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Proposal for

Saint Paul Regional Water Services

System Assessment of the Centerville Water Supply Source

September 27, 2017

Submitted by:
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September 27, 2017

Matt Anfang
SPRWS Board President
City of Saint Paul
McCarrons Center
1900 Rice Street
St. Paul, MN 55113

RE: Saint Paul Regional Water Services System Assessment of the Centerville Water Supply Source

Dear Mr. Anfang:

We understand Saint Paul Regional Water Services is looking for a highly qualified consultant to provide a high-level condition assessment of the Centerville Water Supply Source. Bolton & Menk, Inc. has the experience and qualifications needed to inspect the infrastructure and create a useful and readable document to help you weigh the benefits, risks, and impacts of resuming use of this infrastructure and water source. We believe you will find outstanding value in our approach for the following reasons:

Experienced and Qualified Staff – Our project and task managers each have more than 20 years of relevant experience. This expertise in conjunction with our experience with water conveyance infrastructure, water treatment, water resources, and planning gives the Bolton & Menk team the resources necessary to effectively and efficiently complete this project.

Well-Defined Work Plan – Our staff understands which information will be valuable to you when making the decision to maintain or decommission this system. We have developed an efficient, well-defined work plan that includes coordination with your staff and provides the information you need in a timely and effective process. We have also proposed an innovative additional service that would allow a more comprehensive evaluation of the conduit system integrity. With more than 12,000 feet of conduit, the integrity of this system component will be a major factor in determining the risks and costs associated with keeping it in service.

Commitment – Bolton & Menk has a history of commitment to client satisfaction. We don't just do the work, we do it right. We are dedicated to partnering with Saint Paul Regional Water Services and earning your trust. We promise every client two things; we'll work hard for you and we'll do a good job.

In continued service to the City of Saint Paul and Saint Paul Regional Water Services, we are excited at the opportunity to complete the System Assessment of the Centerville Water Supply Source for you. I will personally serve as your project manager and lead client contact on this project. Please contact me at 612-772-4272 or ericle@bolton-menk.com if you have any questions regarding our proposal.

Respectfully submitted,

Eric Leagjeld, P.E.
Senior Project Manager



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Detailed Project Approach

Section 4



Detailed Project Approach

Client Service Philosophy

Bolton & Menk's philosophy for serving our clients' needs consists of many components. The first is our dedicated professional approach to working with each and every client as if we are an extension of their staff as well as a member of their team. We work closely with our clients to ensure all project goals are met, designed, constructed, and managed properly, resulting in a successful project for you.

Bolton & Menk understands that responsiveness to a client's needs, questions, project issues, and emergencies is of the utmost importance to the successful delivery of a project. As such, all of our professionals are dedicated to rapid response and availability. With our four offices located throughout the metropolitan area the Bolton & Menk team is a short distance away from Saint Paul Regional Water Services (SPRWS) offices and the project site.

Project Understanding

SPRWS is seeking a qualified consultant to evaluate the condition of the Centerville, Otter, and Deep Lake raw water conveyance infrastructure. In conjunction with the condition assessment work, the consultant will evaluate the social and economic factors related to the infrastructure and the water resource. The final report will provide guidance to allow SPRWS staff and the Board of Water Commissioners to decide whether the infrastructure should remain in service or be decommissioned.

Coordination

Prior to the field condition assessment work we will meet with SPRWS staff to review the project goals, evaluate existing data, and review the proposed project schedule.

As part of our data gathering, we request access to SPRWS and Rice Creek Watershed District (RCWD) files and reports to gather information related to the following

- Current and projected water demands
- Maintenance or operations records related to the Centerville Lake raw water system
- Water quality testing results
- Current and proposed projects involving water quality and quantity improvements
- Capacities of primary and secondary raw water sources

To continue coordination and collaboration with SPRWS staff during the report phase, we would propose three additional project review meetings to discuss each of the key phases:

- Meeting 1
 - Pipeline condition assessment and hydraulic and system capacity
 - Watershed capacity and impacts with future use as a raw water source; this meeting would also include the Rice Creek Watershed District
- Meeting 2
 - Considerations to make system operational
 - Considerations to decommission the system
 - Future uses of the ROW if system is decommissioned
- Meeting 3
 - Final report review

Project Schedule

To meet the proposed project schedule, it will be important to promptly schedule field condition assessment work. We have developed the attached project schedule assuming a notice to proceed is issued shortly after the next schedule SPRWS board meeting on October 10, 2017.

To facilitate our field work and provide access to key infrastructure, we would request the presence of SPRWS maintenance staff at the project site during late October and early November.

