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January 14, 2026

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

**Re: Pembroke Pines Water Treatment Plant
PSUT-25-06 WTP Eng Services for Ion Exchange (IX) PFAS Removal – Phase 1**

Dear Mr. Welch:

As requested, Hazen and Sawyer, D.P.C. (Hazen) is pleased to offer professional engineering services for the pilot testing, preliminary design, detailed design, permitting and bidding for the new PFAS Removal Ion Exchange (IX) facility and other improvements at the City of Pembroke Pines (City) Water Treatment Plant (WTP).

Background

The City of Pembroke Pines owns and operates a series of public water supply wells and treats Biscayne Aquifer water through lime softening with regenerable fixed-bed ion exchange (FIX), capable of reducing regulated contaminants to below US EPA regulatory limits. Per- and polyfluoroalkyl substances (PFAS) have recently been detected in the City's wells. PFAS are a group of manufactured chemicals used to make coatings that resist heat, oils, stains, grease, and water. Throughout production and use, PFAS can migrate into soil and water, eventually entering drinking water sources. PFAS do not break down naturally in the environment, making them a persistent contaminant that can accumulate over time.

US EPA regulations, promulgated in April 2024, require those compounds be removed below regulatory limits of four (4) parts per trillion prior to March 2029. However, on May 14, 2025, EPA announced its intent to extend the compliance deadline to year 2031 for PFOA and PFOS. The City's existing lime softening WTP cannot remove these contaminants. The City will require a change in treatment at the WTP to meet these new regulations. Based on the Technical Memorandum *PFAS Treatment Feasibility Evaluation* (Carollo, March 2025) provided as part of the Request for Qualifications, a non-regenerable IX treatment is recommended.

The City has requested the services of Hazen to perform planning, pilot testing, design, permitting and bidding assistance for a new 18 million gallon per day (MGD) non-regenerable IX PFAS removal facility. This project is intentionally phased with this work authorization as the first of sequential work authorizations for this project. The Design Services for Construction will be authorized under a separate work authorization.



Under this effort, Hazen will also provide engineering services for additional WTP improvements as noted below:

- Expansion of the existing regenerable FIX system from 12 to 18 MGD
- Four-log disinfection improvements and certification through Florida Department of Environmental Protection (FDEP) for modified WTP
- Replacement and/or retrofitting of filter and backwash recovery system valves to facilitate automated operation
- Site boundary screening as required for proposed and existing treatment processes along select boundaries
- Perform review of IX resin suppliers, assess disposal capabilities, and provide a cost evaluation of related products

The scope of services for this work is described herein.

Scope of Services

Task 1 – Project Kickoff, Data Collection and Progress Meetings

Subtask 1.1: Kickoff Meeting

Hazen will conduct and lead a kickoff meeting with City staff within two weeks from receipt of Notice to Proceed. The purpose of this task is to discuss the overall workplan and schedule and identify project protocols, establish coordination between Hazen and City staff, and collect any additional available documents from the City. Prior to the meeting, Hazen will provide City with a list of required data, including the information listed below. The City will provide Hazen with required data within four weeks of receipt of the data request.

Deliverables:

- Hazen will prepare an agenda prior to the meeting and electronically distribute meeting minutes following the meeting.

Subtask 1.2: Data Collection

Hazen will request data from City for review. City will provide pertinent data in electronic format (where possible). Data request will include, but not be limited to the following:

- All available PFAS data
- Raw water quality data for 2020 to current (including monthly and annual analyses)
- Monthly WTP operating reports for 2020 to current



- Lead and Copper Rule (LCR) compliance data for 2020 to current
- Map that illustrates the locations that City samples for compliance with LCR for lead and copper and water quality parameters (WQPs).
- Copy of the CITY's Lead and Copper Rule (LCR) sampling plan that has been approved by the FDEP.
- Geographical Information System (GIS) shape files or geodatabase of the water distribution system
- Water distribution system Supervisory Control and Data Acquisition (SCADA) pressure data (if available)
- WTP Daily operational logs
- WTP record drawings, including process flow diagrams and site layouts
- Onsite lift station record drawings and operation data
- Pump Curve for the existing WTP sanitary lift station
- Pump Curve for FIX transfer pumps
- Wellfield Operating Plan
- Chemical usage data (polyphosphate, ammonia, chlorine) and current chemical injection points
- Current corrosion control strategy and related data
- Current disinfection strategy and related data
- Filter operational data for 2020 to current
- FIX system operation data for 2020 to current
- Previous Four-Log Virus Certification reports and permit application documents prepared by others, including bench scale studies for breakpoint chlorination
- Data collected for Disinfection By-Products Rule (DBPR) compliance. Provide copies of completed reports in Form 62-550.822/40CFR141.629 titled "STAGE 2 TOTAL TRIHALOMETHANES (TTHM) AND HALOACETIC ACIDS FIVE (HAA5) REPORT"
- Overall site plan depicting location of raw water wells and WTP
- Recent geotechnical reports for the WTP site
- South Florida Water Management District (SFWMD) Stormwater Permit
- 2025 Water Supply Facilities Work Plan Update
- Copy of all WTP Permits
- WTP O&M Manual (written by the design engineer) that provides existing plant design criteria



Hazen will review and assimilate these data for use on this project.

Deliverables:

- Data Request Log: Hazen will prepare and electronically issue a data request log in the form of an Excel spreadsheet.
- Data Request Log Updates: Hazen will issue periodic updates to the data request log; updates will document status of each data request item.

Subtask 1.3: Progress Meetings

Hazen will perform the following Project Progress Meeting activities:

- Prepare project meeting presentation materials that reflect project development, pilot performance updates, items that require decisions and “next steps”.
- Prepare monthly Project Progress Meeting Agenda/Summaries.

Deliverables:

- Monthly Project Agenda/Summaries
- Monthly Project Meeting Materials

Subtask 1.4: Commission Meetings

Hazen will participate in City Commission Meetings as required to provide project updates and highlight key issues and progress. Hazen will develop materials, including PowerPoint presentation for use with the City Commission meetings. Hazen will document key decisions and actions arising from each meeting.

Deliverables:

- Hazen will prepare PowerPoint presentation slides.
- Hazen will prepare and electronically distribute summary notes following the meetings.

Task 2 – Planning and Evaluation

This task will guide decisions regarding full scale implementation of a PFAS IX treatment system. The objectives are to identify optimal PFAS IX resin for the City, recommend ways to enhance its performance, and assess how total organic carbon (TOC) levels affect resin efficiency. TOC levels may be a major driver of PFAS IX performance. Hazen will also evaluate integration with current plant processes, including disinfection strategy and polyphosphate dosing. As with any major treatment change, a comprehensive assessment will ensure the PFAS IX resin does not adversely impact downstream treatment, water quality (such as DBPs), or distribution system corrosion control. Hazen will review historical water data and supplement it with new field samples, conduct PFAS piloting and corrosion evaluation, and work with City stakeholders to recommend a final treatment approach.

Hazen will evaluate the City's current corrosion control, water quality, and disinfection to establish baseline criteria that will be used as a benchmark for implementing PFAS IX treatment.

Subtask 2.1: Water Quality Analysis and Field Sampling

2.1.1 Summarize Historical Data

Hazen will review and summarize the City's PFAS data, major WTP summary raw and finished water quality parameters, and WTP flow data collected in Subtask 1.2 and identify any water quality data gaps.

2.1.2 Additional Field Sampling

Hazen will develop a Water Quality Sampling Plan (WQSP) which outlines our approach to perform water quality sampling events at the City's WTP. The WQSP will facilitate robust data collection and analysis from multiple locations within the treatment process to support operational and regulatory objectives. It is anticipated that Hazen will perform up to six (6) sampling events at the WTP. Sampling will be conducted at several points within the City's WTP, including:

- Combined raw water from Central and Eastern Wellfield
- Combined filter effluent
- Post regenerable FIX
- Post disinfection clearwell
- Point of Entry (POE) to distribution system

Hazen will collect samples for laboratory analyses of PFAS, TOC, alkalinity, hardness, anions, cations, bacteria, and total dissolved solids (TDS). Hazen will also perform field analyses of pH, chlorine, total chlorine, and chloramines.

