TO: **James L. App, City Manager**

FROM: **Doug Monn, Public Works Director**

SUBJECT: **Water Treatment Plant**

DATE: **November 16, 2010**

NEEDS: For the City Council to consider a contract for surface water treatment plant design.

FACTS:

1. Nacimiento water will be available for customer delivery beginning in spring 2011.
2. The City must design and construct a 4 million-gallon per day (MGD) treatment facility (expandable to 6-MGD) to use lake water.
3. Treatment plant construction is expected to cost approximately $21.M
4. The City solicited statements of qualifications/proposals for design.
5. Selection criteria were approved by the Council Ad-Hoc Committee on February 20, 2007; three firms were interviewed March 1, 2007.
6. The top two ranked firms were asked to propose on the final design on September 8, 2010.
7. AECOM provided the City with a cost of $921,486 to design the treatment process and support structures, necessary tanks and blending pipelines, control systems, booster station, and assistance with contractor outreach and bid phase services.
8. An allocation of $1,071,486 (which includes a $150,000 contingency to offset the cost of possible unforeseen conditions) is needed.

ANALYSIS & CONCLUSION

Over the past 3.5 years several design options have been considered as the City worked towards a community supported water rate. A brief description of each plant concept is provided below:

Treatment Capacity	Construction Cost	Notes
6- (MGD) expandable to 12MGD	$41M	Taken to 60% design level. Rate challenges required development of alternative plat configuration.
2 MGD (Phase I) +2 MGD (Phase II) +2 MGD (Phase III) Plant build-out capacity = 6 MGD	$14M+ $21M+ Planned for 2018	Phase I taken to the 90% design level. This was the pay-as-you-go approach outlined under measure A09. The community's rejection of this rate prompted the development of the current all-commodity rate and a third treatment plant concept.
4 MGD expandable to 6 MGD.	$27M-$29M	Design level not taken beyond initial concept and cost estimate. Costs exceed the $25.4M budgeted in the current water rate prompted decision to rebid design work.

The current rate structure assumes a total treatment-plant cost of $25.4M. The preliminary 4-MGD construction cost estimate of $27-$29M is not financially feasible. Therefore, a rebid of the final design work was indicated for more competitive design phase pricing and an opportunity to reevaluate treatment process elements (with the goal of reducing construction costs and satisfying treatment goals).

Proposers were asked to submit a design fee for final design of the 4-MGD treatment concept. AECOM proposed a design fee of $0.921M and Black and Veacth $0.995M.

Additionally, the RFP requested the design firms to submit recommended changes to the treatment process that would satisfy treatment objectives, yet lower up-front capital requirements, reduce operation and maintenance costs and/or improve the process overall.

A revised process has been proposed by AECOM that will meet the City's treatment goals at significantly reduced construction costs of $19 – $21M. Design is expected to be complete by September 2011.

Additionally, AECOM's fee for final deign is the most reasonable. Their refined treatment process will result in lower capital and operating costs and will utilize all available preliminary engineering (technical analysis, soils investigation, survey, etc.) and drafting performed to date.

POLICY REFERENCE: Economic Strategy; Integrated Water Resource Plan; Nacimiento Water Project Entitlement Contract.

FISCAL IMPACT: AECOM proposes professional engineering design services for a cost not to exceed $921,486. Because of the scope of the Nacimiento Water Project, complexities involved in design of a public drinking water treatment facility, and the possibility of design amendments, particularly those that may come up during regulator reviews, design workshops, bidability and constructability reviews, a $150,000 contingency should be included. The costs for these services have been budgeted in the FY 9/10 to 10/11 Financial Plan (Budget No. 229.910.5452.544).

Below are current accounts balances in Nacimiento Related funds.

Nacimiento Water Development Fee Fund	$3.43M
Nacimiento Water User Fee Fund	$9.36M
Nacimiento Water Treatment Development Fee Fund	$.034M

OPTIONS:

a. Adopt Resolution No. 10-xx authorizing the City Manager to enter into a contract with AECOM in the amount of $921,486 plus contingency to provide professional engineering design services associated with the design of the 4-MGD treatment facility.

b. Amend, modify, or reject the above option.

Prepared by: Christopher Alakel, P.E.
Water Resources Manager

Attachments (2)
1) Resolution
2) Scope of Work

RESOLUTION NO. 10-xxx

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF PASO ROBLES APPROPRIATING FUNDS AND AWARDING A CONTRACT TO AECOM FOR PROFESSIONAL ENGINEERING DESIGN SERVICES ASSOCIATED WITH THE DESIGN OF A WATER TREATMENT PLANT

WHEREAS, the City of Paso Robles is a partner in securing water from Lake Nacimiento; and

WHEREAS, integration of Nacimiento Water into the City's distribution system will require the construction of a four million gallon per day treatment facility; and

WHEREAS, the design process will require a professional engineering firm to ensure its functionality; and

WHEREAS, because of their demonstrated depth of experience, understanding of the purpose of the treatment plant, direct experience with the Nacimiento Pipeline Project, and the needs of the City, it would appear to be in the best interest of the City of Paso Robles and its water users to retain the service of AECOM to provide Professional Engineering Design Services for the design of the treatment facility at a cost not to exceed. $921,486 plus a contingency of $150,000 for unforeseen design amendments.

THEREFORE, BE IT RESOLVED AS FOLLOWS:

SECTION 2. The City Council does hereby award a contract to AECOM for Professional Engineering Design Services associated with the design of the treatment facility in an amount not to exceed $1,071,486 and authorizes the City Manager to execute the contact.

