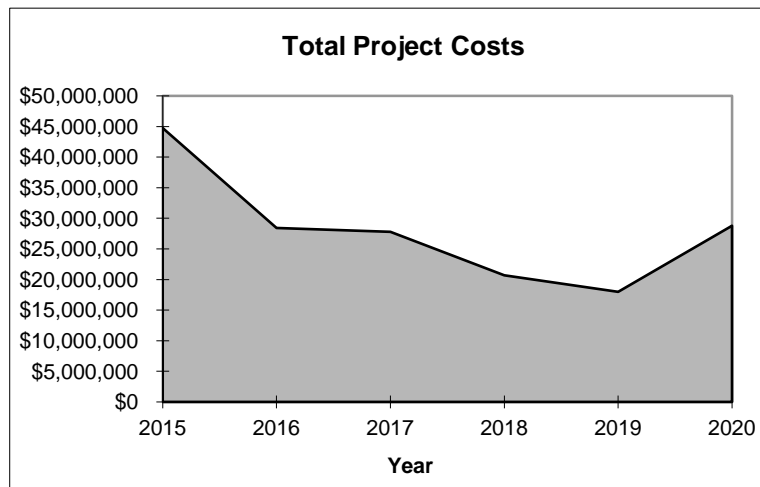


2015 Capital Budget Capital Improvement Program

Agency Name: **Water Utility**

Agency Number: **64**

Project Name	Capital Budget	Future Year Estimates				
	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
1 Water Mains - Replace/Rehab/Improve	\$12,128,000	\$ 9,637,000	\$ 9,930,000	\$10,667,000	\$11,467,000	\$12,336,000
2 Water Mains - New	1,256,000	1,837,000	2,011,000	2,202,000	2,412,000	2,644,000
3 Zone 4 Fire Flow Supply Augment	5,593,000	654,000	0	0	0	0
4 Arbor Hills Suppl Fire Flow Supply	642,000	0	0	0	0	0
5 Unit Well No. 7 - Fe and Mn Filtration	2,544,000	891,000	0	0	0	1,003,000
6 East Side Replacement Well (Well 3)	0	0	0	0	0	1,813,000
7 Zones 7&8 Suppl Supply-Whitney Way	526,000	1,546,000	5,250,000	0	0	1,471,000
8 Lakeview Reservoir Reconstruction	6,092,000	594,500	0	0	0	0
9 System Wide Miscellaneous Projects	2,217,000	2,074,000	2,231,000	2,774,000	2,336,000	2,598,000
10 Paterson St. Bldg Remodel/Upgrade	7,017,000	1,741,000	0	0	0	0
11 Booster Station #106 Reconstruction	1,099,000	891,000	612,000	0	0	0
12 Far West Elevated Reservoir	356,000	3,075,000	927,000	0	0	0
13 Misc. Pump Station/PRV/Facility Projs.	887,000	990,000	1,039,000	1,091,000	1,144,000	771,000
14 Booster Pump Station 129 Reconstr.	0	0	0	0	0	294,000
15 Well 19 Iron & Manganese Filter	481,000	3,290,000	0	0	0	0
16 Well 30 Iron & Manganese Filter	0	0	0	0	560,000	3,840,000
17 Near West Side Water Supply Project	0	0	0	0	63,000	482,000
18 Well 29 Filter Capacity Expansion	446,000	0	0	0	0	0
19 Well 12 Conversion to Two-Zone Well	1,039,000	0	0	0	0	0
20 Booster Pump Station/PRV 124 Constr.	0	0	0	0	0	294,000
21 Pressure Zone 9 Storage	0	0	0	0	0	63,000
22 Pump Station 220 - Raymond Road	0	0	0	0	0	65,000
23 Booster Pump Station 115 Upgrade	2,367,000	0	0	0	0	0
24 Unit Well No. 8 - Fe and Mn Filtration	55,000	1,196,000	5,350,000	1,040,000	0	1,104,000
25 Unit Well 18 - VOC Air Stripper	0	0	436,000	2,910,000	0	0
Total	<u>\$44,745,000</u>	<u>\$28,416,500</u>	<u>\$27,786,000</u>	<u>\$20,684,000</u>	<u>\$17,982,000</u>	<u>\$28,778,000</u>



