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BARR

April 12, 2013

Mr. Stefan Higgins
Assistant City Engineer
City of Blaine
10801 Town Square Drive NE
Blaine, MN 55449

Re: Northeast Well Field Study Proposal

Dear Mr. Higgins:

This letter is intended to serve as a proposal and definition of scope of engineering services that Barr Engineering Co. (Barr) will provide for the City of Blaine (City). The services to be provided are generally described as a multi-phased engineering study designed to reduce risk and uncertainty as it relates to the proposed Northeast Well Field which is located near the intersection of Lexington Avenue and 125th Avenue. The tasks in this proposal were recommended in a preliminary study of the proposed well field which indicated the need for additional work to ensure that the Minnesota Department of Natural Resources (DNR) will allow the City to fully utilize any wells drilled at this location. Wells would be completed in either the Quaternary glacial drift aquifer or the Tunnel City-Wonewoc (TCW) aquifer (formerly known as the Franconia-Ironton-Galesville or FIG aquifer). The tasks are focused on estimating the impact that wells constructed at this location might have on nearby wetlands and surface water bodies of concern. The services proposed generally fall into three distinct phases each intended to provide a stopping point for the City to reconsider direction should results be unfavorable. The phases include:

1. A detailed paper study including a review of publicly available hydrogeologic data followed by more detailed groundwater modeling than was performed in previous work
2. An aquifer test using the City's existing wells observed from new monitoring wells installed by others at strategic locations as part of this phase.
3. A site specific aquifer test of a new pumping well installed by others in the Northeast well field, to further verify the potential impact on the features of concern.

The work described in this document will be performed under the master contract agreement between the City and Barr should you elect to hire us for this work. This letter would then serve as a subagreement between Barr and the City. This letter includes the following sections:

- Project Understanding
- Project Team
- Assistance Provided by the City of Blaine

- Scope of Services
- Cost
- Project Schedule

Project Understanding

Based on the results of the preliminary evaluation of the proposed Northeast Well Field completed by Barr Engineering, the City would like to further evaluate the feasibility of developing a new well field in the northeastern portion of the City in the vicinity of the intersection of Lexington Avenue NE and 125th Avenue (see Figure 1). As indicated on Figure 1, the DNR has identified scientific and natural areas and wetlands of concern in the vicinity of the proposed Northeast Well Field area that may be adversely impacted by operation of municipal water supply wells at this location. In addition to these wetlands, there are several surface water bodies nearby that may also be adversely affected by the wells. Given the recent concern generated by dropping lake levels in White Bear Lake these are also a focus of this phased study.

The study that led to this proposal identified risks and uncertainties related to installing municipal water supply wells in the Northeast well field. The main risk is that if the City were to proceed with installing the wells without additional study, the DNR may restrict their use to a low flow rate making them a poor long term investment. There are also two main uncertainties driving this work, they are:

1. The spatial continuity of a clay layer in the region that may protect wetlands of concern and surface water features from the effects of pumping in the aquifers that lie beneath the proposed Northeast Well Field site.
2. The presence and areal extent of the Quaternary sand aquifer beneath the proposed Northeast Well field site.

To address the risk and uncertainties, we have laid out a phased study presented in this proposal intended to further evaluate the feasibility of constructing a municipal water supply well field in the selected area. It is our understanding that there are four main goals of the phased study. They are:

1. Evaluate the continuity of the clay layer in the vicinity of the proposed well field to see if it will protect nearby wetland areas and water bodies of concern from water table drawdown induced by pumping in the Northeast Well Field.
2. Better characterize the presence and continuity of the Quaternary sand unit beneath the proposed well field site.
3. Provide data to the DNR so that they will be able to make a determination regarding the rate of pumping they will allow for new wells constructed in the Northeast Well Field.
4. Better characterize the impacts of the proposed well field on nearby existing wells.

