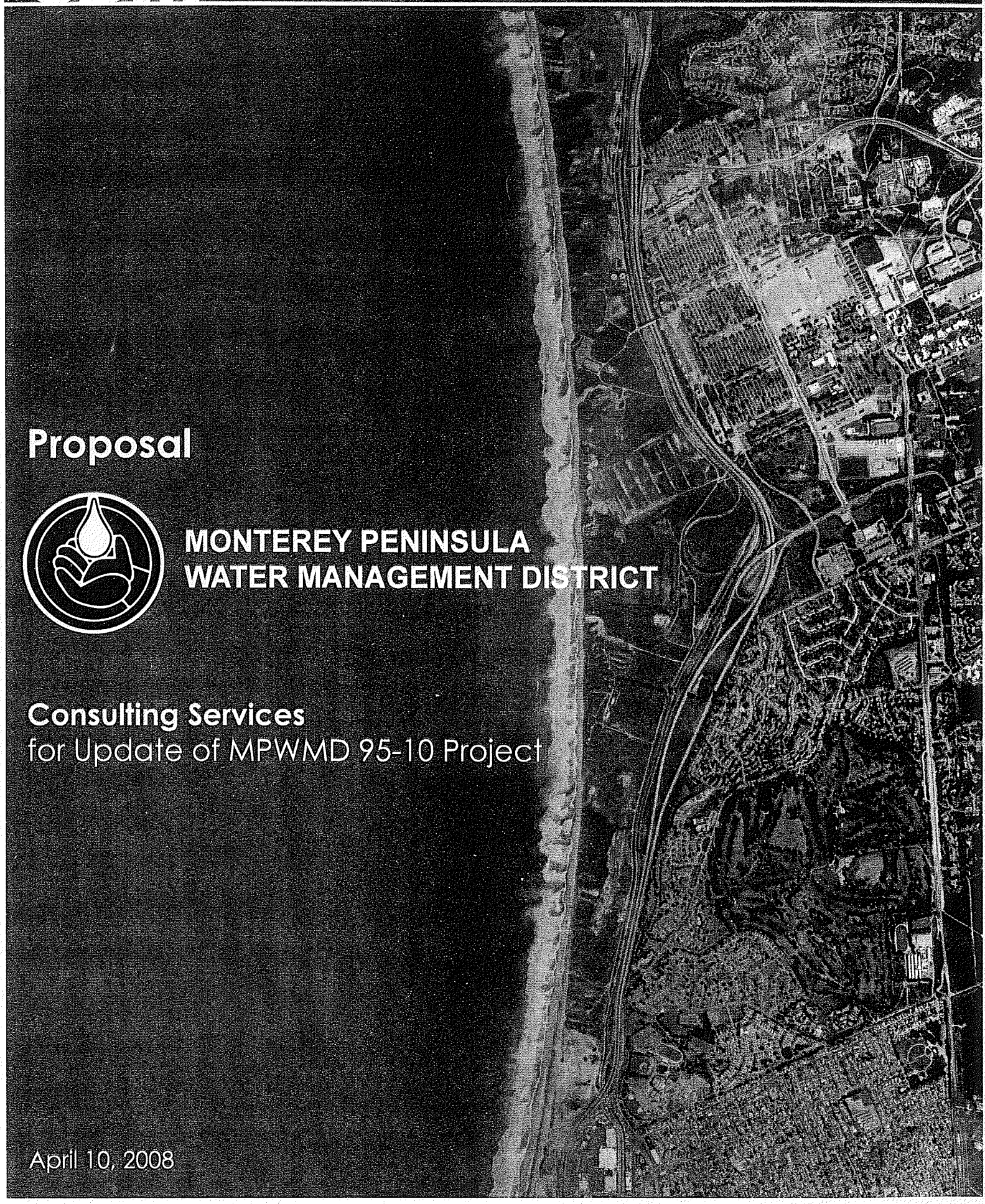
CDM



Proposal

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

Consulting Services
for Update of MPWMD 95-10 Project

April 10, 2008

One Walnut Creek Center
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Walnut Creek, CA 94596
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April 10, 2008

Andrew M. Bell, P.E.
District Engineer
Monterey Peninsula Water Management District
5 Harris Court, Building G
Monterey, CA 93942

Subject: Proposal for Consulting Services to Update the MPWMD 95-10 Project

Dear Mr. Bell:

Camp Dresser & McKee Inc. (CDM) is pleased to submit this proposal for engineering services to update the MPWMD 95-10 Project. CDM understands that successfully identifying a new water supply for the Monterey Peninsula that would allow California-American Water Company, the local water purveyor, to meet the provisions of State Water Resources Control Board Order 95-10, which limits production from the Carmel River.

We know that identifying a new water supply on the Peninsula does not occur without controversy. Challenging land use options, sensitive environmental receptors in the Monterey Bay, and an engaged, well-informed community all require that a new project be fully vetted and found to be technically sound. The MPWMD 95-10 Project, as CDM learned from our earlier studies in 2004, demonstrated the complexities with of installing beach wells in a marginally understood hydrogeologic environment. Since then, with the Seaside Basin adjudication, the complexities have only increased. Successful development of the MPWMD 95-10 Project is projected to be expensive (production water exceeding $2,500 per acre foot) with risks and uncertainties that require factoring into decision making on the project alternative.

To address these uncertainties, CDM has developed a three phased program approach. In the first phase, we will work with Jones & Stokes Associates (JSA) to complete a constraints analysis to redefine a project alternative that focuses on a successful feed water collection system. We will collect and compile all new groundwater and project information and propose to conduct a design workshop with the District and the technical team to identify the best alternative(s) given the group's collective knowledge of the program and the area. In Phase 2, we will develop and refine the project description. In this phase, we will identify and undertake the necessary field studies to finalize the project description for the EIR. Once field studies are completed, the project description will be refined to incorporate new information from the field studies. In the third phase, CDM will provide technical support to JSA for the project EIR.

CDM has assembled an experienced technical team, with strong qualifications in water resources planning, as well as localized experience in the Monterey Peninsula. I will be serving as the CDM project manager, the same role that I had for the Monterey Peninsula Water Supply Project, and will draw on CDM's nationwide technical resources and others who assisted me with the desalination project facilities plan. Ben Swann, P.G., C.HG., will be leading the Hydrogeologic Investigations task. Mr. Swann brings a diversified hydrogeologic background, with experience in groundwater investigations, including field data collection, groundwater modeling and feasibility studies. We have also included Martin Feeney, P.G., C.HG., C.EG., and Derrik Williams, P.G., C.HG., of Hydrometrics, LLC, in a technical review role reflecting their past work in understanding the complex near-shore hydrogeologic system.

We recognize that in the contentious field of defining new water supplies, projects are rarely selected on the strength of their technical merits. As you read our approach, you will see that we have incorporated the key institutional and regulatory issues that together with a well defined scope in Phase 1, will obtain consensus from the technical community and MPWMD stakeholders on the direction of the project.

We appreciate the opportunity to work with you once again, and look forward to this important and exciting project. Please feel free to call me with any questions that you have on our proposal.

Very truly yours,

Polly L Boissevain

Polly Boissevain, P.E.
Principal and Proposed Project Manager
Camp Dresser & McKee Inc.

Section 1
Project Approach and Scope of Work

Project Understanding/ Objectives

CDM understands the District would like to review the viability of the ocean desalination project initially considered in 2003 and 2004 as part of the Monterey Peninsula Water Supply Project. As part of the earlier project, CDM provided engineering support to Jones & Stokes in the preparation of an Environmental Impact Report (EIR), for an 8,400 acre-foot per year desalination project in the Sand City area, using beach collector wells in the Sand City area with brine disposal either through wells at former Fort Ord or using the Monterey Regional Water Pollution Control Agency's (MRWPCA) ocean outfall.

CDM's work included the development of conceptual facilities layouts, sizing and costs for project facilities, including seawater collection and disposal facilities, raw water transmission, a reverse-osmosis treatment plant, and treated water storage, booster and transmission facilities, as documented in CDM's report Project Facilities Alternatives for the Sand City Desalination Project (CDM, October 13, 2003, with minor revisions, June 23, 2004).[1] Project concepts provided the basis for an environmental impact analysis by ICF Jones & Stokes, culminating in the preparation of the Board Review Draft EIR, submitted to the District Board in December 2003.

In parallel to this effort, CDM also conducted a hydrogeologic investigation, including field geotechnical and geophysical field evaluations, to further evaluate project feasibility and refine project yields. This work is documented in CDM's report entitled Sand City Desalination Project Feasibility Study, dated April 16, 2004. Findings from the Sand City Desalination Project Feasibility Study (Feasibility Study) concluded that the project as initially conceptualized, using off shore horizontally directionally drilled (HDD) wells, was likely not possible because of new geologic interpretations made during the course of the study. Geologic interpretation of the former Fort Ord area concluded that brine disposal proposed in this area may not be possible due to hydraulic connection between the Seaside Groundwater Basin aquifer system and the overlying dune sand aquifer. The feasibility study did conclude that an HDD collector system could be designed to meet the project goals if drilled parallel to the beach in both the Sand City and former Fort Ord areas. With collector wells in these areas, brine disposal would require use of the MRWPCA ocean outfall.

After CDM's field investigations and feasibility study report in 2004, the project was put on hold by the District. Neither project facilities information nor the EIR were updated to reflect the findings of the field investigation.

The Feasibility Study identified several geologic and technical issues that would need further evaluation involving collector well configurations. This scope of work addresses these geologic and technical considerations, in addition to incorporating new technical information that has been collected since 2004.

It is our understanding that the District's goal is to reevaluate the 8,400 AF/year project and determine whether a project is still feasible at this production capacity. Given the urgency of implementing a project, the evaluation should also consider how technical, logistical and permitting uncertainties factor into the implementation time line and whether a smaller project that would require less field work could be implemented more quickly. The study will identify the largest viable project that can be constructed, as well as the project size that could be implemented based on maximizing use of existing data and limiting future field efforts.

To address the District's goal, CDM has developed a three phased scope of work. We have provided a detailed scope and cost for Phase 1 and a preliminary scope and range of cost for Phases 2 and 3, given the many uncertainties associated with

[1] The 2003 project was named the Sand City Desalination Project. The name has been changed to the MPWMD 95-10 Project to distinguish it from the City of Sand City Desalination Project, currently in design and construction.

defining a new project description. We provide the range of costs for Phases 2 and 3 to give the District an understanding of the types of activities and costs that could be involved.

Phase 1 - Conduct Constraints Analysis
ICF Jones & Stokes will take the lead on the Phase 1 constraints analysis, with CDM supporting ICF Jones & Stokes with the technical evaluations, based on new information available.

Significant new technical information has been developed and new programs have been undertaken that may affect the project conceptualized in the 2004 feasibility report. These programs include the advancement of the City of Sand City desalination project, which is now in the design and construction phase, and the Seaside Groundwater Basin adjudication. This new information will be collected, compiled, and reviewed, and new potential project alternatives will be developed with collaborative input from the District.

ICF Jones & Stokes will use this information to meet with resources agencies to obtain input on land use and other restrictions. ICF Jones & Stokes and CDM will compile agency review and technical findings and conduct a constraints analysis to identify the most favorable alternatives. As noted above, it is anticipated that two projects of different sizes may be identified – one that could potentially meet the production goal of 8,400 acre-feet/year, and a smaller project that could be implemented more quickly, minimizing collection of new field data.

Phase 2 – Develop Detailed Project Description
CDM will perform Phase 2. Using the recommended alternative(s) from Phase 1, CDM will prepare a conceptual project description for the project desalination collection facilities. Also as part of Phase 2, CDM will identify and carry out the additional field studies that are needed to further refine the project and finalize the project description for the EIR. These studies would include identifying locations, methods and anticipated yields of seawater intake facilities, and confirming the viability of the use of MRWPCA's regional treatment plant outfall for discharge of brine produced as part of the seawater desalination process.

The focus of CDM's Phase 1 work and Phase 2 field investigations will be the evaluation of possible seawater desalination collection facilities, with brine disposal assumed to be at the MRWPCA outfall, and re-evaluation of potential desalination treatment plant sites. Other aspects of the project, such as raw and treated water transmission, which would be affected by changes in the desalination facilities or treatment plant site, would be evaluated later in Phase 2, if a feasible project is identified after conclusion of field work.

Phase 3 - Prepare EIR
ICF Jones & Stokes will take the lead on this Phase. CDM's scope includes assisting ICF Jones & Stokes by providing pertinent technical information for the completion of the draft EIR. CDM will also assist ICF Jones & Stokes with responses to comments on the draft EIR and preparation of the final EIR.

Scope of Work

Phase 1 - Conduct Constraints Analysis

CDM will work with ICF Jones & Stokes and the District to provide the necessary technical evaluations to conduct a constraints analysis, and identify one to two potential project alternatives to be carried forward.

Task 1.1: Initiate Project

Objective: Assist with developing a set of project objectives that can be used to help develop and screen components of a new project alternative. For example: should the project consider new drilling technologies with uncertain production capacity for collector wells?

Activities:

- **1.1.1.** CDM will work with ICF Jones & Stokes to develop a preliminary list of program objectives on project sizing, environmental considerations, technical complexity, institutional uncertainty, and legal and regulatory risk that might affect elements of the project.
- **1.1.2.** During the project kickoff meeting, refine and prioritize project objectives. Identify District desired project outcome and schedule.

Deliverable: Preliminary and agreed-to project objectives.

Task 1.2: Review Existing Data

Objective: Review all existing new data and information compiled since the 2004 Feasibility Study that might affect or shape the project alternative.

Activities:

- 1.2.1. Review reports pertaining to the study area, including:
  - CDM Sand City Desalination Project Feasibility Study
  - Sand City Brackish Water Project report and information
  - Hydrometrics Seaside Ground Basin monitoring information
  - Seaside Groundwater Basin: Update on Water Resources Conditions 2005
  - Review pertinent information with the Seaside Groundwater Basin Watermaster
- 1.2.2. Meet with the City of Sand City and select private property owners to identify potential new desalination plant site. Budgeting assumes up to three meetings.
- 1.2.3. Meet with the MRWPCA to update information on use of the outfall for brine disposal. Compile issues and potential costs for use of the regional wastewater treatment plant outfall for brine disposal. Identify changes since 2004 analysis that could impact use of the outfall. Identify necessary studies to allow for use of the outfall for brine disposal.
- 1.2.4. Revise near shore and offshore geological conceptual model by working with new available information and consultation with geologic experts familiar with recent studies.
- 1.2.5. Review and compare the various groundwater models developed in the project area to use as a screening tool to evaluate the groundwater effects resulting from implementing a new project alternative. The goal of this activity is to define whether an existing model can be used or modified to provide a defensible representation of groundwater extraction from the near beach/coastal environment. Models in the project area include:
  - Seaside Groundwater Basin Watermaster model developed by California- American Water Company
  - Sand City brackish water project model developed by Derrik Williams for Sand City
  - Sand City Desalination Project Feasibility Study model developed by CDM for the District.

  CDM will recommend which one of the models can be used, or whether a new model should be developed.
- 1.2.6. Identify any new drilling technologies that might meet project goals and objectives.

Deliverables:

- Reference of all documents and interviews for the Phase 2 summary report.
- Summary of groundwater models and recommendation for groundwater model to be used.

Task 1.3: Conduct Constraints Analysis

Objective: Based upon data collected in Task 1.2, develop a preliminary project description for seawater collection that best meets the District's project objectives. The critical components of this task will be defining feedwater collection methodology and locations.

In the 2004 Feasibility Study, CDM identified HDD wells positioned horizontally to the beach in both Sand City and former Fort Ord areas as options presenting the greatest opportunity for success. Radial collector wells may also be feasible in conjunction with the HDD wells. This task defines a process to identify the ideal location and methodology for wells based upon geologic, institutional, and land use constraints.

Activities:

- 1.3.1. Compile a toolbox of potential well drilling technologies that can be used for conventional, HDD, radial, and offshore well installations. The toolbox will include items, such as cost, that could be significant in the constraints evaluation.
- 1.3.2. Utilize the project technical review committee, ICF Jones and Stokes, District staff, and others experts and community leaders at the direction of the District to screen feed water collection alternatives in a design charrette workshop.[2] The purpose of the charrette is to identify all potential alternatives that meet the project objectives. The charrette will ideally be

[2] A design charrette workshop is a collaborative session in which a group of designers develops a solution to a design problem.

held in the District's office or in CDM's Walnut Creek office. Activities for the charrette include:

- Identify all possible well locations and configurations based on well drilling technology, geology, regulatory considerations, and potential impacts to the City of Sand City project.
- Develop a universal matrix of feedwater extraction alternatives and compare to the District's set of objectives developed in Task 1.1.
- Prioritize feedwater collection alternatives based upon ability to meet project objectives.
- The workshop will be led by a CDM facilitator.

