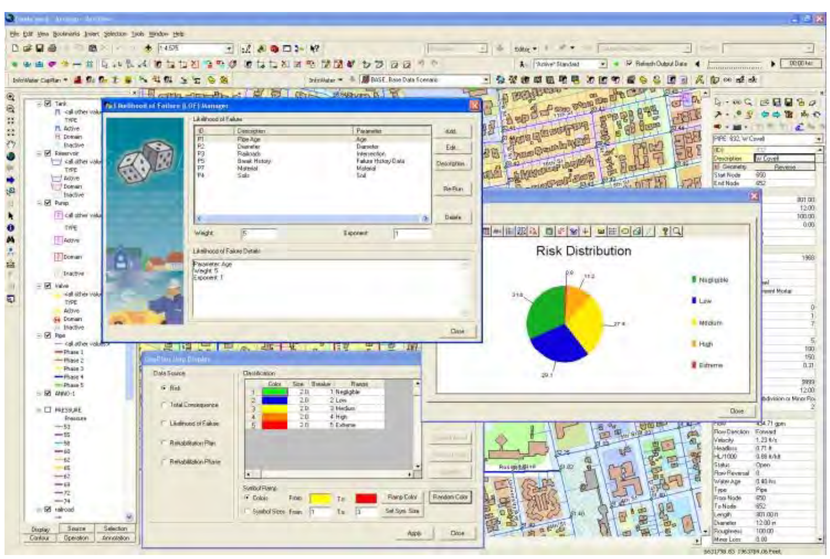
# 10. PROFILE: CITYVIEW



## 11. WATER and SEWER UTILITIES: INNOVYZE

Innovyze is a leading global provider of wet infrastructure business analytics software solutions designed to meet the technological needs of water and wastewater utilities, government industries, and engineering organizations worldwide.

Underground infrastructure is rapidly deteriorating and many utilities struggle with developing a rehabilitation and replacement program that addresses the most critical pipes in the system. Many capital improvement programs spend millions of dollars annually, but often do little to lower total system risk. CapPlan Water offers utilities the tools in one off-the-shelf software package to build or refine the capital improvement plans to provide maximum benefit for the lowest cost. Determining the likelihood of failure for a pressurized underground water pipe is a critical task. CapPlan Water combines infrastructure, hydraulic, spatial, and historical data from numerous sources to estimate for likelihood of failure. Understanding the consequences of a pipe failing is critical to determining its replacement priority. CapPlan Water has powerful tools to assess the hydraulic, geographic, spatial, and public relations criticality of each pipe in the system—including automatically taking each pipe out of service and determining the hydraulic and water quality consequences. A Risk Factor is determined for each pipe based on the Likelihood and Consequence of Failure. CapPlan Water has a wide range of budgeting options available to evaluate the highest priority pipes within existing budgets and to determine necessary budgets over the long-term to mitigate high risk levels.



## 12. REFERENCES

The Water Research Foundation would like to acknowledge and thank the researchers and contributors to this study.


- American Public Works Association (APWA) members www.apwa.net
- California Society of Municipal Finance Officers (CSMFO) members www.csmfo.org
- Government Finance Officers Associations (GFOA) members www.gfoa.org
- Interviews of software marketing and technical staff at industry conferences.
- http://resources.arcgis.com
- http://www.fhwa.dot.gov
- http://www.nrc-cnrc.gc.ca/eng/index.html
- www.accela.com
- www.agileassets.com
- www.cartegraph.com
- www.cityworks.com
- www.elementsxs.com
- www.energov.com
- www.esri.com
- www.infor.com
- www.infotivity.com
- www.innovyze.com
- www.lucity.com
- www.maintenanceconnection.com
- www.msgovern.com
- www.oracle.com
- www.oracle.com
- www.plantservices.com
- www.pubworks.com
- www.reliabilityweb.com
- www.vueworks.com
- www-01.ibm.com

## WFRF

The Water Finance Research Foundation (www.Water FinanceRF.org) is a non-profit organization dedicated to finding solutions which help local governments and utilities address the challenges of aging infrastructure, funding and a declining workforce. The WFRF supports and provides research, surveys, analysis, publications and training concerning best practices for municipal and utility management.

The WFRF promotes municipal infrastructure asset management practices for state, county and local governments which increase efficiencies while reducing long-term operations, maintenance, and capital costs. A special focus is on wet infrastructure which includes water, wastewater, storm drain and reuse. A core program also includes creating opportunities for the next generation to gain knowledge and experience through research and publication opportunities. The WFRF also strives to help municipalities and utilities explore financing and funding solutions which includes rate and fee increases, debt refinancing, private-public partnerships, grants and other innovative programs.

The Water Finance Research Foundation is proud to sponsor and promote in 2013, The American Public Infrastructure Asset Management Association (API-AMA). API-AMA focuses on traditional municipal infrastructure asset management combined with public asset management (the connectivity of assets with business activities and citizens). The evolution and power of GIS and other technologies has increased our ability to translate data into intelligence for improved resource investment decision making.

The American Public Infrastructure Asset Management Association API-AMA represents:

- Public Works Managers
- Municipal and Utility Asset Managers
- GIS Professionals
- CMMS (Computerized Maintenance Management Systems) Personnel
- Asset Management and Work Order Maintenance Management Software Managers
- Risk Management Managers
- Infrastructure and Design Engineers
- Capital Funding and Budget Approval Professionals
- Economic Development and Growth Planning Managers

## LEGAL NOTICE

Please be advised, this study and survey was completed based on numerous sources including third parties and has not been independently verified. Software is continually updated and revised and the information and functionality assessment is evaluated at a point in time and does not represent future enhancements. WFRF assumes no legal liability or responsibility for the accuracy, completeness, or usefulness of any information, nor does the WFRF represent that its use would not infringe on any privately owned rights.  This study may include facts, views, opinions and recommendations of individuals and organizations deemed of interest and assume the reader is sophisticated in this industry and will make their own independent decisions. Users waive any rights it might have in respect of this study under any doctrine of third-party beneficiary, including the contracts (Rights of Third Parties) Act 1999. The use of this study is at the users' sole risk and no reliance should be placed upon any other oral or written agreement, representation or warranty relating to the information herein.

THIS STUDY IS PROVIDED ON AN "AS-IS" BASIS, WFRF DISCLAIMS ALL WARRANTIES OF ANY KIND, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT. WFRF, NOT ITS MEMBERS, AFFILIATES, SERVICE PROVIDERS, OFFICERS, DIRECTORS, OR EMPLOYEES SHALL BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR RELATING TO THIS REPORT OR RESULTING FROM THE USE OF THIS REPORT, INCLUDING BUT NOT LIMITED TO DAMAGES FOR LOSS OF PROFITS, FUTURE PROFITS, USE, DATA OR OTHER TANGIBLE DAMAGES, EVEN IF SUCH PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. THE CONTENT OF THIS STUDY SHOULD NOT BE USED FOR ANY UNLAWFUL OR UNINTENDED PURPOSE.

**Appendix 5-F**

Excerpt on Cheyenne BOPU from DRAFT

"Legacy of Manganese Accumulation in Water Systems: Assessment, Consequence and Prevention", Water Research Foundation (WRF), 2013.

