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|  | PROJECT SCOPING DOCUMENT | Project Manager: | Al Larson, P.E. 608.266.4653 allarson@cityofmadison.com |
| | | Project Information: | Arbor Hills Supplemental Fire Flow Supply Project / 1-0850-82 |
| Alder Dist: 14 Alder: Tim Bruer | Section: Engineering | 2 nd Draft: | December 19, 2008 |
| | | Refd by Water Board: | November 25, 2008 |
| | | Approved: | |

Project Scoping Document

Arbor Hills Supplemental Fire Flow Supply

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Arbor Hills Supplemental Fire Flow Supply

1. Project Description

A description of the project, including a map showing existing facilities, approximate location of proposed facilities, documented contaminated sites, the extent of the Eau Claire shale (if applicable) and the location of floodplain areas.

The Arbor Hills Supplemental Fire Flow Supply project has three objectives, 1) to improve fire flow availability, 2) to provide a redundant water supply to the Arbor Hills Neighborhood and 3) to add the ability to transfer water between Zones 6 and 7. While there are several alternative projects that could meet these three objectives, the Water Master Plan recommends constructing a booster pumping station and pipeline. Booster Pumping Station 118 (BPS 118) is the project identified in the Utility's 2006 Water Master Plan prepared by Black and Veatch Corporation (Water Master Plan) to address the Arbor Hills deficiency. The Water Master Plan identifies water distribution system deficiencies and establishes a capital improvement program for addressing those deficiencies. The BPS 118 project involves the construction of a southern interzone booster pump station. The proposed pumping station would connect Pressure Zone 6, the main pressure zone, and the higher Pressure Zone 7, allowing the transfer of water from the Unit Well 18 area (located in Pressure Zone 6) to the Arbor Hills area (located in Pressure Zone 7). See Figure CP1 for location details.


BPS 118 consists of a booster station, located near the intersection of Landmark Place and the West Beltline Highway 14/151/18 and an additional pipeline along the Beltline Highway southerly frontage road. Due to changes in the area, the current configuration places the booster pump station near the railroad corridor and the Frontage Road. The pipeline would be constructed under the Cannonball Run bike path. The pump station would be configured with three booster pumps, each with a capacity of 1,000 gallons per minute (gpm). The general service area for the project being considered is illustrated on Figure CP1. The service area potentially impacted by the proposed pump station is also noted on Figure CP1, along with the related Pressure Zone boundaries.

2. Purpose

The purpose and necessity of the project, with supporting data including recent and anticipated water consumption data and hydraulic model summarizations.

Currently a single 8-inch diameter pipeline serves Arbor Hills from Pressure Zone 7 to the west. Any interruption of this supply line would put the Arbor Hills area in Zone 7 out of water. This single source of supply makes the area vulnerable to water outages due to main breaks. Also due to this single source of supply, computer modeling runs of the City's water distribution system; using both current and projected water demands, identify serious fire flow supply deficiencies in Arbor Hills.

This project will provide improved reliability of water service and improved fire flow capacity to this area of the City. It will also provide for transfer of water from Pressure Zone 6 to Pressure Zone 7. Utilizing excess capacity in Unit Well 18 to supplement the supply in Zone 7 will reduce the reliance on Unit Well 10 and possibly delay future supply or new well projects within Pressure Zone 7.

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The existing water main piping grid in the Arbor Hills and Well 18 areas is undersized and will need to be replaced with larger mains at some point in the future. For analysis in the water distribution system computer model, new 12-inch diameter pipe has replaced some existing 6-inch and 8-inch diameter pipe north and east of the proposed location of BPS 118. This will improve the hydraulics between Unit Well 18 and the Arbor Hills pumping station. It is expected that construction of these pipeline upgrades will occur over the next 5 years.