- **1.3.3. Assist ICF Jones & Stokes with Agency Review.** CDM will summarize information from the design charette and develop a summary and maps showing potential locations of facilities (e.g. general locations and approximate number of well heads) for ICF Jones & Stokes to use in meetings with the agencies. CDM will participate in agency meetings as needed. It is anticipated that CDM would participate in meetings with the City of Sand City, Regional Water Quality Control Board, and the Seaside Groundwater Basin Watermaster.
- **1.3.4**. Assist ICF Jones & Stokes in conducting a constraints analysis of the top prioritized feedwater collector alternatives based on technical, regulatory, and land use considerations. Review team would include CDM, Jones and Stokes and the District. The analysis would identify the top one to two possible configurations for collection and treatment facilities for the project. Possible configurations would include: 1) a smaller project that would make use of existing data and minimize future field collection efforts; 2) a larger project that may require significant new engineering evaluation. CDM would provide input to ICF Jones & Stokes on technical aspects of the constraints analysis for incorporation into the Constraints Analysis report.

Deliverables:

- Workshop meeting materials to prioritize feed water collection alternatives.
- Input to ICF Jones & Stokes on technical elements of constraints analysis. Budgeting assumes that summary information would be included in this report. More detailed documentation of the analysis is budgeted in the Task 2.4 Summary Report.

Task 1.4 Project Management

Purpose: Maintain project budget, schedule, and team communication.

Activities:

- **1.4.1**. Prepare monthly invoices and status reports.
- **1.4.2**. Hold regular phone calls with the District on project status.
- **1.4.3**. Coordinate technical activities with environmental consultant ICF Jones and Stokes.
- **1.4.4**. Hold one progress meeting with the District.

Deliverables: Monthly Status Report, meeting minutes.

Phase 2 – Develop Detailed Project Description

In Phase 2, CDM will develop a conceptual project description, identify and undertake field studies to refine the project description and finalize the project description based on results of the field studies.

Task 2.1 Prepare Conceptual Project Description

- **2.1.1**. Develop a conceptual alternative design description and layout of the top prioritized one to two collection alternatives. Description would include conceptual layout of collection facilities, location, depth and length of wells, general location of infrastructure, and facilities.
- **2.1.2**. Based on identified potential desalination plant sites identified in Phase 1, prepare conceptual alternative design description and layout for plant sites, for up to three plant sites.

Assumption: Raw and treated water pipeline facilities alignments and sizes will be configured later in Phase 2, following the field studies. Brine will be disposed of in the ocean outfall.

Task 2.2: Groundwater Modeling of Conceptual Alternative

Objective: Use a groundwater model to simulate the effects of the conceptual alternative on the near-shore/coastal groundwater.

Activities:

- 2.2.1. Update/revise numerical groundwater model. This model could be an expansion of one of the available existing groundwater models, or a new model. The specific model used will be defined in Task 1.2, activity 1.2.5.
- 2.2.2. Simulate the groundwater effects (flow direction and water level changes) from the conceptual alternative on the near-shore and offshore environment.
- 2.2.3. Simulation will be done at several extraction rates. One configuration change to the seawater collector wells will be performed to maximize extraction of ocean water collection and minimize freshwater influence. Potential impacts to the City of Sand City's project will also be identified.

Deliverable: Model development, calibration, and results will be presented in the summary report.

Assumptions:

- The groundwater modeling will be performed as a screening tool for the alternative.
- The model domain will be constrained to the approximate top 100 feet of the dune sand/beach sand environment and the near shore and offshore environment.
- Existing information will be used to estimate hydrogeologic properties and the depth of the beach sands.
- Costs conservatively include the development of a new groundwater model.

Task 2.3: Identify Data Gaps/ Field Studies

Objective: Identify geologic, hydrogeologic, ocean outfall and other technical data gaps requiring further field investigation or study.

Activities:

- 2.3.1. Compile list of data gaps based on Phase 1 and 2 evaluations.
- 2.3.2. Prepare a field study work plan and cost for execution.

Deliverables: List of data gaps and detailed work plan and estimated cost to conduct field studies. This information will be presented in the summary report.

Task 2.4: Prepare Summary Report

Objective: Prepare a summary report on the feedwater collection and disposal alternatives selection process evaluated in Phase 1 and 2. The report will catalog all new information on geology, and technology, used to develop the alternative.

Activities:

- 2.4.1. Project report will include:
  - Alternative layout and conceptual design of collector wells, including estimated yield
  - Geologic conceptual model of the coastal environment
  - Groundwater effects of the alternative in the coastal area
  - Workplan for subsequent Phase 2 field activities
  - Summary of permitting requirements and land use restrictions, as documented in the Phase 1 Constraints Analysis report
- 2.4.2. CDM will develop a draft and final report version. We will provide 7 hard copies of the draft report and 30 copies of the final report. One electronic copy will be provided of each report.

Deliverables: Draft and final reports.

Task 2.5: Perform Detailed Hydrogeologic, Ocean Outfall Investigation, and Collection Well Pilot Testing

Specific scope for this task will be identified in the work plan developed in Task 2.3.2. It is not known at this time what field studies will be required. Therefore, the degree of the studies and the cost are not known. It may be possible with a smaller project to conduct limited or no field investigative studies and proceed to the Phase 3 EIR. If a larger project is identified as possible, it is assumed that detailed field studies and pilot testing will be required to confirm project yields and understand project impacts. The specific studies detailed in the work plan will be developed following concurrence with the technical and environmental team and the District based upon the selected conceptual alternative. Studies will be undertaken to adequately define the project for presentation in the EIR. The most significant activity in this task will be pilot testing of HDD collection wells in both the Sand City area and Fort Ord if systems are deemed possible.

Objective: Execute the workplan for field studies developed under Task 2.3. Confirm lithologic and hydrogeologic properties of sediments in the location of collector wells. If necessary, install a pilot test well(s) to assess drilling and well installation technology and confirm the well's ability to provide estimated feed water rates. Confirm modifications as necessary to the ocean outfall to accept project brine water.

Potential Activities: (Field activities have not been developed but could include the following):

- 2.5.1. Install 10-20 piezometers using cone penetrometer technology. Log general lithology to the maximum hole depth- estimated at 100 feet. Piezometers would be installed to help understand groundwater water levels in the coastal environment and the effects that the project might have on up-gradient (land side) groundwater levels including the Sand City desalination project. Piezometers could also be used to understand vertical groundwater flow gradients between the various aquifer units (Dune Sands and Paso Robles Formation). Piezometers could be installed at Sand City, Fort Ord Dunes State Park or both depending upon the project alternative.
- 2.5.2. Install 5-10 soil borings and collect soils samples for hydraulic properties analysis including hydraulic conductivity and permeability. Convert boring to monitoring wells. Detailed soil sampling would be conducted using a drilling rig (rotary or hollow stem auger depending upon drilling depth) to collect actual formation samples. Wells could be installed at Sand City, Fort Ord Dunes State Park or both depending upon the project alternative. Collected soil samples would likely be retained for laboratory analysis including, porosity, permeability, and grain size.
- 2.5.3. Develop two pilot scale HDD collector wells. Depending upon the selected alternative, one pilot collector well could be installed at Sand City and one at Fort Ord Dunes State Park. Operate wells for a three to six month period and monitor aquifer response using piezometers and groundwater wells. . The pilot testing will likely be necessary to assess drilling technologies, project impacts, and well yields. The quantity of feed water HDD wells at Fort Ord Dunes State Park or Sand City will be capable of delivering is not known. Previous collection rate estimates have ranged from 1-4 gallons per minute per linear foot (gpm per foot) of installed well screen. Three gpm per foot equates to approximately 4300 gallons per day per linear foot of well screen. To deliver a project with product water quantities of 7.5 MGD (8,400AF annually) requires approximately 15 MGD of feedwater and 3,500 feet of collector screen at an assumed collection rate of 3 gpm per foot. If collection rates are lower or higher the required screen length changes accordingly. Hence, the actual collection rate is a significant factor in project sizing, yield, and cost and should be field pilot tested to confirm rates. It may be possible to proceed to the EIR with out pilot testing eliminating this task. If a smaller project is identified in the Sand City area and concurrence is gained from the technical community on the proposed well's performance.
- 2.5.4. Ocean outfall modeling, as needed, and design modification to outfall diffuser. This scope assumes that the brine will be disposed of in the ocean outfall. It may be possible to use existing studies to understand how brine will act in the ocean environment. Ocean outfall modeling to assess brine disposal impacts to the marine environment is being performed for the Coastal Water Project. Scoping in Task 2.3 will evaluate whether these studies are sufficient for the 95-10 project EIR, or supplemental analysis is required.

Deliverables: Procedures and results of the field activities.

Assumptions: Actual field activities will be defined in Task 2.3. A broad range of cost is presented that represents the uncertainty in the field program.

Task 2.6: Finalize Project Description

Objective: Finalize facilities layouts for the MPWMD Seawater Desalination Project for the EIR update.

This task will focus on finalizing locations/ configurations for collector well facilities. However, it is also anticipated that other facility sizing and location assumptions may change as a result of the Phase 1 and Phase 2 investigations. For example, current project layouts are based on a desalination treatment plant with a baseload operation to provide a year-round supply. Previous analysis of Cal American water distribution system seasonal demands indicated that there is sufficient wintertime

demand to use the desalination supply. However, if production capacity can be increased, different operational schemes may need to be considered, such as pairing the plant with a conjunctive use program, providing seasonal storage, or providing peaking capability for the plant.

Potential Activities: (Specific activities will depend on Phase 1 findings but could include the following:)

- 2.6.1. Update project facilities layouts for wells and pipelines for alternatives based on available information from hydrogeologic field investigations.
- 2.6.2. Update cost estimates based on revised project layouts.
- 2.6.3. Update hydraulic modeling operational analysis, if needed, to evaluate treated water conveyance sizing and need for additional new facilities, such as pairing desalination with conjunctive use in the Seaside Groundwater Basin, providing seasonal storage of treated water, or providing peaking capacity in the collection well system and treatment plant.
- 2.6.4. Incorporate/update, as needed, layouts developed in Task 2.1 for RO treatment process, facility size, and location based on project sizing.
- 2.6.5. Review electrical service provisions, and update as needed.
- 2.6.6. Prepare layouts and descriptions for ICF Jones & Stokes for environmental assessments. Descriptions will identify general footprint requirements and pipeline corridors.
- 2.6.7. Update capital and operating cost estimates for project.
- 2.6.8. Update Project Facilities Alternatives Technical Memorandum (CDM, October 2003), incorporating changes.

Deliverables:

- Draft and Final Project Facilities Technical Memorandum.

Task 2.7 Project Management

Purpose: Maintain project budget, schedule, and team communication.

Activities:

- 2.7.1. Prepare monthly invoices and status reports.
- 2.7.2. Hold regular phone calls with the District on project status.
- 2.7.3. Coordinate technical activities with environmental consultant Jones and Stokes.
- 2.7.4. Hold progress meetings with the District.
- 2.7.5. Prepare a final presentation to the District or the District Board.

Deliverables: Monthly Status Report, meeting minutes.

Phase 3 – Prepare Project EIR

Phase 3 involves the preparation of the revised draft and final EIR. ICF Jones & Stokes will lead this phase. CDM will provide engineering support to ICF Jones & Stokes.

Task 3.1: Provide Engineering Support for Revised Draft EIR

Purpose: Provide engineering support during preparation of revised draft EIR.

Activities:

- 3.3.1. Address questions and provide additional information to ICF Jones & Stokes, as needed, for project descriptions.
- 3.3.2. Review project description sections of administrative draft and public draft EIR.
- 3.3.3. Address District comments on engineering aspects of administrative draft EIR.
- 3.3.4. Participate in public meetings.

Task 3.2: Provide Engineering Support for Final EIR

Purpose: Provide engineering support during preparation of the final EIR

Activities:

- 3.2.1. Assist in preparation of EIR responses to public comments for questions relating to project facilities.
- 3.2.2. Review project description sections of administrative final and public final EIR.
- 3.2.3. Participate in EIR Certification meeting.

Section 2
Proposed Schedule and Budget

Schedule

Our proposed project schedule for Phase 1 activities is 3 months. The schedule for Phase 2 activities will be dependent upon the specific activities identified. For the field work, a 1 to 2 year program is expected, primarily due to the anticipated complexity of permitting and approvals for the field program. Tasks and durations are shown below, based on an anticipated start date of May 1, 2008.

✓ May 1, 2008	Task 1.1: Kick-off meeting.
✓ May – June 2008	Task 1.2: Data Review Meetings with Agencies, Hydrogeologic data review, conceptual model update, groundwater model evaluation
✓ July 2008	Task 1.3: Constraints Analysis. Well location charrette, constraints analysis
✓ Aug 2008	Task 2.1: Develop Conceptual Project Description
✓ Sep – Oct 2008	Task 2.2: Groundwater Modeling
✓ Oct 2008	Task 2.3: Data Gap Evaluation/Phase 2 Work Plan
✓ Nov 2008	Task 2.4: Summary Report
✓ 2009 – 2010	Phase 2 Field Program*

* It may be possible to accelerate the field program for a smaller project that relies on maximizing use of existing field data and minimizing new field work. This accelerated program would require consensus from technical team experts on the viability of the proposed project alternative and the extent of potential impacts from the project.

The scope and schedule are structured to have ongoing MPWMD staff input and feedback during the Phase 1 and Phase 2 tasks. CDM will work closely with MPWMD to meet the project schedule.

The work will be directed from CDM's Walnut Creek office, with support from CDM's Sacramento office. With a local staff of over 90 people in Walnut Creek, CDM has a large local resource pool to draw upon, as well as access to staff with relevant expertise in our other California offices (Sacramento, Ontario, Carlsbad, Irvine, and Los Angeles). Polly Boissevain, our Project Manager, will commit the resources necessary to complete the project on schedule.

Budget

The table below summarizes the not-to-exceed total budget for Phase 1 and Phase 2 through Task 2.4 of the project, showing the estimated budget for each task. A range of costs is provided for Task 2.5 Field Investigations and Phase 3, for budget estimating purposes only.

In task 2.3, CDM will use the analysis and findings from Phase 1 and early Phase 2 activities to develop a detailed scope and budget for specific Phase 2 field studies and technical evaluations required to further refine the project.

The task budgets include meetings - as described in the Section 1 scope - to obtain comments and feedback from MPWMD staff, discuss requested changes, and review project progress.

A billing rate and expense schedule is also provided. All hourly billing rates shown on the schedule are fully burdened.

The proposed budget is based on the level of effort anticipated for the proposed Phase 1 and early Phase 2 (Tasks 2.1 through 2.4) scope of work

described in Section 1, and our understanding of the available information. As noted above, a range of costs is provided for Phase 2, Task 2.5 and for Phase 3, for budget estimating purposes.

Task	CDM Labor Hours	Expenses	Total Costs [1]
Phase 1 – Conduct Constraints Analysis			
Task 1.1. Initiate Project	16	$500	$4,200
Task 1.2. Review Existing Data			
• Hydrogeologic data review, update conceptual model, investigate drilling technologies	278	$500	$44,200
• Groundwater model review/ recommendations	48	$100	$8,400
• Agency meetings, MRWPCA analysis	116	$300	$16,400
Total Task 1.2	442	900	$69,100
Task 1.3. Conduct Constraints Analysis	160	$1,800	$32,100
Task 1.4. Project Management and Meetings	55	$500	$9,900
Phase 1 Subtotal	**641**	**2,700**	**106,900**
Phase 2 – Develop Detailed Facilities Plan for EIR (Detailed budgets for Phase 2 program will be developed based on Phase 1 activities. An estimated range of costs is provided, below, for budget estimating purposes only			
Task 2.1 Conceptual Project Description	92	$100	$13,100
Task 2.2 Groundwater Modeling			$70,000 [2]
Task 2.3. Identify Data Gaps/Field Studies	96	$200	$14,900
Task 2.4 Prepare Summary Report	196	$3,700	$32,200
Task 2.5 Perform Detailed Hydrogeologic Investigations	$500,000 - $1,500,000		
Task 2.6 Finalize Project Description	$35,000 – $70,000		
Task 2.7 Project Management and Meetings	$35,000 - $70,000		
Phase 2 Subtotal		**$700,000 - $1,770,000**	
Phase 3 – Prepare EIR			
Task 3.1 Prepare Revised Draft EIR	$10,000 – $20,000		
Task 3.2 Prepare Final EIR	$15,000 – $30,000		
Task 3.3 Project Management and Meetings [3]	$12,000		
Phase 3 Subtotal	**$36,000 – $62,000**		
Project Totals (rounded)	**$840,000 - $1,940,000**		

(1) Total burdened cost (rounded) includes labor costs, sub costs, and expenses.

(2) Groundwater modeling needs and budget will be determined in the Task 2 groundwater modeling review. The $70,000 budgeted assumes a new model would need to be developed.

(3) Assumes 6 to 8 month duration.

Section 3
Proposed Team

CDM's team brings together experienced professionals with the necessary expertise for successful completion of the MPWMD 95-10 Project Update.

This project will be managed and performed by CDM Walnut Creek office staff with support from CDM's Sacramento office. Ms. Polly Boissevain, the proposed Project Manager, has led similar water supply planning studies, and is familiar to MPWMD, having managed CDM's work on the Monterey Peninsula Water Supply Project.