The information for the Utility C case study was obtained from various sources, including: responses to the project utility questionnaire, site visit and interview notes (Dec-2012), case study information, participation in other WRF projects, O&M practices and observations, distribution system water quality from recent consultant investigations and reports, and responses to further Project Team questions. Utility C was selected for a case study because it has a long history of discolored water events and has known Mn accumulation in the raw water feed lines and distribution system piping. This utility has taken significant measures to prevent additional Mn from entering the distribution system. These projects have been very successful. However, the utility does continue to experience on-going challenges related to colored water events. This is attributed to Mn accumulation and associated periodic destabilization/release events. Utility C regularly performs distribution system monitoring and pipe cleaning practices to control the occurrence of legacy Mn.

For this project, Utility C performed four sampling of hydrant flushes to supplement data provided by the survey and case study interview. Water quality samples were obtained during the late spring before the annual system flush and prior to peak summer demands. Samples were taken from four locations within the system that were likely to carry water that traveled through the primary treated water distribution line which has shown evidence of Mn accumulation. All sample locations were taken off the same diameter main line, had similar average velocities ($\leq$0.3 feet per second) and similar system pressure (113-145 psi). The objective of the proposed field testing was to determine the total mass of Mn released and which compounds are released into the water supply during typical operational flushing and colored water events.

## Customer Satisfaction

### *Documentation of Dissatisfaction*

#### Perceived

Utility C has been experiencing colored water events since 1995. The first known event related to Mn corresponded with the construction of a new water storage tank located at the head of the distribution system down stream of existing wells. At this time Utility C had no Mn treatment in place, although free chlorine was used for disinfection and to provide disinfectant residual. The utility believes that the new tank provided enough additional detention time to permit the oxidation of soluble Mn by free chlorine. They believe particulate Mn formed in the tank, would periodically enter the distribution system, causing colored water events.

Utility C reported that consumer confidence was impaired following major colored water events in 2002 and in 2006. The event in 2002 corresponded to start up of a new WTP during which they changed the Mn treatment process. The 2002 Mn event occurred during the conditioning of the new mixed media filters with permanganate in order to prepare the filters for Mn removal by surface oxidation and sorption (e.g. greensand effect). The utility was not sure if the colored water event was somehow due to the passage of permanganate used during the conditioning process or from background Mn which was not removed during the start-up process.

The event in 2006 was primarily attributed to high Mn concentrations in the raw water supply. In 2006 the utility changed its water supply management strategy in the terminal reservoir supplying the WTP. This change in how and which water source was being supplied to the reservoir resulted an intense period of thermal stratification in the reservoir. High concentrations of soluble Mn were released during this period which overwhelmed the removal capacity of the WTP. Hence high Mn concentrations passed into the distribution system, causing a widespread color event. Improvements to the raw water supply system made in 2009, primarily consisting of the addition of a hypolimnetic aeration system in the terminal reservoir, significantly reduced the frequency and concentration of dissolved Mn entering the WTP. This in turn significantly reduced the amount of Mn entering the distribution system.

Anecdotally, approximately half of all colored water events are localized to the oldest part of the distribution system, which is supplied by a major treated water distribution line that has previously shown evidence of Mn accumulation. The pipe in the Mn impacted area is primarily 4” diameter unlined ductile or cast iron pipe. According to utility staff, these areas tend to have more tuberculation and increased sediment accumulation. The remaining events are spread throughout the distribution system, which consists of a variety of pipe diameters and materials.

### Measured

Utility C began documenting customer complaints in 2000. A summary of the total number of complaints per year is provided in Table 1.1. With the exception of the large events in 2002 – caused by the start-up of a new WTP and 2006 – caused by a change in raw water management strategy, and smaller events in 2011 and 2012, Utility C typically receives an average of 50 complaints per year. The number of complaints has slightly increased over the last few years. The utility attributes this to special circumstance in 2011 and 2012. In 2011, due to the success of the lake aeration system added in 2009, Utility C discontinued the use of free chlorine upstream of their filters, allowing them to become biologically active. In anticipation of this change Utility C treated their filter media with sodium bisulfate to solubilize Mn which had accumulated on the filter. Even though this process was successful, the utility believes some residual Mn occasionally leaches from the filters, possibly causing an increase in colored water events in 2011.

The increase in complaints in 2012 is attributed to early summer (domestic irrigation) demands. Utility C regularly performs a non-unidirectional system flush each spring in anticipation of increased demands during the summer. The utility’s intent is to do an early flush to purge accumulated sediment, including Mn which may accumulated during low demand periods.

The increase in complaints in 2012 is attributed to the first peak demand of each year occurring before the system flush. The water demands neared peak summer demands in the early spring before the annual system wide flush had occurred. The bulk of complaints in 2012 occurred in early spring from March to May. The high velocities in the system resulting from the peak demands are thought to have acted as an unintentional system flush, dislodging scale in the pipes and resulting in colored water events.

The total number of complaints per month for the 2000 through 2012 time frame is shown on Table 1.1. The years are classified as ‘event’ years and ‘baseline’ years. Event years, 2002, 2006, 2011 and 2012 are years where specific events can be related to colored water events in the distribution system. Baseline years are those years when no exceptional event occurred and colored water complaints are most likely related to ‘routine’ disturbances in the distribution system.

**Table** Error! No text of specified style in document.**.1 Total number of colored water complaints per year**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | 14 | 5 | 10 | 4 | 0 | 2 | 5 | 2 | 0 | 0 | 3 | 3 | 15 |
| February | 6 | 6 | 16 | 3 | 4 | 3 | 4 | 3 | 2 | 3 | 5 | 0 | 1 |
| March | 9 | 18 | 25 | 3 | 3 | 1 | 29 | 2 | 3 | 2 | 5 | 5 | 12 |
| April | 3 | 11 | 54 | 6 | 1 | 4 | 36 | 4 | 1 | 1 | 1 | 5 | 18 |
| May | 2 | 8 | 140 | 4 | 2 | 6 | 10 | 5 | 0 | 4 | 1 | 5 | 14 |
| June | 0 | 4 | 42 | 1 | 4 | 5 | 3 | 11 | 6 | 2 | 4 | 18 | 6 |
| July | 2 | 3 | 54 | 4 | 3 | 2 | 0 | 1 | 1 | 1 | 4 | 6 | 4 |
| August | 4 | 2 | 5 | 5 | 4 | 3 | 99 | 5 | 4 | 2 | 3 | 7 | 1 |
| September | 1 | 3 | 7 | 10 | 1 | 0 | 1 | 2 | 1 | 8 | 4 | 11 | 4 |
| October | 4 | 3 | 11 | 1 | 3 | 0 | 3 | 3 | 8 | 4 | 1 | 7 | 3 |
| November | 14 | 6 | 7 | 1 | 0 | 2 | 0 | 0 | 7 | 2 | 2 | 6 | 4 |
| December | 1 | 22 | 6 | 0 | 4 | 9 | 2 | 3 | 3 | 3 | 10 | 2 | 1 |
| Total: | 60 | 91 | 377 | 42 | 29 | 37 | 192 | 41 | 36 | 32 | 43 | 75 | 83 |
| Year Classification | ? | ? | Event | | Baseline | | Event | | Baseline | | | Event | Event |

Utility C provides service to over 20,000 service connections and over 20 wholesale connections. This results in a complaint ratio ranging from approximately 1 complaint per 53 to 690 service connections per year. Excluding the high complaint years, due to construction of the new WTP in 2002 and the Mn pass through event in 2006, the complaint ratio ranges from 1 complaint per 220 to 690 service connections per year.

