

TO: City Council

FROM: James L. App, City Manager

SUBJECT: **Water & Wastewater Resource Management**

DATE: January 4, 2005

NEEDS: For the City Council to consider amending Boyle Engineers' Water & Sewer Master Plan contract to broaden and integrate planning for water and wastewater resources.

- FACTS:**
1. The City provides water and wastewater services to residences and businesses within City limits.
 2. The City relies on water supply from two groundwater sources – the Salinas River underflow and the Paso Robles groundwater basin. Sixteen wells produce approximately 7,500 acre feet per year but are strain to meet high summer water demands.
 3. Salinas River underflow withdrawals are expressly limited by State permit/license. Groundwater basin use is not, but is subject to competitive pressures, limited safe annual yields, and localized water level decline.
 4. Groundwater is hard, locally affected by selected constituents, and subject to diminishing quality. Water treatment is provided at each wellhead.
 5. The City recently committed to the Nacimiento Lake surface water project, which will deliver 4,000 acre feet per year of relatively high quality, raw (untreated) water beginning in approximately 2009/10.
 6. Approximately 2,900,000 gallons per day (3,300 acre feet per year) of wastewater is collected, treated, and disposed from a central plant located adjacent to the Salinas River.
 7. City water and wastewater services are regulated by a number of public agencies including:
 - San Luis Obispo County Department of Environmental Health
 - Regional Water Quality Control Board
 - State Department of Fish and Game
 - State Department of Health Services
 - State Department of Water Resources
 - State Water Resources Control Board
 - U.S. Army Corp of Engineers
 - U.S. Department of Fish & Wildlife
 - U.S. Environmental Protection Agency

8. County, State and Federal regulations control the quality (concentrations of salts and specific constituents) of water supply sources and wastewater. Regulatory limits on specific constituent concentrations are increasingly rigorous.
9. Development and delivery of water and wastewater services is also guided by the City's General Plan, Municipal Code, Urban Water Management Plan, Water Master Plan, and Sewer Master Plan.
10. Increasing water demands and ever-tightening regulations on both water and wastewater quality necessitate development of *integrated* water and wastewater management practices and more advanced treatment regimens. New management strategies need to include:
 - Identification of specific water quality targets to meet multiple objectives and rigorous requirements for public health, groundwater, Salinas River, watershed sustainability, and environmental enhancement; and
 - Definition of water treatment alternatives to achieve water quality targets, and
 - Recognition of recycled wastewater as a resource that can help address seasonal water shortages, water conservation, groundwater basin supply, watershed enhancement, and environmentally sound wastewater treatment and disposal objectives; and
 - Development of integrated management of surface water, groundwater, recycled water and river resources, so that the integrity, quality, and supply of these unified resources can be sustained for the long term.

**ANALYSIS &
CONCLUSION:**

A long-term, reliable supply of good quality water is essential to life, public health, environment, business, and a strong economy. Paso Robles water resources are limited, subject to ever-increasing demands, and at risk of water quality degradation. The management of water supplies, demands, uses, discharge and replenishment must, therefore, be a guiding criterion in public decisions.

Paso Robles provides water and wastewater service to over 27,000 people today, increasing to over 40,000 by 2025. The City's use of, and discharge to, area waters may affect even more. A long-term strategic and integrated management plan to sustain these resources and services must be developed.

Boyle Engineers is currently preparing the City's water and wastewater master plans, as well as a wastewater treatment plant operations audit. Their work should be expanded to integrate water and wastewater planning so that the City may amplify and galvanize its efforts to:

- Improve water quality;
- Increase & diversify water supplies;
- Increase reliability of water supplies;
- Lessen groundwater basin pumping;
- Reduce salt loading into groundwater;
- Anticipate and comply with regulatory mandates;
- Safeguard water rights; and
- Prioritize expenditures to achieve these goals.

Integrating water and wastewater master planning will fuse water source development, treatment, reclamation, disposal, use, and reuse together as a complete water cycle/system management effort. The integrated plan would be comprised of a wide range of strategies, programs and projects. Boyle Engineers is currently developing some of the plan's components:

- Sewer Master Plan update.
- Water Master Plan update.
- NPDES Wastewater Discharge Permit.
- Wastewater Treatment Plant Operational Audit.
- Water Storage Tank Site Evaluation, Design and Development.

Additional features needed to both fulfill current obligations and permits, and effect integrated water cycle/system management planning include development of:

- Nacimiento, groundwater, and wastewater treatment alternatives;
- Groundwater source analysis (well field operations and recharge options);
- Recycled Water Study update and demand analysis;
- Wastewater Pretreatment/Source Control Program;
- Salt Reduction program update; and
- Prioritized capital improvements program, schedule and cash flow analysis.

Given the complexity and broad scope of such an effort, it is prudent to take advantage of Boyle Engineer's comprehensive knowledge of, and involvement with, the City's water and wastewater systems, operations, regulatory challenges, and the Nacimiento Water Project. Accordingly, Boyle Engineers was asked to develop a supplemental proposal to integrate the City's water and wastewater master planning. Their proposal (attached) takes advantage of the work already under contract/development, and incorporates and integrates all of the features listed above.

An integrated plan will provide an approach which unifies water cycle, demand, treatment, use, discharge and replenishment management to ensure adequate, sustainable, diverse, and quality water supplies for the long-term. It is an effort vital to the community's future.

POLICY

REFERENCE: California Urban Water Management Planning Act; California Toxics Rule; Paso Robles General Plan, Municipal Code, Urban Water Management Plan, Water Master Plan, & Sewer Master Plan.

FISCAL

IMPACT: \$400,000 to be appropriated from the Water and Sewer Funds.

Phases I & II of the supplemental work are estimated at \$300,000. Phase III costs will be determined following completion of the preceding phases, but are expected to be approximately \$40-70,000. Additionally, it is possible that new, unforeseen conditions/complications will be discovered in the course of the evaluation necessitating additional work and associated costs. Accordingly, a budget of \$400,000 is sought to provide for these contingencies.

Until such time as the nature and extent of study outcome is determined, 50% of the cost will come from Water, and 50% from Sewer, resources - both retained earnings and impact fees.

The impact fee, or new development, shares will be equivalent to the cost allocations for preparation of the sewer and water master plans, 90% and 39%, respectively. This will necessitate a future minor increase in both the sewer and water impact fees. For sewer, the increase would be \$35 per residential unit and \$10 for water. A connection fee resolution will be presented for action at a future date.

OPTIONS: a. **Adopt Resolution No. 05-xx appropriating \$400,000 for, and authorizing the City Manager to amend the contract with, Boyle Engineers to prepare an Integrated Water & Wastewater Master Plan.**

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

Attachments: Resolution
Proposal

RESOLUTION NO. 05-

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF PASO ROBLES
APPROPRIATING \$400,000 FOR, AND AUTHORIZING THE CITY MANAGER TO
AMEND THE CONTRACT WITH, BOYLE ENGINEERS TO PREPARE AN
INTEGRATED WATER & WASTEWATER MASTER PLAN

WHEREAS, the City has contracted for 4,000 acre feet of raw (untreated) water from the Nacimiento Water project annually; and

WHEREAS, raw water must be treated before distributed for human consumption and use; and

WHEREAS, certain City wells are indicating levels of undesirable constituents that may require more rigorous treatment and/or blending than currently provided; and

WHEREAS; area ground and Salinas River water indicates high levels of salts; and

WHEREAS, water once used must be treated before being discharged; and

WHEREAS, reuse of water is a viable means of supplementing supply; and

WHEREAS, Boyle Engineers has been, and is currently, assisting the City with fresh and waste water matters; and

WHEREAS, Boyle Engineers is currently under contract to update the City's Water and Sewer Master Plans; and

WHEREAS, increasing water demands and ever-tightening regulations on both water and wastewater quality necessitate development of integrated water and wastewater system planning; and

WHEREAS, development of a comprehensive water cycle/system management effort and infrastructure plan will aid in the prioritization, and maximize the value, of utility investments.

NOW, THEREFORE, BE IT RESOLVED by the City Council of the City of El Paso de Robles to:

1. Appropriate \$400,000 as follows:

Water Development Impact Fee Fund	\$ 78,000	220-910-5224-770
Water Operations Fund	\$122,000	600-910-5224-770
Sewer Development Impact Fee Fund	\$180,000	221-910-5224-770
Sewer Operations Fund	\$20,000	601-910-5224-770

2. Authorize the City Manager to amend the contract with Boyle Engineers to prepare an Integrated Water & Wastewater Master Plan as documented in their proposed scope of work attached hereto and included herein by reference.

3. As soon as practical, prepare and present appropriate sewer and water development impact (connection) fee increase actions for Council consideration.

PASSED AND ADOPTED by the City Council of the City of El Paso de Robles this 4th day of January 2005 by the following vote:

AYES:

NOES:

ABSTAIN:

ABSENT:

Frank R. Mecham, Mayor

ATTEST:

Sharilyn M. Ryan, Deputy City Clerk



Proposal for
Adaptive Integrated Water
Resources Plan

November 2004

BOYLE

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Employee Owned

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City of Paso Robles
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Paso Robles CA 93446

November 15, 2004
BK-B99-197-01

Proposal for Adaptive Integrated Water Resources Plan (IWRP)

Dear Jim,

The Integrated Water Resources Plan will incorporate evaluation of all available water and wastewater sources defining a sustainable, high quality, long-term water supply for the City. Based on our team meetings, and comments received from your technical advisors, we have developed the attached proposal. As discussed herein, we propose to develop this Plan in three (3) phases.

Phase I will establish the City's goals for the Plan. We will work closely with you, your Water Resources Manager, and your technical advisors during this phase to develop the program guidelines and ensure our subsequent work meets the City's needs.

Phase II will include a detailed analysis of the options available and a comparison with the goals and objectives/requirements set out in Phase I. As we advised you in prior meetings, it is our intent to use information developed as part of the Sewer and Water Master Plans (currently underway) to evaluate alternatives. These documents will provide a source of information as to facilities that can be used or expanded in order to accommodate the IWRP. We anticipate that various alternatives will be defined and summarized by use of simple spreadsheet computer programs. These programs will be available for use by the City for modifications of the IWRP as the programs are developed and goals and requirements change. We anticipate that the 2006 update of the City's Water Management Plan will use these programs and Plans extensively.

The second phase will include the development of alternatives without regard to construction or operating costs, beyond that of the judgment of the professionals involved, to determine water quality and sustainability issues of the supplies available. During this phase the water system model, sewer model, treatment plant model, and demand estimates will be used extensively to identify system improvements and operational changes that would be needed to attain the results desired. At this point costs would not be assigned, but judgment applied as to what is feasible. At the end of this Phase II we would have several meetings with the City staff and consultants to

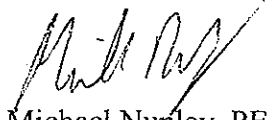
review the Integrated Water Resources Plan to confirm that all of the reasonable options are defined and the evaluation factors are as agreed.

Phase III will involve detailed analysis of the options defined in Phase II of the Integrated Water Resources Plan. Also the capital and operating costs and phasing will be defined for the IWRP. Phase III will define the Capital Improvement Program (CIP) for the program. At the end of this phase the City would have a clear Plan as to what sources and quantities of water would be needed (and at what times). If a source is not available (now or in the future), a plan as to how it would be developed or replaced with an alternative source will be defined. The City is in a unique position at this time with a new source of high quality water (Nacimiento Water) that could be available at numerous locations in the system. This high quality water will need to be treated and delivered. An alternative would be to recharge a portion as a supplement to the existing ground water resources thereby using the groundwater basin for mixing and storage. If this is done, we believe higher quality could be obtained from the basin and that peaking supplies would be more readily provided by use of the groundwater reservoirs.

We believe that our proposal will attain the goals that we jointly concluded were necessary for the Integrated Water Resources Plan. Our approach will develop a specific plan of facilities, a capital improvement program, and a clear direction for the City to follow for the next ten or more years.

Please review the above and should you have any questions please do not hesitate to contact me. We are prepared to move forward on this Integrated Water Resources Plan immediately so that it can be used as a basis for the City's Water Management Plan due in 2006.

Boyle Engineering Corporation



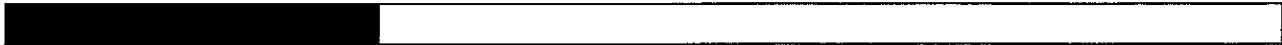
Michael Nunley, PE
Program Manager

cc: Christine Halley, TJ Cross
Iris Priestaf PhD, President of Todd Engineers
David Hardan, Boyle Engineering
Christopher Alakel, Boyle Engineering

CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES
PLAN

NOVEMBER 2004

1	PROJECT UNDERSTANDING
2	PROJECT APPROACH
3	PROJECT TEAM
4	PROJECT BUDGET
5	PROJECT SCHEDULE
6	APPENDIX



CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES
PLAN

NOVEMBER 2004

1 PROJECT UNDERSTANDING

CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES PLAN
BK-899-197-01

BOYLE

Project Understanding

The City's 4.0-million gallon Golden Hills Reservoirs were damaged during the December 2003 San Simeon earthquake. During the summer of 2004, one of the City's Golden Hills Reservoirs was out of service for repair. City staff were concerned that without adequate storage, a failure at one of the wells could result in an emergency water shortage. Their concern resulted from their observations during the summer of 2003, when City staff noted water storage levels dropping throughout the summer **with both tanks in service**. The City reacted quickly, in the spring of 2004 implementing a water conservation program to help reduce demands and prevent a water shortage.

The City endured the summer months without resorting to drastic emergency measures. But the concerns related to growth, declining groundwater quantity and quality, wastewater disposal limits, and coordination with the Nacimiento Project are persistent. These concerns are related, since changes in source water quantity and quality affect wastewater quantity and quality.

Population. According to the 2000 Census, 24,297 people lived in the City of El Paso de Robles. In December 2003, the Council approved a 2025 growth limit of 44,000 and agreed to annex approximately 513 acres southeast of the City. It is our understanding that the City expects growth to occur mostly on the east side, with less development anticipated on the west side. Growth will require additional water sources, treatment, and distribution and will result in an increased demand on wastewater collection, treatment, and disposal systems.

Groundwater Condition. In the past year or two, the City completed efficiency testing of 14 of the City's 16 wells, which showed that summer production capability is about 61% of the design capacity of the wells (winter production capacity is about 75% design capacity). Because the City's reliability assumptions were based on design capacity, the lower actual production capability has narrowed the reliability buffer to a critical point. Thus, it is vital that the City develop a better understanding of actual well field capacity by assessing the entire well field.

For instance, why are the wells producing less than their design capacity? The summertime production capacities range from 21% to 90% of the original design capacity. There are numerous potential reasons, including inaccurate initial estimates of well capacity (an engineering problem), declining well efficiency (a

pump problem), declining well production (a well problem, perhaps due to clogging), declining water levels (an aquifer problem), or some combination of causes.

Looking at the water level records for the past five years shows that, for the most part, standing water levels in the aquifer have not seriously declined, suggesting that it is not an aquifer problem. However, the results of the recent Paso Robles Groundwater Basin Study (for which Fugro, our Hydrogeologic consultant, acted as Project Manager and prime investigator/author) show that water levels are declining along the Highway 46 corridor from the eastern edge of Paso Robles out to Whitley Gardens. Therefore, if aquifer problems are not the root of the problem with some of the City's wells now, they may be soon.

Inspection of the water level records of some of the wells show a relatively stable standing water level history, but declining pumping water levels. This may be caused by well clogging and/or increased well competition and interference.

Lastly, the results of the efficiency testing showed very low well motor efficiencies, ranging from 32% to 63% with an average of 51%. In many respects, this is an entirely different problem than that described above, and is likely mostly related to an unrealistic expectation of the well design capacity.

Water quality has been an issue, as well. The total dissolved solids (TDS) and hardness of Paso Robles' groundwater is high and will continue to rise as water is extracted from the basin, used, and recharged.

The City is not the only user of groundwater within the basin, as City staff is well aware. Other agricultural, industrial, and domestic users share this resource but no program exists for facilitating basin-wide coordination.

Wastewater Disposal Issues. The City has several critical challenges ahead related to its wastewater treatment and disposal. With its current operational approach of direct discharge to the river, the effluent does not consistently comply with RWQCB limits for TDS, chloride, sulfate, and sodium. Furthermore, it is likely that the RWQCB will require cessation of a direct discharge operation. The last update of the City's Waste Discharge Requirements established effluent limits in trace quantities (parts per *billion*) for cyanide, selenium, trihalomethanes, and a plasticizer called bis-2-ethylphthalate.

The City has evaluated several strategies to resolve these issues. Two potential alternatives, perhaps working in conjunction, are (1) the development of wastewater disposal percolation ponds along the Salinas River, and (2) development of a wastewater disposal/groundwater recharge facility in the area east of the City where basin water levels are declining. The RWQCB has mandated that new, stringent discharge requirements *unique to river and creek dischargers* will be placed on the City within 5 years unless the City ceases their current discharge operation.

Nacimiento Water Project. The City recently signed an agreement to purchase water from the Nacimiento Water Project, which will provide high quality raw water (low TDS) to the City for treatment and distribution. The appropriate treatment process, blending approach with groundwater, and system connections to maximize the cost-effective usage of this water must be determined soon since design of the pipeline and appurtenances will begin in the next few months.

Need for Integrated Planning

The relationship between these issues, and the need to address them soon to meet schedules dictated by the Nacimiento Water Project, WWTP discharge permit, and pending regulations, indicate a **need for integrated planning to identify, prioritize, and plan infrastructure improvements.** Integrated planning will provide a “road map” to meeting the City’s goals of **sustainability, reliability, and efficiency** throughout their water resources programs and services.



CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES
PLAN

NOVEMBER 2004

2 PROJECT APPROACH

Approach

Our scope of work is outlined below. We propose to complete this work in three phases. Phase I includes establishment of goals and regulatory review. Phase II includes studies that will complement and expand the ongoing Water and Wastewater Master Plans, addressing groundwater management, water quality, utilization of Nacimiento Water, recycling and conjunctive use opportunities, and capacity of existing infrastructure. The studies will require close coordination to ensure all work is consistent with the City's vision and goals and to ensure recommendations can be integrated into one comprehensive program. Phase III will provide a detailed engineering analysis with schedule and cashflow for implementation of recommended improvements.