It is our understanding that the TCW bedrock as well as the overlying unconsolidated Quaternary sediments are the target aquifers for this evaluation. This study will proceed in a phased manner to allow the City "off ramps" at various stages if accumulated information indicates that the proposed location is either not suitable for a municipal well field capable of meeting the City's identified needs or may result in severely restricted well flow rates by the DNR. The study will be mindful of safe yield requirements listed in the State Rules. The proposed project phases are as follows:

- Phase 1: Detailed Paper Study
- Phase 2: Aquifer Test with Existing Wells
- Phase 3: Site-Specific Aquifer Test

The scope of services listed below is based on the following assumptions. This is not a complete listing of all assumptions just those most critical to the work and the cost estimate.

- Phase 1 work will be based on existing data only.
- Coordination with the City will be necessary during the planning and implementation of all aquifer tests but especially the one in Phase 2 that utilizes only existing City wells. The City may need to make alterations to the way it normally supplies water in order to facilitate long term continued pumping from wells that may not normally be heavily used.
- The City will contract directly with drillers for the installation of new monitoring wells and, if the work proceeds to Phase 3, a new large diameter test well in the Northeast Well Field.

Project Team

Barr proposes to utilize staff who have been involved in the planning, design, and construction of numerous municipal wells and well fields. Staff dedicated to this project will also include those who worked on the preliminary evaluation of the proposed Northeast Well Field. Key staff that will be dedicated to this project include:

- Brian LeMon, PE: Principal-in-charge and primary project contact
- John Greer, PG: Project manager and lead hydrogeologist/groundwater modeler.

Brian and John will work with and direct our experienced staff of hydrogeologists/groundwater modelers and well design engineers to complete this project.

Assistance Provided by the City

This proposal is based on the assumption that the City will provide the needed information requested by Barr to perform the tasks required to meet the stated goals. Once the project is initiated, and following

the project kickoff meeting, a full list of data needed will be sent to the City along with a further clarification of scope, if warranted. At this time we expect that the following data/tasks will be provided:

1. Water demand for the City in 2012.
2. Water pumped by each City well each month in 2012.
3. Any changes to future water demand projections (average day, maximum day, ultimate build out average day, and ultimate build out maximum day) made since the City provided future water demand projections to Barr in March of 2012.
4. Information on any planned changes to the sequencing of existing City wells that would affect the annual percentage of volume pumped from any of the existing City wells.
5. Assistance obtaining data from any existing monitoring well networks already in place such as those in Pioneer Park or any that may be present in any of the scientific and natural areas or wetlands of concern in the vicinity of the proposed Northeast Well Field.
6. Assistance planning the aquifer test in Phase 2 that may result in significant changes to the way you currently deliver water to your citizens.
7. The City will obtain all easements and access agreements associated with any monitoring wells installed on properties not owned by the City.
8. Assistance recording static and pumping water levels in City wells prior to, during and after any aquifer tests. Monitoring shall be frequent in nature and carried out by automated means and validated with manual readings on occasion.

Scope of Services

The scope of services is described below.

Phase 1 – Detailed Paper Study

Task 1-1: Kick-Off Meeting

The purpose of this task will be to meet with you to and make sure that we agree on the objectives and direction of this study so that we can deliver to you what you need with respect to planning for the Northeast Well Field. John Greer and Brian LeMon will meet with you at your offices and go over the project plan and respond to any questions. If the meeting results in any changes we will modify the project scope, schedule and budget accordingly. In preparation for the meeting we will develop a list of data we need the City to help obtain.

Deliverable: Meeting agenda, minutes, modification to project scope, schedule and budget as appropriate and only if needed.

Task Cost: $1,700

Task 1-2 Hydrogeologic Data Collection/Evaluation

Barr will acquire and review existing hydrogeologic information for the Blaine area to identify additional data regarding Quaternary geology and the hydraulic connection between the upper and lower portions of the Quaternary glacial drift aquifer and between the TCW aquifer and the overlying Quaternary glacial drift. Using the data, Barr will update the groundwater model for the area with additional detail, recalibrate the model, and then use the updated model to better estimate potential impacts to surface water bodies and wetlands from pumping in the proposed Northeast Well Field. This is a relatively low cost initial step to gain more understanding of the Quaternary geology of the area and ensure that it is adequately represented in the model being used to analyze the well field.

