

SSFL NPDES WORKPLAN: ENTS & Expert Panel Workplan for SSFL Outfalls 008 & 009

BACKGROUND

The Regional Water Quality Control Board, Los Angeles Region (Regional Board) adopted Cease and Desist Order (CDO) No. R4-2007-0056 on November 1, 2007. This CDO requires The Boeing Company (Boeing) to submit a workplan to evaluate, select and implement natural treatment BMPs (referred to in this report as engineered natural treatment systems, or ENTS) for stormwater discharges in the areas tributary to Santa Susana Field Laboratory (SSFL) Outfalls 008 and 009 (Figure 1). ENTS are an increasingly used practice for treating urban stormwater runoff. Examples of ENTS include constructed treatment wetlands, vegetated detention basins, retention ponds, bioretention systems, and biofiltration systems.

Conventional engineered water treatment systems, such as those employed for the treatment of industrial and municipal wastewaters, use physical, chemical and/or biological treatment processes to remove pollutants from a waste stream. These systems are often operation-intensive and reliant on the consistent availability of resources including power, chemicals, and labor. Any interruption of these resources can render these systems non-operational. For these and other reasons, conventional water treatment systems are rarely used to treat stormwater, particularly given the sporadic, unpredictable, and widely varying volume/flowrate characteristics of these flows.

Additionally, there are other, generally proprietary, mechanical treatment technologies designed specifically for stormwater that rely on sedimentation and/or filtration for sediment and pollutant removal. However these technologies have rarely been applied to stormwater at the scale necessary for implementation at Outfalls 008 and 009 at the SSFL.

ENTS, on the other hand, offer several advantages over proprietary stormwater treatment technologies and conventional water treatment systems. For instance, ENTS are less subject to upset, generally require less maintenance, and are less environmentally intrusive at most locations. Conventional water treatment systems, if constructed at the scale required for treating stormwater design flows and volumes at the SSFL, may cause significant environmental impacts due to the materials, energy, and area required for siting, constructing, operating, and maintaining the necessary structures (e.g., dams, storage tanks, treatment equipment, power supply facilities, and chemical storage). In addition, ENTS have the advantage of treating a wide

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range of pollutants while also potentially offering other environmental benefits such as habitat creation. Finally, Boeing recently agreed to donate their portion of the SSFL to the State to be used as open space after Boeing has completed clean-up of soil and groundwater contamination. ENTS are more compatible with this open space goal than conventional treatment systems and their associated infrastructure.

ENTS utilize many of the same processes as conventional treatment systems by creating conditions favorable to pollutant removal either through physical controls or by incorporating biological processes that perform similar functions as the physical or chemical processes of conventional treatment systems (e.g., filtration, adsorption and sedimentation). ENTS have an advantage however in that they are less reliant on external resources (e.g., power and labor). Furthermore, ENTS can be designed to reduce hydraulic and pollutant loadings by encouraging infiltration (where feasible and appropriate) and evapotranspiration of runoff as well as reduce in-channel runoff velocities by increasing detention storage and desynchronizing the runoff hydrograph.

To help meet effluent limitations for stormwater discharges from the SSFL, engineered multimedia filtration systems have been implemented where immediately feasible, including at Outfalls 003-007, 010, 011 and 018 (shown in Figure 1). Engineered treatment systems have not yet been designed or implemented at Outfalls 008 and 009, primarily due to a reluctance to build environmentally-intrusive treatment structures, with their associated construction-related impacts, at these remote and difficult-to-access riparian areas. ENTS would be preferable in these jurisdictional drainage locations in particular because of the lesser environmental impact they would have on the riparian and other habitats that currently exist there. Therefore, because historical data suggest that treatment of stormwater discharges at these outfalls is required to meet the effluent limits in the NPDES permit, Boeing proposes to implement ENTS in the areas tributary to these compliance points as well as at the outfalls themselves, where possible.

The design process for stormwater treatment systems, including ENTS, requires a “design storm” for sizing guidance. A “design storm” is an expression of the volume, or flow rate, of water to be treated. However, in general, the larger the volume of stormwater to be treated, the greater the size of the treatment system and its water storage area, and therefore the greater the environmental impacts. Regional Board staff originally suggested that the 1 year, 24-hour storm, based on consistency with the Los Angeles Region Trash Total Maximum Daily Loads (TMDLs), may be an appropriate site specific design storm for sizing stormwater treatment systems at the SSFL. This storm was estimated to be equivalent to a 2.3 inch 24-hour event (which has a 6% probability of occurring on any given storm day [i.e., a day recorded with 0.1 inches of rain or greater], based on data from Ventura County Watershed Protection Department

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gauge #249 formerly located at the SSFL) using methods consistent with the Los Angeles County Department of Public Works Hydrology Manual. The existing engineered treatment systems in use at the site, as well as initial design concepts for the ENTS proposed for the Outfall 008 and 009 watersheds, were sized based on this existing site specific design storm. The NPDES Permit for stormwater discharges at the SSFL includes a provision to re-open the permit and incorporate a site specific design storm once one has been recommended to and approved by the Regional Board. For stormwater flows or volumes above the site specific design storm, Boeing has proposed that the numeric effluent limits of the NPDES Permit for stormwater discharges from the SSFL apply only as non-enforceable benchmarks.

Constructing stormwater treatment systems, whether ENTS or conventional water treatment systems, at many locations in the Outfall 008 and 009 watersheds will likely require permits from and coordination amongst Federal, State, and local agencies. The conceptual approach for treatment at these locations and the design of the treatment systems need to be well vetted before this process is initiated. To assist with this vetting and to help assure that the proposed conceptual ENTS designs incorporate the current state of art for stormwater treatment and control, Boeing has proposed to assemble a panel of stormwater hydrology and BMP design experts to perform the following tasks. The expert panel will review and provide recommendations for:

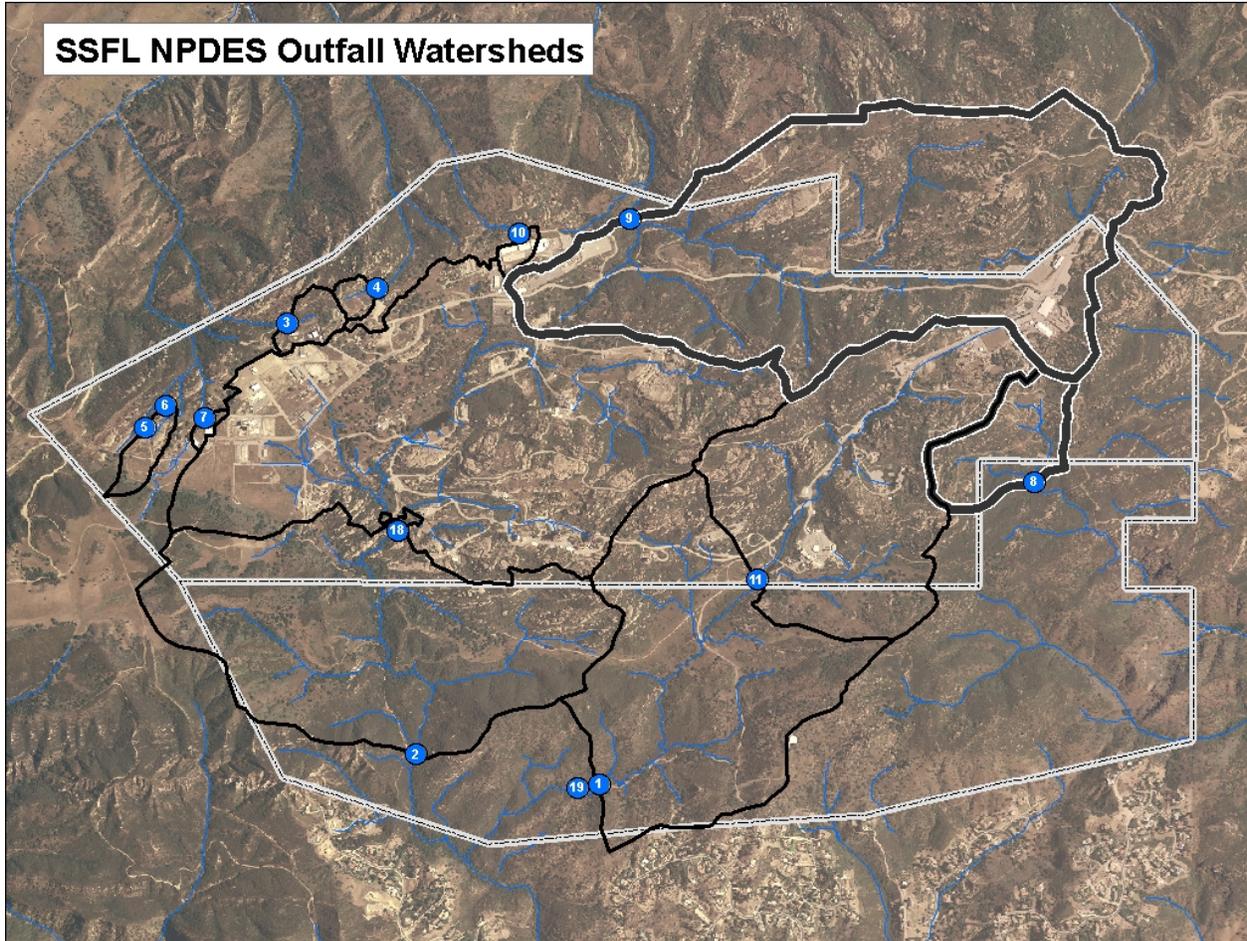
- the proposed site specific design storm for use in sizing all stormwater treatment systems at the SSFL, including the ENTS, and
- the ENTS designs proposed for implementation in the Outfalls 008 and 009 watersheds.

This document is intended to fulfill the requirement of the CDO for the preparation of a workplan, and, in particular, details the tasks and any resulting deliverables required for the review of the proposed design storm, the ENTS evaluation and implementation process, and the proposed schedule for completion.

While the workplan includes a proposed time schedule for the completion of certain tasks, the schedule is intended only to provide an approximate timeframe. It is the Regional Board and Boeing's intention to provide public review and an opportunity to comment at certain stages of the process, which may impact the proposed schedule. Also, availability of the Expert Panel members may affect when work can be completed. Lastly, to the extent permits are required from governmental agencies, Boeing is unable to ensure when such permits are issued. Thus, the various dates included in this workplan are not intended to function as deadlines. The only applicable compliance dates are those set forth in the NPDES permit for the SSFL and the CDO.

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Figure 1. Outfall 008 and 009 Watersheds (drainage boundaries highlighted)



OUTFALLS 008 & 009 ENTS IMPLEMENTATION AND SITE SPECIFIC DESIGN STORM DEVELOPMENT WORK PLAN

This workplan describes the individual steps that will be taken to implement ENTS in the areas tributary to Outfalls 008 and 009 at the SSFL and to develop a site-specific design storm. Table 1 itemizes each task, the team members involved and the target dates for completion. Each task is then described in more detail below.

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Table 1. ENTS Workplan Tasks and Estimated Completion Dates

Task	Involvement	Estimated Date of Completion
1. Expert Panel Selection and Assembly	Geosyntec, Regional Board staff, Potential Panelists	December 21, 2007
2. Public Outreach and Involvement	Geosyntec, Boeing (and Boeing Project Team Members), Interested Stakeholders	Ongoing
3. Complete Review of Site Specific Design Storm and Report to Regional Board	Expert Panel, Geosyntec	February 15, 2008
4. Presentation of Draft Conceptual ENTS Designs to Expert Panel	Geosyntec	February 15, 2008
5. Complete Review of Conceptual ENTS Designs	Expert Panel, Geosyntec	April 15, 2008
6. Complete Final Conceptual ENTS Designs	Geosyntec (with final review by Expert Panel)	May 15, 2008
7. Presentation of Preliminary ENTS Designs to Expert Panel	Geosyntec	June 16, 2008
8. Approval of Final ENTS Designs	Geosyntec (with Review by Expert Panel)	July 15, 2008
9. Complete ENTS Permitting (assuming EIS/EIR is not required)	Geosyntec, Other Contractors, Boeing	August 15, 2008
10. Complete ENTS Construction (assuming EIS/EIR is not required)	Geosyntec, Other Contractors, Boeing, and review by Expert Panel	October 31, 2008
11. Report First Season Results of ENTS Performance Monitoring	Geosyntec, Other Contractors, Expert Panel	June 10, 2009

Task 1. Expert Panel Selection and Assembly

Estimated Completion Date: December 21, 2007

Deliverables: Panel Selection summary memorandum

An independent panel of experts will be assembled to establish a design storm and to provide technical oversight on the design of the ENTS being evaluated for Outfalls 008 and 009. Geosyntec Consultants (Geosyntec) submitted a proposal to Boeing on October 30, 2007, to

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manage the Expert Panel design storm and ENTS design review process and was provided to Regional Board staff on November 1, 2007. This proposal is included as Attachment 1 to this workplan. The proposal includes a proposed organization chart describing the project team and the lines of communication for the ENTS design and Expert Panel review process.

Geosyntec has compiled an extensive list of potential panelists who are each an expert in a field related to stormwater hydrology and/or BMP design. This list was based on recommendations from Boeing's consultants (including Geosyntec) and included input from Regional Board staff and a local environmental advocacy group, Heal the Bay. A list of these experts, and their resumes (for those who provided them), is included as Attachment 2 to this workplan.

Interest solicitation letters were reviewed by Regional Board staff and then mailed and emailed to each listed potential panel member on Friday, November 16, 2008. An example request letter is included as Attachment 3 to this workplan. The letter introduces the project, inquires about the potential panelist's willingness to participate in the Expert Panel, and asks interested potential panelists to provide a "statement of qualifications" or similar information no later than November 30th, 2007. Upon receiving letters of interest from potential panelists, Geosyntec, in consultation with Regional Board staff, will then choose 4 to 6 preferred panelists representing the various areas of relevant technical expertise. Upon approval from Regional Board staff, Boeing will make public the final list of names and resumes of those experts chosen to serve on the Expert Panel through publication on the Boeing project website as well as through public outreach events (see Task 2). Provided timely input from the Regional Board, the selection process will be completed by December 21, 2007.

Once selected, Geosyntec will provide the Expert Panel with the documents necessary to provide background information on the project and coordinate a site visit and meeting to take place as soon as possible, likely after the first of the year. Geosyntec will then prepare a technical memorandum that describes the purpose, membership, and timeline for the Panel for submittal to the Regional Board, as well as for distribution to the public and posting on the project website. Preliminarily, it is anticipated that the Panel will meet on a regularly scheduled basis during the period of January through March, 2008. The remainder of the coordination and communication with the Panel members will occur through conference calls and emails.

Task 2. Public Outreach and Involvement

Estimated Completion Date: Ongoing

Deliverables: None

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Numerous stakeholder groups and members of the general public have expressed interest in the stormwater issues at the SSFL at past Regional Board hearings. In an effort to keep these groups and others apprised of progress (e.g., of ENTS planning/implementation and of the Expert Panel review process), and provide an opportunity for public input, periodic public forum meetings will be held.

Geosyntec and the Expert Panel will periodically meet with stakeholder groups and the general public during the review and development process. Project status reports and submittal documents will also be posted on the Boeing project website after major project milestones and prior to public outreach meetings. The general public and stakeholder groups will be invited to participate in meetings led by Geosyntec or other Boeing team members to gather public input on the Expert Panel process and the proposed ENTS plans and the site specific design storm. In this way, the public can actively participate in the project, providing stakeholders an opportunity to provide input at various stages throughout the ENTS planning process, including input that the Expert Panel can consider in reviewing and approving the ENTS.

This task will be ongoing. It is anticipated that website publications and meetings will be scheduled when necessary except where particularly noted in each task description. The following public meetings are tentatively scheduled at this time.

Purpose	Approximate Date
Introduce Expert Panel to stakeholder group, present initial ENTS alternatives, stakeholder Q&A	January, 2008
Present conceptual ENTS design status and Expert Panel design storm recommendations, stakeholder Q&A	March, 2008
Present conceptual ENTS designs and Expert Panel ENTS design recommendations, stakeholder Q&A	April, 2008
Present ENTS implementation status	September, 2008
Present initial (year 1) ENTS performance monitoring results	June, 2009

Task 3. Expert Panel Review of Site Specific Design Storm

Estimated Completion Date: February 15, 2008

Deliverables: Recommendations for Site-Specific Design Storm

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Geosyntec will prepare a technical memorandum that summarizes modeled hydrology and potential site specific design storms, as well as analysis results of various potential design storms on stormwater treatment system performance (e.g., percent average annual runoff volume captured and treated, and reduction in number of discharge events per year). The Expert Panel will review this information along with existing precipitation data for the site and area and hydrologic modeling reports and analyses. They will then use this information to assess the appropriateness of the existing 1 year, 24-hour design storm used at the site to size the multimedia stormwater filtration systems currently in place and/or the proposed ENTS. They will evaluate the appropriateness of this design storm, the need, if any, for modifications to this design storm, and ultimately recommend the site-specific design storm (or, potentially, multiple watershed-specific design storms) for use at the SSFL.

Task 4. Draft Conceptual ENTS Designs

Estimated Completion Date: February 15, 2008

Deliverables: Draft ENTS Conceptual Design Report, including ENTS selection rationale technical memorandum, ENTS design flow technical memorandum, ENTS drainage area maps, and conceptual ENTS design drawings

Geosyntec will review drainage information for the outfall subwatersheds, identify priority areas for siting the ENTS, delineate ENTS drainage areas (based on topography data, stormdrain drawings or video technology, and visual observations), and model the drainage areas to compute the 1 year, 24-hour design flows and volumes for use in ENTS sizing. These hydrologic and ENTS sizing calculations may need to be revisited after the Expert Panel provides final recommendations on the site specific design storm. ENTS types and locations will then be selected for the priority locations based on the following objectives:

- Maximize compliance with the Permit's final numeric effluent limits for Outfalls 008 and 009;
- Capable of being implemented within the Permit's compliance schedule;
- Feasible given unique site conditions (i.e. remediation issues, topography, and climate);
- Have the ability to treat stormwater discharges up to the design storm;
- Provide redundant treatment of runoff to maximize compliance;
- Incorporate design options that would minimize and/or mitigate impacts on the surrounding environment; and

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- Provide habitat value to indigenous plant and animal species.

Permitting and CEQA consultants, as well as SSFL remediation staff, will provide input during the ENTS location selection phase to improve the likelihood of project success, and to initiate the permitting process with various agencies. Geosyntec will also coordinate with SSFL remediation and facilities management staff early in the planning process to identify opportunities and constraints according to those personnel most familiar with the site and the areas tributary to Outfalls 008 and 009.

Continuous hydrologic modeling of existing and proposed (i.e., after ENTS implementation) scenarios will be performed to evaluate hydrologic performance and discharge frequency and/or volume reductions. Initial draft concepts, such as the initial proposed ENTS locations and types, which should be available in December, will be presented to the Expert Panel for their consideration and input to facilitate the review process and minimize significant design changes late in the planning process. This information will also be presented to interested stakeholders during a designated public outreach meeting.

Conceptual ENTS design drawings will then be prepared for presentation to and review by the Expert Panel.

Task 5. Expert Panel Review of Draft Conceptual, Preliminary and Final ENTS Designs

Estimated Completion Date: April 15, 2008; July 1, 2008; and July 31, 2008, respectively

Deliverables: Recommendations on ENTS design

Geosyntec will present the draft conceptual, preliminary, and final ENTS designs for Outfalls 008 and 009 to the Expert Panel. The Expert Panel will review the ENTS designs in light of the newly recommended site-specific design storm, BMP performance monitoring studies and reported data, NPDES permit requirements, receiving water issues (including TMDLs), and SSFL effluent limit compliance history and discharge monitoring data. The Expert Panel will evaluate the conceptual BMP designs and recommend modifications as necessary with the intent to finalize conceptual system designs that best meet the previously stated objectives. They will also review the preliminary and final designs provided by Geosyntec.

Task 6. Final Conceptual ENTS Designs

Estimated Completion Date: May 15, 2008

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Deliverables: *Final ENTS Conceptual Design Report*

Geosyntec will prepare final conceptual ENTS designs for Outfalls 008 and 009 based on comments, feedback and recommendations from the Expert Panel on the draft conceptual ENTS designs. These final conceptual designs will be presented to Expert Panel for final review.

Task 7. Preliminary ENTS Designs

Estimated Completion Date: *June 16, 2008*

Deliverables: *Preliminary (30%) ENTS Design documents*

Geosyntec will prepare 30% ENTS designs for Outfalls 008 and 009. Geosyntec will consult with the Expert Panel throughout the preparation of these design documents to ensure that the designs are completed according to the Expert Panel's expectations. The preliminary designs will be presented to the Expert Panel for their review and comment.

Task 8. Final ENTS Designs

Estimated Completion Date: *July 15, 2008*

Deliverables: *Final ENTS Design documents*

Geosyntec will prepare final ENTS designs for Outfalls 008 and 009. Geosyntec will consult with the Expert Panel throughout the preparation of these design documents to ensure that the designs are consistent with the Expert Panel's expectations. The final designs will be presented to the Expert Panel for their review and comment.

Task 9. Acquire Permits

Estimated Completion Date: *August 15, 2008*

Deliverables: *None*

Geosyntec, Boeing staff and other contractors will coordinate with the appropriate agencies regarding any permits required for ENTS implementation. Depending on locations of the ENTS, permits may be required from the following agencies: California Department of Fish and Game (CDFG), Army Corps of Engineers (ACOE), Regional Water Quality Control Board (RWQCB), and the County of Ventura. These permits may or may not include the following: ACOE/RWQCB 404/401 certification; CDFG 1601 streambed alteration agreement;

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CEQA/NEPA approval; SWRCB general NPDES permit for discharge of stormwater from construction sites (including an associated SWPPP); and County grading, encroachment and protected tree permits. Where permits are required, it will be necessary to determine the appropriate level of CEQA/NEPA review, if any. Geosyntec will begin coordination with the relevant agencies early in the design process to prevent delays to construction due to permitting. CEQA/NEPA support will be provided by Impact Sciences. This effort will be initiated in December, 2007 to ensure environmental documentation is completed in time for the targeted construction start date of August 15, 2008. This schedule assumes that an EIS or EIR is not required for construction of the ENTS.

Task 10. ENTS Construction

Estimated Completion Date: October 31, 2008

Deliverables: None

Geosyntec, other contractors and Boeing staff will manage and perform construction of the ENTS at areas tributary to Outfalls 008 and 009 after final designs are completed. The targeted start date for Boeing contractors to begin construction is August 15, 2008, with completion of construction anticipated by October 31, 2008; the final schedule will be dependent upon permitting. The target date for vegetation establishment and system performance stabilization is June 2009, when final Permit effluent limits become effective at Outfalls 008 and 009.

The Expert Panel will be available to provide technical oversight to Boeing contractors during the construction phase of the project so that final system design and installation is conducted according to the Panel's expectations. They will also inspect the facilities upon completion.

Task 11. ENTS Performance Monitoring

Estimated Completion Date: June 2009

Deliverables: ENTS Performance Monitoring Plan, ENTS Performance Monitoring Reports

Geosyntec will coordinate with the Expert Panel to develop an ENTS performance monitoring plan to assess the water quality treatment and Permit compliance performance of the ENTS. The monitoring plan will specify how the performance of the ENTS will be assessed, and will be submitted for Regional Board approval in July 2008. ENTS performance monitoring will begin in the 2008/2009 wet season, however maximum performance will not be expected until after vegetation establishment, or at the start of the 2009/2010 wet season. An ENTS performance

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monitoring report summarizing results from the 2008/2009 monitoring season will be completed prior to the first storm of the 2009/2010 wet season.

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ATTACHMENT 1

30 October 2007

PROPOSAL: SSFL ENTS Design and Expert Panel Management

Geosyntec Consultants (Geosyntec) is pleased to provide this proposal to assist with the development of Engineered Natural Treatment System (ENTS) designs for outfall 008 and 009 watersheds, and management of the Design Storm and ENTS Expert Panel process. An Expert Panel of leading ENTS researchers and practitioners will be convened consistent with requirements of the revised tentative Cease and Desist Order for the Boeing Santa Susana Field Laboratory (SSFL or Site), as part of the NPDES permit for stormwater discharges from the Site. The Expert Panel's primary scope items will consist of reviewing a site-specific design storm and reviewing ENTS designs proposed for outfall 008 and 009 watersheds.

Geosyntec's scope will consist of the following tasks:

- develop an outfall 008/009 work plan for submittal to the Regional Board by December 15, 2007 and to include those components listed in the Cease and Desist Order (i.e., time schedule for planning, design, permitting, and construction tasks that are to be conducted between November 2007 through June 2009; Expert Panel formation and milestones; conceptual ENTS design reports; and schedule to evaluate ENTS performance);
- facilitating and managing Expert Panel meetings;
- coordinating with the Expert Panel, such as providing them with background information on, or answering questions about, the Site;
- developing options for the Expert Panel to consider for potential site-specific design storms and incorporating Expert Panel recommendations on a site-specific design storm into the ENTS conceptual designs for outfall 008 and 009 watersheds;
- incorporating Expert Panel recommendations on the ENTS into revised conceptual designs documents/drawings;
- incorporating follow-up design recommendations from the Expert Panel into the preliminary and final ENTS designs; and
- Manage the implementation of the ENTS designs (i.e., construction and installation).

The attached organizational chart summarizes the key members of our proposed team, including Geosyntec and non-Geosyntec task leaders. Lines of communication are shown, along with roles of each person. The roles included on the organizational chart are described as follows:

Principal in Charge – This person will interface with Geosyntec’s Project Manager. The Principal in Charge for Geosyntec generally has a perspective of the Geosyntec-client relationship that extends beyond the current project. The Principal in Charge also serves as an alternate point of contact if issues arise that need to be discussed with a Geosyntec contact other than the Project Manager.

Expert Panel Coordinator/Facilitator – This person will facilitate Expert Panel meetings, and assist the Expert Panel by providing the resources needed to reach resolution.

Expert Panel Technical Advisor – This person will be responsible for direct interaction with the Expert Panel, including overseeing preparation and presentations of technical documents and fielding technical questions from the Panel on the Panel’s scope and/or questions about proposed plans, designs, potential design storms, project constituents of concerns, permit requirements, and other technical information.

Senior Technical Advisor – This person will provide consultation on high level issues related to the design storm and design recommendations from the Expert Panel, and will provide additional review of design drawings produced by the Geosyntec team. This person will be regularly updated on Expert Panel progress and findings by the Project Manager.

Project Manager – This person will interface directly with the Expert Panel Facilitator and Technical Advisor, will provide both Boeing and Los Angeles Regional Water Quality Control Board (LARWQCB) staff with updates on Expert Panel progress and findings, and will manage budget and schedule issues. This person will also interface with the various technical leaders in managing the overall effort of implementing recommendations received from the Expert Panel.

ENTS Design – These task leaders will be responsible for incorporating ENTS design storm and other recommendations into conceptual, preliminary, and final designs.

Hydrology – These staff will be responsible for conducting additional hydrologic analyses for the purpose of preparing design storm options for the panel to consider, as requested by the Expert Panel, and as needed for design.

Geotechnical – These staff will be responsible for assessing geotechnical issues as they relate to ENTS design and implementation and for assistance in conceptual through final design of the ENTS systems.

Remediation – These staff will be responsible for coordinating with remediation and groundwater hydrology experts as issues arise related to ENTS location, design, and construction.

Construction Oversight – These staff will be responsible for managing contractors, schedule and budget during the ENTS construction effort. They will also provide advice during the planning through final design phases with regards to construction issues (constructability) as well as scheduling of construction.

Performance Monitoring/Adaptive Management – These staff will be responsible for developing ENTS performance monitoring plans, overseeing implementation of the ENTS performance monitoring program, and providing recommendations regarding ENTS design modifications/upgrades based on monitoring results for Expert Panel review.

Other Contractors – These non-Geosyntec contractors will be utilized as necessary to assist with NEPA/CEQA permitting, ACOE and CDFG permitting (for projects planned within jurisdiction drainages), native plant species recommendations, design aesthetics and irrigation issues (landscape architect), shallow and deep groundwater hydrology as depth to groundwater and potential groundwater quality issues impact ENTS designs, hydraulics and pumping design elements, and construction and installation.

As we have not yet secured the entire project team, some roles have question marks remaining in the organizational chart. These project staff assignments will be designated in coming weeks as the scope and project details become clearer after the November 1st Board hearing and ensuing meetings with Regional Board staff, and we have an opportunity to approach candidate contractors to discuss this project opportunity with them.

The Geosyntec staff that are assembled for this project represent highly-qualified experts in their respective fields, and bring many years of relevant project experience to the Site. Biosketches for these key Geosyntec staff are attached.

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30 October 2007
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Please contact us with any questions or comments regarding this proposal. We appreciate the opportunity to continue work on this challenging and interesting site.