Hazen will participate in a review meeting with City to receive and discuss City's review comments for the draft WQSP. Comments received from City will be incorporated into the final version of the WQSP.

In accordance with the approved WQSP, Hazen staff will collect samples from each location using appropriate sampling techniques. Samples will be properly labeled and documented, including date, time and location of collection. Hazen will use an accredited laboratory with expertise in water quality analysis to conduct the testing of the collected samples. All testing methods will comply with EPA-approved or state-certified standards and guidelines.

Once received, Hazen will compile and analyze the water quality field data. Hazen will summarize the findings of the historical water quality analysis and additional field sampling in a Water Quality Technical Memorandum (TM). This information will be used to determine the overall water quality of the existing treatment processes and inform design criteria for adsorptive media treatment systems. Hazen will

participate in a review meeting with City to receive and discuss City's review comments for the draft TM. Comments received from City will be incorporated into the final version of the TM. All deliverables will be electronically issued in PDF format.

Deliverables:

- Draft Water Quality Sampling Plan
- Final Water Quality Sampling Plan
- Draft Water Quality TM
- Final Water Quality TM
- Meetings: Hazen will prepare and electronically distribute summary notes following the review meetings.

Assumptions:

- City staff will provide access and operational support as needed during sample collection.
- Hazen will coordinate sampling events with City staff to minimize operational disruptions and ensure representative sampling under various treatment conditions.

Subtask 2.2: Pilot Study

2.2.1 PFAS Pilot Testing Planning

Hazen will develop a Pilot Testing Plan to evaluate the performance of adsorptive media in a column configuration that assesses treatment longevity of PFAS removal from the City's raw water. The plan will outline objectives, equipment, column design, startup, sampling, and operating conditions. It will also address possible TOC pretreatment using a regenerable FIX resin, similar to that currently used at the WTP.

During pilot coordination, it will be evaluated whether flows from the current full-scale FIX treatment system can be diverted to the pilot setup for blending and testing as part of the TOC pretreatment piloting configuration. If this is not feasible, a separate pilot skid with regenerable TOC resins will be acquired to simulate the full-scale FIX system, blending TOC at levels suitable for PFAS resin treatment.

The plan outlines roles, responsibilities, coordination, contacts, schedule, milestones, and scope for WTP pilot testing. It will guide the core team for efficient execution and serve as the official pilot testing plan, summarizing objectives, investigations, and schedule. A summary of items to be included:

- Project background
- Water quality and operational goals
- Equipment description with associated connections, sizes and process flow schematics

- Pilot testing investigations and schedule
- Pilot testing site plan / layout
- Routine and startup sampling events
- Quality assurance plan
- Safety plan (incl. site access, chemical handling & storage requirements, and emergency response plan)

A QA/QC plan will be provided in the Pilot Testing Plan and will include a summary of key sampling and standard operating procedures (SOPs) and will outline measures taken to provide quality control during the study. Typical measures include scheduled review of operational and data trends by experienced staff, scheduled calibration of water quality instruments, scheduled operational and maintenance (O&M) activities, and scheduled laboratory analysis to verify data from onsite instruments.

Hazen will participate in a review meeting with City to receive and discuss City's review comments for the draft Pilot Testing Plan. Comments received from City will be incorporated into the final version of the Pilot Testing Plan. All deliverables will be issued electronically in PDF format.

Deliverables:

- Draft Pilot Testing Plan
- Final Pilot Testing Plan
- Meetings: Hazen will prepare and electronically distribute summary notes following the review meeting.

2.2.2 Pilot Testing System Design

Hazen will develop the functional design for the pilot testing system through sketches, flow diagrams, and specification notes detailing the pilot skids needed for PFAS adsorption and possibly TOC pretreatment using FIX. Hazen will assess the hydraulics of the pilot system and design the necessary piping, flow controls, and pump requirements. The functional design will cover all major process components required for the proposed systems, such as tanks, pumps, column skids, and more. During the pilot period, it is anticipated that an adsorption testing skid, and potentially a FIX removal skid, will be used.

The following are the assumed components included in the facility design:

- Mixing and Flow Control Tank
- Pre-filters (cartridge filters)
- Filter Feed Flow Control Tank

- Adsorption Racks (six adsorption columns to test multiple PFAS specific IX with and without FIX TOC pretreatment, and with and without dechlorination)
- Chemical Feed Systems (dechlorination)
- Electrical (coordination / relevant data for City's use to provide power)
- Limited essential I&C

Hazen will procure materials to build a six-column PFAS IX adsorption treatment system and one FIX TOC pretreatment system, along with other pretreatment equipment and ancillary equipment needed for the pilot testing investigations.

2.2.3 Construction and Startup of Pilot Testing Systems

Upon delivery, Hazen will install the PFAS IX skid and FIX TOC pretreatment skids and associated auxiliary equipment at the WTP and with assistance from City set-up the equipment and piping to transfer feed water from appropriate locations within each treatment train. In Hazen's experience, permits are not typically required for this type of testing.

- Pilot skids including PFAS IX skid and FIX TOC pretreatment skids and associated auxiliary equipment

System startup and field acceptance testing will be performed to establish baseline performance data and procedures prior to beginning the first investigation.

Hazen will construct the adsorption pilot and necessary connections to both adsorption and TOC pilots. At the end of the pilot testing, Hazen will coordinate decommission of the pilot materials and facilitate site removal or equipment storage.

Deliverables:

- Delivered as part of pilot testing plan in **Subtask 2.2.1: Pilot operation design documentation**

City Responsibilities:

- Provide electrical power to the site for pilot testing
- Provide potable water connection
- Provide liquid waste disposal location
- Access to WTP for pilot testing
- Review deliverables

2.2.4 WTP Pilot Testing

Hazen will conduct pilot testing to assess performance of column testing for evaluation of the best performing adsorptive media based on preliminary results. The scope under this subtask includes the following:

Field Operation

Hazen shall operate the adsorption pilot system and potential TOC pretreatment pilot system at the WTP. The goal of adsorption testing will be to evaluate the number of bed volumes processed before PFAS breakthrough of promising adsorbents occurs. Pilot adsorption columns will be operated for the planned nine (9) months testing period, or until a predetermined breakthrough goal is met. Adsorption column testing will focus primarily on the time to PFAS breakthrough for promising media but will also consider ancillary effects on water quality particularly during initial adsorbent startup. Hazen shall operate and maintain the TOC pretreatment unit to effectively reduce the effluent TOC to a predetermined concentration, most likely 1 mg/L. Hazen shall maintain the TOC pretreatment pilot operation by conducting frequent IX regeneration and backwashing, such that the effluent TOC is relatively stable. It is anticipated that weekly regenerations will be required.

One part-time (25%) Hazen staff member will support field operations for the pilot unit, handling operations, system adjustments based on test results, and minimal maintenance. The pilot system will follow the established protocol in the Pilot Plan but may be adjusted as needed to meet objectives and City requirements, provided that changes to test days, systems, or conditions do not exceed the approved scope.

Water Quality and Data Analyses

Some water quality analyses (e.g., pH, turbidity, etc.) will be conducted onsite to minimize costs. Additional sampling and laboratory analysis will be conducted as scheduled to document performance of the systems to meet the treated water quality goals established in the testing protocol. A sampling and data acquisition plan will be provided in the Pilot Testing Plan prepared under **Subtask 2.2.1**.

Pilot Performance Updates and Coordination Meetings

Hazen will provide pilot status updates during the Project monthly meeting (**Subtask 1.3**) and will incorporate piloting needs and testing updates throughout the duration of the piloting phase.