PASSED AND ADOPTED by the City Council of the City of Paso Robles this 16th day of November 2010 by the following votes:

AYES:
NOES:
ABSTAIN:
ABSENT:

_____
Duane Picanco, Mayor

ATTEST:

_____
Caryn Jackson, Deputy City Clerk

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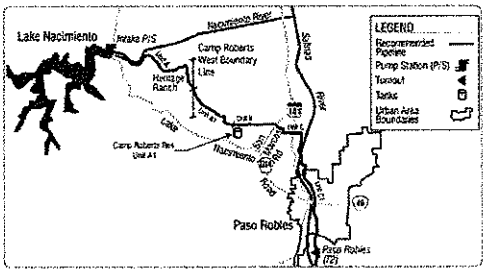
Technical Approach and Scope of Work

The current construction cost opinion for the water treatment plant is $28.9 million, which exceeds the City's available funds for the project. AECOM has developed a strategy focused on cost and risk reduction.

PROJECT OBJECTIVES	PROJECT CHALLENGES
• Meet City's budget for WTP	• $28 Million cost opinion exceeds City budget
• Produce high quality water	• Process components (ozonation and plate settlers) introduce risk and may not be the best fit for this water supply
• Optimally manage City water supplies	• Current blending strategy for groundwater and Nacimiento water complicates operation

Technical Approach

Background



The City of Paso Robles is a Project Participant in the Nacimiento Water Project (NWP) currently being implemented by the San Luis Obispo County Flood Control and Water Conservation District. The NWP is a regional water supply system that will convey raw water from Lake Nacimiento to communities in San Luis Obispo County, including the City.

The City will construct a Water Treatment Plant to treat surface water received from Lake Nacimiento, with the goal of fully utilizing this additional water source to increase supply reliability, particularly during the summer months. This project is also expected to provide a higher quality supply to existing customers, and address increasing water demands within the City.

Overall Process Design Approach

The City desires a robust treatment process to reliably produce drinking water that will meet all California Department of Public Health standards, and will consistently meet consumer aesthetic expectations. Furthermore, although the City currently relies on groundwater as its primary source of supply, the

City wishes to fully capitalize on this new surface water supply, and avoid being required to blend with groundwater sources. The Lake Nacimiento source water is known to contain iron and manganese at levels above secondary drinking water standards; may contain taste and odor causing algae; and has a high disinfection byproduct formation potential. All of these water quality challenges must be met by the selected treatment process if the City's project requirements are to be met.

In order to pay for the proposed surface water treatment plant, the City has enacted significant consumer rate increases. Therefore, the ultimate approach to supplying high quality drinking water to the City's customers must be cost effective (greatest benefit at least cost). Financing the treatment plant project is complicated by the City's Nacimiento Water Project commitments, which require that the City begin paying for access to the Nacimiento water, whether it is used or not. These payments will be several million dollars per year effective immediately. The current construction cost opinion for the water treatment plant is $28.9 million, which exceeds the City's available funds for the project. One of the major objectives of the project must therefore be to reduce the project cost.

To prepare our proposal, we brought together drinking water experts from throughout AECOM (including two of our North American Water Treatment Technical Practice Leaders, Simon Breese and Larry VandeVenter, and our Central California based water treatment experts) to review the treatment process proposed by Black & Veatch and included in the City's RFP. The primary objectives of our review were to:

- Determine whether the proposed treatment process would be capable of reliably meeting the treatment objectives described above.
- Determine whether the treatment process can be modified to significantly reduce capital and/or operational costs without sacrificing performance.

Based on our review, we believe that the proposed process is deficient in several areas and creates an unnecessary risk of poor treatment plant performance and reliability. We are not comfortable that designing and constructing a treatment plant utilizing the proposed process would be in the City's best interest. However, we are confident that the treatment process can be modified and all of the prior planning and design work leveraged such that the construction cost can be reduced significantly while reliably meeting all of the project objectives.

Our primary concerns with the process proposed by Black & Veatch are as follows:

- Pre-ozonation of this water introduces unnecessary risk and cost into the project.
- Previous jar tests and anticipated raw water characteristics indicate that dissolved air flotation (DAF) will be a more effective pre-treatment process than the proposed plate settlers. Algae is anticipated to be a seasonal problem, and DAF is considered to be a more reliable method of removal.
- The use of a backup ozone generator is unnecessary and costly.
- If a biologically active process is not incorporated downstream of ozonation, there is a significant risk of bacterial re-growth in the City's distribution system and excessive disinfection byproduct formation.
- Combining water from the Thunderbird wells with the treated surface water upstream of the treated water reservoir reduces the City's flexibility in meeting the treatment plant's disinfection requirements. Blending with groundwater for operational purposes can still be achieved downstream of the treated water reservoir.
- The raw water storage tank appears to be unnecessary.

In order to address these concerns, we are proposing the alternative treatment process shown in **Figure 1.1** displayed at the end of this section.

The most significant differences between the process we are proposing and the process proposed by Black & Veatch are described in more detail below.

Pre-treatment

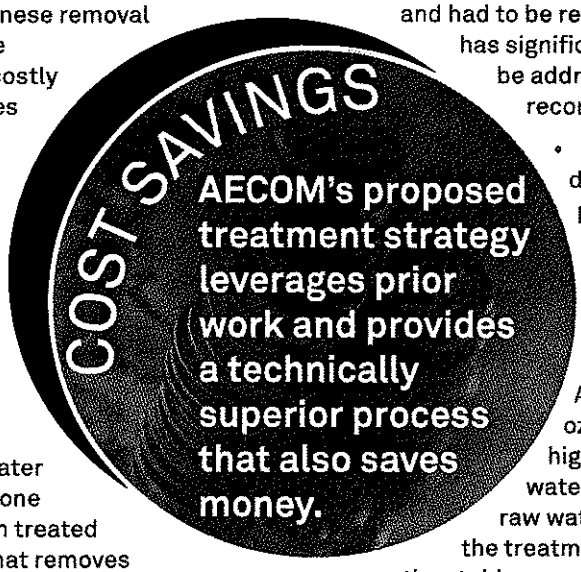
The pre-treatment process proposed by Black & Veatch includes pre-ozonation, potassium permanganate addition, and plate settlers. It appears that these pre-treatment processes are intended to remove iron and manganese from the water, provide primary disinfection, reduce turbidity, and remove some TOC from the water.

