Madison Water Utility MWU	Alternative Evaluation	Project Manager:	Al Larson, P.E. 608.266.4653 allarson@cityofmadison.com
		Project Information:	Arbor Hills Supplemental Fire Flow Supply Project / 1-0850-82
		1st Draft:	August 4, 2009
Alder Dist: 14 Alder: Tim Bruer	Section: Engineering	Refd by Water Board:	
		Approved:	

Alternative Evaluation

Arbor Hills Supplemental Fire Flow Supply

Table Of Contents:

Madison Water Utility	Alternative Evaluation	Project Manager:	Al Larson, P.E. 608.266.4653 allarson@cityofmadison.com
		Project Information:	Arbor Hills Supplemental Fire Flow Supply Project / 1-0850-82
		1st Draft:	August 4, 2009
Alder Dist: 14 Alder: Tim Bruer	Section: Engineering	Refd by Water Board:	
		Approved:	

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 main objectives:

1) Improve fire flow availability to meet Utility standards
2) Provide a redundant reliable water supply to the Arbor Hills Neighborhood
3) Add the ability to transfer water between Zones 6 and 7.

To meet these three objectives, the Water Master Plan recommends constructing a booster pumping station and pipeline. The Utility's 2006 Water Master Plan prepared by Black and Veatch recommends that Booster Pumping Station 118 (BPS 118) in conjunction with a pipeline from Verona Road to Todd Drive be constructed to address the Arbor Hills deficiency. 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). The proposed pipeline would allow water to be pumped to southern portion of Pressure Zone 7. See Figure 1 for location details of the Arbor Hills service area.

The 16-inch diameter pipeline would be constructed under the proposed Cannonball bike path. The pump station recommended in the Master Plan would be configured with three booster pumps, each with a capacity of 1,000 gallons per minute (gpm).

Additional detail is provided in the Project Scoping document that is by reference made a part of this document.

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 along the south Beltline Highway frontage road 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 and the size of the pipe limits hydraulic capacity. 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 due to this single source of supply and the resulting hydraulic restriction. See the project scoping document for additional information and details.

This project will provide improved reliability of water service and improved fire flow capacity to the Arbor Hills area. It will also provide for transfer of water from Pressure Zone 6 to Pressure Zone 7 improving water supply reliability. 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 new well projects within Pressure Zone 7.

Madison Water Utility	Alternative Evaluation	Project Manager:	Al Larson, P.E. 608.266.4653 allarson@cityofmadison.com
		Project Information:	Arbor Hills Supplemental Fire Flow Supply Project / 1-0850-82
		1st Draft:	August 4, 2009
Alder Dist: 14 Alder: Tim Bruer	Section: Engineering	Refd by Water Board:	
		Approved:	

Arbor Hills Supplemental Fire Flow Supply

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 at Well 18 to supplement supply to the Arbor Hills area and the southern portion of Pressure Zone 7.

3. Alternative Evaluation

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

Alt 1. Maintain the status quo. (Do nothing)

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 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; Social Cost: There would be an increased risk of water service interruptions under this Alternative. There would be an expectation of higher property insurance costs due to fire flow deficiencies in the area and this could also reduce development potential in the area.

c. **Engineering Cost:** Not Applicable

d. **Operating Cost:** Not Applicable

e. **Property Cost:** Not Applicable

f. **Schedule:** Not Applicable

g. **Recommendation**: This Alternative does not address the existing deficiencies, does not meet minimum Utility level of service, would not be acceptable to area residents and therefore will not be considered further.

Alt 2. Construct a Pumping Station with a firm pumping capacity of 2,000 gpm and a 16-Inch Water Transmission Main along the Cannonball Bike Path to Transfer Water from Zone 6 to Zone 7 and supplement fire flow capacity to Arbor Hills.

Madison Water Utility MWU	Alternative Evaluation	Project Manager:	Al Larson, P.E. 608.266.4653 allarson@cityofmadison.com
		Project Information:	Arbor Hills Supplemental Fire Flow Supply Project / 1-0850-82
		1st Draft:	August 4, 2009
Alder Dist: 14 Alder: Tim Bruer	Section: Engineering	Refd by Water Board:	
		Approved:	

Arbor Hills Supplemental Fire Flow Supply

a. **Discussion:** This is the recommended alternative for the Arbor Hills area from the Utility's 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 water supply capacity in the southeast corner of Zone 7.