### *Actions Taken to Restore Satisfaction*

#### Internal

Response to Customer Complaints – Utility C follows up on customer complaints of colored water by visiting the particular residence or location that are not cleared by the customer flushing their lines. If warranted the utility representative will perform spot flushing of the water mains in the vicinity of the residence to displace colored water and restore water quality. Water quality samples are not typically obtained for colored water complaints.

#### External

Restitution – Utility C has not made payment or restitution for any damages, whether perceived or real, due to legacy Mn or co-occurring contaminants. However, they have provided several customers with a product that can be used to remove colored water stains from laundry.

Service Interruption Response – Utility C has never interrupted service as a result of a Mn release event.

Public Relations – Utility C employs a full time public outreach director and consistently publishes information regarding water quality, scheduled system improvements, instructions on how to handle colored water events, etc. Notification methods include: posts on the social media site, publications in the local newspaper and a utility newsletter which is mailed with water bills. The individual responsible for public relations does not believe he spends a disproportionate amount of time on colored water events.

Public Meetings – Utility C does not hold public meetings in relation to colored water events.

### *Effectiveness of Actions in Addressing Customer Satisfaction Issues*

Customers seem generally satisfied with Utility C's actions both to inform the public of potential colored water events and with the utility's response to individual complaints.

### Cost Impacts

Response to Customer Complaints – Utility C reportedly spends an average of 2 total person-hours per complaint to visit the customer and flush the line.

Restitution – Utility C has not paid direct costs for restitution.

Public Relations – The amount of time spent specifically addressing colored water concerns are absorbed into the daily workload and do not directly increase the cost of customer outreach.

Public Meetings – Utility C does not hold public meetings in relation to colored water events.

Lost Revenue – Utility C reported no loss of customers or detectable change in water sales due to legacy Mn release events.

## Co-Occurring Contaminants

### *Manganese-Based Inorganics Accumulation*

#### Contaminants

Utility C has monitored for a broad range of contaminants in distribution system water samples since 1995. This includes routine surveillance monitoring at several fixed locations as well as monitoring performed during excursion events and flushing activities. The routine system monitoring program was developed in response to the detection of Mn in the distribution system following installation of the new water tank in 1995. Under this plan, Utility C performs weekly sampling at 9 locations. All analyses are performed in house using ICP.

Parameters regularly monitored include: total Mn, total Fe, other metals, pH, alkalinity and hardness. Organic contaminants (aside from disinfection byproducts) were consistently demonstrated to be non-detect. Similarly, coliform and *E. coli* have not been detected in the distribution system.

#### Distribution System Sampling

Routine system monitoring is not performed with the specific purpose of monitoring metals accumulation. The locations and sampling methods are not optimized to measure potential metals that may have mobilized from the pipe interior and the results are not applicable to this study.

However, Utility C performed field testing to provide additional data for the project. The objective of the proposed field testing was to determine the mass of Mn released and which compounds are released into the water supply during typical planned flushing and reactive flushing after colored water events. There was no attempt to determine the origin of the sediment. Utility C has been practicing conventional flushing for several years and they do not have a unidirectional flushing program in place. The utility has provided anecdotal evidence that they often just “chase Mn around the system” during large scale colored water events. It is likely that sediment in the distribution system has already been transported from various locations within the system and its origin is unknown.

The samples were obtained using conventional flushing methods from four distinct locations. A map of the distribution system and the selected sample sites is provided on Figure 1.3. Each location has a variety of branches and system flow patterns. The velocity that mobilized the sediment is unknown, but the velocity from which the sample was taken ranged from 6 to 13 feet per second. Samples were obtained from the distribution system through hydrants that were likely to carry water that traveled through the primary treated water distribution line. This line is of interest for the following reasons:

A. Mn accumulation evidence which was seen while pigging the line in 1995
B. It carries primarily surface water, which is the source of Mn in this system
C. It feeds the oldest part of the distribution system which has the most evidence of colored water events.

Samples were collected from four locations in the distribution system. The locations were selected based on the following criteria, listed in order of importance:

A. Likelihood that the location is fed by the primary treated water distribution line
B. Water age in the system. The water age at each of the four locations is as follows:
    1. 26 hours
    2. 55 hours
    3. 80 hours
    4. 102 hours
C. All locations have an average winter velocity<0.5 fps
D. All sample points are on a hydrant off an 8” diameter main line
E. Three of the four sample locations were dead ends on the distribution system, allowing for higher scouring velocity in the main line.

The following methodology was followed during sample collection:

A. Completely open hydrant
B. Take a sample (all samples are 500 mL) every 15 seconds after opening the hydrant, for 1 minute
C. Take a sample every 30 seconds for the next two minutes (8 samples per location)
D. Measure turbidity of samples
E. Label the location that the sample was taken and sample number for that location (Label the first sample which would be taken after 15 sec, 1, the second 2, etc.)
F. Take samples from all four locations on the same day, preferably during low demand time

The following methodology was followed during sample testing:

A. Measure turbidity
    1. If turbidity > 1 NTU
        a. Save in unpreserved container and test within 24 hours
        b. Apply EPA Method 3010 A to dissolve solids

c. Run ICP on sample
2. If turbidity < 1 NTU
   a. Save in a standard nitric-preserved container for metals
   b. Run ICP on sample
B. Test HPC, chlorine residual, pH, turbidity, ORP
C. Samples were not filtered in the field, thus only total Mn values were collected

## Findings/Correlations

Colored water was observed at three of the four sample sites. Reference Figure **Error! No text of specified style in document.**.1 for photos of the samples taken from each site.

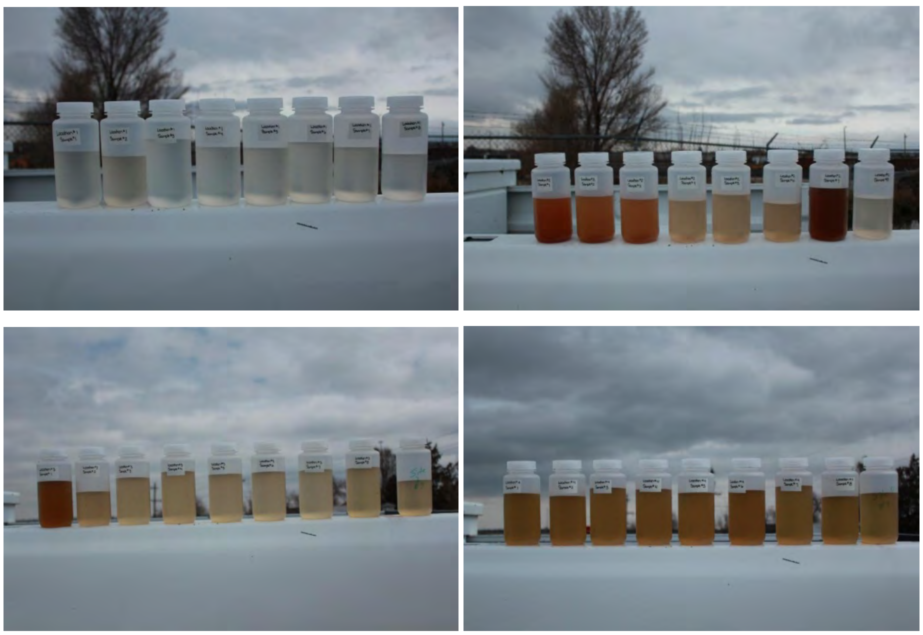


**Figure** Error! No text of specified style in document.**.1 Hydrant flush samples collected from Site 1 (top left), Site 2 (top right), Site 3 (bottom left) and Site 4 (bottom right)**

The samples at Site 1 appeared clear, where as samples from Sites 2, 3 and 4 were noticeably discolored. The estimated amount of Mn released during the four hydrant flushes ranged from 3,800 mg to 14,400 mg. The estimated amount of iron released during the four hydrant flushes ranged from 2,000 mg to 211,000 mg. As shown in Table **Error! No text of specified style in document.**.2, the Mn mass released at Site 3 was more than double the mass released at Site 1 and the mass released at Sites 2 and 4 was nearly four times the mass released at Site 1.

