PROFESSIONAL SERVICES LIBRARY:

WATER AND WASTEWATER ENGINEERING SERVICES
CONTRACT NO. 2020-020
SERVICE AUTHORIZATION No. 07
to
AGREEMENT for PROFESSIONAL ENGINEERING SERVICES
between
the City of Marco Island
and
AECOM Technical Services, Inc.

POTABLE WATER HYDRAULIC MODEL UPDATE & CALIBRATION

THIS DOCUMENT executed this _____ day of _____, 2025 is Service Authorization No. 07 to Agreement for Professional Services Library: Water and Wastewater Engineering Services Contract No. 2020-020, executed between the City of Marco Island (OWNER) and AECOM Technical Services, Inc. (CONSULTANT) November 30, 2020 (hereafter called "Agreement").

A. GENERAL

The OWNER and the CONSULTANT have entered into an Agreement to provide professional engineering services in connection with (1) Water/Wastewater Treatment Plant Engineering (2) Water Distribution/Wastewater Collection System Engineering (5) Regulatory Permitting, Reporting, and engineering study preparation. The Agreement provides for services to be performed based on a SERVICE AUTHORIZATION to be executed by the OWNER and the CONSULTANT. The CONSULTANT's proposed services are authorized upon signature of this SERVICE AUTHORIZATION by both the OWNER and the CONSULTANT and shall commence on receipt of a written Notice-to-Proceed (NTP) from the OWNER.

B. DESCRIPTION OF ASSIGNMENT

The City of Marco Island (City) owns and operates a potable water system that assures a sufficient, dependable, and high-quality potable water supply and meets the needs of the City on a timely basis. The Marco Island potable water treatment system consists of the following two water treatment plants (WTP):

1. North Water Treatment Plant, which treats surface water using lime softening and microfiltration processes with a plant production capacity of 6.67 mgd

2. South Water Treatment Plant, which treats brackish groundwater using reverse osmosis technology with plant production capacity of 6.0 mgd

In addition to City's service area, as of January 17, 2020, Marco Shores community is also supplied with water from the City of Marco Island water treatment plants.

The City's hydraulic model for the potable system includes water main network in the City's service area which was updated in 2012 and indicated to be calibrated. The model was updated again by AECOM in 2017 to include the Marco Shores service area.

The City requested AECOM to provide professional services for the potable water distribution system hydraulic model update and calibration. The scope of services is organized into tasks, as detailed below, aimed at updating and calibrating the City's existing potable water distribution system hydraulic model:

C. SCOPE OF SERVICES

The CONSULTANT will provide the following services for the project:

Task 1: Project Management

The CONSULTANT's Project Manager will supervise and coordinate the work throughout the project, including the scope of work, budget, schedule, team members' roles and responsibilities, and key project success factors. The Project Manager will provide a project status report to the City with each invoice to indicate task progress, coordination of data requirements, and anticipated deliverable dates.

Deliverables

- Monthly invoices and status reports (PDF Format)

Task 2: Data Collection

The following data is required to complete the potable water hydraulic model update and calibration. The existing information/documents listed below will be obtained and reviewed by the CONSULTANT.

- Geographic Information System (GIS) Shapefiles and/or geodatabase with the latest information on the City's potable water system network and connectivity.
- Supervisory Control and Data Acquisition (SCADA) historical 3-year data in 15-minute intervals related to pressures, tank water level, finished water production for the City's two WTPs.
- Utility Billing System Information records for one year for metered water, including the daily customer information and metered consumption.
- Closed valve locations within the WTP service area/Boundary Valves information/any operational changes information.
- High Service Pumps Details with rated capacity of pumps and modes of operation.
- Water loss/non-revenue water (NRW) data records submitted to regulatory agencies.
- Record Drawings/hydraulic profiles for WTP and distribution system storage tanks.
- System pressures, if monitored.

Deliverables

- Request for Information (PDF format)

Task 3: Estimation of Potable Water Demands

The CONSULTANT will develop existing potable water demands for the City's service area based on City's utility billing system information. NRW data records will be used to adjust the gap between finished water production and metered billing records. Based on the estimation of demand, CONSULTANT will establish the following:

- Average Day Demand (ADD)
- Maximum Day Demand (MDD)
- Peak-Hour Demand (PHD)

The potable water diurnal pattern represents the hourly variation of demand generated at each WTP compared to the daily averages. Historical WTP SCADA data, provided by the City, will be analyzed to derive the City's potable water demand diurnal pattern.

