Building a Better World
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March 26, 2024

RE: Munster, Indiana
Proposal for Water Distribution Model
SEH No. MUNST 177970

David Nellans
Town Council President
Town of Munster
1005 Ridge Road
Munster, IN 46321

Dear Mr. Nellans,

The Town wishes to engage SEH of Indiana, LLC (SEH) to construct an updated GIS based water model and provide guidance through the calibration process. This effort is critical to the assurance that the Town's hydraulic model is producing reliable and realistic simulation results. By initiating this process to construct and calibrate a model of the water system, the Town will be taking an important first step in understanding the system's strengths and weaknesses. A water system model is a vital component that will help the Town plan and program for the community's future health, growth and prosperity. Short Elliott Hendrickson Inc. (SEH®) is here to provide expertise in the development of the model. Through our hands-on and collaborative approach, we will develop a model that will empower the Town staff and instill confidence when making water system planning, operation, and design decisions.

PROJECT DESCRIPTION AND SEH SCOPE OF SERVICES

This section describes SEH's proposed approach for the basic services required for the Town of Munster's hydraulic model. This proposal is limited to the creation of a hydraulic model for Munster's water supply, distribution and storage system.

A new computer model of the water distribution system will be developed using Bentley WaterGEMS (WaterCAD v8i). SEH maintains software licensing for all industry leading water system modeling software (InfoWater, WaterCAD, WaterGEMS) and is available to transition between software platforms if needed. However, we intend on utilizing the WaterGEMS software due to the power processing capabilities. SEH will work with existing Utility GIS data to import and update water infrastructure information into the proposed water system model. The model will be constructed on the same coordinate system as existing GIS data allowing for seamless export of model result data in GIS format as needed. This will also allow for simple updates in the future as system components are added or replaced.

TASK 1 – PROJECT MANAGEMENT

The primary goals of Task 1 are to clearly define your requirements and expectations in terms of deliverables, project schedule and budget, and to manage the project to meet these requirements. Communication is a key to this process, and an important tool to facilitate this communication is the project Work Plan.

Project Work Plan: A formal Work Plan will be prepared during project initiation. In order to develop the Work Plan, key team members will complete an initial review of available information obtained from the Town; and a meeting will be held with Utility staff to review and refine project issues, objectives and requirements. From this discussion, an approach will be finalized, including the required deliverables and milestones. An approach that focuses on specific deliverables helps you understand what to expect and helps you to monitor the project progress. The Work Plan will also clearly define individual team member responsibilities, including utility staff who may be heavily involved in the project.

Communication: Utility planning projects require input from many sources, and experience has shown that communication on a comprehensive study of this nature is critical to develop well thought out and coordinated planning recommendations. SEH will communicate with and solicit input from key representatives of the Utility during the entirety of the project.

Progress Reporting: A preliminary project schedule is included at the end of this scope. It will allow a baseline for the project team members to review and report on interim findings and the progress of the study. During these meetings, the scope and direction of project tasks will also be evaluated to assure the project remains focused. The SEH project manager will monitor the progress of the project on a weekly basis, including the completion of project tasks, schedule compliance and budget compliance. Monthly written progress reports will be provided to the Town summarizing the status of the project and planned activities.

TASK 2 – HYDRAULIC MODEL DEVELOPMENT

The model will be created using the most current GIS information. This will allow the model to reflect the water system GIS in a 1:1 manner, so that all digital assets are represented in the model and corelate directly with the GIS data. This step will be foundational to the overall success of the project and future usefulness of the model. This effort will rectify the model to develop a digital twin of the water system.

We will utilize Bentley WaterGEMS for all hydraulic modeling. We will incorporate all data previously developed in the earlier tasks to be included in the water model. The model will be done in a manner that is consistent with AWWA Manual M32. Furthermore, the model will be set up in such a way that it is integrated with the Town’s GIS database.

The newest data available, such as the integration of diurnal demand curves will be incorporated into the model. Furthermore, these composite curves will be developed for categorized customer groups in addition to specific large users with unique water use profiles.

An important step in creating the model will be the proper assignment of current customer demands to the proper pipe junction nodes. We will import demand information spatially from the billing software data in most any file format into the water model. Implementation of geo-located demand data will allow for the model to be used in a way that more closely matches current system operations. More specifically, individual meter reference nodes will be incorporated for each water customer. This will allow for more precise management of system demands within the model.

Finally, a planned QA/QC review will be incorporated into the model development. In conjunction with the model creation, we will provide check-in documents for review by Utility staff to assure that the model completely reflects the real world water system. An additional review effort will include a review of the “future” water system components that have been identified in reviewing comprehensive planning efforts.

<u>Summary of Tasks:</u>

1. Data Collection related to water system features, GIS Data, as-built, etc.

2. Water Model with Current GIS data: 1:1 import into the model, migrate existing C factor pipe data.
3. Integrate model with all available valve data for future resiliency planning.
4. Link current billing data and meter consumption to spatial references of accounts, and transfer meter data to demand nodes in the model (demand distribution).
5. Transfer ground elevations from the latest digital terrain mapping to the hydraulic model for the model elevations.
6. Develop Custom Diurnal Demand Curves based on most recent SCADA Data.
7. Utilize metered sales data to distribute demand in the hydraulic model.
8. Modify the control strategy in the hydraulic model based on the current operating strategy derived through discussions with the Utility water operations staff.
9. Conduct QA/QC review of existing and future water system components.