b. **Estimated Capital Cost:**
- Pump station: $830,000.
- Cannonball pipeline is $2.5 million.
- Pipeline improvements north of the beltline highway = $870,000

c. **Engineering Cost:**
- Design = $120,000
- Construction Administration = $58,000

d. **Operating Cost:**
- Estimated Annual electricity expenses = $12,000
- Labor = No additional cost
- Annual maintenance costs = $41,000

e. **Property Cost:** $150,000

f. **Schedule:** The estimated project timeline includes the following:
- Present the recommendation at a public meeting and to the Water Utility Board in September 2009
- Hire a design consultant in October 2009 for the pump station and to assist with site selection
- Site selection by February 1, 2010
- Preliminary design by March 31, 2010
- Final Design by May 31, 2010
- Architectural review finalized by June 30, 2010
- Bid Award by September 1, 2010
- Construction in Fall/Winter/Spring 2010 and 2011
- Fully operational June 2011

g. **Recommendation:** This alternative meets all of the project objectives and would improve fire flow capacity and water system reliability in the Arbor Hills area. It is an established project from the 2006 Water Master Plan. Based on these factors, it is recommended that the Utility construct a water booster station in the Arbor Hills area that would transfer water from Zone 6 to Zone 7 and improve fire flow

capacity.

Alt 3. Drill a new well.

a. **Discussion**: Drilling a new water supply well in the Arbor Hills area would provide a redundant point of supply and it would improve fire flow capacity. With some design modifications it could transfer water from Zone 6 to Zone 7 using the reservoir and pump station. The Utility's Master Plan did not identify a need for an additional well in this part of the system. Excess capacity does exist at Well 18 and new wells are proposed for more centralized locations within Zone 7. These factors make an Arbor Hills well unnecessary. The estimated capital cost to construct a new well is $3,000,000. Operating and maintaining that well is estimated to be in excess of $100,000 per year. These costs are significantly higher than constructing an interzone booster station. It is acknowledged that there would be significant cost savings in not constructing the necessary piping projects north of the Beltline Highway to move water from Well 18. However to meet the objective to transfer water from Zone 6 to Zone 7 these piping improvements and the Cannonball pipeline are still required. The pipeline projects proposed for north of the beltline provide the additional benefit of replacing aging piping and improving system hydraulics. The full extent and scope of the piping system improvements would have to be evaluated.

b. **Estimated Capital Cost:**
   - Well: $3 million.
   - Cannonball pipeline = $2.5 million.
   - To allow water to be transferred from Zone 6 to Zone 7; Pipeline improvements north of the beltline highway = $870,000

c. **Engineering Cost:**
   - Design = $270,000
   - Construction Administration = $175,000

d. **Operating Cost:**
   - Annual power costs = $12,000.
   - Labor = $9,500
   - Annual maintenance costs = $80,000.

e. **Property Cost:** $200,000

f. **Schedule:** The estimated project timeline includes the following:
   - Present the recommendation at a public meeting and to the Water Utility Board

in September 2009

- Hire a design consultant in October 2009 to assist with site analysis and selection, facility design, bidding and construction
- Site selection and analysis by July 31, 2010
- Test Well drilled and analyzed by October 31, 2010
- Production Well drilled and developed by June 1, 2011
- Preliminary design complete by August 31, 2011
- Final Design by December 31, 2011
- Architectural review finalized by February 28, 2012
- Bid Award by May 1, 2012
- Construction in Summer/Fall/Winter 2012 and 2013
- Fully operational April 2013

g. **Recommendation:** While constructing a new well would meet the project objectives, it would be costly to build and operate and it would delay the project by two years. Excess supply capacity currently 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 constructing a pump station. It is recommended that the Utility not pursue drilling a well in Arbor Hills.

Alt 4. Acquire water from the City of Fitchburg.

a. Discussion: Purchasing water from the City of Fitchburg has the potential of meeting two of the three stated project objectives for the Arbor Hills project. A well would provide a redundant source of water supply to the area improving reliability and it would improve fire fighting capacity. It would not have the capability of transferring water from Zone 6 to Zone 7; however, water could be transferred from the Fitchburg well to the western reaches of Zone 7. This option has been preliminarily discussed with the City of Fitchburg to investigate its feasibility. Based on future projected drinking water demands within the City of Fitchburg, they will be seeking additional wells in the north end of their system. At this point their financial capacity to construct a north end well within the next five years is unknown. Current capacity within the Fitchburg system would not be adequate to supplement the supply to Arbor Hills. Current estimates indicate a required firm capacity of 2,000 gpm for fire fighting needs and an annual average withdrawal of around 500,000 gallons per day. 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 necessary to determine compatibility during the design process. A meter station for billing would be installed to monitor water use by the City of Madison.