AECOM's experts from across North America were independently unanimous in the assessment that Black & Veatch's pre-ozonation concept introduces performance risks and construction and O&M cost into the project.

Iron and Manganese Removal: Removal of iron from the water is relatively easy to accomplish. Removal of manganese is more difficult. The addition of permanganate by itself, with sufficient contact time, should be sufficient to oxidize both iron and manganese to insoluble species so that they can be removed by subsequent physical treatment processes. However, by adding ozone in addition to the permanganate, the fate of the manganese becomes more uncertain. If the ozone dosage is carefully controlled, ozone can oxidize manganese into insoluble (removable) manganese dioxide. However, over-ozonation will form soluble (non-removable) permanganate. In water with high TOC, such as Lake Nacimiento water, the manganese may again revert to the insoluble manganese dioxide, but only after a significant period of time. We are concerned that pre-ozonation will make manganese removal unreliable, and under the worst case scenario creates significant risk of costly manganese fouling of the membranes downstream.

Pre-Ozonation: In addition to the manganese removal issue discussed above, pre-ozonation results in several other significant disadvantages and risks. Some additional concerns with this process include the following:

- Pre-ozonation results in tremendously more expensive capital and O&M cost. The raw water will have a significantly higher ozone demand than water that has been treated through a clarification process that removes a significant portion of the raw water's turbidity and TOC. The higher ozone demand in the raw water translates into a significant increase in the size of the ozone generation system and a corresponding increase in ozone system capital and O&M costs.



Because pre-ozonation has significant risk and cost that can easily be addressed by another strategy, we recommend against it.

- Although mitigation measures can be developed to protect membranes against ozone, we do not recommend adding ozone to the water upstream of membrane filtration. In theory, quenching the ozone residual with calcium thiosulfate upstream of the membranes will remove any ozone residual, but occasionally equipment does fail and human errors do occur. Should any ozone residual remain when the water reaches the membranes, the membranes will likely suffer permanent damage. As an example of this type of unanticipated consequence, the City of Clovis, CA constructed a surface water treatment plant that utilized membrane filtration downstream of a high-rate sand ballasted sedimentation process. In theory, the sand from the sedimentation process should not have carried over to the membranes. In reality, an equipment failure and/or human error resulted in just such an occurrence. The membranes were permanently damaged and had to be replaced. Because pre-ozonation has significant risk and cost that can easily be addressed by another strategy, we recommend against it.
- Pre-ozonation for CDPH disinfection compliance is problematic to control with variable raw water quality. The pre-ozonation process is intended to satisfy CDPH primary disinfection requirements and address DBP formation potential. As previously stated, the raw water ozone demand will be relatively high and will fluctuate with the raw water quality. Any variability in the raw water quality will make it difficult for the treatment plant operators to maintain the stable ozone residual needed to satisfy disinfection requirements.
- Pre-ozonation won't remove TOC that could foul membranes. When the water is ozonated, much of the TOC present in the raw water will be broken down into smaller molecular weight organic substances — the TOC will not actually be removed. These low molecular weight substances are more easily metabolized by bacteria and will therefore tend to facilitate the growth of microorganisms downstream of the ozonation process. We are concerned that this will increase the potential for biological fouling of the membranes. We are also concerned that this will cause bacterial regrowth problems in the City's distribution system. Most water treatment experts assume that a biologically active treatment process will almost always be placed

downstream of ozone. The GAC contactors in the proposed treatment process will serve that function, but will not be able to protect the membranes from biological fouling in their currently proposed placement. Black & Veatch identified the GAC contactors as optional. We recommend that they be incorporated as a required element in the overall treatment process.

- Pre-ozonation introduces increased taste and odor problems. If taste and odor causing algae are present, pre-ozonation may actually increase taste and odor problems by causing a breakdown of the algae cell structure and releasing the chemicals that cause the taste and odor into the water. As will be discussed below, we are recommending the use of DAF upstream of ozonation. The DAF will gently remove most of the algae before the algal cells have a chance to break down.

In fact, having reviewed the available water quality data and planning studies, we believe that ozonation may not be necessary at all. It appears that TOC removal through the DAF and GAC processes may be adequate to keep byproduct formation below the regulatory limits. We are proposing elimination of the pre-ozonation process and designing the treatment plant to accommodate future addition of ozone between the membrane filters and GAC contactors. Our phased approach to meeting taste & odor and DBP control requirements without initially installing ozone is described later in this section. As you will see, our intent is to defer or eliminate unnecessary facilities to bring costs down now and long-term, without risk to treatment performance. AECOM will collaborate with you to make a good decision on this topic, starting at project kickoff and in developing our proposed treatment process and Plant Facilities Basis of Design Technical Memorandum.

If the City does decide to construct ozone facilities with the treatment plant, it may make financial sense to not install a standby ozone generator. Ozone generation equipment is relatively reliable, but expensive. The decision whether to install a standby ozone generator should be based on anticipated ozone demand; availability of standard self contained units in the necessary size range; and the City's risk tolerance. If the City retains the flexibility to use free chlorine as a primary disinfectant, chlorine could be used when an ozone generator was out of service and there would be no need for a standby unit. Even if disinfection byproduct levels rose while free chlorine disinfection was utilized, compliance with the Disinfection Byproduct Rule is based on the locational running annual average of four quarterly samples. The disabled ozone generator could be repaired or replaced in time to avoid exceeding the disinfection byproduct MCL. Additionally, the City will have the flexibility to fall back on the GAC system to remove a greater percentage of the disinfection byproduct precursors during the period when the ozone is down.

Physical Pretreatment: The Lake Nacimiento Rule requires that the City's water treatment process incorporate "coagulation, flocculation, sedimentation, filtration, and disinfection." Since a physical pre-treatment process equivalent to coagulation, flocculation, and sedimentation is required, selection of the process should be based on compensating for the weaknesses of other treatment processes and minimizing cost. Due to the perceived potential for a high algae load, dissolved air flotation was included in the initial design completed by Black & Veatch. In the new process proposed by Black & Veatch, DAF has been replaced by plate settlers. Based on the water quality and jar test data we have reviewed, we believe that DAF remains the better pre-treatment alternative.