**2015
Capital Budget
Expenditure Categories and Funding Sources**

Agency Name: **Water Utility**

Agency No.: 64

All Projects	Capital Budget	Future Year Estimates				
	<u>2015</u>	<u>2016</u>	<u>2017</u>	<u>2018</u>	<u>2019</u>	<u>2020</u>
Expenditures:						
Purchased Services	\$ 1,894,000	\$ 1,379,000	\$ 436,000	\$ 608,000	\$ 623,000	\$ 1,578,000
Materials & Supplies	0	0	0	0	0	0
Inter-Agency Charges	0	0	0	0	0	0
Loans	0	0	0	0	0	0
Professional Fees	978,000	106,000	111,000	117,000	123,000	83,000
Land & Land Improve	17,982,000	15,342,500	13,480,000	13,909,000	13,879,000	18,880,000
Building & Bldg Improve	22,130,000	10,320,000	12,980,000	5,474,000	2,761,000	7,619,000
Equipment and Vehicles	1,483,000	980,000	479,000	265,000	274,000	285,000
Other	278,000	289,000	300,000	311,000	322,000	333,000
Total Project Costs	\$ 44,745,000	\$ 28,416,500	\$ 27,786,000	\$ 20,684,000	\$ 17,982,000	\$ 28,778,000
Funding Sources:						
Federal Sources	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0
State Sources	0	0	0	0	0	0
Impact Fees	0	0	0	0	0	0
Private Contributions	0	0	0	0	0	0
Revenue Bonds	44,745,000	28,416,500	27,786,000	20,684,000	17,982,000	28,778,000
Special Assessments	0	0	0	0	0	0
TIF Cash	0	0	0	0	0	0
County Sources	0	0	0	0	0	0
Reserves Applied	0	0	0	0	0	0
Other	0	0	0	0	0	0
Total Other Sources	\$ 44,745,000	\$ 28,416,500	\$ 27,786,000	\$ 20,684,000	\$ 17,982,000	\$ 28,778,000
G.O. General Fund	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0
G.O. Non-General Fund	0	0	0	0	0	0
Total G.O. Debt	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0
Estimated Annual Debt Service						
G.O. General Fund	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0
G.O. Non-General Fund	0	0	0	0	0	0

Capital Budget

Water Utility

Water Mains - Replace/Rehab/Improve Project No. 1 Acct. No. 810455

GO \$ 0
Other 12,128,000
\$ 12,128,000

Madison Water Utility has a planned system replacement and upgrade program that provides for annual main replacement and rehabilitation. Assessment of an aging infrastructure indicates the Utility needs to replace or rehabilitate over 400 miles of pipe in approximately a 40 year period to renew and maintain the system. A planned annual increase in spending to accomplish this goal by 2050 will be continued. The budget for 2015 includes pipeline replacement on East Johnson Street (\$780,000) and Verona Road (\$558,000). Other funding includes \$3,005,000 in reauthorized revenue bonds from 2014.

Water Mains - New Project No. 2 Acct. No. 810455

GO \$ 0
Other 1,256,000
\$ 1,256,000

This project installs new water mains to help strengthen the existing distribution system, improve pressures, improve fire protection, allow transfer of water from pressure zone to pressure zone, and serve the growing Madison area. Mains installed within this project will implement recommended hydraulic improvements from the Utility's Master Plan that was adopted in 2006. The Capital Improvement Program proposes to significantly increase pipeline investment for hydraulic needs beginning in 2016, and then increase this portion of the budget over the next succeeding 15 years to meet Master Plan recommendations. Other funding includes \$290,000 in reauthorized revenue bonds from 2014.

Zone 4 Fire Flow Supply Augment Project No. 3 Acct. No. 810517

GO \$ 0
Other 5,593,000
\$ 5,593,000

The Well 31 project will correct a significant system deficiency identified by the Water Master Plan in the southeast corner of the system. Due to significant expansion of the system over the years to the south and east, the hydraulics of the system will not adequately serve this area for fire flow supply or system reliability and redundancy. Adding a second source of supply to the area will improve fire flow capacity and bring the water system level of service for the area up to Utility standards. Two test wells were constructed in 2012, and the production well was drilled in 2013. Unit Well 31 is scheduled to be designed in 2014, and construction will start in mid 2015. The well is expected to be finished and in service in 2016. Other funding includes \$185,000 in reauthorized revenue bonds from 2014.

Arbor Hills Suppl Fire Flow Supply Project No. 4 Acct. No. 810516

GO \$ 0
Other 642,000
\$ 642,000

Booster pump station #118 was constructed and put into service in 2012. Pipeline improvements also were constructed in 2012, and the last phase of the project, Phase 4 of the Cannonball pipeline, is budgeted to be constructed in 2015. Other funding includes \$642,000 in reauthorized revenue bonds from 2014.

Unit Well No. 7 - Fe and Mn Filtration Project No. **5** Acct. No. 810459

GO \$ 0
Other 2,544,000
\$ 2,544,000

Construction of the filter addresses the water quality issues that exist due to iron and manganese levels that exceed or approach the EPA secondary standard. A filter will significantly reduce the iron and manganese levels in the water pumped from the facility into the system. Filtering the water and removing iron and manganese will reduce the likelihood of customers experiencing colored water and will allow the Utility to increase the use of the well. Construction commenced in June 2014, and the facility will be fully operational in 2015. Piping improvements are included in the budget to improve hydraulics in the system and allow water to be pumped to a wide area of the east and north side of Madison. Other funding includes \$2,544,000 in reauthorized revenue bonds from 2014.

East Side Replacement Well (Well 3) Project No. **6** Acct. No. 0

GO \$ 0
Other 0
\$ 0

Well 3 was abandoned early in 2008 due to elevated levels of Carbon Tetrachloride. This project is intended to replace that lost supply capacity in Pressure Zone 6E, the East Isthmus area. The need for a replacement well was verified by the East Side Water Supply Study. It is expected that the well will need a filter for iron and manganese removal and this is included in the budget. There also is the possibility that volatile organic compound (VOC) contamination will be present due to long term industrial land use on the Isthmus. This well will be designed with the intention of adding treatment, if necessary. If the test well indicates that iron and manganese filtration is not needed, the capital cost will be significantly reduced.

