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November 22, 2023

Mr. Mike Bailey, P.E.  
Public Services Director  
City of Pembroke Pines  
Public Services Department  
Division of Environmental Services  
8300 South Palm Drive  
Pembroke Pines, FL 33025

Subject: Water System Design Evaluations

Dear Mr. Bailey:

The City of Pembroke Pines has requested engineering services from Carollo Engineers, Inc. (CAROLLO) covered under the Continuing Professional Services Agreement between the City of Pembroke Pines and Carollo Engineers, Inc. dated June 26, 2023. As indicated in this agreement the City may request from Carollo from time to time, on an as-needed basis, specific professional engineering and related services for various projects and assignments. At this time, the City wishes to conduct performance and/or feasibility evaluations for the following treatment areas in order to identify improvements to the City's water system:

- Plant Filter Performance Evaluation
- Liquid Ammonia Conversion Evaluation
- Ion Exchange (IX) System Performance Evaluation
- Fletcher Park Monitoring Well Evaluation

### **Scope of Work for Design Evaluations for the Water System**

The scope of services to complete the evaluations, and develop recommendations for facilities improvements requested by the City are as follows:

#### **Task 1 - Project Management**

##### **Task - 1.1 Project Management**

CAROLLO will establish internal project controls to monitor status, budget, staffing, and schedule for the duration of the project. Budget and schedule status will be reviewed by CAROLLO weekly. The project manager will communicate at least monthly, and on an as-needed basis with the City to keep them informed of the project status and to discuss upcoming tasks, deliverables, etc. The project management effort has been combined for all projects to gain some economies and is shown as such.

##### **Task 1.2 - Review Meetings**

CAROLLO will prepare meeting agendas and notes to document discussions, decisions, and work progress. CAROLLO will conduct the following meetings:

- Technical Memorandum (TM) Review Meetings: CAROLLO will attend review meetings after submission of the draft TMs to discuss its findings with City staff and obtain review comments. This effort will also include an interim check-in meeting after the initial review of information and data obtained.

Related Task	Meeting	Assumptions
Project Management	Interim Meeting	Interim check-in meeting after initial information/data review
Plant Filter Evaluation	Draft TM Review	1 hour meeting to review Draft TM
Liquid Ammonia Feasibility Evaluation	Draft TM Review	1 hour meeting to review Draft TM
Ion Exchange (IX) System Evaluation	Draft TM Review	1 hour meeting to review Draft TM
Chloride Monitoring Wells at Fletcher Park	Draft TM Review	1 hour meeting to review Draft TM

**Deliverables:**

- Kick-off Meeting Agenda and minutes
- Task 2-6 Draft TM review meeting notes

## Task 2- PLANT FILTER PERFORMANCE EVALUATION

The City wishes to conduct a comprehensive assessment of its existing filters. The purpose of this study is to determine the existing condition of the filters, evaluate their past performance, and determine what improvements may be needed to maintain efficient filter operation into the future. As part of this work Carollo will also observe the backwash process to identify if there is any cracking or mounding of the media, depth to top of media, level of troughs, and if there are any mudballs present as these are all indicators of filter performance. The approach for performance assessment will include comparison to design intent and equipment specifications, regulations, and industry benchmarks for systems of similar size and age.

### Task 2.1 – REVIEW EXISTING FILTRATION FACILITIES

Carollo will review the historic plant monthly operating data (for a period of up to 2 years) and regulatory permits to assess the existing filters as it pertains to the activities identified. Carollo shall perform an assessment of the existing filtration facilities to include the following:

- Current description of existing filtration facilities
- Tabulation of existing filter facility sizes, depths, plant hydraulics, media types
- Description of filter operations and controls
- Summary of filter performance over time
- Previous filter studies conducted
- Compare filter performance in terms of intended function and capacity as it pertains to meeting the established permitted regulatory criteria and applicable industry standard guidance documentation. This review will include a review of existing equipment shop drawings, record drawings, operations and

maintenance manuals, or equipment nameplates to be field verified to document existing performance criteria.

#### **TASK 2.2 – TECHNICAL MEMORANDUM**

Carollo shall prepare a TM documenting the results of investigations and assessment. The TM will include a summary of water quality challenges, process, and hydraulic system conditions, and make recommendations for filter process enhancements or changes, as well as propose operational and training courses for operators to increase knowledge and experience as it pertains to the challenges identified.