Based on the water quality and jar test data we have reviewed, we believe that DAF remains the better pre-treatment alternative.

The pre-design report references jar testing of Lake Nacimiento water that showed that, "upon the addition of alum, solids formed and tended towards flotation. Furthermore any solids that did settle were light and fluffy in consistency." The Predesign Report cited turbidity removal as being the primary advantage of plate settlers. Because membrane filtration is proposed for this project, turbidity removal by the pre-treatment process, while important, is of less concern than removal of algae and TOC. Membranes are very good at removing turbidity from water with much higher influent turbidity than what is expected at this facility. The only likely disadvantage to using DAF instead of plate settlers is slightly higher operating cost. However, we feel that any marginal increase in cost is offset by the improvement in treatment effectiveness.

AECOM will leverage the previously completed DAF design work into the final design with City concurrence.

Filtration

All design work to date has been based on the use of membrane filtration instead of conventional media

filtration. Membrane filtration is widely accepted to be superior to media filtration for turbidity and pathogen removal. However, membranes are not generally considered effective at removal of TOC (which is usually dissolved) or taste and odor causing compounds. Care must also be taken to protect the membranes from substances that may foul them, including substances from upstream treatment processes. Provided that any ozone is added downstream of the membranes, we are comfortable with the decision to incorporate the pre-selected Siemens pressure-driven microfiltration membranes into the design. The use of membranes should provide an excellent barrier against pathogens and very low turbidity water, regardless of influent water quality.

The use of biologically-active, deep-bed, GAC filters, instead of membrane filtration, would be equally feasible and efficacious and could significantly reduce capital and operating costs.

If the City wishes to retain the pre-ozonation process ahead of a membrane system, the design must incorporate fail-safe measures for ozone quenching. Based on the work to date, we understand the City is committed to using membranes for filtration. We concur that this is a feasible and efficacious approach. As a matter of professional due diligence, we would be remiss if we did not point out that the use of biologically-active, deep-bed, GAC filters, instead of membrane filtration, would be equally feasible and efficacious and could significantly reduce capital and operating costs. The combination of ozone followed by biologically active filtration has been shown to be very effective at removing disinfection byproduct precursors and taste and odor causing compounds. However, as with any media filters, operators will need to closely monitor the process parameters to prevent filter breakthrough and ensure maximum water recovery. AECOM is equally expert in this approach and will be happy to discuss it further should the City wish to entertain it.

Phased Taste and Odor and Disinfection Byproduct Control

The greatest challenges that have to be overcome by the treatment process are excessive disinfection byproduct formation and tastes and odors. The control of chlorination byproducts can only be accomplished in two ways: 1) remove the precursors (TOC); or 2) eliminate free chlorine disinfection and carry a monochloramine residual into the distribution system. For taste and odor control, the responsible compounds must either be destroyed or removed from the water.

Converting the water system over to a monochloramine residual is often adequate to keep DBP levels below the regulatory limit, but would require the City to retrofit all well sites with ammonia feed systems. Chloramination would also result in the need for increased distribution system water quality monitoring, flushing, and maintenance in order to avoid nitrification problems. We have assumed that the City would prefer not to convert the water system to monochloramine residual disinfection. If our assumption is incorrect and this is something the City would like to explore further, several members of our project team have experience planning, designing, and implementing chloramination at other utilities throughout the state.

The two most reliable ways of removing TOC and taste and odor causing compounds that are not removed through clarification and filtration are 1) adsorption; and 2) biologically active processes. The process proposed by Black & Veatch includes GAC contactors downstream of the membranes. We concur with the use of GAC contactors at this location, but would like to suggest the following phased approach to addressing the TOC removal problem. We believe this alternative approach will significantly reduce the treatment plant construction cost, while still adequately mitigating the risk of taste and odor or DBP problems:

The decision to blend would be a matter of economics, not necessity.

- Construct the treatment plant without ozone, but with specific features that would allow for the practical addition of a deep bubble ozone contactor between the membranes and the GAC contactors if necessary. Chlorine contact in the treated water reservoir would be used to meet primary disinfection requirements.
    a. The DAF should reduce the TOC significantly. The GAC contactors can always be used to treat all or a portion of the water for adequate DBP precursor removal and taste and odor control.
    b. If the City chooses, Thunderbird well water can be blended with the surface water to meet the

same DBP and taste and odor objectives, but at a lower carbon usage rate. Blending will be possible whether the wells are tied in upstream or downstream of the treated water reservoir. The City would always have the flexibility of using GAC to meet the requirements without having to resort to blending with groundwater. The decision to blend would be a matter of economics, not necessity.

- Should it become apparent that carbon replacement costs are too high to make GAC adsorption a long-term solution to the DBP and/or taste and odor problem, the City can construct the ozone generation and contact facilities.
    a. The ozone would then serve as the primary disinfectant.
    b. The GAC contactors would remain, but would become biologically active, thus reducing carbon replacement costs and increasing TOC and taste and odor removal.

This phased approach may save the City several million dollars (at least $5 Million based on Black & Veatch's latest construction cost estimate) if the ozone is not needed to meet the water quality objectives. Even if ozone is ultimately required, this approach may allow the City to move forward with construction of the first phase of the treatment plant when it would not have been economically feasible otherwise. Consumers will receive good quality water regardless of whether the ozone is used or not.

A phased approach to installation of systems for taste and odor and disinfection byproduct control could save several million dollars in the long run with no risk to regulatory compliance or customer satisfaction.