Zones 7&8 Suppl Supply-Whitney Way Project No. **7** Acct. No. 810517

GO \$ 0
Other 526,000
\$ 526,000

The 2006 Water Master Plan recommends an additional well to serve Pressure Zones 7 and 8 to improve operational flexibility and system reliability to the west side. This recommendation was verified in 2009, during preliminary planning for the project. This facility will ultimately benefit five different pressure zones across the entire west side. Projected development and growth on the west side and the Utility's stated policy of limiting average well pumpage to 50% of capacity for long-term groundwater management, make this an important water supply project. The project is projected to be fully operational in 2018. Other funding includes \$397,000 in reauthorized revenue bonds from 2014.

Lakeview Reservoir Reconstruction Project No. **8** Acct. No. 810458

GO \$ 0
Other 6,092,000
\$ 6,092,000

Reconstruction of the Lakeview Reservoir will replace an aging storage tank for Pressure Zone 5 and provide much needed additional gravity fed water storage in Zone 6E on the north side of the City. Storage is needed in Zone 6E to provide additional operational flexibility and emergency backup. The reservoir is being developed as a two zone facility to optimize the use of the site. This project is justified in the Water Master Plan, and will improve fire fighting capacity and reliability to both Pressure Zone 5 and Pressure Zone 6E. The schedule for the reconstruction has been pushed back to 2015, with the reservoir on line in late 2015. Other funding includes \$2,740,000 in reauthorized revenue bonds from 2014.

System Wide Miscellaneous Projects Project No. **9** Acct. No. 810458

GO \$ 0
Other 2,217,000
\$ 2,217,000

These miscellaneous projects repair, rehabilitate and improve Utility facilities, as well as improve security and monitoring of facilities. These projects include but are not necessarily limited to lighting, roofing, painting, video camera surveillance, improved doors and hatches, fencing, alarm systems, online monitoring, and other upgrades to the Utility's 33 remote sites, the administration building, and operations center's vehicle storage building. Other funding includes \$320,000 in reauthorized revenue bonds from 2014.

Paterson St. Bldg Remodel/Upgrade Project No. **10** Acct. No. 810703

GO \$ 0
Other 7,017,000
\$ 7,017,000

This project funds rebuilding of the Utility's Operations Center at Paterson Street, currently scheduled to start in 2015, and be finished and in service in early 2016. The vehicle maintenance area is too small for modern equipment and compromises employee safety. Building air quality and ventilation does not meet modern standards. The office space, locker rooms and other functional storage spaces do not meet current needs. The project also includes construction of a materials handling building that will free up space in the vehicle storage building and improve efficiency during winter operations. Utility staff have been working with City Planning on use of the property considering redevelopment of the area. Other funding includes \$6,771,000 in reauthorized revenue bonds from 2014.

Booster Station #106 Reconstruction Project No. **11** Acct. No. 810516

GO \$ 0
Other 1,099,000
\$ 1,099,000

The rebuilding of outdated Booster Pump Station 106 will be finished by mid 2014. Booster Pump Station 106 is a critical link between Pressure Zones 6 and 7 and allows water to be moved between zones. The new facility replaces the oldest pump station and brings the pump station up to current safety standards and codes. The pump station improves reliability of operation, and improves access and employee safety. To fully benefit from the pump station upgrade, hydraulic capacity improvements to the distribution system have been budgeted. These piping improvements will allow Station #106 to provide excellent water supply service to the near west side. Other funding includes \$616,000 in reauthorized revenue bonds from 2014.

Far West Elevated Reservoir Project No. **12** Acct. No. 0

GO \$ 0
Other 356,000
\$ 356,000

This project combines 2014 capital projects #14 (Zone 11 Blackhawk Elevated Reservoir) and #23 (Zone 10 Far West Elevated Reservoir) into one. The intent is to combine Pressure Zones 10 and 11, and construct a single far west side one million gallon elevated reservoir to hydraulically balance the two zones and supplement the storage at High Point Road. The 250,000 gallon High Point Road reservoir is reaching its capacity and does not provide sufficient emergency reserve capacity. Providing minimum fire flow requirements to this area of the distribution system is necessary to meet minimum Utility standards. The project also provides a second feed to the area by using Booster Station 128, improving reliability. The 2006 Water Master Plan identified two elevated reservoirs for the far west side and this project will combine those two projects.

Misc. Pump Station/PRV/Facility Projs. Project No. **13** Acct. No. 810516

GO \$ 0
Other 887,000
\$ 887,000

This project includes various pump station, pressure reducing valve (PRV) stations, well improvement and upgrade tasks recommended by the Water Utility Master Plan.

Booster Pump Station 129 Reconstr. Project No. **14** Acct. No. **0**

GO \$ 0
Other 0
\$ 0

This project will replace the temporary pump station constructed on the Well 29 site in 1990. Pump station 129 will continue to transfer water from Pressure Zone 6E to Zone 3 and back again through a pressure reducing valve (PRV). The operation will provide supply and fire flow capability to the far east side of the system. It will benefit customers through increased reliability and flexibility of operations.