#### **Task 2.3 – FILTER TESTING**

Prior to field testing, Carollo will meet with plant staff to understand filter monitoring, process control strategies and goals for filter operations. Carollo will work with plant staff to collect media samples and analyze turbidity levels at various depths and develop a turbidity profile plot. This effort will be performed on a filter prior to backwashing, then the same filter following a backwash. The information collected will allow Carollo to analyze the effectiveness of filter backwashing and make recommendations for potential improvements.

#### **Deliverables:**

- A draft TM will be prepared documenting the results and findings of Task 2.1, 2.2 and Task 2.3. A draft copy will be issued to the City staff for review. Review comments received from the City will be addressed in writing and a response prepared. Accepted comments will be incorporated into the Final TM.

### **Task 3- LIQUID AMMONIA CONVERSION EVALUATION**

Anhydrous ammonia (gas) is currently added to the treated water along with sodium hypochlorite to create chloramines at the City's water treatment plant. Chloramines are used to provide residual disinfection of the finished water in the distribution system. Gaseous ammonia is stored in pressurized vessels and poses a potential safety risk in the event of a leak. The City wishes evaluate the feasibility of switching from gaseous ammonia to liquid ammonium sulfate which is safer to store and handle at the water treatment plant. The City has requested that Carollo provide engineering services to evaluate this changeover in the type of ammonia used.

#### **Task 3.1 Review of Existing System**

Carollo will review the historic plant monthly operating data (for a period of up to 2 years) and regulatory permits to assess the existing ammonia storage and feed system as it pertains to the activities identified. Carollo shall perform an assessment of the existing ammonia facilities to include the following:

- General description of existing ammonia feed system
- Historical ammonia use and trends tabulations
- Summary of past ammonia feed rates and usage
- Summary of existing ammonia feed system design
- Annual costs of ammonia gas system

- Future ammonia use projections (based on finished water demand projections by City)

### Task 3.2 TECHNICAL MEMORANDUM

Following review of the existing ammonia system, Carollo shall prepare a technical memorandum (TM) to evaluate the feasibility of converting to a liquid ammonia storage and feed system that meets existing operational goals, regulatory requirements, and established criteria. The following items will be reviewed, and the features identified for a liquid ammonia system:

- Design Criteria for liquid ammonia system at WTP
- Conceptual layout and design of liquid ammonia facilities
- Comparison of Gas vs. Liquid Ammonia Systems
- Advantages and Disadvantages of Liquid Ammonia
- Cost comparisons: Gas vs. Liquid Ammonia
- Conceptual construction schedule

The TM will also include a summary of water quality challenges, process system conditions, and make recommendations on the feasibility of conversion to liquid ammonia.

#### Deliverable

A draft TM will be prepared documenting the results and findings of Task 3.1 and 3.2. Draft copy will be issued to the City staff for review. Review comments received from the City will be addressed in writing and a response prepared. Accepted comments will be incorporated into the Final TM.

### Task 4- ION EXCHANGE (IX) SYSTEM PERFORMANCE EVALUATION

The City wishes to assess the performance of the ion-exchange (IX) treatment system at its water plant and has requested a proposal from Carollo to address this project. Carollo previously performed a WTP preliminary process evaluation in 2021 which included the IX system. Since that time there have been changes to the monitoring and control of the IX system with iSCAN equipment and other process improvements at the facility. As a result, the City requests Carollo to review prior project documents, the current operation of the IX system, and recommend improvements (if required) to be designed to improve the operation of the system.

Carollo will review historic plant monthly operating data (for a period not more than 2 years) and regulatory permits to assess the existing IX as it pertains to the activities identified. Review of existing project documents will also be performed. Carollo shall perform an assessment of the existing IX facilities to include the following:

- Status of iSCAN monitoring System installation
- Flow distribution to IX units to provide equal flow split
- Resin analysis to determine useful life remaining
- Overflows of the filter backwash system

- Review of clearwell improvements consisting of new piping as described in the referenced clearwell evaluation report, including a clearwell bypass.

**Deliverables:**

A technical memorandum (TM) will be prepared which will provide a review summary of the reference and operating information, observations based on the identified activities, and recommendations for enhancements. Following submission of the draft TM, a review meeting will be held with the City to discuss the alternatives and accept review comments. A final TM will be prepared and submitted which addresses comments from the meeting and provides a recommendation for the access alternative to be provided.