**Table** Error! No text of specified style in document.**.2 Estimate of Mn and Fe released during flushing**

| Site | Primary Material | Sample | Cumulative Time | Volume expelled | Total Mn mass expelled during interval | Mn released per surface area of pipe flushed | Total Fe mass expelled | Fe released per surface area of pipe flushed |
|---|---|---|---|---|---|---|---|---|
| | | | sec | gal | mg | mg/ft$^2$ | mg | mg/ft$^2$ |
| 1 | Ductile Iron | 1 | 0 | 0 | | | | |
| | | 2 | 15 | 511 | 493 | 1.2 | 399 | 1.0 |
| | | 3 | 30 | 1,021 | 366 | 0.9 | 395 | 1.0 |
| | | 4 | 45 | 1,532 | 219 | 0.5 | 225 | 0.5 |
| | | 5 | 60 | 2,043 | 289 | 0.7 | 198 | 0.5 |
| | | 6 | 90 | 3,064 | 634 | 0.8 | 245 | 0.3 |
| | | 7 | 120 | 4,086 | 638 | 0.8 | 178 | 0.2 |
| | | 8 | 150 | 5,107 | 584 | 0.7 | 159 | 0.2 |
| | | 9 | 180 | 6,128 | 556 | 0.7 | 159 | 0.2 |
| | | | Total for Site | | 3,780 | 0.8 | 1,959 | 3.9 |
| 2 | Ductile Iron | 1 | 0 | 0 | | | | |
| | | 2 | 15 | 488 | 1,134 | 2.9 | 74,941 | 191.6 |
| | | 3 | 30 | 975 | 991 | 2.5 | 53,850 | 137.7 |
| | | 4 | 45 | 1,463 | 856 | 2.2 | 34,439 | 88.0 |
| | | 5 | 60 | 1,950 | 751 | 1.9 | 10,433 | 26.7 |
| | | 6 | 90 | 2,925 | 1,765 | 2.3 | 15,774 | 20.2 |
| | | 7 | 120 | 3,900 | 4,703 | 6.0 | 13,018 | 16.6 |
| | | 8 | 150 | 4,875 | 4,224 | 5.4 | 8,836 | 11.3 |
| | | | Total for Site | | 14,424 | 3.7 | 211,291 | 492.1 |
| 3 | PVC | 1 | 0 | 0 | | | | |
| | | 2 | 15 | 552 | 1,947 | 4.4 | 580 | 1.3 |
| | | 3 | 30 | 1,105 | 997 | 2.3 | 484 | 1.1 |
| | | 4 | 45 | 1,657 | 870 | 2.0 | 478 | 1.1 |
| | | 5 | 60 | 2,209 | 862 | 1.9 | 622 | 1.4 |
| | | 6 | 90 | 3,314 | 1,583 | 1.8 | 1,394 | 1.6 |
| | | 7 | 120 | 4,418 | 1,322 | 1.5 | 1,265 | 1.4 |
| | | 8 | 150 | 5,523 | 1,362 | 1.5 | 1,316 | 1.5 |
| | | | Total for Site | | 8,942 | 2.0 | 6,139 | 9.4 |
| 4 | Ductile Iron | 1 | 0 | 0 | | | | |
| | | 2 | 15 | 500 | 1,337 | 3.3 | 770 | 1.9 |
| | | 3 | 30 | 1,001 | 1,289 | 3.2 | 690 | 1.7 |
| | | 4 | 45 | 1,501 | 1,244 | 3.1 | 687 | 1.7 |
| | | 5 | 60 | 2,001 | 1,305 | 3.3 | 704 | 1.8 |
| | | 6 | 90 | 3,002 | 2,642 | 3.3 | 1,613 | 2.0 |
| | | 7 | 120 | 4,002 | 2,411 | 3.0 | 1,489 | 1.9 |
| | | 8 | 150 | 5,003 | 2,153 | 2.7 | 1,322 | 1.6 |
| | | 9 | 180 | 6,004 | 2,126 | 2.6 | 1,322 | 1.6 |
| | | | Total for Site | | 14,507 | 3.0 | 8,596 | 14.3 |

As previously described, ICP analysis was performed on each sample collected. Compounds detected in the samples included: aluminum, barium, beryllium, boron, calcium, cadmium, cobalt, copper, iron, potassium, lithium, magnesium, manganese, nickel, strontium, thallium, vanadium and zinc.  The concentration of iron and manganese exceeded their respective secondary maximum contaminant levels (SMCLs) at all four sites in at least one of the samples taken.  The concentration of aluminum exceeded its SCML in half of the samples taken at Site 2 and in the first sample taken at Site 3.  However, there was no evidence that any compounds detected in the samples exceed drinking water standards established by the SDWA.  The three compounds mentioned are secondary contaminants and the SMCLs are classified by the SDWA as non-enforceable guidelines for contaminants that may cause cosmetic effects or aesthetic effects in drinking water.  It is likely that in addition to manganese, iron and aluminum contribute to the colored water events that are occasionally seen in Utility C's system.  The concentration of aluminum, iron and manganese for each sample taken is summarized in Table **Error! No text of specified style in document.**.3; samples that exceed the SMCL are shown in bold.

Table **Error! No text of specified style in document.**.3 Summary of co-occurring compounds released during flushing