The CDM project team was selected for their technical expertise and familiarity with the Monterey Peninsula. Mr. Swann, the Hydrogeologic Investigation task lead brings a diversified background in water resource planning including a wide variety of projects involving groundwater water resources investigations. Mr. Swann and Mr. Heywood are currently working together on groundwater and surface water supply issues in other parts of Northern California. Several members of the technical team worked together on the desalination project facilities planning for the Monterey Peninsula Water Supply Project.

CDM has included three team members to provide technical review for various project aspects. Mr. Craig Von Bargen brings specific experience on the on the Facilities Planning aspects of the project, having served as CDM's Technical Director on the Monterey Peninsula Water Supply Project.

Mr. Martin Feeney and Mr. Derrik Williams will provide technical review of hydrogeologic and groundwater modeling aspects of the project, respectively. Both bring intimate knowledge of the Monterey Peninsula area, having been involved in many technical investigations in the area relating to the Seaside Groundwater Basin.

Table 3-1 on the next page summarizes the experience of each key team member relevant to MPWMD 's project. Resumes (abbreviated version) of the team members are in the Appendix.

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

PROJECT MANAGER

Polly Boissevain, P.E.

TECHNICAL REVIEW

Craig Von Bargen, P.E.
Facilities Planning

Martin Feeney, P.G., C.HG., C.EG.[1]
Hydrogeology

Derrik Williams, P.G., C.HG.[2]
Groundwater Modeling

PROJECT TEAM

Hydrogeologic Investigation

Ben Swann, P.G., C.HG.
Task Leader

Brian Heywood, P.E.
Groundwater Modeling

Robert TerBerg, P.G.
Tom Titus
Hydrogeology/ Field Investigation

Dennis Kesmodel, P.G., C.HG.[3]
HDD Wells/Tunneling

Facilities Planning

Polly Boissevain, P.E.
Task Leader

Doug Brown, P.E.
Water Quality/Treatment

James Kim, P.E.
Engineering Evaluations

Chuck Lindquist, P.E.
Electrical

Youssif Hussein, P.E.
Hydraulic Modeling

[1] Independent Consultant
[2] Hydrometrics
[3] Registered in Tennessee

Table 3-1: Project Team Summary

Individual/Role	Experience Relevant to MPWMD
Polly Boissevain, P.E. 24 years experience Office Location: Walnut Creek *Project Manager, MPWMD Seawater Desalination Project Update*	✓ More than 24 years of professional experience in water resources planning, with extensive experience in distribution system master planning and hydraulic modeling of water and wastewater systems. ✓ Project Manager – MPWMD, Monterey Peninsula Water Supply Project, Phase 1 and Phase 2. ✓ Project Manager – Zone 7 Water Agency, Delta Water Supply Reliability Study. Evaluation of storage alternatives for increasing supply reliability in light of potential Delta water supply regulatory restrictions. ✓ Project Manager – Santa Cruz Water Supply Alternatives Study. Evaluation of several water supply options for City, including desalination, storage reservoirs, groundwater wells. ✓ Project Manager – Cal Water King City District Water Supply and Facilities Master Plan. Development of a supply and distribution system master plan for King City in southern Monterey County. ✓ Engineering Task Lead – CalFed, Bay Area Water Quality and Supply Reliability Study. Oversaw technical development of regional water supply and water quality projects, including new storage reservoirs, desalination, conjunctive use, and conveyance projects. ✓ Engineering Task Lead – U.S. Bureau of Reclamation. Overseeing technical development of alternative projects to increase supply delivery reliability to San Felipe Division and South of Delta contractors.
Craig Von Bargen, P.E. 34 years experience Office Location: Walnut Creek *Technical Review*	✓ Over 34 years of managerial and technical experience in the areas of water resources analysis, master planning and development, water system operation and analysis, facility siting and design, and general civil design. ✓ Project Director, Monterey Peninsula Water Management District Water Supply EIR – Engineering. ✓ Project Director, ABAG/CALFED Bay Area Water Quality and Water Supply Reliability Program. ✓ Project Manager, Regional Water Supply Conveyance Study for the Zone 7 Water Agency. ✓ Project Manager for development of water supply for a 20,000 acre project in the Carmel Valley area. ✓ Project Director/Manager/Engineer on over 30 water master plans.
Martin Feeney, P.G., C.HG., C.EG 25 years experience Office Location: Ventura *Technical Review*	✓ A Professional Geologist and Certified Hydrogeologist in California with more than 25 years experience in groundwater consulting. ✓ Third Party Reviewer – Monterey Peninsula Water Management District's Sand City Desalination Project. ✓ Currently participating in the development of a small desalination project to provide additional water supply for the City of Sand City. ✓ Primary author or co-author of several basin-wide hydrogeologic characterizations of the Seaside Basin.
Derrick Williams, P.G., C.HG. 21 years experience Office Location: Oakland *Technical Review*	✓ A California Professional Geologist and Certified Hydrogeologist with extensive experience managing, reviewing, and assisting on water supply and groundwater recharge projects. ✓ Soquel Creek Water District Conjunctive Use Alternative Assessment. ✓ Basin-wide flow and transport model for the Charnock Sub-Basin in Los Angeles County. ✓ Santa Clara Valley Water District Regional Groundwater Model. ✓ Avila Beach EIR Groundwater Model.

Individual/Role	Experience Relevant to MPWMD
Ben Swann, P.G., C.HG 23 years experience Office Location: Sacramento *Hydrogeological Investigation Task Leader*	✓ Diversified background in water resource planning including wide variety of projects involving groundwater and surface water supplies, treatment, and quality. ✓ Project Director, Butte County Integrated Water Flow Model and Integrated Water Resources Plan for Butte County Department of Water and Resource Conservation. ✓ Project Director, Integrated Surface water and groundwater Model, Northeastern San Joaquin County Groundwater Banking Authority. ✓ Project Manager, Hydrologic investigation - Lake Davis Pike Eradication, California Department of Fish and Game. ✓ Project Manager, Integrated Water Resources Management Plan and Agency Strategic Plan, Solano County Water Agency. ✓ Project Manager, Lake County Groundwater Management Plan, Lake County. ✓ Project Director, Truckee Meadows Remediation Plan and Regional Flow model, Truckee Meadows Remediation District.
Brian Heywood, P.E. 10 years experience Office Location: Sacramento *Groundwater Modeling*	✓ Over 10 years of experience in a wide array of groundwater supply, contamination, and surface water/groundwater interaction projects. ✓ Project Manager/Project Engineer, Integrated Groundwater-Surface Water Modeling, Butte County. ✓ Project Manager/Project Engineer, Conjunctive Use Project, San Joaquin County. ✓ Project Engineer, Saltwater intrusion modeling for marina development/excavation study, Coast of Oahu, HI. ✓ Project Engineer, Groundwater modeling for regional groundwater basin study, Reno, NV. ✓ Project Engineer, Groundwater modeling and integration/automation with GIS for 1,300 wells in source water contributing areas assessment, Long Island, NY. ✓ Groundwater Specialist, CA Department of Water Resources Environmental Water Account, groundwater resources sections of EIR. ✓ Project Engineer, Groundwater modeling at petroleum terminals to support remedial investigations, multiple locations in Southern CA and NV. ✓ Project Engineer, Groundwater modeling for salt contamination remedial investigation, Valparaiso, IN.
Doug Brown, P.E. 25 years experience Office Location: Denver *Water Quality & Water Treatment*	✓ Over 25 years of experience designing treatment plants and the associated infrastructure using a wide variety of technologies including large microfiltration systems, conventional coagulation and filtration, reverse osmosis, activated carbon filters, and advance oxidation. ✓ Construction management experience on several treatment plants using design-build and fast-track construction techniques. ✓ Project Manager, Alameda County Water District Desalination Project. ✓ Project Manager, City of Folsom and San Francisco's San Andreas WTP Expansions.
Youssif Hussein, P.E. 20 years experience Office Location: Walnut Creek *Hydraulic Modeling, GIS*	✓ Over 20 years of specialized experience in modeling for water distribution systems, wastewater and stormwater collection sewer system, and hydrology. ✓ Task Leader for hydraulic modeling for Cal Water's Water Supply & Facilities Master Plan for South San Francisco, Mid-Peninsula, Bear Gulch, and Selma Districts. ✓ Expert in hydraulic model development and calibration, including interface with GIS tools. ✓ Hydraulic modeling for Water Master Plans for EBMUD, Livermore, Benicia, Mountain View, Rio Linda, Klamath Falls, Calleguas Municipal Water District. ✓ Provided hydraulic modeling support to CCWD for Treated Water Master Plan Update, Ayer Reservoir Evaluation, Elderwood Pump Station Rehabilitation, and other projects. ✓ Hydraulic modeling for over a dozen agencies, many using H2ONet and other models. ✓ Conducted model training for clients on many projects using hands-on approach with real-life examples.
James Kim, P.E. 5 years experience Office Location: Walnut Creek *Engineering Evaluations*	✓ Over 5 years of experience modeling hydraulic water distribution systems, performing hydraulic surge evaluations, preparing facilities master plans, preparing phase I environmental site assessments, and civil, mechanical and structural design. ✓ Design Engineer, Preliminary Design of Well Water Conveyance System, Knightsen, California. ✓ Design Engineer. Hydraulic Surge Evaluations for various projects.

Individual/Role	Experience Relevant to MPWMD
Chuck Lindquist, P.E. 35 years experience Office Location: Walnut Creek *Electrical*	✓ Over 35 years of experience in the planning, design, construction and startup phases as well as value engineering of the electrical and instrumentation systems of water and wastewater treatment facilities. ✓ Senior Electrical Engineer, City of Fernley, NV Water Treatment Plant. ✓ Project Electrical and Instrumentation for the Contra Costa Water District's new City of Brentwood Water Treatment Plant. ✓ Project electrical and instrumentation engineer for the design of major improvements to 100 and 80 mgd water treatment plants owned by the Santa Clara Valley Water District.
Tom Titus 10 years experience Office Location: Sacramento *Hydrogeology/Field Investigations*	✓ Over 10 years of professional experience in water supply with primary areas of expertise including well drilling, design, construction, and development; aquifer pump test design and interpretation; soil and groundwater collection and evaluation; and permitting. ✓ Task Manager, East Valley Water District, Highland, CA. Supervised several geologists and coordinated all drilling, construction, development and testing activities for a deep water production well. (this would replace last bullet point) ✓ Task Manager, Conjunctive Use Groundwater Storage Project, Orange County, CA. Supervised several geologist and the drilling, construction, development, and testing of eight deep water production wells (this would replace first bullet point) ✓ Task Manager, Loma Linda, CA. Supervised drilling, construction, development, and testing of three deep water production wells. ✓ Task Manager, Yorba Linda Water District, Loma Linda, CA. Supervised well field analysis which included testing several wells; evaluating specific capacities and interference effects; and determining sustainable well field production rates. ✓ Site Geologist, Groundwater Replenishment System, Orange County, CA. Supervised drilling, construction, development, and testing of several groundwater injection wells. ✓ Site Geologist, Monte Vista Water District, Montclair, CA. Supervised drilling, construction, development, and testing of production well.
Robert TerBerg, P.G. 15 years experience Office Location: Walnut Creek *Hydrogeology/Field Investigations*	✓ An environmental geologist with over 15 years of experience in geological characterization, infiltration monitoring and modeling, water supply development and testing, and well hydraulics. ✓ Project Geologist, Municipal Redevelopment Evaluation, for the City of Brisbane. ✓ Project Geologist, Municipal Water Supply Alternative Analysis, for the City of Salinas. ✓ Senior Staff Hydrogeologist, Characterization of Water Supply Contamination, for the City of Santa Monica.
Dennis Kesmodel, P.G., C. HG 10 years experience Office Location: Sacramento *HDD Wells/Tunneling*	✓ Over 10 years experience specializing in geotechnical engineering and engineering geology and tunneling, and has extensive experience in subsurface exploration and mapping. ✓ Tunnel Geologist, Mather Interceptor, Sacramento. ✓ Engineering Geologist, New York Harbor Siphon Tunnel, New York. ✓ Engineering Geologist for the preliminary design of 10 miles of 25 to 30 ft inside diameter combined sewer overflow tunnels in Washington, D.C.

Staff Availability

The work for the MPWMD 95-10 Project Update will be performed from CDM's Walnut Creek office with support from the CDM Sacramento office.

The table at right shows the availability of project staff.

Team Member	% Available
Polly Boissevain	25%
Craig Von Bargen	10%
Martin Feeney	10%
Derrik Williams	10%
Ben Swann	30%
Brian Heywood	35%
Doug Brown	15%
Youssif Hussein	15%
James Kim	40%
Chuck Lindquist	15%
Tom Titus	30%
Robert Terberg	30%
Dennis Kesmodel	10%

Section 4
Firm Qualifications

About CDM

CDM is a full-service consulting, engineering, construction, and operations firm helping public and private clients improve the environment and infrastructure. CDM provides services in water management; environmental management; transportation; construction, design/build and operations; information management and technology; institutional management consulting; facilities design and geotechnical engineering.

Founded in 1947, CDM is an employee-owned corporation with a multi-disciplinary staff of 4,000 worldwide. By listening carefully to each client's unique concerns – technical, financial, regulatory, community, construction, and operational – we deliver the right total solution for each client's needs. We offer expertise and flexibility, from initial concept through design, construction, commissioning, and operations.

Headquartered in Cambridge, Massachusetts, CDM operates from over 100 offices in the U.S. and abroad. Our state-of-the-art communications network allows each local office to draw quickly upon the expertise of CDM staff worldwide.

CDM's Western Region consists of over 300 professionals covering over 30 engineering and scientist disciplines. CDM's Walnut Creek office is one of the company's five design centers nationwide.

CDM's experience in water resources planning spans the areas of greatest relevance for MPWMD's 95-10 Project Update:

1. Understanding the relevant building blocks: groundwater development and desalination treatment. At both the broad planning level of developing water supply alternatives and at the detailed level of designing and constructing water supply facilities, the proposed CDM team brings a depth of experience.
2. Synthesis of information from a diverse array of disciplines.
3. Sound knowledge of engineering costs: working on projects from inception through construction provides CDM the ability to accurately forecast costs.

CDM Highlights

- 50 years of environmental consulting
- Over 100 offices in the U.S. and abroad
- 4,000 employees worldwide
- Full-service environmental and infrastructure firm
- Ranked 6th in Top 20 Design Firms in Water by ENR in 2007

Our selection of relevant projects highlights our team's experience in water supply planning, groundwater evaluations, and desalination planning and design.

Relevant Project Descriptions

Engineering Support for Monterey Peninsula Water Supply Project Environmental Impact Report

Client: Monterey Peninsula Water Management District (MPWMD)

Relevance to MPWMD Project

- Technical evaluations are basis for current water supply project.
- Facilities planning in support of environmental analysis.

CDM Team Members:

Polly Boissevain, Craig Von Bargen, Martin Feeney, Doug Brown, Chuck Lindquist, Youssif Hussein

The Monterey Peninsula Water Management District (District) is responsible for managing the water resources for the Monterey Peninsula along the California central coast. The service area, with a population of approximately 100,000, has a water supply that is a mix of local surface and groundwater from the nearby Carmel River and Seaside groundwater basin. The Carmel River has been a focal point for years, with regulatory mandates to reduce pumping from the alluvial aquifer, especially during summer low flow periods. Regulatory agencies have focused on water rights issues and natural resources protection along the river. The District contracted with Jones & Stokes to prepare an Environmental Impact Report (EIR) to evaluate water supply alternatives that reduce Carmel River summertime use. New water supply projects must collectively yield between 8,000 and 12,000 acre-feet/year. CDM supported Jones & Stokes in the EIR effort, providing engineering support to formulate alternatives that were evaluated in the EIR.

In the initial project phase, CDM developed technical information for the following water supply projects:

- Conjunctive use projects that would divert Carmel River water during winter-time high flow periods for storage in local groundwater or surface water storage reservoirs for subsequent recovery during peak summer-time demand periods.
- Reverse osmosis desalination of seawater.
- Wastewater reclamation through the expansion of existing and planned projects by local community wastewater and water agencies.
- Stormwater re-use projects, focusing on customer incentive programs for individual on-site stormwater collection and use.

CDM's engineering support included defining the range of potential supply yields for each of the water supply options that will make up the alternatives; identifying specific types, locations and sizes of facilities required for each of the alternatives; and developing feasibility level capital costs for alternatives. Based on a number of factors, desalination of seawater was selected as the preferred alternative that was evaluated in the EIR. The desalination alternative selected included use of beach wells for collection of seawater and brine disposal.

In parallel with the EIR evaluation, CDM conducted an extensive hydrogeologic field investigation to better define seashore aquifer characteristics and evaluate the feasibility of different seawater collector wells to meet project needs. Investigation methods include on-shore and off-shore geophysical surveys, coupled with on-shore borings, to define hydrogeologic conditions. Results of the investigation wereused to refine project facility requirements and yields. Results will also prove invaluable to the general understanding of the near on-shore and off-shore hydrogeology of the Monterey Bay area.