Sincerely,



For Eric Strecker, P.E.
Principal

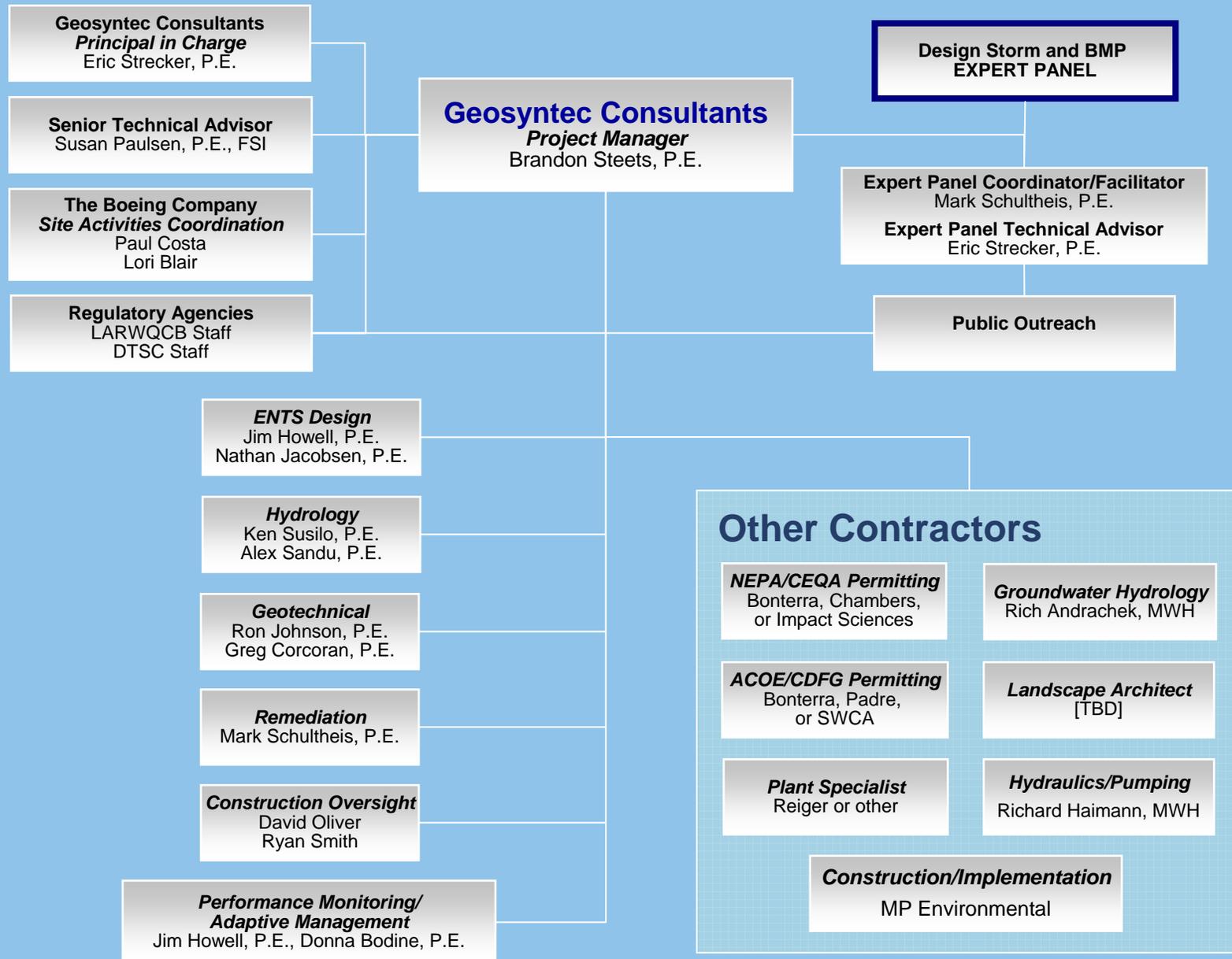


Brandon Steets, P.E.
Project Manager

Attachments: Organizational Chart and Geosyntec Staff Biosketches

Copies to:

SSFL ENTS Design Team



Eric Strecker, P.E. – Principal-In-Charge, Expert Panel Technical Lead, Performance Monitoring/ Adaptive Management

Mr. Strecker is a recognized authority in the area of stormwater management, especially in the design, monitoring, and evaluation of BMPs. For over 17 years, Mr. Strecker has provided technical direction and assistance to public and private sector clients in stormwater master planning, NPDES permitting and surface water pollution assessment and control. On behalf of the United States Environmental Protection Agency (USEPA), Mr. Strecker conducted a comprehensive, nationwide study of BMP effectiveness. Included in this study was an assessment of the protocols used to evaluate BMPs. The results, which concluded that there exist wide discrepancies in evaluating the effectiveness of BMPs, were provided to USEPA headquarters. He has also prepared municipal NPDES stormwater permit applications for the cities of Portland, Eugene, and Gresham, Oregon, and Boise, Idaho. All four permits involved development of city-wide stormwater management plans specifically designed to address local stormwater pollution issues. The City and County of Honolulu also retained Mr. Strecker to develop water quality standards that the City and County could use to control run-off from new development projects. Mr. Strecker is currently working on the San Diego Creek Natural Treatment System project in Orange County, which involves the design of 31 stormwater treatment wetlands throughout the over 100-square mile watershed; in addition to, the Clackamas County Stormwater Master Plan.

Mr. Mark Schultheis, P.E. – Expert Panel Coordinator, Remediation

Mr. Mark Schultheis, P.E. is an Associate Environmental Engineer with Geosyntec Consultants in Huntington Beach. His professional practice focuses on developing solutions to complex environmental problems, and in gaining consensus from regulatory agencies. He has extensive experience in managing projects for superfund programs that include a broad range of disciplines. His work on such programs includes work plan preparation, remedial investigations, feasibility studies, remedial design, construction management, startup, and operation & maintenance. He has worked frequently on multi-party sites, under regulatory oversight provided by DTSC, RWQCB, and USEPA. Mr. Schultheis also has considerable experience in management of Brownfields sites and other redevelopment projects. For such projects, Mr. Schultheis develops and implements regulatory strategies designed to gain agency concurrence with client redevelopment goals. In particular, Mr. Schultheis has led Geosyntec teams emphasizing redevelopment over properties that pose potential indoor vapor risk.

Brandon M. Steets, P.E. – Project Manager

Mr. Steets has significant experience in conducting and managing water quality modeling projects to support BMP planning, watershed assessment, and TMDL development/implementation activities. His experience includes watershed modeling, stormwater water modeling, BMP selection and design, water quality monitoring, and providing regulatory liaison support for municipal NPDES and WRR permits. Recent projects have included: technical review of complex watershed and groundwater-surface water interaction modeling studies for the Santa Clara River nutrient and chloride TMDLs, management of an intensive ongoing receiving water monitoring program to support a proposed wastewater reclamation plant's municipal NPDES permit application, stormwater quality modeling and BMP design support for various Southern California new development projects, SWPPP development and design and construction of structural stormwater treatment BMPs for a hazardous waste site in Orange County, and development of the Los Angeles Countywide Structural BMP Methodology for Heal the Bay, Los Angeles County, and the City of Los Angeles.

James Howell, P.E. – ENTS Design, Performance Monitoring / Adaptive Management

Mr. Howell has more than nine years of experience in water resources projects. His experience includes; designing and installing stormwater quality monitoring equipment for Portland BES and Caltrans, stormwater monitoring for the Cities of Gresham, Portland, and Spokane, statistical analysis and reporting of stormwater monitoring data (USEPA and Caltrans), and water quality modeling. Mr. Howell conducted research on Best Management Practices (BMP) effectiveness for EPA's Nationwide BMP Database. Mr. Howell is also familiar with stormwater

BMP design, construction, and maintenance requirements having personally conducted an assessment of over 150 privately owned stormwater BMPs for Washington County's Unified Sewerage Agency. Mr. Howell developed the stormwater monitoring plan for the Crystal Cove development in southern California. Mr. Howell is also managing the "ODOT Water Quality Facility Investigation" and the "North Natomas Wet-Basin Study" currently being conducted by GeoSyntec. Mr. Howell has worked on several innovative water quality improvement projects. He was project manager for a pilot study to evaluate the effectiveness of constructed wetland at removing selenium from groundwater for which he set up and evaluated both micro- and mesocosm scale experiments. He designed a reclamation and reuse system for a private golf facility that captures and treats return flows using cisterns and pumps all but eliminating surface discharge from the property. He designed and constructed outlet modifications for a marsh system that employs siphons to regulate discharge under complex tidal backwater conditions. He was lead design engineer for a landfill phyto-cap leachate reuse irrigation system that employed booster pumps, an integrated control system to optimize irrigation application based on evapotranspiration and soil moisture, complex telemetry, and large scale hydraulic design.

Nathan Jacobsen, P.E. – ENTS Design

Mr. Jacobsen specializes in hydrology and hydraulics, water quality analysis and sampling and design of BMPs. Some of his relevant experience includes his recent involvement in providing emergency post-fire assessment of potential erosion and flooding impact from the October 2003 San Diego County fires. Mr. Jacobsen was the Lead Coordinator of field teams assessing impacts and implementing erosion and sediment control BMPs to mitigate watershed impacts. For the Huntington Beach Surf Zone and Urban Runoff Water Quality Investigation, Mr. Jacobsen assisted in the design of a Surf Zone Monitoring Plan, which included continuous water quality sampling at various locations of State and City-owned beaches. He led a field crew to conduct 24-hour surf zone sampling; assisted in the identification and coordination with the analytical laboratory; developed sanitary surveys specifically designed to identify bacterial water quality of urban runoff; defined the watershed boundaries through analysis of storm drain and topographic maps; and assisted in the conceptual designs of BMPs to remedy bacterial effects in the surf zone. For the Caltrans Detention Basin Optimization Study, Mr. Jacobsen assisted in the redesign of 18 detention basins along SR-73 to assess the effectiveness of various detention basin sizes and outlet controls to improve water quality. The design included determination of existing hydrology and hydraulics, establishing basin layouts to minimize construction costs and facilitate maintenance equipment, and developing plans, specs, and estimates for construction.

Ken J. Susilo, P.E., D.WRE, CPSWQ– Hydrology

Mr. Susilo, has over 16 years of experience in engineering design, hydraulics, hydrology, computer modeling, and storm water management. This experience includes project management and using statistical and analytical models for water quality, hydraulic, and hydrologic analyses. A major part of Mr. Susilo's work involves water quality and NPDES Phase I and Phase II permitting, and strategies for the improvement of water resources. Mr. Susilo's efforts focus on the development of multi-benefit, environmentally sensitive solutions to design and planning efforts, while cost-effectively leveraging leading-edge technologies to enhance the natural and built environment. In 2006, Ken was recognized as the ASCE Outstanding Civil Engineer in the Private Sector by the Los Angeles Section, Metropolitan Los Angeles Branch, and Region 9 (State of California). Mr. Susilo was the Technical Project Manager for the Santa Monica Bay Bacterial TMDL Implementation Plan (J1/4), Technical Consultant to the Los Angeles Unified School District, and was technical lead or manager for BMP prioritization studies conducted for the Santa Monica Bay Restoration Commission, North East Trees, City of Anaheim and Heal the Bay. He served on the ASCE Report Card subcommittees for Urban Runoff for Los Angeles County, Orange County, and the State of California. He is also a Board Member for the AWRA Southern California Section (Founding Member), the Urban Water Institute, and University of California, Berkeley Engineering Alumni Association.

Alex Sandu, Ph.D., P.E. - Senior Staff Engineering Specialist

Dr. Sandu's water treatment design experience includes performing multidisciplinary calculations for wetland design (natural treatment systems), hydraulic modeling for storm system sewer design, and preparing detailed design plans using AutoCAD. He proposed the conceptual design for the Constructed Treatment Wetlands Fairview Park Restoration Project in Cost Mesa, CA. Dr. Sandu prepared designed plans for the implementation of a prospective BMP (Street Ends Biofiltration Project) for the City of Los Angeles, which involved the calculation of site runoff volumes using multiple methods. Dr. Sandu has analyzed water and land development, environmental data, health parameters, watershed planning and Brownfields data. Dr. Sandu also developed and applied an innovative GIS database for historically polluted sites to support multi-criterion and multi objective analysis and decision making for Brownfields resource planning, rehabilitation and management. Dr. Sandu has also interpreted pilot water treatment plant results, analyzed water quality parameters, and written technical reports. As a project manager, Dr. Sandu has interfaced with numerous City and Public Works agencies, has prepared and evaluated plans, progress reports, and cost evaluations, has conducted code compliance inspections, and has supervised and coordinated work schedules for up to 80 employees.

Ron Johnson, P.E. – Geotechnical

Mr. Johnson's 18 years of experience includes that of a design manager, team leader, and project manager/engineer on individual geotechnical consulting assignments and multidisciplinary civil engineering projects. He is responsible for engineering analysis and design, technical administration, scheduling, quality assurance, client relations and financial management. His experience project experience includes transportation and water infrastructure, solid waste facilities, low-level radioactive waste disposal facilities, power generation, large land development, high-rise developments, commercial/industrial facilities, coastal structures, landslides, and heap leach mining facilities. He has been the PM for three engineering service contracts with San Diego County.

Gregory T. Corcoran, P.E. – Geotechnical

Mr. Corcoran's experience in civil and geotechnical engineering practice and construction includes technical contributions to many geosynthetic, embankment, landfill liner system, and landfill closure system designs. Mr. Corcoran has over 15 years of landfill design and construction experience and has been involved with the design and construction of over 60 landfill bottom liner and final cover systems consisting of geosynthetic and natural soil and aggregate materials. Mr. Corcoran's experience with environmental remediation includes technical contributions to several soil vapor extraction (SVE), dual phase extraction (DPE), pump and treat, excavation and removal, chemical oxidation, bio-augmentation, and natural attenuation remedial technologies. His experience in design/build/operate (DBO) of remediation systems has allowed for several successful turn key projects.

David Oliver – Construction Oversight

Mr. Oliver has more than 25 years of experience in general construction and environmental remediation, specializing in management, design build/value engineering, design review for constructability, problem resolution, contract administration, project controls, quality assurance/quality control (QA/QC). His experience includes projects in public utilities, soil and groundwater remediation under CERCLA and RCRA, landfill leachate and landfill gas controls, the space and defense industries, and in dealing with local, state, and federal regulatory agencies. Past projects have included design and construction services for groundwater, leachate and semiconductor manufacture waste water treatment systems, building demolition the excavation and disposal of PCB, VOC- and hydrocarbon-laden soils; installation of underground utility systems, mechanical and electrical system installation, and building construction. Mr. Oliver has managed construction projects and coordinated Brownfield redevelopment projects. He has supervised the preparation of project schedules and cost estimates and managed project cost tracking. In addition, Mr. Oliver has supervised subcontractors, monitored on-site health and safety and managed field construction, operation and maintenance and contract administration staff.

Ryan Smith – Construction Oversight

Mr. Smith has 6 years experience in the environmental industry and has a solid background in environmental assessment and remediation. His professional experience includes removal, assessment and remediation at Leaking Underground Fuel Tank sites, including design, field implementation, and oversight of groundwater monitoring well installation, remedial excavations, thermal oxidizer/Soil Vapor Extraction installation and operation, groundwater extraction and treatment systems, and hydrogen peroxide injection systems. Mr. Smith has direct field experience with soil and groundwater remediation system installation, remedial soil excavation, groundwater monitoring well installation and sampling, aquifer pump testing and monitoring, surface water monitoring and sampling, and soil vapor probe installation and monitoring and sampling.

Donna Bodine – Performance Monitoring / Adaptive Management

Ms. Bodine has twelve years of experience in environmental consulting specializing in water resources. Her primary areas of expertise are municipal NPDES Permit compliance and stormwater management. Ms. Bodine has experience conducting water quality monitoring and data analysis. She has designed and implemented monitoring studies to evaluate the effectiveness of stormwater treatment systems and other best management practices, and to evaluate the effects of watershed activities on water quality. This includes preparation of monitoring and quality assurance plans, field sampling activities (including training of field crews), and data analysis. Ms. Bodine is also an expert in evaluating the quality and limitations of analytical data and has served as project chemist on more than 50 surface water, groundwater, and soil investigation projects.

ATTACHMENT 2

Invited Expert Panel Members (in alphabetical order by last name)

1. Rich Ambrose, Ph. D
2. Michael Barrett, Ph. D
3. Norris Brandt, P.E.
4. Bob Gearheart, Ph. D
5. Wayne Huber, Ph. D, P.E.
6. Bill Hunt, Ph.D, P.E.
7. Rich Horner, Ph. D
8. Jon Jones, P.E.
9. Mike Josselyn, Ph. D
10. Robert H. Kadlec, Ph. D
11. Bob Pitt, Ph. D, P.E.
12. Larry Roesner, Ph. D, P.E.
13. Betty Rushton, Ph. D
14. John Sansalone, Ph. D
15. Ken Schiff
16. Mike Stenstrom, Ph. D, P.E.
17. Martha Sutula
18. Ben Urbonas, P.E.
19. Marty Wanielista, Ph. D

ROBERT A. GEARHEART

EDUCATION

- Ph.D. Civil Engineering University of Oklahoma, 1969,
Professor George Reid
- M.S. Civil Engineering- University of Oklahoma, 1965,
Professor George Reid
- B.A. Biology and Mathematics- North Texas State University, 1964,
Dr. J. K. G. Silvey

Professional Engineer – Registered Civil Engineer State of California –C 38158

EMPLOYMENT EXPERIENCE

- 1975- Emeritus Professor, Department of Environmental Resources Engineering, Humboldt State University, Arcata, California, undergraduate engineering instruction water quality, low cost water and wastewater treatment, water and wastewater treatment, hazardous waste management. Co-Director of International Development Technology Program Graduate Program. Research wetland treatment systems for domestic effluent and water reclamation, non-point source pollution marsh treatment system, use of wetlands for denitrification and perchlorate reduction, role of wetland restoration and watershed management, use of conjunctive watershed/lake models to manage eutrophication, surf zone and ocean monitoring, solid and hazardous waste management, and environmental impact analysis. Advising graduate students, Engineering, Biology, Geology and International Development, Faculty Advisor for HSU's Chapter of Engineers Without Borders
- 1971-1975 -Associate Professor, Division of Environmental Engineering, Utah State University, undergraduate and graduate instruction, research, statewide extension program, water supply, water reclamation, wastewater treatment and solid waste management, spray irrigation of waste effluent.
- 1970-1971 -Engineer-Manager, Beaver Water District, Regional Water Supply System, Northwest Arkansas (one-half time). Design, operation, personnel and fiscal tasks associated with 10 MGD plant.
- 1968-1971 -Assistant Professor of Civil Engineering; University of Arkansas-Undergraduate and graduate courses in Sanitary Engineering-Research in eutrophication and water quality modeling, and biological treatment processes.

ORGANIZATIONS/AFFILIATIONS

- American Water Works Association-Life member
- Water Environment Federation
- International Water Association
- Society of Wetland Scientists
- Sierra Club
- Audubon Society

RESEARCH AND CONSULTING EXPERIENCE

- 2007 Water Reuse Foundation, Water Reuse Alternatives for small Communities, John Carollo Engineers, Walnut Creek, Ca.
- 2007 US Fish and Wildlife Service, Sprague River Valley, Oregon, Design of Constructed Wetland to treat irrigation tailwater and agricultural runoff
- 2007 City of Arcata, California, Upgrade of Arcata's water reclamation constructed wetland
- 2007 Humboldt Bay Harbor and Recreation District, Community member on 5 years strategic master plan-water quality and harbor natural resources
- 2007 Orick Community Service District, Orick, California, MOU between HSU and District to assist with decentralized wastewater treatment and water reclamation
- 2007 WorldBank, Wastewater Management Master Plan, Dhaka, Bangladesh, Mike 11 Model
- 2007 USEPA, Review of stormwater wetland system for Boise, Idaho, Dept. of Public Works
- 2007 Brown and Caldwell, Portland, Oregon, Review of Boeing Aircraft Stormwater Wetland
- 2006 Guizhou Province, China, Feasibility Plan for Use of Constructed Wetland to Treat Refinery Waste and to Restore Wetland Habitat, Sino-US Prosper in Peace Association
- 2006 Garberville, California, Design of constructed wetland to treat domestic effluent with use of UV

for disinfection, LACO Engineers, Eureka, California

2006 Conceptual Design of Wetland System to Treat Domestic and Agricultural Wastewater, Lake Qarun, Fayoum, Egypt, Montgomery Watson Harza Engineering

2005-Present Hatfield Science Team, USFWS-Klamath Falls, Oregon

2005 City of Cumberland, B.C., Design of Constructed Wetland to treat Domestic Wastewater

2004 City of Fort Bragg, California, Wetland Treatment Conceptual Plan for Redevelopment of the Georgia /Pacific Industrial Site

2004 Technical Review Team for Malibu Lagoon Restoration Plan-Heal the Bay/California Coastal Conservancy

2003-Present Review Bureau of Reclamation Flow Studies for the Klamath River-Yurok Tribal Council

2003 Wetland restoration design Caledonia Marsh, Klamath Falls Oregon, USFWS

2004 Wetland design, agricultural runoff, K and K Ranch, Klamath Falls, Oregon USFWS

2004 Treatment Wetland Design for Collins Products, Klamath Falls, Oregon

2004-Present Public Utility Commission, City and County of San Francisco, Technical Review Team, Water Reuse and reclamation, technical selection process for wastewater treatment systems

2001 –2003 Fish and Wildlife Service-Klamath Falls Oregon-Wetland design-agricultural runoff/habitat

2002 Santa Clara Valley Water District – Water reuse wetland application.

2002 DeForest Park Wetland Design – Long Beach, CA Coastal Conservancy.

2001-Present Colorado Lagoon – Long Beach, CA. Non-point source pond/wetland treatment system.

2001 Port Authority, City/County San Francisco, CA. Non-point source Master Plan

2001 Status of the Science White Paper, Klamath River Basin, Hader Foundation, New York, NY

2001 American Red Cross, Honduras, Design of Wetland Treatment systems for two re-settlement communities- Ciudad Espana and Colonia Cruz Roja

2000 **USAID/Harza Engineering**, El-Fayoum, Egypt, Middle Egypt Water and Sanitation Master Plan, Lake Qaran, Maadi, Egypt. Low cost wastewater treatment (wetlands), Lake water quality, waste load allocation, and stream modeling.

2000 City of Petaluma, California – Value Engineering- Review of Facility Plan, specific input dealing with low cost treatment and reuse options, Carollo engineering, walnut Creek, Ca.

2000 City/County of Phoenix, Az., Review Design and operation and maintenance requirements for the full scale effluent polishing, habitat enhancement, water reclamation wetland system.

1999-present Use of Constructed Wetlands to treat perchlorate contaminated groundwater (denitrification/perchlorate reduction), Apache Nitrogen Products, Benson, Arizona, Super Fund Project, Hargis and Associates, Tucson, Arizona.

1999-Present National Recreational Area – Page, Arizona. Wahweap wetland treatment reuse system in conjunction with Parson’s Engineering, Phoenix, Arizona.

1999-Present City of Willits, California, Wetland Treatment -Effluent Disposal and Treatment Upgrade Plan, Larry Moran, Water and Wastewater Supervisor.

1998-Present City of Willits, California, Effluent Management Plan and Pond-Wetland Treatment Design

1998 **USAID/World Bank** - Estuarine Restoration Use of Expert System to Choose Appropriate Wastewater Technologies - Recife, Brazil.

1999-Present Collins Wood Forest Products, Klamath Falls, Oregon, Bureau of Reclamation/Fish and Wildlife Service Wetland Restoration Initiative, Travis Huntley, CWP

1998-Present Warm Beach Christian Camp – Stanwood, Washington. Wetland treatment with effluent reuse, in conjunction with H. R. Esvelt Engineering, Bainbridge Island, Washington.

1997-Present **World Bank** - working with an International consulting firm combined with local engineering firms on a World Bank wastewater treatment project in Recife, Brazil. This includes assessing the capability of natural systems, wetlands and mangrove swamps to treat wastewater for protection of natural systems.

1997-Present **Department of Justice**, Couer D’ Alene, Idaho - Expert Witness-US Department of Justice - analysis of restoration techniques and monitoring methods and expert analysis of water quality and watershed contaminant loading issues associated with mining -Super Fund Project

1997 West Valley Sanitation District, Coachella Valley, Ca. – Wetland Treatment design-ENARTEC Engineers, Bill Imus, San Diego, Ca.

- 1997 USEPA-Prepared the Draft Free Surface Constructed Wetland Design Manual, Cincinnati USEPA, Jim Kriessl.
- 1997 USEPA/ETI - City of Phoenix, 1997, Technology Prepare Draft **Technology Assessment of Constructed Wetlands**, Review and evaluation of constructed free surface constructed wetlands to treat domestic wastewater. Paul Kinshella, City/County of Phoenix Az. Water and Wastewater Division.
- 1997 Finalize the WAWTTAR decision support software for **USAID/EHP** for selecting appropriate wastewater/water reclamation technologies. Utilization of an expert system to compare wetland treatment system with conventional treatment systems. Craig Hafner Environmental Health Project, Arlington, Virginia.
- 1997 Technical Review Team, California State University San Luis Obispo Campus Center for Alternative and Innovative Water, Wastewater, Energy, and Solidwaste Management-Wetland Treatment Component.
- 1996-1997 **The Nature Conservancy of Oregon** - Project manager for developing a restoration plan for the Williamson River at Upper Klamath Lake, Oregon. Five thousand acres of diked and drained wetlands converted to riverine, riparian, and wetland values and functions, Mark Stern, TNC, Portland.
- 1996-Present **City and County of San Francisco**, California Public Utility Commission Technical Review Committee for Alternative Source Reduction, Source Control, Wastewater/CSO treatment, and Wastewater reuse options for watershed management masterplan.
- 1996 **Korea/KAWACO** - Consultant for Harza Engineering working with SunJin Engineers in designing a constructed wetland to treat non-point source pollution and untreated domestic wastewater, Dr. B.K. Lee, Harza Engineering, Chicago, Ill.
- 1996 -Arcata, California Design and construction of a free surface constructed wetland to treat animal waste from a 200 head dairy in Humboldt County.
- 1996 -Dinuba, California - **Odwalla Corporation** - 1996. Assist in the design of a closed loop water, wastewater, energy, and solid waste system for a juice company concerned with a wide range of environmental and community issues related to food processing industries. Includes a wetland treatment process of industrial wastewater.
- 1996 -Initiative to Combat Desertification, **World Bank** - Tunisia
Assist in the design and implementation of a workshop to evaluate wastewater treatment/reuse options in arid and semi-arid countries. Included use of constructed wetlands - Jordan, Egypt, Tunisia, Israel, and Palestinian National Authority.
- 1996 **-Palau Republic** - Winzler and Kelly Engineers and Engineering Science Parsons. Presented three seminars to local decision makers concerning the use of constructed wetlands to treat domestic wastewater. Prepared a basis for design report for the use of constructed wetlands for Karor, Palau to protect nearshore receiving water within the barrier reef.
- 1995 **-USAID/EHP Project**, Design-Gaza City- Evaluation of wastewater wetland for water reclamation.
- 1995 -Del Norte County, CA. Solidwaste Management Authority, Assessment of and Treatment Alternatives for a Landfill Leachate Hazardous Waste.
- 1995 -Anacortes, Washington, Constructed Wetland Treatment System, HDR Engineers, Seattle Washington.
- 1994 **-EPA Region 9/Bechtel Engineering**, Apache Powder Super Fund Site - Use of Constructed Wetlands to Treat Contaminated Groundwater. Dentrifying wetland system.
- 1994 **-Bureau of Reclamation** - Klamath Lake, Oregon - Use of Constructed Wetlands to Reduce Phosphorus Loading to Hyper Eutrophic Lake, Watershed Model, Reservoir Model, Pilot Projects.
- 1994 **-City of Phoenix**, Arizona - Technical Review Team for Use of Constructed Wetlands to Polish Activated Sludge Effluent for Discharge into the Tres Rios River for Supporting Fisheries and Wildlife.
- 1994 -Manila Community Service District, Humboldt County, California, Facility Plan and Basis for Design of a Pond/Wetland/Infiltration System.
- 1994 -Palo Cedros High School, Shasta County, California-Non-point Source Wetland System for 120 acre development.

- 1994 -**World Bank, PEC DAR** (Palestinian Economic Commission for Development of Reconstruction). Strategy for improving sanitation facilities and reusing effluent for Gaza and the West Bank.
- 1994 -**USAID's Environmental Health Project** (Arlington, Virginia/Low Cost Wastewater Treatment System for Rural Communities in Egypt.
- 1993 -Union Carbide, Seaport, Texas, Use of Free Surface Constructed Wetland to Remove Suspended Solids from Oxidation Pond Effluent - Polyester Plant.
- 1993 -City of Ashland, Oregon, Woodward-Clyde Consultants Wetland Treatment Alternative/Rapid Infiltration Alternative - Facility Plan Amendment.
- 1993 -City of Napa, California - Constructed Wetland Alternatives for Treating Oxidation Pond Effluent - Facility Plan Amendment.
- 1993 -City of Santa Rosa, California - Technical Review Team for EIR Supplement - Wetland Treatment/Habitat Alternative.
- 1993 -**USAID/Mideast Bureau of State Department**, Development of An Interactive Expert Computer Model To Select Appropriate Water and Wastewater Treatment System for Reuse in Developing Countries, Workshop July 25-Aug. 5, 1993 at Newport Beach, California for 17 representatives from Middle East countries.
- 1993 -American Canyon, California, Brown and Caldwell Engineering - Basis for Design for Free Surface Constructed Wetland.
- 1992-93 -**Tennessee Valley Administration/USAID/EPA** Feasibility Plan for Constructed Wetlands in Tata and Fertorakos, Hungary.
- 1992 -Lihi-Lani Recreation Community- Oxidation Pond/Wetlands Wastewater Treatment and Reclamation System, Engineering Concepts, Honolulu, HI.
- 1992 -Kingman, Arizona, Concept Plan for Wetland Treatment for Effluent Polishing - Nitrogen Removal - John Corolla Engineers, Phoenix, Arizona.
- 1992 -**Technical Advisory Panel "Everglades Protection Project** - Phosphorous Removal in Wetlands", Nolte and Associates, Sacramento, CA.
- 1992 -**State of Washington Attorney General**, expertise witness for the state on use of constructed wetland as a viable wastewater treatment alternative - City of Sequim, WA.
- 1992 -American Cyanamid - Niagara Falls, New York - Use of Constructed Wetland to Remove Ammonia Levels of An Industrial Waste Leachate.
- 1991-Present -**Bureau of Reclamation** - Eastern Municipal Water District, Hemet, California - Technical Review Team - Use of Constructed Wetlands In A Total Water Reuse System in Arid Areas.
- 1991-Present -Design, Construction and Study of a Constructed Wetlands Demonstration Project - Sacramento Regional Wastewater Treatment Plant - Nolte and Associates, Sacramento, CA.
- 1991 -City of Davis Wetlands Demonstration Project, Larry Walker and Associates, Davis, CA.
- 1990 -Mount Angel, Oregon, Wetland Treatment System, Westech Engineering, Salem, Oregon.
- 1990 -Eastern Municipal Water District, Hemet, California- Wetland Treatment /Water Reuse/Groundwater Recharge - Bureau of Reclamation Project.
- 1990 -**AAAS- Sub-Saharan Malaria Project**- Committee Member- Contribution Author - An Intersectional Approach to Malaria in Development in Africa.
- 1988 -**Consultant to Peace Corps-Programming Water Supply and Health/Sanitation Volunteer-Pre-service and in-service training courses** - Sierra Leone, Ghana, Nepal, Morocco, Mauritania, and Niger.
- 1980-Present -**Consultant to USAID through Water & Sanitation for Health Project (WASH I & WASH II)**- short term technical assistance training programs in area of rural water supply/sanitation-hygiene education for Indonesia, Belize, Sierra Leone, Kenya, Tanzania, Swaziland, Malawi and Ghana.