Our adaptive management approach will require us to redirect and focus our work, as needed, through the development of the IWRP. Because of this, we will provide close communication and coordination with the City throughout our work. Boyle will submit to the City monthly budget reports for these planning efforts along with a summary of our budget status. We also propose to provide monthly status reports (in writing) for the Integrated Water Resources Plan in the City Council staff report format for review and use by the City.

Scope of Work

Phase I - Establish Goals

Boyle will meet with the Project Team (including City staff and technical advisors) to establish goals for the IWRP. Boyle will review water (CDHS), water rights (SWRCB), and wastewater (RWQCB) regulations, providing a summary of existing and pending regulations that must be considered and addressed in the IWRP. Key members of the Project Team will attend a workshop on the groundwater basin study in order to review regional groundwater issues and evaluate the City's position with respect to them. We will also review the City's current Salt Management Plan and Source Control monitoring programs (as required in the City's WDRs and NPDES permit) and make recommendations for revising or augmenting those programs.

Boyle will also review the City's utility expenses from the last 2 years, meet with operations staff, and identify operational concerns to be addressed in the subsequent phases.

Deliverables: This work will be summarized in a draft report for review by City staff. A final report will be submitted after comments are received and incorporated. Boyle will also prepare a presentation of the Phase I work for City Council.

Phase II – Water Resource Planning

The Phase II tasks will expand the ongoing Water and Wastewater Master Plans. We have included a description of the ongoing Plan at the end of this section. These plans will serve as the basis of the work described in this proposal, since many of the models developed therein can be applied to the alternatives evaluation for the Integrated Plan.

When the City developed the scope of work for the Master Plans, the scope included only demand estimates (under existing and future conditions) and hydraulic capacity evaluations. Quantity, quality, and sustainability of available water sources (Nacimiento, groundwater, and reuse) were not addressed. These Plans also did not include an update of the City's Water Reuse study, which would evaluate potential uses (primarily groundwater recharge and irrigation) and facilities required for delivery of reclaimed water.

Our Phase II work will provide the additional information necessary to develop and evaluate water source, treatment, storage, and delivery alternatives. The Phase II Scope of Work addresses the work required in addition to the ongoing Master Plans. Tasks IIA and IIB (Source Water Evaluation and Nacimiento Treatment Evaluation) will address the quantity, quality, and sustainability of groundwater and Nacimiento water. Task IIC (Recycled Water Study Update) will evaluate recycled water as a resource for meeting irrigation demands and for recharging groundwater. Task IIC will include an estimate of existing and future water demands that could be met with recycled water and recommendations for storage and delivery to users.

Cost for meetings and deliverables included in the Master Plan scopes will be reduced since meetings will discuss overall progress of the Integrated Plan and draft Technical Memoranda will be submitted instead of finished Master Plans.

Meetings: We will schedule monthly progress meetings to present the ongoing work, discuss additional concerns, and redirect efforts as we develop more information. It is assumed the Boyle Team will prepare two (2) presentations of the Phase II studies for City Council during the progress of this work.

Deliverables: As described below, deliverables will consist of both draft and final Technical Memoranda. An outline of our standard format is provided at the end of this section. Six (6) copies of draft Technical Memoranda will be provided to the City for review. Six (6) copies of final Technical Memoranda, including one camera-ready unbound copy, will be provided.

Task IIA - Groundwater Source Analysis:

Task IIA will expand the Water Master Plan to include a groundwater source evaluation. This task will estimate the quantity of available groundwater under short-term and long-term demand conditions. The Boyle team will perform the following tasks as part of the groundwater evaluation and water well assessment:

- Prepare detailed geologic/well log profiles through the water bearing strata in well field areas.
- Estimate the hydraulic characteristics of the aquifers, based on well performance tests previously conducted on the City's wells. Any related ongoing work that has been done by Cleath and Associates would be incorporated in this work.
- Prepare groundwater elevation maps for drought and normal years
- Review groundwater level fluctuations in wells
- Perform an assessment of performance and drought yield for each City well.
- Address local interference impacts between City wells and other nearby private wells.
- Discuss alternative management scenarios to maximize production from wells during summer and drought periods
- Present strategies for operating the well fields during critical periods when individual wells may need to be operated at rates and duration more than what is normally allowed
- Provide recommendations for addressing potential short-term shortfalls in water supply, either in drought conditions or during an interim period while new water supplies are developed
- Determine "baseline conditions" for the City groundwater wells, in order to evaluate the effect of groundwater recharge on production levels and quality.

Deliverable: A draft technical memorandum will be submitted to allow review and comment by City staff prior to integration with the other Phase II work and development of the Integrated Water Resources Plan.

Task IIB - Nacimiento Water Treatment Plant Evaluation:

Boyle will develop recommendations for optimizing the use of Nacimiento water. We will evaluate alternatives for treating and delivering the water to the City's distribution system efficiently and cost-effectively, while meeting the City's goals for water quality, sustainability, and operability. Boyle's scope of work for the Nacimiento Water Treatment Plant Evaluation includes the following tasks:

- Perform site selection and feasibility analysis to identify up to three (3) potential water treatment facility sites for centralized treatment of Nacimiento water and groundwater.
- Identify locations for multiple or alternate turnouts from the Nacimiento Water Project other than the turnout proposed in the EIR.
- Perform an evaluation of the City's existing groundwater supply to recommend treatment approaches for reducing the California Toxics Rule limits that apply to the Wastewater Treatment Plant.
- Evaluate alternative disinfection methods and taste/odor control processes.
- Develop up to three (3) conceptual flow diagrams, treatment system layouts, process descriptions, and evaluations of both capital and operating costs.
- Perform conceptual evaluation of methods of residual disposal.
- Identify facilities and layout required to connect the recommended treatment facilities (up to three sites) to the City distribution system.
- Provide a screening-level environmental constraints analysis for the recommended sites, identifying primary environmental constraints (including biological resources, geohazards, noise, aesthetics, and traffic). The analysis will be based on a review of existing technical studies and information. The general environmental permitting requirements related to the key agencies (US Army Corps of Engineers, US Fish and Wildlife Service, and California Department of Fish and Game) will be described. The results of the environmental analysis will be presented in

matrix form, for the purpose of identifying an environmentally-preferred site.

- Discuss relative costs and benefits of developing a regional water treatment facility with Atascadero Mutual Water Company and Templeton Community Services District, based on the recommended treatment plant site and layout. Provide an analysis of the “economies of scale” for serving these other agencies, as well as the City. We propose meeting with the other participants to discuss this.

Deliverable: A draft technical memorandum will be submitted to allow review and comment by City staff prior to integration with the other Phase II work and development of the Integrated Water Resources Plan.

Task IIC - Recycled Water Study Update

Boyle will update the City’s Comprehensive Recycled Water Study (2001), considering the current CTR requirements and anticipated tightening of regulations for surface water dischargers.

Recycled water is a resource that could offset potable water demands by meeting irrigation and industrial demands. It could also be used for groundwater recharge, improving the overall sustainability of the entire groundwater basin. Task IIC will determine demands, water quality requirements, and delivery strategies through the development of alternatives and recommendations for utilizing this resource in a cost-effective manner.

The user survey will be reviewed and updated. We will determine which agricultural and urban irrigation water users could take reclaimed water and identify water quality requirements (based on regulations and long-term operations/maintenance concerns) for those users. Boyle will evaluate groundwater recharge, agricultural irrigation, and urban irrigation as potential disposal or usage alternatives. Opportunities to recharge groundwater aquifers, and thereby protect the City’s water rights position, will be a focus of this work.

A screening process will be developed to identify potentially suitable sites for both percolation (3 sites near the River) and groundwater recharge (3 sites in the Estrella area). Key issues for the percolation pond concept include percolation capacity,

floodplain issues, local geology and hydrogeology, water quality discharge limitations (RWQCB), effluent quality, and other factors that will be identified and addressed. Once the sites are identified, borings will be drilled at each site (two per site) to appropriate depths (no greater than 50 feet) to verify soil conditions, percolation capacity, and stratigraphy. Estimates of sustained infiltration rates will be based on laboratory-determined permeability values (undisturbed samples). No percolation tests will be performed until gross feasibility is determined.

The Project Team will also provide a screening-level environmental constraints analysis for the recommended sites, identifying primary environmental constraints (including biological resources, geohazards, noise, aesthetics, and traffic). The analysis will be based on a review of existing technical studies and information. The general environmental permitting requirements related to the key agencies (US Army Corps of Engineers, US Fish and Wildlife Service, and California Department of Fish and Game) will be described. The results of the environmental analysis will be presented in matrix form, for the purpose of identifying an environmentally-preferred site.

To address the disposal/recharge concept in the Estrella area, the key issues to evaluate include vadose (unsaturated) zone stratigraphy, permeability, and lithology, regulatory limitations (RWQCB and State DHS), depth to water, presence and lateral extent of confining or retarding clay layers, effluent quality, and other factors that may be specific to the type of recharge concept that appears most feasible. The advantages, disadvantages, and feasibility of various recharge mechanisms will be evaluated, including recharge ponds, spray field disposal, and injection. Potential impact on existing groundwater conditions will be evaluated.

The study will include a map of possible discharge/user sites, schematic maps for conveyance piping, winter storage assessment, and pumping requirements.

Deliverables: A draft technical memorandum will be submitted to allow review and comment by City staff prior to integration with the other Phase II work and development of the Integrated Water Resources Plan. **Since the Recycled Water Study Update is required for compliance with the City's 2004 Waste Discharge Requirements, we would provide a final submittal to the Regional**

Water Quality Control Board in accordance with the permit requirements.

Supplemental Task – Wastewater Pretreatment/Source Control Program

While not an integral component of the Integrated Plan, the Pretreatment/Source Control Program is required by the Regional Water Quality Control Board for compliance with the current Wastewater Treatment Plant discharge requirements. The goals established in Phase I of the Plan, as discussed above, will be applied as the water quality goals for this Program. Boyle proposes to complete this work as a task within the Integrated Water Resources Plan since the background information (water quality, wastewater quality, and regulatory setting) will be available at the completion of Phase I.

Boyle will develop a Wastewater Pretreatment/Source Control Program Report, including the following:

- Identify components for the City's Program.
- Assist the City with developing recommendations for revising the City sewer ordinance requirements for copper, cyanide, pH, sodium, chloride, sulfate, selenium, copper, bis(2-ethylhexyl)phthalate, TDS, and trihalomethanes (particularly bromoform, dichlorobromomethane, and chlorodibromomethane).
- Salts Reduction Program update: Boyle would review the City's salt monitoring data, previous studies, and existing salts reduction program and identify additional steps for the City's program. Approaches may include the following:
 - Encourage softener service for centralized salt regeneration at other locations (no discharge to City);
 - Public workshops to discourage the use of salt-regenerating water softeners (workshops by others);
 - Ordinances or other measures to prohibit the use of such softeners by existing and future homeowners (legal support by City-furnished sources); and
 - Ordinance requiring Salts Management Plans from industrial dischargers, including the local water softening industries (legal support by others).
- Provide recommendations for expanding the pretreatment monitoring program and auditing dischargers to the collection system in order to address the waste parameters

listed above.

- Prepare a Source Control Plan and/or a Pollutant Minimization Plan in accordance with the RWQCB's permit requirements to address the California Toxics Rule (CTR) limits.
- Budget estimates will be developed for implementation of the recommended approaches.

Deliverable: A draft technical memorandum will be submitted to allow review and comment by City staff prior to integration with the other Phase II work and development of the Integrated Water Resources Plan. **Since Salts Reduction Program and Pretreatment/ Source Control Program are required for compliance with the City's 2004 Waste Discharge Requirements, we would also provide one (1) copy of the final submittal to the Regional Water Quality Control Board in accordance with the permit requirements.**

Current Water and Wastewater Master Plans

In order to present a complete discussion of our Integrated Planning approach, we have included the scopes of the Water and Wastewater Master Plans below. This work will be used as the basis for the Phase II evaluations.

Water Master Plan (Ongoing) Scope of Work

The ongoing Water Master Plan will provide estimates of existing and future demands (including predicted impact of water conservation), assess capacity of the existing storage and distribution system, and recommend improvements to the storage and distribution system. We will also review current maintenance programs and provide recommendations for improvement or expansion.

Boyle will work with City staff to obtain available data pertaining to operation of the water distribution system. Historic production and consumption records from 1995 to present provided by the City will be used to estimate existing average daily, maximum, and peak hour demands for the overall system.

Boyle will obtain existing land use information from the City Planning Department throughout the water service area. We will compare land use to water consumption and determine an

applicable “water duty factor”. The General Plan land use data, population and growth rate projections will be used with the duty factors to estimate build-out demand. The anticipated impact of water conservation, various water recycling options, and unaccounted-for water will be included in projection of future water duty factors and build-out demand.

Boyle will meet with water operations staff to verify system operation specifics, discuss known deficiencies and identify recurring operations problems. We will interview City staff to discuss current condition and maintenance regimes for system well, pumps, valves etc. We will also prepare a water system schematic of system operations and zone-to-zone water movement for inclusion in the Master Plan report.

A hydraulic model will be prepared using WaterCAD software (by Haestad Methods) to simulate the operation of the water system. WaterCAD incorporates the Hazen-Williams formula as a basis of calculating flow distributions and pressures throughout the distribution system. A representative model of the pipe, tanks, pumps, and wells will be developed using the City’s most recent water atlas map, well production records, available pump curves, elevations of tanks and wells, and available topographic mapping.

This model will allow us to evaluate fire protection, water main capacity, and pressure issues throughout the community under existing future demand scenarios. The system will be developed and calibrated based on field hydrant testing. It is assumed that City staff will assist Boyle staff by providing flow and pressure gauges for hydrant testing; by operating hydrants, valves, and pumps; and by determining the status of pumps and tanks during testing. Model runs will be developed to simulate average daily flows, peak hour demands, and fire flow analyses at various locations throughout the system with imposed maximum daily demands under scenarios with the wells on and/or off.

Proposed design standards (for use in master planning and in future facility design) will be presented for use by City staff in meeting existing and future demand, supply, storage, and distribution system requirements. Design standards will generally conform, at a minimum, with the following standards: California Water Works Standards – Title 10; Uniform Plumbing & Fire Codes; Fire Chief Recommendations; Insurance Services Organization; the City; and the City’s previous Water Master Plan Update.

Recommendations for improving the modeled facilities, in order to meet existing and future demands and proposed waterworks standards, will be provided. The model of future conditions will incorporate the recommendations from the Task IIA (Groundwater Source Assessment) and Task IIB (Nacimiento Treatment Evaluation). In other words, additional well sites and/or treatment plant location(s) will be included in the distribution system model.

Typical maintenance activities (and frequency) will be determined and summarized in the Master Plan. Future maintenance needs, based on existing and recommended master planned facilities, will be evaluated.

Boyle will assess existing emergency generator / back-up power capabilities at wells and booster stations and comment on their ability to provide continued supply during an emergency. We will also make recommendations for enhancing City's back-up capabilities.

Deliverable: A draft technical memorandum will be submitted to allow review and comment by City staff prior to integration with the other Phase II work and development of the Integrated Water Resources Plan.

Wastewater Master Plan (Ongoing)

Scope of Work

The ongoing Wastewater Master Plan will provide estimates of existing and future demands (including predicted impact of water conservation and recycling), assess capacity of the existing collection system, and recommend improvements to the collection system. We will also review current maintenance programs and provide recommendations for improvement or expansion.

Boyle will place flow meters at 11 locations in the gravity sewer system. Boyle will acquire 3 gravity sewer flow meters and one Doppler-type flow meter for use in this study, allowing us to place multiple meters in the system simultaneously. This will allow us to compare the effect of a single rainfall event on inflow at several locations in the system, since we will be recording flows at 3 different locations during one event. We anticipate acquiring 2 to 3 weeks of data at each location. Boyle will acquire rainfall data for use in analysis. We will also place Doppler-type flow meters on each force main (if sufficient pipe length is available inside the

valve vaults for strapping the unit on the pipes) to measure pump flows. This will allow us to accurately measure the actual pump flow rates and compare them to the original pump design criteria. Data from the WWTP rain gauge and effluent flow meter will be collected for comparison to Boyle's data.

Boyle will analyze and graph the flow data, estimating rainfall-dependent I/I, groundwater inflow contribution, and base sewer flows by examining wet and dry weather flows, and will determine unit flow rates by land use category. Our work will also include a peaking factor analysis for estimating peak hourly, peak season day, and peak wet weather flows.

Future flow projections for 2025 will be developed based on the unit flow rates estimated above, population projects, the City General Plan, and future development information provided by City planners. Existing and future design flows (wet weather, dry weather, peaked flows, and infiltration and inflow) for trunk mains will be developed for use in the capacity analysis. The anticipated impact of water conservation, various water recycling options, and unaccounted-for water will be included in projection of future water duty factors and build-out demand.

The sewer as-built information incorporated in the City's GIS system will be used to develop a model of the City's sewer mains and lift stations using SewerCAD by Haestad Methods. It is assumed that peak hourly, average dry and wet weather, and peak season daily flows will each be applied to the model under existing and future demand conditions. No dead-end pipes or laterals will be included in the model.

Development of the sewer model will require the following steps:

- Import existing AutoCAD information into SewerCAD;
- Convert information to SewerCAD model;
- Incorporate pipes or facilities into the model based on the City's sewer atlas;
- Assign existing and future land use and unit flow information to nodes for demand values. Develop demand scenarios for Peak Hourly Flow (PHF), Peak Wet Weather Flow (PWWF), Peak Dry Weather Flow (PDWF), and Average Daily Flow (ADF) under both existing and future conditions. The anticipated impact of water conservation, various water recycling options, and unaccounted-for water will be included in projection of future water duty factors and build-out demand.

- Perform a calibration run of the completed model, using a subset (12 to 24 hour duration) of the Boyle flow meter data or WWTP flow meter data collected in Task 1. Perform at least 1 validation run (12 to 24 hour duration) based on the flow meter data. Calibration and validation runs are performed to compare the sewer model to actual flow meter data. This is valuable when evaluating estimated roughness coefficients and manhole head losses.
- Develop model scenarios for the existing system and future system (with improvements from the Master Plan). Prepare color-coded maps with capacity information for plotting and delivery to the City. (It is assumed that 8 model scenarios will be developed.)

Boyle will provide a CD to the City with the complete sewer model in electronic format. We would also provide advice to the City in their purchase of a software package. Boyle proposes to provide one day of training to City staff in manipulation of model input parameters and in developing a wide variety of output files.