**Task 5: FLETCHER PARK MONITORING WELL EVALUATION**

There are monitoring wells located at Fletcher Park (FP) adjacent to the water treatment plant that are used to monitor chloride levels in the aquifer. These monitoring wells are located on a public site and City staff has experienced several occurrences of tampering of these monitoring wells. The City is contemplating abandonment and/or relocation of these wells to minimize public exposure and future tampering. It is unclear at this time if the wells are needed for regulatory compliance or if it is a legacy monitoring well.

Carollo will prepare a compilation known information about the existing monitoring wells in the vicinity of Fletcher Park and document the following:

- Identification of existing monitoring wells the vicinity of FP
- Map showing location of wells.
- Tabulation of age, construction methods, and expected condition of subject FP wells
- Review of existing WTP and DIW permits for related monitoring well requirements.
- Chloride data obtained monitoring wells over the past three years.
- Carollo will discuss findings with City staff and assist City in discussions with appropriate regulatory agencies with the recommended approach.
- Review existing sampling/operations data related to iron bacteria and providing recommendations for remediation.

**Deliverable**

A draft letter report will be prepared summarizing the findings of the evaluation and include options for abandonment and/or replacement. After a review meeting with the City, Carollo will incorporate comments and submit a final letter report for City.

**Schedule**

The table below summarizes key project milestones and planned task durations:

Task	Task Name	Duration From NTP
-	Notice-to-Proceed	-
1	Project Management	Duration of project
2	Plant Filter Performance Evaluation	12 weeks
3	Liquid Ammonia Conversion Evaluation	12 weeks
4	Ion Exchange (IX) System Performance Evaluation	8 weeks
5	Fletcher Park Monitoring Well Evaluation	6 weeks

### Method and Amount of Compensation

CONSULTANT agrees to accept as full compensation for the engineering services described herein the amount of \$133,976.00 for all the projects. The fee amount is broken down as follows.

Task Number	Task Name	Fee Amount
1	Project Management (All Projects)	\$23,780.00
2	Plant Filter Performance Evaluation	\$42,268.00
3	Liquid Ammonia Conversion Evaluation	\$35,544.00
4	Ion Exchange (IX) System Performance Evaluation	\$20,168.00
5	Fletcher Park Monitoring Well Evaluation	\$12,216.00
	<b>Total</b>	<b>\$133,976.00</b>

The compensation amount is in accordance with the Engineers' Labor Rates more particularly described in Exhibit "C" of the Agreement. (See the attached level of effort breakdown and other direct costs summary). An amount will be invoiced monthly based on incurred costs in accordance with Exhibit "C" of the Agreement. A breakdown of the hourly, not-to-exceed fee is provided in Attachment "A".

### City Responsibilities and Assumptions

Due to the nature and schedule of this project, certain assumptions apply to this Scope of Services. To the extent possible, these assumptions are stated within this document and are reflected in the budget.

1. If the project task requirements are different from the assumptions presented in this Scope of Services or if the CITY desires additional services, the resultant changes in scope will serve as a basis for amending this project assignment or initiating the development of a new project assignment as agreed upon by both the CITY and CONSULTANT.

- a. CONSULTANT shall be entitled to rely upon the accuracy of information supplied by the CITY without independent review or evaluation.
- b. The schedule provided is based on the timely receipt of the data from CITY.
- c. The CITY shall pay for all fees associated with permitting.
- d. The material terms of the "Agreement for General Consulting Services" supersedes and nullifies any and all assumptions outlined below that are contrary and/or conflict with said terms and conditions in said Agreement:
  - i. CONSULTANT shall perform the services required hereunder in accordance with the prevailing standard of care by exercising the skill and ability ordinarily required of consultants performing the same or similar services, under the same or similar circumstances, in the State of Florida.
  - ii. CONSULTANT makes no warranty that CITY's actual project costs, financial aspects, economic feasibility, schedules, and/or quantities or quality realized will not vary from CONSULTANT's opinions, analyses, projections, or estimates.
  - iii. Documents, including drawings and specifications, prepared by CONSULTANT pursuant to this Service Authorization are not intended or represented to be suitable for reuse by CITY or others for this Project or on any other project. Any reuse of completed documents or use of partially completed documents without written verification or concurrence by CONSULTANT for the specific purpose intended will be at CITY's sole risk and without liability or legal exposure to CONSULTANT.
  - iv. The services to be performed by CONSULTANT are intended solely for the benefit of the CITY. No person or entity not a signatory to this Service Authorization shall be entitled to rely on CONSULTANT's performance of its services hereunder, and no right to assert a claim against CONSULTANT by assignment of indemnity rights or otherwise shall accrue to a third party as a result of this Service Authorization or the performance of CONSULTANT's services hereunder.