SEMINARS AND SHORT COURSES

- 2006 -Lorman Seminar Series., Constructed and Restored Wetlands:: The Future of California Water Quality, San Francisco, California
- 2006 -UJBO-Oaxaca, Mexico, Constructed Wetland Short Course

- 1996-2004 -Annual Constructed Wetland Workshop, Humboldt State University, Director and Lead Instructor for a 5 day lecture, laboratory, and fieldwork workshop for engineers, planners, and biologists. Use of Constructed Wetlands for Improved Water Quality-Planning and Design,
- 2001 -Wetland Short Course, Butte Montana, Montana AWWA-WEF Annual Conference
- 1998-1999 -Technology Transfer Workshop, EPA Region 4, Kansas City, Kansas Use of Constructed Wetland to Treat Domestic Effluent.
- 1998 -Constructed Wetland Workshop - Hungarian Ministry of the Environment, Budapest, Hungary, Oct. 11-20. Lead instructor.
- 1992 -Graduate Seminar, Environmental Engineering Department - UC Berkeley, Constructed Wetland - Design Consideration, March 1992.
- 1991 -EPA-Technology Transfer Conference- Denver, Colorado -Design, Construction, and Operations of Constructed Wetlands, Sept. 1991.
- 1991 -EPA-Technology Transfer Conference-Portland, Oregon, June Constructed Wetland Technology.
- 1990 -City of Paradise, California- Constructed Wetland Treatment Systems.
- 1990 -Graduate Seminar Presentation- Civil Engineering Dept., U.C. Davis on Arcata Wetland Treatment System- May 1990.
- 1989 -Wetland Treatment Systems, Anacortes, Washington.
- 1988 -Gearheart, R.A. and George Allen- Co-Director- National Workshop on Wetlands for Wastewater Treatment and Resource Enhancement. August 3-6, 1988. Humboldt State University, Arcata,.

SELECTED PUBLICATIONS AND REPORTS

- Gearheart, R.A., Use of Constructed to Manage Water Quality, Southwest Hydrology, January-March
- Gearheart, R. A. The Use of A Free Surface Constructed Wetland As An Alternative Process Treatment Train To Meet Unrestricted Water Reclamation Standards, *Water Science*, Vol. 40, pp. 375-382, 1999.
- Gearheart, R.A. Criteria for Design of Free Surface Constructed Wetlands Based Upon A Coupled Ecological and Water Quality Model. Presented at the 5th International Conference on Wetland Systems for Water Pollution Control. Vienna, Austria September 15-19, 1996.
- Gearheart, R.A. "Watershed and Lake Management Strategy For Improving Water Quality in Upper Klamath Lake, Oregon". The First Klamath Basin Ecosystem Research and Coordination Meeting, March 14-16, 1995. Sponsored by the Klamath Basin Ecosystem Restoration Office - OIT, Klamath Falls, Oregon.
- Gearheart, R.A., "Using Wetlands for Nitrogen Polishing. Proceedings on Nitrogen, Environment, and People- an International Conference, Everett, WA. 1995.
- Gearheart, R.A. "Watershed-Wetlands-Wastewater Management", Natural and Constructed Wetlands for Wastewater Treatment and Reuse - Experiences, Goals, and Limits, International Seminar, Centro Studi Provincia Perugia, Italy, 26-28 October, 1995.
- Gearheart, R.A., "Eight Years of Full-Scale Operations at a Free-Surface Wetland Treating Domestic Wastewater", 86th Annual American Society of Agronomy/Crop Science Society of America/Soil Science Society of America, Seattle, WA. - Nov. 13-18, 1994.
- Gearheart, R.A. "Use of Constructed Wetlands to Treat Domestic Wastewater - City of Arcata, California," *Water Science. Technology*, Vol. 26. No. 7-8 pp 1625-1637, 1992.
- Gearheart, R.A. "Phosphorus Removal in Constructed Wetlands", presented at the 66th WEF Annual Conference, Anaheim, California, October 3-7, 1993.
- Gearheart, R.A. et al., Metals Literature Review - Wetland Process, submitted to Union Sanitary District East Bay Dischargers Authority and East Bay Regional Park District, 128 pages. February 1992.
- Gearheart, R.A. et al., "Integrated Site Metals Data and Implications for Food Web Toxicity, Hayward Marsh, Union Sanitary District, East Bay Dischargers, and East Bay Regional Park District, 125 pages, February 1992.
- Gearheart, R.A. and George Waller, "An Overview of Potential Wetland Opportunities in the Malibu Creek Watershed", prepared for Marsh System Subcommittee, Malibu Regional Wastewater Systems Citizen Committee, August 1989.
- Gearheart, R.A., "Constructed Open Surface Wetlands: Water Quality Benefits and Wildlife Benefits, City of Arcata, California", International Conference on Constructed Wetlands for Water Quality Improvement. University of

- West Florida, Pensacola, Florida, October 1991. Proceedings in print.
- Gearheart, R.A., "Nitrogen Cycle in Constructed Wetlands", 1991 Annual WEF Conference, Washington, D.C. Manuscript in progress.
- Gearheart, R.A., Community Based Maintenance and Cost Recovery of Piped Rural Water Schemes- Malawi, WASH Report No. 309.
- Gearheart, R.A., "Criteria for Selection Low Cost Water and Wastewater Technology for Developing Country," Symposium on African Water Supply- Sponsored by Atlanta University/USAID, Atlanta, Georgia, May 6-9, 1987.
- Gearheart, R. A. and Brad Finney, "Utilization of Wetlands As A Reliable Low Cost Wastewater Treatment Process". Proceedings of the Aquatic Plants for Water Treatment and Resource Recovery Conference, Orlando, Florida, July 1986.

HONORS AND AWARDS

- | | |
|------|---|
| 2002 | Specially Recognized Alumnus Biology Department-North Texas University, Denton, Texas |
| 1998 | American Society of Civil Engineers Northcoast Section-Engineer of the Year |
| 1989 | -Scholar of the Year - Humboldt State University. |
| 1988 | -Boston Visions - 2nd Place Award for a solution to Boston Harbor's water quality problems - use of wetlands to treat point and non-point source pollution affording recreational opportunities in an urban setting - Boston Society of Architecture and Boston's Redevelopment Agency. |
| 1986 | -Meritorious Service Award - Humboldt State University |
| 1987 | -Ford Foundation Award - Part of the City of Arcata's Task Force (1978-1986). Resulting in the Arcata Marsh and Wildlife Sanctuary - Principal Engineer on the project. \$100,000 award. |

BACKGROUND AND QUALIFICATIONS

Richard R. Horner

I have 30 years of experience in the urban stormwater management field and 11 additional years of engineering practice. During this period I have performed research, taught, and offered consulting services on all aspects of the subject, including investigating the sources of pollutants and other causes of aquatic ecological damage, impacts on organisms in waters receiving urban stormwater drainage, and the full range of methods of avoiding or reducing these impacts.

I received a Ph.D. in Civil and Environmental Engineering from the University of Washington in 1978, following two Mechanical Engineering degrees from the University of Pennsylvania. Although my degrees are all in engineering, I have had substantial course work and practical experience in aquatic biology and chemistry. For 12 years beginning in 1981 I was a full-time research professor in the University of Washington's Department of Civil and Environmental Engineering. I now serve half time in that position and have adjunct appointments in two additional departments (Landscape Architecture and the College of Forest Resources' Center for Urban Horticulture). While my research and teaching continue at a somewhat reduced level, I spend the remainder of my time in private consulting through a sole proprietorship. My full credentials are available upon request.

I have conducted numerous research investigations and consulting projects together involving all aspects of stormwater management. Serving as a principal or co-principal investigator on more than 40 research studies, my work has produced two books, approximately 30 papers in the peer-reviewed literature, and over 20 reviewed papers in conference proceedings. I have also authored or co-authored more than 75 scientific or technical reports. In addition to graduate and undergraduate teaching, I have taught many continuing education short courses to professionals in practice. My consulting clients include federal, state, and local government agencies; citizens' environmental groups; and private firms that work for these entities, primarily on the West Coast of the United States and Canada but in some instances elsewhere in the nation.

I have helped to develop stormwater management programs in Washington State, California, and British Columbia and studied such programs around the nation. I was one of four principal participants in a U.S. Environmental Protection Agency-sponsored assessment of 32 state, regional, and local programs spread among 14 states in arid, semi-arid, and humid areas of the West and Southwest, as well as the Midwest, Northeast, and Southeast. This evaluation led to the 1997 publication of "Institutional Aspects of Urban Runoff Management: A Guide for Program Development and Implementation" (subtitled "A Comprehensive Review of the Institutional Framework of Successful Urban Runoff Management Programs").

My background includes 14 years of work in Southern California, where I have been a federal court-appointed overseer of stormwater program development and implementation at the city and county level and for two Caltrans districts. I was directly involved in the process of developing the 13 volumes of Los Angeles County's Stormwater Program Implementation Manual, working under the terms of a settlement agreement in federal court as the plaintiffs' technical representative. My role was to provide quality-control review of multiple drafts of each volume and contribute to bringing the program and all of its elements to an adequate level. I have also

evaluated the stormwater programs in San Diego, Orange, Riverside, San Bernardino, Ventura, Santa Barbara, San Luis Obispo, and Monterey Counties and a multi-county program in the San Francisco Bay Area. At the recommendation of San Diego Baykeeper, I have been a consultant on stormwater issues to the City of San Diego, the San Diego Unified Port District, and the San Diego County Regional Airport Authority.

RICHARD R. HORNER, PH.D.

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November 30, 2007

Eric Strecker
Geosyntec Consultants
55 SW Yamhill, Suite 200
Portland, OR 97204

Cassandra Owens
Los Angeles Regional Water Quality Control Board
320 W. 4th Street, Suite 200
Los Angeles, CA 90013

Dear Mr. Strecker and Ms. Owens:

Thank you for the invitation to join the panel for Design Storm and BMP Selection at the Santa Susana Field Laboratory. I am interested in participating but must alert you that I have time limitations and, particularly, constraints on travel. Before detailing my availability, I refer you to my attached curriculum vitae and other biographical materials as statements of my qualifications and areas of expertise.

I have previous commitments that limit my availability for meetings in southern California to the following dates and times in the first six months of the year: from 1:00 PM Mondays to 12:00 noon Fridays the weeks of January 7, 14, and 21; February 11; March 10, 17, and 24 (only March 24 and 25 of that week); April 7 and 14; May 12, 19, and 26; and June 2 (only June 2 and 3 of that week), 16, 23 (only June 23 and 24 that week), and 30. I must note that I do have to make some other arrangements that could take away some additional dates for panel activities. I hope that you can work with my constraints, but if you anticipate difficulties in getting the work done with my schedule, I certainly will understand if you choose not to include me.

I would be pleased to provide any other information you may need.

Sincerely,



Richard R. Horner

BIOGRAPHICAL SKETCH

HORNER, Richard Ray
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Seattle, WA 98107

Telephone: (206) 782-7400
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Consulting services in the analysis and management of watershed systems, water resources, and stormwater

Research Associate Professor, University of Washington (half time); Landscape Architecture, Civil and Environmental Engineering (Adjunct), and Center for Urban Horticulture (Adjunct)

Date of Birth: 11-26-43

EDUCATION

1978 University of Washington, Seattle, WA; Ph.D. (Civil Engineering, Environmental Engineering and Science Program)

1966 University of Pennsylvania, Philadelphia, PA; M.S. (Mechanical Engineering)

1965 University of Pennsylvania, Philadelphia, PA; B.S. (Mechanical Engineering)

EMPLOYMENT

1986-Present Richard R. Horner, Environmental Engineering and Science, Sole Proprietor

1981-Present University of Washington, Seattle, WA

1969-1981 Northampton Community College, Bethlehem, PA; Professor of Engineering and Environmental Studies

1976 - 78 University of Washington, Seattle, WA; Research Engineer and Research Assistant

1966 - 69 Exxon Research and Engineering Company, Florham Park, NJ; Project Engineer

SELECTED RESEARCH PROJECTS

Ultra-Urban Stormwater Management; sponsored by Seattle Public Utilities; 1999-2004.

The Ecological Response of Small Streams to Stormwater and Stormwater Controls; sponsored by U. S. Environmental Protection Agency, cooperating with Watershed Management Institute (Crawfordsville, FL); 1995-2003.

Vegetated Stormwater Facilities Maintenance; sponsored by Washington State Department of Transportation; 1998-2000.

Puget Sound Wetlands and Stormwater Management Research Program; sponsored by Washington Department of Ecology, U. S. Environmental Protection Agency, and King County, WA; 1986-1996.

Critical Phosphorus Concentrations in Flowing Water, Phase 1-4; sponsored by National Science Foundation; 1980-1996.

Evaluation of Infiltration Practices for Storm Runoff Quantity and Quality Control; supported by grant from Washington Department of Ecology for establishment of the Center for Urban Water Resources Management at the University of Washington; 1990-1993.

Environmental Monitoring and Evaluation of Calcium Magnesium Acetate for Roadway Deicing; sponsored by Transportation Research Board, National Research Council; 1985-87.

SELECTED CONSULTING PROJECTS

Santa Monica Baykeeper v. Carson Auto, Inc.; Special Master advising United States District Court, Central District of California, Los Angeles, CA; 2001-present.

Storm Water Pollution Prevention Program, City of San Diego; Advising on response to municipal stormwater NPDES program; 2001-present.

Clean Water Act lawsuits, technical expert; consultant to Natural Resources Defense Council, Los Angeles, CA; 1993-present.

Washington Department of Ecology Stormwater Management Manual Update; 1994-1995 and 2000-2001.

Constructed Wetlands Pilot Treatment Project for City of Stanwood, WA; subconsultant to Kramer, Chin and Mayo, Seattle, WA; 1993-2001.

BOOKS PUBLISHED

Azous, A.L. and R.R. Horner. 2000. *Wetlands and Urbanization: Implications for the Future*. Lewis Publishers, Boca Raton, FL.

Horner, R. R., J. J. Skupien, E. H. Livingston, and H. E. Shaver. 1994. *Fundamentals of Urban Runoff Management: Technical and Institutional Issues*. Terrene Institute, Washington, D. C.

SELECTED JOURNAL AND BOOK CHAPTER PUBLICATIONS

Horner, R. R. et al. 2002. Structural and Non-Structural Best Management Practices (BMPs) for Protecting Streams. In *Linking Stormwater BMP Designs and Performance to Receiving Water Impact Mitigation*, B. K. Urbonas (ed.), American Society of Civil Engineers, New York, pp. 60-77.

Comings, K. J., D. B. Booth, and R. R. Horner. 2000. Storm Water Pollutant Removal by Two Wet Ponds in Bellevue, Washington. *Journal of Environmental Engineering* 126(4):321-330.

Anderson, E. L., E. B. Welch, J. M. Jacoby, G. M. Schimek, and R. R. Horner. 1999. Periphyton Removal Related to Phosphorus and Grazer Biomass Level. *Freshwater Biology* 41:633-651.

Horner, R. R., D. B. Booth, A. Azous, and C. W. May. 1997. Watershed Determinants of Ecosystem Functioning. In *Effects of Watershed Development and Management on Aquatic Ecosystems*, L. A. Roesner (ed.), American Society of Engineers, New York; pp. 251-274.

Horner, R. R. 1995. Constructed Wetlands for Urban Runoff Water Quality Control. *Proc. National Conference on Urban Runoff Management*, Chicago, IL, 1993; pp. 327-340.

Reinelt, L. E. and R. R. Horner. 1995. Pollutant Removal from Stormwater Runoff by Palustrine Wetlands Based on a Comprehensive Budget. *Ecological Engineering* 4:77-97.

Horner, R. R. 1995. Toward Ecologically Based Urban Runoff Management. In *Urban Runoff and Receiving Systems*, E. E. Herricks (ed.), Lewis Publishers, Boca Raton, FL; pp. 365-378.

Walton, S. P., E. B. Welch, and R. R. Horner. 1995. Stream Periphyton Response to Grazing and Changes in Phosphorus Concentration. *Hydrobiologia* 302:31-46.

Horner, R. R. and M. V. Brenner. 1992. Environmental Evaluation of Calcium Magnesium Acetate for Highway Deicing Applications. *Resources, Conservation and Recycling* 7:213-237.

Brenner, M. V. and R. R. Horner. 1992. Effects of Calcium Magnesium Acetate on Dissolved Oxygen in Water. *Resources, Conservation and Recycling* 7:239-265.

- Reinelt, L. E., R. R. Horner, and R. Castensson. 1992. Nonpoint Source Water Quality Management: Improving Decision-Making Information through Water Quality Monitoring. *Journal of Environmental Management*. 34:15-30.
- Horner, R. R., M. V. Brenner, R. B. Walker, and R. H. Wagner. 1991. Environmental Evaluation of Calcium Magnesium Acetate. In *Calcium Magnesium Acetate (CMA): An Emerging Bulk Chemical for Multi-Purpose Environmental Applications*, D. L. Wise, Y. A. Lavendis, and M. Metghalchi (eds.), Elsevier Science Publishers BV, The Netherlands; pp. 57-102.
- Horner, R. R., E. B. Welch, M. R. Seeley, and J. M. Jacoby. 1990. Responses of Periphyton to Changes in Current Velocity, Suspended Sediments and Phosphorus Concentration. *Freshwater Biology* 24:215-232.
- Horner, R. R. 1989. Long-Term Effects of Urban Stormwater on Wetlands. In *Design of Urban Runoff Quality Controls*, L. A. Roesner, B. Urbonas, and M. B. Sonner (eds.), American Society of Civil Engineers, New York; pp. 451-466.
- Welch, E. B., R. R. Horner, and C. R. Patmont. 1989. Phosphorus Levels that Cause Nuisance Periphyton: A Management Approach. *Water Research* 23:401-405.
- Butkus, S. T., E. B. Welch, R. R. Horner, and D. E. Spyridakis. 1988. Lake Response Modeling Using Biologically Available Phosphorus. *Journal of the Water Pollution Control Federation* 60:1663-1669.
- Reinelt, L. E., R. R. Horner, and B. W. Mar. 1988. Nonpoint Source Pollution Monitoring Program Design. *Journal of Water Resources Planning and Management* 114:335-352.
- Welch, E. B., J. M. Jacoby, R. R. Horner, and M. R. Seeley. 1988. Nuisance Biomass Levels of Periphytic Algae in Streams. *Hydrobiologia*, 157:161-168.
- Reinelt, L. E., R. Castensson, and R. R. Horner. 1987. Modification of an Existing Monitoring Program to Address Nonpoint Source Pollution, A Case Study of the Svarta River Basin, Sweden. *Vatten* 43:199-208.
- Mar, B. W., R. R. Horner, J. S. Richey, D. P. Lettenmaier, and R. N. Palmer. 1986. Data Acquisition, Cost-Effective Methods for Obtaining Data on Water Quality. *Environmental Science and Technology* 20:545-551.
- Welch, E. B., D. E. Spyridakis, J. I. Shuster, and R. R. Horner. 1986. Declining Lake Sediment Phosphorus Release and Oxygen Deficit Following Wastewater Diversion. *Journal of the Water Pollution Control Federation* 58:92-96.
- Richey, J. S., B. W. Mar, and R. R. Horner. 1985. The Delphi Technique in Environmental Assessment, Part 1: Implementation and Effectiveness. *Journal of Environmental Management* 21:135-146.
- Richey, J. S., R. R. Horner, and B. W. Mar. 1985. The Delphi Technique in Environmental Assessment, Part 2: Consensus on Critical Issues in Environmental Monitoring Program Design. *Journal of Environmental Management* 21:147-159.
- Horner, R. R., E. B. Welch, and R. B. Veenstra. 1983. Development of Nuisance Periphytic Algae in Laboratory Streams in Relation to Enrichment and Velocity. In *Periphyton of Freshwater Ecosystems*, R. G. Wetzel (ed.), Dr. W. Junk BV, The Hague, The Netherlands, pp. 121-134.
- Horner, R. R. and E. B. Welch. 1981. Stream Periphyton Development in Relation to Current Velocity and Nutrients. *Canadian Journal of Fisheries and Aquatic Sciences* 38:449-457.

CURRICULUM VITAE

HORNER, Richard Ray

Environmental Engineering and Science
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Seattle, WA 98107
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Facsimile: (206) 781-9584

University of Washington part-time affiliations:
Research Associate Professor, Departments of
Civil Engineering and Landscape Architecture
Adjunct Associate Professor, Center for Urban
Horticulture

Date of Birth: 11-26-43

EDUCATION

- 1976 - 78 University of Washington, Seattle, Washington; Ph.D. (Civil Engineering)
- 1965 - 66 University of Pennsylvania, Philadelphia, Pennsylvania; M.S. (Mechanical Engineering)
- 1961 - 65 University of Pennsylvania, Philadelphia, Pennsylvania; B.S. *Cum Laude* (Mechanical Engineering)

HONORS AND AWARDS

Augustus Trask Ashton Scholarship, University of Pennsylvania, 1961 - 65
Annual Academic Honors, University of Pennsylvania, 1961 - 65
Tau Beta Pi National Engineering Honor Society
National Science Foundation Traineeship, University of Pennsylvania, 1965 - 66

EMPLOYMENT

- 1986 - Present Richard R. Horner, Environmental Engineering and Science, Sole Proprietor
- 1981 - Present University of Washington, Seattle, Washington
- 1986 - 1990 King County, Seattle, Washington
Coordinator of Puget Sound Wetland and Stormwater Management Research Program (part-time; continuing through present under contract to University of Washington)
- 1969 - 81 Northampton Community College, Bethlehem, Pennsylvania
Engineering Department (Coordinator, 1971 - 73 and 1978 - 79)
Environmental Studies Department (Co-coordinator, 1973 - 76 and 1978 - 1981)
Professor, 1978 - 1981; Associate Professor, 1973 - 78;
Assistant Professor, 1969 - 73,
Leave of Absence, 1977 - 78; Sabbatical Leave, 1976 - 77
- 1977 - 78 University of Washington, Seattle, Washington
Department of Civil Engineering
Research Engineer, Highway Runoff Water Quality Project

- 1976 - 77 University of Washington, Seattle, Washington
Department of Civil Engineering and Institute for Environmental Studies
Research Assistant and Teaching Assistant
- 1966 - 69 Exxon Research and Engineering Company, Florham Park, New Jersey;
Project Engineer
- 1965 - 66 University of Pennsylvania, Philadelphia Pennsylvania
Department of Mechanical Engineering; Research Assistant

NATIONAL COMMITTEES

National Academy of Sciences Panel on Reducing Stormwater Discharge Contributions to Water Pollution, 2007-2009.

Technical Advisory Panel for Water Environment Federation projects on Decentralized Stormwater Controls for Urban Retrofit and Combined Sewer Overflow Reduction, 2005-2007.

Co-chair, Engineering Foundation Conference on Effects of Watershed Development and Management on Aquatic Ecosystems, 1996.

National Academy of Sciences Panel on Costs of Damage by Highway Ice Control, 1990-91.

American Society of Civil Engineers Urban Water Resources Research Council, continuing appointment beginning in 1990.

U.S. Environmental Protection Agency National Wetland Research Planning Panel, 1988, 1991.

RESEARCH PROJECTS

* Principal Investigator.

** Co-Principal Investigator. (Where undesignated, I was a member of the faculty investigation team without principal investigator status).

Ultra-Urban Stormwater Management; Seattle Public Utilities; \$1,035,000; 1999-2007.*

Roadside Vegetation Management Study; Washington State Department of Transportation; \$50,000; 2004-2005.

The Ecological Response of Small Streams to Stormwater and Stormwater Controls; U. S. Environmental Protection Agency, cooperating with Watershed Management Institute (Crawfordsville, FL); \$579,117; 1995-2003.*

Vegetated Stormwater Facility Maintenance; Washington State Department of Transportation; \$86,000; 1998-2000.*

Roadside Drainage System Management for Water Quality Improvement; King and Snohomish (WA) Counties; \$70,000; 1997-2000.*

Standardization of Wet Weather Protocols for Stream Impact and Treatment Technology Performance Assessments; Water Environment Research Foundation, cooperating with

Water Research Center (Huntington Valley, Pennsylvania) and University of Illinois; \$125,000; 1996-97.

Road Shoulder Treatments for Water Quality Protection; Washington State Department of Transportation and King County Roads Division; \$90,000; 1995-96.**

Control of Nuisance Filamentous Algae in Streams by Invertebrate Grazing; National Science Foundation; \$193,691; 1994-96.

Criteria for Protection of Urban Stream Ecosystems; Washington Department of Ecology; \$230,000; 1994-96.

Region-Specific Time-Scale Toxicity in Aquatic Ecosystems; Water Environment Research Foundation, cooperating with Water Research Center (Huntington Valley, Pennsylvania) and University of Illinois; \$670,000; 1994-96.

Establishing Reference Conditions for Freshwater Wetlands Restoration; U. S. Environmental Protection Agency; \$75,000; 1993-1997.

Stormwater Management Technical Assistance to Local Governments; Washington Department of Ecology; \$115,000; 1992-93.*

Center for Urban Water Resources Management; Washington Department of Ecology; \$336,490; plus \$157,400 matching support from seven local governments; 1990-93.*

University of Washington Cooperative Unit for Wetlands and Water Quality Research; King County, Washington; amount varied by year; 1987-1995.*

Assessment of Portage Bay Combined Sewer Overflows; City of Seattle; \$132,676; 1990-91.*

Water Quality Impacts of CMA, An Alternative Road Deicing Agent; Graduate School Research Fund; \$3,945; 1989-90.*

Velocity-Related Critical Phosphorus Concentrations in Flowing Water, Phase 3; National Science Foundation; \$108,332; 1988-90.**

Design of Monitoring Programs for Determining Shellfish Bed Bacterial Contamination Problems; Washington Department of Ecology; \$12,000; 1988-89.*

Puget Sound Protocols Development; Tetra Tech, Inc. and Puget Sound Estuary Program; \$10,144; 1988.*

Improving the Cost Effectiveness of Highway Construction Site Erosion/Pollution Control, Phase 2; Washington State Department of Transportation; \$97,000; 1987-89.*

Wetland Mitigation Project Analysis; Washington State Department of Transportation; \$74,985; 1987-89.*

Lake Chelan Water Quality Assessment; Harper-Owes, consultant to Washington State Department of Ecology; \$42,977; 1986-88.

Quality of Management of Silver Lake; City of Everett; \$67,463; 1986-88.

Effectiveness of WSDOT Wetlands Creation Projects; Washington State Department of Transportation; \$42,308; 1986-87.*

Improving the Cost Effectiveness of Highway Construction Site Erosion/Pollution Control; Washington State Department of Transportation; \$41,608; 1986-87.*

Management Significance of Bioavailable Phosphorus in Urban Runoff; State of Washington Water Research Center and Municipality of Metropolitan Seattle; \$32,738; 1986-87.**

Environmental Monitoring and Evaluation of Calcium Magnesium Acetate (CMA); National Academy of Sciences; \$199,943; 1985-87.*

Conceptual Design of Monitoring Programs for Determination of Water Quality and Ecological Change Resulting from Nonpoint Source Discharges; Washington State Department of Ecology; \$49,994; 1985-86.**

Development of an Integrated Land Treatment Approach for Improving the Quality of Metalliferous Mining Wastewaters; Washington Mining and Mineral Resources Research Institute; \$4,000; 1985-86.*

Preliminary Investigation of Sewage Sludge Utilization on Roadsides; Washington State Department of Transportation; \$6,664; 1984-85.*

Source Control of Transit Base Runoff Pollutants; Municipality of Metropolitan Seattle; \$26,867; 1984-85.**

Lake Sammamish Future Water Quality; Municipality of Metropolitan Seattle; \$28,500; 1984-85.

Implementation of Highway Runoff Water Quality Research Results; Washington State Department of Transportation; \$13,998; 1984-85.*

Performance Evaluation of a Detention Basin and Coalescing Plate Oil Separator for Treating Urban stormwater Runoff; Washington State Water Research Center; 1984-85; \$11,724.**

Velocity-Related Critical Phosphorus Concentrations in Flowing Water, Phase 2; National Science Foundation; \$99,088; 1983-85.**

Development of a Biological Overland Flow System for Treating Mining Wastewaters; Washington Mining and Mineral Resources Research Institute; \$6,030; 1983-84.*

Nutrient Contributions of Agricultural Sites to the Moses Lake System; Moses Lake Conservation District; \$15,039; 1982-84.*

Planning Implementation of Runoff Water Quality Research Findings; Washington State Department of Transportation; \$12,735; 1982-83.**

Transport of Agricultural Nutrients to Moses Lake; Brown and Caldwell Engineers; \$22,725; 1982-83.**

Investigation of Toxicant Concentration and Loading Effects on Aquatic Macroinvertebrates; University of Washington Graduate School Research Fund; \$3,788; 1982.*

Sampling Design for Aquatic Ecological Monitoring; Electric Power Research Institute; \$542,008; 1981-86.

Velocity-Related Critical Phosphorus Concentrations in Flowing Water; National Science Foundation; \$70,310; 1980-82.

Highway Runoff Water Quality; Washington State Department of Transportation; \$461,176; 1977-82.

BOOKS

Shaver, E., R. Horner, J. Skupien, C. May, and G. Ridley. . *Fundamental of Urban Runoff Management: Technical and Institutional Issues*, 2nd Edition. U.S. Environmental Protection Agency, Washington, D.C., in press.

Azous, A. L. and R. R. Horner. *Wetlands and Urbanization: Implications for the Future*. Lewis Publishers, Boca Raton, FL, 2000.

Horner, R. R., J. J. Skupien, E. H. Livingston, and H. E. Shaver. *Fundamental of Urban Runoff Management: Technical and Institutional Issues*. Terrene Institute, Washington, D. C., 1994.