Pump station analysis will include graphs of the estimated system curves (based on available as-built information or GIS data provided by the City) and pump curves. A range of system curves will be developed and graphed based on range of wetwell levels and assumed force main roughness coefficients. This analysis will include a comparison of the calculated pump design points to the measured flow data collected in Task 1.

General observations and recommendations regarding the condition and reliability of the lift stations, controls, equipment, and operators' input will be recorded during our field review and included in the analysis.

Deliverables: A draft technical memorandum will be submitted to allow review and comment by City staff prior to integration with the other Phase II work and development of the Integrated Water Resources Plan.

Phase III - Implementation Plan

The recommended Capital Improvement Projects developed in the Phase II work (including the ongoing Water and Sewer Master Plans and Wastewater Treatment Plant Audit) will be evaluated with City staff and prioritized. An implementation schedule and cashflow analysis for these projects will be developed to provide a program-level Integrated Water Resources Plan. In order to

provide tools for adaptive management of the City's water resources (i.e. predicting water quality impacts under various water source and treatment scenarios) we will also provide spreadsheets to the City.

Estimating the individual tasks and budget for this work is not possible at this time, since the Phase II analyses must be completed prior to determine which alternatives will be pursued for implementation. We propose to develop the detailed scope and budget for this Phase after we have completed Phase II and agreed upon a comprehensive water resource development strategy.

**Standard Format for
Phase II - Technical Memoranda**

The outline provided below, and brief descriptions, summarize Boyle's anticipated format for the Technical Memoranda.

- | | |
|---------------------------------------|--|
| I. Scope of Task | Discuss scope of this individual task as a component of the Integrated Water Resources Plan |
| II. Integration Issues | Identify integration issues. Summarize the findings from other tasks (ongoing or completed) that influence the assumptions established for this analysis. Identify goals of this task and their relationship to other Phase II work. |
| III. Background | Describe setting and history. |
| IV. Literature Review | Discuss prior studies and findings applicable to this work. |
| V. Existing and Future Demands | Identify existing and future demands and/or goals. |
| VI. Existing Conditions | Present an analysis of the capacity and performance of existing facilities and/or effectiveness of existing programs with respect to demands and goals (existing and future). |
| VII. Alternatives Evaluation | Develop, present, and compare alternatives for meeting demands and/or goals. |
| VIII. Recommendations | Present recommended alternative and provide "project description" to City. |
| IX. Conclusion | Discuss the "next steps" for implementing this recommendation. Describe issues that must be addressed with the other Phase II work prior to incorporating these recommendations into integrated plan. |

CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES
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3 PROJECT TEAM

Project Team

Our team members are listed below, along with their availability. An organization chart is provided on the next page.

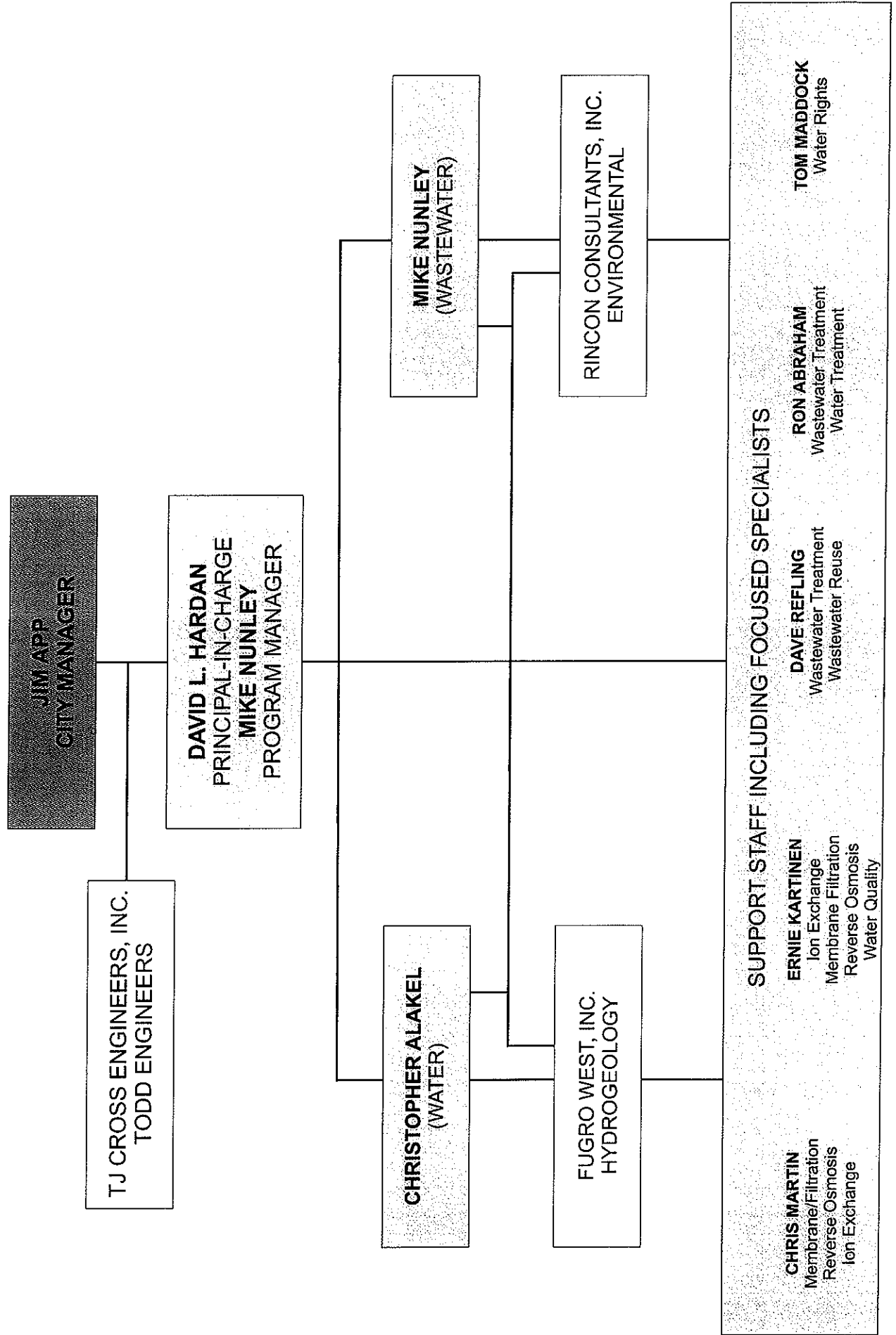
Dave Hardan – Principal-In-Charge (8 hrs/week)
 Mike Nunley – Program Manager and Project Manager- Wastewater (16 hrs/week)
 Christopher Alakel – Project Manager-Water (12 hrs/week)
 Ron Abraham – Wastewater Treatment (20 hrs/week)
 Ernie Kartinen – Water Treatment (12 hrs/week)
 Chris Martin – Water Treatment (12 hrs/week)
 Dave Refling – Wastewater Treatment and Wastewater Reuse (8 hrs/week)
 Tom Maddock – Water Rights (8 hrs/week)
 Ben Horn – Quality Control (8 hrs/week)

These engineers will be supported by the almost 300 other engineers, CADD operators, and clerical personnel in Boyle's California offices as needed. Please recognize that these individuals will be committed 100% of their time for several weeks or a month at a time to complete work. There will also be times when they may only be required to work on the project for 10% or less of their time. We are committing these people 100% but know they will only spend the amount of time necessary to complete the work required in the time required. Resumes and qualifications for Boyle team members are included at the end of the proposal.

Boyle's team will include Fugro West, Inc., for hydrogeology and Rincon Consultants, Inc., for environmental planning and permitting. We will provide their resumes and qualifications upon request.

Organization Chart

Paso Robles Adaptive Integrated Water Resources Plan



CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES
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4 PROJECT BUDGET

CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES PLAN
BK-B99-197-01

BOYLE

Budget

Boyle proposes that payment be on a time and materials basis. The attached budget details the budget for this scope of work and is based on the fee schedule provided herein. As we progress with this work, we may identify some work items that could be removed from our scope, or where scope and budget should be increased. We commit to working closely with the City to ensure the most efficient use of their funds as this program develops.

The City has authorized Boyle to complete the Water and Wastewater Master Plans. A deduct of \$15,000 for reporting, meetings, and Council presentations would be applied toward the Phase II budget described in the attached spreadsheets since the Master Plans will become part of this integrated plan.

Phase I	\$48,965
Phase II	\$261,197
Wastewater Pretreatment/Source Control Program	\$39,985
Deduction – Water/Wastewater Master Plans	-\$15,000



Project Budget

Adaptive Integrated Water Resources Plan - Phase I

City of Paso Robles
Public Works Department

Task Description	Personnel Hours						Budget					
	Principal	Senior II	Associate	Assistant	Drafter	Clerical	Total Hours	Labor	Non-Labor Costs	Subconsultants	Total Non-Labor	Total
								\$	\$	\$	\$	\$
Establish Goals												
Kickoff workshop	6	6	6				18	2,520	252	1,000	1,252	3,772
Groundwater basin workshop	2	2	2				6	840	84		84	924
RWQCB and CDHS regulatory review	24	14	18			15	71	8,980	897		897	9,877
Water rights review	16	2	4				22	3,500	349		349	3,849
Progress meeting with City	4	4	4				12	1,680	167		167	1,847
Review utility expenses and meet with operators		16	16				32	3,920	392		392	4,312
Draft Report		17	45			8	70	7,601	760		760	8,361
Final Report		12	16			8	36	3,856	386		386	4,242
Meeting with City	4	8	8			8	28	3,156	316		316	3,472
Plan and attend City Council presentation	4	4	8			8	24	2,916	292		292	3,208
Quality Control	4	4	8			4	8	948	95		95	1,043
Subtotal	64	85	127	-	8	43	327	39,917	3,989	1,000	4,989	44,906
Program Status Reports												
Monthly project budget reports		5	5			10	20	1,845	185		185	2,030
Monthly status reports		5	5			10	20	1,845	185		185	2,030
Subtotal	-	10	10	-	-	20	40	3,690	369	-	369	4,059
Total	64	95	137	-	8	63	367	43,607	4,358	1,000	5,358	48,965

Amounts shown are fee.

Project Budget

Adaptive Integrated Water Resources Plan - Phase II

City of Paso Robles
Public Works Department

Task Description	Personnel Hours						Budget				Total	
	Principal	Senior II	Associate	Assistant	Drafter	Clerical	Total Hours	Labor	Non-Labor Costs	Subconsultants		Total Non-Labor
Task IA - Groundwater Source Analysis												
Groundwater source analysis			8			4	12	\$ 1,088	\$ 109	\$ 36,000	\$ 36,109	\$ 37,197
Water shortage response plan		8	16				24	\$ 2,800	\$ 280		\$ 280	\$ 3,080
Draft Technical Memorandum	4	12	40			4	60	\$ 6,828	\$ 683		\$ 683	\$ 7,511
Quality Control	8					4	12	\$ 1,648	\$ 165		\$ 165	\$ 1,813
Subtotal	12	20	64	-	-	12	108	\$ 12,364	\$ 1,237	\$ 36,000	\$ 37,237	\$ 49,601
Task IIB - Nacimiento Treatment Evaluation												
Treatment Facility - Site selection and feasibility analysis	80	12	16		40	2	150	\$ 21,564	\$ 2,156		\$ 2,156	\$ 23,720
Groundwater treatment evaluation	60	24	80				164	\$ 22,260	\$ 2,226		\$ 2,226	\$ 24,486
Permitting		8	16				24	\$ 2,800	\$ 280	\$ 12,000	\$ 12,280	\$ 15,080
Draft Technical Memorandum		13	29			8	50	\$ 5,361	\$ 526		\$ 526	\$ 5,897
Quality Control	8					4	12	\$ 1,648	\$ 165		\$ 165	\$ 1,813
Subtotal	148	57	141	-	40	14	400	\$ 53,633	\$ 5,363	\$ 12,000	\$ 17,363	\$ 70,996
Task IIC - Recycled Water Study Update												
Review and update user survey	4	16		16			36	\$ 4,460	\$ 446		\$ 446	\$ 4,906
Alternatives evaluation (3 percolation sites, 3 recharge sites)	4	24		24			52	\$ 6,340	\$ 634	\$ 70,000	\$ 70,634	\$ 76,974
Recommendations	4	16		16			36	\$ 4,460	\$ 446		\$ 446	\$ 4,906
Draft Report		21	5	24			50	\$ 5,745	\$ 575		\$ 575	\$ 6,320
Final Report		12		24			36	\$ 3,960	\$ 396		\$ 396	\$ 4,356
Quality Control	8					4	12	\$ 1,648	\$ 165		\$ 165	\$ 1,813
Subtotal	20	89	5	104	-	4	222	\$ 26,613	\$ 2,662	\$ 70,000	\$ 72,662	\$ 99,275
Supplemental Task - WW Source Control Program												
Review existing studies and data	4	16				4	24	\$ 3,188	\$ 319		\$ 319	\$ 3,507
Identify components of salts reduction and source control programs	8	16		20			44	\$ 5,540	\$ 554		\$ 554	\$ 6,094
Develop recommendations for revising the City sewer ordinance		16		40			56	\$ 6,040	\$ 604		\$ 604	\$ 6,644
Provide recommendations for expanding monitoring program and auditing dischargers		24		56			80	\$ 8,680	\$ 868		\$ 868	\$ 9,548
Draft Report		21	5	40		16	82	\$ 8,257	\$ 826		\$ 826	\$ 9,083
Final Report		12		16		8	36	\$ 3,696	\$ 370		\$ 370	\$ 4,066
Quality Control	4					4	8	\$ 948	\$ 95		\$ 95	\$ 1,043
Subtotal	16	105	5	172	-	32	330	\$ 36,349	\$ 3,636	\$ -	\$ 3,636	\$ 39,985
Program Status Reports, Meetings, and Council Pres.												

Adaptive Integrated Water Resources Plan - Phase II

Project Budget

City of Paso Robles
Public Works Department

Task Description	Personnel Hours							Budget				
	Principal	Senior II	Associate	Assistant	Drafter	Clerical	Total Hours	Labor	Non-Labor Costs	Subconsultants	Total Non-Labor	Total
Monthly project budget reports	18					60	78	\$ 6,240	\$ -		\$ 624	\$ 6,864
Monthly progress meetings	36	36	36				108	\$ 15,120	\$ 1,512		\$ 1,512	\$ 16,632
Monthly status reports	36					60	96	\$ 8,760	\$ 876		\$ 876	\$ 9,636
City Council presentations (2)	8	16	16		16	8	64	\$ 7,448	\$ 745		\$ 745	\$ 8,193
Subtotal	44	106	52	-	16	128	346	\$ 37,568	\$ 3,757	\$ -	\$ 3,757	\$ 41,325
Total	240	377	267	276	56	190	1,406	\$ 166,527	\$ 16,655	\$ 118,000	\$ 134,655	\$ 301,182

Amounts shown are fee.

CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES
PLAN

NOVEMBER 2004

5 PROJECT SCHEDULE

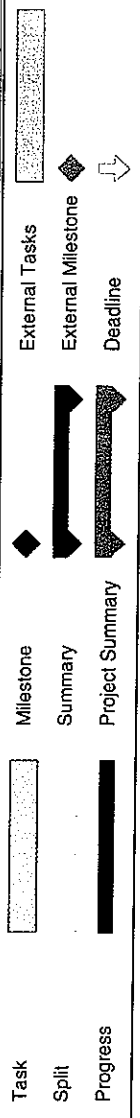
Schedule

Schedules for deliverables will be established during Phase I, as discussed in the Approach Section. Our conceptual schedule is outlined in the attached Gantt chart.



ID	Task Name	Start	Finish	2005
1	Phase I - Establish Goals	Tue 12/14/04	Fri 2/4/05	N D J J F M A M J J A S O N
2	Phase II - Water Resource Planning	Sun 12/12/04	Mon 8/15/05	
3	Task IIIA - Groundwater Source Analysis	Sun 12/19/04	Fri 5/6/05	
4	Groundwater source analysis	Sun 12/19/04	Thu 5/5/05	
5	Water shortage response plan	Sun 12/19/04	Thu 5/5/05	
6	Draft Technical Memorandum	Thu 5/5/05	Fri 5/6/05	
7	Task IIIB - Nacimiento Treatment Evaluation	Fri 2/4/05	Mon 6/13/05	
8	Treatment Facility - Site selection and feasibility analysis	Fri 2/4/05	Fri 5/13/05	
9	Groundwater Treatment Analysis - CTR, centralized softening, and all. disinfection	Fri 2/4/05	Fri 5/13/05	
10	Permitting	Sun 2/6/05	Fri 6/10/05	
11	Draft Technical Memorandum	Fri 6/10/05	Mon 6/13/05	
12	Task IIIC - Pretreatment/Source Control Program	Tue 12/14/04	Mon 5/30/05	
13	Review existing studies and data	Tue 12/14/04	Fri 1/14/05	
14	Identify components of salts reduction and source control programs	Tue 12/14/04	Fri 3/4/05	
15	Develop recommendations for revising the City sewer ordinance	Tue 12/14/04	Fri 4/1/05	
16	Provide recommendations for expanding monitoring program and auditing dischargers	Fri 3/4/05	Fri 4/29/05	
17	Draft Report	Fri 4/29/05	Mon 5/2/05	
18	Final Report	Sun 5/29/05	Mon 5/30/05	
19	Task IIID - Water and Sewer GIS Atlas	Sun 12/12/04	Fri 2/25/05	
20	Revise existing maps	Sun 12/12/04	Fri 2/25/05	
21	GIS conversion	Sun 12/12/04	Fri 2/25/05	
22	Task IIIE - Water Distribution System Evaluation	Fri 2/4/05	Mon 7/11/05	
23	Prepare list of required information	Fri 2/4/05	Thu 2/24/05	
24	Compile and review data	Fri 2/4/05	Thu 2/24/05	
25	Meet with City staff to discuss data findings/deficiencies/additional reqts	Fri 2/4/05	Thu 2/24/05	
26	Existing demand estimates	Thu 2/24/05	Fri 3/25/05	
27	Update water duty factors	Fri 3/25/05	Fri 4/22/05	
28	Future demand	Fri 4/22/05	Thu 5/5/05	
29	Review existing operations	Fri 2/4/05	Thu 3/24/05	
30	Prepare operations schematic	Fri 2/4/05	Thu 3/24/05	
31	Review maintenance programs	Thu 3/24/05	Thu 4/7/05	
32	Model preparation	Fri 2/4/05	Thu 3/24/05	
33	Determine existing and build-out demands based on updated duty factors	Sun 4/17/05	Fri 5/27/05	
34	Existing demand model runs (average, max day, peak hour, fire-flow)	Sun 4/17/05	Fri 4/29/05	
35	Future demand model runs (average, max day, peak hour, fire-flow)	Fri 5/27/05	Fri 6/10/05	
36	Determine design standards criteria	Sun 6/5/05	Fri 6/17/05	
		Fri 6/17/05	Fri 6/24/05	

Schedule is approximate at this time, since start date is not known. Submittal dates for Interim deliverables (Technical Memoranda) and progress meetings will be established after Notice to Proceed is issued.