We stand ready to discuss any questions you may have regarding these proposals and look forward to working with you.

Sincerely,  
CAROLLO ENGINEERS, INC.



Bob Ortiz, PE  
Vice-President

Tung Nguyen, PE, PMP  
Principal Water Engineer

c: Tung Nguyen  
Enclosures: Attachment "A" – Project Fees Breakdown

Mr. Michael Bailey, PE  
City of Pembroke Pines  
November 22, 2023  
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**ATTACHMENT "A"**

**PROJECT FEES BREAKDOWN**

City of Pembroke Pines  
Water System Evaluations  
Fee Estimate

Task Description		Labor Hours and Cost												
		Corporate Officer	Corporate Officer	QAQC/Technical Advisor	Project Manager	Lead Engineer	Staff Engineer	Sr. Engineer	CADD Designer	Clerical/Administrative	Total Hours	Labor Cost	Expense	Total Cost
		Ortiz	Hart	Reinbold	Nguyen	Boaz	Bell	Torres	Lead	Woody				
		\$330.00	\$330.00	\$288.00	\$252.00	\$191.00	\$126.00	\$218.00	\$175.00	\$108.00				
<b>1</b>	<b>PROJECT MANAGEMENT</b>	10	0	5	60	16	0	0	0	8	99	\$23,780.00	\$0.00	\$23,780.00
1.1	Project Management, Reporting, Contract Administration	6		1	52					8	67	\$16,236.00	\$0.00	\$16,236.00
1.2	Interim Meeting	4		4	8	16					32	\$7,544.00	\$0.00	\$7,544.00
											0	\$0.00	\$0.00	\$0.00
<b>2</b>	<b>PLANT FILTER PERFORMANCE EVALUATION</b>	0	0	24	60	0	104	6	16	28	238	\$42,268.00	\$0.00	\$42,268.00
2.1	Evaluation of Existing System			4	20		52			4	80	\$13,176.00	\$0.00	\$13,176.00
2.2	Technical Memorandum			12	24		36	6	16	24	118	\$20,740.00	\$0.00	\$20,740.00
2.3	Filter Testing and Data Evaluation			8	16		16				40	\$8,352.00	\$0.00	\$8,352.00
											0	\$0.00	\$0.00	\$0.00
<b>3</b>	<b>LIQUID AMMONIA CONVERSTION EVALUATION</b>	0	12	0	16	40	80	8	24	36	216	\$35,544.00	\$0.00	\$35,544.00
3.1	Evaluation of Existing System		4		8	16	24			4	56	\$9,848.00	\$0.00	\$9,848.00
3.2	Technical Memorandum		8		8	24	56	8	24	32	160	\$25,696.00	\$0.00	\$25,696.00
											0	\$0.00	\$0.00	\$0.00
											0	\$0.00	\$0.00	\$0.00
											0	\$0.00	\$0.00	\$0.00
<b>4</b>	<b>ION EXCHANGE (IX) SYSTEM PERFORMANCE EVALUATION</b>	0	0	12	8	40	56	0	0	0	116	\$20,168.00	\$0.00	\$20,168.00
4.1	Technical Memorandum			4		16	32				52	\$8,240.00	\$0.00	\$8,240.00
	System Performane Evaluation			8	8	24	24				64	\$11,928.00	\$0.00	\$11,928.00
											0	\$0.00	\$0.00	\$0.00
											0	\$0.00	\$0.00	\$0.00
<b>5</b>	<b>FLETCHER PARK MONITORING WELL EVALUATION</b>	0	0	4	8	24	32	0	0	4	72	\$12,216.00	\$0.00	\$12,216.00
5.1	Letter Report			4	8	24	16			4	56	\$10,200.00	\$0.00	\$10,200.00
	Data review						16				16	\$2,016.00	\$0.00	\$2,016.00
											0	\$0.00	\$0.00	\$0.00
											741			
	<b>TOTAL HOURS</b>	10	12	45	152	120	272	14	40	76				
	<b>TOTAL COST</b>	\$3,300.00	\$3,960.00	\$12,960.00	\$38,304.00	\$22,920.00	\$34,272.00	\$3,052.00	\$7,000.00	\$8,208.00		\$133,976.00	\$0.00	\$133,976.00