REFEREED JOURNAL PUBLICATIONS AND BOOK CHAPTERS

Horner, R. R. et al. Structural and Non-Structural Best Management Practices (BMPs) for Protecting Streams. In *Linking Stormwater BMP Designs and Performance to Receiving Water Impact Mitigation*, B. K. Urbonas (ed.), American Society of Civil Engineers, New York, pp. 60-77, 2002.

Comings, K. J., D. B. Booth, and R. R. Horner. Storm Water Pollutant Removal by Two Wet Ponds in Bellevue, Washington. *Journal of Environmental Engineering* 126(4):321-330, 2000.

Anderson, E. L., E. B. Welch, J. M. Jacoby, G. M. Schimek, and R. R. Horner. Periphyton Removal Related to Phosphorus and Grazer Biomass Level. *Freshwater Biology* 41:633-651, 1999.

Horner, R. R., D. B. Booth, A. Azous, and C. W. May. Watershed Determinants of Ecosystem Functioning. In *Effects of Watershed Development and Management on Aquatic Ecosystems*, L. A. Roesner (ed.), American Society of Civil Engineers, New York, pp. 251-274, 1997.

Horner, R.R. Toward Ecologically Based Urban Runoff Management. In *Urban Runoff and Receiving Systems*, E.E. Herricks (ed.), Lewis Publishers, Boca Raton, Florida, pp. 365-378, 1995.

Walton, S. P., E. B. Welch, and R. R. Horner. Stream Periphyton Response to Grazing and Changes in Phosphorus Concentration. *Hydrobiologia* 302:31-46, 1994.

Reinelt, L. E. and R. R. Horner. Pollutant Removal from Stormwater Runoff by Palustrine Wetlands Based on a Comprehensive Budget. *Ecological Engineering* 4:77-97, 1995.

- Horner, R.R. and M.V. Brenner. Environmental Evaluation of Calcium Magnesium Acetate for Highway Deicing Applications. *Resources, Conservation and Recycling* 7:213-237, 1992.
- Brenner, M.V. and R.R. Horner. Effects of Calcium Magnesium Acetate on Dissolved Oxygen in Water. *Resources, Conservation and Recycling* 7:239-265, 1992.
- Reinelt, L.E., R.R. Horner, and R. Castensson. Nonpoint Source Water Quality Management: Improving Decision-Making Information through Water Quality Monitoring. *Journal of Environmental Management* 34:15-30, 1992.
- Horner, R.R., M.V. Brenner, R.B. Walker, and R.H. Wagner. Environmental Evaluation of Calcium Magnesium Acetate. In *Calcium Magnesium Acetate (CMA): An Emerging Bulk Chemical for Multi-purpose Environmental Applications*, D.L. Wise, Y.A. Lavendis, and M. Metghalchi (eds.), Elsevier Science Publishers B.V., The Netherlands, pp. 57-102, 1991.
- Horner, R.R., E.B. Welch, M.R. Seeley, and J.M. Jacoby. Responses of Periphyton to Changes in Current Velocity, Suspended Sediments and Phosphorus Concentration. *Freshwater Biology* 24:215-232, 1990.
- Horner, R.R. Long-Term Effects of Urban Stormwater on Wetlands. In *Design of Urban Runoff Quality Controls*, L.A. Roesner, B. Urbonas, and M.B. Sonnen (eds.), American Society of Civil Engineers, New York, pp. 451-466, 1989.
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- Butkus, S.R., E.B. Welch, R.R. Horner, and D.E. Spyridakis. Lake Response Modeling Using Biologically Available Phosphorus. *Journal of the Water Pollution Control Federation* 60(9):1663-1669, 1988.
- Reinelt, L.E., R.R. Horner, and B.W. Mar. Nonpoint Source Pollution Monitoring Program Design. *Journal of Water Resources Planning and Management* 114(3):335-352, 1988.
- Welch, E.B., J.M. Jacoby, R.R. Horner, and M.R. Seeley. Nuisance Biomass Levels of Periphytic Algae in Streams. *Hydrobiologia*, 157:161-168, 1988.
- Reinelt, L.E., R. Castensson, and R.R. Horner. Modification of an Existing Monitoring Program to Address Nonpoint Source Pollution, A Case Study of the Svarta River Basin, Sweden. *Vatten* 43:199-208, 1987.
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- Horner, R.R., J.S. Richey, and G.L. Thomas. A Conceptual Framework to Guide Aquatic Monitoring Program Design for Thermal Electric Power Plants. *Rationale for Sampling and Interpretation of Ecological Data in the Assessment of Freshwater Ecosystems*, Special Technical Publication 894 of the American Society for Testing and Materials, Philadelphia, Pennsylvania, pp. 86-100, 1986.
- Welch, E.B., D.E. Spyridakis, J.I. Shuster, and R.R. Horner. Declining Lake Sediment Phosphorus Release and Oxygen Deficit Following Wastewater Diversion. *Journal of the Water Pollution Control Federation* 58(1):92-96, 1986.

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- Horner, R.R. and B.W. Mar. Assessing Impacts of Operating Highways on Aquatic Ecosystems. *Transportation Research Record* 1017:47-55, 1985.
- Horner, R.R., E.B. Welch, and R.B. Veenstra. Development of Nuisance Periphytic Algae in Laboratory Streams in Relation to Enrichment and Velocity. In *Periphyton of Freshwater Ecosystems*, R.G. Wetzel (ed.), Dr. W. Junk BV, the Hague, The Netherlands, pp. 121-134, 1983.
- Horner, R.R. and B.W. Mar. A Guide for Assessing Water Quality Impacts of Highway Operations and Maintenance. *Transportation Research Record* 948:31-40, 1983.
- Chui, T.W., B.W. Mar, and R.R. Horner. A Pollutant Loading Model for Highway Runoff. *Journal of Environmental Engineering Division, ASCE* 108:1193-1120, 1982.
- Horner, R.R. and E.B. Welch. Stream Periphyton Development in Relation to Current Velocity and Nutrients. *Canadian Journal of Fisheries and Aquatic Sciences* 38:449-457, 1981.

REVIEWED PROCEEDINGS PUBLICATIONS

- May, C.W. and R.R. Horner. 2002. The Limitations of Mitigation-Based Stormwater Management in the Pacific Northwest and the Potential of a Conservation Strategy Based on Low-Impact Development Principles. Proc. 2002 ASCE Stormwater Conference, Portland, OR.
- Horner, R. R. and C. R. Horner. Performance of a Perimeter (“Delaware”) Sand Filter in Treating Stormwater Runoff from a Barge Loading Terminal. Proc. Comprehensive Stormwater and Aquatic Ecosystem Management Conf.; Auckland, New Zealand; February 1999, pp. 183-192, 1999.
- Horner, R. R. and C. W. May. Regional Study Supports Natural Land Cover Protection as Leading Best Management Practice for Maintaining Stream Ecological Integrity. Proc. Comprehensive Stormwater and Aquatic Ecosystem Management Conf.; Auckland, New Zealand; February 1999, pp. 233-248, 1999.
- Horner, R. R. Constructed Wetlands for Urban Runoff Water Quality Control. Proc. National Conf. on Urban Runoff Management; Chicago, Illinois; March 1993, pp. 327-340, 1995.
- Horner, R. R. Training for Construction Site Erosion Control and Stormwater Facility Inspection. Proc. National Conf. on Urban Runoff Management; Chicago, Illinois; March 1993, pp. 426-450, 1995.
- Horner, R. R. Overview of the Puget Sound Wetlands and Stormwater Management Research Program. Proc. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995, pp. 141-145, 1995.

- Horner, R. R. and L. E. Reinelt. Guidelines for Managing Urban Wetlands. Proc. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995, pp. 171-178, 1995.
- Taylor, B. K. Ludwa, and R. R. Horner. Urbanization Effects on Wetland Hydrology and Water Quality. Proc. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995, pp. 146-154, 1995.
- Reinelt, L.E. and R.R. Horner. Urban Stormwater Impacts on the Hydrology and Water Quality of Palustrine Wetlands in the Puget Sound Region. Proc. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1991; pp. 33-42.
- Horner, R.R. Environmental Effects of Calcium Magnesium Acetate, Emphasizing Aquatic Ecosystem Effects. Proc. Conf. on Environmental Impacts of Highway Deicing, Institute of Ecology Publication No. 33, University of California, Davis; 1990; pp. 97-119.
- Stockdale, E.C. and R.R. Horner. Using Freshwater Wetlands for Stormwater Management: A Progress Report. Proc. Wetlands 1988: Urban Wetlands and Riparian Habitat Symposium; Oakland, California, June 1988.
- Horner, R.R. Highway Construction Site Erosion and Pollution Control: Recent Research Results. Proc. 39th Annual Road Builders' Clinic; Moscow, Idaho; March 1988; pp. 37-54.
- Horner, R.R., F.B. Gutermuth, L.L. Conquest, and A.W. Johnson. Urban Stormwater and Puget Trough Wetlands. Proc. 1st Annual Meeting on Puget Sound Research; Seattle, Washington; March 1988; pp. 723-746.
- Weiner, R.F., R.R. Horner, and J. Kettman. Preliminary Comparative Risk Assessment for Hanford Waste Sites. Proc. Waste Management 88; Tucson, Arizona; February 1988.
- Stockdale, E.C. and R.R. Horner. Prospects for Wetlands Use in Stormwater Management. Proc. Coastal Zone 87 Conf.; Seattle, Washington; May 1987; pp. 3701-3714.
- Horner, R.R. A Review of Wetland Water Quality Functions, Proc. Conf. on Wetland Functions, Rehabilitation, and Creation in the Pacific Northwest: The State of Our Understanding; Port Townsend, Washington; May 1986; pp. 33-50.
- Bain, R.C., Jr., R.R. Horner, and L. Nelson. Nonpoint Pollution Control Strategies for Moses Lake, Washington. Proc. Fifth Annual Conf. North American Lake Management Society; Lake Geneva, Wisconsin; November 1985; pp. 170-176.
- Shuster, J.I., E.B. Welch, R.R. Horner, and D.E. Spyridakis. Response of Lake Sammamish to Urban Runoff Control. Proc. Fifth Annual Conf. North American Lake Management Society; Lake Geneva, Wisconsin; November 1985; pp. 229-234.
- Horner, R.R., J.S. Richey, and B.W. Mar. A General Approach to Designing Environmental Monitoring Programs. Proc. Pacific Section AAAS Sym. on Biomonitors, Bioindicators and Bioassays of Environmental Quality; Missoula, Montana; June 1985.
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- Horner, R. R. Review of the Literature on Constructed Wetlands for Municipal Wastewater Treatment. Report to Kramer, Chin and Mayo, Inc., Seattle, Washington, 1994.
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- King County Resource Planning Section (R. R. Horner contributing author). Development of Guidance for Managing Urban Wetlands and Stormwater. Report to Washington Department of Ecology, Olympia, 1991.
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- Horner, R.R. and K.J. Raedeke. Guide for Wetland Mitigation Project Monitoring. Report to Washington State Department of Transportation, 1989.
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- Horner, R.R., M.V. Brenner, and C.A. Jones. Design of Monitoring Programs for Determining Sources of Shellfish Bed Bacterial Contamination Problems. Report to Washington Department of Ecology, 1989.
- Horner, R. R. and C. R. Horner. A Technical Review of the Sediment/Toxicant Retention and Nutrient Removal Transformation Functions of WET 2.0. Report to AScI Corporation and U. S. Environmental Protection Agency, Duluth, Minnesota, 1989.
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- Welch, E.B., J. Oppenheimer, R.R. Horner, and D.E. Spyridakis. Silver Lake Water Quality Nutrient Loading and Management. Report to City of Everett, 1988.
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- Horner, R.R., E.B. Welch, M.R. Seeley, and J.M. Jacoby. Velocity-Related Critical Phosphorus Concentrations in Flowing Water, Phase II. Report to National Science Foundation, 1986.
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- Horner, R.R. and S.R. Wonacott. Performance Evaluation of a Detention Basin and Coalescing Plate Oil Separator for Treating Urban Stormwater Runoff. Report to State of Washington Water Research Center and U.S. Geological Survey, 1985.
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- Horner, R.R. Highway Runoff Water Quality Research Implementation Manual, Vol. 1-2, FHWA WA-RD 72.1,2. Report to Washington State Department of Transportation, 1985.
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- Mar, B.W., D.P. Lettenmaier, R.R. Horner, J.S. Richey, R.N. Palmer, S.P. Millard, and M.C. MacKenzie. Sampling Design for Aquatic Ecological Monitoring, Vol. 1-5. Final Report on Electric Power Research Institute, Project RP1729-1, 1985.
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- Brown and Caldwell Engineers and R.R. Horner. Moses Lake Clean Lake Project, Phase I. Report to Moses Lake Irrigation and Rehabilitation District, 1984.
- Mar, B.W., D.P. Lettenmaier, J.S. Richey, R.R. Horner, R.N. Palmer, S.P. Millard, and G.L. Thomas. Sampling Design for Aquatic Ecological Monitoring, Phase II--Methods Development, Vol. 1-2. Report to Electric Power Research Institute, 1984.
- Horner, R.R. Highway Runoff Water Quality Technology Transfer Workshop Handbook. Prepared for Washington State Department of Transportation, 1983.
- Pedersen, E.R., R.R. Horner, and G.L. Portele. SR 528 - 4th Street Extension, Marysville, Snohomish County, Washington: Draft Environmental Impact Statement. Prepared for City of Marysville, 1983.
- Horner, R.R., B.W. Mar, B. Chaplin, and F. Conroy. Implementation Plan for Highway Runoff Water Quality Research Results. Report to Washington State Department of Transportation, 1983.

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- Horner, R.R. and B.W. Mar. Guide for Water Quality Assessment of Highway Operations and Maintenance, FHWA WA-RD-39.14. Report to Washington State Department of Transportation, 1982.
- Mar, B.W., D.P. Lettenmaier, R.R. Horner, D.M. Eggers, R.N. Palmer, G.J. Portele, J.S. Richey, E.B. Welch, G. Wiens, and J. Yearsley. Sampling Design for Aquatic Ecological Monitoring, Phase 1. Report to Electric Power Research Institute, 1982.
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- Wang, T.S., D.E. Spyridakis, B.W. Mar, and R.R. Horner. Transport, Deposition, and Control of Heavy Metals in Highway Runoff, FHWA WA-RD-39.10. Report to Washington State Department of Transportation, 1982.
- Chui, T.W., B.W. Mar, and R.R. Horner. Highway Runoff in Washington State: Model Validation and Statistical Analysis, FHWA WA-RD-39.12. Report to Washington State Department of Transportation, 1981.
- Mar, B.W., J.F. Ferguson, D.E. Spyridakis, E.B. Welch, and R.R. Horner. Year 4, Runoff Water Quality, August 1980-August 1981, FHWA WA-RD-39.13. Report to Washington State Department of Transportation, 1981.
- Horner, R.R. and S.M. Grason. An Ecological Study of the Monocacy Creek and its Groundwater Sources in the Vicinity of Camels Hump. Report to the Monocacy Creek Watershed Association, Bethlehem, Pennsylvania, 1981.
- Horner, R.R. and E.B. Welch. Background Conditions in the Lower Pilchuck River Prior to SR-2 Construction. Report to Washington State Department of Transportation, 1979.
- Horner, R.R. and B.W. Mar. Highway Runoff Monitoring: The Initial Year, FHWA WA-RD-39.3. Report to Washington State Department of Transportation, 1979.
- Horner, R.R. and E.B. Welch. Effects of Velocity and Nutrient Alterations on Stream Primary Producers and Associated Organisms, FHWA WA-RD-39.2. Report to Washington State Department of Transportation, 1978.

Horner, R.R., T.J. Waddle, and S.J. Burges. Review of the Literature on Water Quality Impacts of Highway Operations and Maintenance. Report to Washington State Department of Transportation, 1977.

Horner, R.R. A Method of Defining Urban Ecosystem Relationships Through Consideration of Water Resources. U.S. Man and the Biosphere Project 11 Report, 1977.

Horner, R.R. and R. Gilliom. Bear Lake: Current Status and the Consequences of Residential Development. Report to Bear Lake Residents' Association, Kitsap County, Washington, 1977.

PRESENTATIONS AND DISCUSSIONS

*Presented by a co-author. In all other cases, I presented the paper.

Stormwater Runoff Flow Control Benefits of Urban Drainage System Reconstruction According to Natural Principles. Puget Sound/Georgia Strait Research Meeting; Vancouver, British Columbia; April 2003.

Structural and Non-Structural Best Management Practices (BMPs) for Protecting Streams. Invited presentation at the Engineering Foundation Conference on Linking Stormwater BMP Designs and Performance to Receiving Water Impact Mitigation; Snowmass, Colorado; August 2001.

Performance of a Perimeter (“Delaware”) Sand Filter in Treating Stormwater Runoff from a Barge Loading Terminal. Invited presentation at the Comprehensive Stormwater and Aquatic Ecosystem Management Conf.; Auckland, New Zealand; February 1999.

Regional Study Supports Natural Land Cover Protection as Leading Best Management Practice for Maintaining Stream Ecological Integrity. Invited presentation at the Comprehensive Stormwater and Aquatic Ecosystem Management Conf.; Auckland, New Zealand; February 1999.

Watershed Determinants of Ecosystem Functioning. Invited presentation at the Engineering Foundation Conference on Effects of Watershed Development on Aquatic Ecosystems Urban Runoff and Receiving Systems; Snowbird, Utah; August 1996.

Overview of the Puget Sound Wetlands and Stormwater Management Research Program. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995.

Guidelines for Managing Urban Wetlands. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995.

Urbanization Effects on Wetland Hydrology and Water Quality. Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1995 (prepared with B. Taylor and K. Ludwa).*

Constructed Wetlands for Urban Runoff Water Quality Control. Invited presentation at National Conf. on Urban Runoff Management; Chicago, Illinois; March 1993.

Training for Construction Site Erosion Control and Stormwater Facility Inspection. Invited presentation at National Conf. on Urban Runoff Management; Chicago, Illinois; March 1993.

Toward Ecologically Based Urban Runoff Management. Invited presentation at The Engineering Foundation Conference on Urban Runoff and Receiving Systems; Crested Butte, Colorado; August 1991.

How Stormwater Harms Shellfish. Invited presentation at the Pacific Rim Shellfish Sanitation Conference; Seattle, Washington; May 1991.

Environmental Evaluation of Calcium Magnesium Acetate for Highway Deicing Applications. Invited presentation at Conference on Calcium Magnesium Acetate, An Emerging Chemical for Environmental Applications; Boston, Massachusetts; May 1991.

Issues in Stormwater Management. Statement to State Senate Environment and Natural Resources Committee; Olympia, Washington; January 1991.

Urban Stormwater Impacts on the Hydrology and Water Quality of Palustrine Wetlands in the Puget Sound Region. Invited presentation at Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; January 1991 (prepared with L.E. Reinelt).

The Impact of Nonpoint Source Pollution on River Ecosystems. Invited presentation at the Northwest Rivers Conference; Seattle, Washington; November 1990.

Research Program Overview and Discussion of Hydrologic and Water Quality Studies. Presented at the Puget Sound Wetlands and Stormwater Management Research Program Workshop; Seattle, Washington; October 1990.

Control of Urban Runoff Water Quality. Invited presentations at American Society of Civil Engineers Urban Stormwater Short Courses; Bellevue, Washington; April, 1990; Portland, Oregon; July 1990.

Various Aspects of Erosion Prevention and Control. Invited presentations at University of Wisconsin Erosion Control Short Course; Seattle, Washington; July 1990.

Examination of the Hydrology and Water Quality of Wetlands Affected by Urban Stormwater. Presented at the Society of Wetland Scientists Annual Meeting; Breckenridge, Colorado, June 1990 (prepared with L.E. Reinelt).*

Analysis of Plant Communities of Wetlands Affected by Urban Stormwater. Presented at the Society of Wetland Scientists Annual Meeting; Breckenridge, Colorado; June 1990 (prepared with S.S. Cooke).*

Environmental Evaluation of Calcium Magnesium Acetate. Invited presentation at the Symposium on the Environmental Impact of Highway Deicing; Davis, California; October 1989.

Application of Wetland Science Principles in the Classroom and Community. Invited presentation at the Annual Meeting of the Association of Collegiate Schools of Planning; Portland, Oregon; October 1989.

Structural Controls for Urban Storm Runoff Water Quality. Invited presentation at the Northwest Regional Meeting of the North American Lake Management Society; Seattle, Washington; September 1989.

The Puget Sound Wetlands and Stormwater Management Research Program. Invited presentation at the U.S. Environmental Protection Agency Workshop on Wetlands and Stormwater; Seattle, Washington; September 1989.

An Overview of Storm Runoff Water Quality Control. Invited presentation at the American Water Resources Association Workshop on Forest Conversion; LaGrande, Washington; November 1988.

Progress in Wetlands Research. Invited presentation at the Pacific Northwest Pollution Control Association Annual Meeting; Coeur d'Alene, Idaho; October 1988.

Long-Term Effects of Urban Stormwater on Wetlands. Invited presentation at the Engineering Foundation Conference on Urban Stormwater; Potosi, Missouri; July 1988.

Highway Construction Site Erosion and Pollution Control: Recent Research Results. Invited presentation at the 39th Annual Road Builders' Clinic; Moscow, Idaho; March 1988.

Urban Stormwater and Puget Trough Wetlands. Presented at the 1st Annual Puget Sound Water Quality Authority Research Meeting; Seattle, Washington; March 1988 (prepared with F.B. Gutermuth, L.L. Conquest, and A.W. Johnson).

Preliminary Comparative Risk Assessment for Hanford Waste Sites. Presented at Waste Management 88; Tucson, Arizona; February 1988 (prepared with R.F. Weiner and J. Kettman).*

What Goes on at the Hanford Nuclear Reservation? Invited presentation at the Northwest Association for Environmental Studies Annual Meeting; Western Washington University, Bellingham, WA; November 1987.

The Puget Sound Wetlands and Stormwater Management Research Program. Invited presentation at the Pacific Northwest Pollution Control Association Annual Meeting; Spokane, Washington; October 1987.

Design of Cost-Effective Monitoring Programs for Nonpoint Source Water Pollution Problems. Invited presentation at the American Water Resources Association, Puget Sound Chapter, Annual Meeting; Bellevue, Washington; November 1986.

A Review of Wetland Water Quality Functions. Invited plenary presentation at the Conference on Wetland Functions, Rehabilitation, and Creation in the Pacific Northwest: The State of Our Understanding; Port Townsend, Washington; May 1986.

Nonpoint Discharge and Runoff session leader. American Society of Civil Engineers Spring Convention; Seattle, Washington; April 1986.

Prevention of Lake Sammamish Degradation from Future Development. Invited presentation at the American Society of Civil Engineers Spring Convention; Seattle, Washington; April 1986.

- Design of Monitoring Programs for Nonpoint Source Water Pollution Problems. Invited presentation at the American Society of Civil Engineers Spring Convention; Seattle, Washington, April 1986 (prepared with L.E. Reinelt, B.W. Mar, and J.S. Richey).*
- Nonpoint Pollution Control Strategies for Moses Lake, Washington. Presented at the Fifth Annual Meeting of the North American Lake Management Society; Lake Geneva, Wisconsin; November 1985 (prepared with R.C. Bain, Jr., and L. Nelson).
- Response of Lake Sammamish to Urban Runoff Control. Presented at the Fifth Annual Meeting of the North American Lake Management Society; Lake Geneva, Wisconsin; November 1985 (prepared with J.I. Shuster, E.B. Welch, and D.E. Spyridakis).*
- A General Approach to Designing Environmental Monitoring Programs. Invited presentation at the Pacific Section AAAS Symposium on Biomonitors, Bioindicators, and Bioassays of Environmental Quality; Missoula, Montana; June 1985 (prepared with J.S. Richey and B.W. Mar).
- Panel Discussion on the Planning Process for Non-point Pollution Abatement Programs. Non-point Pollution Abatement Symposium; Milwaukee, Wisconsin; April 1985.
- Nutrient Transport Processes in an Agricultural Watershed. Presented at the Fourth Annual Meeting of the North American Lake Management Society; McAfee, New Jersey; October 1984 (prepared with E.B. Welch, M.M. Wineman, M.J. Adolfson, and R.C. Bain Jr.).*
- Nutrient Transport Processes in an Agricultural Watershed. Presented at the American Society of Limnology and Oceanography Annual Meeting; Vancouver, British Columbia; June 1984 (prepared with M.M. Wineman, M.J. Adolfson, and R.C. Bain, Jr.).
- Factors Affecting Periphytic Algal Biomass in Six Swedish Streams. Presented at the American Society of Limnology and Oceanography Annual Meeting; Vancouver, British Columbia; June 1984 (prepared with J.M. Jacoby and E.B. Welch).*
- A Conceptual Framework to Guide Aquatic Monitoring Program Design for Thermal Electric Power Plants. Presented at the American Society for Testing and Materials Symposium on Rationale for Sampling and Interpretation of Ecological Data in the Assessment of Freshwater Ecosystems; Philadelphia, Pennsylvania; November 1983 (prepared with J.S. Richey, and G.L. Thomas).
- Panel Discussion. Public Forum: Perspectives on Cumulative Effects; Institute for Environmental Studies; University of Washington; Seattle, Washington; August 1983.
- A Guide for Assessing the Water Quality Impacts of Highway Operations and Maintenance. Presented at the Transportation Research Board Annual Meeting; Washington, D.C.; January 1983 (prepared with B.W. Mar).
- Assessment of Pollutant Loadings and Concentrations in Highway Stormwater Runoff. Presented at the Pacific Northwest Pollution Control Association Annual Meeting; Vancouver, British Columbia; November 1982 (prepared with B.W. Mar and L.M. Little).
- Phosphorus and Velocity as Determinants of Nuisance Periphytic Biomass. Presented at the International Workshop on Freshwater Periphyton (SIL); Vaxjo, Sweden; September 1982 (prepared with E.B. Welch and R.B. Veenstra).*

The Development of Nuisance Periphytic Algae in Laboratory Streams in Relation to Enrichment and Velocity. Presented at the American Society of Limnology and Oceanography Annual Meeting; Raleigh, North Carolina; June 1982 (prepared with R.B. Veenstra and E.B. Welch).

A Predictive Model for Highway Runoff Pollutant Concentrations and Loadings. Presented at the Stormwater and Water Quality Model Users' Group Meeting; Alexandria, Virginia; March 1982 (prepared with B.W. Mar).

Stream Periphyton Development in Relation to Current Velocity and Nutrients. Presented at American Society of Limnology and Oceanography Winter Meeting; Corpus Christi, Texas; January 1979 (prepared with E.B. Welch).

A Comparison of Discrete Versus Composite Sampling of Storm Runoff. Presented at the Northwest Pollution Control Association Annual Meeting; Victoria, British Columbia; October 1978 (prepared with B.W. Mar and J.F. Ferguson).*

A Method of Defining Urban Ecosystem Relationships Through Consideration of Water Resources. Presented at UNESCO International Man and the Biosphere Project 11 Conference; Poznan, Poland; September 1977.

GRADUATE AND UNDERGRADUATE COURSES TAUGHT (University of Washington)

Landscape Architecture 590, Urban Water Resources Seminar; 3 quarters.

Landscape Architecture 522/523, Watershed Analysis and Design; 15 quarters.

Engineering 260, Thermodynamics; 1 quarter.

Engineering 210, Engineering Statics; 2 quarters.

Civil Engineering/Water and Air Resources 453, Water and Wastewater Treatment; 1 quarter.

Civil Engineering/Water and Air Resources 599, Analyzing Urbanizing Watersheds; 1 quarter.

CONTINUING EDUCATION SHORT COURSES TAUGHT (University of Washington; multiple offerings)

Infiltration Facilities for Stormwater Quality Control

Wetlands Ecology, Protection, and Restoration

Storm and Surface Water Monitoring

Fundamentals of Urban Surface Water Management

Applied Stormwater Pollution Prevention Planning Techniques

Construction Site Erosion and Pollution Control Problems and Planning

Construction Site Erosion and Pollution Control Practices

Construction Site Erosion and Sediment Control Inspector Training
Inspection and Maintenance of Permanent Stormwater Management Facilities
Biofiltration for Stormwater Runoff Quality Control
Constructed Wetlands for Stormwater Runoff Quality Control

LOCAL COMMITTEES

Technical Advisory Committee, City of Seattle Environmental Priorities Project, 1990-91.
Environmental Toxicology Graduate Program Planning Committee, University of Washington, 1990.
Habitat Modification Technical Work Group, Puget Sound Water Quality Authority, 1987.
Underground Injection Control of Stormwater Work Group, Washington State Department of Ecology, 1987.
Nonpoint Source Pollution Conference Advisory Committee, 1986-87.
Puget Sound Wetlands and Stormwater Management Research Committee, 1986-90.
Accreditation Review, University of Washington Department of Landscape Architecture, 1986.
Planning Committee for University of Washington Institute for Environmental Studies Forum on Perspectives on Cumulative Environmental Effects, 1983.

CONSULTING

Smith and Lowney, PLC, Seattle, Washington; Technical assistance in Clean Water Act legal cases; 1996, 2002-present.
U. S. Federal Court, Central District of California; Special master in Clean Water Act case; 2001-present.
Orange County Coastkeeper and Lawyers for Clean Water; Assistance with legal cases involving construction site pollution control and monitoring; 2001-present.
Storm Water Pollution Prevention Program, City of San Diego; Advising on response to municipal stormwater NPDES program; 2001-2002.
San Diego Baykeeper, San Diego, California; Technical and program analysis and testimony on potential legal cases involving municipal and industrial stormwater NPDES permit compliance; 1996.
Clean South Bay, Palo Alto, California; Technical and program analysis and testimony on potential legal cases involving municipal and industrial stormwater NPDES permit compliance; 1996.

Resource Planning Associates, Seattle, Washington; Assistance with various aspects of monitoring under Seattle-Tacoma International Airport's stormwater NPDES permit; 1995-97.

Watershed Management Institute, Crawfordsville, Florida; Writing certain chapters of guides for stormwater program development and implementation and maintenance of stormwater facilities; 1995-present.

Natural Resources Defense Council, Los Angeles, California; Technical and program analysis and testimony on legal cases involving municipal and industrial stormwater NPDES permit compliance; 1993-present.