Project: Paso Robles AIWRP
Date: Thu 11/18/04

Task: [Bar] Milestone: [Diamond] Summary: [Bar] Project Summary: [Bar]

Split: [Bar] Progress: [Bar]

External Tasks: [Bar] External Milestone: [Diamond] Deadline: [Bar]

ID	Task Name	Start	Finish	2005	N	D	J	F	M	A	M	J	J	A	S	O	N
37	System improvements assessment/recommendations	Fri 6/24/05	Fri 7/8/05														
38	System maintenance recommendations	Fri 6/10/05	Fri 7/8/05														
39	Backup power assessment	Sun 4/17/05	Fri 5/6/05														
40	Draft Technical Memorandum	Fri 7/8/05	Mon 7/11/05														
41	Task III - Wastewater Collection System Evaluation	Fri 2/4/05	Tue 7/5/05														
42	Review General Plan and Circulation Plan and meet with City staff	Fri 2/4/05	Thu 3/10/05														
43	Place flow meters	Fri 2/4/05	Thu 4/28/05														
44	Check meters	Fri 2/4/05	Thu 4/28/05														
45	Retrieve meters	Fri 2/4/05	Thu 4/28/05														
46	Download and format raw data	Fri 2/4/05	Thu 5/12/05														
47	Collect and analyze rain gauge data	Fri 2/4/05	Thu 5/12/05														
48	Establish design I & I	Thu 5/12/05	Thu 5/19/05														
49	Establish wet and dry weather flows	Thu 5/12/05	Thu 5/19/05														
50	Perform peaking factor analysis	Thu 5/12/05	Thu 5/19/05														
51	Import atlas information into SewerCAD	Thu 4/28/05	Thu 5/19/05														
52	Incorporate recent changes into model	Sun 4/17/05	Fri 5/20/05														
53	Incorporate recent changes and develop demand scenarios	Sun 4/17/05	Fri 5/20/05														
54	Assign demand values and develop demand scenarios	Fri 5/20/05	Fri 6/3/05														
55	Model calibration/validation	Sun 6/5/05	Fri 6/17/05														
56	Develop model scenarios and output mapping	Fri 6/17/05	Fri 7/1/05														
57	Easement/ROW identification	Fri 6/17/05	Fri 7/1/05														
58	Develop list of recommended improvements	Fri 2/23/05	Thu 3/17/05														
59	I/I Reduction program	Fri 7/1/05	Mon 7/4/05														
60	Identify maintenance needs	Fri 7/1/05	Mon 7/4/05														
61	Draft Technical Memorandum	Fri 2/4/05	Thu 4/28/05														
62	Task II G - Recycled Water Study Update	Mon 7/4/05	Tue 7/5/05														
63	Review and update user survey	Fri 2/4/05	Mon 8/15/05														
64	Alternatives evaluation (3 percolation sites, 3 recharge sites)	Fri 2/4/05	Thu 3/10/05														
65	Recommendations	Fri 2/4/05	Fri 4/22/05														
66	Draft Report	Fri 2/4/05	Fri 4/22/05														
67	Final Report	Fri 4/22/05	Mon 4/25/05														
	Phase III - Implementation Plan	Sun 5/15/05	Mon 8/15/05														
		Mon 7/4/05	Fri 9/30/05														

Project: Paso Robles AIWRP
Date: Thu 11/18/04

Task	Milestone	External Tasks
Split	Summary	External Milestone
Progress	Project Summary	Deadline

CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES
PLAN

NOVEMBER 2004

RESUMES

CITY OF PASO ROBLES
ADAPTIVE INTEGRATED WATER RESOURCES PLAN
BK-B99-197-D1

BOYLE

David L. Hardan, PE

Senior Vice President

Project Assignment	Principal-in-Charge
Fields of Special Competence	Water Resources Engineering Technical/Economic Feasibility Studies of Water Resource Facilities Project Management
Education	BS/Civil Engineering/1965 Washington State University
Registration	Professional Civil Engineer/California (1969), CO, IA, ID, KS, MT, NE, ND, OR, WA, WI, SD, UT, WY
Years of Experience	Joined Boyle - 1966 With Others - 1 years
Professional Affiliations	American Society of Civil Engineers Consulting Engineers Association of California American Water Works Association Member, AWWA, California-Nevada Section, Water Management Committee

Related Experience

Mr. Hardan is an expert in the development and implementation of water resources projects. He specializes in facilities feasibility studies, design and construction administration of major water resources projects.

Mr. Hardan has been instrumental in developing and refining Boyle's unique QA/QC program and has been certified by the firm as a Quality Technical Reviewer (QTR).

- **Owens Lake Shallow Flood Project Transmission Mains, Los Angeles Department of Water and Power, California.** Responsible for design of 4.7 miles of 60-in. diameter welded steel main conveyance pipeline, and 66,119 LF of 42", 8,599 LF of 48" and 3,476 LF of 30" fiberglass pressure pipe, in one of the most aggressive environments in the world. As project engineer, formulated project options, alignments, costs, and was responsible for final design for design-build team. Provided construction support services. Project requirements were to have design completed so project could be constructed and in operation by an absolute completion date, (no time extension allowed). Project met all design and construction and operation deadlines to comply with court ordered deadline placed on project owner.
- **Domestic-Agricultural Water Network (DAWN) Project, Antelope Valley-East Kern Water Agency, Kern and Los Angeles Counties, CA.** Facilities feasibility studies, design and construction for distribution of 140,000 acre-feet per year of water from the State Water Project (SWP) to retail agencies. Water service contracts were developed to provide for deliveries to M&I and agricultural users and served as the basis to define the layout and capacity of distribution facilities. Construction started in 1975; water treatment plants,

David L. Hardan, PE

storage facilities, and more than 150 miles of pipeline have been constructed. Monitoring indicate that the operational plan of imported water deliveries have substantially reduced the overdraft on groundwater resources. (1974-present) Project Cost - \$75 million. Also, served as Agency's Chief Engineer from 1972 to 2002.

- **Groundwater Recharge Project**, Rosedale-Rio Bravo Water Storage District, Kern County, CA. Preparation of facilities feasibility studies to provide for delivery of SWP, Kern River and Friant Kern water (capacity 300 cfs) to groundwater recharge facilities. Responsible for design and construction of \$5 million in facilities including 11 miles of canals, water control structures, and groundwater recharge areas. The recharge capacity of the project is 145,000 af/yr. (1968-present)

Related Experience—continued

- **Project Engineer** for \$25 million **Westside Irrigation Project** delivering SWP water to 90,000 acres in Kern County. Responsible for facilities feasibility study, design and construction of 40 miles of lined canals (max. capacity 600 cfs), pump stations, pipelines and regulating reservoirs.
- **Project Manager** for WEB Rural Water Development Project to transport quality treated water from the Missouri River to a 6,400 square mile area in central South Dakota. Boyle's feasibility report served as the basis for Congressionally-authorized and appropriated funding.
- **Principal-in-Charge** for facilities feasibility studies, design, and construction of \$120 million **Southwest Pipeline Project**. Project delivers Missouri River water to cities and rural areas in southwest counties in North Dakota.

Mr. Hardan has served in capacities from design engineer to principal-in-charge on several major water projects, each having capital improvement values in excess of \$120 million. Those projects involved facilities feasibility studies and design for water resources development including conjunctive use of surface and groundwater. He has overseen projects from the feasibility study phase through design, construction and operational startup.

Publications

Publications and Presentations

- Maddock, Thomas S. and Hardan, David L., (1982) "Groundwater Recharge Project Provides Economical Water Supply Plus Drought Protection," presented at the American Society of Civil Engineers 1982 National Spring Convention, Las Vegas, NV.

David L. Hardan, PE

- Maddock, Thomas S. and Hardan, David L., (1979) "The Cross Valley Canal - A Case Study of Project Implementation by Local Agency Joint Venture," presented at American Society of Civil Engineers National Specialty Conference, jointly sponsored by the Irrigation and Drainage Division of the Water Resources Planning and Management Division, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, July 1979; published in Proceedings to Specialty Conference, American Society of Civil Engineers, Blacksburg, VA.

Michael K. Nunley, PE

Senior Engineer II/ Branch Manager

Education	BS/Environmental Engineering Virginia Polytechnic Institute & State University, 1995 MS/Civil Engineering University of California at Berkeley, 2000
Registration	Professional Civil Engineer (2001)
Years of Experience	Joined Boyle 2002 With Others 6 years
Professional Affiliations	Environment and Water Resources Institute American Society of Civil Engineers

Related Experience

Mr. Nunley has extensive experience in master planning, flow analysis, and hydraulic modeling of sanitary and storm sewers. He has developed capital improvement projects in Virginia, North Carolina, South Carolina, and California.

Project Engineer for Sewer Master Plan, City of Arroyo Grande. Performed analysis of flow meter data from gravity sewers, force mains, and performed lift station capacity analysis (pumps and wetwell). Developed recommendations and estimates for sewer system improvements.

Project Engineer for Sewer Master Plan and Lift Station Analysis, Town of Wytheville, VA. Installed and calibrated flow meters, interpreted data, developed I/I estimates, and determined design flows and peaking factors.

Project Engineer for Sewer Master Plan and Hydraulic Model, Town of Blacksburg, VA. Performed analysis of flow meter data, developed I/I estimates, and determined design flows and peaking factors.

Project Engineer for Capacity Assessment – County Service Area 7A (Oak Shores Community at Lake Nacimiento). Evaluated capacity of receiving sewer, lift stations, and wastewater treatment/disposal facilities to receive wastewater from proposed 345-home development.

Project Engineer for Storm Drainage Projects, City of Greenville, SC. Developed hydraulic analysis and recommendations for upgrading and replacing approximately 3000 lf of storm sewer in four different areas within the City.

Project Manager for Atascadero Mutual Water Company Hydraulic Model Update. Performed update of water distribution system model, including development of demand data from GIS land use information and unit factors.

Project Manager for Water Usage Analysis, City of Morro Bay. Performing update of City's water equivalency unit (weu) table, evaluating historic water demand information by land use category, and projecting future demands.

Christopher Alakel

Associate Engineer

Education	MBA/Masters of business Administration/2001 California Polytechnic State University San Luis Obispo, CA
	MS/Engineering Management/2001 California Polytechnic State University San Luis Obispo, CA
	BS/Civil Engineering/1997 California Polytechnic State University San Luis Obispo, CA
Registration	Professional Engineer, PE (Utah)
Years of Experience	Joined Boyle 2001 With Others 4 years

Related Experience

Project Engineer – County of San Luis Obispo, Kansas Ave. Sewer Replacement Project. The project involves preparation of construction drawings and specifications for the replacement of two segments of aging sewer lines as well as the abandonment and replacement of a series of sewer manholes. In total the project will replace approximately 1-mile of failing sewer lines. In addition to being the prime client contact, responsibilities also encompass the scheduling and coordination of all necessary activities and efforts.

Project Engineer – City of Paso Robles, Southwest Reservoir Project (SWR)

The SWR Project is to provide an additional 1M gallons of storage to a newly created pressure zone in the Southwest portion of the City. Efforts include preparation and identification of the pipeline alignment, necessary improvements to existing infrastructure, preliminary design reports, project plans, specifications and drawings for the new reservoir. In addition to being the prime client contact, responsibilities also encompass the coordination and management of all Subconsultant activities and efforts.

Project Engineer – Cayucos Area Water Organization, 2001 Water Management Plan Update. Worked directly with the water purveyors serving the community of Cayucos to update their Water Management Plan to help ensure the existence of adequate water resources to support the growing community. Efforts included the determination of existing demand placed on each of the 3 purveyors, the per-capita demand for the community, total production, and estimating the total build-out demand for the community based on undeveloped parcels, local zoning and building regulations.

Project Engineer – County of San Luis Obispo, Nacimiento Water Supply Project

The Nacimiento project is a 100 million water supply project planned to deliver water to 15 communities along California's Central Coast. Efforts include preparation of technical and financial impact analysis resulting from project implementation.

Project Engineer / Project Management - Construction of Albanian Refugee Camp (Camp Hope) – AFCAP. Assisted the US Air Force in the construction of an Albanian refugee camp in Albania. Camp was designed to provide food, shelter and other necessities for refugees displaced by the crisis in Kosovo. Responsibilities included logistical and technical support in the design and construction of the 30,000-person camp. Efforts focused on the design and construction of water filtration systems used to ensure the safety of drinking water supplies.

Project Management / Project Estimator - Military Base Closures (Navy Clean), United States Department of Defense. Developed preliminary designs and cost estimates for long-term groundwater remediation treatment trains. These efforts included both in-situ and ex-situ technologies that included bioventing, funnel and gate, soil vapor extraction and carbon adsorption. Project management responsibilities included the forecasting of cost and schedule variances, developing and maintaining master work schedules, preparation of client progress reports, initiation and incorporation of contract modifications resulting from forecast trends.

Christopher J. Martin, PE

Principal Engineer

Fields of Special Competence	Pilot Plant Design and Operation Water Treatment by Ion Exchange and Reverse Osmosis Computer Applications to Process Control Computer Simulation of Chemical Processes
Education	BS/Chemical Engineering University of Washington/1982
Registration	Professional Chemical Engineer/CA (1989)
Years of Experience	Joined Boyle 1986 With Others 5 years
Professional Affiliations	American Institute of Chemical Engineers American Desalination Association American Water Works Association

Related Experience

Mr. Martin is experienced in the design and implementation of pilot studies for advanced water treatment including ion exchange, arsenic treatment, membrane filtration, and membrane desalination. He has extensive experience in analysis planning, and process design of municipal water treatment plants for these processes. He has written and presented numerous papers concerning advanced water treatment.

Irvine Ranch Water District. Technical leader for design of the Deep Aquifer Treatment System, a 4-MGD nanofiltration treatment plant intended to treat highly-colored groundwater. Boyle served as Owner's Engineer for this design-build project.

Poseiden Resources. Provided concept-level design for 50 MGD seawater desalination system to be located in Carlsbad, CA. Design included significantly constrained site. Design was used to support proposal to MWDC to obtain subsidy.

Metropolitan Water District of Orange County. Technical leader for concept-level design of 50 MGD seawater desalination plant to be located near Dana Point. Design was used to support proposal to MWDC to obtain subsidy.

Served as special consultant to the City of Kamloops for design review of River Street Water Treatment Plant, a 30 MGD ZeeWeed ultrafilter treatment plant. Provided value engineering and process review representing the City.

Technical leader for membrane filtration for the **Olivenhain Water Storage Project**, a 25 MGD initial, 60 MGD ultimate capacity membrane filtration project in Southern

Christopher J. Martin, PE

Related Experience—continued

California. This project included pilot testing to evaluation membrane performance and obtain Health Department certification of alternate treatment technology, design of the membrane filtration treatment plant, and startup services.

Technical leader for the **El Paso Public Utilities Board's** pilot evaluation which is expected to lead to design and construction of an 80 MGD membrane filtration treatment plant treating water from the Rio Grande River. This pilot study includes evaluation of at least five different membrane filtration systems.

Project manager for **Edwards Air Force Base Arsenic Treatment Study**. This is an evaluation of treatment technology to remove naturally occurring arsenic from 15 wells serving the Edwards Air Force Base. Project includes sampling the wells, bench and pilot scale evaluations of arsenic treatment processes, and preliminary design of treatment facilities.

Project manager for 4 MGD groundwater reverse osmosis treatment plant for **Seymour, Texas**.

Technical leader for design of 8 MGD nanofiltration treatment plant for organic removal for **Irvine Ranch Water District, California**.

Project engineer for process design of reverse osmosis treatment of brackish groundwater for the **Sweetwater Authority in San Diego, California**. Responsibilities include process design, equipment selection, pilot plant installation and operation, and site layout for the 4 MGD plant.

City of La Junta, Colorado. Technical leader for design of a 6 MGD brackish water reverse osmosis system treating brackish groundwater with high iron and manganese concentrations. This project included pilot testing, preliminary design, and design phases.

Irvine Ranch Water District. Technical leader for design of the Deep Aquifer Treatment System, a 4-MGD nanofiltration treatment plant intended to treat highly-colored groundwater.

Metropolitan Water District of Orange County. Evaluated technical and economic feasibility of a 25 MGD seawater reverse osmosis treatment system.

Developed integrated ion exchange iron removal process reverse osmosis pretreatment at **Capistrano Beach County Water District, California**.

Provided process design for the 1.15 MGD **Cambria, California** seawater reverse osmosis treatment plant.

Served as project manager for **Metropolitan Water District of Southern California Nitrate Removal Feasibility Study**. This project involved laboratory scale

Christopher J. Martin, PE

Related Experience—continued

evaluation of ion exchange for nitrate removal, calibration of Boyle's ion exchange model, and development of conceptual designs for a 100 MGD treatment plant.

Designed, installed, and operated ion exchange demineralization pilot plant for treatment of secondary treated wastewater for the **North of the River Sanitary District**

Served as project manager for **Chino Prison Water Treatment Facilities**

Project engineer for a feasibility study for treatment of nitrate and VOC contaminated groundwater for the **City of Glendora, California**. Project included treatment evaluation, site requirements, transmission system requirements, and comparison of project costs with the purchase of imported water.

Publications

Martin, C.J. and Kartinen, E.O. "**Economic Comparison of Methods to Desalt High Nitrate Groundwater**", presented at the AMTA Biennial Convention, Tampa, Florida, August, 2002.