Deliverables:

- Operation pilot testing systems, document activities in daily reports.
- Summary Table of Water Quality Results

Subtask 2.3: Life Cycle Cost of PFAS Treatment

Based on the results of PFAS adsorption pilot including TOC pretreatment considerations, Hazen will develop a comparative life-cycle performance and cost evaluation for implementation of the technologies (including TOC pretreatment) at the WTP to address PFAS removal.

Additionally, Hazen will utilize pilot testing results to define design parameters to size treatment systems at the WTP. This information will be utilized to develop conceptual level design layouts, including site plans, preliminary hydraulic profiles, and equipment cut sheets for PFAS treatment approaches. Equipment siting concepts will be reviewed with the City's staff to understand constraints and feasibility of locating PFAS treatment equipment on the plant site.

In recognition of the challenging water quality and PFAS concentrations at the WTP, the life cycle cost and feasibility assessment will focus on the identification and evaluation of various treatment scenarios, including:

- Full plant PFAS treatment (up to 18 MGD) with partial treatment of TOC to reduce TOC loading prior to PFAS treatment via IX
- Treating all flow for TOC prior to PFAS IX treatment (18 MGD).

During the pilot test operations, waste flow will be monitored from adsorption pilot equipment to determine the impacts of waste production and disposal on any future project. This will include potential impacts to the wastewater plant or other residuals handling systems.

Hazen will prepare a TM to summarize the findings of this evaluation. The TM will include summary table of life cycle costs (capital and O&M), design parameters for full scale treatment, conceptual level IX system site layouts and system hydraulic profile. Hazen will participate in a review meeting with City to receive and discuss City's review comments for the draft TM. Comments received from City will be incorporated into the final version of the TM. All deliverables will be electronically issued in PDF format.

Deliverables:

- Draft Life Cycle Cost Evaluation TM
- Final Life Cycle Cost Evaluation TM
- Meetings: Hazen will prepare and electronically distribute summary notes following the review meeting.

Subtask 2.4: Spent IX Disposal

Options and costs associated with disposal of spent media and/or IX regenerant brine disposal for TOC resins will be included in this analysis. Hazen will review IX resin disposal alternatives for multiple resin providers (including landfilling/incineration options and locations for disposal) to ensure that the selected disposal outlet is suitable for long term residuals management. Investigation of IX regenerant management derived from the TOC IX resin will also be included to evaluate if further treatment may be required in the future based on current residuals disposal practices.

Hazen will prepare a TM to summarize IX Disposal Options for both single-use PFAS IX resins and TOC IX regenerant brine. Hazen will participate in a review meeting with City to receive and discuss City's



review comments for the draft TM. Comments received from City will be incorporated into the final version of the TM. All deliverables will be electronically issued in PDF format.

Deliverables:

- Draft IX Disposal TM
- Final IX Disposal TM
- Meetings: Hazen will prepare and electronically distribute summary notes following the review meeting.

Subtask 2.5: Multi-criteria Design Analysis (MCDA) for PFAS Treatment Configurations

Upon completion of pilot testing, an assessment of tested and alternative options will be developed, focused on direct comparison of cost- and non-cost factors, to facilitate technology selection. To accomplish this, Hazen will leverage cost estimates developed from pilot testing and the alternatives feasibility assessment and utilize a MCDA framework for consideration of non-cost factors. Tools used to facilitate the MCDA will ensure collaborative evaluation of alternatives across various decision-making criteria. Specifically designed tools for facilitating a comprehensive and transparent alternatives comparison process will be utilized, based on quantitative performance metrics for alternatives factoring in City's priorities.

The transparent alternatives evaluation approach will be outlined as follows:

- Evaluate performance of alternative approaches for meeting PFAS MCLs. Eliminate any options that cannot reliably attain compliance from future consideration.
- Compare cost estimates for all remaining alternatives (developed under Task X.4.7). Eliminate any options that are infeasible based on capital or life-cycle cost.
- Use MCDA tool to develop “benefit scores” for remaining options by developing quantitative performance metrics for alternatives based on the City’s priorities. Eliminate any options that do not exceed a minimum feasible benefit score.
- Generate benefit to cost ratios as the ratio of benefit score to cost, and rank options according to City’s priorities.

A workshop will be held with City staff to develop a framework for the benefits assessment. As the benefits of the alternative approaches are inherently specific to the City’s priorities, it is critically important to receive input on criteria development, weighting and scoring of benefits associated with each PFAS treatment or management approach. This workshop will be held with various stakeholders within the City (i.e. operations, management, water supply) to define and weight the decisive criteria for the alternatives analysis. An additional follow-up workshop with all stakeholders present will be held to review results of the multi-criteria decision analysis to define the utility-wide priorities. All deliverables will be issued electronically in PDF format.

Deliverables:

- Draft Multi-Criteria Decision Analysis TM
- Draft Multi-Criteria Decision Analysis TM
- Meetings: Hazen will prepare and electronically distribute summary notes following the review workshops.

Subtask 2.6: Pilot Study Evaluation Report

Upon completion of pilot testing efforts and the treatment alternatives evaluation, a Pilot Study Evaluation Report will be developed. The report will summarize findings from Subtasks 2.2 through 2.5, including pilot testing efforts, alternatives evaluation, life cycle cost and feasibility, and the MCDA. It will also provide recommendations and conclusions for a holistic PFAS Treatment strategy to ensure compliance.

Hazen will participate in a review meeting with City to receive and discuss City's review comments for the draft Pilot Study Evaluation Report. Comments received from City will be incorporated into the final version of the Pilot Study Evaluation Report. All deliverables will be issued electronically in PDF format.

Deliverables:

- Draft Pilot Study Evaluation Report
- Final Pilot Study Evaluation Report
- Meetings: Hazen will prepare and electronically distribute summary notes following the review meeting.

Subtask 2.7: Desktop Evaluation to Assess Phosphate Effectiveness

The City currently doses polyphosphate into the lime-softened water before filtration to prevent calcification in the filters and for corrosion control. The City desires to optimize this process and has requested Hazen to conduct a desktop evaluation of polyphosphate effectiveness at the WTP. The City has indicated that the current polyphosphate feed system serves only Filters 1-2. This will allow for a desktop evaluation of filter run times and effluent turbidity to provide a direct comparison of filter performance with and without polyphosphate dosing.

Hazen will review daily operational logs, MORs, available SCADA data, as well as historical finished water quality data, filter operational data and polyphosphate usage. Data request submitted under **Subtask 1.2**.

As part of Subtask 2.8, Hazen will analyze the impacts of completely removing polyphosphate after lime softening but before filtration. If continued use is required, Hazen will recommend relocating the injection point and adjusting dosage. If removal is feasible, Hazen will draft a Polyphosphate Testing Plan outlining the removal process and water quality monitoring. Upon plan approval, Hazen will conduct full-scale testing, including measuring of total phosphate and orthophosphate level at multiple stages in the process:

- Before and after the phosphate chemical addition point but prior to filtration,
- After filtration (and before IX treatment),

- Point of entry to measure total phosphate and orthophosphate level

Hazen will summarize findings and recommendations in a TM, addressing phosphate optimization, application point changes, or discontinuation. Results from **Subtask 2.8** will inform final recommendations. Hazen will participate in a review meeting with City to receive and discuss City's review comments for the draft TM. Comments received from City will be incorporated into the final version of the TM. All deliverables will be issued electronically in PDF format.

Deliverables:

- Draft Phosphate Evaluation TM
- Draft Phosphate Evaluation TM
- Meetings: Hazen will prepare and electronically distribute summary notes following the review workshops.

Subtask 2.8: Water Stabilization Desktop Evaluation and Corrosion Control

Implementation of the IX PFAS treatment system is anticipated to affect finished water quality, potentially impacting distribution system water quality and corrosion control measures. Prior studies suggest that any changes will be relatively short-lived, however, it is essential to evaluate these effects due to their largely site specific nature.