The updated groundwater model will be used to perform a series of model runs for evaluating the proposed well field site. Model runs will include:

Baseline: A steady state model run using only existing wells will be run to establish baseline conditions to which the results of subsequent model runs will be compared. The baseline condition run will include annual average water demand for the City over the last 5 years distributed among existing wells according to data provided by the City so that the modeled well pumping reasonably approximates actual conditions.

Evaluate Average Impact of Pumping in the Northeast Well Field: We will then run up to four steady state scenarios: two of the scenarios will include two new wells pumping in the Northeast Well Field and two will include a fully developed 6,000 gpm well field. Pumping rates for the Northeast well field wells and existing City water supply wells will be determined based on projected use information provided by the City. In the first two scenarios, the new wells will pump from the TCW aquifer. If the results of the hydrogeologic data review indicate that Quaternary sand and gravel aquifer(s) at the site can likely support municipal well pumping we will run an additional set of two scenarios in which the new wells pump from the Quaternary sand and gravel aquifer. Results of these scenarios will be compared with the baseline run to evaluate what effect, if any, pumping from wells in the Northeast Well Field is likely to have on wetlands of concern in the area.

Evaluate Peak Day Production: We will then run a set of scenarios that with the same well configurations identified in the steady state runs but instead use them to meet projected peak day demands for a continuous period of four weeks. These runs will be performed in transient mode so that we can see the progression of drawdown and identify when it may become a problem for either surface water features or nearby wells. This will theoretically predict the worst case drawdown that might occur in the future with the wells. If not all wells are needed to meet the projected peak water demand it will be distributed in such a way to load the Northeast well field wells first so as to create a worst case scenario for the new wells.

Each of the runs will be compared to the Baseline run. Modeling results will be presented as impacts to groundwater shown as drawdown relative to the Baseline case. Maps showing the impacts will include surface water bodies and wetlands of concern so that general implications of impacts to surface water bodies and wetlands due to pumping in the proposed well field can be discussed.

Barr will summarize the results of the work performed in a report. The report will also include a recommendation regarding whether the project should proceed to Phase 2. A DRAFT report will be submitted to the City first followed by a final report that will address City comments on the draft report. If the work completed in Phase 1 does not identify any fatal flaws then the project will proceed to Phase 2. The modeling will be used to plan the Phase 2 aquifer test and siting of any new monitoring wells that may be needed for use in observing the test.

Deliverables: A report summarizing the data compiled during Phase 1 along with a discussion of the modifications made to the groundwater flow model. The report will include updated geologic cross sections cut through various parts of Blaine to better show the DNR and others the basis of the conceptual hydrogeologic model and appendices with the raw data used in updating the model and cross sections if appropriate. The report will also include a series of maps showing the impacts of pumping in the proposed Northeast Well Field on groundwater levels as compared to baseline water levels will be provided to the City as part of the report summarizing the findings of the Phase 1 work. The report will include a table identifying wells that are likely to be interfered with as a result of the new wells installed in the Northeast Well Field. Finally, the report will include preliminary information related to the aquifer test planned for Phase 2.

Task Cost: $28,300

Phase 2: Aquifer Test with Existing Wells

Task 2-1 Meet with DNR

Brian LeMon and John Greer will meet with the DNR to present the results of the Phase 1 work and identify their expectations regarding a pumping test using existing City water supply wells. Barr will provide a summary of the meeting discussion to the City.

Deliverable: Meeting agenda and minutes.

Task Cost: $1,700

Task 2-2 Aquifer Test Work Plan Preparation

Based on the results of the Phase 1 work and the results of the meeting with the DNR, Barr will prepare a work plan for conducting an aquifer test utilizing existing City water supply wells and

accessible existing monitoring wells, if any are available, in the vicinity of surface water/wetlands of concern and the proposed Northeast Well Field. The results of the Phase 1 work and the locations and construction of any accessible existing monitoring wells will be used to determine if additional monitoring wells/well nests are needed in order to obtain sufficient information on the hydrogeologic system in the vicinity of the proposed Northeast Well Field and near the surface features of concern. Barr will work with you during the preparation of the work plan to ensure that the existing wells most likely to stress the aquifer near the features of concern are used during the test.