San Francisco Bay Area Water Quality and Supply Reliability Program

Client: Association of Bay Area Governments and Bay Delta Authority

CDM worked with seven major San Francisco Bay Area water agencies (San Francisco, Santa Clara Valley Water District, Bay Area Water User Association, Alameda County Water District, Alameda County Flood Control and Water Conservation District – Zone 7, East Bay Municipal Utility District, and the Contra Costa Water District) to develop regional water supply reliability and water quality improvement projects.

Relevance to MPWMD Project

- Facilitated planning for water system quality and reliability improvements.
- Established water system objectives that benefited multiple stakeholders.
- Evaluated large surface water, groundwater, reclamation, and desalination projects.

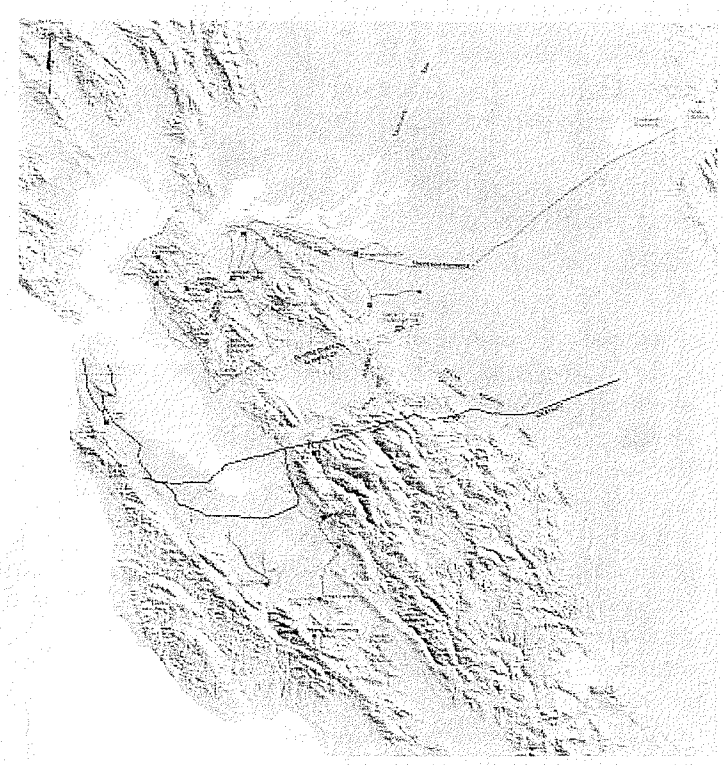
CDM Team Members:

Polly Boissevain, Craig Von Bargen

Under the auspices of the Bay Delta Authority this program identified potential groundwater storage/conjunctive use, surface water storage, reclamation, conservation, water recycling, desalination, and re-operation concepts to improve both the water supply reliability and water quality of these seven agencies.

CDM worked closely with the agencies and the environmental community to identify the objectives and performance measures to evaluate the alternatives. Groups of individual concepts (portfolios) were developed to provide benefits throughout the entire region. These portfolios were evaluated based on the objectives and performance measures and to develop a preferred group of 4 to 6 portfolios to be carried forward for more detailed engineering and environmental analysis.

CDM facilitated this process and developing the analytical tools to allow evaluation of multiple faceted and complex combinations of portfolios.



CDM facilitated the evaluation of region-wide water supply alternatives for the Bay Area.

Integrated Groundwater-Surface Water Modeling

Client: Butte County Department of Water and Resource Conservation

The Butte County Department of Water and Resource Conservation initiated a program that will result in the integrated management of water resources to meet the current and future needs of agricultural, municipal and industrial users, the environment in Butte County and will support regional water management in the Sacramento Valley.

As part of this program CDM completed a review and update of an integrated groundwater-surface water model using the Department of Water Resources IWFM code. The model is being used to support the county's management of water resources particularly in the area of assessing out-of-basin transfers.

For the first phase of work, CDM's scope included reviewing the proposed application of the model, assessing the compatibility of the modeling code (particularly its ability to simulate groundwater-surface water interaction, surface water diversions, irrigation and agricultural pumping) and updating the model to reflect the latest available hydrogeologic, hydrologic, and land use data.

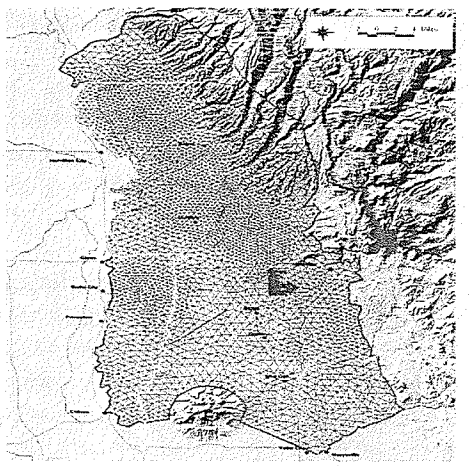
Phase II of the project involved calibration of the updated model and development of a base-case and drought and transfer scenarios to evaluate water management alternatives.

Relevance to MPWMD Project

- Developed groundwater model to predict future water management needs
- Compile extensive data on groundwater on complex groundwater flow system

CDM Team Members:

Ben Swann, Brian Heywood

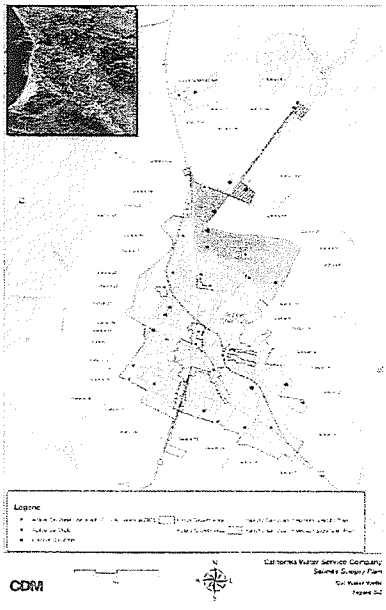


CDM compiled a complex groundwater data set and developed the Butte County integrated surface water and groundwater flow modle.

Feasibility Study for a Long-term Water Supply Plan for the Salinas District

Client: California Water Service Company (Cal Water)

This feasibility study is providing a rigorous analysis of water supply alternatives in order to meet the challenge of future supply shortages in the Salinas District. Our streamlined and iterative approach is working towards developing alternatives for water supply. Tools developed by CDM are being used to address various risk scenarios and to identify areas where further information can improve the quality of decision-making. Key issues being addressed are: identifying risk factors and characterizing their water supply consequences as an important first step in development of a long-term water supply plan; careful examination of the cost equation for different alternatives; coordination with regional efforts in which Cal Water can participate; and groundwater yield and impacts.



CDM is working with Cal Water to develop a cost-effective, defensible long-term water supply portfolio to meet Salinas' needs.

Relevance to MPWMD Project

- Facilitated planning for water supply to agricultural, municipal, and residential water users
- Study of groundwater water withdrawal as part of meeting water demand

CDM Team Members:

Polly Boissevain, Robert TerBerg, Brian Heywood

Integrated Water Resources Management Plan

Client: San Joaquin County

CDM developed an Integrated Water Resources Management Plan for San Joaquin County. One of California's largest agricultural producers, the County, like other parts of the State, has experienced record population growth. Furthermore, the County is home to a large portion of the Bay-Delta that is an over-allocated source of drinking water, irrigation, and environmental water. Extensive groundwater extraction from the Eastern County was contributing to saline intrusion from the Bay-Delta..

Relevance to MPWMD Project

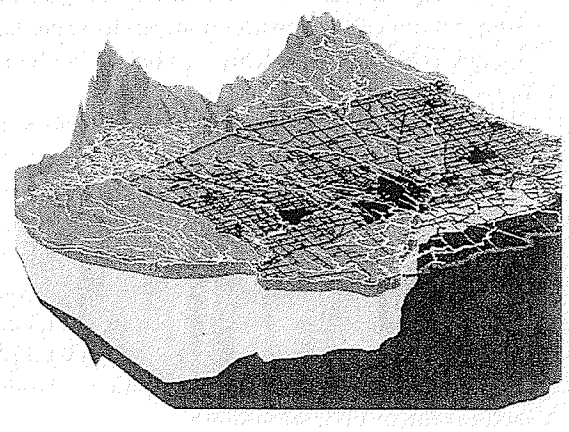
- Evaluated complex hydrogeologic data set.
- Developed surface water/groundwater model to project future water needs and track migration of saline groundwater intrusion.

CDM Team Members:

Ben Swann, Brian Heywood

The Water Resources Management Plan was undertaken to develop a comprehensive, stakeholder-driven approach to address these water resource issues. Major elements of the Plan were year 2030 agricultural and urban water demand projections and development of an integrated surface water/groundwater model using the DYN code. The model has been used to simulate the affects of water management programs in retarding saline groundwater intrusion and used extensive field data collected by the USGS on the presence and movement of the saline groundwater front.

The Water Resources Management Plan received broad acceptance by more than 20 County water agencies and districts, and has been adopted by the County as the tool to steer the future of water policy and project development in San Joaquin County to meet future water needs. The project was selected by the San Joaquin County Council of Governments for the Judges Award for Regional Excellence in Planning.



Land and water data was used to create an interactive surface water/groundwater model.

Semitropic Phase II Groundwater Banking Project Special Study

Client: U.S. Bureau of Reclamation, Mid-Pacific Region

CDM was tasked by the Bureau of Reclamation to complete a Special Study Report for the Semitropic Phase II Groundwater Banking Project. The purpose of the study was to determine if a potential Federal interest exists in participating in the Stored Water Recovery Unit (SWRU). The project synthesis a large amount of available information on the groundwater bank and included a comprehensive economic analysis of banking operations.

Semitropic is one of eight water storage districts in California and is the largest in Kern County. They sought Reclamation's participation in the SWRU to help meet its objectives of improving surface water availability and groundwater reliability to support agriculture production, environmental protection, and the longevity of the underlying aquifer within Semitropic.

Relevance to MPWMD Project

- Planning process development to assess technical and cost-effectiveness of a complex water program.
- Extensive review of groundwater banking technologies.
- Economic analysis of groundwater and costing of Federal Water Resources Planning.

CDM Team Members:

Ben Swann

Reclamation's planning objectives for potential participation in the SWRU included the storage of Central Valley Project (CVP) water to increase operational reliability and flexibility. CDM developed a process to formulate alternative ways for Reclamation to participate in the SWRU to achieve its planning objectives and complies with the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&Gs). The first step was to specify planning objectives as the basis to determine the Federal interest. Alternative management measures were then identified to address problems, take advantage of opportunities, and achieve the planning objectives. The management measures were then evaluated to determine how well each measure achieves the Federal planning criteria: completeness, effectiveness, efficiency, and acceptability. Lastly, a scenario of the management measures was developed and evaluated to determine the type and extent of Federal interest.

CDM reviewed extensive technical information pertaining to groundwater use, potential injection and extraction technologies, a review of the FEMFLOW3D model developed for the bank, and policies and ordinances governing groundwater storage and banking. This data was collected to prepare a detailed economic analysis of banking operations and assess risks due to program uncertainties.

Groundwater Replenishment System

Client: Orange County Water District (OCWD) and the Orange County Sanitation District (OCSD)

The Orange County Water District (OCWD) and the Orange County Sanitation District (OCSD), which serve approximately 2 million customers in Orange County, has implemented a Groundwater Replenishment System (GWR System) project that will help solve many of the region's most critical water resource issues: providing a long-term, locally controlled potable and reclaimed water supply; protecting the Orange County Groundwater Basin from further degradation due to seawater intrusion; and providing a means of reducing the amount of treated wastewater that is discharged to the Pacific Ocean, thereby delaying or eliminating the need for a second outfall.

Relevance to MPWMD Project

- Extensive groundwater data collection, modeling pilot testing effort.
- Extensive facilities planning on a regionally controversial project.
- Saltwater intrusion analysis.

CDM Team Members:

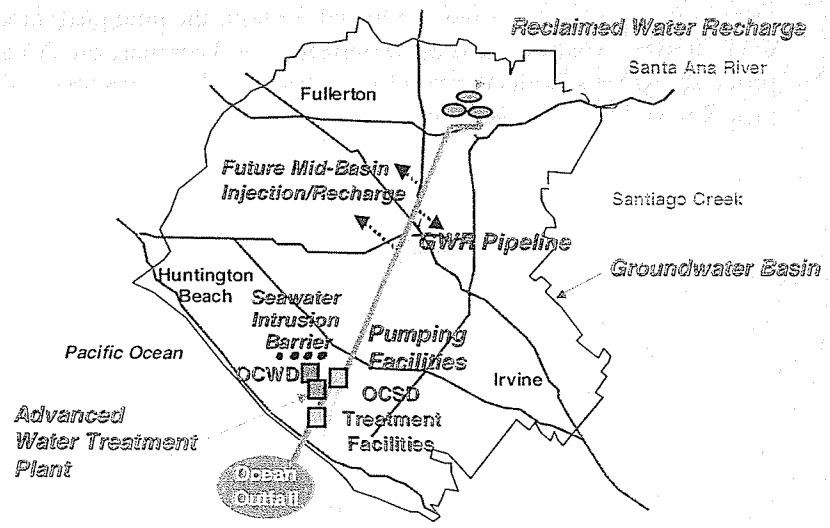
Brian Heywood, Tom Titus

CDM was awarded a contract by OCWD to lead the project development phase, final design, bidding, construction, and operations and maintenance services of a world-class groundwater replenishment system project—the largest indirect potable reuse wastewater reclamation project in the world.

The GWR System will reclaim and recycle up to 70 million gallons per day (mgd) of secondary effluent from OCSD's Plant No. 1. The secondary effluent will undergo three additional levels of treatment, including microfiltration (MF), 100-percent reverse osmosis (RO) treatment, and ultraviolet (UV) disinfection. The highly treated water will be used to prevent seawater intrusion through a series of strategically placed injection wells and will be distributed to basins to recharge the groundwater supply with near-distilled water quality—the highest quality water available for recharge. Over time, the water quality in the groundwater basin will be significantly improved.

Project components designed by CDM include the 70-mgd output (expandable to 130 mgd) MF/RO/UV treatment facility, three project water pumping stations, a 13-mile 60- to 78-inch-diameter GWR pipeline to transport the water to the recharge basins, 16 injection wells on eight sites to expand the existing seawater intrusion barrier, and approximately 3 miles of barrier pipeline.

Groundwater modeling was performed by CDM to determine the optimum locations of the wells. In addition, CDM supported the agencies with presentations at Board Meetings, public meetings, meeting with groundwater pumpers, meetings with the Independent Advisory Committee, and meetings with regulatory agencies throughout the project. Seven major construction contracts were prepared on budget and on schedule with two contracts successfully completed and five currently underway, with completion scheduled for the Fall of 2007.



Santa Cruz Seawater Reverse Osmosis Desalination Pilot Test Program

Client: Santa Cruz Water Department

As part of its Integrated Water Plan (IWP), the City of Santa Cruz seeks to build a 2.5-MGD (expandable to 4.5-MGD) ocean water desalination plant using RO to supplement existing regional water supplies as well as supply drought year needs. Prior to design initiation of the full-scale facility, CDM is conducting a pilot testing program to evaluate various pretreatment processes, establish optimal design and operating parameters for full-scale facility, and potentially test various technology innovations. The pilot plant will be operated for 12 consecutive months and be tested over a range of operating conditions and water quality parameters for the most effective treatment process in terms of treated water quality, operational reliability and cost. The pilot test is partially funded by a Proposition 50 grant.

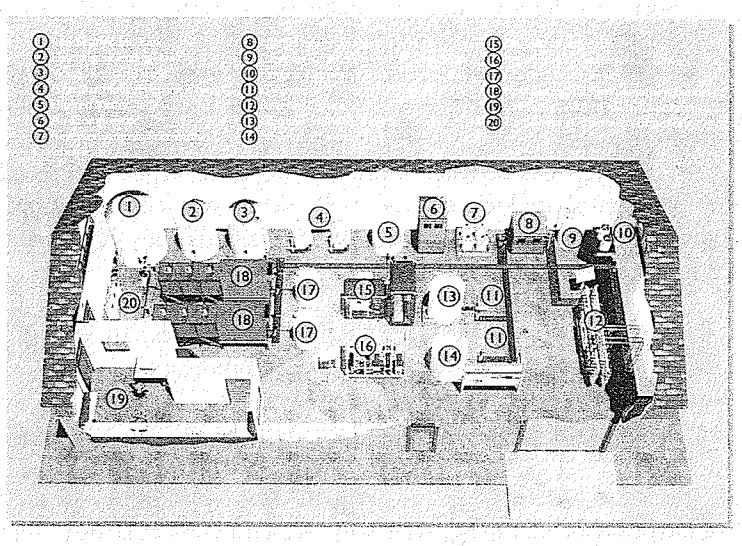
Relevance to MPWMD Project

- Seawater desalination in the Monterey Bay area
- Treatment evaluations will provide input to conceptual designs for MPWMD 95-10 Project.

CDM Team Members:

Polly Boissevain – coordinating role with Santa Cruz design team, located in same office.