| Site | Primary Material | Sample | Cumulative Time | Volume expelled | Aluminum Concentration | Iron Concentration | Manganese Concentration |
|---|---|---|---|---|---|---|---|
| | | | sec | gal | mg/L | mg/L | mg/L |
| 1 | Ductile Iron | 1 | 0 | 0 | ND | 0.109 | **0.225** |
| | | 2 | 15 | 511 | ND | **0.305** | **0.286** |
| | | 3 | 30 | 1,021 | ND | 0.104 | **0.094** |
| | | 4 | 45 | 1,532 | ND | 0.129 | **0.133** |
| | | 5 | 60 | 2,043 | ND | 0.077 | **0.167** |
| | | 6 | 90 | 3,064 | ND | 0.050 | **0.162** |
| | | 7 | 120 | 4,086 | ND | 0.042 | **0.169** |
| | | 8 | 150 | 5,107 | ND | 0.040 | **0.134** |
| | | 9 | 180 | 6,128 | ND | 0.043 | **0.154** |
| 2 | Ductile Iron | 1 | 0 | 0 | **0.07** | **53.504** | **0.707** |
| | | 2 | 15 | 488 | **0.06** | **27.829** | **0.523** |
| | | 3 | 30 | 975 | **0.08** | **30.614** | **0.553** |
| | | 4 | 45 | 1,463 | 0.04 | **6.762** | **0.377** |
| | | 5 | 60 | 1,950 | ND | **4.560** | **0.439** |
| | | 6 | 90 | 2,925 | ND | **3.999** | **0.519** |
| | | 7 | 120 | 3,900 | **0.18** | **3.065** | **2.033** |
| | | 8 | 150 | 4,875 | ND | **1.730** | **0.259** |
| 3 | PVC | 1 | 0 | 0 | **0.06** | **0.306** | **1.325** |
| | | 2 | 15 | 552 | ND | 0.250 | **0.541** |
| | | 3 | 30 | 1,105 | ND | 0.214 | **0.415** |
| | | 4 | 45 | 1,657 | ND | 0.244 | **0.419** |
| | | 5 | 60 | 2,209 | ND | **0.352** | **0.407** |
| | | 6 | 90 | 3,314 | ND | **0.316** | **0.351** |
| | | 7 | 120 | 4,418 | ND | 0.291 | **0.282** |
| | | 8 | 150 | 5,523 | ND | **0.340** | **0.370** |
| 4 | Ductile Iron | 1 | 0 | 0 | ND | **0.456** | **0.689** |
| | | 2 | 15 | 500 | ND | **0.358** | **0.726** |
| | | 3 | 30 | 1,001 | ND | **0.372** | **0.638** |
| | | 4 | 45 | 1,501 | ND | **0.354** | **0.678** |
| | | 5 | 60 | 2,001 | ND | **0.390** | **0.702** |
| | | 6 | 90 | 3,002 | 0.04 | **0.463** | **0.695** |
| | | 7 | 120 | 4,002 | ND | **0.325** | **0.580** |
| | | 8 | 150 | 5,003 | ND | **0.374** | **0.559** |
| | | 9 | 180 | 6,004 | ND | **0.325** | **0.566** |
| | | | | Estimated Minimum Detection Limit (mg/L): | 0.04 | 0.007 | 0.002 |
| | | | | SMCL (mg/L): | 0.05 | 0.3 | 0.05 |

The pipe specimen shown in Figure **Error! No text of specified style in document.**.2 had been removed from Utility C's distribution system and was being stored prior to disposal. Evidence of tuberculation resulting from metals precipitation can be seen on the pipe interior.

**Figure** Error! No text of specified style in document.**.2 Evidence of tuberculation inside scraped water main**

### *Regulatory Compliance Issues*

#### MCLs/SMCL

Utility C has not faced any regulatory compliance challenges excluding a temporary exceedence of the secondary MCL for Mn during the 2006 pass through event. They have never faced compliance issues associated with release of legacy Mn or potential co-occurring metals.

#### Other

Utility C reported an improvement in chlorine residual stability since routine flushing activities were initiated in 1995. This may be due to the removal of Mn solids and other chlorine-demanding compounds.

### *Cost Impacts*

#### Labor Effort

Utility C performs routine weekly surveillance monitoring of inorganic contaminants within its distribution system at selected TCR sites. The utility considers this informal monitoring program as a good management practice. Since this monitoring is not specifically focused on Mn, the cost of this surveillance is not directly due to Mn accumulation. Viewed from another perspective, Utility C would do this monitoring independent of their experience with Mn.

#### Analytical

The costs of lab analytics are not directly due to Mn accumulation.

#### Contractor

Utility C performs monitoring activities in-house and thus does not incur contractor-related costs.

## Response to Manganese Accumulation/Release

### *Trends in Manganese Occurrence*

Manganese accumulation occurs to some degree throughout the utility distribution system, as reflected by complaints of colored water that are not related to Mn passing through the WTP. However, there is a strong spatial component to the extent of accumulation. Mn accumulation is most prevalent and problematic in the oldest part of the system, in the downtown area. Pipe materials in these areas are primarily unlined ductile and cast iron pipe. Additionally, this area is the first to receive water that has traveled through a system delivery main that has previously shown evidence of Mn accumulation. It is possible that Mn accumulates in the supply main and is occasionally flushed into the oldest part of the distribution system.

Utility C reported that very large Mn events tend to be system wide, in which the utility responds to customer complaints by flushing a local hydrant. The problem then tends to move throughout the system. It seems as though the operators are “chasing the Mn around the system” until it has been dispersed throughout system taps and hydrant flushes.

### *Utility Response Measures*

#### System Monitoring

In addition to performing routine weekly monitoring within its distribution system, Utility C performs sampling/monitoring as part of their annual flushing activities. They typically collect and analyze approximately 125 samples over the course of the one month flushing program. They typically collect 4- 5 samples in each system area, but sample locations are not consistent.

Monitoring includes both on-site field tests and samples for off-site analyses. While the parameters assessed vary depending on the nature of the issue, location, and other factors, the following parameters are often tested: pH, temperature, alkalinity, conductivity, hardness, turbidity, color, chlorine residual, metals, anions, and HPC.

#### Reactive Flushing

Utility C uses conventional flushing methods. System pressures are fairly consistent throughout the distribution system, ranging from ~120-150 psi. The flushing velocity is difficult to predict because lines are not isolated during a flush.  Water velocity is dependent on the quantity and diameter of lines feeding the flush site, which is further dependent on other system demands during the time of the flush.

In response to individual or isolated customer complaints, Utility C performs localized flushing as described previously. In response to events involving more numerous and widespread complaints, the utility performs area wide flushing. If needed to restore water quality, the utility will flush the area or zone multiple times as warranted based on data. Utility C flushes until the water runs clear when responding to colored water complaints, typically 15-20 minutes from the time of opening the hydrant.

Labor impacts/costs associated with distribution system flushing are summarized in Table **Error! No text of specified style in document.**.4. Separate columns are provided for reactive flushing for three selected years, 2006 which represents an unusually high annual number of complaints due to high Mn concentrations which passed through the WTP, 2008 which represents a typical complaint year and 2012 which represents a year with a high number of complaints that are attributed to Mn release from within the distribution system. Response costs for 2012 are expected to be more representative of legacy Mn costs compared to 2006 costs which include more costs due to Mn pass through events. A column for routine annual system-wide preventative flushing is also included. Note that routine preventative maintenance is much more costly than any of the annual costs for complaint response.

**Table** Error! No text of specified style in document.**.4 Summary of reactive and preventative flushing impacts**

| Parameter | Unit | 2006 Complaint Response[4, 8] | 2008 Complaint Response[4, 9] | 2012 Complaint Response[4, 10] | Routine Preventative[5] |
|---|---|---|---|---|---|
| # of complaints | | 192 | 36 | 83 | N/A |
| Pipe-Miles Flushed[1] | pipe-mile | 96 | 18 | 42 | 434 |
| Number of Days of Flushing | days | 48.0 | 9.0 | 20.8 | 20 |
| Average Cleaning Rate | pipe-mile/day/crew[2] | 2 | 2 | 2 | 2 |
| Total Pipe-Miles in Area | pipe-mile total | 433 | 434 | 435 | 434 |
| Area Turnover per Year | % of service area | 22% | 4% | 10% | 100% |
| Total Labor for Field Crew | person-hours | 384 | 72 | 166 | 1760 |
| Normalized Labor for Field Crew | person-hours/pipe-mile flushed | 4.0 | 4.0 | 4.0 | 4.1 |
| Estimated Cost of Field Crew Labor[3] | $ | $14,884.80 | $2,790.90 | $6,434.58 | $68,222.00 |
| Normalized Cost of Field Crew Labor[3] | $/pipe-mile flushed | $155.05 | $155.05 | $155.05 | $157.19 |
| Mileage | Total miles driven[6] | 1,920 | 360 | 830 | 2,250 |
| Annual Fuel Cost | Fuel Cost[7] | $448.00 | $84.00 | $193.67 | $525.00 |
| Normalized Fuel Cost | Fuel Cost/pipe-mile flushed | $4.67 | $4.67 | $4.67 | $1.21 |

1. Based on one half mile flushed per complaint.
2. Based on 8-hr shifts per day
3. Based on burdened labor rate of $38.76/hour

4. One person crews are needed for complaint response, 2 hours needed per complaint
5. Eleven person crews are needed for routing preventative flushing
6. Assume 9 trucks for annual flushing driving 12.5 miles per day, assume each complaint requires 10 miles driving
7. Assume 15 miles per gallon and $3.50/gallon
8. 2006 was selected to represent an unusually high number of complaints due to Mn passing through the WTP
9. 2008 was selected to represent a typical complaint year
10. 2012 was selected to represent a year with a high number of complaints that are due to Mn release from the distribution system

### *Equipment Fouling*

Utility C has not knowingly experienced equipment failure due to Mn accumulation. Tuberculation has been observed in removed pipe specimens throughout the system, but neither pipes nor equipment have had to be replaced or repaired as a direct result of Mn accumulation.

