Hazen and Sawyer
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April 21, 2026

Timothy A. Welch, PE
Utilities Director
City of Pembroke Pines
8300 South Palm Drive
Pembroke Pines, FL 33025

Re: Pembroke Pines Wastewater Transmission System
Work Order 17 – Development of Wastewater Transmission System Hydraulic Model

Dear Mr. Welch:

As requested, Hazen and Sawyer, D.P.C. (Hazen) is pleased to offer engineering services for the development of a wastewater transmission system hydraulic model.

Background

The City of Pembroke Pines (City) operates and maintains its own wastewater collection system and wastewater treatment facility. The wastewater collection system consists of a gravity collection system and a transmission system composed of pressurized force mains and lift stations. This system conveys wastewater flows generated east of Flamingo Road to the City of Hollywood's Southern Regional Wastewater Treatment Plant. The remainder of the wastewater flows are directed to the City's Wastewater Treatment Plant.

The City has recognized the need to establish a Wastewater Transmission System Hydraulic Model to support the effective fulfillment of municipal responsibilities. This tool will support the delivery of high-quality services to residents and customers, facilitate future growth and economic development, and safeguard public health, safety, and the environment.

This Work Order describes the development and calibration of a hydraulic model for the City's wastewater transmission system, including major gravity mains (such as those connecting lift stations and those over 24 inches in diameter), force mains, and lift stations, using InfoWorks ICM to create a comprehensive sewer system model.

Scope of Services

Task 1 – Development of the Wastewater Transmission System Hydraulic Model

Hazen will develop a wastewater transmission system hydraulic model based on the City's current Geographical Information System (GIS) records. This effort will include the force main network and upstream lift stations owned, operated, and maintained by the City. The model network will also include any lift stations discharging to gravity mains that direct wastewater to downstream lift stations. This

model, representing current flow conditions (baseline system), will be used for calibration and will include the existing infrastructure.

Subtask 1.1 – Development of InfoWorks ICM Hydraulic Model

During the preparation of this Work Order, Hazen reviewed a legacy hydraulic model provided by the City. This model was developed in WaterCAD and covers the eastern portion of the transmission system. Hazen will extract and verify basic information from the WaterCAD model (wet well dimensions, pump curves, etc.). WaterCAD is a program developed to evaluate water distribution systems and has historically been applied to force main networks due to the lack of other tools specific to sewer collection systems. The industry has moved away from that practice, adopting more modern programs that simulate, within the same computational environment, the type of flow observed in gravity collection (open-channel flow) and in force main networks (pressurized flow). One of these programs is InfoWorks ICM. Hazen will develop the hydraulic model within the InfoWorks ICM platform. Legacy model files will be converted to InfoWorks ICM as the starting point before the update.

Based on the City's GIS Database of the wastewater collection and transmission system (WCTS), Hazen will delineate/refine the service area of each Lift Station (LS). This delineation will be used, in conjunction with the Broward County population distribution by Traffic Analysis Zones (TAZ), to assign the population served by each LS and characterize the flows that each LS receives. The InfoWorks ICM Unit Hydrograph (RTK) and Groundwater Modules will be configured to define the components of the model's hydrographs. This methodology will enable the City to simulate the effects of storm events of varying sizes and frequencies on the WCTS.

The City's WCTS GIS will also be used to develop the pipe network in the hydraulic model. As mentioned in the introduction, the hydraulic model will include major gravity mains (such as those connecting lift stations and those over 24 inches in diameter), force mains, and lift stations.

Subtask 1.2 – Desktop Data Collection

Hazen will gather, compile, and analyze data required to develop the City's wastewater hydraulic model. These data include the following:

- As-built and/or record drawings of wastewater facilities and infrastructure constructed in the last ten years in the eastern portion of the system, including those facilities and infrastructure that may have been built as part of approved development applications
- As-built and/or record drawings of all wastewater facilities and infrastructure in the western portion of the system, including those facilities and infrastructure that may have been built as part of approved development applications. It is assumed that the City's GIS is up to date and includes all the recent changes and updates in the transmission system.
- Updated records detailing any City rehabilitation efforts, such as lift station pump replacement or pipelining activities
- Updated pump curves for lift stations

- City lift station SCADA flow and pressure data for the years 2018 through 2025, if available. SCADA WWTP hourly influent flow data for the same period
- City interconnects SCADA flow data (to the City of Hollywood) for the years 2018 through 2025

Table 1 summarizes the data to be provided by the City. The table includes the "Preferred" format required to expedite its processing and verification.