CDM is designing, procuring, installing and operating various components of the treatment processes to be investigated and tested. We are optimizing the design and operating conditions of two RO pretreatment process using conventional filtration and MF/UV. The project will complete process and risk evaluation of all pilot treatment systems tested and, using the life-cycle cost analysis, established the most cost-effective and reliable treatment process train. CDM is evaluating toxins and emerging contaminants that have been described as key challenges for seawater desalination. CDM is conducting a number of tests on the impact of algal toxins, algal by-products, and other contaminants on resulting water quality from RO treatment processes.



CDM is conducting raw water quality characterization and jar tests, as required, to design and operate the facility. Sampling and testing is being conducted for both the pilot plant intake location and proposed full-scale plant intake location for raw water characterization and comparison. After developing preliminary design of the pilot processes CDM will meet with subcontractors and manufacturers to confirm design, delivery and installation program, and terms of contract.

Design/Build of Seawater Desalination Facility

Client: City of Sand City

With a population of only a few hundred people, the town of Sand City swells to almost 40,000 when people flock to the quaint, central coast city in the summer to shop and visit. Growth is projected in both new and redevelopment areas to meet future population demands and continue the City's prosperity.

Relevance to MPWMD Project

- Design/construction data from this project will provide relevant design and cost information for conceptual designs for MPWMD 95-10 project

CDM Team Members:

Polly Boissevain – coordinating role with project design/construction team, located in same office.

Sand City has initiated a 0.6 mgd design/build project that will facilitate the treatment of seawater drawn from beach wells to domestic water standards including a fully-operational water treatment facility and required permits. Sand City selected CDM to provide design/build services for this project. The proposed project will augment existing water supplies as the City grows and redevelops, and must meet the City's timeframe for completion.

A key aspect of this project has been permitting for the first full-scale seawater desalination plant in California permitted under the new surface water treatment regulations. The plant draws its source water from beach wells, returning waste concentrate to subsurface discharge wells. The treatment facility will include UV disinfection plus reverse osmosis to provide disinfection credits in keeping with the newly enacted Long Term 2 Enhanced Surface Water Treatment Rule. Product water stabilization will be provided through calcite contactors, caustic soda, and blending with existing water from the California-American water distribution system.

Polly Boissevain, P.E.

Project Manager

Education

M.S. - Civil Engineering, Cornell University, 1987

B.S. - Civil Engineering, Stanford University, 1980

Registration

Professional Engineer: California (1983), and Oregon

Ms. Boissevain has more than 24 years of professional experience in water resources planning, with extensive experience in distribution system master planning and hydraulic modeling of water and wastewater systems. She has served as project engineer and project manager for a variety of projects in support of planning, design, and operations evaluations. Ms. Boissevain has directed numerous distribution system studies for a wide variety of water systems in California.

Project Manager, Monterey Peninsula Water Supply Project, Monterey Peninsula Water Management District, Monterey, CA. The Monterey Peninsula is seeking up to 11,000 acre-feet/year of new supply to replace groundwater pumped from the Carmel River alluvial groundwater basin that the State Water Resources Control Board has determined to be a surface diversion without a valid water right. Ms. Boissevain directed an evaluation to assess local water supply options, including aquifer storage and recovery and desalination using beach wells for seawater collection and brine disposal. CDM provided detailed planning evaluations to identify required facilities, pipeline alignment alternatives, and planning-level costs for new water supply facilities. CDM is currently providing technical support to an environmental consultant for preparation of an environmental impact report for the project.

Project Engineer, Bay Area Regional Water Quality and Supply Reliability Study, Association of Bay Area Governments, Oakland, CA, and California Bay Delta Authority, Sacramento, CA. CDM worked with seven major San Francisco Bay Area water agencies (San Francisco, Santa Clara Valley Water District, Bay Area Water User Association, Alameda County Water District, Alameda County Flood Control and Water Conservation District – Zone 7, East Bay Municipal Utility District, and the Contra Costa Water District) to develop regional water supply reliability and water quality improvement projects.

Under the auspices of the Bay Delta Authority this program identified potential groundwater storage/conjunctive use, surface water storage, reclamation, conservation, water recycling, desalination, and re-operation concepts to improve both the water supply reliability and water quality of these seven agencies, evaluated alternatives and formulated sample water supply portfolios.

As Project Engineer, Ms. Boissevain was responsible for technical direction of the consulting team.

Project Manager, Delta Supply Reliability Study, Zone 7 Water Agency, Livermore, CA. Ms. Boissevain is managing a project to evaluate supply reliability implications of recent Delta environmental rulings that impact Delta water supply, evaluate potential water supply projects that would increase the Agency's supply reliability, and develop a recommended supply reliability strategy for the Agency.

Project Engineer, Water Supply Alternatives Study, City of Santa Cruz, Santa Cruz, CA. Ms. Boissevain served as project engineer for a study to investigate water supply alternatives for the City of Santa Cruz. The project involved a systematic screening of several water supply alternatives including surface water, groundwater, desalination, and wastewater reclamation projects. Her responsibilities included overseeing technical activities of the project staff, presenting findings to the client's advisory committee overseeing the study, and coordinating with subconsultants to incorporate geotechnical and environmental analyses into the study.

Task Leader, Portland Distribution System Master Plan, Portland, OR. CDM is developing a comprehensive distribution system master plan for the city that includes establishing service goals and planning performance criteria, evaluating the hydraulics of the backbone transmission system that conveys water to various areas within the City, and performing a condition assessment of the key distribution system pump stations and tanks. Ms. Boissevain is overseeing the hydraulic evaluation of the backbone system, identifying improvements for the City to meet distribution system needs through 2030.

Project Manager, Water Master Plan Update, City of Pleasanton, Pleasanton, CA. Ms. Boissevain managed a project to update the city's water master plan. Since the last master plan update, the city has implemented a geographic information system (GIS). The analysis used GIS-based tools to develop a new hydraulic model of the city's distribution system, and allocate customer demands to the model using customer billing information. The system evaluation included hydraulic and water quality assessment of the distribution system to assess current performance and identify required improvements, development of a capital improvement program, and updating the city's connection fees for new development. Ms. Boissevain was responsible for managing technical and financial aspects of the project.

Project Manager, Water Supply and Facilities Master Plan, King City District, California Water Service Company, San Jose, CA. Ms. Boissevain is managing this project, which will evaluate supply options, project demands and develop a staged facility plan for this rapidly growing community in the upper Salinas Valley in the Central California coastal area.

Craig Von Bargen, P.E.

Vice President/Technical Review

Education

M.E. - Engineering, Harvey Mudd College, 1974

B.S. - Engineering and Economics, Harvey Mudd College, 1973

Registration

Professional Civil Engineer: California (1977) and Arizona (1984)

Professional Control System Engineer: California (1980)

Mr. Von Bargen has 34 years of managerial and technical experience in the areas of energy analysis, water resources analysis, master planning and development, water system operation and analysis, facility siting and design, hazardous waste investigations, and general civil design.

Project Director, Monterey Peninsula Water Management District Water Supply EIR – Engineering. CDM as the engineering subconsultant is evaluating a series of water supply alternatives including river diversions, surface and groundwater storage, reclamation, and desalination of seawater. A key aspect of the desalination alternatives that range in capacity from 4 to 10 mgd is extraction and disposal of the brine. Options including beach well extraction and disposal, as well as the use of existing sanitary system and power plant intakes and outfalls are being evaluated. These issues are extremely sensitive as the extraction and disposal will occur in the Marine Sanctuary.

Project Director, ABAG/CALFED Bay Area Water Quality and Water Supply Reliability Program. Mr. Von Bargen was the project director for this regional water supply and water supply project assessing regional projects for seven bay area water agencies. These alternatives include new storage, treatment and interconnection projects for these agencies, including the evaluation of regional and local desalination projects, with combined projects ranging from $650 million to $1.4 billion.

Project Manager, Regional Water Supply Conveyance Study. Mr. Von Bargen recently managed the conveyance study evaluation for the Zone 7 Water Agency. This evaluation extends work performed by CDM in developing the Treated Water Facilities Master Plan for Zone 7, and integrates this work with several other planning efforts. This evaluation includes analyzing the Department of Water Resources (DWR) South Bay Aqueduct (SBA), operating the Lake Del Valle Reservoir and the main groundwater basin under conjunctive use, and aquifer storage and recovery (ASR) operations. The results of this study will be the near- and long-term recommendations for the operation of Lake Del Valle, and possible purchase of the Future Contractor Share of the SBA, required facilities and operation of the groundwater basin, and sizing for the transmission and treatment facilities required to meet the 100,000 af annual demands of the agency. This also includes evaluating the water transfer and storage agreements with Berenda Mesa and Semitropic Water Districts.

Project Manager, Treated Water Facilities Master Plan. Mr. Von Bargen managed the integration phase of the recently completed Treated Water Facilities Master Plan for the Zone 7 Water Agency. This plan looked at expanding the existing water treatment plants and constructing a new 24- to

40-mgd water treatment plant. The evaluation also looked at the operation of DWR's South Bay Aqueduct and the Zone 7 transmission system.

Project Manager, ASR Water Master Plan Project. He served as project manager for a water master plan for Calleguas Municipal Water District. This master plan included evaluating groundwater and surface water facilities, including the proposed ASR operation of their 200,000 af of groundwater storage, major transmission, and storage facilities. Optimization tools were used to determine optional facility sizing to minimize energy costs, and maximize hydroelectric generation. Recommendations developed during the master planning process included: over 20 miles of 48- to 72-inch in diameter pipelines; new 100-mgd pumping facilities; expansion of an existing 50-mgd pumping facility to 100 mgd, two hydroelectric units, and two 5 mg reservoirs. During the CDM design effort for these projects, Mr. Von Bargen is responsible for providing technical oversight and operational evaluations.

Project Manager, Surface/Groundwater Supply Development. Mr. Von Bargen was the project manager for development of water supply for a 20,000 acre project in the Carmel Valley area. This project included evaluating surface and groundwater supply potential, long term meteorologic and stream flow measurements, and detailed groundwater investigations. Water rights were developed for portions of the existing surface water supply, and a long-term groundwater program implemented. In addition, the project includes the collection, treatment and reuse of wastewater for irrigation.

Project Manager, Water Master Plans. Mr. Von Bargen has been the project manager/project engineer on several planning projects that included a water master plan study for the Dublin-San Ramon Services District and a water supply/demand study for the Alameda County Water District; water system distribution analysis in Northeast Vallejo, and for the Monte Vista Water District; a Master Water Plan study for Scotts Valley Water District, the City of Pleasanton, and a major development in Livermore, and water analysis studies for Lompoc, California, Glendale, Scottsdale, and Peoria, Arizona and a portion of the City of Austin, Texas; design of water pump stations, reservoirs, and pipelines for Contra Costa Water District and the City of Pleasanton; and a Master Water Plan Update for the City of San Bernardino. Several of these master plans included evaluation of water and energy conservation, and the development of optimal system operation for energy cost minimization. Mr. Von Bargen also designed the Hayward Marsh Expansion; this project included analysis of the hydraulics of the EBDA system, design of the turnout and associated piping and valving to the expansion, and hydraulic design of the marsh basins.

MARTIN B. FEENEY, PG, CEG, CHg
Hydrogeologist

Martin Feeney is a Professional Geologist and Certified Hydrogeologist in California with more than 25 years experience in ground water consulting. Mr. Feeney was a founding Principal of Staal, Gardner and Dunne, Inc. (later became Fugro West, Inc.) and managed this firm's Monterey County office for 9 years. Mr. Feeney later was a member of the firm, Balance Hydrologics, Inc. Mr. Feeney is currently a private consultant. Mr. Feeney's experience in ground water supply issues includes well siting and design, preparation of project specifications and contractor supervision, well maintenance and repair, water treatment, ground water modeling (both flow and solute-transport), perennial yield analysis, water quality assessments, regulatory compliance and ground water modeling. Mr. Feeney has approximately 23 years of experience in Monterey County ground water resource issues. Mr. Feeney's local experience in ground water resources is extensive and dates back to 1983 with the base-wide Fort Ord hydrogeologic investigation performed for the Army Corps of Engineers. Since that time, he has performed a number of studies in the Seaside Ground Water Basin and the Salinas Valley Basin for both public and private clients.

REGISTRATION

Certified Hydrogeologist, California, 1995
Certified Ground Water Professional, NGWA, 1994
Certified Engineering Geologist, California, 1989
Professional Geologist, California, 1989

EDUCATION

M.A., Environmental Planning (Ground Water), California State University, 1987
Graduate Program, Water Science, University of California, Davis, 1981-1982
B.S., Earth Science (Geology), University of California, Santa Cruz, 1976

EMPLOYMENT

CONSULTING HYDROGEOLOGIST 1997 - Present Provides hydrogeologic consulting services to water agencies, private industry, and engineering firms.

BALANCE HYDROLOGICS, INC. 1996-1997, Supervising Hydrogeologist Hydrogeologic analysis of ground water basins; development of ground water flow and transport models; development of saline ground water sources for desalination plants; and injection wells/artificial recharge programs.

FUGRO WEST, INC. 1992-1996, Supervising Hydrogeologist, Principal-in-Charge, Monterey Branch Office Same duties as below. Supervised two to five staff members, depending on workload.

STAAL, GARDNER & DUNNE, INC. (SGD) 1985-1992, Senior Hydrogeologist/Vice President A founding principal of the firm in 1985. Participated in ground water resource evaluations; the development of ground water models; municipal water well feasibility studies, design, and construction management; hazardous waste sites and underground storage tanks; water quality assessments; landfill siting studies. Co-founded Monterey office in 1987. In 1992, SGD became a member of the Fugro group of companies.

GEOTECHNICAL CONSULTANTS, INC. 1983-1985, Staff Geologist Performed geotechnical investigations for major engineering works including dams, oil processing facilities, pipelines, and water reclamation facilities.

M.I.T. DEPT. OF EARTH & PLANETARY SCIENCE 1979-1980, Field Geologist

BORST & GIDDENS, INC. 1977-1978, Petroleum Well-Site Geologist

MEMBERSHIPS

Association of Ground Water Scientists and Engineers
Groundwater Resources Association of California

RELEVANT PROJECTS

Third Party Reviewer – Monterey Peninsula Water Management District's Sand City Desalination Project. Mr. Feeney is currently providing technical review for the work being done by the MPWMD consultant's for the proposed Sand City desalination project.

Marina Coast Water District - Brine Injection Well Mr. Feeney is responsible for an innovative design for the disposal of desalination brine for the 0.3 MGD desalination plant recently constructed in Marina California. Mr. Feeney advanced the idea that the brine could be injected through a well into the near-shore subsurface environment without having adverse effects. Mr. Feeney developed a solute transport ground water model that simulated the effects of disposal, assisted in the permitting of the concept, designed and supervised the installation of the injection well. The well is currently in use for disposal of the RO reject.

City of Sand City – Desalination Facility Mr. Feeney is currently participating in the development of a small desalination project to provide additional water supply for the City of Sand City. Mr. Feeney has applied the concept of "mitigation by design" in conceptualizing a desalination facility that minimizes brine disposal impacts.

Monterey Peninsula Water Management District — Sand City Desalination Plant Saline Intake and Brine Disposal, Monterey County In order to satisfy increased water demands, the MPWMD has proposed the construction of a 3.0 MGD seawater desalination facility that will extract water from coastal dune sands through the use of Ranney collectors. The feasibility of this approach was investigated and the conclusion reached that three Ranney collectors at the site would be capable of producing the required design flow. Also investigated was the use of Ranney collectors to inject brine into the shallow subsurface offshore. The project included drilling, well construction, aquifer testing and solute/flow modeling. It successfully demonstrated that Ranney collectors would be suitable for use and that brine injection was feasible.

Seaside Basin Hydrogeologic Studies – Monterey Peninsula Water Management District Mr. Feeney is the primary author or co-author of several basin-wide hydrogeologic characterizations of the Seaside Basin including the Laguna Seca Subarea, Ryan Ranch and Hidden Hills.

Seaside Basin Injection/Recovery Study, Monterey County This evaluation considered the development of a conjunctive use program to direct surplus runoff of the Carmel River into semi-consolidated aquifers in the Seaside area. The scope included the evaluation of ground-water injection wells to effect seasonal ground water storage. Work included designing injection tests, overseeing modifications to the wells to allow effective testing, evaluating the tests to quantify aquifer properties and likely environmental effects, and simulating likely pressures and geochemical responses.

Seawater Intrusion Delineation — 180 foot Aquifer — Salinas Valley Ground-water Basin, Monterey County Seawater intrusion in the 180-foot aquifer system of the Salinas Valley has advanced inland as far as seven miles. A combination of controlled source audiomagnetotellurics geophysical methods, monitoring well installation and ground-water sampling techniques, was used to delineate the extent of seawater encroachment in this aquifer system. Geophysical data were also combined with well log data to develop an understanding of the nature of the interfingering between fluvial deposits of the Pressure subarea and alluvial fan deposits of the East Side subarea. The project resulted in a significantly improved understanding of the mechanisms controlling the movement of seawater in this aquifer system.