Well 19 Iron & Manganese Filter Project No. **15** Acct. No. **810459**

GO \$ 0
Other 481,000
\$ 481,000

Construction of an iron and manganese filter at Well 19 will address the water quality in the Well 19 service area due to elevated levels of iron and manganese. The iron and manganese levels exceed Madison Water Utility water quality goals. Accumulation of iron and manganese solids in the distribution system results in a need for additional flushing to minimize the risk of colored water reaching customers. Removing the iron and manganese from the water using a filter improves water quality and reduces the need for frequent flushing. The project will benefit existing customers in the west UW-Madison campus area in Pressure Zone 6W. Other funding includes \$338,000 in reauthorized revenue bonds from 2014.

Well 30 Iron & Manganese Filter Project No. **16** Acct. No. **0**

GO \$ 0
Other 0
\$ 0

Iron and manganese concentrations at Well 30 exceed Utility water quality standards and guidelines. Construction of an iron and manganese filter at Well 30 will address the water quality issues and risk of colored water events and customer complaints in the Well 30 service area. Annual system flushing is required in the Well 30 service area to minimize the risk of colored water events due to the accumulation of iron and manganese solids in the system. A filter will improve finished water quality and reduce the need for annual flushing in the Well 30 service area. The budget anticipates construction of a filter in 2020 that will be fully operational in 2021.

Near West Side Water Supply Project Project No. **17** Acct. No. **0**

GO \$ 0
Other 0
\$ 0

Construction of an additional well is scheduled for year 2023. The Water Master Plan has identified this well project to mitigate a supply deficiency in Pressure Zones 6 and 7. The project will provide additional water supply capacity to both Zones 6 and 7. The final location of the proposed well will be determined following a significant public participation process and evaluation period beginning in 2019.

Well 29 Filter Capacity Expansion Project No. **18** Acct. No. **810459**

GO \$ 0
Other 446,000
\$ 446,000

The filter system at Unit Well 29 originally was constructed with 50% capacity of the well. The filters are rated at 1,100 gallons per minute (gpm) due to a concern with contaminants under the Sycamore Landfill. A sentry well was installed between the landfill and the well to monitor water quality. Current pumping and water quality data at the sentry well show no indication of a problem with the Sycamore Landfill with regard to Well 29 operation. It is proposed to increase the capacity of the filtration system to 2,200 gpm to match the capacity of the well while maintaining the annual pumping at 560 million gallons per year. Other funding includes \$446,000 in reauthorized revenue bonds from 2014.

Well 12 Conversion to Two-Zone Well Project No. **19** Acct. No. 810459

GO \$ 0
Other 1,039,000
\$ 1,039,000

The 2006 Water Utility Master Plan recommended that Well 12 be converted to a two zone well. This conversion will provide operational flexibility and reliability to the west side supply system. Pumps and a pressure reducing valve will be added to the Well 12 facility to move water from Pressure Zone 7 to Pressure Zone 8 and vice versa. Other funding includes \$48,000 in reauthorized revenue bonds from 2014.

Booster Pump Station/PRV 124 Constr. Project No. **20** Acct. No. 0

GO \$ 0
Other 0
\$ 0

Construction of a new booster pump station, number 124, will allow water to be transferred across the Yahara River and provide operational flexibility to the system. Pump Station 124 will transfer water from Zone 6W to Zone 6E and back again through a pressure reducing valve (PRV). This operation will benefit customers through increased reliability and flexibility. The pump station will allow the transfer of water from multiple wells, if needed, during a water shortage or equipment maintenance period.

Pressure Zone 9 Storage Project No. **21** Acct. No. 0

GO \$ 0
Other 0
\$ 0

Storage capacity within Pressure Zone 9 was identified in the Water Master Plan as being deficient. With the replacement of the elevated reservoir on Prairie Road in 2011 and 2012 with a 400,000 gallon tank, this situation was partially mitigated. A second reservoir with a capacity of 750,000 gallons will resolve the remainder of the Zone 9 storage deficiency. An elevated reservoir in the western portion of Zone 9 will provide hydraulic balance to the system. Pressure Zone 9 has developed significantly with not only residential but commercial and institutional facilities. The fire flow requirements have increased due to this development to the point that current facilities do not meet minimum standards.

Pump Station 220 - Raymond Road Project No. **22** Acct. No. 0

GO \$ 0
Other 0
\$ 0

This project will construct a booster pump station on the west side to move water between Zones 7, 9 and 10, and back again through a pressure reducing valve (PRV). Booster Pump Station 220 - Raymond Road will set up operational flexibility within Pressure Zones 7, 9 and 10. The station will transfer water from Zone 7 to Zones 9 and 10, and back again through a PRV. This operation will provide the ability to share water supply resources between zones and fully use existing facilities in providing operational flexibility. The project will also provide supply redundancy to the far west side.

Booster Pump Station 115 Upgrade Project No. **23** Acct. No. 810516

GO \$ 0
Other 2,367,000
\$ 2,367,000

This project was previously included in 2014 CIP Project #15, Misc. Pump Station / PRV / Facility Projects. The upgrade of Booster Pump Station 115 will mitigate a long standing low pressure problem in the Bunker Hill Reservoir area. The upgraded facility also will provide the Utility with operational flexibility and a supplemental water supply point to the east side of Interstate Highway 90. The station will transfer water from Zone 6E to Zone 3 and back again through a pressure reducing valve. UW Hospital is building a new facility in the American Family area and requires a redundant water supply. This project will meet that need. The upgraded pump station will benefit customers through gained system reliability. Other funding includes \$1,667,000 in reauthorized revenue bonds from 2014.