Table 1: Data Items to be provided by City

Data Item	**Preferred Format**
2018 to 2025 SCADA time series data, including but not limited to: • WWTP hourly influent flow data and master pump station flow data • Hourly pump run time, on-off events, and pump speed when applicable • Hourly pressure data at the discharge side of lift stations, where available • Time series of wet well levels. This information should be provided at the smallest available time step. (preferred 3-min data or smaller time steps). Due to the volume of data produced by smaller time steps, the period of record could be reduced to March 1, 2025, through November 30, 2025. *Note: Hazen will request the same information for a period in 2026 that corresponds to the period when field data collection activities are carried out.*	Database, Excel, or Comma-Separated Values (CSV)
Last three years of Water Billing Records by meter/customer	Excel, CSV, Database or GIS
Customer Water Meter Locations	GIS
Wet Well Dimensions	Excel or CSV
Wet Well Pump ON-OFF level setpoints	Excel or CSV
Wet well influent pipe invert (elevation or distance below finished floor	Excel or CSV
Dry and Wet Weather Control Strategy	PDF or Excel
Pump Curves	PDF or Excel
Latest Sewer Geodatabase	GIS
As-built Drawings for Pumps Stations and Force Mains. (It is assumed that the force main as-builts are mapped to GIS.)	PDF
Historical Sewer Overflow Database	GIS or Excel
Historical Pipe Breaks Database	GIS or Excel
Planned Septic to Sewer Conversion Areas, if any	GIS

Hazen will gather additional data from external sources to support model updates. These data include the following:

- Rainfall data
- Population projection data through the year 2050 from the Broward County and Municipal Forecast and Allocation Model (PFAM)
- Groundwater Current and Future Levels as published by Broward County

Subtask 1.3 – Field Data Collection

In parallel with model development, and in preparation for model calibration, flow monitoring and rainfall data will be collected, along with other field data as needed.

Field Monitoring Plan

A draft monitoring plan will be developed to collect pressure data in the field at key locations within the force main network. Temporary flow meters will also be installed within the system to monitor wastewater flows over approximately one month (preferably during wet weather). Field monitoring will also include installing data loggers to record pump start and stop events to calibrate the hydraulic model. System field monitoring services will be performed by a combination of Hazen staff and a sub-consultant specializing in flow monitoring. City personnel will provide access to and assist in installing the field monitoring devices.

The monitoring plan will include:

- Location and timing for the installation of the start-stop (Hobo) loggers
- Location and number of pressure monitoring locations
- Time periods and time steps of the system pressure monitoring data collections
- Location and number of flow measurement sites
- Time periods and time steps of the flow measurements

The draft monitoring plan will be discussed with the City in a coordination meeting. After the meeting, Hazen will address the City's comments on the document and submit the final monitoring plan.

Continuous Pressure Data Collection

Hazen, with assistance from City staff, will conduct pressure measurements at strategic locations along the distribution network to calibrate the model. Hazen will provide up to ten (10) digital pressure recorders to be installed at pre-planned locations to monitor diurnal variations in pressure at key locations throughout the City's service area. Pressure recorders will be deployed in four sequences for up to seven (7) consecutive days each for a total of 40 locations. After deployment, Hazen will download and summarize the collected data for use in the model development activities described in the following tasks.

Gravity Flow Monitoring

Hazen will install temporary flow meters within the system to monitor wastewater flows for approximately one month (preferably during wet weather) at up to eighteen (18) locations in the collection system and two (2) locations along the Parshall flume at the wastewater treatment plant headworks building. Field monitoring will also include installing Hobo data loggers to record pump start and stop events at the lift stations selected for flow monitoring. System field monitoring services will be performed by Hazen staff and a sub-consultant specializing in flow monitoring. City personnel will provide access to and assist in the installation of field monitoring devices.