North Monterey County Hydrogeologic Study - Monterey County The northern portion of Monterey County is a mixed area of uplifted granitic bedrock, alluvial deposits, eolian sands, and tidal estuaries. The hydrogeologic setting is complex and hydraulically linked to the adjacent areas of the Pajaro and Salinas Ground Water Basins. The area supports a mix of agricultural and residential land uses developed entirely on ground water. The study included the assessment of the water supply conditions including current water balance and water quality issues. The study concluded that overdraft in the area was severe and the water quality issues of seawater degradation and nitrate contamination were wide-spread and increasing.

Hydro Metrics LLC

Derrik Williams, P.G., C. Hg.

Hydrogeologist

OVERVIEW

Mr. Williams has been a practicing hydrogeologist in California since 1987. He is a California Professional Geologist and Certified Hydrogeologist with extensive experience managing, reviewing, and assisting on water supply, groundwater recharge, wastewater disposal, and hazardous waste remediation projects. Mr. Williams is accomplished in analytical hydrogeology, with extensive application of groundwater flow and transport models. He has expertise in aquifer test analyses and is experienced in all aspects of groundwater management.

SKILLS

Important areas of expertise, and prominent skills include:

- Numerous applications of three dimensional groundwater flow and transport models
- Groundwater recharge
- Aquifer test analysis
- Groundwater basin management
- Remedial investigations

REPRESENTATIVE EXPERIENCE

Groundwater Supply/Groundwater Management

Soquel Creek Water District Conjunctive Use Alternative Assessment. Investigated conjunctive use alternatives for the Soquel Creek Water District. Responsible for evaluating the potential for recharge through ASR wells, and for analyzing the threat of seawater intrusion.

Squaw Valley Groundwater Basin Water Supply Plan and Groundwater Model. Evaluated alternative water supply options for the Squaw Valley Public Services District (SVPSD). The project team studied groundwater management alternatives as the main option in a plan to increase the SVPSD's water supply. Developed a groundwater flow model of the Squaw Valley groundwater basin to support the water supply analyses. The model was used to develop pumping strategies that maximize long-term basin yield, and to identify locations of new wells that the SVPSD may use to increase their water supply.

Los Osos Basin Groundwater Assessment and Groundwater Model. Developed a water and nitrate balance of the basin, accounting for all known water recharge

and nitrate sources. Incorporated the water and nitrate balance into a numerical groundwater model, used to predict future groundwater conditions. The model showed that the proposed sewer system significantly lowers nitrate levels in the shallow aquifer. Nitrate already migrating towards municipal wells, however, will continue to impact these wells for decades into the future.

San Benito County Water Agency Investigated groundwater impacts from changing wastewater quality in San Benito County, California. Helped estimate and model groundwater impacts and changing salt loads near the wastewater treatment ponds and at anticipated reclaimed water application sites.

Coastal Water Project ASR. Assisting ASR Systems develop the Aquifer Storage and Recovery (ASR) component of the Coastal Water Project (CWP) along the Monterey Peninsula. Helped design an ASR system that will provide peak flows to supplement supplies from the planned Moss Landing desalination plant. Developed a groundwater model of the target injection zone, based on initial injection test results.

Sand City Saline Groundwater Intake and Disposal System Modeling and Design. Developed a two-phase flow model of a feedwater extraction and brine injection beneath the beach in Sand City for a planned desalination plant. Used the groundwater model to develop a unique arrangement of feedwater wells and horizontal brine disposal wells that reduced environmental impacts on the National Marine Sanctuary.

Marina Coast Water District Desalination Brine Disposal Modeling. Developed a coupled density-dependent flow and transport model to help estimate and visualize the impacts from injecting brine from a small desalination plant beneath the sea floor. The model results suggested that the example brine discharge system created a subsurface brine mound that rose to the sea-floor surface, and entered the ocean at effectively full brine concentration. To obtain all the potential advantages of sea-floor injection, the injection system needed to inject brine over a larger area, at a lower injection rate.

Golden Gate Park Replacement Wells. Managed the City of San Francisco's Golden Gate Park Replacement well project as part of a joint venture. Worked with the Department of Public Works and the Public Utility Commission to site and design two new irrigation wells in the park. The new irrigation wells were designed to meet DPW's goal of an assured water supply, while still allowing PUC to use the wells as emergency potable supply.

East Bay Municipal Utility District Water Supply Improvement Program. Served as assistant manager, coordinating the project, and performing technical analysis for the East Bay Municipal Utility District's Water Supply Improvement Program. Assisted with siting and pre-design of injection and recovery facilities and served as the daily contact for EBMUD and the concerned water districts in California's Central Valley.

Salinas Valley Reclaimed Water Injection and Recovery Program. Implemented a feasibility study for reclaimed water injection/recovery (ASR) in the Salinas Valley. Developed a program for seasonally storing tertiary treated reclaimed water in the salt-water intruded portion of the Salinas Valley Aquifer. Coordinated meetings between local water agencies, city governments, the Water Pollution Control Agency, and various regulatory agencies.

Bear Valley Groundwater Assessment. Conducted a geologic and hydrogeologic investigation showing that the existing wells were extracting groundwater in the most effective areas in the valley. A water budget was developed as part of the hydrogeologic investigation to estimate the amount of groundwater that could potentially be extracted from the valley. Additional wells were determined to be too expensive for the potential benefit.

Groundwater Modeling/Analytical Hydrogeology

Charnock Initial Regional Response Activities (CIRRA) Modeling. Helped develop and use a basin-wide flow and transport model for the Charnock Sub-Basin in Los Angeles County. Acted as a senior consultant for this project. Helped develop and guide the modeling program, calibrated the groundwater model, and provided quality assurance and quality control on the modeling process.

Santa Clara Valley Water District Regional Groundwater Model. Developed the groundwater flow model of the Northern Santa Clara Valley under a joint contract between the City of San Jose and the Santa Clara Valley Water District. The model is presently used by the SCVWD for future water planning.

San Francisco Western Basin Groundwater Model. Provided an independent review of the San Francisco Western Basin groundwater model for the San Francisco Department of Public Works. Produced a plan for field testing and expanding the groundwater model to include the influence of groundwater pumping in Daly City, Colma, and Burlingame on Lake Merced water levels.

Avila Beach EIR Groundwater Model. Developed a flow and transport model of contamination beneath Avila Beach California, where historical hydrocarbon contamination from leaking distribution pipes threatened the Pacific Ocean and the estuary of San Luis Creek. The groundwater model encompassed the entire town of Avila Beach, including the Pacific Ocean and San Luis Creek. Successfully demonstrated that significant impacts would result from proposed remediation.

Salinas Valley Reclaimed Water Injection and Recovery Program Modeling. Employed a series of groundwater flow and contaminant transport models to study the effects of injecting reclaimed water into salt-water intruded aquifers beneath Salinas Valley, California. Used a local, variable density, contaminant transport model and a three-dimensional flow and transport model to

demonstrate the impact of the injected reclaimed water on nearby water supply wells.

Model of a TCE Plume in Scottsdale, Arizona. Retained as a neutral third party modeler for a TCE contaminated site with multiple potentially responsible parties. Used the model in negotiations with the USEPA to develop and implement remedial alternatives that ensure a safe source of drinking water for the City of Scottsdale, while preventing further degradation of the aquifers.

Western New York Nuclear Service Center Model. Reviewed the radionuclide transport model of the Western New York Nuclear Service Center for the U.S. Department of Energy's Southwest Research Institute. The review revealed that the model was inappropriate for estimating the risk posed by closing the Nuclear Service Center.

San Fernando Valley Vadose Zone Modeling. Oversaw vadose zone transport modeling of volatile organic compounds in the San Fernando Valley, under contract to the EPA. Used a three-dimensional vadose zone model that simulated advective and diffusive transport in the soil moisture, and density driven transport in the soil vapor.

Hanford Reservation Evaporation Ponds Model. As a summer employee of Battelle Northwest Labs, helped develop a groundwater model of leaking evaporation ponds at the Hanford Reservation in Richland Washington. Used a groundwater flow model with particle tracking to estimate the impact of leaking evaporation ponds on the nearby Columbia River.

EDUCATION

University of Arizona, Tucson, AZ
Masters of Science in Hydrology, June 1987.
Thesis: *Geostatistical Analysis and Inverse Modeling of the Upper Santa Cruz Basin, Arizona*

University of California, Davis, Davis, CA
Bachelor of Science - Geology. December, 1982.

PUBLICATIONS

Williams, D. and M. Feeney, *Developing Sustainable Water Supplies from a Small Coastal Aquifer with both Onshore and Offshore Environmental Constraints.* The Second International Conference on Salt Water Intrusion and Coastal Aquifers in Monitoring, Modeling, and Management. Merida, Yucatan, Mexico, March, 2003

Oliver, D., and D. Williams, *The Significance of Groundwater Gradient Magnitude on Flow Paths in Simulations of Heterogeneous Aquifers.* Bridging the Gap Between Measurement and Modeling in Heterogeneous Media, International Groundwater Symposium, Berkeley, CA, March, 2002.

Williams, D., N.M. Johnson, and A.C. Fowler, *Conceptual Modeling of a Well Developed Alluvial Basin*, in Subsurface Fluid Flow (Ground-Water and Vadose Zone) Modeling, ASTM STP 1288, J.D. Ritchey and J.O. Rumbaugh, Eds. America Society of Testing and Materials, Philadelphia, PA, 1996.

Jaques, R.S., and D. Williams, *Enhancing the Feasibility of Reclamation Projects through Aquifer Storage and Recovery.* Water Environment Federation, 67th Annual Conference and Exposition, Chicago, Illinois, October, 1994.

Shaukat, N. and D. Williams, *GIS Application to Remedial Investigation and Feasibility Study of San Fernando Valley Basin, Los Angeles, California.* American Geophysical Union fall meeting, October, 1990.

REGISTRATIONS

Registered Geologist, California, #6449
Certified Hydrogeologist, California, #35

PROFESSIONAL AFFILIATIONS

American Geophysical Union
Association of California Water Agencies
National Groundwater Association
Groundwater Resources Association of California

Benjamin M. Swann, P.G., C.HG.

Hydrogeological Investigation Task Leader

Education

B.S. - Hydrogeology, San Diego State University (1985)

Registration

Registered Geologist: California (1989)

Certified Hydrogeologist: California (1995)

Mr. Swann has a diversified background in water resource planning including a wide variety of projects involving groundwater and surface water supplies and quality. His experience encompasses system planning, modeling, field data collection, and feasibility studies. He has also managed numerous as-needed engineering contracts for water and transportation agencies.

Project Manager, Integrated Water Resources Management Plan (IRWMP) and Agency Strategic Plan, Solano County Water Agency. Mr. Swann served as the project manager for the SCWA IWRMP, which integrated water supply and quality, wastewater reuse, and flood control to provide greater flood protection and water supply reliability throughout Solano County. A 30-year strategic plan was developed for the agency to aid in future water resources decisions.

Project Manager, Integrated Water Management Plan, San Joaquin County Flood Control and Water Conservation District. CDM developed an Integrated Water Management Plan for the San Joaquin County Flood Control and Water Conservation District. The plan forms the foundation for the County's water needs and demands to the year 2030. The plan involved an evaluation of water supplies and demand, development of a county-wide integrated groundwater/surface water model, and identification and agreement on new water supplies and storage options to meet the 2030 demand. The project was undertaken to address groundwater overdraft in the central County and surface water quality problems in the Bay Delta. The project was awarded the San Joaquin County Council of Government's Regional Excellence Award for Planning.

Project Manager, Integrated Regional Water Management Plan, North Bay Watershed Association (NBWA). Mr. Swann worked with North Bay Watershed Association member agencies to develop an IRWMP to better manage water and wastewater resources and enhance habitat in the San Francisco North Bay region. The project involved assessing current and future water supplies and demands in the region. The project involved agency leaders and elected officials as stakeholders to identify, describe, and prioritize potential projects and policies to meet plan goals and objectives. Policy recommendations were developed to define future actions of the NBWA.

Project Director, Integrated Regional Water Management Plan (IRWMP) Alternatives Screening, Northeastern San Joaquin County Groundwater Banking Authority. CDM built a systems model to evaluate the performance of several alternatives of the Eastern San Joaquin IRWMP to stabilize groundwater levels in northeastern San Joaquin County. The model, developed using STELLA™ software, incorporated future urban and

agricultural demands, surface water supplies, groundwater pumping, and groundwater basin dynamics to simulate groundwater elevations over different hydrologic conditions. The model was programmed to evaluate the individual and combined affect on groundwater resources of IRWMP alternative elements such as new surface storage, additional conveyance structures, conservation and reclamation programs, agricultural in-lieu supplies, direct recharge, and a regional banking program. Using the STELLA model, the supply projects can be fine-tuned by changing project yield, diversion capacity, and type and location of water use.

Officer-in-Charge, Integrated Water Resources Plan, Butte County Department of Water and Resource Conservation. CDM developed an integrated water resource plan for Butte County for the purpose of protecting future county natural resources. The integrated plan included an analysis of water supply and demand, agriculture demand forecasting, development of stakeholder driven plan objectives, and evaluating and prioritizing water management actions for municipal, agricultural, and environmental water supply.

Project Director, Butte County Integrated Water Flow Model (IWFM), Butte County Department of Water and Resource Conservation. CDM developed a finite differential surface water/groundwater model using Department of Water Resources (DWR) IWFM code for the Butte Basin which spatially covers four California counties. The project team worked with DWR staff to BETA test the IWFM code in this first application at a regional scale. Model inputs included river staging and flow, 9 layer stratigraphy, land use and agricultural, precipitation, recharge and groundwater pumping. Model runs were developed on 1922 to 1994 historical hydrology. The model is fully calibrated and used by Butte County to plan future water supply programs and projects.

Project Manager, San Joaquin County Surface/Groundwater Flow Model, San Joaquin County Flood Control and Water Conservation. CDM developed a finite differential surface water/groundwater model using DYNFLOW code to assess overdraft in the Eastern San Joaquin Groundwater Basin. CDM maintains and runs the model; assisting the County with water assessing water management alternatives and scenarios related to water banking, new storage, and basin overdraft and saline groundwater intrusion.

Project Director, Water Supply/Demand Study, Solano County Water Agency. CDM evaluated the balance of water supplies and demands in Solano County under different future conditions. The project resulted in water supply projections for existing sources and the design of a common approach to accurately compare the supplies and demands of six cities and a dozen agencies within the county. A spreadsheet-based model was developed to test future supply and demand assumptions and scenarios, focused on potential changes in population growth, water demand, and supply reliability.

Brian J. Heywood, P.E.

Water Resources Engineer

Education

M.S. - Civil Engineering (Geo-Environmental), Northeastern University, 1997

B.S. - Civil Engineering (Environmental/Geotechnical), Northeastern University, 1995

Registration

Professional Engineer: California, 2008

As a water resources engineer, Mr. Heywood has experience in a wide array of groundwater supply, contamination, and surface water/groundwater interaction projects. His recent experience includes numerous groundwater resources assessments for environmental documentation and the building, calibration, and application of groundwater flow and contaminant transport models.

Project Manager/Project Engineer, Integrated Groundwater-Surface Water Modeling. Mr. Heywood is working on a program for Butte County, CA, which will aim to integrate the management of water resources to meet the current and future needs of agricultural, municipal and industrial users, the environment in the county. During the first phase of this project, Mr. Heywood worked to review the proposed application of the model, assessing the compatibility of the modeling code (particularly its ability to simulate groundwater-surface water interaction, surface water diversions, irrigation and agricultural pumping). Mr. Heywood was instrumental in updating the county's current model using California DWR's IWFM code. The model was updated to reflect the latest available hydrogeologic, hydrologic, and land use data. As the project manager, Mr. Heywood has overseen work to calibrate and test the updated model. The project tasks currently involve simulating water management scenarios using the updated model. These scenarios will be compared to a "Base Case" simulation to assess the potential changes to the groundwater system and groundwater/surface water interaction.

Project Manager/Project Engineer, Conjunctive Use Project. Mr. Heywood has performed work on a work in San Joaquin County, CA, to assess the potential benefits to the groundwater system as a result of proposed management activities. The project involved assessing changes to groundwater levels and groundwater/ surface water interaction due to potential projects such as in-lieu water transfers, recharge ponds, and groundwater injection.

Groundwater Specialist, Environmental Water Account. Mr. Heywood worked to develop information for the groundwater resources sections of the Environmental Water Account's (EWA's) environmental impact report (EIR). This project involved assessing potential changes in groundwater levels, flow patterns, and groundwater/surface water interaction due to in-lieu groundwater transfers for environmental reasons.

Project Engineer, Source Water Contributing Areas Assessment. Mr. Heywood worked on a project to assess source water contributing areas for more than 1,300 supply wells on Long Island, NY. He developed an automated procedure to convert existing regional groundwater flow models for Long Island to sub-regional flow models covering the entire island at 200

ft node spacing. The procedure also involved developing model output that was compatible with the GIS tools used for further spatial analysis.

Project Engineer, Regional Groundwater Basin Study. For a project in the Reno, Nevada area, Mr. Heywood developed and calibrated a regional groundwater flow model to assess groundwater and contaminant movement within the Truckee Meadows Basin. The model will be used to support remediation plans for the area. Model calibration involved replicating water levels that fluctuate greatly due to seasonal stresses on the aquifer. Large differences in water levels are also seen due to the high degree of anisotropy in the aquifer materials.