Martin, C.J. "**Safety Issues in Design of Membrane Treatment Plants**", presented at the AWWA Distribution System Symposium, Portland, Oregon, September 8-12, 1996.

Martin, C.J. "**Design Elements of the Cambria Seawater Desalting Plant**", presented at the American Desalting Association Biennial Convention, Monterey, California, August, 1996.

Guter, G.A., Kartinen, E.O., Kim, H.S., Martin, C.J., and Poole, R.D. "**Demineralization of San Francisco Bay Water by Reverse Osmosis: Pilot Plant Study**", presented at the AWWA Membrane Technology Conference, Orlando, Florida, March 10-13, 1991.

Guter, G.A., Kartinen, E.O., Kim, H.S., Martin, C.J., and Poole, R.D. "**Demineralization of San Francisco Bay Water by Reverse Osmosis: A Feasibility Study**", presented at the AWWA Annual Conference, Philadelphia, Pennsylvania, June 23-26, 1991.

Guter, G.A., Kartinen, E.O., Kim, H.S., Martin, C.J., and Poole, R.D. "**Demineralization of San Francisco Bay Water by Reverse Osmosis: Pre-Treatment Pilot Plant Results**", presented at the International Desalination Association World Conference on Desalination and Water Reuse, August 26-31, 1991.

Christopher J. Martin, PE

Related Experience—continued

Martin, C.J., **“Remediation of Groundwater Contaminated by Olive Processing Waste.”**, presented at the National Water Supply Improvement Association 1992 Biennial Conference, August 23-27, 1992.

Kartinen, E.O. and Martin, C.J., **“Groundwater Treatment Options for the City of Seward, Nebraska”**, presented at the Nebraska Municipal League Meeting in Kearny, Nebraska, May 5, 1994.

Kartinen, E.O. and Martin, C.J., **“Nitrate Removal by Ion Exchange for a Small Water System”**, presented at the AWWA Annual Conference, New York, New York, June 19-23, 1994.

Kartinen, E.O. and Martin, C.J., **“An Overview of Arsenic Removal Processes”**, presented at the American Desalting Association Biennial Conference, September 11-15, 1994.

Kartinen, E.O. and Martin, C.J., **“Two Midwest RO Projects: Seward, NE and Las Animas, CO”**, presented at the AWWA Membrane Technology Conference, Reno, Nevada, August 16, 1995.

Kartinen, E.O. and Martin, C.J., **“The Cambria Desalter—The Real Cost of Sea Water Desalting”** (poster presentation), presented at the 1998 American Desalting Association Annual Conference, Williamsburg, Virginia.

Kartinen, E.O. and Martin, C.J., **“Ion Exchange Softening as Pretreatment for Reverse Osmosis Feed Water for Iron Contaminated Water”**, presented at the 1998 American Desalting Association Annual Conference, Williamsburg, Virginia.

Kartinen, E.O., Martin, C.J., and Martin, K., **“Selection of Nitrate Removal Process for the City of Seymour, Texas”**, presented at the 1998 AWWA Inorganic Contaminants Workshop, San Antonio, Texas, February 22-24, 1998.

Kartinen, E.O. and Martin, C. J., **“Selection of Nitrate Removal Process for the City of Seymour, Texas”**, presented at the 1999 AWWA Membrane Technology Conference & Exhibition, Long Beach, California, February 28-March 2, 1999.

Kartinen, E.O. and Martin, C. J., **“Treatment Process Design for 25 MGD Membrane Filtration Plant”** presented at 2000 American Desalting Association Conference in Lake Tahoe, California, August 6-9, 2000.

Martin, C.J., Kartinen, E.O., and Fisher, T.J., **“Sweetwater Authority Demineralization Facility Start-Up and Early Operation”**, presented at 2000 American Desalting Association Conference in Lake Tahoe, California, August 6-9, 2000.

Ernest O. Kartinen, Jr., PE

Vice President

Fields of Special Competence	Water Treatment Economic Feasibility Studies
Education	BS/Civil Engineering California State University, Long Beach/1963 MS/Civil Engineering California State University, Long Beach/1969
Registration	Professional Civil Engineer/CA (1967) , OR, WA
Years of Experience	Joined Boyle 1968 With Others 5 years
Professional Affiliations	American Society of Civil Engineers American Water Works Association American Public Works Association American Desalting Association International Desalination Association

Related Experience

Experienced in planning, design, and construction administration of public works projects including: water treatment, transmission, pumping, storage, and distribution facilities; wastewater collection, treatment, and disposal works; drainage improvements; and road and street improvements.

Served as Project Manager for Marin Municipal Water District's proposed 5 MGD (10 MGD ultimate) seawater desalination project. This project included feasibility study, pilot plant and preliminary design report.

Project Manager for Seward, Nebraska, water treatment process study and design of 4 MGD reverse osmosis plant for water with high TDS, nitrate, and hardness. Processes considered included ion exchange, reverse osmosis, electro dialysis reversal, and lime softening.

Technical Leader for design and preparation of plans and specifications for 25 MGD microfiltration plant of Olivenhain Municipal Water District near San Diego, California.

Principal-in-Charge for 3 MGD reverse osmosis plant to desalt brackish water for Seymour, Texas.

Project engineer for design of 6 MGD reverse osmosis plant to treat brackish groundwater for Sweetwater Authority near San Diego, California.

Ernest O. Kartinen, Jr., PE

Related Experience—continued

Technical Leader for pilot plant studies for proposed 80 MGD membrane filtration plant to treat Rio Grande River water for El Paso, Texas.

Technical Leader for preparation of study comparing conventional filtration and membrane filtration for proposed 80 MGD plant to treat Rio Grande River water for El Paso, Texas.

Project engineer for study comparing conventional filtration and membrane filtration for 57 MGD and 120 MGD plants to treat Russian River water for Sonoma County Water Agency, California.

Provided process systems design for seawater reverse osmosis system for the Monterey Peninsula Water Management District as part of design-build team with Hydranautics and Western Summit Constructors.

Project engineer for Channel Islands Beach Community Services District seawater desalting/groundwater desalting study.

Project Manager for City of Riverside groundwater treatment study involving treatment for high TDS, nitrate, radionuclides, organic contaminants.

Principal author for "Desalination for Urban Water Supply" prepared for the California Urban Water Agencies, dated July, 1991.

Project engineer for Sweetwater Authority's (San Diego County, California) study of reclaiming groundwater with high TDS.

Member of Technical Review Committee for expansion of Water Factory 21 (wastewater reclamation, including reverse osmosis treatment, for groundwater recharge).

Member of Metropolitan Water District of Southern California's Peer Review Committee for Vertical Tube Evaporator concept proposed for 80 MGD seawater desalting plant.

Project Manager for design of two 3000 gpm Iron and Manganese Removal Plants for Mammoth County Water District. Design and construction of Plant #1 required just over 4 months.

Project Manager on feasibility study for Monterey Peninsula Water Management District's proposed 3 to 8 MGD seawater desalination plant.

Project Manager of the Glenwood Nitrate Ground Water Reclamation Plant. This 2.7 MGD ion exchange facility utilized planning, design, construction administration, start-up and operator training services provided by Boyle.

Ernest O. Kartinen, Jr., PE

Related Experience—continued

Project Manager for 2.3 MGD Nitrate Removal Facility for Grover City, CA. The project included planning, design, start-up and operator training of the ion exchange facility.

Project Manager for McFarland Nitrate Removal Project. This included R&D, feasibility, design and start-up of two, 1 MGD ion exchange nitrate removal facilities.

Project Manager for reconnaissance level study for San Francisco Bay area seawater desalting plants including preliminary evaluation of three sites and desalting processes.

Project Manager for the Edwards AFB 2.5 MGD Tertiary Wastewater Treatment Project. This effort includes wastewater collection systems, pumping stations, effluent disposal, ground water recharge and environmental permitting.

Principal-in-Charge for the 28.5 MGD Wastewater Treatment Plant No. 2 Upgrade and Expansion for the City of Bakersfield. The project includes the conversion of the existing 19 MGD plant treatment process from an aeration process to an anaerobic digestion facility.

Principal-in-Charge for the North of River Sanitary District No. 1, 6.0 MGD Wastewater Treatment Plant that included a raw wastewater pump station, screening, grit removal, primary clarification, trickling filters, secondary clarification, and anaerobic digestion.

Principal-in-Charge for the California State Prison 2,450-bed men's facility in Delano, California. As the State's prime civil engineering consultant, Boyle provided all environmental, on-site and off-site design engineering services including road improvements, all utilities, water facilities and wastewater facilities including collection and trunk facilities, pump station, force main, pretreatment, and all off-site 0.8 MGD expansion of the City's wastewater plant and effluent disposal system.

Prepared study of costs for removing nitrate from water using ion exchange for Limburg, Holland.

Principal-in-Charge for 3.6 MGD feasibility study and design of ion exchange plant for softening and nitrate removal followed by GAC for VOC removal for Chino Prison Complex in Southern California.

Project Engineer for study comparing costs of conventional filtration and microfiltration for a 20 MGD (expandable to 80 MGD) surface water treatment plant (Colorado River, State Aqueduct, and local lake waters) for Olivenhain MWD preparatory to preliminary and final design.

Technical Leader for design of 25 MGD ultrafiltration plant for Olivenhain MWD.

Ernest O. Kartinen, Jr., PE

Related Experience—continued

Project Engineer for design of 20 MGD reverse osmosis and ion exchange processes for City of San Diego's Wastewater Repurification Project (tertiary treated wastewater "repurified" as feed water to conventional surface water treatment plant).

Project Engineer for design of 0.43 MGD (expandable to 1.15 MGD) reverse osmosis sea water desalting plant for Cambria, California.

Project Manager for design of 4 MGD brackish water reverse osmosis treatment plant for Seward, Nebraska.

Project Engineer for study of treatment options for surface water supply for City of Santa Fe, New Mexico. Design of 10 MGD plant anticipated to begin Spring, 1997.

Technical Leader for reverse osmosis pilot plant for desalting agricultural drainage water in California's San Joaquin Valley.

Technical Leader for reverse osmosis pilot plant and design of 6 MGD groundwater desalting plant for La Junta, Colorado.

Publications

Kartinen, E.O., and Guter, G.A. "**Alternatives For Reducing Nitrate In Municipal Water Supplies**", presented at "Nitrates in Drinking Water" Symposium, American Chemical Society, Division of Environmental Chemistry, 197th Annual Meeting, April 10, 1989, Dallas, Texas.

Kartinen, E.O., Guter, G.A., and Rowles, R.L. "**Ground Water Treatment Versus Imported Water Economics: Nitrate Removal**", presented at the 17th Biennial Ground Water Conference; September 25, 1989; San Diego, CA.

Kartinen, E.O., Guter, G.A., and Hatfield, Robert. "**Treating Water Supplies to Reduce Nitrate Concentrations**", presented at the Iowa Rural Water Association Conference, January 6, 1990.

Kartinen, E.O. "**Nitrate Removal from Municipal Water Supplies**", presented at the Kansas Rural Water Association, March 22, 1990.

Kartinen, E.O. "**Water Treatment Processes for Reducing Mineral Content in Drinking Water**", presented at the Metropolitan Water District, March, 1990.

Kartinen, E.O., and Guter, G.A. "**Review of Operating Ion Exchange Nitrate Removal Plants**", presented at National Water Supply Improvement Association Conference, Orlando, FL, August 19-23, 1990.

Ernest O. Kartinen, Jr., PE

Publications—continued

Kartinen, E.O. “**Economics and Costs of Nitrate Removal**”, presented at the Arizona Nitrate Seminar and Demonstration, February, 1991.

Kartinen, E.O., Guter, G.A., Kim, H.S., Martin, C.J., and Poole, R.D. “**Demineralization of San Francisco Bay Water by Reverse Osmosis: A Feasibility Study**”, presented at the AWWA Annual Conference, June 23-27, 1991, Philadelphia, PA.

Kartinen, E.O., Guter, G.A., Kim H.S., Martin, C.J., and Poole R.D. “**Demineralization of San Francisco Bay Water by Reverse Osmosis: Pilot Plant Study**”, presented at the AWWA Annual Conference, June 23-27, 1991, Philadelphia, PA.

Kartinen, E.O., Guter, G.A., Rowles, R.L., and Argenio, R.K. “**The Economics of Nitrate Removal in the Los Angeles Basin: A Case History**”, presented at the AWWA Annual Conference , June 23-27, 1991, Philadelphia, PA.

Kartinen, E.O., Guter, G.A., Kim, H.S., and Martin, C.J. “**Demineralization of San Francisco Bay Water By Reverse Osmosis: Pre-Treatment Pilot Plant Results**”, presented at the International Desalination Association World Conference on Desalination and Water Reuse, August 26-31, 1991.

Kartinen, E.O. “**Engineering Studies for Marin Municipal Water District**”, presented at the University of Santa Barbara, October 9-10, 1991, Santa Barbara, CA.

Kartinen, E.O. “**Costs of Seawater Desalting in California by Distillation and Reverse Osmosis**”, presented at the University of Santa Barbara, October 9-10, 1991, Santa Barbara, CA.

Kartinen, E.O. “**Nitrate Removal from Municipal Water Supplies**”, presented at the AWWA Conference, November 6, 1991, Grand Island, NE.

Kartinen, E.O. “**Nitrate Removal from Municipal Water Supplies**”, presented at the Groundwater Management Districts Association, December 4-6, 1991, Colorado Springs, CO.

Kartinen, E.O., and Watson, I.C.. “**Application of Demineralization Technology to Potable Water Quality Problems**”, presented at the Nevada Water Conference, January 15-16, 1992, Las Vegas, NV.

Kartinen, E.O. “**The Decision Making Process in Designing Membrane Filtration Facilities from the Engineer's Viewpoint**”, presented at the AWWA Conference, April, 1992.

Ernest O. Kartinen, Jr., PE

Publications—continued

Kartinen, E.O. **“Nitrate Removal by Ion Exchange”**, presented at American Water Works Association Groundwater Treatment Conference, Sacramento, CA, May 18, 1993.

Kartinen, E.O. **“Is There a Future for Desalting in Meeting California’s Water Needs?”**, presented at American Society of Civil Engineers National Conference on Hydraulic Engineering and International Symposium on Engineering Hydrology, San Francisco, CA, July 25-30, 1993.

Kartinen, E.O. **“Summary and Comparison of Sea Water Desalting Projects in California”**, presented at American Water Works Association Membrane Conference, Baltimore, MD, August 4, 1993.

Kartinen, E.O. and Martin, C.J., **“Groundwater Treatment Options for the City of Seward, Nebraska”**, presented at the Nebraska Municipal League Meeting in Kearny, Nebraska, May 5, 1994.

Kartinen, E.O. and Martin, C.J., **“Nitrate Removal by Ion Exchange for a Small Water System”**, presented at the AWWA Annual Conference, New York, New York, June 19-23, 1994.

Kartinen, E.O. and Martin, C.J., **“Reuse of Spent Brine for Anion Exchange Nitrate Removal Plants”**, presented at the American Desalting Association Biennial Conference, September 11-15, 1994, Palm Beach, FL.

Kartinen, E.O. and Martin, C.J., **“Examination of Processes for Multiple Contaminant Removal from Groundwater”**, presented at the American Desalting Association Biennial Conference, September 11-15, 1994, Palm Beach, FL.

Kartinen, E.O. and Martin, C.J., **“An Overview of Arsenic Removal Processes”**, presented at the American Desalting Association Biennial Conference, September 11-15, 1994, Palm Beach, FL.

Kartinen, E.O. and Martin, C.J., **“Two Midwest RO Projects: Seward, NE and Las Animas, CO”**, presented at the AWWA Membrane Technology Conference, Reno, NV, August 16, 1995.

Kartinen, E.O., **“Comparison of Reverse Osmosis, Electrodialysis and Carix Demineralization Processes for Inland Use With Irrigation Disposal of Concentrate”**, presented at the 1997 AWWA Membrane Technology Conference, New Orleans, LA, February 23-26, 1997.

Kartinen, E.O., **“Selection of Desalination and Nitrate Removal Process for Camrosa Water District”**, presented at the 1997 AWWA Annual Conference and Exposition, Atlanta, GA, June 15-19, 1997.

Ernest O. Kartinen, Jr., PE

Publications—continued

Kartinen, E.O. and Martin, C.J., **“The Cambria Desalter—The Real Cost of Sea Water Desalting”** (poster presentation), presented at the 1998 American Desalting Association Annual Conference, Williamsburg, Virginia.

Kartinen, E.O. and Martin, C.J., **“Ion Exchange Softening as Pretreatment for Reverse Osmosis Feed Water for Iron Contaminated Water”**, presented at the 1998 American Desalting Association Annual Conference, Williamsburg, Virginia.

Kartinen, E.O., Martin, C.J., and Martin, K., **“Selection of Nitrate Removal Process for the City of Seymour, Texas”**, presented at the 1998 AWWA Inorganic Contaminants Workshop, San Antonio, Texas, February 22-24, 1998.

Kartinen, E.O., **“Pre- and Post-Treatment for Reverse Osmosis”**, lecture at Seminar on Reverse Osmosis Fundamentals – Presented at American Desalting Association Conference, Long Beach, California, February, 1999.

Kartinen, E.O. and Martin, C. J., **“Selection of Nitrate Removal Process for the City of Seymour, Texas”**, presented at the 1999 AWWA Membrane Technology Conference & Exhibition, Long Beach, California, February 28-March 2, 1999.

Kartinen, E.O. and Martin, C. J., **“Treatment Process Design for 25 MGD Membrane Filtration Plant”** presented at 2000 American Desalting Association Conference in Lake Tahoe, California, August 6-9, 2000.

Martin, C.J., Kartinen, E.O., and Fisher, T.J., **“Sweetwater Authority Demineralization Facility Start-Up and Early Operation”**, presented at 2000 American Desalting Association Conference in Lake Tahoe, California, August 6-9, 2000.

Kartinen, E.O., **“Economic Comparison of Treatment Processes to Desalt and Denitrify Groundwater”**, presented at California-Nevada Section of AWWA Spring Conference in Garden Grove, California, April 25, 2001.

Kartinen, E.O., **“Comparison of Drinking Water Treatment Processes for Groundwater with High Total Dissolved Solids and Very High Nitrate Concentrations”**, presented at AMTA Conference in Tampa, Florida, August, 2002.