Unit Well No. 8 - Fe and Mn Filtration Project No. **24** Fund No. **0**

GO \$ 0
Other 55,000
 \$ 55,000

This project will address current water quality issues at Well 8 resulting from iron and manganese levels that exceed EPA secondary standards. Due to colored water resulting from iron and manganese, well operation is currently limited to summer only and a total production of approximately 100 million gallons per year. The need for this project was verified by the East Side Water Supply project and a public engagement process was started. Initially, this project was scheduled for construction in 2013. Due to concerns about the nearby Madison Kipp Corporation, the project was delayed. Installation of a filter will allow the well to be operational all year long. Space will be included in the facility for the future addition of an air stripper, if it is needed.

Unit Well 18 - VOC Air Stripper Project No. **25** Acct. No. **0**

GO \$ 0
Other 0
 \$ 0

Construction of a VOC Air Stripper at Well 18 will address the pending water quality and regulatory issues due to increasing volatile organic compound (VOC) levels at the well. Recent water quality monitoring at the well has indicated an increasing trend in the VOC levels. Additionally, regulatory changes may result in lower VOC limits dictating the need to treat the water at Well 18. Well 18 provides an excellent source of water to the south side of Madison within Pressure Zone 6W and it is in the Utility's best interests to maintain the well. The proposed budget anticipates construction of an air stripper at Well 18 in 2018, with the facility in full operation in 2019.

All funding is from Water Utility resources.

**2015
Capital Budget
Summary**

Agency Name: Water Utility

Agency Number: 64

Project Name	Agency Request	Executive	Adopted		
			G.O. Debt	Other Funding	Total
1 Water Mains - Replace/Rehab/Improve	\$ 11,978,000	\$ 11,978,000	\$ 0	\$ 12,128,000	\$ 12,128,000
2 Water Mains - New	1,256,000	1,256,000	0	1,256,000	1,256,000
3 Zone 4 Fire Flow Supply Augment	5,593,000	5,593,000	0	5,593,000	5,593,000
4 Arbor Hills Suppl Fire Flow Supply	642,000	642,000	0	642,000	642,000
5 Unit Well No. 7 - Fe and Mn Filtration	2,544,000	2,544,000	0	2,544,000	2,544,000
6 East Side Replacement Well (Well 3)	0	0	0	0	0
7 Zones 7&8 Suppl Supply-Whitney Way	526,000	526,000	0	526,000	526,000
8 Lakeview Reservoir Reconstruction	6,092,000	6,092,000	0	6,092,000	6,092,000
9 System Wide Miscellaneous Projects	2,217,000	2,217,000	0	2,217,000	2,217,000
10 Paterson St. Bldg Remodel/Upgrade	7,017,000	7,017,000	0	7,017,000	7,017,000
11 Booster Station #106 Reconstruction	1,099,000	1,099,000	0	1,099,000	1,099,000
12 Far West Elevated Reservoir	356,000	356,000	0	356,000	356,000
13 Misc. Pump Station/PRV/Facility Projs.	887,000	887,000	0	887,000	887,000
14 Booster Pump Station 129 Reconstr.	0	0	0	0	0
15 Well 19 Iron & Manganese Filter	481,000	481,000	0	481,000	481,000
16 Well 30 Iron & Manganese Filter	0	0	0	0	0
17 Near West Side Water Supply Project	0	0	0	0	0
18 Well 29 Filter Capacity Expansion	446,000	446,000	0	446,000	446,000
19 Well 12 Conversion to Two-Zone Well	1,039,000	1,039,000	0	1,039,000	1,039,000
20 Booster Pump Station/PRV 124 Constr.	0	0	0	0	0
21 Pressure Zone 9 Storage	0	0	0	0	0
22 Pump Station 220 - Raymond Road	0	0	0	0	0
23 Booster Pump Station 115 Upgrade	2,367,000	2,367,000	0	2,367,000	2,367,000
24 Unit Well No. 8 - Fe and Mn Filtration	0	55,000	0	55,000	55,000
25 Unit Well 18 - VOC Air Stripper	0	0	0	0	0
Total	\$ 44,540,000	\$ 44,595,000	\$ 0	\$ 44,745,000	\$ 44,745,000



LEVEL OF SERVICE MEMO

Madison Water Utility
Madison, Wisconsin
119 East Olin Avenue
Madison, WI 53713

Black & Veatch Corporation
B&V Project 169092.0100
B&V File 41.0800

Black & Veatch Corporation
225 E. Mason Street, Suite 801
Milwaukee, Wisconsin 53202

January 10, 2011

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1. BACKGROUND

Criteria for evaluating the performance of existing facilities and for designing future facilities is a combination of regulations established by the Wisconsin Department of Natural Resources (DNR), Madison Water Utility (MWU) service level goals, and industry standards. Often the DNR establishes a minimum level of service, which is exceeded by MWU goals. Planning and Design Criteria are generally guidelines and provide a framework in which to evaluate the performance of the existing system and evaluate recommended facilities to serve future growth or changes in the distribution system.