Deliverables

- Potable water demand calculation spreadsheet (Excel)

Task 4: Hydraulic Model Update

The City's existing potable water system hydraulic model will be updated as below:

Hydraulic Model Network Update: The CONSULTANT will complete an initial review of GIS information to identify network connectivity and gaps for model updates. The hydraulic model network will be compared with the City's latest GIS geodatabase to update the existing infrastructure as necessary. Meetings with City staff and a review of other available information on pipe infrastructure, valve status, or other data discrepancies identified during the initial review, will be conducted to ensure the model represents the actual conditions in the field. Information on the City's capital improvement projects that have been implemented or are currently underway or in the planning process (not including in the City's potable water system GIS geodatabase) will also be used to update the hydraulic model network.

Hydraulic Model Demand Update: The CONSULTANT will update the hydraulic model with demand and diurnal pattern(s) estimated in Task 3. Separate scenarios for ADD, MDD, and PHD conditions will be created in the hydraulic model. Spatially distributed billing records with metered consumption will be used to allocate existing nodal demands in the model. Billing records metered consumption data will be compared with finished water production data to estimate the NRW volume in the City's system. NRW will be distributed across the service area based on the inch-diameter-mile method. SCADA production data for the treatment plants and pumping facilities and tank levels for selected time periods will be reviewed to establish system-wide diurnal patterns.

Deliverables

- Updated hydraulic model (InfoWater Pro Files)

Task 5 - Hydraulic Model Calibration

The following tasks will be performed to calibrate the updated hydraulic from the previous task.

Field Data Collection Plan: A Field Data Collection Plan will be prepared as part of Task 5 to identify field data collection activities required to calibrate the updated hydraulic model. The plan will also identify recommended locations for pressure monitoring and hydrant testing. Test locations will be coordinated with the City to ensure the hydrant flow testing plan is feasible.

Field Data Collection: Pressure loggers and flow meters will be installed at critical locations to record system pressures and flows. The CONSULTANT will be responsible for providing pressure monitoring and hydrant testing equipment required for the field activities. The requirements for field monitoring equipment will be outlined in the Field Data Collection Plan. It is assumed that the City will be responsible for installing the field monitoring equipment and collecting the necessary data. The CONSULTANT will coordinate with the City staff during all the field monitoring activities. The City staff are also requested to check valve positions in the field (closed or partially closed valves). It is assumed that the City will also provide the SCADA data for the monitoring period to be used in the model calibration. Hydrant tests will be aided with continuous pressure loggers to provide additional data points for calibration. The model will be calibrated against field data under the operating conditions (pump status, tank level, demand factor) observed during each field test.

Model Calibration: The updated hydraulic model with the existing system network will be used for calibration under both steady-state simulations (micro calibration) and extended period simulations (EPS) (macro calibration). The steady-state model simulations analyze how the distribution system performs under stress, as indicated by the hydrant flow and pressure testing. The extended period model simulations analyze how the distribution system performs daily based on the data gathered from the extended period flow and pressure monitoring. The hydraulic model will be macro and micro calibrated using the field monitoring and SCADA data. Boundary conditions will also be updated based on continuous pressure monitors, SCADA data, and additional information received from the City.

The primary goal of hydraulic model calibration is to minimize the error between field test data and model simulations and create a “best fit” throughout the system. The following factors typically complicate precise hydraulic model duplication of field results during calibration:

- Pump curves – The manufacturer’s pump curve may not precisely represent the pump’s current operation, especially as the pump ages.
- Unknown closed or partially closed valves.
- Variation of C-Factors – The model assumes a consistent relationship between pipe material, age, and diameter; however, some individual pipes may not follow this assumption.
- Inaccurate system mapping – This is minimized by using the latest GIS mapping; however, inaccuracies still exist that can affect model calibration.

Any of the above inaccuracies, if identified, will be corrected during the calibration process, if possible.