Task 2 – Calibration of the Wastewater Transmission System Hydraulic Model

Subtask 2.1 – Dry Weather Hydrologic Calibration

The baseline sewer flow contribution from each metered sewer shed will be determined to characterize wastewater flows. This characterization divides the flows into three major components:

- Base Sanitary Flow (BSF)
- Dry Weather Ground Water Infiltration (GWI)
- Rain Dependent Infiltration and Inflow (RDII)

The sum of the first two components (BSF and GWI) constitutes the Dry Weather Flows (DWF). Hazen will utilize data from the flow monitoring, in addition to other data for the service area of each LS (population, land use, water consumption, groundwater levels, pipe age, etc.), to define the BSF component of the DWF along with its diurnal pattern, as well as the GWI portion of the DWF. For this task, Hazen will apply HazenQ (an internal Hazen tool). The HazenQ outcome will be added to the InfoWorks ICM model. The model will be run to simulate the WCTS's performance under dry conditions. Total flows produced by this simulation at the end point of both systems (East and West) will be compared against metered data. The model parameters will be adjusted until the desired match between simulated and observed data is achieved, and an error target of less than ten percent (10%) will be used.

Subtask 2.2 – Wet Weather Hydrologic Calibration

Wet Weather Flows (WWF) correspond to DWF plus the RDII. In this task, Hazen will also use flow-monitoring data to perform a hydrologic calibration of the RDII portion of the WWF, starting from the DWF obtained in the previous step. Hazen will apply the HazenQ tool to derive the parameters required to characterize the RDII. Those parameters include the variables (R, T, K) used to define a unit hydrograph to represent the inflow portion of the RDII, and the Groundwater module parameters used to describe the infiltration portion of the RDII. Similar to the process used for DWF, the RDII parameters will be transferred from HazenQ to the InfoWorks ICM model to simulate the WTCS response to several storm events. Total flows produced by these simulations at the end point of both systems (East and West) will be compared against metered data. The model parameters will be adjusted until the desired match between simulated and observed data is achieved, and an error target of less than ten percent (10%) will be used.

Subtask 2.3 – Hydraulic Calibration

Once the wastewater flow drivers are defined in the hydrologic calibration, the InfoWorks ICM model will be run to simulate the weather conditions observed during the pressure-monitoring period. Modeled pressures will be compared against the gauged pressure data. An additional check of the model's performance will be conducted by comparing historical pump runtimes between dry and wet months. Model parameters (friction coefficients, minor losses, connectivity) will be reviewed and modified based on these comparisons.

Typically, modeled and measured pressures differ due to incorrect pump characteristics (pump curve, wet well dimensions). To resolve these discrepancies, some fieldwork would be required. Hazen will coordinate with the City to visit up to ten (10) LS to confirm the information used in the model. This confirmation may include a pump drawdown test and a pump pullout to confirm the pump model and impeller size. Hazen will rely on the City operations staff to perform the required activities.

To verify that the modifications made to the hydraulic parameters did not affect the hydrologic calibration, and similar to the process used for Hydrologic calibration, flows obtained with the InfoWorks ICM model simulations of the pressure monitoring period weather events at the end point of both systems (East and West) will be compared against metered data. Model parameters will be refined until the desired match between simulated and observed data is achieved, and an error target of less than ten percent (10%) will be used.

Task 3 – Deliverables, Workshops, and Presentations

The Consultant shall submit the following deliverables to the City:

- WCTS Model Development and Calibration Technical Memorandum
- WCTS InfoWorks ICM Calibrated Model Transportable Database
- Presentation materials, agenda, and summary of the WCTS Model Development and Calibration Workshop

Task 4 – Project Management, Project Kickoff, and Coordination Meetings

Hazen will provide overall project coordination services, including maintaining a project progress schedule, attending a project kickoff meeting, and periodic project progress meetings.

Assumptions

The following assumptions were made in the preparation of this scope:

- It is assumed that the City’s GIS is up to date and includes all the recent changes and updates in the transmission system.