Arbor Hills Supplemental Fire Flow Supply

b. **Estimated Capital Cost:**
- Well: $3 million – financed by the City of Fitchburg.
- Cannonball pipeline = $2.5 million.

c. **Engineering Cost:** (All by the City of Fitchburg)
- Design = $270,000
- Construction Administration = $175,000

d. **Operating Cost:** (All by the City of Fitchburg)
- Annual power costs = $12,000.
- Labor = $9,500
- Annual maintenance costs = $80,000.

e. **Water Cost:** Based on an estimated purchase of 100 million gallons per year the estimated annual water cost = $165,000

f. **Property Cost:** $200,000 (By the City of Fitchburg)

g. **Schedule:** The estimated project timeline includes the following:
- Present the recommendation at a public meeting and to the Water Utility Board in September 2009
- Work with the City of Fitchburg to define project criteria, siting and design parameters. Complete by March 31, 2010
- Site selection and analysis by September 30, 2010
- Test Well drilled and analyzed by June 1, 2011
- Production Well drilled and developed by October 31, 2011
- Preliminary design complete by January 31, 2012
- Final Design by April 15, 2012
- Architectural review finalized by June 1, 2012
- Bid Award by August 1, 2012
- Construction in Summer/Fall/Winter 2012 and 2013
- Fully operational July 2013

h. **Recommendation:** Purchasing water from the City of Fitchburg would meet two of the three project objectives; it would not allow water to be transferred from Zone 6 to Zone 7. Currently the City of Fitchburg does not have the necessary capacity to provide the water needed for Arbor Hills and they would have to construct a new well. A well would be costly to build and operate and it would delay the project by two to five years. Considering the fact that excess supply capacity currently exists

in the southern part of Zone 6, this fact makes the alternative less attractive to MWU. The alternative only meets two of the three project objectives and it requires significant coordination and financing from the City of Fitchburg. The alternative of relying on Fitchburg to construct a well to solve a City of Madison system deficiency is not recommended. This alternative will not be considered further.

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

a. **Discussion:** To address the issue of fire flow capacity in the Arbor Hills neighborhood, it is proposed to construct a 750,000 gallon elevated storage tank in the Landmark Place area. An elevated reservoir would stabilize the pressures while providing some gravity fed water storage. Pipe improvement projects would also be needed to address the localized fire flow deficiencies. A booster pump station from Zone 6 and therefore Well 18 would fill the elevated storage tank. This arrangement provides a redundant supply to the Arbor Hills area and a limited interzone transfer of water from Pressure Zone 6 into Pressure Zone 7. The Cannonball Trail Water Main is not included with this alternative as it is not necessary to meet the fire flow capacity requirements. Due to the limited capacity of the 8-inch diameter main along the Beltline Highway frontage road, water transfer from Zone 6 to Zone 7 would be minimal.

A 750,000 gallon reservoir matching the hydraulic gradient of Zone 7 would have an overflow elevation of 1171. Constructing the elevated tank at the highest point in the area would place the base at an elevation of approximately 985. Assuming a site could be obtained, this would make the tower almost 200 feet tall. A 200 foot tall 750,000 gallon tank would loom over the neighborhood. Siting a large tall elevated reservoir would be very difficult and would be strongly resisted by local residents.

b. **Estimated Cost:**
- Elevated Reservoir = $1.65 Million.
- Pump Station = $750,000

c. **Engineering Cost:** $335,000

d. **Operating Cost:**
- Estimated Annual electricity expenses = $10,000
- Labor = No additional cost
- Annual maintenance costs = $30,000

e. **Property Cost:** $$350,000

Arbor Hills Supplemental Fire Flow Supply

f. **Schedule:** The estimated project timeline includes the following:
- Present the recommendation at a public meeting and to the Water Utility Board in September 2009
- Reservoir and pump station site selection and analysis by May 31, 2010
- Preliminary design complete by July 31, 2010
- Final Design by October 31, 2010
- Architectural review finalized by December 31, 2010
- Bid Award by April 1, 2011
- Construction in Summer/Fall 2011
- Fully operational January 1, 2012

g. **Recommendation:** Due to the visual impact on the neighborhood, the expected strong resistance to constructing an elevated reservoir in the Arbor Hills neighborhood, and the expected difficulty in procuring property for the reservoir, no further consideration will be given to this alternative.

4. Recommendation

A summary of the recommendation of the preferred alternative.