To effectively transfer water from Zone 6 to Zone 7 and to provide redundant supply to the Arbor Hills area, the Water Master Plan proposes a pipeline. The Master Plan indicates the construction of a pipeline along the southerly frontage road along the Beltline Highway. Due to recent construction and improvements in this area, construction of a water transmission main in this area is unlikely. An alternate route is proposed along the City's new Cannonball Run bike path. This route provides the additional advantage of separating the two pipelines.

Unit Well 18 currently produces an annual average of 1.1 million gallons of water per day (mgd). The full rated capacity of Unit Well 18 is approximately 3 mgd and the extended production capacity is established at 2.7 mgd. Currently an excess supply capacity of about 1.6 mgd exists on the average day at Unit Well 18. This project targets the utilization of a portion of this excess capacity to supplement supply to the Arbor Hills area and the southern portion of Pressure Zone 7. The pump station will also improve fire flow capacity to the Arbor Hills area.


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| 3. Projected Effect | <i>The projected affect of the project on quality and reliability of service, and hydrologic impacts.</i> |
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Impacts on Water Supply Redundancy
Construction of the Cannonball Run pipeline and a pump station to transfer water from Pressure Zone 6 to Pressure Zone 7 will provide the needed supply redundancy to the Arbor Hills neighborhood. It will reduce the stress on wells located in Zone 7, and it will minimize the risk of lost supply to the area and greatly improve system reliability.

The ability to move water from Pressure Zone 6 to Pressure Zone 7 will delay the need for either replacement of Well 10 or the construction of a filter. It will also provide a backup supply to Zone 7 during maintenance of Wells 12 and 20.

The pump station will be equipped with a pressure reducing station that will allow water to move from Pressure Zone 7 to Pressure Zone 6. This facility flexibility will allow the station to be used to supplement flow to Pressure Zone 6 during maintenance of Wells 18 or 30.

Impacts on Fire Flow Capacity
A combination of the proposed pump station and pipeline improvements will eliminate the fire flow capacity deficiency. Available fire flow capacity throughout the Arbor Hills area will be

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improved and customers will experience more stable pressures during high demand periods such as water main flushing. Improved fire protection will make the area more attractive and valuable to commercial and light industrial development.

Hydrogeologic Impacts of the Project

The preferred project alternative does not include the addition of a new well, hydrogeologic impacts would be the result of the additional pumping required at Unit Well 18. Impacts to the groundwater system from this project would involve a shift in the source of the water supply for the Arbor Hills area. Average day pumping for Unit Well 18 is currently 1.1 million gallons. Any increase in the amount of groundwater pumped by Unit Well 18 would represent a corresponding decrease in the amount of groundwater pumped by other wells in the water distribution system.


In the project scenarios that consider either drilling a new well or acquiring water from the City of Fitchburg would essentially shift the groundwater withdrawal from existing wells to the new well. In this case, the hydrogeology will be impacted by groundwater drawdown in the vicinity of the new well. The groundwater drawdown at existing wells will benefit from the reduced pumping.

4. Alternatives

A description of alternative projects or programs considered (This does not include specific site comparisons during early phases of the project).

Attached please find the Arbor Hills portion of Figure 5-8 from the Water Master Plan. This Figure is included to demonstrate the current fire flow deficient areas within the study area. Different colored shading depicts the current and projected zoning in the area. The gray-shaded areas, which include larger buildings and gathering places including commercial, industrial, and school buildings, have a fire flow service criteria of 3,500 gpm for 3 hours (per fire code requirements described in the Water Master Plan and American Water Works Association Manual of Water Supply Practices, M31). Areas with buildings used for some lighter commercial uses are shown with light green shading and require fire flows of 2,000 gpm for 2 hours. Residential areas, shown as yellow-shaded areas, have fire flow requirements of 1,000 gpm for 2 hours.