- It is assumed that the force main as-builts are mapped to GIS.
- Planned urban developments used to enhance population growth assumptions will be provided by the City in a tabular format for incorporation into wastewater flow projections. The planned developments list will include the following: name, GIS coordinates or parcel number, planned flows from the development, receiving lift station and approximate year of connection. Hazen will use population growth estimates prepared by Broward County and will not be responsible for their accuracy.
- Hazen will utilize a subconsultant for data collection services. These services will be charged to reimbursables as a direct charge with no markup by Hazen. Total charges will not exceed the upper limit of the established allowance for reimbursables.
- City will review documents within two weeks of receipt and provide written comments.
- Hazen will make assumptions related to model inputs in the absence of available data. All assumptions will be documented in the Technical Memoranda

Compensation

The engineering services for this project will be performed on a Not-to-Exceed basis for $493,850. A fee schedule is attached.

Schedule of Completion

The services outlined in this Task Order will be completed within 6 months from the date of the initial RFI response. Engineering services for the project will be performed under our Continuing Professional Services Contract dated January 13, 2021. Services provided by Hazen shall be limited to those services specifically identified in this work authorization.

Note that several factors affecting the project are beyond Hazen's control, including work by others and the delivery of information to be supplied by others. Consequently, the schedule presented herein is dynamic and represents a best-case scenario. The completion time will be updated when appropriate.

We look forward to your reply. Should you have any questions or require further information, please contact us.

Sincerely,

Guillermo A. Regalado

Guillermo Regalado, PE
Vice President

Enclosure

c: N. Ahuja
File 04800-017

CITY OF PEMBROKE PINES

Work Order No. 04800-017 - Development of the Wastewater Transmission System Hydraulic Model
Fee Schedule
April 21, 2026

Employee Title		Technical Expert / QAQC	Senior Associate	Associate	Engineer	Assistant Engineer	Total H&S Hours	Cost	Cost Per Task
Person		Regalado	Tian	Ahuja	Warier / Lucado	Wilches			
Billing Rate		$305.00	$275.00	$225.00	$160.00	$140.00			
Task	Description								
LABOR									
1.0	Development of the Wastewater Transmission System Hydraulic Model						818		$143,570
1.1	Development of InfoWorks ICM Hydraulic Model	24	60	40	160	120		$75,220	
1.2	Desktop Data Collection	0	0	12	60	120		$29,100	
1.3	Field Data Collection								
1.3.1	Field Monitoring Plan	8	0	12	16	32		$12,180	
1.3.2	Continuous Pressure Data Collection	8	0	8	60	16		$16,080	
1.3.3	Gravity Flow Monitoring	6	0	8	32	16		$10,990	
2.0	Calibration of the Wastewater Transmission System Hydraulic Model						952		$178,880
2.1	Dry Weather Hydrologic Calibration	16	16	80	120	60		$54,880	
2.2	Wet Weather Hydrologic Calibration	24	24	80	160	60		$65,920	
2.3	Hydraulic Calibration	16	16	80	140	60		$58,080	
3.0	Deliverables						408		$73,700
3.1	WCTS Model Development and Calibration Technical Memorandum	12	12	24	128	88		$45,160	
3.2	WCTS InfoWorks ICM Calibrated Model Transportable Database	0	0	0	4	0		$640	
3.3	WCTS Model Development and Calibration Workshop	16	12	40	32	40		$27,900	
4.0	Project Management, Project Kickoff, and Coordination Meetings						82		$15,810
4.1	Kickoff Meeting	2	0	2	4	4		$2,260	
4.2	Coordination Meetings (5)	10	0	20	20	20		$13,550	
	TOTAL						1,442	$411,960	$411,960
DIRECT EXPENSES									
	Flow Monitoring Subcontract							$87,317	
	SUBTOTAL (EXPENSES)								$87,317
	TOTAL (LABOR AND EXPENSES)								**$499,277**

The fee schedule is based upon an estimate of the personnel to work on the project. The actual breakdown of personnel and associated hours may vary based based upon availability and area of expertise. It is agreed that the the method of compensation is Not to Exceed which means the CONSULTANT shall perform the services set forth in the Work Authorization for total compensation in the amount of or less than the stated total.