We have assumed that at least two new monitoring well nests will be needed for the aquifer test. Barr will design the wells and prepare technical specifications to be used in obtaining quotes for their construction. We anticipate that new monitoring well locations will include the proposed Northeast Well Field as well as a location near valued environmental features previously identified by the DNR and surface water features for which the City may wish to evaluate the effect of pumping. Locations for new monitoring wells installed in the proposed Northeast Well Field for the aquifer test will be strategically sited to not only provide data from the aquifer test but also help to better characterize Quaternary geology in the proposed Northeast Well Field. We have assumed that the City will contract directly with a driller for the well installation and that Barr will provide contracting assistance as necessary.

Deliverable: An aquifer test plan to be submitted to the DNR. Technical specifications/bidding documents for the monitoring well nests.

Task Cost: $7,400

Task 2-3 Well Installation and Aquifer Testing

Barr will provide field oversight for installation of new monitoring wells. A Barr geologist or hydrogeologist will inspect and log drilling cuttings so that an accurate description of the stratigraphic column can be prepared for each drilling location. If necessary, monitoring well intake intervals will be modified from the intervals identified in the well design specifications based on the geologic materials encountered during drilling.

An aquifer test will be conducted following installation and development of the new monitoring wells. The test will include a pre-test monitoring period, a pumping period of duration to be determined based on discussions with City staff and the DNR, and a post-pumping monitoring period. Water levels will be monitored during all phases of the test. In monitoring wells, LevelTroll transducers/dataloggers manufactured by In-Situ, Inc. will be used to monitor water levels. In City pumping wells, the City's SCADA system will be used to monitor and record water levels at a frequency sufficient to meet the needs of the test.

Deliverable: Technical memorandum summarizing well installation, aquifer test data, and analysis of the aquifer test data. .

Task Cost: $19,600

Task 2-4 Model Refinement, Scenarios, & Report

Data gathered during the drilling of new monitoring wells and during the aquifer test will be used to further refine the groundwater model of the Northeast Well Field area. The more refined groundwater model will be used to rerun the scenarios identified above under Phase 1.

Prior to preparing a detailed report we will meet with the City and then with the DNR to present the results of the pumping test and the groundwater model. The purpose of the meeting will be to ensure that there is agreement on interpretation of the test and modeling results. Input from the DNR will be obtained and included in the final report for this phase of work.

If the work in Phase 2 work does not identify any fatal flaws then the project will proceed to Phase 3.

Barr will summarize the results of the work performed in a report. The report will also include a recommendation regarding whether the project should proceed to Phase 3. A DRAFT report will be submitted to the City first followed by a final report that will address City comments on the draft report.

Deliverables: A report similar to the one prepared for Phase 1 summarizing the results of the Phase 2 work but updated with the refined results based on the aquifer test. The updated report will include new drawdown figures and a new well interference table.

Task Cost: $19,500

Phase 3: Site-Specific Aquifer Test

Task 3-1 Meet with DNR

Brian LeMon and John Greer will meet with the DNR to present the results of the Phase 2 work and identify their expectations regarding a pumping test conducted in the Northeast Well Field. Barr will provide a summary of the meeting discussion to the City.

Deliverable: Meeting agenda and minutes.

Task Cost: $1,700

Task 3-2 Pilot Borings & Aquifer Test Work Plan Preparation

An aquifer test will be conducted utilizing a test well constructed in the proposed Northeast Well Field. The objective of the aquifer test will be to evaluate impacts to environmental features of interest and determine well capacity. Prior to the test, several pilot holes will be drilled into the bedrock around the Northeast Well Field. The number of pilot holes drilled will depend on the data gaps identified during Phases 1 and 2. A Barr geologist or hydrogeologist will inspect and log drilling cuttings so that an accurate description of the stratigraphic column can be prepared for each drilling location. Data collected from the drilling will be used to complete characterization of the proposed Northeast Well Field site and select an aquifer for a new City pumping well, Well 18.

Barr will then prepare a work plan for the aquifer test in the proposed Northeast Well Field. The work plan will include the design of the proposed pumping well and any additional monitoring well locations(if needed), contract documents for the construction of the test well, identification of any other existing wells that will be monitored during the test, the procedures to be followed during the test, and test data analysis procedures. Barr will look for input from City staff during the preparation of the work plan.