Kartinen, E.O., and Martin, Christopher J., **“Concentrate Disposal – The Achilles Heel of Desalting”**, presented at California-Nevada Section of AWWA Conference in Reno, Nevada, October 16, 2002.

Kartinen, E.O. **Solving Morro Bay’s Seawater Desalting Plant Iron Problem**, presented at AWWA Membrane Conference, Atlanta, Georgia, March 4-7, 2003.

David R. Refling, PE, DEE

Principal Engineer

Education

BS/Physics
University of Wisconsin/1972

MS/Environmental Engineering
Johns Hopkins University/1975

Registration

Professional Engineer/Florida 1981 #31107

Years of Experience

Joined Boyle 1996
With Others 21 years

Professional Affiliations

Florida Water Environment Association
Water Environment Federation
Diplomate, American Academy of Environmental Engineers
National Society of Professional Engineers
Florida Engineering Society

Related Experience

Mr. Refling has 22 years of experience in the planning, design, and management of water, wastewater, stormwater, and reuse system projects. His broad experience covers water and wastewater treatment, distribution, and collection systems; effluent reuse and disposal; sludge treatment and disposal; facility master planning; and water quality. He holds special expertise in process design having designed and supervised the startup and operation of the first Bardenpho wastewater treatment facility in the United States. He has co-authored 14 articles on innovative wastewater treatment systems.

Serving a manager of Boyle's Orlando office, his involvement in projects includes Project Director, Principal-in-Charge, or Technical Advisor responsible for overall direction of a project.

Project experience includes the following:

- **Northwest Water Reclamation Facility (NWRf) Rerating, Orange County, Florida.** Project involved the preliminary and final design for rerating the NWRf from a capacity of 3.5 mgd to 7.5 mgd. New treatment processes will be constructed as part of this \$15.5 million project including preliminary treatment, filtration, and sludge dewatering. Existing unit processes which will be expanded include the preanoxic tanks for denitrification, carousel aeration basin system, secondary clarification, disinfection, and sludge holding.
- **Eastern Water Reclamation Facility, Orange County, Florida.** Responsibilities included operating permit renewal, O&M performance, and capacity analysis reports for the 19 mgd Bardenpho/Carousel AWT facility.

Related Experience—continued

- **Continuing Services, Seminole County, FL.** Served as Principal-in-Charge for a continuing services contract that included miscellaneous wastewater system improvements as well as stormwater system improvements for the Howell Creek and Little Wekiva River basins.
- **Continuing Environmental Services, City of Mount Dora, FL.** Principal-in-Charge for continuing environmental services for such projects as Gilbert Park, 6th Avenue and Jefferson Drive drainage improvement projects.
- **Continuing Services, City of Ormond Beach, FL.** Principal-in-Charge for hydrogeological and environmental services for miscellaneous projects.
- **Wastewater Master Plan, Collier County, FL.** Prepared a wastewater master plan for the South County Service Area, including capacity evaluation of the existing 8-mgd oxidation ditch wastewater treatment plant. Recommendations included the addition of anoxic basins to enhance nitrogen removal.
- **West Regional Wastewater Treatment Plant, Indian River County, FL.** Project Manager for the study and design of the West Regional Wastewater Treatment Plant expansion to 2 mgd, with provision for an ultimate capacity of 5 to 6 mgd. This project included unique BNR/oxidation ditch technology utilizing anaerobic/anoxic/aerobic stages to achieve AWT effluent for reuse and discharge to an artificial wetlands.
- **Water and Wastewater Consulting, Florida Leisure Communities, FL.** Project Manager for the Pennbrooke water system evaluation and rehabilitation and related improvements to the Pennbrooke wastewater treatment facility including reuse via golf course irrigation.
- **Reuse Services, Lee County, FL.** Performed permitting and project management for the design of reuse water service to the County's Resource Recovery Facility.
- **General Consulting Services, Barceloneta, Puerto Rico.** Provided general consulting services at the Barceloneta wastewater treatment plant. Assignments included contract operations program; rehabilitation project design overview/value engineering; aerobic digestion pilot study; and aeration system evaluation.
- **Wastewater Treatment Plant, City of Springdale, AR.** Provided wastewater treatment plant operations assistance and designed modifications related to nitrification optimization.
- **Wastewater System, City of Oldsmar, FL.** Directed the master planning, design, and permitting of the City's wastewater system including the expansion and upgrade of the wastewater treatment plant from 1.0 to 2.25 mgd using the Bardenpho advanced biological process. A master site plan was developed to expand this Bardenpho facility to 4.5 mgd. An innovative effluent disposal/reuse system was designed and permitted which included spray irrigation and wet

David R. Refling, PE, DEE

Related Experience—continued

weather discharge of disinfected effluent to Mobly Bay. Provided assistance to secure financing for the program. Directed the completion of a master plan for the recovered water system including development of a reuse ordinance and manual for recovered water use policies and regulations.

- **Citywide Wastewater and Reuse System, City of Ocoee, FL.** Directed the development of a citywide Wastewater and Reuse System Master Plan and designed the expansion of the WWTP No. 2 to 3.0 mgd utilizing innovative oxidation ditch technology. Managed Phase I construction of the facility. Project included evaluation of treatment facilities, collection system, effluent disposal/reuse methods and system, and the initial phases of a design/build municipal golf course reuse project.
- **Transmission System and Disposal/Reuse System, Indian River County, FL.** Directed the planning, design, and permitting of a 16-inch transmission system and disposal/reuse system. Developed an innovative approach to using effluent in shallow aquifer as a hydraulic barrier to saltwater intrusion.
- **Buena Ventura Lakes West Wastewater Treatment Facility, Orange Osceola Utilities, Inc., Kissimmee, FL.** Directed the planning, design, permitting, and construction administration for the 1.5-mgd West Wastewater Treatment Facility. This AWT facility uses the Bardenpho process with a hyacinth pond treatment system to further reduce nitrogen and phosphorus levels below permit limits of 1.25 and 0.2 mg/l, respectively, prior to discharge. Disinfected effluent is being reused on a local 18-hole golf course and discharged through an innovative infiltration berm system to adjacent stormwater management facilities.
- **Falkenburg Wastewater Treatment Plant Expansion, Hillsborough County, FL.** Project Manager for the design process and portions of the final design of an expansion from a capacity of 3.0 mgd to 6.0 mgd. This facility was also upgraded to achieve AWT effluent quality utilizing an anoxic/aerobic Carrousel system with denitrification polishing utilizing deep-bed filters. Also responsible for O&M Manual preparation and operator training.
- **Valrico Wastewater Treatment Plant, Hillsborough County, Florida.** Served as Project Manager as a subconsultant to another firm for the process design and portions of the final design of a 3.0 mgd AWT facility incorporating an anoxic/aerobic Carrousel system with deep-bed filters. Also responsible for O&M manual preparation and operator training.
- **O& M Manuals and Operator Training, cities of Rogers and Springdale, AR.** Prepared O&M manuals for the Rogers' 6.7-mgd Bardenpho/Carrousel facility and upgrading of Springdale's 15.6-mgd facility to incorporate Bardenpho/Carrousel biological nutrient removal technology. Provided operations training services and start-up services including on-site training for operation and maintenance personnel. Also provided trouble-shooting assistance concerning nitrification toxicity.

David R. Refling, PE, DEE

Related Experience—continued

- **South Beaches Sanitary Gravity Sewer, Brevard County, FL.** Provided planning, design, and permitting for a sanitary gravity sewer and reuse system.
- **Kelso on Lake Butler Water System Improvements, Orange County, FL.** Responsible for the evaluation of alternatives to upgrade a remote system to provide sulfide removal, telemetry, and a distribution hydraulic model.
- **Wastewater Master Planning, Orange County, FL.** Directed the initial phases of Orange County's wastewater master planning effort, including evaluations and studies to determine the most cost-effective and environmentally acceptable transmission, treatment, and effluent disposal alternatives for implementation on a countywide basis.
- **General Consulting, Orange County, FL.** Responsible for the evaluation of recovered water utilization alternatives within the Eastern Service Area; NPDES and SJRWMD permitting; preliminary feasibility assessment of renovated wastewater reuse for irrigation and lake recreation at Big Sand Lake; capacity analysis and request for rerating of the Sand Lake Road WWTP; and preliminary design reports for various subregional wastewater facilities programs.
- **Initial Eastern Service Area Wastewater Treatment Facilities Program, Orange County, FL.** Served as project manager for the County's wastewater treatment facilities program. Phase I included a 2.5-mgd treatment facility with partial denitrification and effluent disposal by rapid infiltration basins. Phase II included expansion of the Phase I facility to 6.0 mgd using the Bardenpho/Carrousel advanced biological treatment process, effluent filtration, and effluent reuse through natural wetlands and as cooling water at the Stanton Energy Center. The Phase III expansion to 12 mgd utilized the Bardenpho/Carrousel process, effluent filtration, and an innovative effluent disposal technique using a combined overland flow and artificial/natural wetlands application system. Assisted Orange County in obtaining the first wetlands exemption granted by the FDER (FDEP) to a large project.
- **Wastewater Treatment Plant Expansion, Orange County, FL.** Project manager for a wastewater treatment plant expansion from 6.0 to 9.0 mgd for a private resort and recreational development in southwest Orange County. Design included biological nitrogen and phosphorus removal and in-vessel sludge composting system.

As a Senior Development Engineer with Eimco PMD Division of Envirotech, performed the process design and supervised the startup and operation of the Palmetto, FL, 1.4-mgd Bardenpho wastewater treatment facility, the first treatment facility in the U.S. to use this process. Also, planned and managed research and development projects; design parameter evaluations for biological nitrogen and phosphorus removal in the Carrousel and Bardenpho activated sludge systems including the pilot plant study of the Bardenpho system prior to the design and construction of any facilities in the U.S.; aeration efficiency testing development for the Carrousel system, including full-scale evaluations at treatment plants from 0.4 to

David R. Refling, PE, DEE

Related Experience—continued

4.2 mgd; and development and evaluation of innovative wastewater treatment alternatives such as an oxidation ditch system with an integral clarification zone (issued a US patent).

Publications

Refling, David R., H. David Stensel, Don E. Burns, and James L. Barnard, "Facility Modifications for Nutrient Removal Using the Bardenpho Process", presented at the 50th Annual WPCF Conference, Philadelphia, Pennsylvania, 1977.

Stensel, H. David, David R. Refling, and J. Holland Scott, "Carousel Activated Sludge for Biological Nitrogen Removal", in Biological Nutrient Removal, edited by M.L. Wanielista and W.W. Eckenfelder, Ann Arbor Science, 1978, pp. 43-63.

Refling, David R. and David Stensel, "A Rational Basis for Designing Denitrification Systems", presented at the 51st Annual WPCF Conference, Anaheim, California, 1978.

Refling, David R. and Lawrence K. Barber, "Advanced Wastewater Treatment of a Tannery Effluent", presented at the 7th Annual WWEMA Industrial Pollution Conference, Philadelphia, Pennsylvania, 1979.

Stensel, H. David, N. Sakakibara, David R. Refling, and Chuck R. Burdick, "Performance of First US Full Scale Bardenpho Facility", in Proceedings of the International Seminar on Control of Nutrients in Municipal Wastewater Effluents, Volume III, pp. 34-73, 1980.

Refling, David R., Mark G. Biesinger, and Lawrence K. Barber, "Advanced Biological Treatment of Tannery Wastewater", Industrial Wastes, Vol. 27, No. 3, May/June 1981, pp. 16-18.

Hartman, Gerald C., and David R. Refling, "Technical Aspects of Wastewater Treatment and Disposal", Sewage Treatment/Wastewater Disposal Workshop - The Florida Bar Environmental and Land Use Law Section, May 21, 1982.

Burdick, Chuck R., David R. Refling, and H. David Stensel, "Advanced Biological Treatment to Achieve Nutrient Removal", Journal Water Pollution Control Federation, Vol. 54, No. 7, July 1982, pp. 1078-1086.

Denton, Keith T, Gerald C. Hartman, and David R. Refling, "Developers Help Finance New Plant", American City and County, Vol. 98, No. 11, November 1983, pp. 35-40.

Refling, David R. and Alan B. Ispass, "An Innovative Wastewater Management Program", in proceedings of the 1985 National Conference, Environmental Engineering Division of the ASCE, July 1985, pp. 787-793.

David R. Refling, PE, DEE

Publications—continued

Refling, David R. and Alan B. Ispass, "Orange County's Eastern Service Area Wastewater Treatment Facility", Florida Water Resources Journal - The Overflow Magazine, Vol. XXXVI, No. 5, September/October 1985, pp. 5-7.

Refling, David R. and Alan B. Ispass, "An Innovative, Economical Advanced Biological Treatment Process", presented at the 58th Annual WPCF Conference, Kansas City, Missouri, October 1985.

Refling, David R., Charles J. Voss, and Thomas Schanze, "Implementation of an Overland Flow/Wetlands Application Demonstration Project", presented at the 59th FS/AWWA, FPCA, and FW&PCOA Joint Technical Conference.

Refling, David R. and Carolina D'Angelo, "Biological Phosphorus Removal: An Overview", presented at the 57th Annual Conference and Short School, Arkansas Water Works and Pollution Control Association, April 1988.

Refling, David R., Gary J. ReVoir, III, and M. Johnson, "Economical Wastewater Treatment for Enhanced Nutrient Removal", presented at the 64th Annual WPCF Conference, Toronto, Ontario, October 1991.

Ronald G. Abraham, PE

Principal Civil Engineer

Mr. Abraham specializes in wastewater treatment and water treatment.

Fields of Special Competence

Wastewater Treatment Planning and Design
Water Treatment Planning and Design
Disinfection Facility Design
Chlorine Scrubber Design
Pump Station Design

Education

BS/Civil Engineering
South Dakota State University/1984

MS/Sanitary Engineering
South Dakota State University/1987

Registration

Professional Civil Engineer/CA (1989), SD, IA
Water Treatment Plant Operator, CA/Grade 4 (T4)

Years of Experience

Joined Boyle 1986
With Others 1 year
3 Years Tertiary Wastewater Treatment Plant Operator

Professional Affiliations

American Water Works Association
American Society of Civil Engineers
Water Environment Federation
American Society of Military Engineers
International Ultraviolet Association
Association of State Drinking Water Administrators

Related Experience

Mr. Abraham is Boyle's Central Valley Region Director of wastewater treatment. His experience as a project manager and design engineer includes planning, design and construction phase services for wastewater, water and industrial treatment facilities, both in the United States and Internationally. Many of his projects include evaluation (audit) of surface water treatment and reclamation plants which have special project specific regulatory requirements.

Ron has three years experience working as a tertiary wastewater treatment plant operator and laboratory technician and is certified as a Grade 4 water treatment plant operator in California.

He also has experience with value engineering of projects and has completed a 40-hour Value Engineering Workshop.

As a project manager and process team leader, Mr. Abraham is experienced in many wastewater and water treatment plant projects.

Wastewater

Ronald G. Abraham, PE

Related Experience—continued

Technical leader for **New Tirupur Area Development Corporation Limited (NTADCL) 70 MGD Water and Wastewater Infrastructure Project in Tirupur, India**. Responsibilities included providing technical assistance to Stone & Webster for due diligence evaluation and recommendations of EPC and Operation & Maintenance Contracts for surface water intake, pumping, surge control, water treatment, storage and conveyance facilities; and wastewater treatment, sewer collection, and lift stations. Tasks also included site visits and coordination meetings with Owners NTADCL and Tirupur Municipality, Lenders (Bank of India, USAID, United Utilities, American Bechtel Inc., Mahindra Realty, Hindustan, etc.), and the contractors (Bechtel International LTD, United Utilities, and Mahindra). The expected construction cost for this project is approximately **\$250 million dollars**.

Assistant project manager and lead project designer for **Cedar Rapids, Iowa, Water Pollution Control Facilities Phase II Odor Control and Capacity Improvements**. The project includes two new bioscrubbers to provide odor control (hydrogen sulfide removal) for four 140 feet diameter by 24 feet deep roughing towers. The current plant flow is 42 million gallons per day with a roughing tower biochemical oxygen demand (BOD) capacity of 90,000 lbs. per day. The BOD capacity will be increased to 120,000 lbs. per day by converting the nitrifying trickling filter/bioscrubber back into the roughing filter. The total plant loading is 300,000 lbs. BOD per day. The foul air exhaust from the roughing towers is blown through the bioscrubbers to remove hydrogen sulfide. Total air flow to the bioscrubbers is 120,000 cfm with an influent hydrogen sulfide concentration of 150 to 500 parts per million. The treated air has a discharge goal of less than 0.5 part per million. This project also included preliminary design of a second stage air phase carbon polishing scrubber. Ancillary odor control and corrosion protective elastomeric liners are also provided for the primary and intermediate clarifier launders, influent Parshall flume, distribution and junction flow control structures, roughing tower distribution structure and dissolved air flotation thickeners. This is accomplished by routing the foul air from these facilities into the roughing towers as a portion of roughing filter inlet air supply. The project includes addition of corrosion resistant aluminum geodesic dome covering the fourth roughing filter to match the existing units. All above ground ducting, fans, launder and structure covers, and bioscrubber media support system are made of corrosion resistant fiberglass reinforced plastic construction. Buried ducting is made of high-density polyethylene plastic. The bioscrubbers are contained in PVC lined corrosion resistant concrete structures and covered with corrosion resistant aluminum truss roof system. Responsibilities included facility planning, preliminary design, pilot testing, guidance, processed civil design and coordination with client and design team. Also includes bid phase and construction phase engineering services.

Process design leader for **Naval Air Weapons Station China Lake, CA Industrial Wastewater Collection and Treatment Systems**. This project provides for the collection, treatment and reuse of industrial wastewater from existing research and development facilities in the China Lake Propulsion Laboratory (CLPL) and the Salt Wells Pilot Plant (SWPP) area at the naval Air Weapons Station, China Lake, CA. The collection system consists of pump stations, level controls and secondary

Ronald G. Abraham, PE

Related Experience—continued

containment monitoring at Navy constructed collection tanks. It also includes approximately 30,000 linear feet of above ground secondary contained collection piping which incorporates leak detection and heat tracing systems. The collection system delivers the untreated industrial wastewater from the generating facilities to the industrial wastewater treatment plant. The treatment facility includes flow equalization, precipitative softening (caustic soda, soda ash), advanced oxidation processes (ozone, UV, and hydrogen peroxide) for removal of organics including acetone and nitroaromatics, and reverse osmosis for metals removal. Treated industrial wastewater will be reused as non-contact cooling tower makeup supply for the Propulsion Laboratory's main cooling tower, thus providing beneficial reuse.