### *Cost Impacts*

#### Labor Effort

The labor time/cost associated with performing monitoring and local flushing in response to individual customer complaints is factored into the average figure of 2 total person-hours per complaint.

#### Analytical

Samples are not collected or analyzed for colored water complaints.

#### Contractor

Utility C performs flushing and monitoring activities in-house and thus does not incur contractor-related costs for these tasks, aside from contract laboratory expenses as previously discussed.

## Prevention of Manganese Accumulation/Release

### *Triggers or Indications of Accumulation or Release*

Discoloration events are typically associated with release of accumulated precipitates and/or dispersion of black slime layers. The degree of discoloration depends on the amount of material entrained. Release events occur due to physical/hydraulic mobilization resulting from flow reversals and velocity changes, as well as chemical destabilization and solubilization resulting from water chemistry shifts.

Utility C can often associate a colored water event with street sweeping in the area. The street sweeping crew will often use a large volume of water from a single hydrant which can mobilize sediment. Similarly, Utility C can expect to have calls related to dirty or colored water following a water line break or a fire event.

### *Prevention Methods*

#### Treatment

Mn specific treatment has been used in Utility C's treatment system for nearly 20 years. The Utility's new WTP was built in 2002. It included conventional treatment and Mn coated filter media to remove Mn. Beginning in 2004, chlorine dioxide was fed upstream of the new WTP to improve Mn removal efficiency. Potassium permanganate was also fed into the raw water line upstream of the new plant on a seasonal basis to control Mn. However, Mn would still pass through the treatment barriers and into the distribution system during periods of high raw water Mn concentration due to Mn release in the stratified raw water reservoir.

As previously mentioned, improvements were made to Utility C's raw water system in 2009 which have significantly reduced the concentration and frequency of Mn loading to the WTP. Preoxidants are no longer added to the raw water and the coated filter media was cleaned to release the accumulated Mn. The raw water improvements have effectively eliminated the need for Mn removal at the WTP. Utility C maintains free chlorine residual throughout its distribution system for secondary disinfection purposes, with a target range of 0.3 – 1.0 mg/L as $Cl_2$.

#### Preventative Flushing

Utility C developed a conventional flushing program in 1995 in response to a Mn event. Prior to this, the utility only performed conventional spot flushing as needed to address discoloration complaints. Annual flushing is performed on the entire system, but only using 50% of the hydrants; selected hydrants are alternated each year. The purpose of this effort is to control solids and metals buildup, including but not exclusive to Mn, with the goal to prevent further excursion events. System flushing for prevention of Mn events is performed in the same manner as reactive flushing described above.

#### Preventative Pigging

Pigging was performed on the main water line that conveys treated water from the area of the new WTP to the oldest part of the distribution system. The pigging was performed in 1995 following the first confirmed Mn event. Utility C reports that a black slime layer was observed on the pipe interior during the pigging operation. No additional pigging has been performed since this time and none is currently planned.

#### Effectiveness of Measures

Utility C reports fewer dirty water calls over the summer high demand months since the flushing program has been in place. The increase in colored water complaints in 2011 is attributed to filter cleaning at the WTP. The increase in 2012 is attributed to an early hot spring during which, peak summer demands were seen prior to the annual system flush. It is thought that the early peak demands resulted in an unintentional system flush that mobilized sediment and possibly freed tuberculation particulates which resulted in an increase of colored water events.

### *Cost Impacts*

#### Labor Effort

Labor effort/costs associated with sample collection for routine Mn monitoring are part of the overall costs for routine distribution system monitoring.

The labor time/cost for water department field crew to perform system-wide flushing is included in Table **Error! No text of specified style in document.**.5. The effort typically requires about 1,760 person-hours per year for routine flushing and 150 person-hours per year for complaint response (based on flushing done in 2011.) With a system inventory of over 430 pipe-miles, this equates to an average of 4.1 person-hours per pipe-mile preventatively flushed, which is nearly identical to that of response flushing. However, given that preventative flushing is based on

100% turnover and response flushing is based on 9% turnover, the person-hours per total pipe-miles are comparatively lower. The average burdened rate for field crew is $38.76 per hour.

### Analytical

All lab work is performed in house at the WTP laboratory. Laboratory analytical costs associated with routine Mn monitoring are part of the overall costs for routine distribution system monitoring.

The absolute labor time/cost associated with water quality monitoring during preventative flushing typically requires four hours per sample, for approximately 125 samples, or 500 person-hours per year. This includes time to collect and analyze the sample. Approximately two and a half hours are spent by a staff person to collect the sample and an additional one and a half hours are spent by a lab supervisor to analyze the sample. The average burdened rate for lab staff is $35.49 and a lab supervisor is $50.66 per hour. There is an additional cost of $15 per sample for equipment and chemicals to run the analytics. The approximate lab costs associated with annual flushing are $22,464 per year. A summary of these costs are included in Table **Error! No text of specified style in document.**.5.

### Contractor

Utility C performs flushing activities in-house and thus does not incur contractor-related costs for that activity.