Deliverable: Technical memorandum summarizing drilling results. Aquifer test work plan to be submitted to the DNR and the City. Technical specifications/bidding documents for the test well (Well 18) and any additional monitoring wells needed.

Task Cost: $23,100

Task 3-3 Well Installation and Aquifer Testing

Upon acceptance of the aquifer test work plan by the DNR and the City, a new test well, Well 18, will be installed by others in the well field along with any additional monitoring wells called for in the work plan. We have assumed that the City will contract directly with a driller for the well installation and that Barr will provide contracting assistance as necessary. Note that the test well will only include the main well casings and screens (if needed). It will not include the final pump and motor, pitless adaptor or well house, and any piping. It is intended to serve only as a test well at this phase. A subsequent bid package not included in this scope of work will be needed to obtain a contractor to install the remainder of the well infrastructure should the well be viable and accepted by the DNR.

Barr will provide field oversight for installation of the new well(s). During installation of the well(s), a Barr geologist or hydrogeologist will be onsite to observe the drilling and inspect and log drilling cuttings so that an accurate description of the stratigraphic column can be prepared for each drilling location. If necessary, well intake intervals will be modified from the intervals identified in the well design specifications based on the geologic materials encountered during drilling.

The aquifer test will be conducted following installation and development of the new well(s). The test will include a pre-test monitoring period, a pumping period of a duration to be determined based on discussions with City staff and the DNR, and a post-pumping monitoring period. Water levels will be monitored during all phases of the test. In monitoring wells and Well 18, LevelTroll transducers/dataloggers manufactured by In-Situ, Inc. will be used to monitor water levels.

Deliverable: Technical memorandum summarizing well installation, aquifer test data, and analysis of the aquifer test data.

Task Cost: $23,400

Task 3-4 Data Analysis & Report

Data gathered during the aquifer test will be analyzed and the results will be compared to a simulation of the aquifer test using the refined groundwater model. If the test and model results do not agree the test results will be used to further refine the groundwater model. If further model refinement is done then the modeling scenarios defined in Phase 1 above will be rerun with the most refined version of the groundwater model. Our cost estimate assumes that additional refinement of the groundwater model will not be necessary.

Prior to preparing a detailed report we will meet with the DNR again to present the results of the pumping test and the groundwater model. The purpose of the meeting will be to ensure that there is agreement on interpretation of the test and modeling results. Input from the DNR will be obtained and included in the final report for this phase of work.

Barr will summarize the results of the work performed in a report. A DRAFT report will be submitted to the City first followed by a final report that will address City comments on the draft report. The report will include a final recommended configuration for the Northeast Well Field so that additional wells can be designed and drilled according to a schedule determined by the City in response to increasing water demand.

Deliverables: A report summarizing the results of the Phase 3 aquifer test.

Task Cost: $13,600

Cost

The tasks listed in this subagreement will be performed for the lump sum costs identified for each task above. Bills will be sent monthly based on the percentage of the work complete at the time. The total for the project will not to exceed $140,000 without prior approval from the City. Bills will be sent once every 4 weeks according to Barr's billing schedule.

Project Schedule

The intention of this project is to have the work under Phase 1 completed within 12 weeks of notice to proceed. The schedule for Phases 2 and 3 will depend upon several factors including discussions with the DNR, the number and depth of wells to be installed, and flexibility of the City's pumping schedule.

If the terms of this subagreement are acceptable to the City of Blaine, please date and sign in the space provided below. Keep one copy for your records and return the other to Barr Engineering Co. If you have any comments or questions, please contact me at 952-832-2774.

