

ATTACHMENT A  
To  
AGREEMENT FOR PROFESSIONAL ENGINEERING SERVICES  
For  
WATER FACILITIES MASTER PLAN

OWNER: CITY OF LAWRENCE, KANSAS  
Lawrence, Kansas  
ENGINEER: BURNS & McDONNELL ENGINEERING COMPANY, INC.  
Kansas City, Missouri

BACKGROUND

ENGINEER will conduct an evaluation of the existing water supply, treatment and distribution systems and prepare a Water Master Plan (Project) for improvements to serve development planned through year 2030. ENGINEER will serve as OWNER's technical consultant and will perform engineering services required for the Project. Design years for the Project are Existing Development (2010), 2020, 2030 and build-out to match OWNER's growth projections.

SCOPE OF SERVICES

The Scope of Services to be provided by ENGINEER is as follows:

1. Initial Services to include the following tasks *(248 hours)*:
  - 1.1. Project Team will meet with OWNER to conduct a project kick-off meeting. Meeting purposes will include review of Project team, goals, scope, schedule, study area, and sources of and availability of information. *(20 hours)*
  - 1.2. Collect and organize information from OWNER that will be used to develop subsequent tasks. The information includes the list of requested information and other information as determined during and following the kick-off meeting. *(28 hours)*
  - 1.3. Perform project management and coordination with all parties for the duration of the study and technical supervision. A project management plan will be prepared for use during the execution of the study. Communication will be maintained via phone calls, conference calls, email, and monthly reports. *(112 hours)*
  - 1.4. Prepare for, attend, and complete meeting minutes for up to four meetings in Lawrence. Meetings will be conducted to finalize demand projections, discuss findings at the WTP, discuss improvements to the water distribution system and review draft report. *(68 hours)*
  - 1.5. Prepare for and conduct for up to one presentation in Lawrence to the Commission. *(20 hours)*

2. Demand Projections to include the following subtasks (95 hours):
  - 2.1. Organize and evaluate the requested available data. (9 hours)
  - 2.2. Compare the water and wastewater service areas developed by the OWNER and determine differences in number and class of customers with GIS. (13 hours)
  - 2.3. Coordinate with City for their meetings with existing and potential wholesale customers to determine water needs through the year 2030. Customers include Douglas County Rural Water District Nos. 1, 2, 4, 5, and 6; Jefferson County Rural Water District No. 13; and Baldwin City. Associated customers for the above-listed wholesalers will be included in the water need analysis. (4 hours)
  - 2.4. Based on available customer and water use data, service area, and zoning, prepare average day and maximum day demand projections for years 2010, 2030 and build-out for the OWNER's review and approval. These projections and the location of these demands will serve as the foundation for the PROJECT. Projections will also consider future non-revenue water percentage and demand management. (68 hours)
  
3. Water Rights (0 hours):
  - 3.1. OWNER will provide water rights information for all diversions summarized in an Excel table for use in the report. (0 hours)
  
4. Diversion Options for the Plants (0 hours):
  - 4.1. Data from a pending report will be used in this Project to summarize a conversion from surface water intake to vertical wells along the Kansas River. (0 hours)
  - 4.2. Data from a pending report will be used in this Project to summarize a conversion from surface water intake to a horizontal collector well(s) along the Kansas River. (0 hours)
  
5. Water Plant Regulation and Process Review to include the following subtasks (76 hours):
  - 5.1. Complete a regulatory review of the Kaw River Water Treatment Plant and the recently expanded Clinton Lake Water Treatment Plants comparing existing water quality data to existing and pending Safe Drinking water Act regulations and focusing on taste and odor at the Clinton Lake plant and TOC and DBPs at the Kaw River plant. Based on these evaluations and the plants continuing to operate under conventional treatment processes, recommend equipment replacement and potential operational changes. (76 hours)

6. Net Water Needs to include the following subtasks (*8 hours*):
  - 6.1. Compare the projected average day and maximum day demands to the existing diversion water rights, diversion capacity, and water plants capacity to determine net water needs and the year of the projected deficit. This data will be used to schedule improvements for the capital improvements plan (CIP). (*8 hours*)
  