2.8.1 Corrosion Control Desktop Study

Hazen will conduct a Corrosion Control Desktop Study that evaluates water stability and the proposed treatment modifications as described herein. This evaluation is a necessary step in assessing the existing conditions of corrosion control, predicting the effects of treatment changes on corrosion control, and reviewing the effectiveness of various corrosion control strategies. Hazen will submit a data request to the City that outlines the historical data and information needed for the study.

The objectives of the Corrosion Control Desktop Study are as follows:

- Assess current water chemistry at the point of entry and within representative locations across the distribution system, considering factors such as pressure zones and water age
- Identify sources of lead and copper
- Determine additional materials in the distribution system that may be susceptible to degradation
- Evaluate historical treatment practices, including corrosion control measures and water quality data, with respect to corrosion and metals release
- Review relevant and applicable corrosion control materials

- Review relevant material in the technical literature regarding treated water quality associated with IX treatment approach
- Examine IX PFAS treatment data from the CITY's PFAS reduction pilot study

The Corrosion Control Desktop Study will assess how the future IX water treatment process may affect distribution system conditions, including the corrosivity of treated water to lead, copper, and other materials. As the first phase in evaluating corrosion control treatment, the study will inform potential future testing and decisions for optimization and IX plant start-up. It will compare current baseline water quality to projected future conditions with the IX process for PFAS reduction, using pilot data.

The desktop study will be informed by field sampling as follows:

- Distribution System Water Quality Sampling: Distribution water sampling will be performed by Hazen to establish a baseline for the corrosion study. Up to 10 locations within the distribution system including point of entry will be sampled. The locations selected for sampling will reflect the system's material make-up, pressure zones, and other considerations.
- Sampling Plan: A sampling plan will be prepared that defines the following:
 - Frequency of sampling (monthly sampling is anticipated)
 - Duration of sampling program (six months is anticipated)
 - Parameters that will be measured. Analytes to be considered include inorganic parameters (Fe, Mn, Ca, Si, S, P (total), and others), wet chemistry (alkalinity, chloride, orthophosphate, free ammonia), pH, temperature, ORP, and total chlorine.

This effort will identify to what level phosphate enter the distribution system, and more specifically whether significant levels of orthophosphate are important with respect to corrosion control. Investigations performed under Subtask 2.7, will be conducted concurrently with the distribution system monitoring program.

Hazen will summarize the results of the desktop evaluation in an TM. Hazen will participate in a review meeting with City to receive and discuss City's review comments for both the draft Corrosion Control Desktop Study TM and Distribution System Water Quality Sampling Plan. Comments received from City will be incorporated into the final version of the TM and Sampling Plan. All deliverables will be issued electronically in PDF format.

Deliverables:

- Draft Corrosion Control Desktop Study TM
- Final Corrosion Control Desktop Study TM
- Draft Distribution System Water Quality Sampling Plan
- Final Distribution System Water Quality Sampling Plan



- Meetings: Hazen will prepare and electronically distribute summary notes following the review meetings.

2.8.2 Distribution System Materials Scale Analysis (Optional)

Hazen will assess distribution system scale to better understand corrosion control and predict treatment impacts, especially if phosphate is present. Over time, deposits and corrosion by-product scale layers develop on the interior of distribution pipes and drinking water service lines. Analyzing pipe deposits and corrosion scale—such as their composition and structure—will help optimize corrosion control strategies.

Hazen will develop a Pipe Harvesting Plan that outlines where pipes will be collected and includes preservation protocols for the harvested pipes. The Plan will include:

- Define locations within the distribution system to target pipe harvesting. The locations will be selected based on available distribution system material data along with locations identified for tap sampling in homes.
- Protocol for harvesting pipe and preserving the harvested pipe.
- Identification of laboratory that harvested pipe will be shipped to.
- Description of laboratory analyses to be performed on the pipe samples.

The solids to be analyzed may consist of copper pipes, copper pipes with leaded solder, galvanized iron pipes, and cement-lined pipes, depending on what is available. Up to four pipe samples will be collected for scale analysis, with each sample expected to be about three feet in length. Whenever possible, pipes should be taken from locations where baseline tap sampling was performed to help correlate lead levels with scale characteristics.

Hazen will prepare a TM to summarize the results of the scale analysis which will assist in evaluating corrosion control treatment alternatives. Hazen will participate in a review meeting with City to receive and discuss City's review comments for the draft Pipe Harvesting Plan and TM. Comments received from City will be incorporated into the final version of the Plan and TM. All deliverables will be issued electronically in PDF format.

Deliverables:

- Draft Pipe Harvesting Plan
- Final Pipe Harvesting Plan
- Draft Pipe Scale Analysis TM
- Final Pipe Scale Analysis TM
- Laboratory Coordination and Costs: CONSULTANT will perform all necessary coordination with the laboratory selected for scale analysis. CONSULTANT's fee includes reimbursables for payment of laboratory analyses.

- Meeting: Hazen will prepare and electronically distribute summary notes following the review meetings.

City's Responsibilities:

The City will work with Hazen to identify pipes extraction locations. The City will be responsible for extracting pipes from premise plumbing locations and shipping to Hazen according to procedures provided by Hazen.

2.8.3 Post IX Plant Startup Water Quality Sampling Plan

Hazen will provide a Post IX Plant Startup Water Quality Sampling Plan. The plan will be in the form of a memorandum. The Post IX Plant Startup Water Quality Sampling Plan will recommend distribution system sampling after start-up of the new treatment process. The data collected from executing the Post IX Plant Startup Water Quality Sampling Plan would provide distribution system water quality that can be compared to data collected during the desktop evaluation period. The data following the treatment change can provide valuable insight into operational adjustments of the IX plant. Furthermore, the data would allow the City to identify unintended treatment change consequences and address them accordingly in a timely manner. The City is responsible for the execution of the Post IX Plant Startup Water Quality Sampling Plan.

Hazen will participate in a review meeting with City to receive and discuss City's review comments for the draft IX Startup Water Quality Sampling Plan. Comments received from City will be incorporated into the final version of the Plan. All deliverables will be issued electronically in PDF format.

Deliverables:

- Draft Post IX Plant Startup Water Quality Sampling Plan
- Final Post IX Plant Startup Water Quality Sampling Plan
- Meeting: Hazen will prepare and electronically distribute summary notes following the review meetings.

Subtask 2.9: Ground-Water Rule Four-Log Virus Treatment Evaluation

The City currently complies with the Ground-Water Rule (GWR) by following the Triggered Source Water Monitoring track. The GWR was adopted and incorporated by reference into Rule 62-550.828, Florida Administrative Code (FAC). The City desires that its WTP become certified by the Florida Department of Environmental Protection (FDEP) as achieving four-log (99.99%) virus treatment prior to the first consumer.

The City reported it submitted documentation to obtain four-log virus treatment certification in 2010. The application documents provided to Hazen for that effort are incomplete. The City did not obtain four-log certification. Based on the available documentation it appears that the 2010 application was for disinfection credit using free chlorine through the clearwell. However, it appears that the City's application was not approved due to the presence of chloramine residual.

Free ammonia is naturally occurring in the Biscayne Aquifer. The City's Master Plan (Task 2.4.2 Hydraulic / Process Review TM, Table 3) indicates that free ammonia ranges from 0.19 to 1.96 mg/L as NH₃-N. Under the GWR, disinfection credit for four-log virus treatment cannot be obtained if free ammonia is present in the water supply. To obtain disinfection credit for four-log virus treatment the City must first remove the raw water ammonia via breakpoint chlorination. The City can then obtain disinfection credit for four-log virus treatment through either free chlorine residual or monochloramine residual.

The City's current disinfection practice is to combine chlorine (in the form of sodium hypochlorite) with ammonia (in the form of anhydrous ammonia) in the clearwell at a ratio to form stable monochloramine. The City wants the WTP to be certified for four-log virus treatment following construction of the improvements needed for PFAS treatment. The following outlines the approach to four-log virus treatment certification for modified WTP that incorporates the proposed WTP improvements as recommended under Task 2 - Piloting.