Our detailed proposed schedule is included on page 14.

There is no such thing as a one-size-fits-all solution. We recognize that every project and client are unique and we treat them that way.



Sinkhole along Centerville 54-inch concrete conduit alignment

Field Condition Assessment

Structure Field Condition Assessment

Our approach to the field work will begin by visually observing the key structures on the Centerville, Otter, and Deep Lake conveyance system. Our proposed staff is confined space trained and will attempt to enter the structures when they are deemed safe, following our confined space procedures. As part of our inspection, we propose to inspect the following structures:

- Centerville Lake intake structure
- Centerville Lake pumping station
- Centerville Lake conduit manholes MH18-31
- Junction Chamber structure
- Otter Lake headwall structure
- Otter Lake intake structure
- Otter Lake conduit manholes MH1-MH5
- Deep Lake headwall structure
- Deep Lake conduit manholes MH1-MH17

Any structures that cannot be entered, either due to safety or lack of access, will be identified and documented with the reason for an incomplete inspection. The manhole structures will be inspected in conjunction with the conduit inspection.

Pipeline Field Condition Assessment

It is our expectation the conduits will be filled or partially filled with water and entry will not be possible. In the event the conduit is found to be substantially dewatered and in suitable condition, we will enter the manholes to investigate the condition of the structure and the conduit that is visible from the manhole. All manholes will be treated as a permit required confined space and any entry will be performed using confined space entry procedures.

If the conduits are found to be filled with water and a more complete evaluation is deemed necessary by SPRWS, we would propose as an additional service, the use of the [ECA Group](http://www.ecagroup.com) (www.ecagroup.com) SPC 3000 pipeline inspection system. This system utilizes sonar and an optional TV camera to allow an inspection of water filled pipes in real time. The system will also allow for the determination of sediment volume deposited on the conduit invert.

Knowing the condition of the conduits may be a major factor in determining the cost and viability of using the system in the future. The majority of the concrete pipe was constructed between 1895 and 1912, well before the use of air-entrained concrete. Due to the age and conditions the pipe has been subjected to, it is possible the pipe has moderate to severe deterioration due to freeze-thaw damage, corrosion of the reinforcement, and scour of the concrete surfaces. Acknowledgment of known pipe failures in Addendum No. 2 by SPRWS is indicative that the pipe is likely deteriorating and may warrant a more comprehensive inspection process.

Photographs will be taken of the surface conditions at approximately 200-foot intervals along the conduit corridors for Centerville, Otter, and Deep Lake. Photographs will also be taken at all observed pipe breaks or similar deficiencies. The photo log will be uploaded to our GeoCP™ software and transmitted as a final deliverable with the final report. The GeoCP software is a portable web application that allows photos to be viewed as thumbnails in a catalog view or geospatially located on a map view. As an alternative, we would be happy to provide our project photographs in a GIS file for importing into your own GIS system.

The general condition of the manhole structures will be documented according to the NASSCO Manhole Assessment Certification Program (MACP). This allows consistent and efficient documentation of the conditions.

Resource Availability and Impacts

The water supply capacities of the Centerville water supply source are controlled by several interrelated factors:

- System infrastructure capacity
- Surface water hydrology and quality
- Regulatory appropriations and authorizations
- Social impacts due to using the raw water resource

Hydraulics and System Capacity Evaluation

The SPRWS is currently permitted by the Minnesota Department of Natural Resources to use 8,000 million gallons of water from the Centerville Lake System annually. The existing pumps located within the Centerville Lake pumping station have a combined rated capacity of 40 MGD, which theoretically have adequate capacity to supply St. Paul with its average daily water demand.

Based on our field work, we would propose to determine or verify the system capacity, considering the current conditions of intakes, pumps, and conduits. Capacity of the system could potentially be reduced by factors such as increased pipe roughness and reduced cross section due to sedimentation.

Watershed Capacity and Quality

To assist SPRWS with determining a path forward, we are proposing to analyze the Centerville Lake system and assess the surface water hydrology to determine the available water supply. The contributing watersheds will be delineated to Centerville Lake and Otter Lake. We will determine stage versus storage relations for Centerville, Peltier, and Otter Lakes and work with SPRWS to define the “useable storage volumes,” acknowledging that it is not likely either lake can be completely drawn down for water supply purposes since there are also competing uses for the available water (habitat, recreation, aesthetics, etc.).