King County Roads Division, Seattle, Washington; Teaching two courses on construction erosion and sediment control; 1995.

Snohomish County Roads Division, Seattle, Washington; Teaching a course on construction erosion and sediment control; 1995.

Alaska Marine Lines, Seattle, Washington; Performance test of a sand filter stormwater treatment system; 1994-95.

Economic and Engineering Services, Inc., Bellevue, Washington; Assessment of the potential for water quality benefits through modifying existing stormwater ponds; technical advice on remedying operating problems at infiltration ponds; 1994-96.

Washington State Department of Transportation, Olympia, Washington; Teaching courses on construction erosion and sediment control; 1994.

City of Bellevue, Washington; Peer review of documents on potential erosion associated with a road project; analysis of stormwater quality data; 1993-95.

City of Kelowna, B. C., Canada; Teaching short courses on constructed wetlands and erosion and sediment control; 1993.

Oregon Department of Environmental Quality, Portland, Oregon; Technical review of Willamette River Basin Water Quality Study reports; 1992-93.

Whatcom County, Bellingham, Washington; Mediation on lakeshore development moratorium among county, water district, and local community representatives; 1993.

Boeing Commercial Airplane Company, Renton, Washington and Sverdrup Corporation, Kirkland, Washington (at request of City of Renton); Review of stormwater control system design; design of performance monitoring study for system; 1992-94.

Golder Associates, Redmond, Washington; Technical advisor for study of stormwater infiltration; 1992.

Smith, Smart, Hancock, Tabler, and Schwensen Attorneys, Seattle, Washington; Technical advice on a legal case involving a stormwater detention pond; 1992.

PIPE, Inc., Tacoma, Washington; Teaching a course on the stormwater NPDES permit; 1992.

CH₂M-Hill, Inc., Bellevue, Washington and Portland, Oregon; Technical seminar on constructing wetlands for wastewater treatment; literature review on toxicant cycling in

arid-region wetlands constructed for waterwater treatment; literature and data review on lake nutrient input reduction; expert panel on TMDL analysis for Chehalis River; 1989-1995.

Kramer, Chin and Mayo, Inc., Seattle, Washington; Watershed analysis in Washington County and Lake Oswego, Oregon; literature review in preparation for stormwater infiltration system design; literature review and contribution to design of constructed wetland for municipal wastewater treatment; 1989-1995.

Woodward-Clyde Consultants, Portland, Oregon and Oakland, California; Analysis of wetland capabilities for receiving urban stormwater; design of a constructed wetland for urban stormwater treatment; technical advisor on Washington Department of Ecology and City of Portland stormwater manual updates; 1989-present.

R.W. Beck and Associates, Seattle, Washington; Assessment of pollutant loadings and their reduction for one master drainage planning and two watershed planning efforts; 1989-92.

Boeing Computer Services Corporation, Bellevue, Washington; mediation among Boeing, citizens' group, and City of Bellevue on stormwater control system design; 1990.

Parametrix, Inc., Bellevue, Washington; Review of Kitsap County Drainage Ordinance; 1990.

U.S. Environmental Protection Agency, Duluth Laboratory; Review of certain provisions of WET 2.0 wetland functional assessment model; 1989.

King County Council, Seattle, Washington; Review of King County Surface Water Design Manual; 1989.

Port of Tacoma, Washington; Assessment of stormwater control strategies; 1989.

Municipality of Metropolitan Seattle, Seattle, Washington; Assessment of land treatment systems for controlling urban storm runoff water quality; 1988-1992.

Impact Assessment, Inc., La Jolla, California (contractor to Washington State Department of Ecology); Socioeconomic impact assessment of the proposed high-level nuclear waste repository at Hanford, Washington; 1987.

Technical Resources, Inc., Rockville, Maryland (contractor to U. S. Environmental Protection Agency); assessment of water treatment waste disposal at pulp and paper plants; 1987-88.

Dames and Moore, Seattle, Washington; analysis of the consequences of a development to Martha Lake; 1987.

Harper-Owes, Seattle, Washington; project oversight, data analysis, and review of limnological aspects for Lake Chelan Water Quality Assessment Study; 1986-88.

URS Corporation, Seattle, Washington and Columbus, Ohio; presentation of a workshop on nonpoint source water pollution monitoring program design; analysis of innovative and alternative wastewater treatment for Columbus; development of a stormwater utility for Puyallup, Washington; watershed analysis for Edmonds, Washington; 1986-88.

Entranco Engineers, Bellevue, Washington; environmental impact assessment of proposed highway construction; technical review of Lake Sammamish watershed management project; technical review of Capital Lake wetland development; 1981-82; 1987-88; 1990.

Washington State Department of Ecology, Olympia, Washington; review of literature on wetland water quality, preparation of conference plenary paper, and leading discussion group at conference; analysis in preparation for a Shoreline Hearing Board case; 1986-87.

Richard C. Bain, Jr., Engineering Consultant, Vashon Island, Washington; analysis of watershed data and development of a policy for septic tank usage near Moses Lake, Washington; 1984-87.

University of Washington Friday Harbor Laboratory; analysis of adjacent port development and preparation of testimony for Shoreline Hearing Board; 1986.

Washington State Department of Transportation and Morrison-Knudsen Company, Inc./H.W. Lochner, Inc., Joint Venture, Mercer Island, Washington; environmental assessment of disposal of excavated material by capping a marine dredge spoil dumping site; 1984.

Foster, Pepper, and Riviera Attorneys, Seattle, Washington; analysis and testimony on provisions to reduce pollutants in stormwater runoff from a site proposed for development; 1983.

Williams, Lanza, Kastner, and Gibbs Attorneys, Seattle, Washington; collection and analysis of water quality data to support a legal case and preparation of testimony; 1982.

Herrera Environmental Consultants, Seattle, Washington; lake data analysis and report preparation; 1982-83.

Brown and Caldwell Engineers, Seattle, Washington; data collection and analysis for watershed study; 1982-83.

City of Marysville, Washington; environmental impact assessment of proposed bridge construction; 1982-83.

F.X. Browne Associates, Inc., Lansdale, Pennsylvania; contributions to manual on lake restoration for U.S. Environmental Protection Agency; preparation of funding proposals and permits for lake restoration; lake data analysis; literature reviews and analysis of septic tank contributions to lake nutrient loading and availability of different forms of nutrients; 1980-83.

Reston Division of Prentice-Hall, Inc., Reston, Virginia; review of and contributions to texts on environmental technology; 1978-79.

Butterfield, Joachim, Brodt, and Hemphill Attorneys, Bethlehem, Pennsylvania; analysis of environmental impact statements; expert witness; 1973.



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November 29, 2007

Via Federal Express

Mr. Eric Strecker, P.E.
Geosyntec Consultants
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Portland, OR 97204

Ms. Cassandra Owens
Los Angeles Regional Water Quality Board
320 West 4th Street, Suite 200
Los Angeles, CA 90013

Re: Santa Susana Field Laboratory Expert Panel

Dear Mr. Strecker and Ms. Owens:

I was honored to receive your November 16, 2007 letter in which you asked if I would like to participate as an expert panel member to oversee the selection and design of engineered natural treatment systems (ENTS) to meet National Pollutant Discharge Elimination System (NPDES) permit-specified numeric limits for stormwater runoff at Boeing's Santa Susana Field Laboratory (SSFL), located in southern California. I (with the assistance of the other members of our firm, Wright Water Engineers, Inc. [WWE]) am highly interested in serving as an expert panel member. I sincerely appreciate your consideration of my qualifications to serve in this capacity, as summarized in this letter and the attachments.

To prepare this submittal, I have reviewed your November 16 letter and information on the various websites that were referred to in that letter. In addition, earlier in 2007, WWE was privileged to provide peer review for Geosyntec, Inc. on the post-fire recovery assessment for the SSFL. Tasks involved compiling a literature summary of post-fire watershed recovery data, providing input on the field sampling plan and analysis of data collected, and observing Geosyntec in the field to provide input on data collection methods. Through these activities, we became familiar with SSFL.

Based on our current knowledge of this site and our review of the information that you referred to, this letter and the attachments are divided into the following categories to demonstrate my personal (as well as WWE's) experience to serve as a panel member:

1. Engineered natural treatment systems, including channel stabilization.
2. Development of site-specific design storms.
3. NPDES permit compliance, including the requirement that stormwater discharges meet numeric limits.
4. Post-fire recovery.

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5. Stormwater monitoring.
6. Radionuclide migration and mitigation.
7. Construction phase water quality protection.
8. Stormwater management at industrial sites with known sources of surface water and groundwater contamination.
9. California experience.
10. Serving as a member of expert panels and on controversial projects with significant public input.

Prior to addressing each of these subjects, I have prepared a brief overview of WWE's history, and my personal experience, as follows.

GENERAL BACKGROUND

WWE was founded in 1961. I joined the firm in 1981 after having worked as a college student intern for the United States Environmental Protection Agency (USEPA) for three years. WWE works throughout the United States and internationally on water resources engineering assignments. I have personally worked on assignments in 26 states and am a registered professional engineer in 10 states. WWE is characterized by long-term, highly satisfied clients, many of which have retained us for 20 years or longer. We have particular expertise and a strong track record on projects that require public presentation and/or expert testimony on controversial, politically charged situations involving complex technical issues.

Beginning approximately 10 years ago, the University of Denver School of Business helped us to begin an annual survey of our clients. We ask eight questions on a scale of 1 to 5, including (as examples) clarity of communications, engineering competence and cost-effectiveness. WWE's composite score is consistently 4.6 to 4.7 (out of 5.0). Representatives of the University of Denver have told us that this is outstanding for a service organization. Such ratings are likely one reason that we have been privileged to receive such awards as the 1996 "Colorado Ethics in Business Award" and the equivalent award at a national level in 1999 by the National Society of Financial Professionals.

I have bachelor's and master's degrees in civil engineering from the University of Virginia in 1980 and 1981. In my nearly 27 years at WWE, I have worked on numerous projects involving stormwater management around the United States, for public and private sector clients. I was privileged to chair the committee of over 100 engineers from the United States, Canada and Europe that prepared the widely disseminated 1992 reference published by the ASCE and WERF entitled *Manual of Practice for the Design and Construction of Urban Stormwater Management Systems*. I was a contributing author on the follow-up reference published by ASCE and WERF

in 1998 entitled *Manual of Practice for Urban Runoff Quality Management*. Along with Eric Strecker, P.E., I serve as co-principal investigator of the *International Stormwater BMP Database*, described below. I have been privileged to serve as coauthor of numerous stormwater drainage criteria manuals, watershed plans and major drainageway master plans around the United States. I am particularly proud to have served in this capacity for Volumes 1 and 2 of the Denver Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual*, which is one of the most widely cited documents of its kind in the contemporary literature. The Denver Manual provides detailed, "hardcore" design guidance. As shown in my resume (which is the final document in the attached comb-bound collection of materials), I regularly publish and serve on numerous professional committees. I have testified as an engineering expert on approximately 75 occasions. Over the past decade, I have managed many assignments for WWE involving ENTS and the development of site-specific design storms, as described below.

Eric Strecker is familiar with WWE's business practices (and my personal qualifications and approach to business), having worked with us for the past 10 years on co-development of the *International BMP Database* (www.bmpdatabase.org). This is the largest scientific database of BMP performance available. The database is co-sponsored by the Water Environment Research Foundation (WERF), American Society of Civil Engineers (ASCE), USEPA, Federal Highway Administration (FHWA), American Public Works Association (APWA) and the Environmental and Water Resources Institute (EWRI). This database, which will be highly relevant for the SSFL expert panel, has been well received by stormwater management practitioners nationally and internationally, and was selected by the American Society of Civil Engineers in 2004 for its prestigious Innovative Project of the Year award. I cite the *International BMP Database* as a representative project not only because of its relevance to SSFL, but also because it demonstrates key characteristics of my approach to assignments:

1. Provide regular and clear written and verbal communications.
2. Assure timeliness
3. Provide work of excellent quality
4. Foster collaboration with other experts
5. Seek out independent review by recognized experts
6. Commit to getting the work done well, even under challenging conditions (Geosyntec and WWE have continued to support the BMP Database even when funding was minimal.)

With that as brief introduction, I turn now to providing representative examples of my personal and our corporate experience in the ten broad categories listed above.

Engineered Natural Treatment Systems

WWE is regularly called upon by our public and private sector clients to assist with the planning, design, construction oversight and follow-up maintenance/monitoring of sustainable ENTS, such as wetlands, slow-flow channels, wet ponds, low impact development (LID) practices, infiltration facilities, and other features of this kind. Since WWE's inception in 1961, we have consistently called for the preservation of natural drainage systems and have advocated "designing with nature." We emphasize the need for stormwater quantity and quality management facilities that are safe, community amenities, multipurpose in nature and which will last for many years. Eric Strecker knows that many of our staff conduct paleohydrologic research at Machu Picchu in Peru, Mesa Verde National Park in Colorado, and Roman waterworks in Europe. Our research has shown that properly engineered water supply and drainage systems can serve as community amenities for centuries, in a sustainable manner.

Specific examples of my personal and our corporate ENTS experience are as follows (please refer to the tabs in the attached comb-bound document):

- Tab 1 The Cliffs at Castle Pines Subdivision, Douglas County, Colorado—These LID design drawings are highly relevant for Santa Susana because the topographic setting is similar. Essentially, very large homes sit at the top of a cliff, and our design objective was to minimize adverse impacts to houses located at the base of the cliff and to remove pollutants from stormwater runoff. Steep, ephemeral channels drain the property. The various LID components that were constructed have proven to be highly effective hydrologically and from a water quality standpoint, and they have been maintainable, functional and attractive.
- Tab 2 Chatfield Green Stormwater Bypass/Management System—Chatfield Green is a residential development on the west side of the Denver metro area. It is located immediately upslope from the Denver Arboretum, owned by the City and County of Denver. Denver was concerned about receiving contaminated stormwater runoff from the development, so WWE co-designed a stormwater bypass and management system. Key components of this systems were three large wet ponds and two wetlands. Drawings for the wetlands are included. WWE worked with the parties to develop a stormwater quality monitoring plan. On the basis of the data collected, the Denver Arboretum came to recognize that the ponds and wetlands were highly effective at removing pollutants from the stormwater, and they ultimately asked that the treated stormwater be discharged onto the arboretum for irrigation. This has been a highly successful project that was initially controversial and somewhat confrontational (prior to WWE's involvement).
- Tab 3 Wilson Mine in Hot Springs, Arkansas—For the past decade, WWE has been working for Union Carbide on a large mine reclamation plan for a uranium/vanadium open pit mine near Hot Springs, Arkansas. We have designed and overseen the construction of numerous ENTS at this mine, including the photographs that appear under Tab 3, for wetlands, slow-flow wetland channels, grade control structures and the like. Our work

is overseen by the Arkansas Department of Environmental Quality (ADEQ), and they require that all facilities are sustainable. I provide this as an example not only because the ENTS that we have designed have been successful, but also because stream water quality/biology has shown a continual improvement in response to the implementation of the ENTS, and, because similar to Santa Susana, this site contains a complex mixture of industrial surface and subsurface pollutants.

- Tab 4 Biotechnical Engineering Features/Pond Edge and Channel Treatments—This single sheet drawing depicts generalized approaches that we use for the design of channels and pond/wetland edge treatments. We have found that the approaches depicted on that drawing are not only effective hydraulically and from the standpoint of maintaining channel stability, but that they are also sustainable, attractive, and well received by local residents.
- Tab 5 Strategies for Minimizing Adverse Hydrologic Impacts to Wetlands—This single sheet drawing demonstrates various techniques that we have utilized to minimize hydrologic impacts to wetlands and streams of development features such as buildings, roads, etc. I have overseen the preparation of numerous stormwater quality management plans for mountainous development, and a common objective with these is to strictly minimize adverse impacts to wetlands and stream water quality (many of these projects are in sensitive environmental settings). Post-construction monitoring by our staff indicates that the kinds of features depicted on this drawing are highly effective hydrologically, require little maintenance, and are sustainable.
- Tab 6 Valley Water Mill Reservoir Wetland in Springfield, Missouri—These drawings depict a wetland design that we conducted for the Watershed Committee of the Ozarks for a pretreatment wetland at the upper end of Valley Water Mill Reservoir in Springfield, Missouri. The purpose of this wetland was to provide pretreatment of wet weather flows prior to their discharge into a reservoir. To perform this design, it was necessary to develop an understanding of the groundwater and surface water hydrologic regime, which proved to be complex. We also estimated sediment loadings/movement through the wetland. It was necessary for us to assess bed load and suspended load movement into and through the wetland as part of our design.
- Tab 7 Rocky Mountain Arsenal Stormwater Habitat Pond—WWE is extremely proud of a large ENTS that we designed and oversaw the construction of on the Rocky Mountain Arsenal, as shown in these drawings. Since this facility's construction, follow-up field observations indicate that the wetland is thriving and that the facility serves as a magnet for wildlife. It is highly attractive. The wetland/pond complex is highly regarded by local governments and federal agencies.
- Tab 8 Eagles Nest Golf Course—The Eagles Nest Golf Course and residential community is located in Summit County, Colorado, and is adjacent to the Blue River, which is a Gold Medal trout stream. It was necessary for our client, Intrawest, to develop Eagles Nest with a high level of water quality sensitivity. Consequently, we worked closely with

Intrawest and their general site civil engineer to design ENTS that would provide a high level of treatment prior to discharge to the Blue River. We have conducted annual macroinvertebrate monitoring in the Blue River immediately upstream and downstream from Eagles Nest to evaluate the effectiveness of the water quality protection strategy that we developed, and field data demonstrate that there have been no measurable adverse effects to aquatic life from the development.

- Tab 9 Lena Gulch Channel Improvements—Lena Gulch is a major drainageway near Golden, Colorado, in a residential area. WWE was retained by Jefferson County and the Urban Drainage and Flood Control District to develop a channel restoration plan that would emphasize water quality enhancement, aesthetics and the creation of a “natural” feel. The resulting plan was developed through extensive communications with residents of the neighborhood. Aesthetic grade control and stream channel stabilization measures were utilized (see photograph).
- Tab 10 Greens at Springfield—Working as a subconsultant to Crafton Tull Sparks Consulting Engineers (Rogers, Arkansas), WWE prepared a stormwater quality management plan for a golf course/apartment development in southwest Missouri known as the “Greens at Springfield.” Tab 10 provides drawings of the many stormwater quality management features that were used at the site, including, for example, slow-flow channels, aesthetic grade control structures, wetlands, wet ponds, multiple nonstructural measures for the golf course, such as integrated pest management and others. The objective was to provide a high level of treatment using aesthetic features to protect the downstream public water supply reservoir. Our philosophy was to utilize multiple measures in series (i.e., a “treatment train” approach) and to utilize conservative design criteria.
- Tab 11 Lone Tree Pond L-3 Water Quality Improvements—This recent project serves as a good example of retrofitting a conventional stormwater detention pond into a water quality treatment facility. This work was conducted for a long-time client, the Arapahoe County Water and Wastewater Authority. Water quality retrofitting is a component of many of our assignments.
- Tab 12 Grade Control Structures in Springfield, Missouri Storm Drainage Criteria Manual—From the materials that you have sent, it appears that stream channel stabilization measures will need to be utilized at the Santa Susana site. I (and WWE) have considerable experience in this area, at projects around the United States. Tab 12 provides examples of drop structure designs that we prepared for the City of Springfield, Missouri and Greene County, Missouri, in a storm drainage criteria manual we recently prepared. Note that we developed details for “sculpted-architectural” drops that we have successfully utilized elsewhere. These are designed to blend into the natural topography, yet be fully functional and stable in the design storm. To be sustainable, the SSFL channel stabilization measures will need to be structurally sound during large runoff events and heavy debris loads.

DEVELOPMENT OF SITE-SPECIFIC DESIGN STORMS

I (and WWE) have considerable experience with the development of site-specific design storms for water quality facilities, and rainfall analysis, in general. For example, please see representative text from the 1992 *Manual of Practice for the Design and Construction of Urban Stormwater Management Systems* that I have provided in Tab 13, and the “Rainfall” chapter from the Denver Urban Storm Drainage Criteria Manual, provided as Tab 14. I played a major role in the preparation of the text of those documents, including the underlying technical foundation/analysis.

In 2003–2004, I was asked to assist land planners and civil engineers in Columbia, Missouri with the development of a sophisticated, multifaceted stormwater quality management plan for a proposed 500-acre commercial/residential development known as Phillips Farm. The Phillips Farm site drained into two streams that were classified as “sensitive” by the City of Columbia—Gans Creek and Clear Creek. The City had specified that certain impervious area limits could not be exceeded by the development. There was local skepticism that stormwater best management practices (BMPs) could work effectively to protect the receiving streams, during both construction and post-construction conditions. One of the key elements of our work was to develop site-specific design storms. The objectives that we needed to meet with these storms were (1) protection of existing stream channel morphology/stability, (2) removal of pollutants to predevelopment levels (the site had historically been a dairy farm, so the expectation was the nutrient and solids loading could be reduced), and (3) attenuation of larger storms to predevelopment levels, up to and including the 100-year storm. Ultimately, the storm drainage system for the full site was designed on the basis of the 70th percentile annual exceedance probability event, 1-year storm and 2-year storm for channel stability and water quality objectives, coupled with the 10-year, 25-year and 100-year storms for flood control. WWE developed continuous hydrologic simulation models to evaluate the effectiveness of these design events.

As another example, WWE prepared the master drainage plan for the 11-square mile Rocky Flats nuclear weapons complex, northwest of downtown Denver (see Tab 15). This U.S. Department of Energy (DOE) facility has now been remediated and is in the final stages of transformation into a wildlife refuge to be administered by the U.S. Fish and Wildlife Service. When the site was an active industrial facility, the DOE and its prime contractor tasked WWE with the preparation of an overall site master drainage plan, which included development of site-specific design storms that would be acceptable to local governments, the State of Colorado and the USEPA. Relative to water quality, WWE provided recommendations for storms smaller than the one-year event, along with the 1- and 2-year events for channel stability and water quality enhancement. WWE’s master plan, along with additional studies related to off-site transport of uranium, americium and plutonium were adhered to by DOE during site closure activities and are being followed today with the site in a post-closure condition.

In approximately 2002, WWE was retained by Laing-Village Homes, LLC to prepare a water quality protection plan for Aurora Reservoir, a public water supply reservoir for the City of

Aurora, Colorado, in response to a proposed 800-acre residential development immediately upstream from the reservoir. This was another case where WWE developed a continuous hydrologic simulation model to define suitable site-specific design storms, along with appropriate assemblages of BMPs to assure that the reservoir would be adequately protected.

WWE has frequently designed and installed rain gage networks and has maintained these rain gages. For example, we played a significant role in the design of the rainfall/runoff data collection program at the Rocky Flats nuclear weapons site. We have assisted various municipalities with addressing the question of how many rain gages are necessary and where they should be located to provide statistically reliable rainfall data. On numerous occasions, we have statistically analyzed large amounts of rainfall data, ultimately leading to master planning and/or designs.

NPDES PERMIT COMPLIANCE, INCLUDING NUMERIC STANDARDS

WWE (and I) have worked on numerous NPDES permitting assignments throughout the United States, for public and private parties. These permits have addressed wide-ranging issues, including industrial wastewater treatment, municipal wastewater treatment, construction site stormwater runoff, post-development urban stormwater runoff, dewatering discharges, and others. Representative NPDES clients include:

- Coors Brewing Company
- Arco Coal Company and Arch Coal Company
- U.S. Department of Energy
- City of Springfield, Missouri
- City of Lincoln, Nebraska
- City of Rockford, Illinois
- City of Tulsa, Oklahoma
- City of Overland Park, Kansas
- City and County of Denver
- ExxonMobil
- BP America
- Colorado ski resorts
- Numerous residential developers and homebuilders, including, as examples, Lennar Homes, Centex Homes and Pulte Homes

I have frequently been retained by public and private entities that need to meet numeric limits with stormwater discharges. The factors prompting this requirement have varied widely, ranging from complying with local environmental regulations to satisfying downstream water owners/users.

An excellent example is provided in Tab 16, an article from *Stormwater* magazine concerning the Grant Ranch residential development in Littleton, Colorado. For the past eight years, WWE

has maintained a network of five fully automated stormwater collection stations to monitor the performance of three extended dry ponds, all which feed into a water quality–wetland pond. The discharges from this system must comply with numeric limits for multiple contaminants (see article for list of constituents), for four wet weather and four dry weather events, each year. Long-term performance of the system has been superb, with total suspended solids (TSS) levels consistently less than 10 mg/l and often less than 5 mg/l, and total phosphorus values typically in the range of 0.10 to 0.13 mg/l. There has rarely been a metals concentration above the detection limit, and all have been below lake standards. The factor that triggered these numeric discharge limits was that the proposed Grant Ranch residential development was to discharge into Bow Mar Lake, which is owned by the Bow Mar Homeowners Association and used for swimming and fishing. The homeowners would not accept the stormwater unless stringent limits were agreed to. I negotiated the list of constituents and their respective limits with engineers who worked for Bow Mar, and prepared the structure of the overall stormwater agreement. We also developed a numeric limit for the construction phase of the development. Based on guidance from the Missouri Department of Environmental Quality (MDEQ) and our experience in that state, we adopted a limit of 2.5 ml/l/hour for total settleable solids, using an Imhoff cone.

I have worked at many other sites where our clients need to meet numeric limits with stormwater discharges, including, for example, the Rocky Flats nuclear weapons site (including 12 large retention ponds that we have designed retrofits for), Chatfield Green residential development, the Phillips Farm commercial/residential development in Missouri and, currently, a proposed residential development by Deltic Timber in the Lake Maumelle public water supply watershed outside of Little Rock, Arkansas (Geosyntec has worked on this project).

POST-FIRE RECOVERY

WWE has extensive experience in post-fire recovery of watersheds. As noted in the introduction to this letter, we provided peer review for Geosyntec on the post-fire recovery assessment for SSFL. I thought that you might be interested in two somewhat detailed explanations of other fire recovery projects that we have conducted, one at the Los Alamos National Laboratory and the other in the San Juan National Forest in southwest Colorado.

Regarding the Los Alamos example, in May, 2000, a controlled burn at the Bandolier National Monument that got out of hand started the Cerro Grande wildfire, which burned extensive parts of the Los Alamos National Laboratory (LANL). LANL is a location where contamination from nuclear experimentation is known to exist and where nuclear testing facilities are still active, so the changes in hydrology were of great concern for safety of the laboratory, downstream communities and water quality in the Rio Grande. WWE worked as part of the LANL modeling team to assess changes in hydrology, hydraulics, floodplain extents and sediment transport following the fire. For example, we used the HEC-HMS model for hydrologic analysis, relying heavily on GIS information for input of such parameters as coverage of burned areas, watershed sizes, flow path lengths, etc. This enabled us to develop a hydrologic/hydraulic model for a network of canyons encompassing more than 20 square miles. We followed this up with HEC-RAS modeling that included more than 2,000 cross sections. This was followed by initial

sediment transport work and recommendations regarding erosion and sediment control measures that could be utilized in the field to minimize the risk of downstream sediment transport.

The Missionary Ridge wildfire in 2002 burned more than 70,000 acres, mostly in the San Juan National Forest near Durango, Colorado. There was immediate concern about adverse downstream impacts to aquatic life and public water supplies. The Florida Water Conservancy District retained WWE to design rehabilitation measures. The Conservancy District, through WWE, obtained a Section 319 grant through the Colorado Department Public Health. Approximately \$600,000 was spent on rehabilitation. For instance, log erosion barriers were installed over 230 acres at a density of 90 to 250 per acre. These were routinely monitored, sediment was removed and positions were adjusted. Thirteen check dams and detention basins were constructed and were regularly maintained and monitored. Five steel debris racks ranging in width from 15 to 47 feet were installed along major drainage paths and trapped thousands of cubic yards of debris. Approximately 100 acres of the most critical areas were mulched with approximately 200 tons of straw (75 acres of which were hand crimped, seeded and planted). The crimping significantly bolstered effectiveness. A 700-foot long bypass channel was constructed with barriers above an endangered spillway area. The effectiveness of all of these measures was put to the test in early September, 2003, when 2.5 inches of rain fell over a 13-hour period. While typical sediment yield rates following other wildfires in the area had approached 50 tons/acre/year, the soil loss rates in the area where our restoration work had occurred ranged from 7 to 14 tons/acre. The Colorado Department of Public Health and Environment cited this project as a model Section 319 project and awarded WWE and our client the 2004 Section 319 "Hall of Fame" Award.

STORMWATER MONITORING

WWE has designed, implemented and maintained numerous stormwater monitoring systems. For most of these projects, I have served as WWE's managing principal or project manager. Eric Strecker is familiar with our monitoring capability, because one of the major documents that was prepared as part of the *International BMP Database* was a manual on how to monitor BMP performance. Geosyntec took the lead on preparing this document, although WWE provided substantial review and input.

An excellent example of our experience with monitoring is that Grant Ranch residential development, described above and summarized in an article in Tab 16. Another example is the monitoring that we are now conducting for the National Renewable Energy Laboratory (NREL) at a WalMart store in Aurora, Colorado. This monitoring is being conducted as part of WalMart's consent decree with the USEPA for construction site NPDES permit violations. The WalMart store has five different stormwater BMPs (including various types of porous pavement), all of which are being monitored by WWE. Our fully automated monitoring is being conducted over three years, and it includes not only collection of water chemistry data (such as to measure bioswale performance), but also hydrologic data for the porous pavement, to determine how much of the precipitation runs off versus how much is infiltrated.

I also have considerable experience with monitoring the effectiveness of construction site BMPs. A number of our clients have had to meet numeric limits of some sort with construction discharges, typically for TSS, turbidity or settleable solids. For example, when Keystone Resort proposed constructing the Schick Lodge adjacent to the Snake River in Summit County, Colorado, the local government expressed concern about sediment and phosphorus loading to the river from the approximately one-third mile long driveway to the lodge. WWE designed the construction-phase water quality controls, obtained a discharge permit from the Colorado Department of Public Health and Environment (CDPHE) that addressed both dewatering and stormwater discharges and monitored the site during dry weather and wet weather conditions. Numeric limits were applied for TSS, turbidity and other constituents. The system performed exceptionally well under difficult site constraints.