Sincerely yours,

BARR ENGINEERING COMPANY

By 

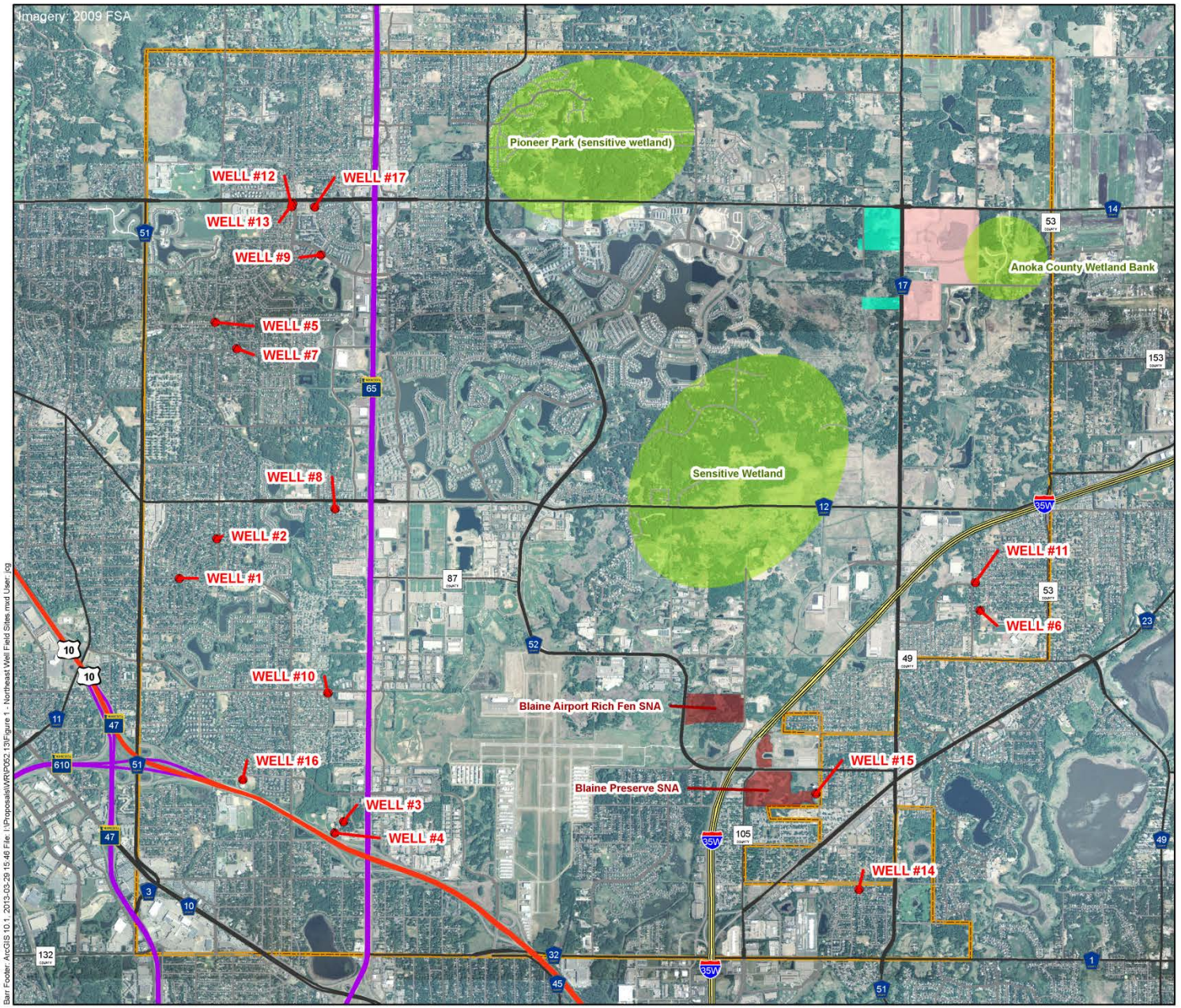
Brian K. LeMon
Its Vice President

Accepted this ___ day of _____, 2013

CITY OF BLAINE

By_____

Its_____



Blaine Municipal Well
Scientific and Natural Area (SNA)
MnDNR-identified Wetland of Concern
Preferred Well Field Site
Alternate Well Field Site
Blaine City Limits

Miles
1 0 1

Kilometers
1 0 1

BARR

Figure 1

NORTHEAST WELL FIELD LOCATIONS
NE Well Field Siting Proposal
City of Blaine
Anoka County, MN