2. UNIT WELLS

Criteria established for the unit wells include well capacity and emergency power/pumping. They are summarized in Table 1.

Table 1 – Unit Well Planning and Design Criteria

Criteria	Guideline
Well Capacity	For each pressure zone served by a well the well capacity must meet all of the following: <ul style="list-style-type: none"> • Average run time on unit wells less than 12 hours during the average day demand (ADD). • Total capacity of wells at least 115% of the maximum day demand (MDD). • Firm capacity (largest well in the zone out of service) of wells at least 100% of MDD. For pressure zones 6E and 6W, firm capacity shall be based on two wells out of service. ⁽¹⁾
Emergency Operation	Emergency power generation (or engine powered pump capacity) to meet at least the ADD.
Notes: ⁽¹⁾ Alternate guidelines for pressure zones 6E and 6W based on their size and importance.	

3. PRESSURE

Pressure criteria are established for low, high and emergency operations. The low pressure criterion is established to provide customers with adequate pressures for normal operation of residential and commercial fixtures including irrigation systems. The high pressure criterion is established to protect fixtures and pipelines from undue stress. Customers with normal operating pressures over 90 psi may consider installing a pressure reducing valve (PRV) on their service to protect indoor fixtures. MWU will reimburse 50 percent of the cost of the PRV for customers with normal pressures over 110 psi and 100 percent of the cost of the PRV for pressures over 125 psi. The emergency operating criterion is established to prevent negative system pressures during emergency and fire flow events. Table 2 summarizes the pressure criteria.

Table 2 – Pressure Planning and Design Criteria

Criteria	Guideline
Minimum Pressure Peak Demands	
Non-emergency	40 psi
Emergency	20 psi (at any point in the pressure zone)
Preferred Operating Pressure	50 – 90 psi
Maximum Operating Pressure	<125 psi (everywhere) <100 psi (expansion areas)

4. PIPELINES

Pipeline criteria are established for velocity, pipe roughness, minimum sizing, and pipe material. Velocity criteria are used to minimize system headlosses due to pipe size or roughness and to minimize the impact of transients in the distribution system. A roughness criterion is generally assumed or measured and is used for hydraulic model calibration and evaluation. Minimum sizing is used to ensure adequate capacity for fire protection. Table 3 summarizes planning and design criteria for pipelines.

Table 3 – Pipeline Planning and Design Criteria

Criteria	Guideline
Maximum Velocity	
Maximum Hour during MDD	< 5 fps
Fire during MDD	< 10 fps
Hazen-Williams Roughness Coefficient (C)	
Existing Pipes	125 ⁽¹⁾
High Density Polyethylene (HDPE) (new)	150 ⁽²⁾ (horizontal directional drilling only)
Ductile Iron (new, cement lined)	140 ⁽²⁾
Pipe Diameter ⁽³⁾	
General Grid Considerations	16-inch minimum diameter on 1 mile grid 12-inch minimum diameter on 0.5 mile grid (Larger diameter or closer spacing may be required based on use or zoning).
Arterial Collector Roads	12-inch minimum diameter
ICI Areas	10-inch minimum diameter
Residential Areas	8-inch minimum diameter (6-inch may be permitted for residential dead-end lines that are less than 200 feet in length with a fireflow requirement less than 1000 gpm).
Pipe Material	Ductile Iron Class 52 or greater ⁽⁴⁾
Notes:	
(1) From the 2006 IDSE hydraulic model calibration	
(2) WAC NR 811.70	
(3) MWU Planning Guidelines	
(4) HDPE is permitted for directional drilling or slip lining only (minimum pressure class 160 psi).	

5. BOOSTER PUMP STATIONS AND STORAGE

Pump station and storage criteria are designed to ensure adequate capacity for maximum hour, fireflow, or emergency demands. Table 4 summarizes planning and design guidelines for booster pump stations and storage.