Integration of Thunderbird Wells

The currently proposed process includes blending of ground water from the Thunderbird wells with treated surface water upstream of the treated water reservoir. Combining the groundwater and surface water upstream of the reservoir has a significant disadvantage should the City want or need to utilize free chlorine for primary disinfection. The available chlorine contact time in the reservoir would be drastically reduced due to the need to disinfect both the ground water and surface water. If the wells are blended with the surface water downstream of the treated water pump station this problem is eliminated.

Based on the Black & Veatch Predesign Report, this approach appears to have been selected in an effort to minimize disinfection byproduct formation. However, disinfection byproduct compliance is determined at sampling locations in the distribution system. As long as the well water is blended with the surface water prior to the first water consumer and the actual CT achieved in the reservoir is limited to only what is necessary, whether the blending occurs upstream or downstream of the reservoir should have a negligible impact on disinfection byproduct formation.

We recommend that the City consider relocating the blending location downstream of the treated water pump station unless there is an operational advantage or preference to including storage between the wells and the distribution system. Relocating the blending location would reduce the project cost by eliminating most, if not all, of the modifications to the Thunderbird wells.

Scope of Work

The prior sections of this proposal presented an overview of our project understanding, including AECOM's assessment of the most recently proposed treatment process for the project, and our proposed treatment process approach to address the goals of the City and the concerns raised by our water treatment experts. AECOM's proposed treatment process approach results in a plant that will be easier to operate and control, will be less prone to membrane fouling or damage, and will ultimately be less expensive to construct than the Black & Veatch design presented in the City's Request for Proposals

The following sections present our detailed Scope of Services for the Nacimiento Water Treatment Plant Project (Project). It serves as the basis for development of our fee estimate for the Project. As discussed elsewhere in our proposal, the basis for our proposal is that AECOM will utilize the studies and design efforts prepared during prior iterations of the project as the initial basis for this final design effort. To prepare the Scope of Services and associated fee estimate, AECOM performed a review of the key studies and drawings from these prior iterations to assess their applicability going forward and to determine the level of effort needed to finalize the design. In the Scope of Services that follows, we provide annotations and clarifications to the scope provided in the City RFP,

describing our approach to utilizing the prior work in detail. These annotations and clarifications are shown in *blue italic text*. While we have attempted to be as thorough as possible, absent any clarifying comments on our part in the Scope of Services that follows, AECOM is assuming that the treatment process, general facility arrangement on site, or other design concepts as shown in the most current iteration of the project documents will remain feasible and viable for final design and construction. Our fee estimate is based on this assumption. As discussed in our technical approach, we will collaborate with City staff on an on-going basis, most importantly at project kickoff, early workshops, and through development of our Design Basis technical memo, to clarify any ambiguities among those prior document, should any remain, and to develop an approach that suits the City's needs.

Also note that we understand the City's need to make a direct comparison of scopes and budgets between the firms providing proposals. The Scope of Services (and subsequently presented personnel hours estimate and fee estimate) that follows therefore presents two alternatives, one for the process presented in the RFP, the other for AECOM's cost-saving alternative process.

AECOM's proposed detailed Scope of Services is as follows:

I. Background

A. Plant Site

The City currently owns the site for the treatment facility. The site, which is approximately 18 acres, contains four groundwater wells (the Thunderbird wells) and one monitoring well. The site is between the Salinas River and Highway 101, northeast of the intersection of Highway 101 and Highway 46 West. A California Environmental Quality Act (CEQA) determination has already been completed by the City. A topographic survey and geotechnical investigation of the site have also already been completed for this project. The City will provide the boundary survey map, topographic survey map, and geotechnical report to the selected consultant.

B. Plant Size

The treatment plant shall have a firm treatment capacity of 4 MGD (6.2 CFS) with the ability to be expanded to a firm treatment capacity of 6 MGD (9 CFS) at buildout. The East and West distribution zone treated water pumping stations shall have firm pumping capacities of 6,000 gpm and 3,000 gpm respectively. 1.2 million gallons of treated water storage shall be provided in the treated water reservoir.

C. Treatment Process

Based on the City's Integrated Water Resource Management Report and the 2007 Water Treatment Plant Project Preliminary Design Report the City has determined that the following components will be used at the facility:

Component	Description
Raw Water Facility	• The raw water facility will be an above ground structure, consisting of a 16" raw water pipeline, sampling points, water quality station (pH, Temperature and Turbidity) and ozone and KMnO4 injection point. *For the AECOM alternative process option, the ozone injection point will be located downstream of the membrane filtration system.*
Ozone System and Pipeline Contactor	• A new ozone system consisting of two (1 duty + 1 standby) ozone generators and a pipeline contactor with at least 7 minutes detention time will be provided for T&O reduction and primary disinfection. • The ozone generators will be housed within Membrane Building. The LOX and ozone destruct systems will be outdoors with a partial canopy cover over the vaporizers at the LOX system. *For the AECOM alternative process option, the ozone system will be smaller in capacity and set up to be capable to defer its construction.*
Raw Water Storage Tank	• A 100,000-gal raw water storage tank (welded steel) will be constructed to provide storage for the excess Nacimiento flow when one or more membrane racks are out of service for maintenance cleaning, backwash or integrity testing. *For the AECOM process option, this tank is not provided.*

Component	Description
Pretreatment System	• The Phase I system will include two 2-MGD trains consisting of two-stage flocculation, sedimentation with plate settlers and sludge collectors, and a common flash mix pump. *For the AECOM alternative process option, this is substituted with a dissolved air flotation (DAF) system.*
Membrane Filtration System	• Membrane filtration system will consist of membrane feed pumps, strainers, four membrane filtration trains (Phase I), and auxiliary components. • Membrane auxiliary equipment will consist of CIP chemical feed, reverse filtration pumps, compressed air system, neutralization tank, and other ancillary equipment. • Membrane modules and auxiliary equipment will be housed in a pre-engineered metal building with the required footprint for future expansion to 6 MGD. • The pre-engineered metal membrane building will also house ozone generators, a mechanical room, a break room, storage, restrooms, and two offices.
GAC System	• The system will include four trains. Each train consists of two GAC vessels with 20,000 lbs of media per vessel (40,000 lbs per train) and operates in a lead-lag configuration. • The backwash waste could be sent either to the Backwash Recovery Pump Station or directly upstream of the pretreatment system. • The capacity of each train is approximately 700 gpm with 10-12 minutes of empty bed contact time.
Waste Stream	• The pretreatment sludge waste and the membrane neutralized CIP waste will be collected and pumped to the existing sewer. • The pump station will be a cast in place wetwell structure with two VFD driven submersible pumps.