Project Engineer, Tank Farm Contamination Study. Mr. Heywood has also applied groundwater models to a petroleum site near Reno, Nevada. He was involved in the calibration of an existing model after flooding resulted in major changes in site hydrogeology. His work with the groundwater model has been used in the design of groundwater pump-and-treat systems and in preparation of an application for an Underground Injection Control (UIC) permits. This work included assessment of capture zones for remedial wells and particle tracking for evaluation of recirculation of treated water.

Project Engineer, Groundwater Modeling. Mr. Heywood worked on a project involving 3-dimensional salt water intrusion modeling conducted as part of a series of investigations to determine if deepening of the Savannah, GA, Harbor channel has the potential to impact the water quality in Upper Floridan Aquifer within the project area. The Floridan Aquifer is the largest source of freshwater in the coastal area of Georgia and the potential for saltwater intrusion is a growing concern among the coastal communities and State and Federal agencies. Project tasks included reviewing and compiling historical data and creating a model dataset, developing and calibrating a numerical model of the hydrologic system including and underlying the navigation channel, simulations of planned project dredging, and preparation of a report.

Project Engineer, Marina Development Project. Mr. Heywood completed the calibration of a groundwater flow model for a site on the island of Oahu, Hawaii. This modeling effort involved detailed calibration to tidal fluctuations. Water levels in monitoring wells were both damped and lagged from tide changes. Tide levels varied on both a daily and long-term (e.g. year) time frames. Modeling was done to predict the impact of major excavation in the area. Mr. Heywood's modeling work is being used to assess changes, if any, in aquifer water levels are occurring during on-going excavation activities.

Douglas R. Brown, P.E.

Water Quality/Treatment

Education

M.S. – Civil Engineering, University of Illinois, 1979

B.S. – Civil Engineering, Oklahoma State University, 1978

Registration

Professional Engineer: California, Colorado (1983) and Utah

Mr. Brown has over 25 years of experience designing treatment plants and the associated infrastructure using a wide variety of technologies including large microfiltration systems, conventional coagulation and filtration, reverse osmosis, activated carbon filters, and advance oxidation. His responsibilities have included preparation of evaluation reports, construction plans and specifications, and operational procedures. Primary technical responsibilities include the overall process design and chemistry, hydraulics and piping, and control philosophy associated with the water treatment facilities. In addition, Mr. Brown has construction management experience on several treatment plants using design-build and fast-track construction techniques.

Project Manager, Alameda County Water District Desalination Project. Mr. Brown was project manager for the design of a 15-mgd reverse osmosis treatment process to reduce dissolved solids and hardness in a clean groundwater. Membrane procurement procedures were developed and included performance requirements and manufacturer qualifications. Technical documents for discharge of concentrate from the full-scale RO system were prepared and included acute toxicity testing and rejection characteristics for trace metals. Detailed construction plans for the $20 million project included RO arrays, chemical systems, pumping equipment, 13,000 sq. ft. process building and 4 miles of pipeline were prepared for competitive bidding of the project. Mr. Brown provided startup assistance and process training for the system.

Project Manager, City of Folsom WTP Expansion. Mr. Brown was project manager responsible for the design and construction services for a new 40 mgd conventional filtration system to replace the existing treatment plant. The projects were developed in 5 phases to comply with Health Department requirements and financial constraints and have included raw water, settled water, and filtered water pumping, mechanical flocculation, sedimentation basins, dual media filters, on-site hypochlorite generation disinfection system, chemical system upgrades, raw and filtered water pipelines, building upgrades, and new SCADA system. The improvements have been designed to allow expansion of the facility to 75 mgd in 12.5 mgd increments by constructing two additional filters. The existing WTP remained operational throughout each construction phase, and future expansion can be constructed without any extended shutdowns.

Project Manager, Alameda County Water District Treatment Facility. Mr. Brown was project manager for a $12 million new automated treatment facility. The facility included a new 13,000 sq ft building with hazardous occupancy classification in 5 rooms, a 4000 ampere electrical service utilizing a cable tray system, an instrument and control system for over 1000 analog and discrete points. The I&C system was configured around the clients standardized system and included over 40 P&I drawings and reference drawings.

Lead Practitioner, Allen WTP Englewood, Colorado. Mr. Brown provided design criteria and review for the retrofit of the Allen WTP with auxiliary air scour grids. Mr. Brown developed the valve sequence for air scour and backwash operation to minimize backwash water and lost media.

Project Manager, Jordan Valley Water Conservancy District Groundwater Treatment Evaluation. Mr. Brown developed conceptual plans for the treatment of high sulfate groundwater using a low pressure RO system. The evaluation included raw water quality analysis, RO performance projections, cost estimates, and preliminary system layouts. The proposed system consists of two 3.5 mgd RO systems, pipelines, and infrastructure with an estimated construction cost of $35 million.

Project Manager, Saratoga Water Treatment Plant 5.0 mgd Upgrade. Mr. Brown compared evaluated alternate treatment technologies based a life cycle economic analysis of the alternative using PUC mandated depreciation rates and capitalization of membrane upgrades. A system using six 7' x 20' treatment units, controls, compressors, and main switchgear was installed in the existing 1600 sq ft building. Mr. Brown coordinated all construction and startup activities to complete the required 12-month design-build schedule.

Project Engineer, CCWD Bollman Water Treatment Plant. Mr. Brown served as project engineer for preliminary and final design of GAC media installation and auxiliary air scour filter improvements at the Contra Costa 80 mgd Water District Bollman Water Treatment Plant. This project included bench- and pilot-scale testing of alternative granular activated carbon (GAC) media configurations, design of air scour diffuser grid and powdered-activated carbon (PAC) improvements, and prepurchase of GAC filter media and air scour system. Mr. Brown completed the design of new sludge collection equipment, chemical feed systems, and an emergency generator system associated with the installation of a settled water ozonation system.

Project Engineer, San Andreas Water Treatment Plant Expansion No. 2. Mr. Brown was process mechanical project engineer responsible for upgrading six 2500 sq ft filters with a new air scour underdrain support gravel system, 180 mgd raw water pump station including three 300 HP VFD and three 900 HP two speed pumps, and an 80 mgd pressure reducing station. The pump station utilized an optimization program to assist operators in minimizing pumping costs as TDH requirements varied from 45 to 98 feet.

Project Engineer, Cucamonga County Water District, Southern California. Mr. Brown was project engineer for this fast track design/build 30 mgd expandable to 60 mgd water treatment plant in Southern California. Mr. Brown was responsible for day-to-day production including coordination of all design disciplines and coordination with the contractors regarding design details and specifications. The design was a conventional treatment process, and was operational 16 months after the design was started.

Youssif H. Hussein, P.E.

Hydraulic Modeling

Education

M.S. - Civil Engineering,
University of Texas, Arlington, 1983

B.S. - Civil Engineering,
University of Texas, Arlington, 1982

Registration

Professional Engineer:
California (1996)

Mr. Hussein has specialized experience in modeling for water distribution systems, wastewater and stormwater collection sewer system, and hydrology. He is particularly experienced in creating and setting up hydraulic models using GIS applications and databases, performing hydraulic analyses, and evaluating model results.

Project Engineer, Water Distribution Model. Mr. Hussein updated the City of Benicia, California's existing water distribution model to include recent projects and configuration and performed hydraulic analysis with extended period simulation using H2ONET model to evaluate potential reservoir sites to replace an existing old reservoir. He evaluated several alternatives and assessed their impact on the existing system, identified advantages and disadvantages of each alternative, and recommended the best alternative to optimize system operation.

Project Engineer, Lake Chabot Dam and Spillway Modeling. Lake Chabot is a major feature within the City of Vallejo, California. Mr. Hussein performed modeling of the dam and spillway and evaluated the design modifications and their impact on the creek downstream.

Project Engineer, Tuolumne River Hydrologic Model. Mr. Hussein developed a hydrologic model for the Tuolumne River and the Dry Creek basins to aid in ongoing litigation. The study included evaluating the extent of flooding downstream near the City of Modesto, California during a major storm event; developing hydrologic parameters for subwatersheds; calibrating the model to actual event using historical data; analyzing the basins under several design rainfall events; evaluating the impact and determining the extent of flooding. HEC-1 and HEC-2 software were used to perform the analysis.

Project Engineer, Ayers Reservoir Hydraulic Model Review. Mr. Hussein reviewed the Contra Costa Water District's hydraulic model to confirm that the Ayers Reservoir is appropriately sized based on the Master Plan Criteria. He evaluated identified site locations for hydraulic differences and potential sites that could provide more hydraulic benefits to the water system.

Project Engineer, Model Review for the Elderwood Pump Station Rehabilitation. Mr. Hussein updated and reviewed the Contra Costa Water District's H2ONET model to reflect facility improvements since the completion of the Master Plan. He performed model runs for critical operational scenarios including fire flow analysis and extend period simulation.

Project Engineer, Hydraulic Model Review for the Bailey and Pine Hollow Pumping Facilities. Mr. Hussein reviewed the Contra Costa Water District's hydraulic model to check the basic data for Zones 31 and 41. He performed hydraulic analysis to evaluate the capacity of the Bailey and Pine Hollow pumping facilities to meet existing and future demands using extended period simulation for a maximum day conditions. Plotted and compared pump curves to system curves using model results for different demand conditions.

Project Engineer, Hydraulic Modeling for Water Distribution System Master Plan. Mr. Hussein developed a hydraulic model to evaluate the existing Rio Linda/Elverta Community Water District water system under different demand conditions. He used GIS to develop junctions demand from land use coverages and aerial photography. Mr. Hussein performed hydraulic analysis for several demand scenarios and identified existing system deficiencies and future capacity requirements. He is currently evaluating alternatives to determine the distribution system improvements needed for each demand scenario and develop a staged Capital Improvement Program.

Project Engineer, Modeling for Water Master Plan. Mr. Hussein conducted modeling tasks for the water master plan for the City of Benicia. Mr. Hussein collected pipe data, digitized water mains, land use subareas, and zoning data, and wrote a computer program to update and maintain a comprehensive database of the entire city water system. He also assisted in developing water demand projections, allocating demands to model nodes for existing and future land use conditions, and performed hydraulic analysis of the water system for existing and future conditions using the Kentucky Model.

Project Engineer, 1999 Water Master Plan Updates. Calleguas Municipal Water District is a wholesale provider, serving 22 agencies in Ventura County. Mr. Hussein participated in the preparation of the District's master plan update and performed a hydraulic analysis to evaluate the adequacy of the water facilities to meet current and projected demands.

Project Engineer, Hydraulic Evaluation for Conveyance Facilities. Mr. Hussein performed hydraulic evaluation in support of the Calleguas Municipal Water District's proposed four-million-gallon Grimes Canyon Reservoir and the proposed Aquifer Storage and Recovery project pipeline and pump station conveyance facilities.

Project Engineer, Water System Master Plan. Mr. Hussein was an engineer for the City of Klamath Falls, Oregon, water system master plan that defined improvements to the distribution, storage, and supply systems and made recommendations to modernize and optimize the system. Mr. Hussein assessed the hydraulic model, utilizing H_20Net, for their water system plan update.

James Y. Kim, P.E.

Engineering Evaluations

Education

M.S. – Civil and Environmental Engineering, Stanford University, 2003

B.S. – Mechanical Engineering, University of Illinois, at Urbana-Champaign, 1998

Registration

Professional Engineer: California (2006)

Mr. Kim is a water resources engineer with three years of experience modeling hydraulic water distribution systems, performing hydraulic surge evaluations, designing surge mitigation systems, supporting the design of pump stations and water conveyance systems, preparing facilities master plans, preparing phase I environmental site assessments, and writing and executing sampling plans. His computer skills include AutoCAD, H20Net, H20Map, and ArcGIS.

Design Engineer, Preliminary Design of Well Water Conveyance System, Knightsen, California. For Diablo Water District, Mr. Kim completed the preliminary design of the conveyance system from a well to an existing raw water line 9,000 feet away. Mr. Kim sized the pipeline and well pump based on the expected range of flow and head conditions. The 18-inch pipeline was aligned underneath an existing road that included a bridge crossing and both underground and overhead utilities. Mr. Kim also evaluated the hydraulic system for surge conditions and used the results to size and place surge mitigation equipment, which included a 350 gallon surge tank.

Design Engineer. Hydraulic Surge Evaluations for various projects. In design support of Little Rock 68 MGD combined sewer force main, Mr. Kim analyzed the system for potential surge conditions during transitions between different operating modes such as the open/close of 24-inch and 48-inch valves. Mr. Kim sized and located surge mitigation equipment to prevent damaging high pressure or vacuum conditions. Equipment included, air vacuum relief valves, air release valves and pressure relief valves. For design support of Camp Pendleton 4 MGD reclaimed water pipeline, Mr. Kim analyzed possible surge conditions and designed surge mitigation along the 20,000 foot long pipeline. Equipment was sized and located such that working pressures and surge pressures would remain within pipeline ratings. For design support of the water treatment plant in Gila River Indian Reservation, Mr. Kim analyzed both the 6 MGD well conveyance and 8 MGD treated water conveyance systems for surge conditions. On the well conveyance pipeline, combination air vacuum valves/air release valves were sized and located to prevent damaging pressures. On the treated water pipeline, a surge tank was sized to meet minimum pressure requirements.

Water Resources Engineer. Water Distribution System Model for Bear Gulch District, California. For Cal Water, Mr. Kim developed a water distribution system model for Cal Water's Bear Gulch District. Development of the computerized hydraulic model in H2OMap consisted of configuring pipes, pumps, valves, and storage tanks. Mr. Kim utilized a geographic information system (GIS) database to input elevations and a geocoding routine to allocate water demands. The model was calibrated using field test data and verified using historical operating data. Mr. Kim analyzed the

system for future demand conditions and identified potential areas for improvement.

Water Resources Engineer. Water Distribution System Evaluation for Mid-Peninsula District, California. Mr. Kim developed a model from a GIS database, calibrated it with field test data, and verified it using historical field data. Mr. Kim performed a hydraulic analysis with extended period simulation using H2ONET model to identify deficiencies and evaluate potential improvements of pipelines, pump stations and tanks.

Water Resources Engineer. Water Distribution System Model for South San Francisco System, California. For the California Water Service Company (Cal Water), Mr. Kim updated the hydraulic model and relabeled model elements according to Cal Water's naming convention.

Water Resources Engineer. Water Distribution System Model for Diablo Water District, California. Mr. Kim assisted in the development of a water distribution system model featuring three scenarios: existing, near-term and future capacity. Model development included allocating water demands utilizing land use methods, collecting fire hydrant test data in the field, and calibrating the model to match field conditions. With the calibrated model, he performed extended period simulations for different system demands and operating conditions. Based on the simulations, Mr. Kim evaluated and sized water facilities for future capacity.

Environmental Engineer. ENV America Incorporated, San Francisco, California. Mr. Kim wrote phase I environmental site assessments for commercial properties, and designed, wrote and executed a lead sampling plan for a commercial property. In addition, he mobilized a soil excavation to remove diesel-contaminated soil saving 40 percent of the budget as a result of resourceful planning. He also created an operation's manual for a groundwater treatment system.

Professional Activities

Co-founded Engineers for a Sustainable World – Stanford Chapter.

Charles A. Lindquist, P.E.

Lead Electrical Engineer

Education

B.S. - Electrical Engineering, Bradley University, 1971

Registration

Professional Electrical Engineer: California (1975), Washington, and Nevada

Mr. Lindquist has over 35 years of experience in the planning, design, construction and startup phases as well as value engineering of the electrical and instrumentation systems of water and wastewater treatment facilities. Mr. Lindquist has supervised electrical and instrumentation systems design and construction services for numerous water and wastewater facilities and expansion projects.

Senior Electrical Engineer, City of Fernley Water Treatment Plant. Mr. Lindquist is CDM's senior electrical engineer responsible for all phases of the electrical and instrumentation design for the new City of Fernley water treatment plant. The plant features a 480 volt plant distribution system utilizing ANSI C37 style switchgear, switchboards and motor control centers. The size of the electrical services required by the plant load necessitated significant coordination with the local electrical utility company, Sierra Pacific Power Company. The plant design incorporates variable speed pumps ranging in size from 1 Hp to 300 Hp. A 1,500 kW diesel powered standby generator provides the standby power requirements for the plant during utility power outages. The feasibility for an energy recovery facility converting water pressure into electrical energy feasibility is presently under development. The plant control system is based on Programmable Logic Controllers (PLCs) and personal computers running the Wonderware HMI system. Integration of the existing city off-site SCADA system is presently being evaluated for integration into the plant control system. Mr. Lindquist will be heading the CDM team performing the application engineering for the PLC/PC system provided and installed by the contractor. Specialty systems including fire alarm, security, communication and access control systems were also included at the plant.

Project Electrical and Instrumentation, CCWD City of Brentwood Water Treatment Plant. For the Contra Costa Water District, Mr. Lindquist was electrical and instrumentation engineer for a new 13 mgd water treatment plant. This facility includes 5 kV and 480 VAC electrical systems, emergency generator system, and central Uninterruptible Power Supply system distributing power to a multi-building campus site. The specialty systems include CCTV (closed circuit TV), communication (telephone and intercom), fire alarm system, process control data highway and information management over a combination of fiber and copper media WAN. Process control was via PLC/PC based SCADA system. Dedicated data highway systems were employed for particle counting and motor operated valve systems.