While precise duplication of field-testing results during model calibration is unrealistic, limits to the amount of allowable error must also be made to ensure the calibrated model is a reasonable, accurate representation of the actual water distribution system and can be used with confidence to evaluate system

deficiencies and improve the water distribution system. The tolerance levels agreed upon with the City prior to initiation of model calibration efforts for macro and micro calibration are listed below:

Macro Calibration Criteria:

- System pressure to match +/- 5 psi of the peak pressure of the extended period simulation for 95% of the pressure monitoring locations.
- At least 80 percent of the hourly pressures of the extended period simulation to be within +/- 5 psi at 95 percent of the pressure monitoring locations.

Micro Calibration Criteria:

- Model simulations to be performed for each field test, one during no hydrant flow (static) conditions and one during hydrant flowing (dynamic) conditions. The static condition simulates the water system during normal operating conditions, while the dynamic condition simulates the water system during the stressed (high flow condition) of flowing a hydrant. While the individual pressures under both static and dynamic conditions are important, the general criterion for model calibration is to match the pressure drop for each test location (the difference between static and dynamic pressure). The steady state calibration process provides confidence that the hydraulic model can accurately simulate static and dynamic conditions throughout the water system. The criterion for micro calibration is to match the pressure drop between the model and field conditions within +/- 5 psi

Parameters within the model will be adjusted and simulations repeated until the criteria established for the calibration is met within allowable tolerances.

Deliverables

- Field Data Collection Plan (PDF Format)
- Calibrated hydraulic model (InfoWater Pro Files)

Task 6: Technical Memorandum

The results and findings from the City's potable water system hydraulic model update and calibration will be summarized in a Technical Memorandum. The draft TM will be submitted for City's Review. The CONSULTANT will conduct a workshop with City staff to review the recommendations and draft Technical Memorandum along with the hydraulic modeling results. The City's comments will be addressed, and a Final Technical Memorandum (PDF Format) will be prepared documenting the results of the workshop and City comments.

INFORMATION REQUESTED FROM THE CITY

The City will provide available data and information when the CONSULTANT has prepared and submitted a Request for Information.

D. TIME OF PERFORMANCE

A summary of the proposed schedule is provided in the following table and figure.

Milestone/Deliverable	Approximate Cumulative Days from NTP
Task 1 – Project Management	180 days
Task 2 – Data Collection	20 days
Task 3 – Estimation of Potable Water Demands	45 days
Task 4 – Hydraulic Model Update	90 days
Task 5 – Hydraulic Model Calibration	150 days
Task 6 – Technical Memorandum	180 days

The CONSULTANT will observe the time limitations. However, should there be delays in receiving information from others and in obtaining subsequent authorization, approvals, and review comments from the City, and other governmental agencies, the schedule will be updated and adjusted as mutually agreed upon by the CONSULTANT and the City. The CONSULTANT shall not be responsible for delays that occur as the result of action or inaction of others.

F. OWNER RESPONSIBILITIES

1. The City will provide requested information and conduct deliverable reviews in a timely manner.

G. EXCLUSIONS AND ADDITIONAL PROVISIONS

1. The CONSULTANT shall be entitled to rely upon the accuracy of data and information collected and provided by the City and others without independent review or verification. However, any discrepancies discovered by the CONSULTANT will be brought to the immediate attention of the City.

2. During the course of the Project, the City may request additional services from the CONSULTANT. Additional services shall be provided as mutually agreed between the City and the CONSULTANT.

H. COMPENSATION

For the professional services set forth in this SERVICE AUTHORIZATION, OWNER shall pay the CONSULTANT using a lump sum method of compensation under Article 5.10 of the Agreement using CONSULTANT's Employee Hourly Rate Schedule established in Schedule A of the Agreement. The maximum fee for the services described in the SERVICE AUTHORIZATION shall not exceed **$ 81,480** as listed in the Project Budget unless authorized by the City in writing. A breakdown of the fee per task is

provided below for information only. When executing work, the actual fees per task may vary, however total fee shall not exceed **$ 81,480.**

Project Budget

Task	Fee/Budget
Task 1 – Project Management	$ 8,160
Task 2 – Data Collection	$ 5,152
Task 3 – Estimation of Potable Water Demands	$ 8,350
Task 4 – Hydraulic Model Update	$ 13,057
Task 5 – Hydraulic Model Calibration	$ 36,563
Task 6 – Technical Memorandum	$ 10,198
Total	$ 81,480

Attachment A to this SERVICE AUTHORIZATION provides additional details of the proposed Project Budget. Execution of this SERVICE AUTHORIZATION will serve as the City's authorization.