Background Raw Water Ammonia Data Collection:

The jar testing described in the next subtask is affected by the concentration of ammonia from each well, the well pumping rate, and which wells are operating to collect water for the jar testing. Consequently, data on the ammonia concentration from each well along with the combined influent ammonia concentration for typical wellfield operating scenarios are required to determine a Jar Testing Plan that is suitable for breakpoint curve development. Under this subtask the following data will be collected:

- City records of measured ammonia concentration at each well (three years of data are desirable)
- City records of measured ammonia concentration at the WTP influent (three years of data are desirable), correlated with which wells were operating during the time the sample was taken
- If the above-described historical water quality information is not available, Hazen will discuss with City a plan for City staff to collect the needed data. City staff will collect and analyze grab samples to generate the required information. Data collected by City will be provided to Hazen in Excel spreadsheet form.

Hazen will compile and analyze the ammonia data to develop a Jar Scale Testing Plan. Hazen will participate in a review meeting with City to receive and discuss City's review comments for the draft Plan. Comments received from City will be incorporated into the final version of the Plan. All deliverables will be electronically issued in PDF format.

Deliverables:

- Draft Bench Scale Testing Plan
- Final Bench Scale Testing Plan
- Meeting: Hazen will prepare and electronically distribute summary notes following the review meeting.

Breakpoint Curve Development:

Raw water jar testing will be performed to develop a breakpoint curve for the combined raw water influent to the WTP. It is noted that multiple breakpoint curves might need to be developed depending on the findings of the subtask titled "Background Raw Water Ammonia Data Collection". Parameters that will be measured include the following:

- Total Ammonia
- Free Ammonia
- Total Chlorine
- Free Chlorine
- Monochloramine
- pH

These data will be used to inform the development of disinfection strategy to remove background raw water ammonia via breakpoint chlorination described in the following subtask.

Four-Log Disinfection Strategy Development:

Up to three disinfection strategies will be evaluated as follows:

1. Strategy 1: Free Chlorine Through Clearwell
 - Breakpoint chlorination to achieve free chlorine
 - Free chlorine through clearwell
 - Compliance monitoring sampling of free chlorine at downstream end of clearwell for disinfection credit using free chlorine
 - Convert to chloramine at discharge of clearwell prior to transfer to storage; relocation of existing ammonia injection point downstream of clearwell
2. Strategy 2: Chloramine Through Clearwells and Storage
 - Breakpoint chlorination to achieve free chlorine
 - Monitoring of free ammonia, total ammonia, free chlorine, monochloramine, and total chlorine prior to ammonia addition proving successful breakpoint
 - Ammonia addition in clearwell to form monochloramine
 - Monochloramine through clearwell and storage tanks
 - Compliance monitoring sampling of monochloramine on the discharge side of high service pumps for disinfection credit using monochloramine
3. Strategy 3: To be determined with City staff

Based on the data collected in the prior subtasks, Hazen will assess the efficacy of relocating chlorine and ammonia injection points, dosages, and sampling points for compliance monitoring to remove raw water ammonia via breakpoint chlorination through the City's existing treatment infrastructure. The goal of this subtask is to assess the feasibility of obtaining two-log free chlorine disinfection credit under the GWR through the existing WTP infrastructure that does not require a major capital improvement project investment.

Furthermore, under this subtask, the chlorine residual compliance monitoring point will be identified. It is assumed that the compliance monitoring point will be sampled and analyzed by a ChemScan UV-2250/S Chloramination Analyzer.

This subtask included the preparation of preliminary four-log virus treatment disinfection calculations. Disinfection calculations shall be based on the methods presented in document titled *Guidelines for Four-Log Virus Treatment for Ground Water* issued by FDEP in October 2009. These calculations will inform if a disinfection strategy utilizing the City's modified infrastructure is feasible.

This scope assumes that the City will use monochloramine as the disinfectant residual in its on-site storage and water distribution system.

WTP DBP Testing:

Free chlorine contact time for disinfection following ammonia oxidation to "breakpoint" has the potential to impact the formation of disinfection byproducts (DBPs). The free chlorine contact time prior to adding ammonia to form monochloramine will be estimated based on operational practice and customer demand. Jar testing shall be performed to simulate a free chlorine disinfection strategy and measure DBPs after the following free chlorine contact times: 0 hour, 1 hour, and every hour thereafter for 8 hours. Hazen will forward samples to an independent certified laboratory to determine total organic carbon (TOC), trihalomethane (THM), and haloacetic acid (HAA) levels.

Simulated Distribution System DBP Testing:

Simulated distribution system tests will be performed to ensure that the free chlorine disinfection strategy does not exceed the limits set by the Disinfection Byproduct Rule. It is assumed that monochloramine will be formed prior to transfer of water to storage and ultimately to the distribution system.

- Prepare samples to achieve a free chlorine residual of 2.5 mg/L after 8 hours of contact time. Then add ammonia to form chloramine.
- Hold samples for three days (or another appropriate period as directed by WTP operations personnel) to simulate detention time in the distribution system and develop simulated DBP samples.
- Forward samples to an independent certified laboratory to determine TOC, THM, and HAA levels.

Deliverables:

- Draft Jar Testing TM

- Final Jar Testing Plan
- Meeting: Hazen will prepare and electronically distribute summary notes following the review meeting.

Hazen will prepare a TM to summarize the results of the Jar Testing, including disinfection strategy to remove background raw water ammonia via breakpoint chlorination and impacts on DBPs. The TM will also document recommended WTP improvements required to achieve four-log virus certification. Hazen will participate in a review meeting with City to receive and discuss City's review comments for the draft TM. Comments received from City will be incorporated into the final version of the TM. All deliverables will be issued electronically in PDF format.

City's Responsibility

- Perform additional wellfield sampling to collect ammonia data, if needed

Four-Log Certification Documents:

If a feasible four-log strategy is identified under the subtask titled "Four-Log Disinfection Strategy Development", then Hazen will apply for Four-Log Virus Certification under Task 5 – Permitting.

Subtask 2.10: Site Development

According to *PFAS Treatment Feasibility Evaluation Technical Memorandum (Carollo, March 2025)*, the recommended location for the new PFAS removal IX treatment facility is a paved area in the southwest corner of the WTP, next to the existing perimeter fence. During a preliminary site walk-through conducted on November 13, City proposed an alternative option to accommodate the proposed PFAS removal IX treatment facilities. This option will require demolition of the existing Utilities Maintenance Building, located east of the existing FIX system, and siting of proposed PFAS removal IX system there.

In addition, a sodium bisulfite system may be required for dechlorination of the FIX treated effluent prior to the PFAS removal IX system. The need for this system will be determined based on results of the pilot testing performed under **Subtask 2.2**. The location and sizing for proposed sodium bisulfite chemical facility has not been determined.

The successful identification of feasible locations for the proposed facilities is crucial for addressing the City's water treatment needs and meeting the project's schedule. The purpose of this task is to perform a detailed review of existing records to evaluate the feasibility of the City's proposed alternative site modification for IX system and identify a location for the proposed bisulfite system. Hazen will provide recommendations that optimize logistical efficiency and minimize impacts to the Project.

Hazen will also perform the following additional tasks:

- Landscaping - evaluate options for site boundary screening as required for proposed and existing treatment processes along the site perimeter.
- Determine requirements for design of stormwater management improvements.

Based on the findings of this evaluation, Hazen will develop a TM, including a preliminary overall site plan and stormwater management plan for submittal to City. Hazen will participate in a site planning workshop with City staff to review and finalize the preliminary overall site plan based on City review comments. All deliverables will be transmitted electronically in PDF format.

Deliverables:

- Draft Site Development TM
- Final Site Development TM
- Meeting: Hazen will prepare and electronically distribute summary notes following the review meetings.