Evaluating variations in streamflow and runoff volumes from year to year and seasonally are especially important in water supply studies, so we will present statistics to show mean annual values and variability. Our team will also determine the annual runoff volumes to each site. Streamflow gaging data from the USGS Gaging Station on Rice Creek and USGS regional regression equations¹ will be used to compute flow duration curves and standard low-flow frequency estimates at each appropriation site for annual and seasonal occurrences (e.g. 10-year 7-day low flows, 10-year 30-day low flows, etc.). This data will be used to estimate an average yield for each site.

¹ Ziegeweid, J., Lorenz, D. et al, Methods for estimating flow-duration curve and low-flow frequency statistics for ungaged locations on small streams in Minnesota, U.S. Geological Survey Scientific Investigations Report 2015-5170



Centerville 40 MGD pumping station

As an additional service, we would propose to conduct modeling to create an unsteady HEC-RAS hydraulic model of the lakes. An unsteady model simulates changing stages, volumes, and flows over time. We would review lake level records and select representative seasons or years of wet, dry, or normal conditions. The model will first be used to simulate the observed conditions within the study lakes, then modified to simulate conditions with hypothetical daily, seasonal, or annual withdrawals for water supply. Model results will show the impact of the various hypothetical withdrawal scenarios on lake water levels and discharges downstream. Lake level data will be mapped in an ArcMap GIS to show pool extents of the simulated minimum and maximum lake levels for each scenario.

Understanding the contribution of each watershed, the Mississippi River, and the well field to the overall water supply system is an important step in determining whether the Centerville system can be decommissioned.

Centerville and Peltier Lakes are eutrophic with average water quality values of 50 parts per billion (ppb) total phosphorus, 27 ppb chlorophyll-a, and 1-meter transparencies. Each have EPA listed impairments for nutrient/eutrophication biological indicators. Peltier and Otter Lakes have EPA listed impairments for mercury in fish tissue. Otter Lake has better water quality with average transparencies of 2 meters.

The Rice Creek Watershed District is also exploring options to lower the phosphorous levels in the Centerville and Peltier Lake basins, which could potentially increase the desirability of this raw water source by SPRWS. As part of our evaluation, we propose to review the work underway by RCWD and discuss the potential benefits this may have for SPRWS. As part of our evaluation, we

will assemble existing monitoring data, modeling reports, and other water quality data for Centerville, Peltier, and Otter Lakes. The available data will be evaluated and the findings summarized. Based on the available data, we will characterize the water quality from each source as a potential water supply for the SPRWS and describe the treatment efforts and costs needed to process water from these sources for distribution within the SPRWS.

Regulatory Appropriations and Authorizations

The SPRWS is currently permitted by the MNDNR to use 8,000 million gallons of water from the Centerville Lake System annually. Copies of the existing appropriation permits for each source will be obtained from the SPRWS or the MNDNR. The authorized appropriation volumes will be outlined and associated permit requirements and restrictions will be described in the final report.

Available records of daily, seasonal, and annual appropriations from the Centerville Lake and Otter Lake sites will be collected from the SPRWS. The recorded appropriations will be tabulated and compared to the surface water hydrology estimates, the infrastructure capacity, and the permitted appropriation volumes as a reality check between what the system has actually yielded and its theoretical capacity and regulatory authorizations.

Social Impacts of Future Use as a Raw Water Source

One of the key and most influential social impacts of SPRWS using raw water from the Centerville system will be the lowering of water levels on Centerville, Peltier, and other lakes hydraulically connected within the watershed. As part of our optional hydraulic modeling we will develop preliminary lake level contour maps based on an average daily pumping rate for a wet, dry, and average precipitation year.



Centerville raw water intake

Lowering lake levels may also contribute to other social concerns. As part of this work, we propose to identify other potential concerns, including

- Potential expanded plant growth both at the perimeter and interior of the lake; the lake is currently infested with Eurasian watermilfoil
- Reduced recreational use of Centerville and surrounding lakes by boaters due to lower lake levels and increased congestion
- Reduced recreational use of Centerville Lake for fishing due to decreases in access, fish habitat, and populations
- Reduced real estate values for lake front properties

Considerations to Keep System Operational

Upon completion of the field condition assessment work, our team can begin the process of developing the list of necessary repairs to return the system to operation. During this phase, coordination and input will be needed from SPRWS staff to determine what is deemed necessary, from an operational and maintenance standpoint, to use this raw water source. Input will be required on numerous infrastructure requirements, including but not limited to

- Acceptable leakage rates through conduits
- Required reliability of system to provide raw water
- Control and monitoring system requirements
- Integrity, capacity, and backup systems for pumping station electrical system
- Electrical operating cost of pumps
- Ability to operate intakes, valves, gates, and meters

Once the infrastructure requirements are established, budgetary costs can be developed for the repairs necessary to make the system operational again. To develop sound budgetary cost estimates, we plan to use multiple resources including bid tabulations from similar projects, budgetary costs from equipment and material suppliers, and budgetary cost data from qualified contractors.