Component	Description
Backwash Recovery Pump Station	• The membrane backwash waste will be collected in a 20,000-gal basin and recycled to the raw water facility. • The pump station will be a cast in place wetwell structure with two VFD driven submersible pumps.
1.2-MG Treated Water Reservoir	• A new welded steel reservoir, approximately 104-ft diameter and 19-ft water depth will be constructed to provide storage and disinfection contact time for blended water. The steel tank will not have any architectural treatment. • A hypochlorite injection point will be provided downstream of blending point and upstream of treated water reservoir for disinfection. • A flow meter will be provided at reservoir inlet to monitor the total blended flow. • Water quality stations will be provided at reservoir inlet and outlet to measure water quality (turbidity, pH, temperature and chlorine).
Treated Water Pump Station (TWPS)	• Vertical can type pumps will be used to transfer treated water from the Treated Water Reservoir to the Main East and Main West distribution zones. • The Main East distribution zone will have two 3,000 gpm pumps installed, with one spare pump can. • The Main West distribution zone will have one 3,000 gpm pump installed. The discharge headers of two zones will be interconnected to share the standby pump and accommodate fluctuations in demand between the two zones. • The treated water pumps will be outdoors on a concrete slab with a canopy over the pump area. • An electrical room will be provided adjacent to the pump area to house the pump motor control center.

Component	Description
Sodium Hypochlorite, PACL, CTAs, and Permanganate Feed and Storage System	• A sodium hypochlorite system will be provided for disinfection of blended water. • A PACL system will be provided for coagulation. • A permanganate system will be provided for Mn removal. • A calcium thiosulfate system will be provided for ozone quench. • The chemical feed systems will be located in secondary containment areas underneath a canopy roof.
Overflow Retention Basin	• A 200,000-gal overflow retention basin will be constructed to provide storage for emergency overflow. • The overflow basin will be a cast in place partially buried structure with two submersible pumps rated 200 gpm each to transfer flow to the existing sewer.
Thunderbird Well Modifications	• The four existing Thunderbird wells will be configured to be blended with treated surface water upstream of the treated water reservoir. • The four existing Thunderbird well pumps will be replaced with new VFD driven pumps to pump groundwater to the Treated Water Reservoir. • The existing hypochlorite feed and storage systems at each well head will be demolished. • *For the AECOM alternative process option, we recommend the City consider configuring wells to deliver downstream of the treated water reservoir.*

Component	Description
Yard Piping	The yard piping will include the following: • 16" raw water supply • 20" combined membrane filtrate to blending point • 12", 16" and 20" Thunderbird well discharge to blending point • 24" blended water to reservoir • 24" treated water from reservoir to TWPS • 16" TWPS discharge to main east and main west • 8" process waste to sewer • 6"-8" plant potable, non-potable (KMN dilution) and fire water supply • Sanitary sewer and storm-water collection
Standby Generator	• Existing 500 kW engine generator unit will be sufficient to support the load profile of a 350 hp TWPS pump and 4 Thunderbird well pumps.
Major Utilities	• A transformer will be provided by PG&E to supply power to the Phase I WTP facilities including all Thunderbird well pumps. • There will be no gas line.
I&C/SCADA Systems	• The WTP will include a new SCADA System. The WTP process monitoring and control systems will consist of I&C systems designed for automatic and manual control of the plant via the Plant Control System (PCS). The design will stress efficient monitoring and control of equipment and process conditions. • As part of the WTP work, the existing City distribution system SCADA Hardware/Software will be upgraded and configured to be integrated with the new WTP SCADA system. • *AECOM understands that the City distribution system SCADA upgrade is by others.*

II. Scope of Services

A. Project Management

- Work closely with City staff and their designated representatives, keeping them informed of project status. Notify City staff of pending issues and needed decisions. Solicit and document staff input and approval on design and format issues.
  In addition to ad hoc phone calls, e-mails, and other correspondence provided to maintain a high level of communication and consensus, AECOM's Project Manager will conduct a regularly scheduled telephone conversation with the City's Project Manager to discuss project status and issues. For budgeting purposes, it is assumed that the project will be 9 months (40 weeks) in duration, with regularly scheduled calls being 30 minutes in duration, conducted weekly. To facilitate communication and documentation, AECOM will prepare and maintain a Project Decision Log which AECOM's Project Manager will review with City staff on a regular basis.

- Prepare, maintain, update, and periodically submit a Gantt and a critical path schedule for the project. The schedule should show key meetings, deliverables, milestones and decision points. The schedule should indicate dates the City is expected to provide inputs or feedback during the design period. For example, preliminary design, 30 percent, 60-percent, 90-percent design, and final camera ready documents. The schedule shall indicate when review comments are expected and shall allow a minimum of 10 working days for City input on each milestone. Provide a summary of the key dates for completion of major tasks and activities.

- Facilitate and attend a monthly progress meeting, or more frequently as needed, with the City. Prepare agenda and action item list for each meeting.
  For budgeting purposes for a 9 month project schedule, a total of 9 regular formal meetings and 3 additional ad hoc formal meetings are assumed.