Based on the alternatives developed and the information gathered during Phase 2 of this project, it is recommended that the Utility proceed with the construction of an interzone booster pump station in the Arbor Hills area. This pump station will move water from Pressure Zone 6 to Pressure Zone 7. The pump station and the Cannonball 16-inch diameter transmission main will work together to meet the three objectives of the project. Fire flow capacity will be improved to meet Utility standards. Water supply redundancy will be provided to the Arbor Hills neighborhood in two ways, through the Cannonball transmission main and via the booster pump station. And finally, the booster pump station will allow excess supply capacity in Zone 6 to be pumped to Zone 7.

The recommendation to construct a booster pumping station in the Arbor Hills area will be presented to the Water Utility Board for consideration. With authorization from the Water Utility Board, the project will move into site selection and final design.

Madison Water Utility	Alternative Evaluation	Project Manager:	Al Larson, P.E. 608.266.4653 allarson@cityofmadison.com
		Project Information:	Arbor Hills Supplemental Fire Flow Supply Project / 1-0850-82
		1st Draft:	August 4, 2009
Alder Dist: 14 Alder: Tim Bruer	Section: Engineering	Refd by Water Board:	
		Approved:	

Arbor Hills Supplemental Fire Flow Supply

5. Attachments

Documents referenced in the Scoping Document.

List of Attachments

Project Service Area	Figure 1
Recommended Alternative	Figure 2

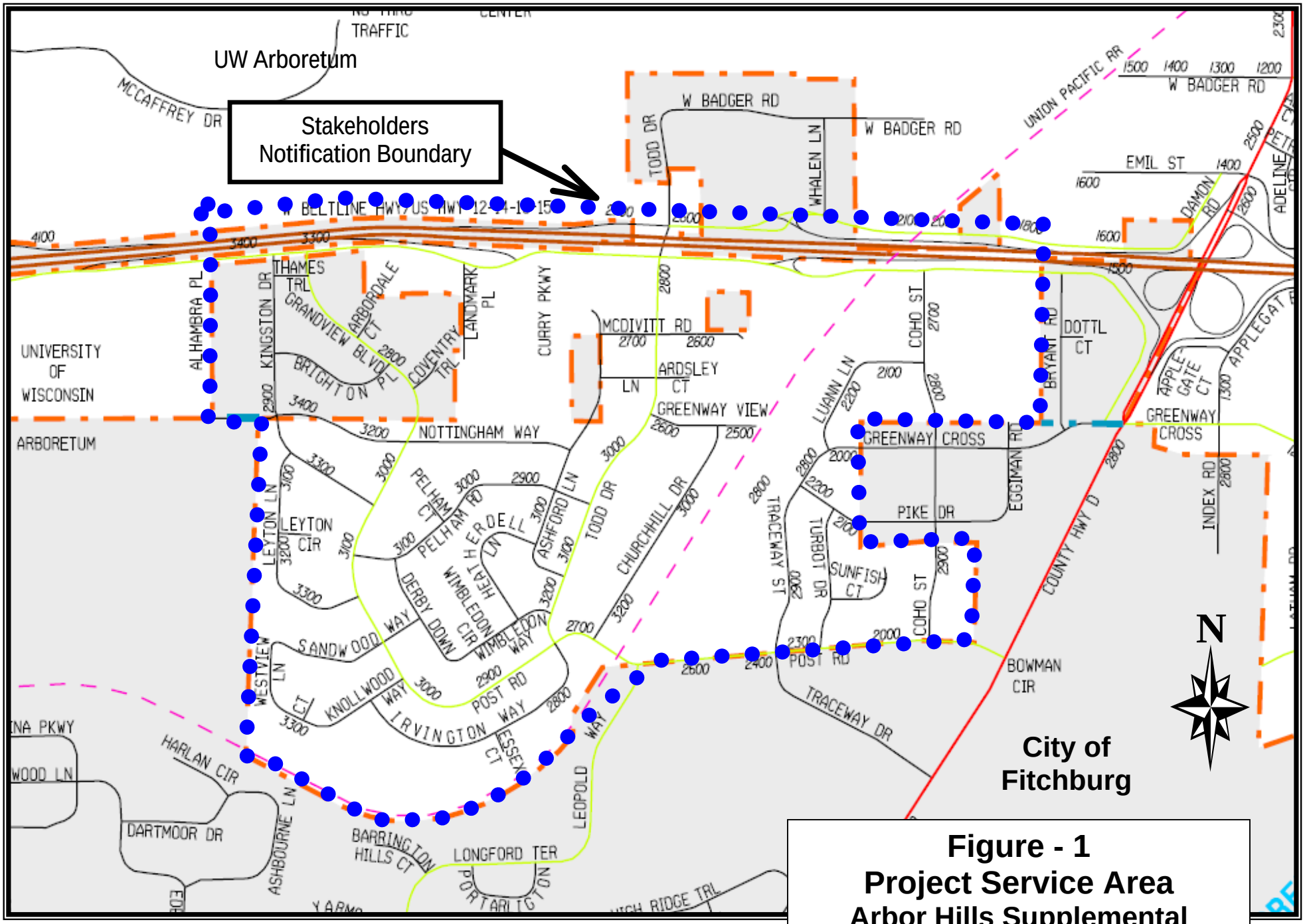

Figure - 1
Project Service Area
Arbor Hills Supplemental Fire Flow Supply Project
August 10, 2009