7. Dynamic Hydraulic Modeling to include the following subtasks (*444 hours*):
  - 7.1. Model Construction - construct the model from the OWNERs ArcSDE 9.3 enterprise wide geodatabases including roads, elevations, piping, and parcels. The model will be skeletonized around fire hydrants, but will include every transmission and distribution system pipe; service lines will not be included. Pump stations and tanks will be added to the model. (*48 hours*)
  - 7.2. Existing Demand Distribution – Based on OWNER provided actual meter records by physical meter address for the selected 12 month period, distribute the actual water usage based on parcels in the model. Non-revenue water and unallocated or unmatched demands will be added to the actual sales data. (*48 hours*)
  - 7.3. Diurnal curves and Storage Analysis – use OWNERs SCADA data for the tanks, flow meters, and pumps to develop diurnal curves for both pressure zones for a week long high demand period. Determine the peak hour factor, minimum hour factor, and equalization storage factor for both zones. (*20 hours*)
  - 7.4. Model Calibration and Verification – OWNERs SCADA data for the tanks (water level) and pumps (suction and discharge pressure and flow), in combination with the existing model's GIS elevations, demand distribution, existing skeletonized transmission main model C-values, and estimated C-values based on pipe diameter, age and condition to calibrate and verify the model of the existing water system. C-values will be the primary focus of calibration / verification. (*48 hours*)
  - 7.5. Base Model Evaluation – Use the calibrated and verified water model to run average day, maximum day, peak hour on the maximum day, minimum hour on the maximum day, and maximum day plus fire flow at all nodes at current demands. Evaluate the model for system high and low pressure areas and areas with low fire flow. (*16 hours*)
  - 7.6. Future Demand Distribution – based on the approved demand projections, distribute demand to future growth areas, wholesale customers, and additional dry year demand to existing customers. (*58 hours*)

- 7.7. Hydraulic Analysis – Run the model for build-out, years 2030 and 2020 to determine necessary improvements to meet future demands, pressure, and fire flow. Improvements will determine the pipelines necessary to supply future developments and improve system hydraulics, pressure zone adjustments, future pressure zones, pump stations, storage tanks, and water plant expansions. Demand scenarios include average day, maximum day, peak hour on the maximum day, minimum hour on the maximum day, and maximum day plus fire flow at all nodes. *(120 hours)*
- 7.8. Schedule Improvements and Trigger Demands – Based on the model results in task 7.7, develop a summary table of improvements between years 2010 to 2020, years 2020 to 2030, and 2030 to build-out including demand triggers. Improvements between years 2010 to 2020 will be prioritized for the CIP. Cost opinions will be prepared for each improvement in Task 8 below. *(44 hours)*
- 7.9. Model Training – Provide training on the model and GIS integration, customer projections by growth areas, demand allocation by physical address or parcel, demand projections by growth areas, and improvement prioritization. OWNER will attend software training provided by Bentley. *(42 hours)*
8. Project Schedule and Opinions of Probable Cost to include the following subtasks *(116 hours)*:
  - 8.1. Cost Opinions for CIP Distribution System Improvements – prepare opinions of probable cost for pipelines, pump stations, and storage tanks for transmission / distribution and fire flow improvements. *(48 hours)*
  - 8.2. Cost Opinions for CIP WTP Improvements – prepare opinions of probable cost for water supply diversion and water plant improvements. *(36 hours)*
  - 8.3. Cost Opinions for Small Main and Leak Detection Improvements – prepare opinions of probable cost for small main replacement and leak detection programs. *(12 hours)*
  - 8.4. Assist OWNER with Prioritization and Re-prioritization during OWNER Evaluation of Financial Impacts – Work with OWNER staff to prioritize and re-prioritize improvements based on OWNER’s financial evaluations. *(20 hours)*
9. Report and Quality Control to include the following subtasks *(274 hours)*:
  - 9.1. Draft Report – Prepare a draft report for OWNER staff review and comment in electronic format. Report sections will be provided to OWNER as report sections are completed. *(196 hours)*

9.2. Final Report – Prepare a final report based on OWNERs comments. Provide five paper copies and one copy in electronic format. (78 hours)

10. Additional Tasks:

5A Provide an electrical, process, structural and process review of the Kaw River Water Treatment Plants. Perform a site visit to observe the condition of the equipment and discuss operations and equipment maintenance and plant related issues with OWNER’s operations staff. Based on the site visit and meeting review provided maintenance records, develop a list of improvements with associated cost opinions, and add text and tables to the report. OWNER will drain basins for these reviews. (88 hours)

7A Additional Model Calibration and Verification – Field test data collected in summer 2010 will be used with OWNERs SCADA data to calibrate and verify the model. Data will be combined with Task 7.4. (52 hours)

7B Extended Period Simulation (EPS) – Set-up and run and EPS for three time periods including the existing system, year 2020 and year 2030. EPS will be used to determine the water age at all system nodes for the selected seasonal demand. Model data will be used to evaluate pump and storage tank performance and sizing. EPS controls will be based on City provided control parameters. (92 hours)

