

Handed out  
1/10/11

## 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*

## TABLE OF CONTENTS

|  |   |
|--|---|
| 1. Background .....                        | 1 |
| 2. Unit Wells .....                        | 1 |
| 3. Pressure .....                          | 1 |
| 4. Pipelines.....                          | 2 |
| 5. Booster Pump Stations and Storage ..... | 3 |
| 6. Fire Fighting criteria.....             | 3 |

TABLES

Table 1 – Unit Well Planning and Design Criteria..... 1  
Table 2 – Pressure Planning and Design Criteria .....2  
Table 3 – Pipeline Planning and Design Criteria.....2  
Table 4 – Booster Pump Station and Storage .....3  
Table 5 – Fire Fighting Planning and Design Criteria<sup>(1)</sup> ..... 4

DRAFT

## 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"> <li>• Average run time on unit wells less than 12 hours during the average day demand (ADD).</li> <li>• Total capacity of wells at least 115% of the maximum day demand (MDD).</li> <li>• 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. <sup>(1)</sup></li> </ul> |
| Emergency Operation  | Emergency power generation (or engine powered pump capacity) to meet at least the ADD.  |
| Notes:<br><sup>(1)</sup> 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)<br><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 <sup>(1)</sup>   |
| High Density Polyethylene (HDPE) (new)   | 150 <sup>(2)</sup> (horizontal directional drilling only)  |
| Ductile Iron (new, cement lined)   | 140 <sup>(2)</sup>   |
| Pipe Diameter <sup>(3)</sup>   |  |
| General Grid Considerations  | 16-inch minimum diameter on 1 mile grid<br>12-inch minimum diameter on 0.5 mile grid<br>(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 <sup>(4)</sup>  |
| 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  |
|--|--|
| <b>Booster Pump Stations</b>   |  |
| Capacity   | Firm Capacity (largest pump out of service) able to meet either: <ul style="list-style-type: none"> <li>• MDD for pressure zones with equalization storage</li> <li>• Maximum hour plus fireflow for pressure zones without equalization storage.<sup>(1)</sup></li> </ul> |
| <b>Storage</b>   |  |
| Volume   | Every pressure zone be able to meet both of the following: <ul style="list-style-type: none"> <li>• 12 hour supply at ADD<sup>(2)</sup></li> <li>• Fire flow plus equalization storage</li> </ul>  |
| 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:<br><sup>(2)</sup> Pressure zone 11 is the only existing pressure zone without equalization storage.<br><sup>(3)</sup> 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<sup>(1)</sup>**

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