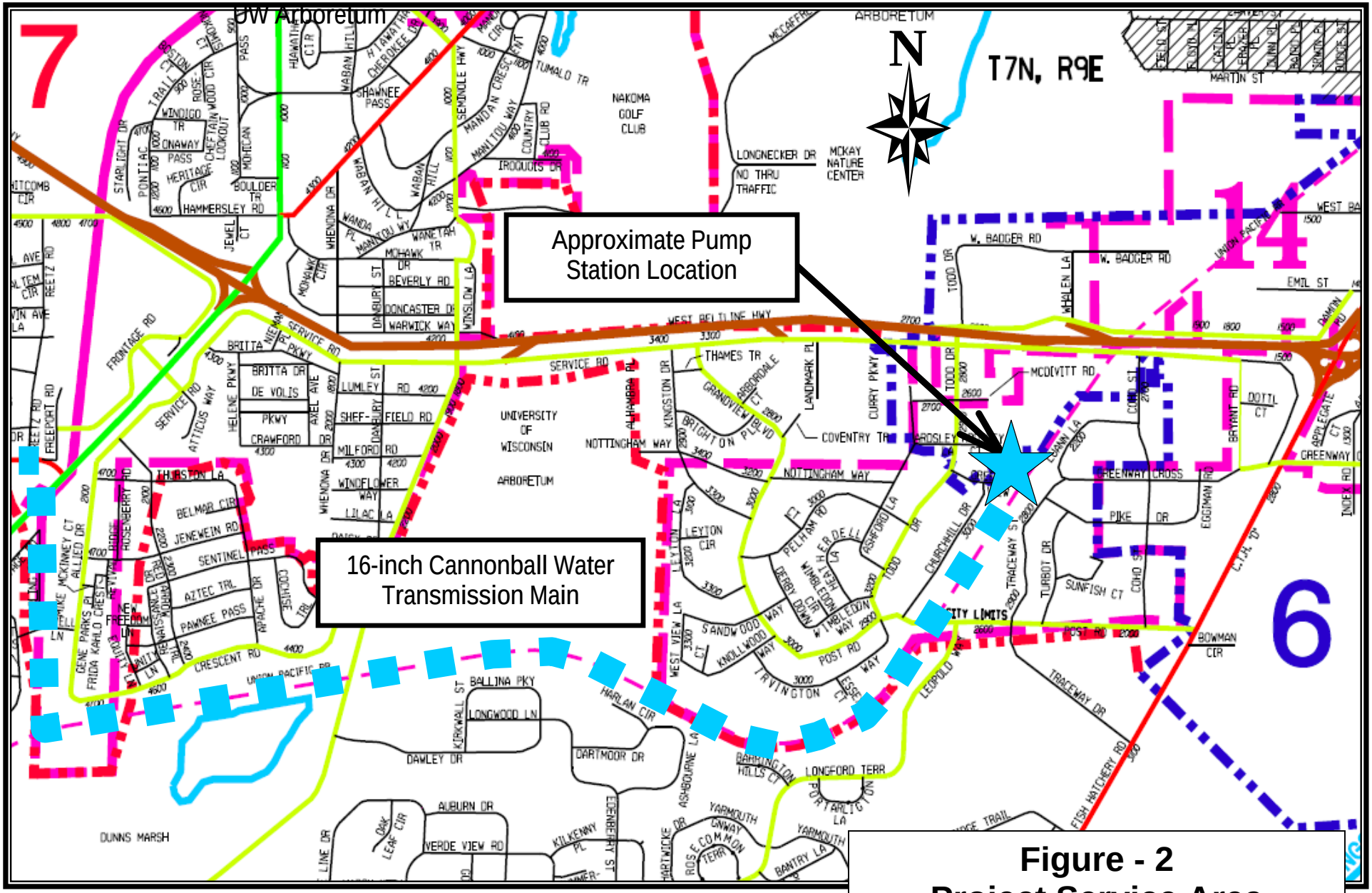

Figure - 2
Project Service Area
Arbor Hills Supplemental Fire Flow Supply Project
August 10, 2009