Project Electrical Engineer, CCWD Bollman Water Treatment Plant 5 kV Replacement Project. The existing Bollman Water Treatment Plant (WTP) 5 kV electrical distribution system for the Contra Costa Water District, installed in 1967, was beginning to experience numerous failures. Mr. Lindquist was responsible for project planning and detailed design for the replacement of the old 5 kV system while maintaining operations of the existing facility. The project included a new plant electrical service building, replacement of all 5 kV equipment in the existing main high lift pump station. Main circuits of the electrical system were provided with the ability for remote monitoring and analysis of the system parameters including power demand and waveform analysis.

Project Electrical and Instrumentation Engineer, SCVWD Water Treatment Plant Improvements. Mr. Lindquist was project electrical and instrumentation engineer for the design of major improvements to 100 and 80 mgd water treatment plants owned by the Santa Clara Valley Water District. The overall value of this project is $125 million. Electrical improvements at the Santa Teresa facility included new 20 kV utility service switchgear and site feeders, 480 VAC switchgear and systems and emergency generator. Instrumentation improvements included an expansion of the existing PLC/PC process control system, fire alarm system, and communication system. The project included electrical and instrumentation additions and improvements at the multi-building site. These improvements for regulatory compliance and treatment capacity include oxygen fed ozone systems, filter modifications, washwater clarification, new chemical systems, new 20 mgd clarifier, and a variety of additional upgrades.

Project Engineer, ACWD Water Treatment Plant. Mr. Lindquist served as engineer for electrical and instrumentation design and construction services for the new Alameda County Water District 30 mgd water treatment plant No. 2. This plant featured a PLC/PC based SCADA package with six major PLCs and approximately 3000 I/O points, a 1200 pound per day ozone generation facility, chemical storage and metering systems (including sodium hypochlorite, alum, aqua ammonia, ferric chloride, fluoride and polymer) and a plant security and fire alarm system. The plant incorporated PLC-based control over the numerous valves involved in the automated filter backwashing schemes.

Project Engineer, SFPUC Sunol WTP Modifications. The modifications to the 160 mgd Sunol water treatment plant for the San Francisco Public Utilities Commission designed by Mr. Lindquist included new chemical storage and metering systems (monitored and controlled by a PC/PLC based control system), a new 350 KW standby engine generator and new main plant 480 Volt electrical service switchgear.

Thomas Titus

Hydrogeology/Field Investigations

Education

M.S. – Geology, Brigham Young University, 1998

B.S. – Environmental Geology, Brigham Young University, 1996

Registration

40-Hour OSHA, 29 CFR 1910.120

Mr. Titus has 10 years of professional experience in water supply and environmental sciences. His primary areas of expertise include well drilling, design, construction, and development; aquifer pump test design and interpretation; soil and groundwater collection and evaluation; and permitting.

Task Manager, Conjunctive Use Groundwater Storage Project. Mr. Titus supervised several geologists and coordinated all drilling, construction, development, and testing activities during the installation of eight deep water production wells in Orange County, California. Mr. Titus ensured that all project specifications were met during project. Mr. Titus provided project updates to the client, public, and regulatory agencies; implemented the health and safety program; and resolved site-specific concerns and issues including changes of scope and public relations. Mr. Titus developed preliminary well designs, bid specifications, proposed well designs, and construction summary reports. Mr. Titus reviewed soil cuttings, analyzed geophysical logs, and inspected well construction materials.

Task Manager, Water Production Well. Mr. Titus supervised several geologists and coordinated all drilling, construction, development, and testing activities during the installation of one deep water production well in Highland, California. Mr. Titus ensured that all project specifications were met during project. Mr. Titus provided project updates to the client, public, and regulatory agencies; implemented the health and safety program; and resolved site-specific concerns and issues including changes of scope and public relations. Mr. Titus developed preliminary well designs, bid specifications, proposed well designs, and construction summary reports. Mr. Titus reviewed soil cuttings, analyzed geophysical logs, and inspected well construction materials.

Task Manager, Wellfield Analysis Project. Mr. Titus supervised several geologists and coordinated all testing activities for the analysis of a water production wellfield (nine wells) in Orange County, California. Mr. Titus ensured that all project specifications were met during project. Mr. Titus provided project updates to the client; implemented the health and safety program; and resolved site-specific concerns and issues including changes of scope. Mr. Titus developed the testing strategy, analyzed the water level data, summarized the data, and prepared recommendations.

Field Geologist. Groundwater Replenishment System. Mr. Titus supervised conductor casing installations, well installation, well development, and aquifer testing activities for several groundwater injection wells constructed in Huntington Beach, California. His specific responsibilities included supervising drilling, USGS soil classification, boring logs, well construction, well development, aquifer testing, and groundwater sampling.

Field Geologist, Water Production Wells. Mr. Titus supervised drilling, construction, and development of three deep high-yield water production wells in a TCE- and perchlorate-impacted water basin for the City of Loma Linda, California. He prepared bid specifications, ensured that specifications were met in field construction, collected and classified soil cuttings, analyzed geophysical logs, developed preliminary well design, inspected well construction materials and workmanship, interfaced with the client, public, and regulatory agencies, implemented the health and safety program, and resolved site-specific concerns and issues including public relations.

He also designed, managed, and conducted the production well pump tests. The pump tests included collecting data for pre-pumping background, step-drawdown pumping, constant-rate pumping, post-pumping recovery, and post-pumping background water levels. Data analysis included determining well efficiency, aquifer yield, and aquifer drawdown, pump and bowl settings, pump size and volume, pumping interference effects, and wellfield potential.

Field Geologist, Deep Monitoring Wells. Mr. Titus supervised the drilling, construction, and development of two deep monitoring wells for the evaluation of wellfield potential and water quality for the County of San Bernardino, California. The work included the review of geophysical logs, drill logs, water quality laboratory results, and geotechnical data to prepare recommendations for water production wells.

Staff Geologist, Drinking Water Source Assessment and Protection Program. Mr. Titus participated in the development of a Microsoft Access database for the State of California Drinking Water Source Assessment and Protection Program (DWSAP) for Water Replenishment District, Southern California. The database contained well data from over 250 water supply wells in the Los Angeles Basin. The project included collecting well data from numerous pumpers, incorporating the data into the database, and generating reports. The database was linked to ArcView GIS to determine the vulnerability of the water source at each well basin.

Staff Geologist, Drinking Water Source Assessment and Protection Permit Applications. Mr. Titus has completed several California Department of Health Services (DHS) Drinking Water Source Assessment and Protection (DWSAP) Permit Applications for municipal water production wells. His activities included preparing drinking water source location maps delineating source area and protection zones, conducting assessment area reconnaissance, identifying and performing vulnerability ranking of possible contaminating activities within the assessment area, analyzing site and well data, preparing and submitting DWSAP application to DHS, and responding to comments from the DHS.

Robert A. TerBerg, P.G.

Hydrogeology/Field Investigations

Education

M.S. – Hydrology, New Mexico Inst. of Mining and Tech., 1993

B.S. – Geology, University of Alberta, 1988

Diploma in Petroleum and Mineral Resource Land Management, Mount Royal College, 1983

Registrations

Professional Geologist: California (1999), Arizona (1999) and Alberta, Canada (1993)

Certifications

40-hour HAZWOPER OSHA Certification and 8-hour refresher

8-hour OSHA Certification for Site Supervisor Training

RailSafe Certified Contractor

Mr. TerBerg is an environmental geologist experienced with geological characterization, infiltration monitoring and modeling, water supply development and testing, and well hydraulics. He has conducted environmental impact assessments for several groundwater projects, including permeability barriers and water supply wells.

Project Geologist, Municipal Redevelopment Evaluation. For City of Brisbane, CA, Mr. TerBerg compiled, drafted and co-authored a hydrogeological analysis of historical contaminant fate and transport in the Baylands area near Sunnydale Avenue and Bayshore Boulevard. This involved a unique interpretation of discrete downward dipping beach sand bodies by invoking a compacting marine basin model for the historically infilled Brisbane bay.

Project Geologist, Municipal Water Supply Alternative Analysis. For Salinas, CA, Mr. TerBerg compiled and drafted several groundwater development options for a report that included analyses of treatment of contaminated wells, fluvial diversions, and desalinization as regional options. Prospective areas were delineated in a maturely developed groundwater basin by sand isopach maps, and by ranking existing production wells by calculated specific capacity, type of well completion, age, depth, water quality problems, and accessibility issues. Multivariate analysis and ranking was performed using Criterium Decision Plus.

Project Geologist, Geotechnical Evaluation. For Contra Costa – Brentwood Water Treatment Plant in Oakley, California, Mr. TerBerg conducted a geotechnical evaluation of the site as input for the design-build work for a new water treatment plant. The investigation involved three soil borings, six CPT borings and one piezometer installation. Project tasks included subcontractor procurement, field work, and reporting.

Senior Staff Hydrogeologist, Characterization of Water Supply Contamination. For the City of Santa Monica, Mr. TerBerg served as the technical oversight lead on behalf of the City of Santa Monica, in Preliminary Assessment/ Site Inspection of 45 drilling investigations carried out within a 12 month timespan in response to EPA CERCLA injunction of liability to potentially responsible parties (all gas station sites, past and present, where MtBE may have been used, within a 1 mile radius each of the two affected water supply wellfields). He provided oversight for three large scale aquifer pumping tests, logging and split-sampling over four excavations and 160 borings by air rotary casing hammer (40), hollow stem auger (70), and mud rotary (50). He had extensive daily interaction and reporting to the City of Santa Monica and EPA. He also reviewed the consultant deliverables from the potentially responsible parties (PRPs) identified in the CERCLA injunction.

Staff Hydrogeologist, Groundwater Wells Installation. For a plastic cutlery manufacturer in Fullerton, California, a consent order required an off-site aquifer Phase II Environmental Assessment (EA). Mr. TerBerg supervised drilling/sampling/installation of 3 shallow groundwater wells by hollow stem auger drilling and 3 CPT borings with discrete-interval groundwater sampling by hydropunch. He found and reported DNAPL contamination in relation to potential sources on client property. A remedial investigation/ feasibility study (RI/FS) was initiated as a result.

Project Geologist, Cache Creek Watershed Mercury Evaluation - Yolo County Segment. For Caltrans, CDM performed a soil sampling investigation to assess Total Maximum Daily Limit (TMDL) run-off potential of naturally occurring methyl mercury in soil and bedrock in the Yolo County segment of the Cache Creek Watershed. Mr. TerBerg designed a study to locate hotspot areas, compiled the work plan, coordinated and staffed up the field work, and wrote up the final report. Sampling involved hand augering shallow soil in Caltrans right-of-ways (ditches) along state highway 16, I-505, and I-5. Sampling sites were ranked on the basis of multivariate qualitative properties, which functioned remarkably well at locating potential hotspots. Geostatistical Lillieflors normality tests were used to test the normality of distributions of mercury analyses associated with different soil types and topographic settings. ANOVA characterization was then used to compare the mercury distributions in different soil types and topographic settings. Interpretations of data, delineation of hotspots, and explanations of risk mitigation were made in the report and approved by the RWQCB.

Project Geologist, Geomorphological Survey. For Carneros Creek, south west of Napa, Mr. TerBerg surveyed cross-sections for geomorphological feature identification at high erosion areas along Carneros Creek. The measurements provided a schematic basis for structureless slope stability planning by a local landowners association. Non-structural mitigative measures for slope fixation include the use of native vegetation and limited grading for natural landscaping.

Project Geologist, Geomorphological Survey. For Wildcat Creek, in San Pablo, Mr. TerBerg coordinated and staffed up the field work for geomorphological feature identification along Wildcat Creek. The measurements provided a schematic basis for structureless slope stability planning by the Urban Creek Council of California. Non-structural mitigative measures for slope fixation include the use of native vegetation and limited grading for natural landscaping.

Dennis E. Kesmodel, P.G., C.HG.

Staff Geologist/Tunnel Geologist

Education

B.S. - Murray State University
Murray, Kentucky
Geology, 1998

Registration

Professional Geologist:
Tennessee, 2006

Certified Professional Geologist
with Association of Professional
Geologists

Certifications/Training

OSHA 40 HR HAZWOPER

Confined Space

MBTA Safety Training

Amtrak Safety Training

Facilities Safety Training

ACI Grade I Testing

Nuclear Gauge Safety/
Operation Training

First Aid/CPR Training

Mr. Kesmodel is a tunnel geologist with 10 years experience in the geotechnical engineering and tunneling industry nationwide. He specializes in geotechnical engineering and engineering geology, and has extensive experience in subsurface exploration and mapping, tunnel construction and tunnel inspection in both soft ground and hard rock environments. Mr. Kesmodel has also developed and managed geophysical exploration and geotechnical instrumentation monitoring programs involved in the design and construction of tunnels. His tunnel experience is predominantly in large water, sewer, highway and rail infrastructure projects. Mr. Kesmodel brings nationwide geological experience in difficult ground conditions and successful constructions methods utilized within these conditions.

Tunnel Geologist, Mather Interceptor, Sacramento, CA. As the tunnel geologist, Mr. Kesmodel is performing technical review of the geotechnical program for the design of more than 16,000 feet of 54- to 72-inch diameter reinforced concrete gravity sewer line. Soil conditions range from clay and silt to extremely hard and abrasive cobbles and small boulders. He is also providing guidance on the engineering geologic conditions for the selection of project construction methods.

Engineering Geologist, New York Harbor Siphon Tunnel, New York, NY. Mr. Kesmodel provided technical review of the metamorphic rock encountered during the marine explorations for this siphon tunnel. The tunnel is 12,000 lf across the entrance channel to NYC harbor and will have a 10 ft inside diameter (ID) with a 72-inch pipeline installed connecting Staten Island and Brooklyn with an emergency water supply to replace an existing service that will be removed when the channel is dredged to a deeper depth. He performed quality control review of rock core logs and developed a Q-Quality engineering rock mass assessment for the geotechnical data report (GDR), geotechnical interpretive report (GIR) and ground freezing design for the shafts at the tunnel termini.

Engineering Geologist, WASA CSO Tunnels, Washington D.C. Mr. Kesmodel is serving as an engineering geologist for the preliminary design of 10 miles of 25 to 30 ft inside diameter (ID) combined sewer overflow (CSO) tunnels in the nation's capital. The project involves design and implementation of an exploration program including 30 borings, all to depths of 250 feet, to develop sufficient subsurface data to make geotechnical recommendations on the various tunnel alignment options and to develop preliminary costs for the selected alignment. The exploration program consists of geophysical seismic testing, *in-situ* testing with pressuremeter, slug testing, and pumps tests. The tunnels are expected to pass through both flood terrace deposits and metamorphic rock.

Technical Reviewer, Catskill and Delaware Aqueducts, New York, NY. Mr. Kesmodel performed technical review of a planning document for the structural inspection of the historic New York Catskill and Delaware Aqueduct tunnels.

Tunnel Geologist, Kensico-City Tunnel, New York, NY. Mr. Kesmodel performed tunnel, geological and geotechnical studies during the detailed facility plan and conceptual design of the proposed water distribution tunnel, intake structure, ultraviolet (UV) plant, and potential infiltration plant. The tunnel is anticipated to be up to 16 miles long, 30 feet in diameter and 700 feet deep in hard rock consisting of schist, gneiss, marble, and quartzite

Tunnel Geologist, Lockbourne Tunnel Columbus, OH. Mr. Kesmodel served as tunnel geologist for this 14 ft diameter sewer tunnel with segmental lining running in glacial drift and alluvial soils. He was responsible for quality control and interpretation of standard boring logs and rota-sonic rock core logs for geotechnical exploration program. Mr. Kesmodel also provided technical guidance and project management in the development of the preliminary engineering report.

Tunnel Geologist, BWOAS Tunnel Project, Columbus, OH. Mr. Kesmodel performed construction inspection on this tunnel consisting of 2.5 miles of 12 foot diameter deep ground sanitary sewer tunnel. Inspection duties included recording tunnel boring machine operation, installation of concrete segments, installation of protective sewer lining, safety observations and a communication link between the city construction management team and the contractor.

Engineering Geologist, North Dorchester Bay CSO Tunnel (MWRA) South Boston-Dorchester, MA. Mr. Kesmodel was responsible for the field supervision of Phase #2 geotechnical exploration program for a 19 ft. diameter combined sewer outlet tunnel running through mostly marine clay. He supervised soil boreholes (rota-sonic and standard), rock coring, permeability testing and installation/development of monitoring wells. He also prepared boring logs, geologic evaluations, boulder assessment and geotechnical data report.

Engineering Geologist, No Business Creek CSO, Snellville, GA. Mr. Kesmodel was responsible for the supervision of soil borings, rock coring (Q-system), and in-situ permeability testing by packers in metamorphic rocks of the Piedmont Physiographic Province. Responsibilities included preparing borings log and permeability reports in GINT Version 4.14 and/or Excel database.