**Table 4 – Booster Pump Station and Storage
 Planning and Design Criteria**

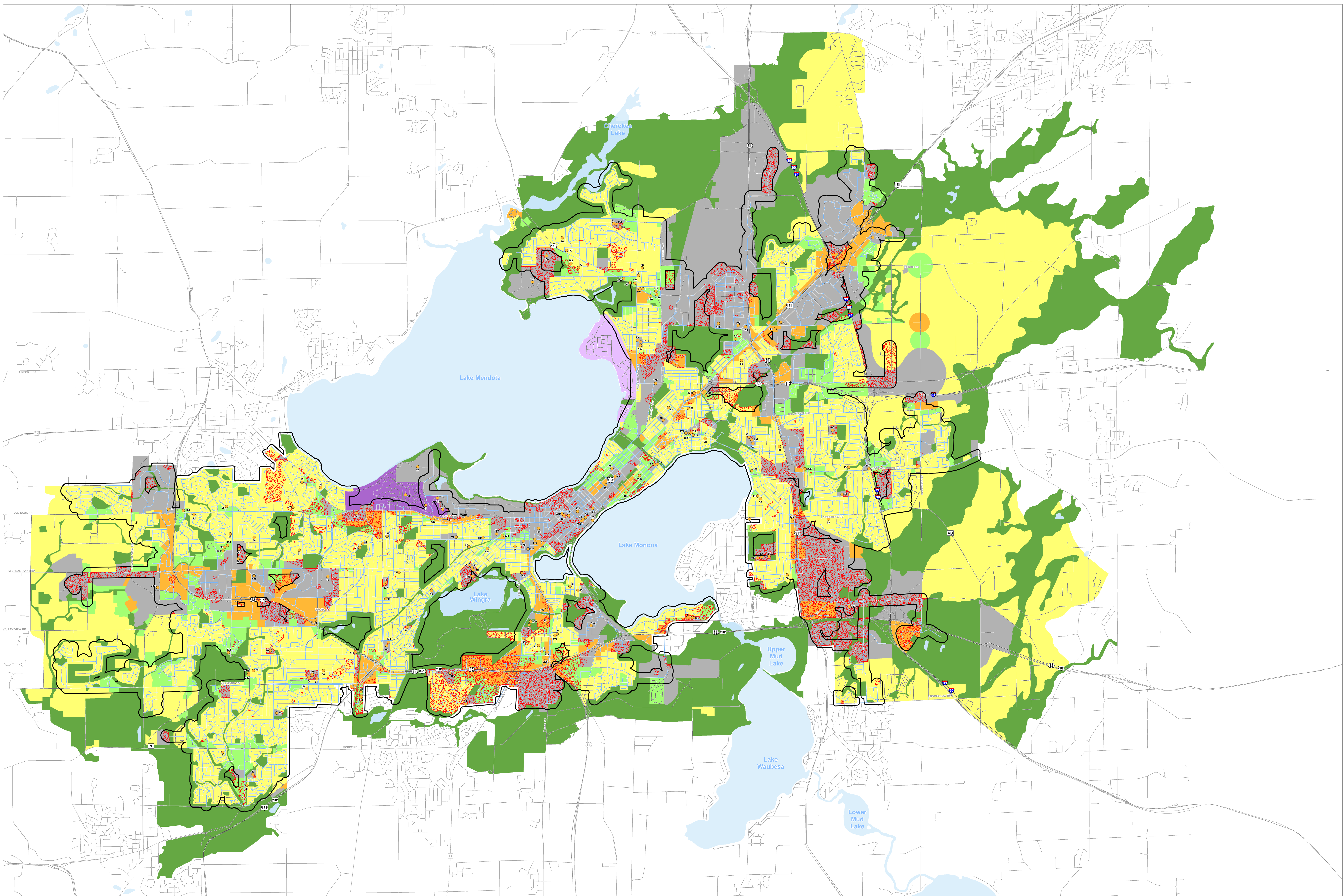
Criteria	Guideline
Booster Pump Stations	
Capacity	Firm Capacity (largest pump out of service) able to meet either: <ul style="list-style-type: none"> • MDD for pressure zones with equalization storage • Maximum hour plus fireflow for pressure zones without equalization storage.⁽¹⁾
Storage	
Volume	Every pressure zone be able to meet both of the following: <ul style="list-style-type: none"> • 12 hour supply at ADD⁽²⁾ • Fire flow plus equalization storage
Equalization storage	Volume required to deliver difference between maximum hour demand (MHD) and MDD for each pressure zone (normally 15 – 30% of MDD)
Fire Storage	Fire flow goal X fire duration (see Table 5 for fire flow and duration recommendations)
Notes:	
⁽²⁾ Pressure zone 11 is the only existing pressure zone without equalization storage.	
⁽³⁾ Emergency reserve	

6. FIRE FIGHTING CRITERIA

Projected water demands are developed from existing water demands and the anticipated impact of growth and conservation on the demand. Table 5 summarizes the fire flow goals and durations.

Table 5 – Fire Fighting Planning and Design Criteria⁽¹⁾

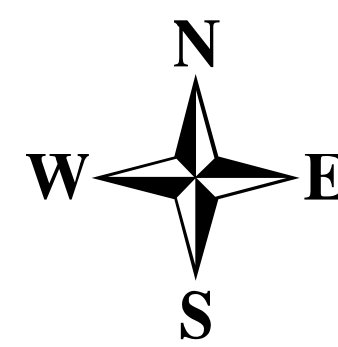
Land Use	Fire Flow Goal (gpm)	Fire Duration⁽²⁾ (hrs)	Hydrant Spacing (feet)
Low Density Residential (LDR), Neighborhood Planning Area (NPA), Traditional Neighborhood Development (TND)	1,000	2	400
Medium Density Residential (MDR), Neighborhood Mixed Use (NMU)	2,000	2	375
High Density Residential (HDR), Community Mixed Use (CMU), General Commercial (GC)	2,500	2	360
Regional Mixed Use (RMU), Regional Commercial (RC), Employment (E), Special Institutional (SI), Downtown (D), Campus (C), Airport (SP), Industrial (I)	3,500	3	300
Notes: ⁽¹⁾ Fire flow in addition to MDD. ⁽²⁾ <i>Distribution System Requirements for Fire Protection, AWWA M31, 1989</i>			



Legend

- Practical limit of Fire Flow delivery
- Area of deficient Fire Flow capacity
- Public Gathering & Services Facility (with Facility ID Number - see Table)
- Existing Pipeline
- Major roads
- Minor Roads