Task 3 – Preliminary Design

Subtask 3.1: Hydraulic Evaluation

Hazen will review the hydraulic profile of the existing lime softening water treatment facility to establish boundary conditions for the proposed improvements. It is assumed that increasing the capacity of the existing FIX system for TOC removal from 12 MGD to 18 MGD, along with adding the proposed 18 MGD bolt-on IX system for PFAS removal, will increase head loss between the filters and the Clearwell. Additionally, based on input from the City, there is currently a hydraulic issue between the filter effluent pipe leaving the weir chamber and the transfer pumps for the FIX system. It is the understanding of Hazen that this issue arises because Filter 3 is directly connected to the effluent pipe between the weir chamber and the FIX transfer pumps. Unlike Filters 1, 2, and 4, whose effluent blends in the weir chamber before being pumped through the FIX system, Filter 3 connects directly to the influent pipe for the FIX system. As a result, the transfer pumps preferentially draw from Filter 3, followed by Filter 1, instead of pulling a blended flow from all four filters. Consequently, effluent from Filters 1, 2, and 4 often bypasses the FIX system and flows directly into the Clearwell via a weir in the clearwell. This is a hydraulic issue that needs to be addressed to ensure that all filter effluent can flow through the proposed PFAS IX system for PFAS compliance.

Under this task, a preliminary hydraulic evaluation will be conducted to determine the pumping modifications required to overcome the additional head loss from the proposed expansion, as well as adjustments to the existing piping arrangement to resolve current hydraulic issues downstream of the filters. The results will inform site planning and design criteria of the recommended improvements, including the IX vessels, blending tank and transfer pumps.

Hazen will prepare a TM summarizing the results of the hydraulic evaluation. Hazen will participate in one review meeting with City to receive and discuss City's review comments for the draft Hydraulic Evaluation TM. Comments received from City will be incorporated into the final version of the Hydraulic Evaluation TM. All deliverables will be transmitted electronically in PDF format.

Deliverables:

- Draft Hydraulic Evaluation TM

- Final Hydraulic Evaluation TM
- Meetings: Hazen will prepare and electronically distribute summary notes following the review meetings.

Subtask 3.2: Topographic and Boundary Survey

Hazen will retain a surveyor to perform a topographic survey and boundary survey of the WTP. The topographic survey will be used in the development of detailed design drawings. The boundary survey is typically a required submittal for the Building Department.

Subtask 3.3: Underground Utility Investigation

Hazen will retain a subconsultant to perform limited subsurface utility exploration to identify underground utilities to the extent possible at potential conflict points with the proposed infrastructure. City will provide as-built or record drawings of existing underground utilities.

Subtask 3.4: Geotechnical Investigation

Hazen will retain a geotechnical engineer to prepare a geotechnical report to determine subsurface soil conditions in the areas of proposed new or modified infrastructure. A total of eight Standard Penetration Test (SPT) borings to depths of 20 feet below the existing ground surface are anticipated.

Subtask 3.5 – Filter and Backwash System Improvements

The City currently operates the existing WTP filter and backwash system manually, which is challenging for the operators. To enhance operational efficiency, reliability and process control, City intends to upgrade to a fully automated system integrated with the WTP's SCADA and PLC control infrastructure.

Hazen will evaluate the existing filter and backwash system and provide recommendations for improvement, including:

- Perform review of existing piping record drawings and instrumentation diagrams
- Conduct a comprehensive site investigation to inventory all filter and backwash system valves and piping, including current actuation methods and conditions.
- Assess electrical, instrumentation, mechanical and civil modifications required for valve automation

Hazen will summarize the findings of the evaluation in a Filter and Backwash Recovery System TM. Hazen will participate in one review meeting with City to receive and discuss City's review comments for the draft TM. Comments received from City will be incorporated into the final version of the TM. All deliverables will be issued electronically in PDF format.

Deliverables:

- Draft Filter and Backwash System TM
- Final Filter and Backwash System TM
- Meetings: Hazen will prepare and electronically distribute summary notes following the review meetings.

Subtask 3.6 – Preliminary Design Report (PDR)

Hazen will prepare a Preliminary Design Report (PDR) consisting of a series of Technical Memoranda which summarize the design criteria and concepts to be used in the final design of Water Treatment Plant improvements. This PDR will also be submitted as supporting documentation for permitting efforts. Hazen will incorporate into the PDR results summarized in Technical Memoranda prepared under previous subtasks. The PDR will consist of general, civil, mechanical, structural, electrical, instrumentation and control disciplines and will represent an overall 15% design completion level. Items to be addressed will include, as applicable:

- Brief description of the project and its purpose
- Description of construction phasing needed due to the site constraints
- Population and water demand projections
- Projected average daily and maximum daily production capacity
- Raw water quality
- Preliminary site plans
- Site security and access
- Unit treatment process sizing
- Evaluation of historical plant flow, individual chemical usage and dosing requirements to establish dosing criteria and equipment sizing and selection for proposed chemical feed systems
- Detailed description of the proposed system components
- Description of ancillary systems including electrical systems, operation and control strategies, monitoring requirements and security.
- Evaluation of requirements for maintenance of plant operations (MOPO) for project
- Preliminary budgetary opinion of probable construction cost (OPCC) for project
- Required permits

The PDR will be formatted to address the pertinent requirements in Florida Administrative Code (FAC) 62-555.520(4)(a), which FDEP uses as a checklist to review Specific Permit to Construct PWC Components applications.

Hazen will participate in one review meeting with City to receive and discuss City's review comments for the draft PDR. Comments received from City will be incorporated into the final version of the PDR. All deliverables will be transmitted electronically in PDF format.

Deliverables:

- Draft PDR
- Final PDR
- Preliminary Opinion of Probable Construction Cost.
- Meetings: Hazen will prepare and electronically distribute summary notes following the review meeting.

Subtask 3.7: Lead and Asbestos Survey

3.8.1 Limited Asbestos Survey (Interior / Exteriors)

The purpose of this survey is to identify and assess the presence of asbestos-containing material within existing structures and buildings planned for demolition to accommodate siting of the proposed WTP modifications. The findings shall be used to ensure compliance with regulatory requirements and inform any necessary remediation actions. The survey shall include the following:

- Site walkthrough and visual inspections
- Sampling and Analysis
- Report summarizing the findings and recommendations

The survey will be performed by a Certified Asbestos Inspector / Subconsultant and will meet local NESHAP/Broward EPA requirements regarding asbestos for local agencies

3.8.2 Limited Lead-in-Coatings Assessment (Interior / Exteriors)

The purpose of this lead-in-coating assessment is to identify and characterize the presence of lead-based coatings within existing structures and buildings in the areas that may be disturbed during planned demolition activities. The findings shall be used to ensure compliance with regulatory requirements and inform any necessary remediation actions. The assessment shall include, but not be limited to,

- Site walkthrough and visual inspections
- Sampling and Analysis

- Report summarizing the findings and recommendations

The assessment will be performed by a Certified Lead Paint inspector/Risk Assessor.

Deliverables:

- Final Asbestos Survey Report to City
- Final Lead Survey Report to City

TASK 4 – DETAILED DESIGN

Based on the conclusions and recommendations approved within the PDR, Hazen will prepare final design drawings and technical specifications that detail the character and extent of the project. The design documents will be prepared as one set of contract documents for bidding to a single contractor.

At each design milestone as described below, Hazen will provide City an electronic copy (PDF format) of construction contract documents (drawings and technical specifications) for that milestone. Hazen will meet with City to receive and discuss City's review comments. Hazen will incorporate into the construction contract documents the review comments of City as required. Twenty-one calendar days of review time for City have been provided for in Hazen's time of performance for each submittal milestone. Hazen will prepare and electronically distribute summary notes following the meetings.