Another key factor to consider is the potential costs necessary to improve the conveyance system condition from operational to functional and efficient on a long-term basis. To determine these costs, an expected design life should be established by SPRWS to guide the process.

To determine a level of safety and reliability in the existing conveyance system, the system should be evaluated in accordance with the applicable AWWA standards. As part of our scope, we would evaluate the different segments

of concrete conduit in accordance with latest edition of AWWA Manual M9 – Concrete Pressure Pipe.

Considerations to Decommission System

To assist SPRWS in determining whether the Centerville raw water supply system should remain operational or not, our team will develop a list of recommended steps to decommission the system and develop budgetary pricing and schedules for those steps.

The decommissioning process will require careful consideration and answers to questions on multiple fronts:

- Is the system of historical significance and will a documentation program be required to meet State Historic Preservation Office requirements?
- What segments of the infrastructure will require complete demolition and removal to allow future development?
- What segments of the infrastructure should be abandoned in place to minimize environmental or social impacts?

Future Land Use of Conduit ROW

In the event SPRWS deems the Centerville raw water conveyance system is no longer economically or socially sustainable, SPRWS will need to be prepared to discuss disposal of the nominal 50-foot wide strip of property that straddles the conduit alignment. The SPRWS property currently crosses four municipalities, two counties, two watershed districts, and a MnDOT right-of way. Our staff of planners is prepared to solicit input from these project stakeholders and develop and recommend a range of beneficial uses.

As the area surrounding the conduit continues to develop, the property could serve multiple uses, including

- Developable commercial and residential property
- Public park and trail space
- Utility corridor

Final Report

To summarize our findings we propose to develop and submit a final report outlining the information requested by the Request for Proposal. This information will be presented in a clear and concise format that will be a useful tool to SPRWS staff and the Board of Water Commissioners in making their decision on the future of the Centerville raw water supply source.



Project Schedule

Section 5



Project Schedule

We have developed a proposed schedule highlighting the anticipated work tasks, timeline, and final completion dates. This schedule is based on our review of the project background, description, and scope of services included in the Request for Proposals and our experience on other similar projects. Upon selection, Bolton & Menk will work with SPRWS staff to revise and update this schedule as needed to ensure successful delivery of this project.

Saint Paul Regional Water Services System Assessment of the Centerville Water Supply Source

Month Week of	2017												2018																									
	September				October				November				December				January				February				March				April									
	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11	18	25	1	8	15	22	29	5	12	19	26	5	12	19	26	2	9	16	23	30			
1.0 Coordination																																						
1.1	SPRWS Board of Commissioners Meeting (October 10, 2017)																																					
1.2	Notice of Award/Notice to Proceed																																					
1.3	Project Kickoff Meeting																																					
1.4	Project Administration																																					
2.0 Field Condition Assessment																																						
2.1	Structure Field Condition Assessment																																					
2.2	Pipeline Field Condition Assessment																																					
2.3	Photo Log and Field Report Preparation																																					
3.0 Resource Availability and Impacts																																						
3.1	Project Coordination Meeting 1																																					
3.2	Hydraulics and System Capacity Evaluation																																					
3.3	Watershed Capacity and Quality																																					
3.4	Regulatory Appropriations and Authorizations																																					
3.5	Social Impacts of Future use as a Raw Water Supply																																					
4.0 Considerations to Keep System Operational																																						
4.1	Project Coordination Meeting 2																																					
4.2	Develop Summary of Required Repairs																																					
4.3	Develop Preliminary Repairs Budget																																					
4.4	Develop Preliminary Repairs Schedule																																					
4.5	Evaluate Conduit Factor of Safety																																					
5.0 Considerations to Decommission System																																						
5.1	Project Coordination Meeting 2																																					
5.2	Evaluate Historical Documentation Requirements																																					
5.3	Evaluate Conduit Segments for Removal or Abandonment in Place																																					
5.4	Develop Preliminary Decommissioning Budget																																					
5.5	Develop Preliminary Decommissioning Schedule																																					
6.0 Future Land Use of Conduit ROW																																						
6.1	Project Coordination Meeting 2																																					
6.2	Review Potential Land Uses with Stakeholders																																					
7.0 Final Report																																						
7.1	Prepare Draft Final Report																																					
7.2	Project Coordination Meeting 3 - Review Draft Final Report																																					
7.3	Prepare and Submit Final Report																																					