Project manager and process team leader for the design of the **City of Bakersfield 28.5 MGD secondary wastewater treatment facility upgrade and expansion**. Responsibilities included design and design supervision of primary and secondary treatment, plant influent sewer and headworks structure corrosion rehabilitation, effluent irrigation pumping, conveyance and storage, sludge handling and disposal (drying beds), and cogeneration facilities. Processes include pretreatment screening, washing and conveyance and grit removal, primary and secondary sedimentation, scum removal, biofilters, plant influent and treated wastewater lift stations, biofilter recirculation pump station, primary and secondary sludge pump stations, existing digester upgrade, corrosion repair, and insulation, new digesters, pump mix and recirculation pumping for digesters, digester gas scrubbing for hydrogen sulfide and mercaptan removal, sludge heating facility modification and expansion, 800 KW cogeneration facility with heat recovery system for digesters, and Air Quality Management District (AQMD) compliance including digester gas scrubbing. Project responsibilities also included coordination with the client, value engineering consultant, the design team, and the funding and permitting agencies, and preparation and management of budgets and schedules. The treated effluent is used to irrigate cotton and alfalfa crops.

Project manager for **City of Madera, CA, 9.0 MGD Wastewater Treatment Plant Upgrade and Expansion Project**. Project includes wastewater treatment plant audit, sludge handling modifications incorporating a centrifuge for mechanical dewatering, and facility expansion improvements, including secondary process modification to meet new waste discharge requirements.

Project engineer for **North of River Sanitary District No. 1 6.0 MGD Wastewater Treatment Plant**. The facility consists of raw wastewater pumping, screening, grit removal, metering, primary clarification, plastic media biofiltration, secondary clarification, and anaerobic digestion utilizing gas mixing, digester gas fired boilers, countercurrent sludge heating. The facility also incorporates an odor scrubbing facility for the headworks and degritting facility. The treated effluent is used to irrigate cotton and alfalfa crops.

Project engineer for **Edwards Air Force Base 2.5 MGD Tertiary Wastewater Treatment Plant**. This facility includes raw wastewater screening, pumping, grit removal, septage receiving and pumping, metering, and "Carrousel" biological

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Related Experience—continued

nitrification/denitrification extended aeration, activated sludge, secondary clarification, flocculation, filtration, disinfection, RAS/WAS sludge pumping, mechanical sludge dewatering utilizing belt filter presses, and aerated static pile composting the dewatered sludge utilizing shredded paper as the carbon source and amendment. Chemical feed systems included sodium hypochlorite (disinfection, alum (coagulation), polymers (coagulation and sludge dewatering), ferric chloride (odor control), and caustic soda (pH control). All the chemical storage facilities and chemical feed lines are provided with secondary containment piping and leak detection monitoring. The treated effluent will be used for landscape irrigation and groundwater recharge. Other responsibilities included sludge report, O&M manual, and Title 22 submittal review.

Wastewater Conveyance and Storage

Project engineer for the **Iowa Highway 71 Utilities Board Utility Relocation Project**. The project includes relocation of water mains and sanitary sewers with service connections and connections to existing utilities, sewer force mains, gas and high pressure gas lines, telephone and cable television along the new Highway 71 corridor through the towns of Arnolds Park and Okoboji, Iowa.

Project manager for the **City of Bakersfield 28.5 mgd wastewater treatment plant** which included a plant influent and treated effluent lift stations which were used to lift the wastewater sufficiently for gravity flow through the treatment processes and ultimately into 5,000 acre feet of effluent storage reservoirs. The stored effluent can then flow by gravity to the fields for irrigation. This project also included a reservoir management plan to facilitate optimum storage and transfer within the reservoir/irrigation system.

Project engineer for **Edwards Air Force Base 2.5 mgd Tertiary Wastewater Treatment Plant** which also included effluent pumping, surge and piping facilities for reclaimed water distribution to the base golf course and landscape irrigation areas. The system included an effluent pump station and intermediate booster station which operate in series to minimize pressure to existing portions of the distribution piping. Water can be pumped directly to the golf course or to above ground storage tanks and landscape irrigation areas.

Project engineer for **Naval Air Weapons Station, China Lake, California industrial wastewater collection and treatment systems**. The collection piping system includes approximately 30,000 feet of above ground secondary contained collection piping with thermal expansion provisions, leak detection monitoring and heat trace. The collection system also includes 12 pump stations, one at each of the Navy constructed collection tanks which deliver untreated industrial wastewater to the collection piping system.

Water Treatment Experience

Ronald G. Abraham, PE

Related Experience—continued

Project manager for **Overseas Bechtel, Assessment for Startup of 1.75 MGD Reverse Osmosis Water System at SEMADCO-Suez, Egypt.** The facility treats high quality industrial water for use at the Egyptian Government owned SEMADCO fertilizer plant. Surface water is supplied to the facility from the Nile River via the Ismalia Canal. Prior to our involvement the RO pretreatment facility was not capable of treating the water to suitable quality for use in the reverse osmosis system. Therefore, several million dollars of essential equipment at the fertilizer plant were setting idle, unable to operate as the high quality water required was unavailable, resulting in a significant loss of revenue.

The assignment included review of system design, an initial assessment and recommended improvements, followed by an on site investigation including performance verification through operational testing and evaluation of actual treatment performance with our recommended improvements incorporated, then our recommendations and observations were refined and summarized in a written report.

Technical leader for **Sonoma County Water Agency 120 MGD Surface Water Treatment Facility Conceptual Design and Feasibility Evaluation.** This project developed alternative designs for a proposed surface water treatment Plant. The conceptual design included 57 and 120 MGD treatment capacities, conceptual design and evaluation of alternative treatment technologies, site layouts and land requirements, identification and selection of alternate water sources, identification and comparison of alternative treatment plant site locations, development of engineer's opinions of probable costs for capital and O & M. It also addressed alternative technologies for achieving *Cryptosporidium* inactivation including ozone and ultraviolet inactivation methods which are likely to be considered a technically feasible and available DBP control technology by USEPA. The three alternative treatment technologies include conventional filtration, sand ballasted flocculation/sedimentation with conventional filtration, and membrane filtration. The conceptual design also addressed required provisions that are needed to meet current and pending regulations for treating surface water.

Project Engineer for **El Paso Water Utility's 80 MGD Surface Water Treatment Facility Conceptual Design and Feasibility Evaluation.** The conceptual design was developed for treating water from the Rio Grande River. The design included comparison of conventional filtration and membrane filtration, development of site layouts, identification of chemical and power usage, staffing and land requirements, development of engineer's opinions of probable costs for capital and O & M, and land requirements. It also addressed alternative technologies for achieving anticipated *Cryptosporidium* inactivation which is likely to be required by USEPA. Technologies included chlorine dioxide, ozone, and ultraviolet inactivation methods.

QA/QC reviewer for **County of San Luis Obispo Report on Treatment of Lake Nacimiento Water.** This project developed alternative designs for a proposed surface water treatment Plant treating water from Lake. The conceptual design

Ronald G. Abraham, PE

Related Experience—continued

included 17 MGD treatment capacity, conceptual design and evaluation of alternative treatment technologies, site layouts and land requirements, identification and selection of alternate water sources, identification and comparison of alternative treatment plant site locations, energy recovery potential, sludge handling and dewatering alternatives and development of engineer's opinions of probable costs for capital and O & M. It also addressed alternative technologies for achieving *Cryptosporidium* inactivation including ozone and ultraviolet inactivation methods which are likely to be considered a technically feasible and available DBP control technology by USEPA. The three alternative treatment technologies include conventional filtration, sand ballasted flocculation/sedimentation with conventional filtration, and membrane filtration. The conceptual design also addressed required provisions that are needed to meet current and pending regulations for treating surface water.

Technical Leader for **Comprehensive Performance Evaluation Study at U.S. Navy's 16 MGD Fena Water Treatment Plant, Guam, U.S.A.** The Fena Plant is a conventional filtration facility that treats surface water from Fena Reservoir and ground water that is under the direct influence of surface water from Amagosa and Bona Springs. Our evaluation was accomplished in compliance with USEPA's Composite Correction Program (CCP) for evaluating surface water treatment plants. Performance limiting criteria that were included in the evaluation consisted of design, operational, maintenance, administrative, and financial factors. We are currently negotiating with the Navy to conduct the Comprehensive Technical Assistance (CTA) phase for this project, where we will provide assistance to implement corrective measures to meet regulatory compliance for achieving and sustaining optimized plant performance.

Project manager for **Santa Fe Irrigation District's 40 MGD Badger Filtration Plant Mechanical Solids Dewatering and Backwash Treatment Project.** This project included development of the preliminary design of a centrifuge dewatering facility and backwash treatment system to meet the District's needs for operations and regulatory compliance including the Interim Enhanced Surface Water Treatment Rule (IESWTR), Drinking Water Source Assessment and Protection Program, Filter Backwash Rule (FBR) and California's voluntary *Cryptosporidium* Action Plan. The Badger Plant is a conventional surface water treatment plant that treats water from the Colorado River, California State Water Project, and Lake Hodges. The primary objectives of the backwash treatment system are to discontinue returning untreated washwater from the filters to San Dieguito Reservoir and to improve the quality of recycle water that is returned to the plant influent for treatment. This design is incorporated into a Design/Build Project along with a solids dewatering facility. The backwash treatment system is designed to provide a level of treatment that achieves effluent quality of less than 1 NTU.

Project Manager for **Kern County Water Agency 48 MGD Henry Garnett Water Purification Filtration Plant Filter Rehabilitation Project.** Consulting services

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Related Experience—continued

included recommendations for filter launder leak repairs with epoxy injection, concrete filter wall repairs and epoxy coating system, filter underdrain tile integrity evaluation and filter media and gravel underdrain replacement.

Project Engineer for Risk Management Program and Risk Management Plan at for **Antelope Valley-East Kern Water Agency's** four water treatment plants, ranging in size from 4 to 65 MGD and a chlorine booster station. The Risk Management Program was prepared in compliance with EPA, OSHA and Cal ARP requirements for risk prevention and process safety management of chlorine facilities.

Technical leader for **Goleta Water District 32 MGD Renovation and Expansion for The Corona Del Mar Water Treatment Plant**. The project includes upgrade and expansion of the existing water treatment plant to comply with Interim Enhanced Surface Water Treatment Rule (IESWTR), Stage I Disinfectants/Disinfection Byproduct D/DBP Rule, and Department of Health Services Cryptosporidium Action (CAP) Plan. The project also includes renovation of the existing plant to provide continued reliable service and increase plant capacity to 32 MGD.

Prior to the design phase of services for upgrading Goleta Water District's 24 MGD Corona Del Mar Water Treatment Plant, Boyle conducted a Report of Investigation and Recommendations (audit) to identify Deficiencies and recommended improvements. Phase I of the Study recommendations has been designed and constructed. Constructed facilities include replacement of the existing filter underdrains, replacement of the filter media with deep bed granular activated carbon (GAC), addition of air scour backwash, replacement of all filter rate of flow controllers and filter control councils; conversion from gas chlorine disinfection to liquid sodium hypochlorite to comply with EPA and OSHA Risk Management Program requirements; replacement of all existing chemical feed and storage facilities, addition of potassium permanganate feed for taste and odor, addition of polymer feed systems for the filters and filter backwash water; upgrade of the powder activated carbon feed and storage, replacement of all chemical feed lines with secondary containment, replacement of the rapid mixer, and upgrade of plant controls to incorporate a new SCADA system.

Project engineer for **Olivenhain Municipal Water District's 80 MGD Surface Water Treatment Pilot Study**. The project includes evaluation of nanofiltration (softening), ultrafiltration, microfiltration and conventional surface water treatment for treating California Aqueduct, Colorado River and Hodges Reservoir surface water.

Project engineer for **Antelope Valley-East Kern Water Agency (AVEK) 65 MGD Quartz Hill Water Treatment Plant Expansion No. 3**. The Quartz Hill Water Treatment Plant Expansion No. 3 Project included addition of seven new sludge drying beds with a total drying area of approximately 6 acres. The additional solids handling capacity was needed to deal with the large quantity of alum sludge that is generated to provide enhanced coagulation. The project also included upgrade to the filter washwater recovery system to handle higher solids loading resulting from

Ronald G. Abraham, PE

Related Experience—continued

enhanced coagulation. Since the Quartz Hill Plant uses chlorine for disinfection it is essential that organics removal is accomplished for compliance with the Disinfection/Disinfectants Byproduct D/DBP Rule. The Quartz Hill Plant treats State Project Water from the California Aqueduct. Sludge drying beds were selected for Quartz Hill Water Treatment Plant as well as AVEK's three other surface water treatment plants because of the high evaporation rate in the surrounding Mojave Desert, and also because of the availability of land adjacent to the treatment plants. The Drying beds are concrete lined and include sand underdrains and collection pipes to facilitate effective drying. Each bed includes an adjustable level control on the outlet structure to optimize water removal and to provide unit isolation. Water that is recovered from the drying beds flows by gravity to a decant recovery station. From there the decant water is recycled for further treatment by pumping it to the spent washwater recovery basin.

Project Engineer for **Las Vegas Valley Water District's Charleston Heights 57 MGD Water Facilities Improvements Project**. This Project includes a 5000 HP pumping station, 20 million gallon storage reservoir, sand settling facilities, and sodium hypochlorite disinfection feed and storage facilities. The facilities receive surface water from lake Mead and ground water from wells in the Charleston Heights area.

Project engineer for **Antelope Valley-East Kern Water Agency (AVEK) 65 MGD Quartz Hill Water Treatment Plant Flocculation and Clarification Optimization Project**. The project includes upgrade of the flocculators to incorporate variable frequency drives (VFD's) for providing greater control of the mixing energy as raw water quality changes in compliance with the DHS *Cryptosporidium* Action Plan for optimized coagulation process. The project also upgraded the weirs in the clarifiers.

Process engineer for **East Niles Community Services District 4 MGD Breckenridge Road Surface Water Treatment Plant Upgrade** for Enhanced Surface Water Treatment Rule compliance. The facility includes Diatomaceous Earth (DE) filters preceded by roughing pressure filters to treat surface water from the Arvin-Edison Water Storage District Canal. The canal receives Kern River, State Project (California Aqueduct), and Friant-Kern waters. Upgrades to the plant included a particle size counter and additional turbidimeters to verify conventional filtration equivalency, coagulation facilities, disinfection facilities and evaluation of the plant for surface water treatment rule compliance.

Technical Leader for **City of San Luis Obispo 16 MGD Water Treatment Plant Audit**. The City's water treatment facility is a conventional filtration Plant that treats surface water from Santa Margarita Reservoir. The plant is also permitted to treat water from Whale Rock Reservoir with direct filtration. The facility incorporates pretreatment ozonation for primary disinfection and to optimize the coagulation process. The audit was performed as part of a water system master plan for the City of San Luis Obispo and included evaluation and recommended improvements for regulatory compliance and plant optimization. It also included engineer's opinions of

Ronald G. Abraham, PE

Related Experience—continued

probable construction and O & M costs, prioritization, and schedule for recommended improvements.

Process engineer for the **City of Redding, CA Buckeye Water Treatment Plant**. The Buckeye facility is a conventional filtration plant which has an ultimate capacity of 56 million gallons per day for treatment of surface water from Whiskey Town Reservoir. Responsibilities included design of facility process components including coagulation, sedimentation and filtration processes, chlorine disinfection, chlorine emergency scrubbing facilities, chemical feed systems, plant and domestic water pumping facilities, air water backwash and washwater recovery facilities, interdisciplinary design coordination and preparation of contract provisions and specifications. The Buckeye Plant has chemical feed systems including alum and polymer for coagulation and gas chlorine for disinfection. The chlorine facility is equipped with a chlorine gas scrubber system. All the chemical feed systems are automatically controlled. All the chemical storage facilities are provided with secondary containment. The chemical feed lines are located within secondary containment utility boxes.

Lead civil/process engineer and construction manager for the **Acton Water Treatment Plant for Antelope Valley-East Kern Water Agency (AVEK)**. The Acton facility is a conventional filtration plant with an ultimate capacity of 8 MGD for treatment of surface water from the California Aqueduct. Responsibilities included design of process and civil components, facility planning, site layout, grading and paving plan, drainage system and coordination with architectural structural, electrical, instrumentation, and soils engineering phases of the facility design. Supporting facilities included chemical feed systems, chlorine disinfection, provisions for future ozonation, granular activated carbon and chlorine scrubber facility. Construction management responsibilities consisted of shop drawing review and coordination, responding to requests for information, construction review and administration, progress pay estimates and change orders. Design also included preliminary design and life cycle costing of modular conventional treatment units. The Acton Plant has chemical feed systems including alum and polymer for coagulation, powder activated carbon and potassium permanganate for taste and odor control, zinc orthophosphate for corrosion control, sodium hydroxide (caustic soda) for pH control, and gas chlorine for disinfection. The chlorine facility is equipped with provisions for a future chlorine gas scrubber system. The entire facility has fully automated controls and can be operated remotely with only intermittent onsite operator staffing. The plant is unmanned 16 hours per day and weekends. All the chemical feed systems are automatically controlled. All the chemical storage facilities are provided with secondary containment.

Project engineer for **City of Coalinga, CA 12 MGD Surface Water Treatment Master Plan and Facility Upgrade and Expansion**. Responsibilities included evaluating existing facilities for regulatory compliance and expansion facilities needed to increase plant capacity and meet surface water treatment rule compliance. Processes included raw water screening, flocculation, sedimentation, filtration, wash water recovery, residuals drying, chlorination, activated carbon, fluoridation, alum,

Ronald G. Abraham, PE

Related Experience—continued

polymer feed systems, washwater recovery, and solar water treatment residuals drying.

Project engineer for **Placer County Water Agency, CA Foothill Surface Water Treatment Plant 25 MGD Upgrade and Expansion**. Processes include raw screening, rapid mixing, coagulation, sedimentation, filtration and treated water storage. Chemical feed systems include PAC, coagulation (alum), lime, polymers (cationic coagulant aid) and pre- and post-chlorination.