The major components anticipated to be incorporated into the design are as follows:

- Expansion of FIX TOC and color removal system, including additional new ion exchange vessels, relocation of brine and regeneration tanks, associated valves and piping
- New non-regenerable IX system for PFAS removal, including ion exchange vessels, associated valves and piping
- New PFAS IX transfer pumping system, including pumps, associated valves and piping
- Upgrades to existing FIX system transfer pumping system, including new pumps, valves and piping
- New sodium bisulfite chemical system for dechlorination, including storage tanks, metering pumps, chemical piping and accessories. Design will also include new injection points and static mixer for sodium bisulfite system.
- New above ground concrete blending tank for equalizing flow prior to entering the IX systems
- Modification to existing effluent piping from Filters No. 1, 2 and 4 weir chamber and Filter No. 3 to the existing FIX system
- Modifications to clearwell influent pipe from FIX system
- Upgrades to filter and backwash system, including replacement and/or retrofitting of filter and backwash system valves to facilitate automated operation
- Proposed new IX process and drain yard piping

- Process piping from regenerable FIX to IX for PFAS removal
- Process piping from IX for PFAS removal to existing clearwell
- Disposal drain pipe from IX for PFAS removal to existing on-site lift station
- Instrumentation and control systems improvements for IX systems, transfer pumping systems, chemical system and filter backwash and recovery valve automation
- Electrical system improvements for IX systems, transfer pumping systems, and chemical systems, including backup power supply
- Site lighting for new IX PFAS removal system
- Chemical facility lighting
- Demolition of former chlorine building
- Temporary relocation of existing carbon dioxide system
- Modifications to existing on-site sanitary lift station
- Civil site modifications and landscaping, including new site boundary screening
- Structural improvements, including new equipment pads, pipe supports, chemical vaults, concrete slabs and modifications to clearwell north facing wall.
- New ventilation system for the sodium bisulfite chemical storage facility
- Plumbing and Fire for sodium bisulfite chemical storage facility
- Improvements for four-log virus certification, including relocation of chlorine and/or ammonia injection points, compliance monitoring enhancements

Subtask 4.1: 30% Design

Hazen will prepare the 30% design milestone submittal. The 30% design submission will consist of schematic-level general, civil, landscaping, irrigation, mechanical, structural, architectural, HVAC, plumbing, fire, instrumentation and electrical disciplines. Draft technical specifications Table of Contents (Division 1 through 50) will also be included in the submittal.

Deliverables:

- 30% schematic-level engineering drawings and specifications Table of Contents in PDF format

Subtask 4.2: 60% Design

Hazen shall incorporate the review comments from the 30% design submission into the 60% design milestone submittal. The 60% design submission will consist of general, civil, landscaping, irrigation,



mechanical, structural, architectural, HVAC, fire, plumbing, instrumentation and electrical disciplines. Draft technical specifications (Division 1 through 50) will also be included in the submittal.

Deliverables:

- 60% design drawings and technical specifications in PDF format

Subtask 4.3: 90% Design

Hazen shall incorporate the review comments from the 60% design submission in the 90% design milestone submittal. The 90% design milestone submittal will consist of the entire contract document set including, technical specifications and construction drawings for all work proposed.

Deliverables:

- 90% design drawings and technical specifications in PDF format

Subtask 4.4: 100% Design

Hazen shall incorporate the review comments from the 90% design submission in the 100% design milestone submittal. The 100% design milestone submittal will consist of the entire contract document set including, technical specifications and construction drawings for all work proposed.

Deliverables:

- 100% design drawings and technical specifications in PDF format

Subtask 4.5: Preparation of Opinion of Probable Construction Cost Estimates

Hazen will develop an opinion of probable construction cost (OPCC) based on the 60%, 90% and 100% design milestone stages of the project. At the 60% design milestone, Hazen will provide a Class 3 level OPCC as defined by the Association for Advancement of Cost Engineering International (AACE International). An OPCC of this type is normally expected to be accurate within +20% and -15%.

At the 90% design milestone, Hazen will update the OPCC provided at 60% design milestone.

At the 100% design milestone, Hazen will update the OPCC provided at 90% design milestone.

Deliverables:

- OPCC at each design milestone

TASK 5 – PERMITTING

At the 100% stage of design, Hazen will submit the design documents with the appropriate application/forms to the permitting agencies listed below for review or permit issuance as noted. As required to support submittals, Hazen will attend meetings with regulatory agencies and City. Hazen shall prepare minutes and distribute them electronically. An electronic copy of all permit submittals in PDF format shall be provided to City. All permit fees required to be submitted with each permit will be paid

directly to the appropriate agency by Hazen up to the limits established in the Reimbursables task. Hazen shall obtain the following permits unless a General Contractor is required to obtain the permit:

Subtask 5.1: Broward County Public Works and Environmental Services Department (PWESD)

- Modify the City's existing Hazardous Material Management Facility License
- Storage Tank Facility License / Permit for new hazardous materials storage tanks
- Development and Environmental Review Approval
- Statement of Responsibilities Regarding Asbestos (SRRA)
- Notice of Demolition or Asbestos Renovation (Hazen will prepare a specification that requires the Contractor to complete this notice)
- Surface Water Management License
- Application to Construct a Wastewater Collection/Transmission System (for the proposed sanitary lift station piping that will service the proposed IX for PFAS removal system)
- FDEP Notification/Application for Constructing a Domestic Wastewater Collection/Transmissions System (submitted to Broward County)

Subtask 5.2: State of Florida Department of Environmental Protection

Subtask 5.2.1: Permit to Construct PWS Components

- Application For a Specific Permit to Construct PWS Components
- A Preliminary Design Report (PDR) that complies with the requirements of Florida Administrative Code 62-555.520(4)(a) 1-19, is required for submission of the water plant construction permit application to the FDEP. PDR will be prepared under **Subtask 3.7**.

Subtask 5.2.2: Four-Log Virus Treatment Certification for Modified WTP

- Hazen shall apply for four-log disinfection credit with the FDEP
- Prepare and submit a Four-Log Virus Treatment Certification Report. The report shall include the following:
 - Documentation of calculations
 - Documentation required by the FDEP to support the four-log disinfection credit certification statement by the Engineer-of-Record
 - Prepare standard operating procedures (SOPs) for the following:
 - Four-Log Virus Treatment Record Keeping
 - Calibration Check for On-line chlorine analyzers

- Treatment process schematic required for the four-log disinfection credit certification statement
- Signed and sealed cover sheets required by the FDEP
- Report shall be signed and sealed by a Professional Engineer
- Attend one meeting with the CITY to discuss the DRAFT Four-Log Virus Treatment Certification Report, prior to submittal to FDEP. The CITY's comments shall be addressed and final Four-Log Virus Treatment Certification Report shall be issued electronically.
- Attend one meeting with FDEP to discuss the FINAL Four-Log Virus Treatment Certification Report and confirm FDEP's requirements for approval of four-log certification.
- Respond to requests for additional information (RAI) from the FDEP. One RAI is assumed.

Subtask 5.3: Development Review Committee

The "Land Development Code of the City of Pembroke Pines, Florida" also known as the "Land Development Code" is detailed in the City's Code of Ordinances Chapter 155. This project requires obtaining a development review certificate from the Development Review Committee (DRC) in accordance with the Land Development Code. Furthermore, this project requires a Site Plan approval from the DRC in accordance with Section 155.301 of the Land Development Code. Hazen will prepare necessary drawings, calculation, supporting documentation and applications as required for the development review certificate and Site Plan. Hazen will participate in DRC meetings and respond to all DRC comments.

It is assumed that this project will also be reviewed by the City Planning and Zoning Board (P&Z Board) for approval. Hazen will prepare and deliver the required presentations to the P&Z Board.