A series of distribution system computer runs were developed to evaluate proposed alternatives to satisfy the three project objectives. Using computer analysis of the system will allow various configurations of piping and pump station to be evaluated and the feasibility of an alternative determined. The projected water demands used in all of the modeling runs are described in detail in the memo to the Madison Water Utility Board (08/22/08). Further, under all of the modeling scenarios, the water distribution system is *stressed* in accordance with the memo, with Unit Wells 6, 10 and 30 all off during the maximum day demand model simulation scenarios.

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Six different scenarios were evaluated using the Utility's distribution system computer model. Graphical representation of the available fire flows for a fire occurring at Leopold Elementary School and other locations within the project area are attached. The six computer scenarios are described as: 1) Current max day conditions with no improvements; 2) Current max day conditions with only the Cannonball Pipeline; 3) Year 2025 10-Day max conditions with both BPS 118 and the Cannonball Trail Water Main constructed; 4) Year 2025 10-Day max conditions with only BPS 118 in operation; 5) Year 2025 10-Day max conditions with BPS 118 in operation and the Cannonball Trail Water Main constructed only to Westview; 6) Year 2025 10-Day max conditions with a 750,000 elevated storage tank and BPS 118. The modeling results indicate the addition of these various facilities significantly improve the fire flow capacity within the project area. A detailed description of each scenario is as follows:

Model Run 1 – Current conditions, Max Day (55 mgd) with Fires and no improvements

The figure for Computer Model Run 1 indicates available fire flows do not meet fire flow requirements as shown on Figure 5-8. Residential fire flows are between 500 and 1,000 gpm, below the identified minimum fire flow service criteria of 1,000 gpm. Commercial and industrial areas indicate more severe fire flow supply deficiencies and do not meet the minimum fire flow capacity criteria of 3,500 gpm.


Model Run 2 – Current conditions, Max Day (55 mgd), Fires, w/ Cannonball Run Main

The figure for Computer Model Run 2 shows improvements in the availability of fire flows with the addition of the Cannonball Trail Water Main. Under current maximum day flow demands of 55 mgd, the addition of the Cannonball Trail Water Main improves available fire flows in the residential areas to above the required 1,000 gpm. However, fire flow capacities remain under the required 3,500 gpm in the commercial, industrial and/or school locations.

Model Run 3 – 2025, 10 Day Max (58 mgd), Fires w/ BPS 118 and Cannonball Run Main

The figure for Computer Model Run 3 indicates increased fire flow capacity with the addition of both BPS 118 and the Cannonball Trail Water Main. In planning for future growth, the year 2025 water demands reflect the increased water distribution system demands adjusted downward to reflect water conservation efforts. This modeling run is also considered to be representative of a water supply scenario of a new water source to the area such as a new well or purchasing water from the City of Fitchburg.

Model Run 3 indicates a fire flow capacity of over 4,200 gpm at Leopold Elementary School. However, available fire flows near Landmark Place are still below 1,500 gpm, well below the service criteria of 3,500 gpm. It should be noted that the Landmark Place locations displaying inadequate fire flows involve two dead-end mains. Upsizing these dead end pipes from 6-inch to 10 or 12-inch diameter pipe and looping them through an easement will significantly improve fire flow capacity at this location. In addition, Landmark Place is at one of the highest elevations in the Arbor Hills service area making it more sensitive to pressure drops. During the refinement of

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project alternatives, fire flow capacity near Landmark Place will be analyzed and system improvements proposed to ensure adequate capacity.

Model Run 4 – 2025, 10 Day Max (58 mgd), Fires, w/ only BPS 118

Figure Model Run 4 indicates conditions with only BPS 118 in use and without the addition of the Cannonball Trail Water Main. The available fire flows at Leopold Elementary School and other industrial and commercial areas are estimated to be below the required 3,500 gpm. Comparing Figure Model Run 3 with Figure Model Run 4 indicates that the Cannonball Trail Water Main is needed in conjunction with BPS 118 meet fire flow criteria.

Model Run 5 – 2025, 10 Day Max (58 mgd), Fires, w/ BPS 118 and Pipeline to Westview Ln.