TASK 3 – WATER SYSTEM FIELD & FLOW TESTING

This work will provide the opportunity to evaluate calibration assumptions. Field testing will be primarily conducted to collect information for evaluating model calibration and accuracy. Additional field testing will then be planned, which will be tailored to rectify system anomalies and bring the model to a level of calibration that is consistent with industry standards and the Utility's requirements. For the **"micro calibration"** effort, scheduled field testing may include hydrant flow testing, C-factor testing and EPS pressure monitoring. The scope of field testing will include working with Utility staff to conduct pressure and flow tests under controlled conditions.

<u>Summary of Tasks:</u>

1. Prepare a field test work plan that will identify the following: test location, purpose of test, Information to be collected, both at the test site and other monitoring locations, forms required for recording test information, field testing schedule, and digital field data collection system.
2. Identify locations for installation of continuous monitoring pressure devices (Telogs) for installation by Utility staff and the field-testing team.
3. Submit field testing work plan to Utility for discussion and agreement prior to performing the field tests, and final the work plan based on the comments from Utility staff.
4. Conduct virtual meeting to review flow testing plan with Utility staff, revise as necessary.
5. Conduct 20+ Hydrant Flow (Fire Flow) tests as part of field-testing activities with assistance from Utility staff.
6. Collect extended period water system operation SCADA data during flow testing activities and beyond (this data will be used for correlation of field-testing data during calibration).

TASK 4 – HYDRAULIC MODEL CALIBRATION AND VERIFICATION

With system demands incorporated into the Utility's hydraulic model, calibration and model proofing efforts can then commence. For this effort, we will compare water system pressure and flow information to predict model results. Pipe age curves developed from industry standard references will be utilized to set baseline friction values for system piping. We will then move into micro and macro calibration efforts to fine tune the model. The macro calibration effort will examine a combination of SCADA data, and the model will be set up to simulate operation over the same time. We will then compare field measurements, including tank levels, pump flow measurements, pumping time, totalized flow data and hydrant pressure data loggers, to those same metrics predicted in the model. Discrepancies between the model and new systemwide data will be documented and reviewed and the model adjusted accordingly. A parallel effort will simulate the operation of each of the **hydrant flow tests**. Each test will be compared with the model simulated result and the model adjusted to reflect real-world performance. Calibration data will be utilized in a genetic algorithm calibration module to optimize model parameters for accuracy. The model will be calibrated to provide accuracy within 5% of field-testing results, meeting industry standards for water distribution system computer models.

Summary of Tasks:

1. Prepare and set up the water model to develop modeling scenarios that represent each of the field tests performed (prepare a multiple step EPS scenario, one time step per flow test).
2. Prepare a model calibration analysis spreadsheet that tabulates the field measurements and operations of tanks and pumps against those predicted by the hydraulic model. Summarize the results in tables and graphs as needed.
3. Modify and adjust the model features to ensure that it accurately represents how the water system operates over an extended period of time.
4. Micro Calibration: Compare flows and pressures simulated from the model to those measured in the field and make the necessary adjustments to the C-values based on the aging curve to ensure close agreement between field and model results.
5. Macro Calibration: Simulate the operation of the water system over a pre-selected period of seven (7) days to make sure overall extended period simulation operation of the model matches the real-world water system. This calibration exercise will help build confidence in the ability of the model to predict water age when using EPS age simulations.
6. Prepare model calibration documentation and present the results of the calibration process to Utility staff with an opinion on the confidence of the level of calibration achieved and suggestions to improve calibration if necessary.

TASK 5 – RESULTS SUMMARY AND MODEL RESULTS

SEH will utilize the calibrated model will be utilized to simulate the operation of the existing water system and identify potential issues. The model will simulate the operation of the Munster water system during average day, maximum day and fire flow events. Water system operational flow capacities and system pressures will be examined to assure that the water system can deliver an effective level of service based on current and projected water system demands. With existing and projected water use information, and current water supply facility capacities, perform a water supply analysis to determine the adequacy of the supply and treatment facilities to provide current and future water needs and identify any shortfalls and develop a water age scenario to better understand travel time of water within the water distribution system. The purpose of this effort will be to provide a baseline understanding of current system operations and limitations. Future efforts for identifying potential alternative solutions can utilize the model upon completion of this effort.

Summary of Tasks:

1. Evaluate the capacities of the water supply and distribution systems to verify that they have adequate capacities to provide water to customers throughout the service area.
2. Perform both steady-state and extended-period simulation analyses to determine the required water storage needs and current limitations

3. Utilize the model to simulate available fire flow in the water system. Prepare maps of water system pressures and available fire flows.
4. Identify system deficiencies on a map and discuss items with Utility staff. (Alternatives analysis of potential solutions not included)
5. Conduct a review meeting with Utility staff to present the identified water system deficiencies and develop a scope for analyzing potential solutions (as part of a new engineering effort).
6. Provide summary report documenting the water model construction, calibration and initial findings.

PROJECT SCHEDULE

Our team is available to begin the project work upon receipt of a signed proposal. Our estimated project schedule is as follows:

Project Initiation & Draft Model Development……June 2024
Water System Field and Flow Testing……………August 2024
Hydraulic Model Calibration & Verification…… September 2024
Initial System Model Evaluation………………… October 2024
Results Summary and Model Results…………… December 2024

COMPENSATION

We propose to complete the hydraulic water modeling efforts for an hourly not to exceed fee of $48,900.00, which includes reimbursement expenses. We understand this fee amount cannot increase without further authorization from you.

We want to thank you for the opportunity to provide the Town of Munster with engineering services. As always, it is very important to us our services continue to meet and surpass your needs and expectations. If you have any questions, feel free to contact me by email at Ckatzenberger@sehinc.com or by telephone at (218) 855-1720.

Sincerely,

SHORT ELLIOTT HENDRICKSON INC.

Chad T. Katzenberger
Project Manager

c: Chris Spolnik, Superintendent of Operations
David White, Water/Sewer Division Supervisor