RADIONUCLIDE MIGRATION AND MITIGATION

WWE (and I) has strong work experience at DOE facilities, dating back to 1989. Our work began for DOE in 1989 at the Rocky Flats nuclear weapons complex shortly after the FBI “raided” the site and shut down all operations due to alleged environmental crimes. Approximately two months after the FBI raid, the State of Colorado Water Quality Commission conducted a special hearing to impose stringent site-specific stream classifications and standards at Rocky Flats and immediately downstream. I was the engineering expert for the DOE (and their prime contractor, Rockwell International) at this hearing. From that hearing in 1989 until the present, we have worked continuously to assist DOE and their various contractors with multiple activities that recently led to final closure of the site. Please refer to Tab 15 for a brief summary of our DOE site experience.

We have also conducted considerable work at the Los Alamos National Laboratory, including post-fire reclamation and associated hydrologic studies. Another major client with water quality issues related to radioactivity is Union Carbide, and its mining subsidiary Umetco. We have assisted Umetco with the design, construction and monitoring of stormwater management facilities in Colorado, Wyoming and Arkansas.

I have personally played a significant role on many of our projects involving DOE and Umetco facilities.

CONSTRUCTION PHASE WATER QUALITY PROTECTION

This is an area of considerable strength for WWE (and for me personally) around the United States. We have prepared numerous guidance documents on erosion and sediment control, and I was an invited reviewer by the USEPA for their BMP guidance manual for construction sites. We have prepared hundreds of construction site stormwater management plans, and have conducted numerous site inspections. Two of the nation’s largest homebuilders have retained us to audit their construction site stormwater programs, nationally. We have frequently been retained by entities such as ski resorts, oil and gas companies and mines which propose

construction in sensitive watersheds and where local, state and federal regulators have viewed it as unacceptable for essentially any sediment to leave the construction zone. For example, over the past two years, we have worked for developers and construction companies that are reconstructing the core of the base area of the Snowmass Ski Area at Aspen/Snowmass, Colorado. For approximately the past six years, we have served in a similar capacity at the Copper Mountain Ski Area in Summit County, Colorado. We have designed, overseen the construction of, and assisted with maintenance/monitoring of, numerous construction BMPs. We have also monitored the receiving water, West Tenmile Creek (a Gold Medal Fishery), immediately upstream and downstream from Copper Mountain. We have conducted both water chemistry and biological monitoring, along with stream channel morphology. We have been very pleased that the physical, chemical and biological data indicate that runoff from the ski resort is having no measurable impact on West Tenmile Creek.

Tabs 10 and 11 provide representative construction BMP drawings.

STORMWATER MANAGEMENT AT INDUSTRIAL SITES WITH KNOWN SOURCES OF SURFACE WATER AND GROUNDWATER CONTAMINATION

I have frequently been asked to consult on stormwater quality management at industrial sites that have known surface and subsurface contamination sources, comparable to the Boeing site. Frequently, these cases have involved a complex mixture of regulatory requirements under RCRA, CERCLA, NEPA and the Clean Water Act. In the course of planning, evaluating and designing BMPs, it has been necessary for us to address not only contaminants on the ground surface, but contributions from contaminated groundwater as well. Frequently, we have developed sophisticated site water balances to facilitate BMP selection.

Representative industrial sites where we have conducted stormwater planning/design assignments (and where I have personal involvement) include, as examples:

- Black Pine Mine in Idaho
- Total Petroleum Refinery in Commerce City, Colorado
- Lowry Landfill in Denver, Colorado
- Black Thunder Coal Mine in Wyoming
- West Elk Mine in Colorado
- ExxonMobil oil and gas facilities in Colorado and Wyoming
- BP America oil and gas facilities in Colorado
- Bekaert Steel in Bentonville, Arkansas
- Dover-Norriseal in Houston, Texas
- Union Carbide (Umetco) mining facilities in Colorado and Arkansas
- U.S. DOE sites—Rocky Flats and Los Alamos

EXPERIENCE IN CALIFORNIA

WWE (and I) has work experience in California. Representative clients include the following:

- Lennar Homes in Fresno and Stockton
- Centex Homes throughout the Los Angeles and San Francisco metropolitan areas
- San Diego County (storm drainage criteria manual peer review)
- Contra Costa Water District (as subconsultant to Carollo Engineering)
- Santa Susana Field Laboratory (as subconsultant to Geosyntec)
- Special study for Coors Brewing Company related to locating a potential new brewery in the Central Valley
- Imperial Irrigation District
- U.S. Internal Revenue Service
- Pauma Indian Tribe

SERVING AS A MEMBER OF EXPERT PANELS AND ON CONTROVERSIAL PROJECTS WITH SIGNIFICANT PUBLIC INPUT

Over my 27 years at WWE, I have frequently served as an expert panel member, often working on highly controversial projects that were in the public eye. As noted in the introduction to the letter, I have testified over 75 times, and on many occasions, in front of juries. Many of our projects have included public participation, so I am quite experienced at responding to questions and comments from members of the public. On many occasions, public comments have been sharp (and, occasionally, hostile), and I am quite comfortable under these circumstances. I serve on many advisory committees, editorial boards and professional committees, and always enjoy the collegiality and professionalism associated with such endeavors. Let me provide you with a few examples that are relevant for the SSFL:

- Approximately two years ago, I was appointed by the Governor of Colorado to serve as a board member of the Cherry Creek Basin Water Quality Authority. The charge of this authority is to protect water quality in Colorado's most important and popular recreational reservoir, Cherry Creek Reservoir, located on the south side of the Denver metro area. Our authority deals with difficult lake water quality management issues routinely, given that there are stringent water quality standards for the reservoir that must be protected. A key aspect of the regulatory program for the Cherry Creek watershed is implementation of BMPs to control phosphorus from urban stormwater runoff. Parties are required to submit calculations to us to project how much phosphorus will be removed from runoff. Wastewater dischargers are required to discharge 0.05 milligrams per liter of total phosphorus, which leads them to believe that they are unfairly being singled out. Local governments do not see eye-to-eye on a number of issues. Most of my fellow board members are elected officials, so I have developed an appreciation for how the political process works.

- I was one member of a committee of approximately eight people who oversaw the transformation of an office site in Boulder, Colorado, from a traditional drainage system into an advanced low impact development-based facility. Parking lot swales, grass swales around the perimeter of the site, planter boxes and other LID features were utilized. This project served as one of 25 projects around the United States that *National Geographic* used as case studies on implementing sustainable water management technologies. Interestingly, WVE was asked to develop a surface water and groundwater quantity monitoring plan for the site, so that a sophisticated water balance could be developed. With financial assistance from the City of Boulder, we developed such a plan and installed the necessary monitoring facilities. The monitoring plan was conducted for three years, and it was noteworthy that during that time, only one precipitation event resulted in off-site runoff (the rest of time, all of the water was retained on site).
- The Colorado State Engineer's Office requested that I participate in revisions to state regulations regarding dam safety, including selection of design storms. This was one of the predecessor steps to significant revision of the state regulations.
- I was requested by the USEPA to serve on a committee that had the charge of determining whether expenditures by the USEPA for water quality improvement were "making a difference." This panel worked during the early 1990s, and the Center for Watershed Protection served as a facilitator. This involved frequent correspondence and occasional meetings. Ultimately, our committee (along with Center for Watershed Protection) developed a long list of "indicators" of water quality progress.
- I have frequently chaired or co-chaired national conferences (Eric, you are quite familiar with this process, having just been through it last summer). For example, I co-chaired the 2001 conference sponsored by the United Engineering Foundation, ASCE and the USEPA entitled "Linking Stormwater BMP Designs and Performance to Receiving Water Impact Mitigation." In the early 1990s, I chaired a conference that was held in Washington, DC, and which was co-sponsored by multiple federal agencies, engineering societies and other professional societies entitled "National Environmental Regulations—Where Is the Pendulum Now?" Through activities such as this and chairing or otherwise participating on numerous committees sponsored by ASCE, Water Environment Federation (WEF), APWA and other organizations, I have worked with peers on numerous occasions to evaluate the kinds of issues that you will be addressing at the Boeing facility in southern California.

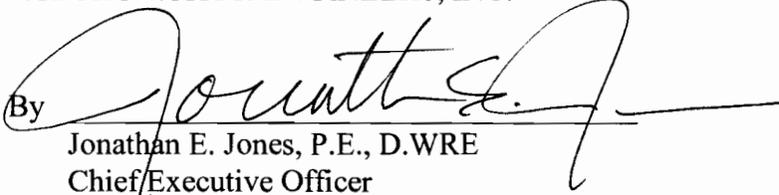
In closing, I reiterate my great enthusiasm at potentially being one of your expert panel members. I am honored by the opportunity to submit my qualifications. I can assure you that if selected, you will find my work to be thorough, competent and timely (I will meet your aggressive schedule requirements). In addition, I sincerely appreciate the opportunity to interact with professional colleagues and members of the public and consistently do so in a positive and constructive manner, even when conditions are not necessarily favorable.

Mr. Eric Strecker, P.E., Ms. Cassandra Owens
November 29, 2007
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Thank you for your consideration and please call with questions.

Sincerely,

WRIGHT WATER ENGINEERS, INC.

By 
Jonathan E. Jones, P.E., D.WRE
Chief/Executive Officer

Attachment

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EXPERT PANEL
DESIGN STORM AND BMP SELECTION AT THE SANTA SUSANNA FIELD LABORATORY

STATEMENT OF QUALIFICATIONS
MICHAEL JOSSELYN, PHD, PWS

PURPOSE

The purpose of this SOQ is to submit my qualifications to serve on the Expert Panel for the Design Storm and BMP Selection at Boeing's Santa Susanna Field Laboratory. I am submitting this statement to provide expertise in wetland restoration and treatment processes.

GENERAL STATEMENT OF QUALIFICATIONS

Scientific knowledge of the wetland ecology

I am currently a Professor Emeritus of San Francisco State University where I taught Wetland Ecology from 1978 to 2000. I also taught courses in Phycology (study of algae), Biological Oceanography, Wetland Ecology and Management, and General Biology. For seven years, between 1982 to 1989, I was Director of the Romberg Tiburon Center for Environmental Studies, a field station of San Francisco State University that focused on the ecology of San Francisco Bay. As director, I supervised other professional researchers and academic scientists in developing a comprehensive program to train graduate students and to undertake basic scientific research on the Bay. During that time, I had research grants from various state and federal agencies to study the ecology of the Bay and I published articles on a wide variety of topics dealing with wetland ecology, restoration, and management.

As President of WRA, Inc., I have led the biological design component of many restoration planning projects in both tidal and non-tidal wetlands, especially within the San Francisco Bay region. Outside of San Francisco Bay, I have been the biological consultant for the 1000 ac Bolsa Chica tidal marsh restoration, the 650 ac Batiquitos Lagoon enhancement project, the 200 ac Ballona Wetlands Restoration, and the 450 ac San Dieguito Lagoon restoration project. I led restoration design for the 400 ac Pacific Commons vernal pool restoration project in Fremont, CA.

Experience on Technical Advisory Panels

I have served and continue to serve on a variety of technical advisory panels. In the past, I have served on Corps of Engineers, Environmental Protection Agency, CalFED, and National Research Council panels dealing with wetland ecology and restoration. I served on a National Panel that investigated the restoration of the Louisiana Delta and issued an independent scientific assessment of the past efforts with recommendations for future restoration. I am currently a scientific panel member with the City of San Francisco PUC investigating alternative treatment systems for waste and stormwater in San Francisco. I am also a scientific panel member on the Scientific Advisory Panel for the Wetland Recovery Project in southern California and the Technical Advisory

Committee for the Ballona Wetlands Restoration project.

Experience conducting quality control

As Director for the Romberg Tiburon Center, I was responsible for many grants and contracts to the Center. Many of these grants, especially those from the SWRCB and Sea Grant required the development and oversight of data quality control programs. I currently serve as a technical reviewer to the SWRCB on regulations related to water quality standards to protect estuarine systems. I have conducted scientific reviews of the TMDL for Upper Newport Bay, the recent San Francisco Bay RWQCB standards for rapid assessment of contaminated sites, and the Guadalupe River Hg TMDL.

Technical expertise

I am a Certified Professional Wetland Scientist and am trained as an ecologist and botanist. My expertise is in wetland ecology and restoration processes.

Ability to attend meetings

I am located in San Rafael, CA, but have easy access to air travel to attend meetings in Southern California.

Interest and compensation

I am very interested in participating in this panel as the type of work involved interests me professionally and I believe I can contribute to the quality of the final product through my experience in wetland restoration and water quality management. I am available to work on this project during the time frame that is provided in the November 16th invitation.

My hourly rate is \$225/hr and expenses will be billed at cost + 10%.

Other supporting information

A brief resume is attached. Information on my firm and its range of projects can be found at www.wra-ca.com. I would serve on this Panel through my firm, WRA, Inc. which is a certified California small business.



MICHAEL JOSSELYN, PH.D. P.W.S.
WRA, Inc.

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San Rafael, CA 94901

415-454-8868/415-454-0129 (fax)/josselyn@wra-ca.com



Michael Josselyn is the founding principal of WRA, Inc. The firm was established in 1982 for the purpose of utilizing the best scientific information to improve wetland management and regulation in the United States. Since then, the firm has performed projects throughout the country and currently has 45 employees based on San Rafael, CA. Under Dr. Josselyn's leadership, the firm has completed over 2000 projects for industry, government, and non-profit organizations.

Dr. Josselyn was a Professor of Biology and former Director of the Romberg Tiburon Center for Environmental Studies at San Francisco State University. He taught wetland and estuarine ecology and as Director headed the University's research program on San Francisco Bay. He is now a Professor Emeritus. He is a certified trainer for the Corps wetland delineation methodology and has regularly provided training in routine and advanced wetland delineation throughout California. He has been an instructor for the Corps of Engineers In-Service Training Program since 1984.

Dr. Josselyn has served as the project manager for wetland mitigation and restoration projects including several projects exceeding 1000 acres. He has been the wetland design team leader coastal wetland restoration at the 400 ac Batiquitos Lagoon for the Port of Los Angeles, the 1000 ac Bolsa Chica wetland for the California Coastal Conservancy, the 400 ac San Dieguito River Wetland Restoration for Southern California Edison, and the 3000 ac Commercial Hay Farm wetland restoration for Public Service Gas and Electric on Delaware Bay. He has been the project leader for restoration in freshwater wetlands, including the 400 acre vernal pool wetland restoration at Pacific Commons in Fremont, CA.

Dr. Josselyn has also performed work for several state agencies including the Department of Fish and Game (DFG), the State Coastal Conservancy (SCC), and the Department of Parks and Recreation (DPR). For DFG, he developed Operation and Management Plans for 12 properties along the Sacramento and Feather Rivers. For the SCC, Dr. Josselyn was the on-call biological consultant from 1984-2000 and he performed assessments and biological studies for the Conservancy throughout the State of California. He has conducted biological assessments for coastal lagoons and rivers throughout the State. He has developed riparian restoration plans for the Conservancy's watershed program including the 100 acre Valley View Ranch riparian habitat restoration on the Santa Clara River. He is a member of the Scientific Advisory Panel for the Southern California Wetlands Recovery Project, Science Team for the South Bay Salt Pond Restoration Project, Science Advisory Committee for the Ballona Wetlands, and the Technical Advisory Committee for the City of San Francisco's Master Water Quality Plan.

Dr. Josselyn has won environmental awards for projects in the City of San Francisco, City of Newark, Orange County, Monterey County, and for the 100 acre Goose Creek wetland, the largest forested wetland restoration in northern Virginia. He was selected as Conservator of the Year by the Bolsa Chica Conservancy in 2000.

Dr. Josselyn is also a leader in his profession. As a certified Professional Wetland Scientist, Dr. Josselyn is a past President of Society of Wetland Scientists Professional Certification Program. He

has served as an advisor to the National Oceanic and Atmospheric Administration's Coastal Ocean Program, a member of numerous panels for the National Research Council, a member of the US-Japan Coastal Ocean's Panel, and a consultant to the Environmental Protection Agency Scientific Advisory Panel. He is an elected member of the California Academy of Sciences.

Degrees:

Cornell University, BS with Distinction 1972

University of Miami, MS 1975

University of New Hampshire, Ph.D. 1978

Selected publications (from list of 50)

Josselyn, M.N. (ed) 1982. Wetland restoration and enhancement in California. California Sea Grant College Program. Report #T-CSGCP-007. 116pp.

a. Josselyn, M.N. and J. Buchholz, Summary of past wetland restoration projects in California. pp1-10

b. Zedler, J.; Josselyn, M.; and Onuf, C. Restoration, techniques, research, and monitoring: vegetation. pp63-72.

Josselyn, M.N. 1983. Estuarine tidal marshes of San Francisco Bay: a community profile. US Fish and Wildlife Service, Division of Biological Services, Washington, DC FWS/OBS-83/23. 102pp.

Josselyn, M., J. Zedler, and T. Griswold. 1989. Wetland mitigation along the Pacific Coast of the United States. pp 1-36. In: Kusler, J. and M.E. Kentula (eds) Wetland Creation and Restoration: The status of the science. Vol 1. Environmental Protection Agency, Washington DC. EPA 600/3-89/038a.

Josselyn, M., S. P. Faulkner, and W.H. Patrick, Jr. 1990. Relationships between seasonally wet soils and the occurrence of wetland plants in California. Wetlands 10:7-26.

Boesch, D.F., M.N. Josselyn, A.J. Mehta, J.T. Morris, W.K. Nuttle, C.A. Simenstad, D.J.P. Swift. 1994. Scientific assessment of coastal wetland loss, restoration, and management in Louisiana. Journal of Coastal Research. 20:1-103.

November, 2007

PROFESSIONAL RESUME

Michael K. Stenstrom

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EDUCATION

- 1976 Ph.D. Environmental Systems Engineering, Clemson University, Clemson, SC. Minors in Chemical and Electrical Engineering. Dissertation Title: "A Dynamic Model and Computer Compatible Control Strategies for Wastewater Treatment Plants".
- 1972 M.S. Environmental Systems Engineering, Clemson University. Thesis Title: "Biological Process Simulation for Operator Training".
- 1971 B.S. Electrical and Computer Engineering, Clemson University.

REGISTRATION

Registered Professional Civil Engineer, California C35497, 1982 - present
Diplomate, American Academy of Environmental Engineers, 1989 - present

HONORS AND AWARDS

Engineering Science/Association of Environmental Engineering Professors Award (AEEP) for the best doctoral thesis relevant to sanitary engineering practice (1975-76), UC Regent's Junior Faculty Fellowship (1978-79), Walter L. Huber Civil Engineering Research Prize ASCE (1989), Harrison Prescott Eddy Research Award, WEF (1992), Dow Chemical Company Environmental Care Award (1995), Science Coalition's Great Advances in Scientific Discovery (1999), Innovation in Water Quality Protection (California Regional Water Quality Control Board, 2002), ASCE-EWRI Standards Development Award (2004), Tau Beta Pi, Phi Kappa Phi, Sigma Xi, Chi Epsilon

WORK EXPERIENCE

- July 1, 1985 to Present Assistant, Associate and Professor, UCLA, School of Engineering and Applied Science. Responsibilities include teaching and research at the graduate and undergraduate levels and various administrative responsibilities, including C&EE Dept. Chair (1991-1999), Assist Dean (1985-1991), Associate Dean (2001-2003).
- August 1975 to September 1977 Research Engineer and Project Manager (1-1-77) for the Amoco Oil Co., (Standard Oil (Indiana)), Naperville, IL.

OTHER PROFESSIONAL EXPERIENCE

Part time consultant to industry, consulting engineering firms and government. Active in professional organizations, including ASCE-EWRI (Member of Oxygen Transfer Standards Committee, 1977-present and Chair, 2001-present); WEF (Member and Chair of IAC Subcommittee, 1999-2001), IWA (Member of Diffuse Pollution Specialty Group (2004-present), ACS and AEESP.

SELECTED REFEREED PUBLICATIONS RELATING TO STORMWATER AND URBAN RUNOFF

17. Stenstrom, M. K., G.S. Silverman and T.A. Bursztynsky, "Oil and Grease in Urban Stormwaters," *J. Env. Engr., ASCE*, **110**, No. 1, pp. 58-72, 1984.
20. Stenstrom, M.K., S. Fam and G.S. Silverman, "Analytical Methods for Quantitative and Qualitative Determination of Hydrocarbons and Oil and Grease in Wastewater, *Envr. Tech. Let.*, **7**, pp. 625-636, 1986.
21. Silverman, G.S., M.K. Stenstrom and S. Fam, "Best Management Practices for Controlling Oil and Grease in Urban Stormwater Runoff," *Journal of the Environmental Professional*, **8**, pp. 351-362, 1986.
22. Stenstrom, M.K., S. Fam and G.S. Silverman, "Analysis of Oil and Grease Components to Assess the Quality of Urban Runoff," Proceedings of the Oil in Freshwater Conference, Pergamon Press, pp. 138-148, 1987.
25. Fam, S., M.K. Stenstrom and G. Silverman, "Hydrocarbons in Urban Runoff," *J. Env. Engr., ASCE*, **113**, pp 1032-1046, 1987.
28. Silverman, G.S., M.K. Stenstrom and S. Fam, "Land Use Consideration in Reducing Oil and Grease in Urban Stormwater Runoff," *J. of Environmental Systems*, **18**, pp. 31-47, 1988/89.
49. Green, G.E. and M.K. Stenstrom, "Ozone Disinfection of Urban Storm Drain Water," *Ozone Science and Engineering*, **16**, pp. 403-428, 1994.
54. Bay, S.M., D.J. Greenstein, S-L. Lau, M.K. Stenstrom and C.G. Kelley, "Toxicity of Dry Weather Flow from the Santa Monica Bay Watershed," *Bulletin of Southern California Academy of Sciences*, **95**, pp. 33-45, 1996.
56. Lau, S-L. and M.K. Stenstrom, "Solid Phase Extraction for Oil and Grease Analysis," *Wat. Env. Research*, **69**, No. 3, pp. 368-374, 1997.
58. Wong, K., E.W. Strecker and M.K. Stenstrom, "A Geographic Information System To Estimate Stormwater Pollutant Mass Loadings," *J. Env. Engr., ASCE*, **123**, pp. 737-745, 1997.
63. Fisher, T.S., D.G. Hayward, R.D. Stephens and M.K. Stenstrom, "Polychlorinated Di-benzo-dioxins and Di-benzo-furans in Los Angeles Urban Runoff," *J. Env. Engr., ASCE*, **125**, pp. 185-191, 1999.
75. Lau S-L., E. Khan and M.K. Stenstrom, "Catch Basin Inserts to Reduce Pollution from Stormwater," *Wat. Sci. and Tech.*, Vol. **44**, pp. 23-34, 2001.
80. McPherson, T.N., S.J. Burian, H.J. Turin, M.K. Stenstrom and I.H. Suffet, "Comparison of the Pollutant Loads in Dry and Wet Weather Runoff in a Southern California Urban Watershed," *Wat. Sci. and Tech.*, **45**, No. 9, pp. 255-261, 2002.
81. Buffleben, M.S., K. Zayeed, D. Kimbrough, M.K. Stenstrom and I.H. Suffet, "Evaluation of Urban Non-Point Source Runoff of Hazardous Metals Entering Santa Monica Bay, California," *Wat. Sci. and Tech.*, **45**, No. 9, pp. 263-268, 2002.
88. Ha, H. and M.K. Stenstrom, "Identification of Land Use with Water Quality Data in Stormwater Using a Neural Network," *Wat. Research*, **37**, pp 4222-4230, 2003.
90. Kim, L-H., M. Kayhanian, M. and M.K. Stenstrom, "Event Mean Concentrations of Litter from Highways during Storms," *Sci. of the Total Env.*, **330**, pp. 101-113, 2004.
91. Lee, H. S-L. Lau, M. Kayhanian and M.K. Stenstrom, "Seasonal first flush phenomenon of urban stormwater discharges," *Wat. Research*, **38**, pp 4153-4163, 2004.
92. Kim, L-H, M. Kayhanian, S-L Lau and M.K. Stenstrom, "A New Modeling Approach for Estimating First Flush Metal Mass Loading," *Wat. Sci. and Tech.*, **51**(3-4), pp. 159-167, 2005.
93. Abellera, L.V. and M.K. Stenstrom, "Application of Remotely Sensed Environmental Data for Control and Automation," *Environmental Instrumentation and Automation*, **9** (4), pp. 1-8, 2005.
94. Lee, H. and M.K. Stenstrom, "Utility of Stormwater Monitoring," *Wat. Env. Research*, **77**, pp 219-228, 2005.
96. McPherson, T.N., S.J. Burian, M.K. Stenstrom, H.J. Turin, M.J. Brown and I.H. Suffet, "Trace Metal Pollutant Load in Urban Runoff from a Southern California Watershed," *J. of Env. Engr., ASCE*, **131**, pp 1073-1080, 2005.
97. Li, Y., S-L Lau, M. Kayhanian and M.K. Stenstrom, "Particle Size Distribution in Highway Runoff," *J. of Env. Engr., ASCE*, **131**, pp 1267-1276, 2005.
98. McPherson, T.N., S.J. Burian, M.K. Stenstrom, H.J. Turin, M.J. Brown and I.H. Suffet, "Dry and Wet Weather Flow Nutrient Loads from a Los Angeles Watershed," *J. Am. Water Resources Assoc.*, **41**, pp. 959-969, 2005.
99. Kim, L.H., M. Kayhanian, K.D. Zoh and M.K. Stenstrom, "Modeling of Highway Runoff," *Sci. of the Total Env.*, **348**, pp 1-18, 2005.

100. Kayhanian, M. and M.K. Stenstrom, "Mass Loading of First Flush Pollutants with Treatment Strategy Simulations," *Trans. Research Record: J. Transportation Research Board*, No. 1904, pp. 133-143, 2005.
102. Lau, S.L and M.K. Stenstrom, "Metals and PAHs Adsorbed to Street Particles," *Wat. Research*, **39**, pp 4083-4092, 2005.
105. Park, M.H. and M.K. Stenstrom, "A New Classification System for Urban Stormwater Pollutant Loading: a Case Study in the Santa Monica Bay Area," *J. Water and Environmental Technology* (Japan), **3**, pp. 191-197, 2005.
108. Kim, L-H., J. Kang, M. Kayhanian, K-I. Gil, M.K. Stenstrom and K-D Zoh, "Characteristics of Litter Waste in Highway Storm Runoff," *Wat. Sci. and Tech*, **53**, pp. 225-234, 2006.
109. Han, Y-H., S-L Lau, M. Kayhanian and M.K. Stenstrom, "Correlation Analysis among Highway Stormwater Pollutants and Characteristics," *Wat. Sci. and Tech.*, **53**, pp. 235-243, 2006.
110. Khan, S., S-L Lau, M. Kayhanian and M.K. Stenstrom, "Oil and Grease Measurement in Highway Runoff-Sampling Time and Event Mean Concentrations," *J. Env. Engr., ASCE*, **132**, pp. 415-422, 2006.
111. Park, M.H. and M.K. Stenstrom, "Spatial Estimates of Stormwater Pollutant Loadings Using Bayesian Networks and Geographic Information Systems," *Wat. Env. Research*, **78**, pp. 421-429, 2006.
114. Li, Y., S-L Lau, M. Kayhanian and M.K. Stenstrom, "Dynamic Characteristics of Particle Size Distribution in Highway Runoff: Implications for Settling Tank Design," *J. Env. Engr., ASCE*, **132**, pp. 852-861, 2006.
115. Kim, L-H., K-D. Zoh, S-M Jeong, M. Kayhanian and M.K. Stenstrom, "Estimating Pollutant Mass Accumulation on Highways during Dry Periods," *J. Env. Engr., ASCE*, **132**, pp. 985-993, 2006.
118. Li, Y, S-L Lau, M. Kayhanian and M.K. Stenstrom, "First Flush and Natural Aggregation of Particles in Highway Runoff," *Wat. Sci. and Tech.*, **54**, No 11-12, pp. 21-27, 2006.
119. Park, M-H and M.K. Stenstrom, "Using Satellite Imagery for Stormwater Pollution Management with Bayesian Networks," *Wat. Research*, **40**, pp. 3429-3438, 2006.
120. Kang, J-H, M. Kayhanian and M.K. Stenstrom, "Implications of a Kinematic Wave Model for First Flush Treatment Design," *Wat. Research*, **40**, pp. 3820-3830, 2006.
121. Han, Y., S-L Lau, M. Kayhanian and M.K. Stenstrom, "Characteristics of Highway Stormwater Runoff," *Wat. Env. Research*, **54**, No. 12, pp 2377-2388, 2006.
122. Park, M-H, I.H. Suffet and M.K. Stenstrom, "Utility of LANDSAT-Derived Land Use Data for Estimating Storm-Water Pollutant Loads in an Urbanizing Area," *J. Env. Engr., ASCE*, **133**, pp. 203-210, 2007.
125. Kang, J.H., Y. Li, S-L Lau, M. Kayhanian and M. K. Stenstrom, "Particle Destabilization in Highway Runoff to Optimize Pollutant Removal," *J. Env. Engr., ASCE*, **133**, pp. 426-434, 2007.
126. Lee, H, X. Swamikannu, D. Radulescu, S-J Kim and M.K. Stenstrom, "Design of Storm Water Monitoring Programs," *Wat. Research*, **41**, pp. 4186-4196, 2007.
128. Park, M-H and M. K. Stenstrom "Classifying Environmentally Significant Urban Land Uses With Satellite Imagery," *J. Env. Management*, **86**, pp 181-192, 2008.
129. Kayhanian, M, C. Stransky, S. Bay, S-L. Lau and M.K. Stenstrom, "Toxicity of urban highway runoff with respect to storm duration," *Sci. Tot. Env.*, **389**, pp 386-406, 2008.