Figure Model Run 5 shows the modeling results with BPS 118 in use and with a reduction in the scope of the Cannonball Trail Water Main project. This scenario includes only a portion of the Cannonball Trail Water Main project; specifically, a 16-inch diameter pipe is constructed and in use from the West Beltline Highway down along the east and south edge of the Arbor Hills neighborhood. This new pipe is highlighted in yellow on Figure Model Run 5. The analysis includes a new 12-inch diameter main along Grandview Boulevard. Although this model run shows available fire flows at some commercial/industrial and/or school locations to be below the minimum fire flow service criteria value of 3,500 gpm, system piping improvement projects around the Arbor Hills area will rectify that situation. Delaying or eliminating the construction of the entire length of the Cannonball Trail Water Main project would save money but would limit the ability to transfer water from Zone 6 to Zone 7. It would also eliminate the redundancy and reliability sought by maintaining a single pipe connection to Zone 7.

Model Run 6 – 2025, Max 10 Day (58 mgd), Fires, w/ only an Elevated Reservoir


The option of the addition of a new elevated storage reservoir within Arbor Hills is analyzed in Model Run 6. A booster pump station is constructed to fill the reservoir from Zone 6 and the Cannon Ball Water Main is eliminated. In this model run, an elevated reservoir is constructed in a central part of Arbor Hills, near the intersection of Derby Down and Pelham Road. The addition of an elevated reservoir greatly improves the overall availability of fire flows throughout the project area except for the Landmark Place area. Landmark Place, due to its elevation, continues to show available fire flows below the desired 3,500 gpm. Looping and increasing the size of the pipe around Landmark Place will improve fire flow capacity to the area.

Alternatives:

Alternatives for improving fire flow supply and overall supply reliability to the Arbor Hills area include but are not necessarily limited to:

1. Maintain status quo.


- a. **Discussion:** Given the fire flow deficiencies noted in the Water Master Plan and in the subsequent water distribution system modeling results and the lack of

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supply redundancy and reliability, this “do nothing” alternative does not meet minimum system standards. Madison Water Utility has the obligation to provide adequate water service, including adequate fire flow capacity to all portions of its service area. Doing nothing and not providing redundancy would continue to expose the residents and businesses of the Arbor Hills area to an unacceptable risk of losing their water supply.

- b. **Estimated Cost:** Capital Cost \$0; Operational cost \$0; There would be an expectation of higher property insurance costs due to fire flow deficiencies.
 - c. **Recommendation:** No further consideration will be given to this alternative.
- 2. Construct a Pumping Station and the Water Transmission Main along the Cannonball Run Bike Path to Transfer Water from Zone 6 to Zone 7**
- a. **Discussion:** This alternative was recommended in the 2006 Water Master Plan. It meets all three objectives of the project. It improves fire flow capacity, it provides a redundant water supply to the Arbor Hills area, and it allows the efficient transfer of water from Zone 6 to Zone 7. The alternative utilizes excess capacity in Well 18 and will delay the need to construct additional supply in the southeast corner of Zone 7.
 - b. **Estimated Cost:** Estimated costs for pump station are about \$900,000. Estimated cost for the pipeline is \$2.6 million.
 - c. **Recommendation:** This alternative efficiently and effectively meets all project objectives and it is the preferred alternative.
- 3. Drill a new well.**
- a. **Discussion:** Drilling a new well in the Arbor Hills area is not considered to be an ideal alternative for several reasons. System supply capacity in the Arbor Hills area was not identified as an issue due to excess capacity at Well 18 and other proposed wells located in Zone 7. Constructing and operating a new well is significantly more costly than constructing an interzone booster station. Savings in avoiding necessary piping projects north of the Beltline Highway to move water from Well 18 would offset some of the cost differential but would not be decisive. A new well would provide redundant water supply to the Arbor Hills Area, but the Cannonball Trail pipeline would still be required to provide an effective interzone transfer to the main part of Pressure Zone 7.
 - b. **Estimated Cost:** Capital cost for a new well is \$3 million. The annual operating cost is estimated to be about \$150,000.