- Design review workshops shall be conducted to present, discuss, and review the contract documents at each of the design stage submittals (pre-design, 60%, and 90% design submittals). Each workshop shall be conducted with City staff to present the information and findings of the design team and to summarize the work. Input from City staff will be obtained and incorporated into the contract documents. Meeting minutes will be prepared and distributed to all attendees.
  AECOM assumes a total of 4 workshops will be conducted. Three will be for the pre-design, 60%, and 90% design submittals. An additional workshop (Treatment Process and Plant Basis of Design Workshop) will be held at project kickoff to discuss the treatment process and membrane procurement, to solicit input and direction from City staff for the treatment process and construction document preparation strategy presented in AECOM's RFP response, and re-confirm other principal design criteria, for incorporation into a Technical Memorandum (Treatment Process and Plant Basis of Design TM). The Treatment Process and Plant Facilities Basis of Design TM will be provided in advance of the 30%/pre-design submittal to memorialize City direction and eliminate ambiguity from prior treatment plant planning and design efforts, and memorialize the treatment process and facility plan to expedite final design preparation. It is assumed that design review workshops will be held coincident with regular monthly progress meetings.

- Attend at least two (2) meetings with DPH in Carpinteria.
  For budgeting purposes, a total of two (2) meetings are assumed.

- Provide a monthly progress report for inclusion with monthly invoices.

- Prepare a monthly invoice for services rendered.

B. Pre-Design/Equipment Procurement

- Prepare a Technical Memorandum (TM) clearly defining the facility design criteria; Phase I process capacities; ultimate build-out process capacities, and estimated construction cost and construction schedule. The pre-design TM shall define the project features to the 30% level of design and shall serve as the 30 percent design level submittal.
  The TM will be comprised of two parts: the Treatment Process and Plant Facilities Basis of Design TM described under Task A, and final design drawings and specifications advanced to the 30% level of design. The Treatment Process and Plant Facilities Basis of Design TM will be provided in Draft form for City review and comment without drawings except some graphics as needed to clarify the text. Development of 30% level of design drawings and specifications will proceed upon City acknowledgement that the Treatment Process and Plant Facilities Basis of Design TM is acceptable.

- Review membrane manufacturers' proposal and provide the City with comments and suggestions for how the

proposal could be modified to reduce cost, improve quality, and/or result in better integration of the membrane system with the overall treatment plant design.
AECOM will provide a peer review the City's procurement documents and the membrane manufacturers' proposal and will provide comments and suggestions. It is our understanding that the membrane manufacturer has already been provided with water quality data, treatment and operational performance criteria, (including for example requirements regarding prevention of fouling and breakage) upon which to provide their proposal, and that the City is comfortable without requesting performance or pilot testing. Therefore, for budgeting purposes, we are assuming only comments and suggestions are needed and that if the City and AECOM determine that additional testing or specification effort is warranted, this can be addressed through scope and fee adjustment at that time.

- Provide engineering support services to the City in connection with the membrane filtration system contract administration; specifically, review of the MFS submittals.
- If applicable, identify additional site investigations or testing that should be performed to support the design of the project.
AECOM will visit the project site during the project kick-off meeting/Treatment Process Workshop, review documentation from prior project planning and design efforts, and will identify additional site investigations or testing that may be needed to support project design. For budgeting purposes, AECOM assumes no additional site investigations or testing will be needed, or that these would be provided by the City.

C. Design

- Prepare the final engineering design for the Project.
*Utilizing construction drawings prepared by others as reference documents and as a basis for initial development of drawings, AECOM will prepare the anticipated construction drawings identified in **Table 1.1 and 1.2** at the end of this section. These tables identify the anticipated level of effort needed to modify and advance the prior prepared construction drawings to completion for this project, based on AECOM's initial review. Table 1.1 reflects the anticipated drawing and level of effort associated with the existing design as described in the RFP. Table 1.2 reflects the anticipated drawings and level of effort associated with the AECOM preferred alternative. Should additional drawings be needed, or significant additional effort be needed to utilize the prior prepared drawings that could not be discerned under initial review, AECOM will alert the City to establish a strategy and determine if additional budget should be authorized.*

  AECOM will prepare technical specifications for the project in CSI format, utilizing AECOM's standard specifications as the basis. Front-end contract documents and general requirements shall be prepared and provided by the City.
- Prepare anticipated construction and design delivery schedules.
- Assist with public involvement programs at appropriate times during design process.
AECOM assumes it will assist with public involvement programs by (1) Preparing graphics, derived from design drawings under preparation, to depict the project; and (2) Preparing for and attending public involvement meetings. A total of two (2) meetings are assumed. A budgetary allowance is provided for these efforts.
- If applicable, arrange for additional surface and subsurface investigations.
AECOM assumes none will be necessary.
- Make presentations to the City as may be necessary or desirable to obtain the approval of the City (Planning Commission and City Council) and assist the City in applying for and obtaining from applicable public agencies any approval, permit, report, or waiver required by law (e.g. Army Corps, Regional Water Quality Control Board, California Department of Fish and Game, etc.).
AECOM has provided a budgetary allowance for these efforts.
- 60% and 90% Design Submittals: Prepare construction drawings (22" x 34" sheets with City standard title sheets), specifications, and contract documents adequate for receipt of construction proposals. All drawings shall be prepared using AutoCAD 2007, with all dimensions indicated in English units. Bid quantities shall be in English units. Five (5) half sized (11" x 17") copies of the final plans and specifications shall be prepared to be distributed to the City for each milestone review (60% and 90%).
- 100% Design Submittal: Upon completion, the paper plots of camera-ready drawings shall be submitted to the City together with one set of the camera-ready project specifications and all other bid documents. The final construction contract documents will be signed and sealed by registered professional engineers licensed in the State of California.

- The electronic files of the 100% drawings, front-end documents and technical specifications shall be provided to the City in .pdf file format on CD/DVD.
- Prepare estimates of quantities and construction costs, for inclusion with the 60%, 90%, and 100% design submittals.
- Conduct internal constructability and bidability design reviews as part of the quality control process, and provide a summary report of findings and recommendations to the City.