- Minimum Fire Flow Service Criteria**
- 3,500 gpm
 - 2,500 gpm
 - 2,000 gpm
 - 1,000 gpm
 - 0 gpm - Parks
 - 0 gpm - Village of Maple Bluff
 - 0 gpm - Village of Shorewood Hills
 - Water body



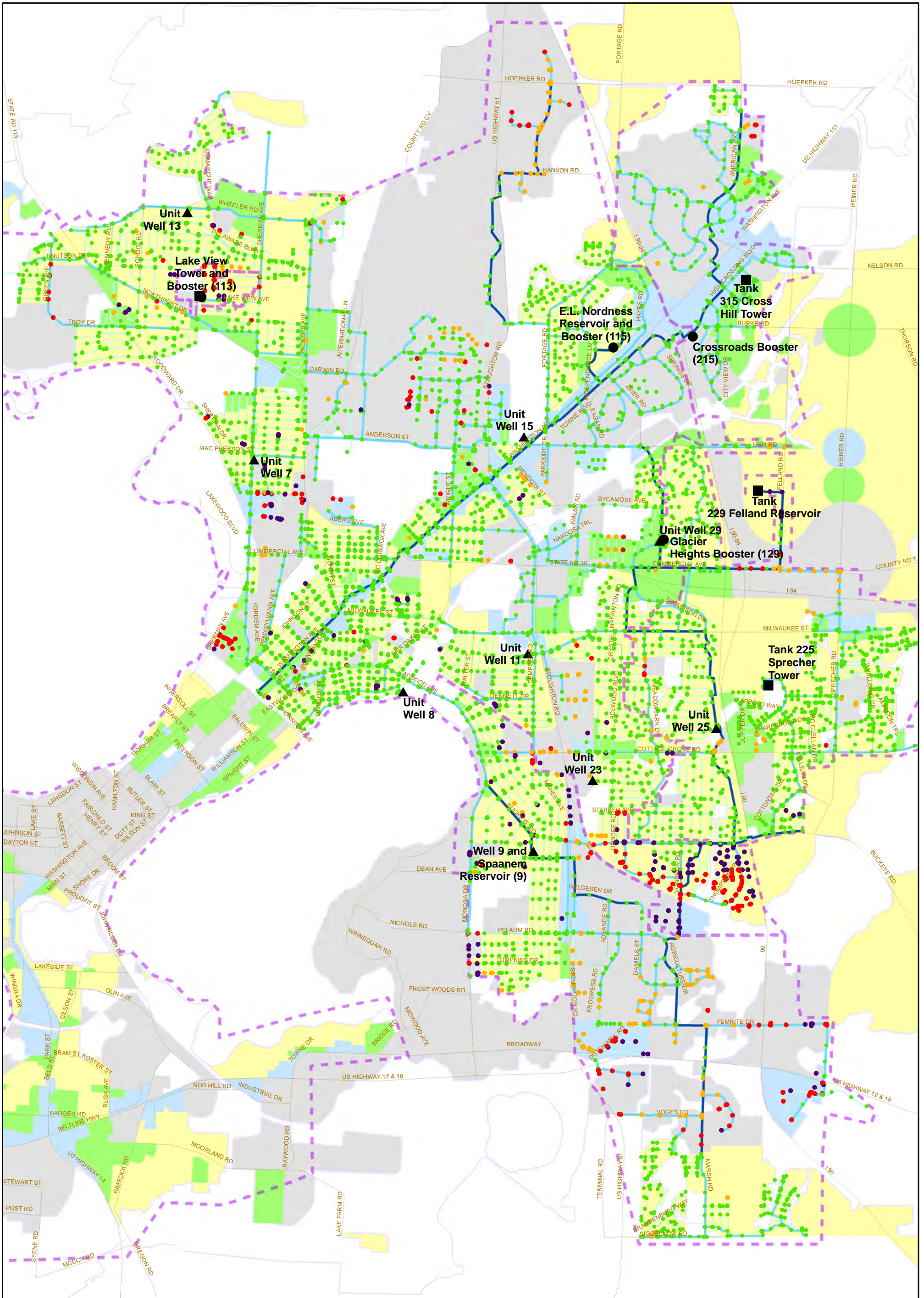
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 Version: 1
 By: DJW
 Date: Nov 17, 2006

Figure 5-8 - Fire Flow Analysis
 Madison Water Utility Planning Area
 Water Master Plan Update
 B&V PN 138101.3120





NOTE: Available fire flow based on the demand at hour 85 of a Maximum 10-Day scenario and is equivalent to Maximum Day demand.

Legend			
Pipe Diameter	Fire Flow Criteria	Junction Fire flow Category	Other Symbols
8 inch or less	0 gpm	Available Flow Meets Criteria	■ Floating Storage
10 - 14 inch	1,000 gpm	Available Flow 75% - 99% Criteria	● Booster Pump Station
16 inch and greater	2,000 gpm	Available Flow 50% - 74% Criteria	▲ Well
	2,500 gpm	Available Flow < 50% Criteria	▬ Pressure Zone Boundary
	3,500 gpm		— Streets

Figure 26
2010 Eastside
Fire Flow Availability