This subtask includes the following:

- Architectural Color Renderings: Color conceptual architectural renderings of the proposed improvements will be prepared for presentation to the DRC and P&Z Board.
- Landscaping Drawings: Develop landscaping and irrigation plans that comply with the Land Development Code.
- Neighborhood Compatibility and Adequacy: It is assumed that a narrative supporting document will be required that documents compliance with the City's Land Development Code Neighborhood Compatibility and Adequacy requirements. Hazen will prepare the required documentation.

Subtask 5.4: City of Pembroke Pines Building Department Preliminary Plan Review

Hazen will submit the design documents to the City of Pembroke Pines Building Department for a preliminary "dry run" review. All technical comments received in a timely manner will be addressed by inclusion into the bid documents or by inclusion through an addendum to the bid documents. Hazen shall participate as needed with the Building Department to resolve outstanding issues.



TASK 6 – BIDDING ASSISTANCE

The purpose of this task is to provide bidding and award services as follows:

Subtask 6.1: Preparation of Final Bid Documents

Hazen shall submit the Bid Set (PDF format) to the City Purchasing Department. Hazen shall make final revisions to the documents based on review comments received by the City Purchasing Department or regulatory agencies. Hazen shall prepare an updated Bid Schedule and provide to City for incorporation into the Front-End documentation. City will provide information for update of Front-End documentation by Hazen and for incorporation into Final Bid Documents.

Deliverables:

Hazen shall provide City with Final Bid Documents including the City's Front End and technical specifications in PDF format.

Subtask 6.2: Pre-Bid Conference and Job Walk-Through

Hazen shall attend one pre-bid conference and job walk-through prior to the advertised date.

Subtask 6.3: Respond to Bidder Questions and Issue Addenda

Hazen, in collaboration with the City, shall prepare timely responses to inquiries by potential bidders through written addenda. These queries shall be transmitted to the Hazen by City. Hazen shall prepare responses to technical inquiries deemed appropriate. Responses to non-technical inquiries shall be provided by City.

Subtask 6.4: Bid Evaluation

City shall forward the lowest responsive bid to Hazen. Hazen shall evaluate bids for technical compliance. Non-technical bid requirements shall be evaluated by City. This Scope of Services does not include time for Hazen to assist City in the event of a bid protest.

Subtask 6.5: Preparation of Contract Documents for Execution

Hazen shall provide bid documents and addenda for execution by City and Construction Contractor within seven calendar days of request by City. Contract Documents shall be provided in electronic, PDF format.

ASSUMPTIONS:

The following additional assumptions were made in development of this scope of work:

1. Hazen's services do not include rate analysis; City is contracted with another consultant to provide these services.

2. The City will provide review comments within three weeks of issuance of the draft documents (PDR, Design Milestone Drawings and Specifications). If comments are not received, Hazen will finalize and issue the final document.
3. City will electronically provide front end documents applicable to the project.
4. One bid package for electronic solicitation will be prepared

Key assumptions related to Hazen's level of effort for **Subtask 2.2 -Pilot Study**:

5. Pilot testing is based upon testing of a PFAS adsorption skid pilot and associated tandem TOC pretreatment pilot.
 - Preliminary Pilot Test System Schematic
 - Preliminary Pilot Test Program – Overview and Summary
 - Preliminary Sampling and Analytical Schedule
 - Preliminary Implementation Schedule
 - Preliminary Site Plan
 - Pilot Test System Supplier's Data Summaries
 - Equipment, Materials and Labor Summary
4. Phased implementation, design and duration of the pilot testing system testing, etc. are all based upon the most current supplier's submittals that define availability of their pilot testing units. It is assumed that pilot testing units will be delivered, installed and tested in accordance with the noted preliminary implementation schedule in the pilot test plan including anticipated pilot testing unit delivery dates and startup dates. The preliminary implementation schedule to be provided in the pilot test plan is a "best-possible" optimistic schedule.
5. Hazen shall utilize existing Record Drawings and related information provided by the City for the design of the pilot testing system. No additional drawing development, field surveys, geotechnical investigations, etc. are anticipated, with the exception if field visits for general coordination, and verification of proposed layouts.
6. Procurement of the pilot system and miscellaneous piloting equipment shall be procured by Hazen with the exception of items/equipment that Hazen can not expeditiously obtain. The City shall assist in the attainment of necessary water, waste, and electrical connections as needed for the piloting period. Additional assistance may be required with managing on-site bulk deliveries of equipment where it is assumed that the City would be available to assist in the mobilization of pilot deliveries with a forklift or pallet jack if available. Hazen shall provide one representative to coordinate procurement with the City and the City shall also provide one representative for procurement and coordination with Hazen.
7. Permitting will be addressed by the City and it is intended that the City will implement this project as a temporary facility using their "on-premises" facility permit. Hazen shall assist the City with addressing "on-premise" permit issues as noted previously. No other permits are anticipated.

8. The City will install, construct, connect to utilities, etc. the pilot testing systems per Hazen design documents for a complete and operational pilot test, in phases as needed to accommodate the pilot testing unit suppliers lease / delivery schedules, and with Hazen services for technical assist. The City will provide deconstruction and restoration services upon completion of the pilot testing. All equipment and materials used for the pilot testing, with the exception of leased equipment and materials, shall become the property of the City for disposal or salvage upon completion of the project.
9. The Proposed Testing Program Outline is preliminary and intended only to estimate testing periods, and therefore develop a total duration for scope purposes. The program and its testing conditions and durations of individual test periods may be modified based upon results obtained during the study. Also, the sequence of testing proposed is preliminary and may be modified as needed to best ensure that the most critical data are obtained initially for use to develop the Life Cycle Performance and Cost Assessment, but also, if possible, to eliminate unnecessary testing and reduce the amount of testing to that actually needed for design support.
10. Laboratory analyses will be collected and performed by contracted laboratories.
11. The City may assist Hazen at times with the startup and operation of the Pilot Testing System, but only with Hazen providing technical direction to ensure unity of responsibility of the pilot testing to Hazen. The City will provide all maintenance for the Pilot Testing System (Hazen may provide some general maintenance as needed.) As a result, the City will provide one full-time staff representative, Monday through Friday, 8-hour per day, basis to assist Hazen with operation and maintenance on an as-needed basis. Also, the City will provide 24-hour per day, 7 day per week, assistance with non – routine operation and maintenance on call, when specifically required.

Compensation:

The engineering services for this project will be performed on a Not-to-Exceed basis for the amount of \$5,012,532.01 for Task 1 to 6 plus reimbursables of \$377,000 for a total of \$6,079,965. Hazen will bill City on a percent complete by task basis up to the limits of each subtask as Task 1 to 6 are completed.

Hazen will bill project-related expenses to City, including permit fees, pilot rental, analytical testing and laboratory costs, communication and reproduction, corrosion study lab and materials and travel costs directly to Project with no markup up to the limits of the Reimbursables expenses. An estimated fee schedule is provided below and a detailed breakdown is attached.

WORK ELEMENT	Fee
1 – Project Kickoff, Data Collection and Progress Meetings	\$207,228.08
2 – Planning and Evaluation	\$1,002,245.93
3 – Preliminary Design	\$865,969.94
4 – Detailed Design	\$3,021,410.15



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5 – Permitting	\$441,772.04
6 – Bidding	\$164,338.85
Subtotal	
Reimbursables	\$377,000
Total-Not-To-Exceed	\$6,079,965.00

Schedule:

The services outlined in this Task Order will be completed within 32 calendar months from date of Notice to Proceed. Engineering services for the project will be performed as part of PSUT-25-06. Services provided by Hazen shall be limited to those specifically identified in this work authorization.

WORK ELEMENT	Task Duration (months)	Estimated Total Months from NTP
1 – Project Kickoff and Data Collection	2	2
2 – Planning and Evaluation	12	12
3 – Preliminary Design	6	12
4 – Detailed Design	12	21
5 – Permitting	6	26
6 – Bidding	6	32
Total (all Tasks 1 to 6 Complete)		32 months

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

Sincerely,

Monique Durand, PE
Senior Associate

Enclosure

c: File 41231-000