Optional Task - Oread Tank / Booster Pump Station Evaluation – Evaluate the existing Oread site, tanks, and booster pump station and develop a preliminary concept for a new pre-stressed tank and new booster station at that site. Evaluate the existing distribution systems ability to meet needs without the existing tanks and the need for the booster pump station. Evaluation will consider schedule and the ability to demolish the site and construct a new tank and booster station from October through March while demands are low. Include the results of this evaluation in the hydraulic analysis of the build-out, year 2030 and 2020 models. (92 hours)

11. OWNER will provide, in connection with this Authorization, the following:
  - 11.1. Copy of any correspondence with KDHE related to the Project.
  - 11.2. Perform all necessary field testing for calibration data.
  - 11.3. Any other required information and prompt review of draft technical memoranda.
  - 11.4. Assistance by placing at ENGINEER's disposal all available information pertinent to the assignment, including previous reports and any other data relative thereto. ENGINEER shall rely on information made available by the OWNER as accurate without independent verification.
  - 11.5. Provide OWNERS most recent population growth and development projections and assist ENGINEER in developing a range of realistic growth scenarios. OWNER will provide existing ultimate build-out population projection from planned land use and population densities. OWNER will review projected growth as developed through Public Participation by sub-area to refine the projected timing and location of growth, according to potential agreed-on development needs, development timing, available utilities, and other influences.
  - 11.6. Meet with existing and potential wholesale customers to determine water needs through the year 2030. Customers include Douglas County Rural Water District Nos. 1, 2, 4, 5, and 6; Jefferson County Rural Water District No. 13; and Baldwin City. Associated customers for the above-listed wholesalers will be included in the water need analysis.
  - 11.7. Electronic Maintenance Management History records (GBA Master Series) for water maintenance for the past 5 years.
  - 11.8. Provide the following information in an appropriate electronic format for its intended use:
    - 11.8.1 Customer:
      - 11.8.1.1. Historical data for 1970 to present by customer class
      - 11.8.1.2. Historical annual metered water use data by customer class, as available, for 1994 to present by customer class
      - 11.8.1.3. Historical annual metered water pumpage data for 1994 to present
      - 11.8.1.4. Historical annual maximum and average day demand data for 1970 through present
      - 11.8.1.5. Historical building permits from 2000 to present
      - 11.8.1.6. Electronic meter book data on actual water usage for a recent City selected year
      - 11.8.1.7. Any population, customer, and water demand projections by others
      - 11.8.1.8. Locations and zoning of anticipated development over the next 10 and 20 years and build-out

- 11.8.1.9. Water conservation measures and rate structure
- 11.8.1.10. Latest Comprehensive Plan
- 11.8.1.11. Current CIP
- 11.8.1.12. Current maintenance and replacement program
- 11.8.2 Diversion and Water Plants
  - 11.8.2.1. Water rights (City and wholesale customers)
  - 11.8.2.2. Raw, plant process and finished water quality data
  - 11.8.2.3. Available drawings or sketches for the plant
  - 11.8.2.4. Information on process treatment equipment
- 11.8.3 Distribution System:
  - 11.8.3.1. Review and update of the distribution system map
  - 11.8.3.2. Location of low pressure, low fire flow, high pressure or other problem areas
  - 11.8.3.3. List of known closed valves, broken, or partially closed valves
  - 11.8.3.4. Pump curves for high service and booster pumps and as-built drawings of associated piping and valves
  - 11.8.3.5. Tank data including capacity, diameter, head range, and base, bottom of tank and overflow elevation
  - 11.8.3.6. SCADA information off City operated continuous recorders and devises for intakes and wells; plant storage, high service pumps, and meters; and distribution system booster pumps, meters and tanks for diurnal curve development and model calibration and verification
  - 11.8.3.7. Description of system operation and control parameters
  - 11.8.3.8. Pressure zone boundary
  - 11.8.3.9. PRV details including location, size and settings
  - 11.8.3.10. Latest Insurance Services Office report
  - 11.8.3.11. EPS control parameters
- 11.8.4 GIS
  - 11.8.4.1. Urban Growth Boundary with population projections for sub-areas
  - 11.8.4.2. Water service area boundaries and City limits
  - 11.8.4.3. Topography
  - 11.8.4.4. Waterlines
  - 11.8.4.5. Available planimetrics of roads, buildings, parcels, etc.
  - 11.8.4.6. Available land use and zoning

- 11.8.4.7. Pipe data including size, construction material, and year installed; comments on general condition; valves; fire hydrants; tanks; etc.
- 11.8.4.8. Water use by customer location or meter location
- 11.8.4.9. Pressure Zone Boundary
- 11.8.4.10. Location or designation of large users

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