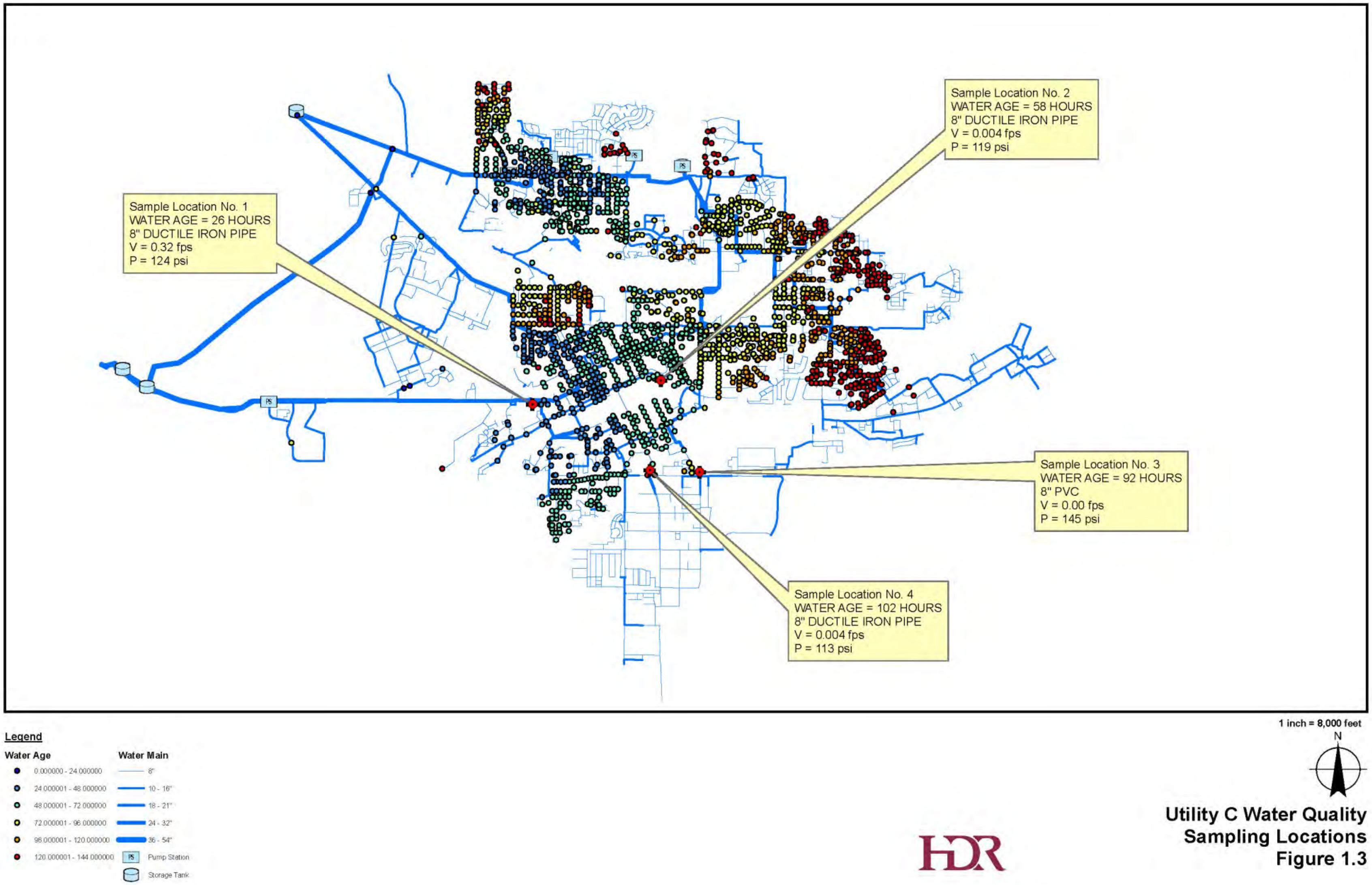
## Summary of Cost Impacts

Table **Error! No text of specified style in document.**.5 summarizes Utility C cost impacts described in this case study associated with, but not necessarily exclusive to, the accumulation of Mn. As previously discussed, some costs are not tracked and cannot be reliably estimated. Except where otherwise noted, internal costs associated with utility labor are based on Y2012 burdened costs inclusive of fringe benefits range from $35.49/hr to $50.66/hr.

As shown in Table **Error! No text of specified style in document.**.5, certain impacts and absolute effort/cost figures have been normalized using spatial and temporal factors. For a given impact, these factors were specific to the zone and timeframe in which the impact data applied or was derived for, e.g., system-wide or excursion area, and annual vs. specific event.

**Table** Error! No text of specified style in document.**.5 Summary of Utility C legacy manganese cost impacts**

| Activity | Absolute Impact and Costs[1] | Normalized Impact and Costs[1] | Notes/Comments |
|---|---|---|---|
| | | ***Response to Mn Accumulation/Release*** | |
| Labor for flushing in response to colored water complaints | 36 per year system-wide (Y2008) | 1 per 556 services per year (Y2008) | See Table **Error! No text of specified style in document.**.4 for more detailed breakdown |
| Labor for addressing customer water quality complaints | 72 hrs/year ~ $3,000/year | 0.004 hrs/service/year = $0.15/service/ year | Average 2 hrs per complaint. |
| Laboratory cost associated with monitoring during complaint follow-up | $0/year | $0/complaint/year | Lab work is not typically performed for colored water complaints |
| | | ***Prevention of Mn Accumulation/Release*** | |
| Labor effort for routine system-wide conventional flushing program | 2,250 hrs/year = $68,200/year | 5.2 hrs/pipe-mile total/year | |
| | | $157/pipe-mile total/year | |
| Equipment costs for flushing program | $525/year | $1.21/pipe-mile flushed | |