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c. **Recommendation:** While constructing a new well would meet the project objectives, it would be costly to build and operate. Excess supply capacity exists in this part of the system that makes this alternative less attractive to MWU. While this alternative meets all of the project objectives, it is not as economically or resource efficient as a pump station.

4. Acquire water from the City of Fitchburg.


a. **Discussion:** Sharing a new well with the City of Fitchburg has been preliminarily discussed with Fitchburg. The City of Fitchburg is seeking additional wells in the north end of its system to meet projected future demands. A new well that would benefit both systems may be an attractive alternative that warrants further consideration. The proposed well would be located in the vicinity of Arbor Hills and would interconnect the City of Fitchburg and the City of Madison water distribution systems. Analysis of the hydraulic gradients of each system would be analyzed to determine compatibility. Pumping facilities would have to be designed to match hydraulic grade lines between the two systems.

b. **Estimated Cost:** Estimated costs for a well, reservoir and pump station are about \$3,000,000. The capital costs of the project would be the responsibility of the City of Fitchburg and an agreement would be developed to sell water to the City of Madison. Madison Water Utility currently has existing contracts for supplying water to other communities. It is expected that similar water rates may be anticipated for Madison to pay to the City of Fitchburg for such an arrangement.

c. **Recommendation:** This alternative would require further study of the hydraulic characteristics of the Fitchburg water system, as well as an inquiry into the political feasibility of this type of inter-governmental agreement. Given the preference for Alternative 2 (Pumping Station and Transmission Main), it not recommended to pursue further study at this time.

5. Construct a 750,000-gallon elevated tank.

a. **Discussion:** This alternative would consist of constructing a new 750,000 gallon elevated storage tank in the Arbor Hills area. An elevated reservoir would stabilize the pressures in the area, and combined with some pipe upsizing in the project area, would also address the noted fire flow deficiencies. An elevated storage tank would be filled with water from Unit Well 18 through a booster pump station, providing a redundant supply to the Arbor Hills area, with the interzone transfer of water from Pressure Zone 6 into Pressure Zone 7. The Cannonball Trail Water Main is not included with this alternative. Due to the limited capacity of the 8-inch diameter main along the Beltline Highway frontage road, significant water transfer from Zone 6 to Zone 7 would be limited with this scenario. Further water

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distribution modeling would identify needed water transmission improvements in both Zone 6 and Zone 7 to fill the proposed elevated storage tank.

A 750,000 gallon reservoir matching the hydraulic gradient of Zone 7 would have an overflow elevation of 1171. The idea area for an elevated tank is the highest point in the area. At the south end of Landmark Place the ground has an elevation of approximately 985. Assuming a site could be obtained, this would make the tower almost 200 feet tall, which is very tall. Siting a large tall elevated reservoir would be very difficult and would be strongly resisted by local residents.

- b. **Estimated Cost:** Capital Cost \$2.1 Million. Estimated annual operating cost of an elevated tank with a new booster pump station is estimated to be \$100,000.
- c. **Recommendation:** Due to the impact on the neighborhood and the expected strong resistance, no further consideration will be given to this alternative.

5. Photographic Examples

Photographic examples of similar facilities with discussion of possible variations.

Photographs of similar pump station facilities are attached. Photos of the Utility's Booster Pump Stations 115, 125, 128 and 215 illustrate the varied architecture that would be used to "fit into" any neighborhood.

6. Cost Estimate


The cost of the project by major plant accounts.

The cost of the BPS 118 project is estimated in the 2010 Capital Budget as \$898,000, which includes:

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| Design and contract administration services: | \$158,000 |
| Construction Cost: | \$740,000 |

In addition, the Cannonball Trail Water Main Project is estimated to be an additional \$2.6 million, which includes:

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| Property Purchase | \$150,000 |
| Public Participation | \$50,000 |
| Design and Construction Cost | \$2.4 Million |

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7. Financing

The proposed method of financing the project.