Certain assumptions have been made in developing the fee for services. To the extent possible, they are stated in this SERVICE AUTHORIZATION. If changes to the work result in changes in the level of effort presented in this SERVICE AUTHORIZATION, the scope of services and professional fees will be revised by mutual agreement.

I. OTHER PROVISIONS

All provisions contained in the Agreement not specifically modified herein shall remain in full force and effect and are incorporated by reference herein.

IN WITNESS WHEREOF, the parties hereto have executed SERVICE AUTHORIZATION No. 03 to be effective as of the date first above written.

CONSULTANT: ***AECOM TECHNICAL SERVICES, INC.***

By:_____
Ronald R. Cavalieri, PE, BCEE
Associate Vice President

Date**:**_____

APPROVED BY:

CITY OF MARCO ISLAND

By:_____
Casey Lucius
Interim City Manager

Date:_____

ATTACHMENT A
Project Budget

Task No.	Description	Personnel							TOTAL			
		Principal / Operations Manager II	Project Manager I	Principal / Operations Manager I (QA/QC)	Project Manager I / Technical Lead	Engineer II / Hydraulic Modeler	Engineer III	Admin Asst II	Hours	ODC	Labor Cost	Total Cost
	Billable Rate ($/hr)	$ 358.00	$ 249.00	$ 351.00	$ 239.00	$ 127.00	$ 169.00	$ 104.00				
1	**Project Management**	**4**	**8**	**-**	**-**	**16**	**-**	**26**	**54**		**$ 8,160**	**$ 8,160**
	Project Management and Administration	4	8	-	-	16	-	26	54		$ 8,160	$ 8,160
2	**Data Collection**	**-**	**-**	**-**	**-**	**16**	**16**	**4**	**36**		**$ 5,152**	**$ 5,152**
	Review and collect existing data	-	-	-	-	16	16	4	36		$ 5,152	$ 5,152
3	**Estimation of Potable Water Demands**	**-**	**4**	**2**	**8**	**32**	**4**	**-**	**50**		**$ 8,350**	**$ 8,350**
	Estimation of annual average daily demands	-	1	-	2	8	4	-	15		$ 2,419	$ 2,419
	Estimation of maximum day demands	-	1	-	2	8	-	-	11		$ 1,743	$ 1,743
	Estimation of peak-hour demands	-	1	1	2	8	-	-	12		$ 2,094	$ 2,094
	Evaluation of diurnal pattern	-	1	1	2	8	-	-	12		$ 2,094	$ 2,094
4	**Hydraulic Model Update**	**-**	**3**	**2**	**16**	**40**	**16**	**-**	**77**		**$ 13,057**	**$ 13,057**
	Hydraulic Model Network Update	-	1	-	8	8	8	-	25		$ 4,529	$ 4,529
	Hydraulic Model Demand Update	-	2	2	8	32	8	-	52		$ 8,528	$ 8,528
5	**Hydraulic Model Calibration**	**-**	**5**	**6**	**10**	**82**	**32**	**-**	**135**		**$ 36,563**	**$ 36,563**
	Field Data Collection Plan	-	2	1	1	8	-	-	12		$ 2,104	$ 2,104
	Field Data Collection	-	1	1	1	24	24	-	51	$ 15,000	$ 7,943	$ 22,943
	Model Calibration	-	2	4	8	50	8	-	72		$ 11,516	$ 11,516
6	**Technical Memorandum**	**2**	**10**	**4**	**4**	**16**	**8**	**12**	**56**		**$ 10,198**	**$ 10,198**
	Draft Technical Memorandum	2	8	2	2	8	4	8	34		$ 6,412	$ 6,412
	Final Technical Memorandum	-	2	2	2	8	4	4	22		$ 3,786	$ 3,786
	TOTAL	**6**	**30**	**14**	**38**	**202**	**76**	**42**	**408**	**$ 15,000**	**$ 81,480**	**$ 81,480**