HDR

**Utility C Water Quality**
**Sampling Locations**
**Figure 1.3**

# Appendix 5-G
# Pipeline Capital Improvement Projects
# Cost Estimates

## Potable Water Near-term Projects

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Water Transmission Main - Phase III** | | | | |
| Water Main | | | | |
| 36-inch Steel Pipe including installation | 10,640 | LF | 350.00 | $3,724,000 |
| 30-inch Steel Pipe including installation | 6,220 | LF | 300.00 | $1,866,000 |
| 20-inch PVC Pipe including installation | 9,367 | LF | 180.00 | $1,686,060 |
| 16-inch PVC Pipe including installation | 6,290 | LF | 150.00 | $943,500 |
| **SUBTOTAL** | | | | **$8,219,560** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $1,232,900 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $986,300 |
| **Construction Subtotal** | | **LS** | | **$10,438,800** |
| Year of Construction | 2015 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $730,700 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $521,900 |
| Engineering (12% of construction subtotal) | | LS | | $1,252,700 |
| Design Contigency (30% of construction subtotal) | | LS | | $3,131,600 |
| **Total Southern Water Transmission Main - Phase III** | | | | **$16,076,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Distribution Mains by 2023 (Year 2015)** | | | | |
| Water Main | | | | |
| 12-inch PVC Pipe including installation | 3,680 | LF | 135.00 | $496,800 |
| **SUBTOTAL** | | | | **$496,800** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $74,500 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $59,600 |
| **Construction Subtotal** | | **LS** | | **$630,900** |
| Year of Construction | 2015 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $44,200 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $31,500 |
| Engineering (12% of construction subtotal) | | LS | | $75,700 |
| Design Contigency (30% of construction subtotal) | | LS | | $189,300 |
| **Total Southern Distribution Mains by 2023 (Year 2015)** | | | | **$972,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Transmission Mains by 2023 (Year 2017)** | | | | |
| Water Main | | | | |
| 18-inch PVC Pipe including installation | 10,800 | LF | 175.00 | $1,890,000 |
| **SUBTOTAL** | | | | **$1,890,000** |
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $283,500 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $226,800 |
| **Construction Subtotal** | | **LS** | | **$2,400,300** |
| Year of Construction | 2017 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $336,000 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $120,000 |
| Engineering (12% of construction subtotal) | | LS | | $288,000 |
| Design Contigency (30% of construction subtotal) | | LS | | $720,100 |
| **Total Southern Transmission Mains by 2023 (Year 2017)** | | | | **$3,864,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Distribution Mains by 2023 (Year 2017)** | | | | |
| Water Main | | | | |
| 12-inch PVC Pipe including installation | 11,190 | LF | 135.00 | $1,510,650 |
| **SUBTOTAL** | | | | **$1,510,650** |
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $226,600 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $181,300 |
| **Construction Subtotal** | | **LS** | | **$1,918,600** |
| Year of Construction | 2017 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $268,600 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $95,900 |
| Engineering (12% of construction subtotal) | | LS | | $230,200 |
| Design Contigency (30% of construction subtotal) | | LS | | $575,600 |
| **Total Southern Distribution Mains by 2023 (Year 2017)** | | | | **$3,089,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Transmission Mains by 2023 (Year 2018)** | | | | |
| Water Main | | | | |
| 24-inch PVC Pipe including installation | 11,780 | LF | 275.00 | $3,239,500 |
| **SUBTOTAL** | | | | **$3,239,500** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $485,900 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $388,700 |
| **Construction Subtotal** | | **LS** | | **$4,114,100** |
| Year of Construction | 2018 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $720,000 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $205,700 |
| Engineering (12% of construction subtotal) | | LS | | $493,700 |
| Design Contigency (30% of construction subtotal) | | LS | | $1,234,200 |
| **Total Southern Transmission Mains by 2023 (Year 2018)** | | | | **$6,768,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Northern Distribution Mains by 2023 (Year 2019)** | | | | |
| Water Main | | | | |
| 12-inch PVC Pipe including installation | 7,540 | LF | 135.00 | $1,017,900 |
| **SUBTOTAL** | | | | **$1,017,900** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $152,700 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $122,100 |
| **Construction Subtotal** | | **LS** | | **$1,292,700** |
| Year of Construction | 2019 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $271,500 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $64,600 |
| Engineering (12% of construction subtotal) | | LS | | $155,100 |
| Design Contigency (30% of construction subtotal) | | LS | | $387,800 |
| **Total Northern Distribution Mains by 2023 (Year 2019)** | | | | **$2,172,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Distribution Mains by 2023 (Year 2021)** | | | | |
| Water Main | | | | |
| 12-inch PVC Pipe including installation | 21,050 | LF | 135.00 | $2,841,750 |
| **SUBTOTAL** | | | | **$2,841,750** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $426,300 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $341,000 |
| **Construction Subtotal** | | **LS** | | **$3,609,100** |
| Year of Construction | 2021 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $1,010,500 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $180,500 |
| Engineering (12% of construction subtotal) | | LS | | $433,100 |
| Design Contigency (30% of construction subtotal) | | LS | | $1,082,700 |
| **Total Southern Distribution Mains by 2023 (Year 2021)** | | | | **$6,316,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Distribution Mains by 2023 (Year 2022)** | | | | |
| Water Main | | | | |
| 12-inch PVC Pipe including installation | 10,680 | LF | 120.00 | $1,281,600 |
| **SUBTOTAL** | | | | **$1,281,600** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $192,200 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $153,800 |
| **Construction Subtotal** | | **LS** | | **$1,627,600** |
| Year of Construction | 2022 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $512,700 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $81,400 |
| Engineering (12% of construction subtotal) | | LS | | $195,300 |
| Design Contigency (30% of construction subtotal) | | LS | | $488,300 |
| **Total Southern Distribution Mains by 2023 (Year 2022)** | | | | **$2,905,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Distribution Mains by 2023 (Year 2023)** | | | | |
| Water Main | | | | |
| 12-inch PVC Pipe including installation | 13,030 | LF | 135.00 | $1,759,050 |
| **SUBTOTAL** | | | | **$1,759,050** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $263,900 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $211,100 |
| **Construction Subtotal** | | **LS** | | **$2,234,100** |
| Year of Construction | 2023 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $781,900 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $111,700 |
| Engineering (12% of construction subtotal) | | LS | | $268,100 |
| Design Contigency (30% of construction subtotal) | | LS | | $670,200 |
| **Total Southern Distribution Mains by 2023 (Year 2023)** | | | | **$4,066,000** |

## Potable Water Mid-term Projects

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Transmission Mains by 2033 (Year 2028)** | | | | |
| Water Main | | | | |
| 24-inch PVC Pipe including installation | 5,210 | LF | 275.00 | $1,432,750 |
| 18-inch PVC Pipe including installation | 41,860 | LF | 175.00 | $7,325,500 |
| 16-inch PVC Pipe including installation | 29,000 | LF | 150.00 | $4,350,000 |
| **SUBTOTAL** | | | | **$13,108,250** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $1,966,200 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $1,573,000 |
| **Construction Subtotal** | | **LS** | | **$16,647,500** |
| Year of Construction | 2028 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $8,739,900 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $832,400 |
| Engineering (12% of construction subtotal) | | LS | | $1,997,700 |
| Design Contigency (30% of construction subtotal) | | LS | | $4,994,300 |
| **Total Southern Transmission Mains by 2033 (Year 2028)** | | | | **$33,212,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Distribution Mains by 2033 (Year 2028)** | | | | |
| Water Main | | | | |
| 12-inch PVC Pipe including installation | 121,300 | LF | 135.00 | $16,375,500 |
| **SUBTOTAL** | | | | **$16,375,500** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $2,456,300 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $1,965,100 |
| **Construction Subtotal** | | **LS** | | **$20,796,900** |
| Year of Construction | 2028 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $10,918,400 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $1,039,800 |
| Engineering (12% of construction subtotal) | | LS | | $2,495,600 |
| Design Contigency (30% of construction subtotal) | | LS | | $6,239,100 |
| **Total Southern Distribution Mains by 2033 (Year 2028)** | | | | **$41,490,000** |

**REVISED** **9/19/13**

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Northern Distribution Mains by 2033 (Year 2028)** | | | | |
| Water Main | | | | |
| 12-inch PVC Pipe including installation | 53,210 | LF | 135.00 | $7,183,350 |
| 8-inch PVC Pipe including installation | 1,290 | LF | 120.00 | $154,800 |
| **SUBTOTAL** | | | | **$7,338,150** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $1,100,700 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $880,600 |
| **Construction Subtotal** | | **LS** | | **$9,319,500** |
| Year of Construction | 2028 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $4,892,700 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $466,000 |
| Engineering (12% of construction subtotal) | | LS | | $1,118,300 |
| Design Contigency (30% of construction subtotal) | | LS | | $2,795,900 |
| **Total Northern Distribution Mains by 2033 (Year 2028)** | | | | **$18,592,000** |

| Item Description | Quantity | Unit | Unit Cost | Total Cost |
|---|---|---|---|---|
| **Southern Water Transmission Main - Phase IV (Year 2028)** | | | | |
| Water Main | | | | |
| 30-inch PVC Pipe including installation | 3,920 | LF | 325.00 | $1,274,000 |
| 16-inch PVC Pipe including installation | 17,860 | LF | 150.00 | $2,679,000 |
| 12-inch PVC Pipe including installation | 19,920 | LF | 135.00 | $2,689,200 |
| **SUBTOTAL** | | | | **$6,642,200** |

| | | | | |
|---|---|---|---|---|
| **GENERAL REQUIREMENTS** | | | | |
| Mobilization, Bonds and Insurance (15% of subtotal) | | LS | | $996,300 |
| Contractor Overhead & Profit (12% of subtotal) | | LS | | $797,100 |
| **Construction Subtotal** | | **LS** | | **$8,435,600** |
| Year of Construction | 2028 | YR | | |
| Escalation Rate | 3.5% | % | | |
| Escalation Costs (year of construction - 2013) | | LS | | $4,428,700 |
| Administrative and Easement Costs (5% of construction subtotal) | | LS | | $421,800 |
| Engineering (12% of construction subtotal) | | LS | | $1,012,300 |
| Design Contigency (30% of construction subtotal) | | LS | | $2,530,700 |
| **Total Southern Water Transmission Main - Phase IV (Year 2028)** | | | | **$16,829,000** |