The capital projects budget is funded through the issuance of revenue bonds.

8. Operational Costs

The estimated annual operating costs of the project, by major expense accounts, to include possible fiscal effects of water treatment if anticipated.

Annual operating expenses of similar facilities within Madison Water Utility distribution system include annual electricity expenses of about \$12,000. As Madison Water Utility already utilizes several similar booster stations within its distribution system, an increase in staff or training requirements are not anticipated with this project. Annual maintenance costs associated with the booster station are estimated to be about \$80,000.

9. Replacement Costs

A description of and the original cost of any property being replaced, by major plant accounts.

This is a new facility. No property will be replaced with the construction of this project.

10. Designation of Affected Parties, Notification List


The designation of public utilities, alders, and other persons materially affected by the project and a list of those, which have been notified.

The Arbor Hills Neighborhood is located in Madison Aldermanic District 14. Tim Bruer, the Alder for District 14, will be involved in this project from the beginning. Due to the proximity of the City of Fitchburg, the Town of Madison, and the UW Arboretum, to the project, these agencies will be notified about this project and updated as the project progresses. A mailing list for all persons and entities potentially affected by this project is included with the project Communication Plan.

11. RFP for Property Valuation Analysis

A draft request for proposals (RFP) for the acquisition of services to determine the impact on values of adjoining properties.

At this time, it is not anticipated that this project will negatively impact any of the Arbor Hills neighborhoods. If deemed necessary to acquire services to determine the impact on values of properties adjoining the project, a request for proposals (RFP) will be prepared for acquiring such services.

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12. Site Selection Criteria

A description of the draft site selection criteria to be used in locating, evaluating, and ranking potential sites for the proposed facility. Site selection criteria categories will include regulatory requirements, groundwater quality and quantity, aesthetic impact, compatibility with existing neighborhood context, historic land use, existence of natural buffers, and environmental equity/justice considerations.


Site selection criteria to be used for this project will include, but not be limited to the following categories: regulatory requirements, Utility standards and level of service requirements, groundwater quality, groundwater quantity, aesthetic impacts, compatibility with existing neighborhood context, historic land use, existence of natural buffers, and environmental equity/justice considerations.

13. Project Timeline

The estimated project timeline, with identifies major project phases and decision points requiring an approved resolution from the Water Utility Board. Project phases requiring a resolution shall, at a minimum, include the establishment of the proposed project, the facility site selection, and the site plan selection.

The estimated project timeline includes the following:

- Week of November 10, 2008 – Meet with Alder and Mayor’s Office for each project, post information on Utility Web Page & notify stakeholders and residents
- November 25, 2008 – Water Board refers the Scoping Document to January 2009 meeting
- Week of January 12th, 2009 – Convene Citizen’s Advisory Committee if one exists
- Incorporate Committee’s comments
- Week of January 19th, 2009 – Hold first public meeting
- Solicit written comments on the documents until February 10th, 2009
- February 17th, 2009 – Public Hearing before the Water Board; Water Board considers the comments and the Scoping Document and acts on whether or not to establish the project.
- If project is established, proceed with design in 2009
- Site selection by July 1, 2009
- Preliminary design by August 15, 2009
- Final Design by November 1, 2009
- Architectural review finalized by January 31, 2010
- Bid Award by May 1, 2010
- Construction in Summer/Fall 2010
- Fully operational January 2011

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14. Appendix

Documents referenced in the Scoping Document.

List of Appendices

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| <u>Project Service Area</u> | <u>Appendix B</u> |
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| <u>Fire Flow Analysis</u> | <u>Appendix B</u> |
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| <u>Computer Model Runs 1 to 6</u> | <u>Appendix B</u> |
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| <u>Photos of Existing Pump Stations</u> | <u>Appendix B</u> |
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