Project engineer for **California Correctional Institution, Tehachapi Prison New Potable Water Source Study**. The study included evaluation of alternative water sources for supplying the Tehachapi Prison including upgrade and expansion of the Prison's existing surface water treatment plant and implementation of new groundwater wells that would be supplied by surface water via a groundwater recharge program. Other responsibilities included conducting a tracer study and recommending improvements to of the existing surface water treatment plant and treated water clear well to facilitate improved disinfection contact credit.

QA/QC reviewer for **State of California Chino Prison 3.6 MGD Water Treatment Plant**. The processes include ion exchange for nitrate removal and granular activated carbon for volatile organics removal. Supporting facilities include pumping units, brine storage, chemical feed and backwash system and distribution piping.

QA/QC reviewer for **County of San Luis Obispo Nacimiento Water Project 17 MGD surface Water Treatment Plant Conceptual Design**. The conceptual design included evaluation of alternative treatment technologies including conventional filtration, Actiflow®, and membrane filtration, development of engineers' opinions of probable cost for construction and O&M. It also addressed regulatory compliance issues i.e., IESWTR, Stage1 D/DBP Rule and Filter Backwash Rule. Disinfection alternatives addressed include sodium hypochlorite, UV, ozone and chloramines.

Project engineer for **Antelope Valley-East Kern Water Agency (AVEK) Mojave Chlorination Station and Bypass Pipeline**. Facility includes chlorination equipment for booster station in the Mojave 40 million gallon Feeder/Reservoir system. Chemical feed facilities are automatically controlled with flow proportioning and chlorine residual trim.

Project engineer for **Edwards Air Force Base/AVEK Phillips Propulsion Laboratory 1 MGD pump station and feeder chlorination booster station**. The booster station uses onsite hypochlorite generation and compound loop control to maintain the chlorine residual for the lab's domestic water supply.

QA/QC reviewer for the **City of Cambria Sea Water Desalting Water Treatment Plant**. The Cambria facility was designed to include chemical feed systems with on-site hypochlorite generation for disinfection, scale inhibitor, and sodium

Ronald G. Abraham, PE

Related Experience—continued

hydroxide (caustic soda) for pH control. All the chemical storage facilities and chemical feed lines are provided with secondary containment.

Technical leader for **East Niles Community Services District (ENCSD) Sanitary Survey Update, Bakersfield, CA**. Services provided include sanitary survey updates for the Arvin-Edison Water Storage District canal facilities, which supplies surface water to ENCSD's Breckenridge Water Treatment Plant.

Project engineer for the **City of Delano, California 3 MGD Well No. 24 Project**. Responsibilities included on-site hypochlorite generation system for hydrogen sulfide removal and disinfection. Disinfection of this groundwater source is in compliance with the California Rule and pending Groundwater Disinfection Rule.

Water Conveyance and Storage

Project engineer for the **Iowa Highway 71 Utilities Board Utility Relocation Project**. The project includes relocation of water mains and sanitary sewers with service connections and connections to existing utilities, sewer force mains, gas and high pressure gas lines, telephone and cable television along the new Highway 71 corridor through the towns of Arnolds Park and Okoboji, Iowa.

Project engineer on **Acton/Vincent Pipeline and Reservoir Project**. This project included four miles of pipelines, two high lift booster stations and two 1.6 million gallon reservoirs to deliver water from the Acton Water Treatment Plant to the community of Acton, California via the Los Angeles County Waterworks District Water System. Each booster station had five 250HP vertical turbine pumps. Each pump station also includes a surge tank system.

Project engineer on **Quartz Hill Water District Calprop pump station and pipeline**. This project included three vertical turbine pumps, two on-line and one standby to provide water service from the district's reservoirs to the Calprop residential development. Water system pressure and fire flow is maintained with a hydro-pneumatic / surge tank system, backup fire protection AVEK pumping is provided by an engine driven horizontal split case pump which actuates on low system pressure.

Project engineer on **Acton Water Treatment Plant** which included a 170,000 gallon above ground steel reservoir for filter backwashing and a 1.6 million gallon partially buried prestressed concrete reservoir for treated water storage. The Acton facility also included extensive buried and exposed in-plant piping. The plant influent included a siphon turnout from the California Aqueduct and influent rate of flow control meter vault.

Project engineer on **Antelope Valley-East Kern Water Agency, East Side Water Treatment Plant 9 million gallon reservoir project**. This project is to provide additional storage capacity for delivery to the Los Angeles County Water Work

Ronald G. Abraham, PE

Related Experience—continued

District. The project also includes on-site hypochlorite boosting to maintain adequate disinfection.

Project engineer for **Antelope Valley-East Kern Water Agency (AVEK) Mojave Chlorination Station and Bypass Pipeline**. Facility includes chlorination equipment for booster station in the Mojave 40 million gallon Feeder/Reservoir system.

Project engineer for the **City of Redding, California Buckeye Water Treatment Plant** which included a 200,000 above ground steel reservoir for filter backwashing. The tank is filled using vertical turbine pumps which take treated water from the clearwell. This project also includes a high pressure plant water system including end suction pumps, a hydropneumatic tank and a piping system to deliver water throughout the entire facility. The Buckeye facility also includes extensive buried and exposed in-plant piping.

Project engineer for **Edwards Air Force Base/AVEK Phillips Propulsion Laboratory 1 MGD pump station and feeder chlorination booster station**. The booster station uses onsite hypochlorite generation and compound loop control to maintain the chlorine residual for the lab's domestic water supply.

Project engineer for **Antelope Valley-East Kern Water Agency, Edwards Air Force Base Investigation of tap water discoloration** and recommended corrosion control measures. This project evaluated the effects of utilizing surface water from the California Aqueduct in conjunction with base well water. The study also included recommendations for treatment at AVEK's Rosamond Water Treatment Plant in the base distribution system. The primary goals being to meet lead and copper rule corrosion requirements while continuing to meet Disinfectant Byproduct Rule (TTHM and HAA) and Coliform compliance.

Publications

Abraham, R., Holderness, P., and Horn, B., "Optimizing Operational Performance of a Diatomaceous Earth Filtration Plant with Particle Counting". Presented at the California-Nevada Sectional AWWA Fall Conference, October 15-18, 1996, Palm Springs, CA

Abraham, R., Paxton C, Horn B, "Design and Operational Issues for converting Disinfection Facilities from Gas Chlorine to Sodium Hypochlorite". Presented at the AWWA Annual Conference and Exposition, June 16-20, 2002. New Orleans, LA.

Thomas S. Maddock, PE

President

Fields of Special Competence

Water Resources Development/Waste water Systems
Technical/Economic Feasibility Studies
Civil/Sanitary/Water Resource Engineering
Irrigation/Agricultural Development
Expert witness, Water Rights/System Valuation

Education

BS/Civil Engineering/Virginia Polytechnic Institute and State University/1950 w/honors
MS/Civil Engineering/Massachusetts Institute of Technology/1951
MBA/Business Administration/Stanford/1957
Advanced Groundwater Hydrology/Massachusetts Institute of Technology/1967
Advanced Management College/Stanford/1976
Western Water Law/University of Colorado School of Law/1985
Water Marketing/University of Denver College of Law/1986

Registration

Professional Engineer — VA (1951), CA, AZ, CO, NV, FL, TX, NC, NM, NE, DC, WA, ID, UT, MT, KS, WY

Years of Experience

Joined Boyle — 1957
With Others — 7 years

Professional Affiliations

American Society of Civil Engineers, Fellow
American Water Works Association
Consulting Engineers Association of California
Institute for Advancement of Engineering, Fellow
Society of American Military Engineers, Fellow
International Committee on Irrigation and Drainage
National Society of Professional Engineers
National Academy of Engineering
National Water Research Institute, Advisory Board

Thomas S. Maddock, PE

Experience Summary

President, Boyle Engineering Corporation. Consulting engineer for preparation of feasibility studies and master plans which have supported financing and successful implementation of over \$500 million of water resources projects both in the United States and internationally.

Principal-In-Charge, Project Manager, and consulting engineer for planning and design of water storage and large diameter pipeline project.

Consulting engineer on special assignments for two major water purveyors in southern California — the 2,300-square-mile Antelope Valley-East Kern Water Agency (AVEK), a State Water Project Contractor, and the Municipal Water District of Orange County (MWDOC), delivering MWD water to 25 retail agencies in Orange County.

Chairman, Statewide Water Resources Committee and Member of the Board of Directors, California Chamber of Commerce. Testimony before State Legislative Committees on State Water Resources Control Board on State water resources issues. President 1987, ASCE, Los Angeles Section; and 1988 Chairman of ASCE California State Council.

Professional Summary

1993 to 2000 President of the Board of Boyle Engineering Corporation

Principal-In-Charge of Woford Mountain Project (\$45 million) in Colorado to supply new yield for Denver and the west slope of Colorado; supervised feasibility studies, design and spillway model studies and construction phase services. Consulting engineer for water resource evaluation for the state of North Carolina and for development of regional water management plan for Mojave Water Agency. Also, consulting engineer for AVEK and MWDOC on statewide water issues including evaluation of potential yield from the Colorado River and the State Water Project.

Thomas S. Maddock, PE

Professional Summary—continued

1989 to 1993

Chairman and Chief Executive Officer of Boyle Engineering Corporation

Overall management of Boyle Engineering Corporation and directs major water resource planning and design assignments throughout the western states. Consulting engineer for MWDOC Colorado River studies and for State Water Project ground water banking in Kern County (Kern Delta Water District and Rosedale-Rio Bravo Water Storage District).

1971 to 1989

President and Chief Executive Officer of Boyle Engineering Corporation

Overall management of Boyle Engineering Corporation and directs water resources activity throughout the firm.

Consulting engineer for State of Colorado Water Conservation Board project evaluating the technical and economic feasibility of an irrigation system, including hydrology storage, distribution and pump storage project potential within the San Miguel Water Conservancy District.

Consulting engineer for the Kern Delta Water District and Rosedale-Rio Bravo Water Storage District in Kern County on facilities plan and environmental impact for utilization of Kern River water rights, including ground water storage and conjunctive use.

Consulting engineer for Green Mountain Exchange Project involving the hydrologic modeling of the Colorado River and preliminary design of six dams to capture unused Colorado River flows for Denver and the west slope.

Consulting engineer for MWDOC on regional storage and distribution plans to provide MWD water to south Orange County leading to design and construction of AMP (Deimer) Pipeline Project. Also, supervised investigations of surface storage alternatives in south Orange County.

Directed preparation of engineering and economic feasibility studies for the Little Blue Water Resources District in south central Nebraska defining plan for diversion, storage and distribution of water from the Platte River to irrigate 66,500 acres of land.

Thomas S. Maddock, PE

Professional Summary—continued

Consulting engineer for the implementation of the \$71 million DAWN (Domestic-Agriculture Water Network) Project for the Antelope Valley-East Kern Water Agency, Quartz Hill, California. The project annually distributes 140,000 acre feet of water from the California State Water Project to serve an area of 2,300 square miles.

Boyle Principal-In-Charge for design and construction of Cross Valley Canal Project and irrigation distribution systems (\$50 million) in Kern County.

1961 to 1971 Vice President, Boyle Engineering Corporation

Project manager for Master Plan of Water Resources for Santo Domingo, Dominican Republic (USAID-financed). Project director for planning and design of municipal waterworks and irrigation projects in Libya, North Africa. Project manager, Westside Irrigation Project for agricultural development of 150,000 acres in the San Joaquin Valley of California (Institute for Advancement of Engineering "Engineering '71 Merit Award.") Project manager on Rosedale-Rio Bravo Water Storage District ground water recharge project.

1957 to 1961 Managing Engineer, Boyle Engineering Corporation,
Bakersfield, California

Project engineer responsible for feasibility studies and designs of municipal waterworks, waste water facilities, and irrigation projects in California.

1955 to 1957 Graduate School of Business, Stanford University, Palo Alto,
California

1952 to 1955 Active Duty, U.S. Navy, Civil Engineer Corps. Construction projects, Philippine Islands, and Public Works Department, MCAS El Toro, California.

Thomas S. Maddock, PE

Honors and Awards

Engineering '71 Merit Award, The Institute for Advancement of Engineering/Westside Irrigation Project, Kern County/Boyle Engineering Project Manager

Honored Citizen, Board of Supervisors/Orange County, CA, awarded to Rear Admiral Thomas S. Maddock for accomplishments as Commander, Reserve Naval Construction Force, headquartered at MCAS, El Toro, CA 1983-1985

RADM Thomas S. Maddock, Twice A Citizen, Honorable Robert E. Badham, Congressional Record, September 19, 1985

1985 Moreell Medal, awarded by Society of American Military Engineers for accomplishments as Commander, Reserve Naval Construction Force

1986 Outstanding Engineer Merit Award, awarded by the Los Angeles Institute for Advancement of Engineering for engineering accomplishments in the field of water resources

Engineer of the Year - 1992, Southern California - George Washington Award, awarded by The Institute for Advancement of Engineering. Mr. Maddock was the unanimous selection of the organization which represents 160,000 members from 46 engineering societies. This is the highest award the engineering community can bestow on an individual.

Engineer of the Year - 1992, awarded by Orange County Engineering Council

State of California Legislature Assembly Resolution, commending and recognizing Thomas S. Maddock's receipt of the George Washington Award and Selection as 1992 Engineer of the Year by The Institute for Advancement of Engineering and for other accomplishments

1992 Parcel-Sverdrup Civil Engineering Management Award, awarded by the American Society of Civil Engineers for contributions in the field of civil engineering management, evidencing high character and professional integrity and regional or national professional reputation.

Thomas S. Maddock, PE

Publications and Presentations

Maddock, Thomas S., acceptance speech as the recipient of the 1992 Parcel-Sverdrup Civil Engineering Management Award given at the American Society of Civil Engineers 1992 Annual Convention, New York, New York, September 15, 1992

Maddock, Thomas S., "A Business Perspective on Statewide Water Issues", published *SCWC Update*, Southern California Water Committee, Inc., June 1992

Maddock, Thomas S., "Newton's First Law Applied to Career Environment for Engineers and Computer Scientists, Commencement Address for the School of Engineering and Computer Science, California State University, Fullerton, California, presented May 31, 1992

Maddock, Thomas S., and Hines, Walter G., "Meeting Future Public Water Supply Needs: A Southwest Perspective", presented at Nevada Water Resources Association, Las Vegas, Nevada, January 15, 1992

Maddock, Thomas S., "Managing Consultants," presented at Southern California Chapter, American Public Works Association, Downey, California, September 19, 1991

Maddock, Thomas S., "Engineer or Manager: Is There A Difference?", presented at Los Angeles Section Engineering Management Technical Group, American Society of Civil Engineers, Los Angeles, California, May 17, 1989, and Nebraska Section, 1990/91

Maddock, Thomas S., "Grindstone Canyon Dam Project, Case Study of Roller Compacted Concrete (RCC) Dam Technology," presented at Massachusetts Institute of Technology, 1989, and Ventura and Santa Barbara Branch, and Southern San Joaquin Branch, American Society of Civil Engineers, 1990/91

Maddock, Thomas S., "Impact of Water Quality Policies on Water Availability," presented at 1990 Nebraska Water Conference, Lincoln, Nebraska, March 13-14, 1990. Published ASCE *Journal of Issues in Engineering*, October 1990.

Maddock, Thomas S., "Business Perspective: Water as Related to the Economy," presented at California Leadership Seminar on Water, Pomona, California, September 16-17, 1988.

Maddock, Thomas S., "Meeting Domestic Water Needs: Where Have We Been? Where Are We Going? A National Perspective," presented at the 29th Annual Meeting of Interstate Conference on Water Policy, San Francisco, California, August 14-18, 1988.

Maddock, Thomas S., "Water Availability - The Ultimate Development Limitation," presented at 1987 Pacific Coast Builders Conference, San Francisco, California, June 17-20, 1987.

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Publications and Presentations—continued

Maddock, Thomas S., "Water Markets, Including Third Party Effects," presented at University of California Conference: "Bridges Over Troubled Waters: Understanding California Water Controversies," Pacific Grove, California, September 30-October 2, 1986.

Maddock, Thomas S., "Financing of Water Projects," presented 1986 Nebraska Water Conference, Lincoln, Nebraska, March 18-19, 1986.

Maddock, Thomas S., Rear Admiral, Civil Engineer Corps, U.S. Naval Reserve, "Seabees: Update '85," published Proceedings, U.S. Naval Institute, July 1985.

Maddock, Thomas S., "To Freshman - To Graduates - About Higher Education," published *Engineering Now*, College of Engineering, Virginia Tech 1982-83.

Maddock, Thomas S. and Hardan, David L., "Groundwater Recharge Project Provides Economical Water Supply Plus Drought Protection," presented Rocky Mountain Region Conference, Albuquerque, New Mexico, September 1983 and National Convention, American Society of Civil Engineers, Las Vegas, Nevada, April 1982.

Maddock, Thomas S., "Murphy's Law Applied to Pump Station Design and Construction," presented Virginia Student Chapters of American Society of Civil Engineers at Virginia Polytechnic Institute and State University, Blacksburg, Virginia, April 1981.

Maddock, Thomas S. and Hardan, David L., "New Day DAWNS for California Water," published *Water & Wastes Engineering*, October 1980.

Maddock, Thomas S., "The Reserve Naval Construction Force," published *The Military Engineer*, March/April 1979.

Maddock, Thomas S., "Smoothing the Merger Acquisition Route," published *Consulting Engineer*, 1979.

Thomas S. Maddock, PE

Publications and Presentations—continued

Maddock, Thomas S. and Hardan, David L., "The Cross Valley Canal - A Case Study of Project Implementation by Local Agency Joint Venture," presented at American Society of Civil Engineers National Specialty Conference, Jointly Sponsored by the Irrigation and Drainage Division and the Water Resources Planning and Management Division, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, July 1978; published Proceedings to Specialty Conference, American Society of Civil Engineers, Blacksburg, Virginia.

Maddock, Thomas S., "Program for Implementation of ASCE Salary and Fringe Benefit Guidelines," presented to American Society of Civil Engineers, Fall Convention and Exhibit, San Francisco, California, October 1977; published by the American Society of Civil Engineers in *Journal of Engineering Issues*, April 1978.

Maddock, Thomas S., "Antelope Valley-East Kern Water Agency Supplemental Water Project - A Case Study," presented Fall meeting, Texas, New Mexico, and Mexico Sections, American Society of Civil Engineers, Albuquerque, New Mexico, October 1977.

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