SELECTED RESEARCH GRANTS AND CONTRACTS RELATING TO STORMWATER AND URBAN RUNOFF

Association of Bay Area Governments	\$15,000	Oil and Grease Control the Richmond Bay Area	4/1/81-9/30/81
Association of Bay Area Governments	\$18,000	Evaluation of Toxic Hydrocarbon Controls	4/15/84-1/14/85
Santa Monica Bay Restoration Project	\$145,000	Assessment of Non-point Source Pollutants to Santa Monica Bay	10/1/90-10/31/92
Santa Monica Bay Restoration Project(with M. Suffet Co-principal	\$135,000	Assessment of Contaminants in Storm Drains: Biological Impacts	4/1/92-12/31/92

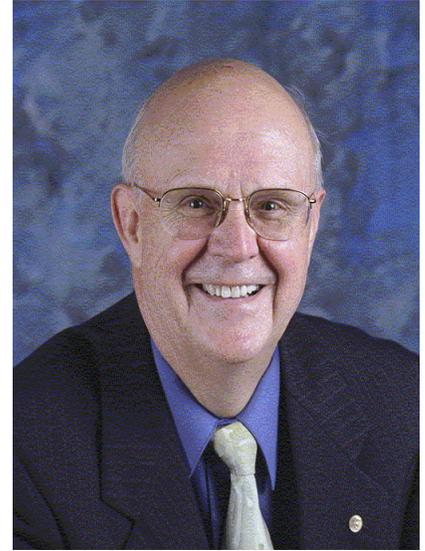
investigator)

Dept. of Water & Power	\$40,000	Urban Stormwater Pollution Reduction from Parking Facilities	9/15/92-9/14/93
Santa Monica Bay Restoration Project(with M. Suffet Co-principal investigator)	\$224,000	Assessment of Biological Impacts of Contaminants in Storm Drains. Phase II - Wet Weather Flow.	11/15/94-10/31/96
Santa Monica Bay Catch Basin Study Consortium	\$80,000	Assessing the Efficiency of Catch Basin Inserts	9/96 - 12/97
Woodward Lungren Association (with I.H. Suffet, Co-PI)	\$80,750	Development of Catch Basin Insert Devices	9/01/96-12/31/97
City of Santa Monica	\$27,000	Catch Basin Insert Devices	6/98-6/99
Calif. Dept. of Transportation (Caltrans)	\$65,955	Litter Technical Assistance	8/01/99-7/1/00
Calif. Dept of Parks & Recreation	\$53,870	Policy Analysis, Conflict Resolution and Strategic Planning	7/01/99-10/30/00
Calif. Dept. of Transportation (Caltrans)	\$1,270,000	First Flush Technical Assistance	8/01/99-12/30/04
Calif. State Water Quality Control Board	\$50,000	Sanitary Survey Protocols for Stormwater	7/1/00-6/30/00
Calif. Regional Water Quality Control Board	\$90,000	Storm Water Industrial Activities Sampling Program Evaluation	7/1/03-6/30/04
Calif. Dept. of Transportation (Caltrans)	\$231,105	Methodology to Measure Small Particles and the Associated Contaminants	5/01/04-5/30/05
Calif. Dept. of Transportation (Caltrans)	\$296,106	Hydrographic Evaluation of Highway Runoff Toxicity	5/01/04-5/30/05
Calif. Dept. of Transportation (Caltrans)	\$17,600	Infiltration Basin Study	7/01/04-5/30/05
Calif. Dept. of Transportation (Caltrans)	\$130,573	Investigation of Particle-Based Pollutant Removal BMPs	10/1/05-5/31/08
Calif. Dept. of Transportation (Caltrans)	\$93,492	Practical Application of First Flush in Treatment BMPs	10/1/05-5/31/08

September 2007

Marty Wanielista

Marty Wanielista is the director of the Stormwater Management Academy, Professor of Engineering, a Pegasus Professor, and Professor Emeritus at the University of Central Florida. He has been at UCF for 37 years. He has a Civil Engineering degree from the University of Detroit, Masters from Manhattan College, and a PhD in Environmental Systems from Cornell. He has completed over 70 research projects in the areas of Hydrology and Stormwater, and is currently working on eight projects. He has over 200 publications including 7 textbooks. He was very active with the new stormwater lab and helped formulate policies for stormwater management in the State. He has been identified as the grandfather of stormwater management and credited with introducing green roofs to the State of Florida as a stormwater management alternative. He is very active in promoting stewardship of sustainable water resources by promoting the reuse of stormwater.



Marty Wanielista – October 2007
Professor, Dept. of Civil and Environmental Engineering
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A. Professional Preparation

Cornell University	Environmental Systems Engineering	Ph.D., 1971
Manhattan College	Sanitary Engineering	M.S., 1965
University of Detroit	Civil Engineering	B.S., 1964

B. Appointments

Academic Appointments at the University of Central Florida

2002 -	Director of Stormwater Management Academy
1993 - 2003	Dean of Engineering
1985 - 1988	Director of Research and Interim Associate Dean
1978 - 1985	Chair of Civil and Environmental Engineering
2006 -	Professor Emeritus
2003 -	Distinguished University Professor
1976 - 2006	Professor of Engineering
1972 - 1976	Associate Professor of Engineering
1970 - 1972	Assistant Professor of Engineering

Recognition

1. Technical Merit Award for Outstanding Contribution to the Science of Lake Management (1985), North American Lake Management Society.
2. North America Lakes Management Award, "Deevie Award" given to one whom advances an understanding and protection of State Waters. May, 1995.
3. Engineer of the Year, State of Florida, Engineering Societies, 2001.
4. Career Achievement Award – Central Fl Chapter, Engineering Societies, Feb, 2004.
5. Spangler Award – Life Time Achievement, ASCE Florida Section, 2004

C. Publications (7 Books, 63 Jour. articles, 86 Tech. Reports, 119 Proc. Papers)

(i) Five Recent Publications Most Related to the Proposal

1. Chang, N. B., Wanielista, M., and O'Reilly, A., "Use of Alternative Sorption Media for Removing Nutrients Associated with Stormwater BMPs," World Environmental and Water Resources Congress, ASCE/EWRI-2007 conference, May 15-19, 2007, Tampa, Florida, oral presentation.
2. O'Reilly, A., Wanielista, M., and Chang, N. B., "Data Mining Analysis of Nitrogen in the Florida Aquifer and BMP Management Strategies," 9th Biennial Conference on Stormwater Research & Watershed Management, May 2-5, 2007, Orlando, Florida, oral presentation.

3. Wanielista, Martin, and Mike Hardin, "A stormwater Management Assessment of Green Roofs." 2nd Stormwater Management Research Symposium, Orlando Florida, May 2006.
4. Wanielista, M.P., "Stormwater Use and Watershed Budgets", 2004 National Hydraulic Engineering Conference, Asheville, N.C., September, 2004.
5. Wanielista, M.P., "Water Budgets in Springshed Areas", ASCE Annual Meeting, Tampa Florida, August 2004.

(ii) Five Other Recent Publications Most Relevant to the Proposal

1. Wanielista, M., "Volume Control for Wekiva Basin", Florida Stormwater Association Annual Meeting, Dec 1-4, Orlando Fl, Dec 1-4, 2004.
2. Wanielista, M, and Josh Spence, "Volume Control Using Inter-Event Dry Periods", 8th Biennial conference on Stormwater Research and Watershed Management, Tampa Fl. April 27-29, 2005.
3. Wanielista, Martin, and Ewoud Hulstein, Stormwater Use for Irrigation: Volume and Nutrient Control, 16th Annual conference of the Florida Lake Management Society, June 7th, 2005, Duck Key, Florida.
4. Gremillion, P. and Wanielista M.P. "Effects of evaporation enrichment on the stable isotope hydrology of a central Florida (USA) river," Journal of Hydrologic Processes, Accepted for publication, **14**, 1465-1484, 2000.
5. Gremillion, P. Gonyeau, A., and Wanielista, M. "Application of alternative hydrograph separation models to detect changes in flow paths in a watershed undergoing urban development, Journal of Hydrologic Processes, Accepted for publication, **14**, 1485-1501, 2000.

D. Synergistic Activities

1. Teaching in the areas of hydrology and stormwater management for over 38 years. Developed curriculum materials and textbooks.
2. Service to the profession on over 100 committees related to the research.

E. Collaborators and other Affiliations

(i) State of Florida Departments of Transportation, Environmental Protection, and Community Affairs, working with watershed and springshed protection models and analyses. Established with the help of national and state programs, a soil erosion and sedimentation lab at the University.

(ii) Thesis Advisor and Postgraduate-Scholar Sponsor:

Completed eleven in the last 5 years. All in the water resources and stormwater management areas.

WETLANDS RESUMÉ

Robert H. Kadlec

July, 2007

Position

Principal, Wetland Management Services, Chelsea, Michigan
Professor Emeritus of Chemical Engineering, University of Michigan

Registration

Professional Engineer (Michigan)

Education

BS, Chemical Engineering, University of Wisconsin, 1958
MS, Chemical Engineering, University of Michigan, 1959
PhD, Chemical Engineering, University of Michigan, 1962

Professional Societies

International Water Association
Society of Wetland Scientists

Honors and Awards:

Editor, AIChE Journal, 1976-1985
MCEC Eminent Conceptor Award (Wetlands Treatment), 1976
ACEC Honor Award (Wetlands Treatment), 1976
All-time Outstanding Engineering Project (Wetlands Treatment), State of Michigan, 1987
Chairman, IAWQ Specialist Group on Macrophytes in Water Pollution Control. 1992-1997
Distinguished Career Award (Wetland Science). IWA and U. FL, 2000

PROFESSIONAL EXPERIENCE

Dr. Kadlec's professional work has been primarily concerned with the implementation of wetland systems for water pollution control, under the business name Wetlands Management Services. He has participated in the design of over one hundred wetland treatment systems, and conducted feasibility studies for many others. These span all types of treatment wetlands: surface and subsurface flow, natural and constructed, domestic and industrial wastewaters, and urban and agricultural runoff.

Design and Construction of Wetland Facilities.

Beginning with a small-scale project at Houghton Lake, Michigan in 1975, Dr. Kadlec has helped develop designs for many wetland treatment systems. This project continues to operate successfully. It was designated as one of the ten most outstanding engineering projects in the history of the State of Michigan. Dr. Kadlec has helped develop and construct pilot wetland systems where there has been a need, and has been involved in the construction of many full scale wetland facilities, as well as in the retrofitting of wetland units. Operating plans have been selected and tested to achieve the desired water treatment goals. Interactions with regulatory agencies are key processes in wetland implementation for wastewater renovation, and Dr. Kadlec works with the agencies to develop proper permits. Monitoring of operational facilities is an ongoing activity at several sites. He has experience with all scales of application, ranging from single family on-site systems to 200+ bgd constructed wetlands of thousands of acres in the Everglades Agricultural Area.

Consultation.

Dr. Kadlec has worked with a wide variety of public and private organizations on wetland related matters. These include USEPA, COE, TVA, USDOJ, USDO, USFS and USFWS at the national level, and several state and regional agencies at the local level. He has collaborated with many consulting engineering firms on the feasibility, design, construction and operation of more than 200 wetland treatment facilities. He currently is an advisor to the US Department of Interior, tasked with monitoring the design and construction of Everglades protection wetlands. Dr. Kadlec is immediate past chairman of the Macrophyte Specialist Working Group of IWA, in which capacity he coordinated international information transfer, and international wetlands conferences.

Monitoring.

Dr. Kadlec has worked on many wetland monitoring projects. These include performance monitoring for natural and constructed treatment wetlands as well as impact assessment monitoring of wetlands that act as receiving waters for treated effluents. Activities include determination of hydrology and water quality, soils and biota; however, he usually contracts with colleagues for any necessary detailed biological assessments. He performs the field work for projects in or near Michigan, and provides direction for field work in more remote sites.

TREATMENT WETLAND APPLICATIONS

Dr. Kadlec has been involved in many applications of treatment wetlands. As the technology has grown and branched into new water types, varied projects have been developed, and are being developed, under his direction. Some examples of projects in diverse usage are:

Domestic Wastewaters

Onsite Treatment: Grand Lake, MN; Millersylvania State Park, WA;
Fenton, MI ; Camp Warren, MN
Lagoon Effluent: Lake Nebagamon, WI; Nulato, AK; Roblin, MAN;
Benton, KY
Secondary Wastewater: Byron Bay, AUS; Eskilstuna, Sweden; Carson City, NV;
Columbia, MO; Phoenix, AZ

Urban and Agricultural Runoff

Urban Stormwater: Calgary, ALB; Miami-Dade, FL, Fort Wayne, IN;
Melbourne, FL
Agricultural Runoff: Wind Lake, WI; Everglades, FL; Brighton, FL;
Klamath, OR
Industrial Stormwater: Lambton, ONT; Savannah River, SC
Urban+Agricultural: Des Plaines, IL; Dixboro, MI; Bar-el-Bakhar, Egypt

Water Reuse

Lagoon Effluent: Sakhnin, Israel (olive crops)
Secondary Wastewater: Salem, OR (nut crops); Phoenix, AZ (green space),
Silverton, OR (botanical garden); Yelm, WA (greenspace)
Industrial Effluent: Connell, WA (fodder crops)

Industrial Wastewaters

Pulp & Paper: Columbus, MS
Food Processing: High River, ALB; Fremont, MI; Carberry, MAN
Fertilizer: White Spring, FL; ICI, ONT; Brandon, MAN
Mining: Musselwhite, ONT; Tucush, Peru; Lynn Lake, MAN

Landfill Leachate

Closed Facilities: Isanti-Chisago, MN; Saginaw, MI; Grand Rapids, MI
Marion, Mercer, Bullitt and Bowling Green, KY; BiState, IL;
Zionsville, IL; Laraway, IL
Open Facilities: Hanover Co., NC; Matanuska-Susitna, Alaska

Groundwater Remediation

Chlorinated Hydrocarbons: Hillsdale, MI; Burlington, IA
Hydrocarbons: Southington, CT; Wellsville, NY; Casper, WY
Metals: Bunker Hill, ID; Bronson, MI; Lynn Lake, Manitoba

RESEARCH, MONITORING AND ANALYSIS

Dr. Kadlec has been involved in many aspects of wetland research for more than thirty years, directing comprehensive multidisciplinary projects. Work has included field investigations of physical, chemical and biological processes in wetlands; as well as laboratory studies and computer simulation of wetland phenomena. Research University research was conducted from 1969 to 1995. As principal of Wetland Management Services, Dr. Kadlec continues active field and desktop research. Primary areas of endeavor include:

Wetland Hydrology

The key factors in the water budgets for wetlands have been studied at several sites. Evapotranspiration and infiltration studies in Florida and Arizona have contributed to understanding of water budget effects on wetland chemistry and biology. Overland flow resistance has been a second focus of research work. Wetland water budget and conveyance computer models have been developed and used successfully at several sites. Work has focused on residence time distributions, head loss in surface flow wetlands, and on the hydraulic capacity of gravel bed wetlands.

Wetland Waterborne Substances

Nutrients, tracers, metals, solids and other constituents have been studied in the context of wastewater discharges to wetland ecosystems. Work has ranged from compliance monitoring to in-depth studies of the fundamental transport processes. Field, laboratory and computer simulation research have been applied to wetland interactions with wastewater, agricultural and industrial chemicals. Phosphorus cycling has been the focus of a large effort related to protection of the Everglades.

Multi-System Analyses of Wetland Processes

The databases on treatment wetland performance have increased remarkably over recent years, due to the rapidly accelerating growth of the technology. Dr. Kadlec has been active in assembling and analyzing that data to gain better understanding of the key pollutant removal processes. Products include his comprehensive textbook, and technology assessments for various wetland types and application areas.

Literature Review.

The literature on wetlands for water quality improvement has been followed since its inception. This involves a considerable amount of information in the form of internal reports, design and operating data, as well as standard scientific publications. A computer database has been compiled for wetland treatment system performance. Dr. Kadlec is a member of the editorial board of Ecological Engineering.

Continuing Education

Dr. Kadlec conducts short courses on treatment wetland technology. These have included many offerings via the University of Wisconsin Extension. Specialized offerings have included courses for the Water Environment Federation, the New Zealand Water and Waste Association, a two week course for participants from the Mediterranean region, held in Zaragoza, Spain; PhD courses in Denmark, plus workshops for the states of Alaska, Arizona, Florida and Virginia, and for Ducks Unlimited Canada.

R. H. KADLEC – WETLAND PROJECTS 2007

Lynn Lake, Manitoba

A mine water tailings leachate treatment wetland is in design.

Madison, Florida

A bottled water backwash wetland feasibility study is in design.

Kimmirut, Nunavut, Canada

A municipal wastewater treatment wetland is in design.

Columbia, Missouri

Performance of treatment wetlands is under evaluation.

Hillsdale, Michigan

Wetland remediation of contaminated groundwater is in operation.

Burlington, Iowa

Wetland remediation of contaminated groundwater feasibility study is in progress.

Kentucky

Four wetlands for landfill leachate treatment are in final design.

St. Clair County, Illinois

Laraway, Illinois

A wetland for landfill leachate treatment is in conceptual design.

Zionsville, Indiana

A wetland for landfill leachate treatment is in conceptual design.

Matanuska-Susitna, Alaska

A wetland for landfill leachate treatment is in conceptual design.

Phoenix, Arizona

A full-scale wetland for re-use is in design.

Everglades, Florida

The evaluation of wetlands for removing phosphorus from agricultural runoff is in progress. The project includes 41,000 acres to treat 1000 mgd.

Armored, Arkansas

Constructed wetlands for metal processing feasibility study is in progress.

Chicago, Illinois

Design of wetlands for river nutrient reduction is in progress at three sites.

DePue, Illinois

A constructed wetland for removing nitrogen from gypsum leachate is in startup.

Glen Arbor, Michigan

A subsurface constructed wetland for domestic wastewater treatment is being evaluated.

Tucush, Peru

Wetlands for metal mine wastewater treatment are in startup.

Alcoa, Tennessee

Treatment wetlands are being piloted for remediation of groundwater cyanide.

Houghton Lake, Michigan, Wetland Treatment System

The response of the wetland to added water and nutrients is being studied for the thirty-fourth consecutive year, the last thirty at full scale.

Wivenhoe, Australia

Treatment wetlands in conceptual design for drinking water reservoir recharge.

Clairmont, Alberta

Treatment wetlands feasibility is in progress.

R. H. KADLEC - WETLAND PROJECTS

Key: F = Feasibility study
M = Facility monitoring
P = Performance evaluation

D = Participated in design
R = Research project
V = Value engineering

USA

STATE	CITY	ACTIVITY	
Alaska	Nulato	F,D	
	Mat-Su	F	
Arizona	Phoenix	D,R	
Arkansas	Armored	F,D	
California	Salinas	F	
	Lake Elsinore	F	
	Petaluma	V	
	Orange County	F	
	Imperial Valley	D,R	
	Southington	F,D,R	
	Connecticut	Bement	F
Illinois	Decatur	F	
	DePue	F,D	
	Des Plaines	F,D,M,R	
	Dresden	F	
	McHenry County	F,D	
	DePue	F,D	
	St. Clair County	F	
	Chicago Calumet	F,D	
	Chicago Centennial Trail	F,D	
	Chicago Powerhouse	F,D	
	Laraway	F,D	
	Indiana	Bloomington	F,D
		Crystal Lake	F,D
		Elkhart	F,D
		Uniondale	P
Poneto		D	
Fort Wayne		F,D	
Maxinkuckee Lake		D	
Idaho	Zionsville	F,D	
	Bunker Hill	D	
Iowa	Hailey	F	
	Norwalk	F	
Florida	Riverside	F	
	Burlington	F	
	Brighton	F,D	
	Everglades(3)	F,D,R,M	
	Lakeland	D,R,P	
	St. John's River (3)	F,D,R	
	Miami	F,D	
Kansas	White Springs	F,D	
	Madison	F,D	
	St. Lucie	D	
	Manhattan	F	
	Ulysses	D	
	Lawrence	F	

R. H. KADLEC - WETLAND PROJECTS

continued

Kentucky	Benton	F,R
	Hardin	F,R
	Madisonville	F
	Pembroke	F,P
	Caney Creek	F,D
	Mercer County	F
	Warren County	F
	Marion County	F
	Bullitt County	F
Massachusetts Michigan	Chicopee	F,D
	Bellaire	F,D,M,R,P
	Berrien County	F
	Boyne City	F,D
	Chelsea	F
	Commerce Township	P
	Fremont	D
	Cranberry	R
	Denton	R
	Dexter	F,M,R,P
	Dixboro	F,D,R,P
	Fenton	D
	Genoa-Oceola	M
	Glen Arbor	P
	Grand Rapids	F
	Hillsdale	F
	Hillsdale-Schilling	F,D,M,P
	Holly	F
	Houghton Lake	F,D,M,R,P
	Hudson	F,D,M
	Kalamazoo	F,D,R
	Kinross	M,R,P
	Ogihara	M
	Lapeer	F,D,P
	North Bronson	F
	Onaway	F,D,P
	Pentwater	R
	Rawsonville	F,D
	Rockwood	D,R
	Saginaw	F,D,P
	Salem Lakes	F
	Stockbridge	F,D
	Sumpter TWP	F,D
	St. Helen	F,D
	Williamston	D
Minnesota	Biwabik	F,P
	South International Falls	F
	Grand Lake	D,R,P
	Camp Warren	F,D,P
	Islanti-Chisago	D,P
	NERCC I	D,R,P
	NERCC II	D
	Northern Lights	D
	Onamia	F,D,M
	Country Supper	D
	Thompson	D
	Duluth	D

Onamia
R. H. KADLEC - WETLAND PROJECTS
 continued

F,M

Mississippi	Columbus	F,D
Missouri	Columbia	F,D,M,R,P
Nevada	Incline Village	F,D,R,P
	Las Vegas	F
	Reno-Sparks	D
New York	Pulaski	F,D
	Wellsville	F,P
	Syracuse	F
North Dakota	Devil's Lake	F
North Carolina	Hanover County	D
Ohio	Mentor	F
	Newberry	F
	Cincinnati	D
Oregon	Hermiston	F,D,M,R
	Quincy	F,D
	Portland (3)	F
	Silverton	F,D
	Upper Klamath Lake	F,D
	Salem	D,R
	Florence	F
South Carolina	Aiken	D
Pennsylvania	Wellsboro	F
Tennessee	Alcoa I	F,D,M,P
	Alcoa II	F,D,M,R
Texas	Fort Worth	F,D
	Richland-Chambers	D,R
Utah	West Bountiful	F
	Logan	F,D
Virginia	Prince William County	D,R
	Dahlgren	P
Washington	Connell	F,D,M,P
	Olympia	F
	Yelm	D
	Lacey	F
	Quincy	D
	Millersylvania	D,P
	Spokane	F
	Spangle	D
	College Place	P
Wisconsin	Drummond	F,D,R,P
	Paasch Lake	F
	Solon Springs	F,D
	Wind Lake	F,D
	Lake Nebagamon	F,D,P
	Waupun	F
	Amnicon	D
Wyoming	Casper	F,D,P

R. H. KADLEC - WETLAND PROJECTS

continued

Canada

Alberta	Calgary	F,D	
	High River	R,P	
	Rocky View	F	
	Grand Prairie	F	
	Clairmont	F	
British Columbia	Creston	F	
	Dease Lake	F,D	
	West Moberly	F,D	
	Fort Nelson	F,D	
	Vancouver	F	
	Vancouver Island	F	
	Delta	F,R	
Manitoba	Roblin	F,D	
	Brandon	F,D	
	Simplot Brandon	F,D	
	Lynn Lake	F,D	
	Carberry	F,D	
Ontario	Listowel	F,D,R	
	Sawmill Creek	D	
	Cottam	F	
	Lambton I	F,D	
	Lambton II	F,D	
	Musselwhite	P,D	
	Pelee Island	D	
	Vaughan	D,R	
	Sudbury	F	
	Falcon Lake	F	
	Deloro	F	
	Alexandria	F,D	
	Elliot Lake	F	
	Brighton	F,D,P	
	Yukon	Ross River	F,D
		Whitehorse	F,D
	Nunavut	Kimmirut	F,D

Other Countries

Australia	New South Wales	R
	Byron Bay	P
	Wivenhoe	F,D
Egypt	Port Said	F,D
	El Sadat City	D
Israel	Sakhnin	R
	Beni Zeid	D
France	Central	F
Sweden	Linköping	D
	Eskilstuna	D
New Zealand	Hamilton	R
	Toenepi	M,R
Peru	Tucush	D

WETLAND MANAGEMENT SERVICES CLIENT LIST

Aarhus University	Homestead Dev.
A.G. Crook	HydroQual, Inc.
Alan Plummer & Assoc.	I.E.S.
ASCI	Inland Seas
Australian CRC	Interfluve, Inc.
Ayres Associates	IRRRB
Becher-Hoppe	Kelley, McLaughlin
Bellaire Village	Kirkbride Assoc.
Black & Veatch	Klohn Leonoff
BHE	Limnotech
Bonar	Liq. Waste Ind. Serv.
Boss	Louis Berger
Brennan Beach	Malcolm Pirnie
British Petroleum	MacVicar, Federico & Lamb
Burns & McDonnell	McCulley, Frick & Gilman
Byron Shire Council, AUS	McNamee, Porter & Seeley
Capital Consultants	Metcalf & Eddy
CDM	Midwestern Consulting
CH2M Hill	Midwest Environmental Cons.
CH2M Gore & Storrie	NIWA
City of Chicago	Novatec, Inc.
City of Portland	O'Brien & Gere
City of Phoenix	Onaway
City of Florence	Parametrix
Coastal Systems Int., Inc.	Parsons Engineering Science
Consoer Townsend	P. Lane Assoc.
Culp, Wesner & Culp	PFRA
Cummins & Barnard	Phytokinetics
Danish Government	Psomas
Davis County	R. A. Smith Assoc.
Delta Consultants	Riparia
Dillon Consultants	SAIC
Ducks Unlimited Canada	SESI
Earth Tech	SEQWater
East Shore Corp.	Service Environmental & Engineering
Ecology & Environment, Inc.	Skillings-Connolly
Environmental Concern	SKVB
Environmental Services & Permitting	Smith-Culp
Environ	So. Florida WMD
Eskilstuna Energi & Miljo	Southwest Wetlands
Foster Pepper & Shefelman	Spicer Engineering
Galilee Society	SRI
Gerber Foods	St. Johns River WMD
Giffels & Webster	St. Louis County
Golder Associates	Svoboda Ecological Resources
Gosling Czubak	Tekniska Verken
Harms & Associates	Terra Environmental
Harza	Tetra Tech
HDR	TetrES Consultants
Hey & Associates	
HLSA	

WETLAND MANAGEMENT SERVICES CLIENT LIST
(continued)

Thatcher Engineering
TRC
TRI
Trow
TVA
TWI
U.S. Dept of Justice
U.S. Dept. of Interior
U.S. Forest Service
United Nations DP
U. MN NRR1
USEPA
V3
Varga Assoc.

Versar
Wade Trim
Washtenaw Co.
Westinghouse SRC
Wetlands Initiative
Wetlands Research, Inc.
Weyerhaeuser
Wolverine Engineering
Woodstone/Homestead
Whitman & Howard
Winter, PLC
Woodward Clyde
YMCA

R. H. KADLEC – WETLANDS PUBLICATIONS (PAPERS OF THE LAST SIX YEARS)

Books

Kadlec, R. H. and S.D. Wallace, 2008. Treatment Wetlands, CRC Press, Boca Raton, FL in press.

Kadlec, R. H. and R. L. Knight, 1996. Treatment Wetlands, CRC Press, Boca Raton, FL, 893 pp.

Kadlec, R. H., R. L. Knight, H. Brix, P.F. Cooper, J. Vymazal and R. Haberl, 2000. Constructed Wetlands for Water Pollution Control: Processes, Performance, Design and Operation, IWA Scientific and Technical Report No. 8, IWA Publishing, London, 156 pp.

Conference Proceedings Edited

K.R. Reddy and R. H. Kadlec, 2001. Wetland Systems for Water Pollution Control, *Water Science and Technology*, Vol. 44, No. 11/12, 625 pp.

Kadlec, R. H. and H. Brix, 1995. Wetland Systems for Water Pollution Control, *Water Science and Technology*, Vol. 32, No. 3, 376 pp.

Tilton, D. L., R. H. Kadlec and C. J. Richardson, 1976. Freshwater Wetlands and Sewage Effluent Disposal, The University of Michigan, Ann Arbor, MI, 343 pp.

Papers

132. Kadlec, R. H., 2006. "Free Surface Wetlands for Phosphorus Removal: The Position of the Everglades Nutrient Removal Project," *Ecol. Eng.*, Vol. 27, No. 4, pp. 361-379.

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127. Hey, D.L., J.A. Kostel, A.P. Hunter and R.H. Kadlec, 2005. "Nutrient Farming and Traditional Removal: An Economic Comparison," Final Report on Project 03-WSM-6CO, Water Environment Research Foundation, Alexandria, VA. www.wetlands-initiative.org/TWIpublications.html

126. Kadlec, R. H., 2005. "Tracer and Spike Tests of Constructed Wetlands," in: Wastewater Treatment in Wetlands: Theoretical and Practical Aspects, Proc. Workshop Starbienino, Poland, H. Obarska-Pempkowiak, Ed., Gdansk University of Technology, Gdansk, Poland, September, 2005, pp. 61-76.

125. Headley, T. and R.H. Kadlec, 2005. "Conducting Hydraulic Tracer Studies in Constructed Wetlands: A Practical Guide," in: Wastewater Treatment in Wetlands: Theoretical and Practical Aspects, Proc. Workshop Starbienino, Poland, H. Obarska-Pempkowiak, Ed., Gdansk University of Technology, Gdansk, Poland, September, 2005, pp. 45-60.

124. Wallace, S. and Kadlec, R. H., 2005. "BTEX Degradation in a Cold-Climate Wetland System," *Water Science and Technology*, Vol. 51, No. 9, pp. 165-171.