D. Bidding Assistance

- Advertising and all printing and distribution of contract documents will be handled and paid for directly by the City.
- Attend one pre-bid meeting and site visit.
- Respond in writing to contractor questions during the bidding period.
- Prepare contract document addenda.
  For budgeting purposes, one (1) addendum is assumed.
- Assist the City with review of bids.
- Prepare conformed contract documents incorporating addenda items into the contract. Provide the City with the drawing and specification files electronically in .pdf file format.

E. Permitting Support

- City plan check
  AECOM assumes the City will orchestrate all reviews among all City departments, and upon completion, will resolve conflicts among its internal review comments. For each formal plan check, AECOM will compile comments into a spreadsheet form to document the comments, and our responses. Meetings, if needed, will be held coincident with other activities described herein for efficiency.
- CDPH permit amendment and Operations Plan
  AECOM will support the City with technical information from the design to support the CDPH permit amendment. AECOM will prepare a basic Operations Plan for the project to support permitting. A more complex operations plan/O&M manual is envisioned for the construction phase; scope and budget for that effort will be addresses at that time.
- Request RWQCB WDR waiver for zero discharge to unlined impoundments and surface water

  AECOM will provide technical information from the design to support the City in their securing the RWQCB waiver.

  In addition to the aforementioned permits, it is our understanding that the project also requires permits from AQMD and for a railroad crossing for installation of waste lines from the plant to the sewer. AECOM will provide technical information from the design to help the City secure a permit from AQMD; AECOM will apply for and coordinate with the railroad for the pipeline crossing permit.

F. Construction Phase

- Construction phase office engineering and construction management services scope and fee to be negotiated as a separate contract.

NOTE: All comments below are additional annotations and clarifications.

III. Additional Engineering Services

If requested by Client, AECOM will provide the following additional services, beyond the services included in Section I, Scope of Services:

A. Attendance to additional meetings beyond those specifically identified in Section I.

B. Environmental services, including environmental reviews, analysis or studies, permit preparation and processing, attendance to public hearings, etc.

C. Planning, analysis or design of additional or alternative facilities, including facilities offsite from the proposed treatment plant site.

D. Construction phase services including such services as office and field engineering support, field observation, construction contract administration, change order review and processing, etc.

E. Any additional project related services not specifically included in Section I, Scope of Services.

IV. Client Furnished Services

The following services or information will be provided by Client or its consultants:

A. Copies of all relevant reports, studies, drawings, correspondence, and other relevant project information or data. It is assumed these will include complete and accurate topographic mapping and boundary survey of the project site, and a comprehensive geotechnical and seismology investigation of the project site suitable to support

structural design and project construction.

B. Copies of drawings prepared for both prior versions of detailed design efforts of the project (2 MGD capacity and 6 MGD capacity versions) in AutoCAD format. It is assumed that all drawings will be useable as basis for preparing drawings under this Scope of Services with only minor modification for formatting.

C. Distribution system transient (surge) analyses prepared for prior iterations of the project design.

D. Hydrology and hydraulic calculations prepared for prior iterations of the project design.

E. Assign one person to serve as the Client's project manager who has authority to represent the Client and will serve as the point of interface for all project issues and communications.

F. Application and processing of all required permits including complete environmental compliance.

G. A complete written description of all pertinent project information and issues, including all unusual or critical requirements of the Client.

V. Other Terms and Conditions

A. Right to Rely. Except as otherwise noted in the Scope of Services (most notably the use of prior design efforts to produce the final design), consistent with the professional standard of care, AECOM shall be entitled to rely upon the accuracy of data and information provided by Client or others without independent review or evaluation. Survey mapping, geotechnical investigations, and water quality data are examples.

B. Opinions of Cost. Any Opinion of the Construction Cost prepared by AECOM represents its judgment as a design professional and is supplied for the general guidance of Client. Since AECOM has no control over the cost of labor and material, or over competitive bidding or market conditions, AECOM does not guarantee the accuracy of such opinions as compared to contractor bids or actual cost to Client.

C. Contractor Indemnification/Insurance. Client will include in the general conditions of any construction contract, language which states that the construction contractor is required to hold harmless and defend the Client, AECOM, and their agents, employees and consultants, from all suits and actions, including attorneys' fees, and all costs of litigation and judgments of any nature and description arising out of or incidental to the performance of the construction contract or work performed thereunder. The Client, AECOM, their agents, employees and consultants shall also be named as additional insureds in any construction contractor's insurance policies.

D. Reuse of Documents/CADD Data. Documents, drawings, specifications, and electronic information/ data, including computer aided drafting and design ("CADD"), prepared by AECOM pursuant to this agreement are not intended or represented to be suitable for reuse by Client or others on extensions of the Project or on any other project. Any use of completed documents for other projects and any use of incomplete documents without specific written authorization from AECOM will be at Client's sole risk and without liability to AECOM. Client assumes full responsibility for such changes unless Client has given AECOM prior notice and has received from AECOM written consent for such changes. Electronic data delivered to Client shall not include the professional stamp or signature of an engineer or architect. Client agrees that AECOM shall not be liable for claims, liabilities or losses arising out of, or connected with the decline of accuracy or readability of electronic data due to inappropriate storage conditions or duration.

E. Schedule and Delays. AECOM shall not be responsible for delays due to causes beyond AECOM's reasonable control. In the case of any such delay, the time of completion shall be extended accordingly.

F. Hazardous Materials. Notwithstanding anything in this Agreement, AECOM shall have no responsibility for the discovery, presence, handling, removal, or disposal of, or exposure of persons to hazardous materials in any form at the project site.

G. Job Site Safety. In accordance with generally accepted construction practices, the construction contractor will be required to assume sole and complete responsibility for job site conditions during the course of construction of the project, including safety of all persons and property, and that this requirement shall be made to apply continuously and not be limited to normal working hours. AECOM shall not have control over or charge of, and shall not be responsible for, construction means, methods, techniques, sequences, or procedures, as these are solely the responsibility of the construction contractor. AECOM shall not have authority to stop of reject the work of the construction contractor.