123. Kadlec, R. H. and J. Pries, 2004. "Hydrograph Controlled Release: Lagoon-Wetland Combinations for Ammonia Control," in: Wetland Systems in Water Pollution Control, 9th International Conference

- IWA Macrophyte Group, A. Lienard, Ed., Cemagref, Lyon Cedex, France, September, 2004, pp. 739-748.
122. Kadlec, R. H., 2005. "Wetland to Pond Treatment Gradients," *Water Science and Technology*, Vol. 51, No. 9, pp. 291-298.
 121. Reddy, K.R., R.G. Wetzel and R. H., Kadlec, 2005. "Biogeochemistry of Phosphorus in Wetlands," In: Phosphorus: Agriculture and the Environment, J. T. Sims and A. N. Sharpley (eds), Soil Science Society of America, Madison, WI, pp. 263-316.
 120. Kadlec, R. H., C.C. Tanner, V.M. Halley and M.M. Gibbs 2004. "Nitrogen Spiralling in Subsurface-flow Treatment Wetlands –Implications for Treatment Response," *Ecol. Eng.*, Vol. 25, No. 4, pp. 365-381.
 119. Kadlec, R. H., 2005. "Phosphorus Removal in Emergent Free Surface Wetlands," *Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering*, Volume 40, Issue 6 - 7, Jun 2005, Pages 1293 – 1306.
 118. Kadlec, R. H., 2005. "Nitrogen Farming: The Use of Wetlands for Nitrate Removal," *Journal of Environmental Science and Health, Part A: Toxic/Hazardous Substances & Environmental Engineering*, Volume 40, Issue 6 - 7, Jun 2005, Pages 1307 – 1330.
 117. Kadlec, R. H., 2005. "Constructed Wetlands to Remove Nitrate," in: E.J. Dunne, K.R. Reddy and O.T. Carton, Eds., Nutrient Management in Agricultural Watersheds – A Wetlands Solution, Wageningen Academic Publishers, Wageningen, Netherlands, pp. 132-143.
 116. Gessner, T.P., R.P. Reaves, R.H. Kadlec and R. Prezbindowski, 2005. Wetland Remediation of Cyanide and Hydrocarbons," *Ecol. Eng.*, Vol. 25, No. 4, pp. 457-469.
 115. Kadlec, R. H., 2005. "Vegetation Effects on Ammonia Reduction in Treatment Wetlands," In: J. Vymazal, Ed., Nutrient Cycling and Retention in Natural and Constructed Wetlands, Backhuys Publishers, Leiden, Netherlands, pp. 233-260.
 114. Bishay, F, Kadlec, R. H., 2005. "Wetland Treatment at Musselwhite Mine," In: J. Vymazal, Ed., Natural and Constructed Wetlands:Nutrients, Metals and Management, Backhuys Publishers, Leiden, Netherlands, pp. 176-198.
 113. Kadlec, R. H., 2003. "Status of Treatment Wetlands in North America," in: The Use of Aquatic Macrophytes for Wastewater Treatment in Constructed Wetlands, Proceedings of 1st International Seminar, V. Dias and J. Vymazal, Eds., Instituto da Conservacao da Natureza and Instituto Nacional da Agua, Lisbon, Portugal, May, 2003, pp. 363-402.
 112. Kadlec, R. H., 2003. "Hydrology and Hydraulics of Constructed Wetlands," in: The Use of Aquatic Macrophytes for Wastewater Treatment in Constructed Wetlands, Proceedings of 1st International Seminar, V. Dias and J. Vymazal, Eds., Instituto da Conservacao da Natureza and Instituto Nacional da Agua, Lisbon, Portugal, May, 2003, pp. 111-136.
 111. Kadlec, R. H., 2003. "Trés Rios Treatment Wetlands," in: The Use of Aquatic Macrophytes for Wastewater Treatment in Constructed Wetlands, Proceedings of 1st International Seminar, V. Dias and J. Vymazal, Eds., Instituto da Conservacao da Natureza and Instituto Nacional da Agua, Lisbon, Portugal, May, 2003, pp. 521-524.
 110. Ferro, A.M., R.H. Kadlec and J. Deschamp, 2002. "Constructed Wetland System to Treat Wastewater at the BP Amoco Former Casper Refinery: Pilot Scale Project," 9th International Petroleum Environmental Conference, Albuquerque, NM, IPEC Consortium Website, <http://ipec.utulsa.edu>.
 109. Kadlec, R. H., 2003. "Effects of Pollutant Speciation in Treatment Wetland Design," *Ecological Engineering*, Vol. 20, Issue 1, pp.1-16.
 108. Haberl R, Grego S, Langergraber G, Kadlec RH, Cicalini A-R, Martins Dias S, Novais JM, Aubert S, Gerth A, Hartmut T, Hebner A (2003): Constructed Wetlands for the Treatment of Organic Pollutants. JSS - J Soils & Sediments. OnlineFirst DOI: <http://dx.doi.org/10.1065/jss2003.03.070>

107. Kadlec, R. H., 2002. "Pond and Wetland Treatment," *Water Science and Technology*, Vol. 48, No. 5, pp. 1-8.
106. Tanner, C.C. and Kadlec, R. H., 2002. "Oxygen flux implications of observed nitrogen removal rates in subsurface-flow treatment wetlands," *Water Science and Technology*, Vol. 48, No. 5, pp. 191-198.
105. Kadlec, R. H., 2003. "Integrated Natural Systems for Landfill Leachate Treatment," In: J. Vymazal, Ed., Wetlands – Nutrients, Metals and Mass Cycling, Backhuys Publishers, Leiden, Netherlands, pp. 1-33.
104. Tanner, C.C., R.H. Kadlec, M.M. Gibbs, J.P.S. Sukias and M.L. Nguyen' 2002. "Nitrogen Processing Gradients in Subsurface-flow Treatment Wetlands– Influence of Wastewater Characteristics," *Ecological Engineering*, Vol. 18, Issue 4, pp. 499-520.
103. Kadlec, R. H., 2001. "Thermal Environments of Subsurface Treatment Wetlands," *Water Science and Technology*, Vol. 44, No. 11/12, pp. 251-258.
102. Werner, T. and R. H. Kadlec, 2000. "An Improved Model for Wetland Tracer Analysis," in: Wetland Systems for Water Pollution Control, 7th International Conference Proceedings, University of Florida, pp. 639-646.
101. Knight, R.L. and R.H. Kadlec, 2000. "Constructed Treatment Wetlands – a Global Technology," *Water 21*, June 2000, pp. 57-58.
100. Kadlec, R. H., 2002. "Wastewater Treatment - Wetlands and Reedbeds for Wastewater Treatment," Contribution to: Encyclopedia of Environmental Microbiology, G. Bitton, Ed., Wiley, New York, pp. 3389-3401.
99. Kadlec, R. H., 2008. "Utilizing Wetland Ecosystem Processes. II. Wetlands for Contaminant and Wastewater Treatment," In: The Wetlands Handbook, E. Maltby, Ed., Blackwell Science Ltd, London, in press.
98. Kadlec, R. H. and E. Maltby, 2008. "Sustainable Utilization of Wetlands: Balancing Ecosystem Functioning and Human Needs. VII. Wetlands Protection, Restoration and Utilization in South Florida," In: The Wetlands Handbook, E. Maltby, Ed., Blackwell Science Ltd, London, in press.
97. Kadlec, R. H., R. Axler and B. McCarthy, 2001. "Subsurface Treatment Wetlands in the Cold Climate of Minnesota," In: (U. Mander and P. Jenssen, Eds.), Constructed Wetlands for Wastewater Treatment in Cold Climates, Advances in Ecological Sciences, Wessex Institute of Technology Press, Wessex, UK, pp.19-52.
96. Kadlec, R. H., 2000. "Using Wetlands to Diminish the Effects of Pollution," In: *Water 2000*, Proceedings of NZWWA Biennial Conference, Auckland, NZ, March, 2000.
95. Kadlec, R. H., 2001. "Phosphorus Dynamics in Event Driven Wetlands," In: J. Vymazal, Ed., Transformations of Nutrients in Natural and Constructed Wetlands, Backhuys Publishers, Leiden, Netherlands, pp. 365-392.

NON-WETLAND VITAE

ROBERT H. KADLEC

1. Name: Robert Henry Kadlec
2. Department: Chemical Engineering
3. Date of Birth: June 11, 1938
Citizenship: U.S.A.
4. Present Academic Rank: Professor Emeritus

Dates of appointment to various academic ranks at The University of Michigan:

- | | |
|----------------------|------|
| Assistant Professor: | 1961 |
| Associate Professor: | 1965 |
| Professor: | 1970 |
| Professor Emeritus: | 1995 |

5. Degrees:
 - B.S.: Chemical Engineering, University of Wisconsin, August 1958
 - M.S.: Chemical Engineering, The University of Michigan, June 1959
 - Ph.D.: Chemical Engineering, The University of Michigan, February 1962
6. Appointment fractions during present term:
7. Other teaching experience:
 - Numerous short courses for Dow Chemical and Procter and Gamble
8. Full-time industrial experience:
9. Part-time industrial experience:
 - Procter and Gamble, Summer 1957, Cincinnati, Ohio
 - California Research Corp., Summer 1959, Richmond, California
 - Esso Research Labs., Summer 1967, Baton Rouge, Louisiana
 - Marathon Oil Co., Summer 1970, Littleton, Colorado
10. States in which registered: Michigan.
11. Consulting work in the past five years:
 - Review panel member, Hazardous Waste Research Center, LSU
12. Scientific and professional societies of which a member (1994):
 - IPS, NSPE, MSPE, SWS, ASCE, WEF, IAWQ.
13. Honors and awards:

Distinguished Service Award for Assistant Professors (Development Council - 1965)

Tau Beta Pi; Phi Kappa Phi; Sigma Xi; Phi Lambda Upsilon; Phi Eta Sigma

Phi Lambda Upsilon Outstanding Teaching and Leadership Award, 1971-72.

MCEC Eminent Conceptor Award, 1976.

ACEC Honor Award, 1976.

Editor, AIChE Journal, 1976-1985

Associate Executive Editor, Encyclopedia of Science and Technology, 1984-

Chemical Engineer of the Year, Detroit AIChE, 1985.

All-time Outstanding Engineering Project, Decade of the 70's, State of Michigan, 1987.

Teaching Excellence Award, College of Engineering, 1988

Chair, IAWQ International Wetland Working Group, 1992-

Advisor, Australian National Wetlands Project, 1992-

14. Committee and counseling assignments in department, college, and university:

15. Recent activities during summer periods outside of academic appointments:

16. Leaves of absence and sabbatical leaves while at Michigan:

Sabbaticals - Winter 1968; Fall 1975; Winter 1982; Winter 1989.

17. Current contracts and grants under your direct supervision:

18. Contract and grant proposals funded during the past year:

19. Students Supervised

Ph.D. Dissertations Supervised:

George R. Chludzinski (1964). Energy Transfer to Solids in R.F. Generated Plasmas.

Donald Grant Fisher (1965). Frequency Response of Flow Forced Heat Exchangers.

Dean L. Smith (1965). Mass and Energy Transfer Between a Confined Plasma Jet and a Gaseous Coolant.

Frederic Melvin Swinehart (1966). A Statistical Study of Local Wall Pressure Fluctuations in Gas Fluidized Columns.

Martin A. Javinsky (1967). Optimal Control of a Continuous Flow Stirred Tank Chemical Reactor.

Mark Richard Newberger (1967). Optimal Operation of a Tubular Chemical Reactor.

George Joseph Quarderer (1967). Photochemical Chlorination of Sulfur Dioxide Utilizing a Plasma.

Roger Keranen Rains (1968). Reduction of Aluminum Oxide to Aluminum in Radio Frequency Generated Plasmas Light Source.

Phillip Hain Turnock (1968). The Separation of Nitrogen and Methane by Pulsating Flow Through a Fixed, Molecular Sieve Bed.

Daniel Edward Kowler (1969). The Optimization of the Cyclic Operation of a Molecular Sieve Adsorber.

Finis Ewing Carleton (1970). Flow Patterns in a Confined Plasma Jet.

John Patrick Duffy (1972). The Behavior of the Dispersed Phase in Liquid-Liquid Cocurrent Flow Through a Packed Bed.

Robert David Oltrogge (1972). Gas Fluidized Beds of Fine Particles.

Everett Anthony Sondreal (1972). Models for Thermal Exhaust Reactors: Limits on Performance Posed by Mixing and Thermal Quenching.

Larry Michael Joseph (1974). The Cyclic Operation of a Vapor-Liquid Separator.

Peter Eddy Parker (1974). A Dynamic Ecosystem Simulator.

Prem Krishna Gupta (1977). Dynamic Optimization Applied to Systems with Periodic Disturbances.

Thomas George Stanford (1977). Development of a Packed-bed Photochemical Reactor.

Kuang-tsan Liu (1980). Determination of Mass Transport Parameters for Fixed-Bed Adsorbers by a Micro-Column Technique.

Robert Henry Griffiths, Jr. (1980). Propane Pyrolysis in a Tubular Reactor with Cyclic Flow.

David E. Hammer (1984). An Engineering Model of Wetland/Wastewater Interactions.

Xiang-Ming Li (1985). Solute Rejection During Freezing of a Peatland and Overlying Water.

Garo G. Vaporciyan (1987). Pressure Swing Chemical Reactors.

I-Der Lee(1989). Simulation of Pressure Swing Reactors: A Study of the Effects of Adsorbent and Catalyst Distributions and Several Design Parameters on the Performance of the Reactors.

Michael L. Call(1989). Estimation of Micromixing Parameters from Tracer Concentration Fluctuation Measurements.

Herbert H. Alvord (1995) The Fate and Transport of Atrazine in Wetlands. (Defended successfully and withdrawn)

Timothy M. Werner (1996). Mixing and Flow in Constructed Wetlands.

M.S. Theses Supervised:

Lisa Kroop (1981). A Study of the Kinetics of Sulfite Oxidation in Concentrated Double Alkali SO₂ Scrubbing Systems.

Thomas Swenson (1982). Oxygen Solubility in Sodium Sulfate and Sodium Chloride Solutions at 50°C.

Gerald Cotten (1984). Segregation of Chloride Ions from NaCl Solutions on Freezing.

Michael L. Call (1985). Reaction Selectivity and Mixing.

Garo Vaporciyan (1985). Periodic Reactor - Adsorber.

Willem Bastiaens (1992) RTDs in Wetlands

Jay Helsel (1992) Fill and Draw Wetlands

20. Specific contributions to classroom and laboratory instruction at both undergraduate and graduate levels:

Courses Developed:

ChE 446, 566 (w/R.L. Curl), 588 (w/B. Carnahan)
407, 507, 607, 400, 500
691, (w/S.W. Churchill)
460 (control laboratory)
Chemical Engineering for Non-ChE's

Courses Taught:

ChE 202, 230, 231, 330, 340, 341, 342, 343, 344, 360
400, 407, 446, 460, 500, 507, 528, 566, 588

607, 691,800,801,895

PUBLICATIONS – Non-wetland:

(1) Patents:

US Patent No. 5,254,368. Periodic Chemical Processing System. 10/19/93.

(2) Journal Articles:

"The Reduction of Al₂O₃ to Aluminum in a Plasma," (with R.K. Rain s), Met. Trans., Vol. 1, (June 1970).

"Optimal Control of a Continuous Flow Stirred Tank Chemical Reactor," (with M.A. Javinsky), AIChE J., (1970).

"Effect of Reynolds and Prandtl Number on the Frequency Response of Concentric Tube Heat Exchangers," (with D.G. Fisher), Canad. J. Chem. Eng., Vol. 48, (August 1970).

"Frequency Response of Different Size Concentric Tube Heat Exchangers," (with D.G. Fisher), Canad. J. Chem. Eng., Vol. 48, (August, 1970).

"The Separation of Nitrogen and Methane Via Periodic Adsorption," (with P.H. Turnock), AIChE J., (1971).

"Mass Transfer Between Coaxial Nitrogen and Argon Plasma Streams," (with D.L. Smith and S.W. Churchill), AIChE J., vol. 17, No. 2, (March, 1971).

"Optimal Operation of a Tubular Chemical Reactor," (with M.R. Newberger), AIChE J., Vol. 17, No. 6, (November, 1971).

"Thermal Reactors Work Better with Correct Air Intake," (with D.J. Patterson), SAE J., Vol. 80, No. 2, (February, 1972).

"Modeling," (with R.L. Curl), Chem. Eng. Educ., Vol. 6, No. 4, (Fall, 1972).

"Impact Tube Gas Velocity Measurement of High Temperatures," (with F.E. Carleton), AIChE J., Vol. 18, No. 5, (September, 1972).

"The Optimal Control of a Periodic Adsorber - Part I: Experiment," (with D.E. Kowler), AIChE J., Vol. 18, No. 6, (November, 1972).

"The Optimal Control of a Periodic Adsorber - Part II: Theory," (with D.E. Kowler), AIChE J., Vol. 18, No. 6, (November, 1972).

"The Kinetics of the Saponification of Diethyl Adipate," (with Mark R. Newberger), AICHE J., vol. 19, No. 6, (November, 1973).

"Chlorination of Sulfur Dioxide in a Plasma Arc Photochemical Reactor Part I. Reactor Performance," (with G.J. Quarderer), AICHE J., Vol. 20, No. 1, (January, 1974).

"Chlorination of Sulfur Dioxide in a Plasma Arc Photochemical Reactor Part II. Chlorination of Sulfur Dioxide," (with G.J. Quarderer), AICHE J., Vol. 20, No. 1, (January, 1974).

"The Cyclic Operation of a Vapor-Liquid Separator." (with Larry M. Joseph), I&EC Process Design and Development, Vol. 14, No. 2, (April, 1975).

"The Behavior of the Dispersed Phase in Liquid-Liquid Cocurrent Flow Through a Packed Bed," (with John P. Duffy), Can. J. Chem. Eng., Vol. 53, p. 621, (December, 1975).

"Equilibrium Periodic Separating Reactors," (with Garo G. Vaporciyan), AICHE J., Vol. 33, No. 8, pp. 1334-1343, (1987).

"Effects of Adsorbent and Catalyst Distributions in Pressure Swing Reactors," (with I-Der Lee), and Applications, AICHE, Symp. in: Adsorption and Ion Exchange: Fundamentals. Series 264, V 88, pp 167-172, 1988.

"Periodic Separating Reactors: Experiments and Theory," (with G.G. Vaporciyan), AICHE J., Vol. 35, No. 5, pp 831-844, 1989.

"Estimation of Micromixing Parameters from Tracer Concentration Fluctuation Measurements," (with M.L. Call), Chem. Eng. Sci., Vol. 46, No. 6, pp. 1377-1389, 1989.

(3) Proceedings and Transactions:

"Heat Transfer to Probes in Argon-Nitrogen Plasmas," (with S.W. Churchill and G.R. Chludzinski), Proceedings of Joint AIChE-BIChE Meeting, London, (1965).

"Reduction of Al_2O_3 to Aluminum in a Plasma," (with R.K. Rains), Proceedings of the 19th Canadian Chemical Engineering Conference, (October, 1969).

"Warmup Limitations on Thermal Reactor Oxidation," (with D.J. Patterson and E.A. Sondreal), SAE 730201, (1973).

"Limiting Factors on Steady State Thermal Reactor Performance," (with D.J. Patterson, E.A. Sondreal, and M.W. Graves Jr.), SAE 730202, (1973).

"Reactor Studies for Exhaust Oxidation Rates," (with H.A. Lord, E.A. Sondreal, and D.J. Patterson), SAE 730203, (1973).

"Modeling Hydrocarbon Disappearance in Reciprocating- Engine Exhaust," (with D.J. Patterson and R.J. Herrin), In: Combustion Modeling in Reciprocating Engines, James N. Mattavi and Charles A. Amann, Eds., Plenum Press, New York-London, (1980).

William F. Hunt, III, Ph.D., PE

Assistant Professor and Extension Specialist, North Carolina State University

Statement of Qualifications

Background Overview

Dr. Hunt is the head of NC State University's Stormwater Engineering Group. The 15-member team conducts applied research and outreach of stormwater management issues. A particular focus is given to stormwater treatment technology performance, water harvesting, maintenance of practices, and economics. Since 2002, Hunt's team has designed, constructed, and / or monitored over 70 stormwater technologies. In addition the team teaches practicing engineers and other design professionals 25-30 workshops in North Carolina and throughout the United States. Stormwater team alumni currently work in Boston, Mass.; New York City, NY; Baltimore, MD; Gainesville, FL; and throughout North Carolina. Hunt was recent chair of the 2nd National Low Impact Development Conference held in Wilmington, NC, in March 2006.

Qualifications Specific to Santa Susana Project

1. Extensive experience in monitoring stormwater management projects, including project specific monitoring and large watershed (>500 acre) monitoring.
2. Design, construction, and monitoring of vegetative stormwater management practices, including stormwater wetlands, bioretention / biofiltration, green roofs, and level spreader – riparian buffer systems. Several projects have specifically been designed for recreation and/ or public amenities.
3. Developing maintenance protocols for above mentioned practices and several others. Creator of first training course in the US dedicated to training and certifying maintenance professionals on vegetated stormwater treatment practices.

List of Current Research Projects (Partial)

Runoff Reduction and Nutrient Sequestering of Grassed Bioretention Cells. Funded by the North Carolina Department of Environment and Natural Resources (NC DENR)

Monitoring of 12 Stormwater Management Practices in Charlotte, NC. Funded by the City of Charlotte, NC.

Pathogenic Bacteria Removal by 5 Coastal Stormwater Practices. Funded by NC DENR

Hydrology of Coastal Plain Bioretention Facilities. Funded by CiCEET

Vegetative Uptake and Phosphorus Sorption of Stormwater Wetlands. Funded by the NC Ecosystem Enhancement Program.

Evaluating Linear Wetland Swales and Traditional Swales in DOT Rights-of-Way. Funded by the NC Department of Transportation.

Side-by-Side Evaluation of Four Permeable Pavement Types for Hydrology and Water Quality. Funded through the US EPA, section 319(h) grants administered by NC DENR.

5 Related Publications (complete list @ www.bae.ncsu.edu/stormwater/pubs.htm)

Hunt, W.F., A.R. Jarrett, J.T. Smith, and L.J. Sharkey. 2006. "Evaluating bioretention hydrology and nutrient removal at three field sites in North Carolina." *J. Irr. Drain. Eng.* 132(6):600-608.

Hunt, W.F., J.T. Smith, S.J. Jadlocki, J.M. Hathaway, and P.R. Eubanks. 2008. "Pollutant removal and peak flow mitigation by a bioretention cell in urban Charlotte, NC." *J. Envir. Eng.* (in press)

Hunt, W.F., C.S. Apperson, S.G. Kennedy, B.A. Harrison, and W.G. Lord. 2006. "Occurrence and relative abundance of mosquitoes in stormwater retention facilities in North Carolina, USA." *Wat. Sci. Tech.* 52(6-7): 315-321.

Bean, E.Z., W.F. Hunt, D.A. Bidelspach. 2007. " Evaluation of four permeable pavements sites in eastern North Carolina for runoff reduction and water quality impacts." *J. Irr. Drain. Eng.* 133(6): 583-592.

Hunt, W.F. and W.G. Lord. 2006. *Stormwater Wetland and Wet Pond Maintenance*. NC Cooperative Extension Publication # AG-588-7. Raleigh, NC. 10 p.

Honors and Activities

Water Conservationist of the Year (NC Governor's Award). 2006

NC State University Alumni Association: Outstanding Extension Award (University-wide honor). 2007

Phi Beta Kappa and *Tau Beta Pi*

American Society of Civil Engineers

Bioretention Committee, Co-Chair

Permeable Pavement Committee, Chair

LID Technical Committee, Member

American Society of Agricultural and Biological Engineers

NC Section, Chair

National Extension Committee, Past-Chair

Related Web Sites:

www.bae.ncsu.edu/people/faculty/hunt - Dr. Hunt's Individual Website

www.bae.ncsu.edu/stormwater - Stormwater Team Website

www.bae.ncsu.edu/topic/bioretention - NCSU Bioretention Research Website

www.bae.ncsu.edu/topic/permeable-pavement - NCSU Permeable Pavement Research Website

www.bae.ncsu.edu/topic/waterharvesting - NCSU Water Harvesting (Cistern) Website

CIVIL AND CONSTRUCTION ENGINEERING

OREGON STATE UNIVERSITY

College of Engineering

HUBER, Wayne C.
Professor

BIRTH DATE
August 2, 1941

DEGREES

B.S., Engineering, California Institute of Technology, 1963
M.S., Civil Engineering, Massachusetts Institute of Technology, 1965
Ph.D., Civil Engineering, Massachusetts Institute of Technology, 1968

ACADEMIC POSITIONS

Research Assistant, California Institute of Technology (summer), 1962
Research Assistant, Massachusetts Institute of Technology, 1963-68
Assistant Professor of Environmental Engineering Sciences, University of Florida, 1968-73
Associate Professor of Environmental Engineering Sciences, University of Florida, 1973-79
Professor of Environmental Engineering Sciences and Affiliate Professor of Civil Engineering,
University of Florida, 1979-91
Professor, Department of Civil, Construction, and Environmental Engineering, Oregon State
University, 1991- present, Department Head, 1991-00

NON-ACADEMIC POSITIONS

Engineering Trainee, California Division of Highways Los Angeles, California (summers), 1960-61
Surveyor, Construction Supervisor, Alaska Department of Highways, Nome, Alaska (summer), 1965

Consultant to:

Environmental Engineering, Inc., Diffusion Studies, 1970
Central and Southern Florida Flood Control District, Hydrologic Studies in Everglades, 1971-72
Pan American Health Organization, Invited Lecturer on Water Pollution, 1972
Water and Air Research, Drainage Studies, Lake Hydrology, Thermal Pollution, EPA 208
Planning, 1972-77
Frederic R. Harris, Inc., Water Quality Studies on St. Johns River, 1973
James F. MacLaren, Ltd., Urban Runoff Studies, 1974-75
Corps of Engineers, Urban Hydrology Lecturer, 1974
Environmental Science and Engineering, Impact of Finger Canals on Harbor Water Quality,
1974-75
University of Massachusetts, Applications of Stormwater Management Models, 1974-76
University of North Carolina, EPA 208 Planning Methodology, 1975
Brevard Engineering Corp., Water Quality Analysis of Urban Development, 1975-76
Howard, Needles, Tammen and Bergendoff, EPA 208 Planning, 1976-77
C.D.D. Howard and Assoc., Urban Runoff Analysis, Hydraulic Transient Studies, 1976-77
Environmental Science and Engineering, Inc., Hydrologic Impact of Marsh Development, 1977
Deltona Corporation, Assessment of Projected Lake Water Quality, 1978-82
Woodward-Clyde Inc., EPA Nationwide Urban Runoff Program Advisory Group, 1978-83
Black and Veatch, Detroit EPA 201 Advisory Committee, 1978-80
Clinton-Bogart Associates, Elizabeth, NJ and Boston EPA 201 Studies, 1978-79
Resources for the Future, Inc., Comparative Evaluation of Terrestrial Runoff Models, 1977-79
Najarian, Thatcher and Associates, Passaic River, NJ, EPA 201 Study, 1980-82

Robert Pitt, Ph.D., P.E., DEE, DWRE Consulting Environmental Engineer
2137 Farley Rd., Birmingham, AL 35226 (205) 979-1073
rpittal@charter.net

December 11, 2007

Eric Strecker
Geosyntec Consultants
55 SW Yamhill, Suite 200
Portland, OR 97204
estrecker@geosyntec.com

cc: Cassandra Owens, LARWQCB, Cowens@waterboards.ca.gov

Subject: Statement of Qualifications

Dear Eric:

Attached is my resume describing my qualifications and experience to participate on your project review team for the Boeing Santa Susana Field Laboratory. I am well qualified to assist in the selection and design of engineered natural treatment systems for stormwater. In addition, I have extensive experience and knowledge concerning stormwater hydrology and stormwater and other characteristics affecting its' treatability and effects.

I have conducted research and developed stormwater controls for more than 35 years for a broad range of applications. For the past 20 years, I have been associated with universities where I have taught environmental engineering and water resources classes. I am currently the Cudworth Professor of Urban Water Systems in the Department of Civil, Construction, and Environmental Engineering at the University of Alabama. Prior to my academic career, I was a senior engineer in industry and government for 16 years. I have conducted more than \$6 million in research concerning the effects, sources, and control of urban runoff during my 20 years in academic positions. I have written more than 100 publications, including journal articles, book chapters, research reports, and several books (including co-authoring of *Construction Site Erosion and Sediment Controls: Planning, Design, and Performance*, 2007; *Contemporary Modeling of Urban Water Systems*, 2007; *Water Systems Modelers User's Guide to SWMM, 10th edition*, 2005; *Stormwater Effects Handbook: A Tool Box for Watershed Managers, Scientists, and Engineers*, 2002; and *Groundwater Contamination from Stormwater*, 1996). I have developed specialized course materials that have been used at many institutions, including international Internet-based instruction in urban water systems. I received a Distinguished Service Citation from the University of Wisconsin, was a member of the project team that received a first place national award for a combined sewer project from the Water Environment Federation, and have received several outstanding teaching and volunteer service awards. I am a registered Engineer (WI), a Diplomate of the American Academy of Environmental Engineers, and a Diplomate of the American Academy of Water Resources Engineers. I have served on numerous professional

committees in the U.S. and abroad, including current memberships on the *Homeland Security Committee* of the EPA's Science Advisory Board; the *Committee on Reducing Stormwater Discharge Contributions to Water Pollution* of the National Academy of Science; and am directing several project review panels for the Water Environment Research Foundation, and others.

I have spent many years studying and developing modeling procedures addressing urban hydrology issues, especially concerning stormwater quality control. Since the late 1970s, I have been developing and expanding the Source Loading and Management Model (WinSLAMM) and the Water Quality Detention Pond Model (WinDETPOND). These models incorporate much of our research findings and are designed to assist regulators and designers in meeting numeric water quality standards. I have developed a number of stormwater quality control devices, including the Multi-chambered Treatment Train (MCTT) and the UpFlow filter, as part of EPA and SBIR-funded research. The development of these devices was based on rigorous research on stormwater treatability and the application of complementary treatment unit processes. I have also conducted much research on the role of soils and other treatment media on stormwater quality enhancement, and protection of groundwater resources associated with stormwater infiltration. Natural treatment systems that we have extensively researched include grass swales and ponds. Many of my research reports are available on my research web site, at: <http://unix.eng.ua.edu/~rpitt/Publications/Publications.shtml>. In addition, my web site also contains most of my lecture materials concerning wet weather flows, at: <http://unix.eng.ua.edu/~rpitt/Class/Classes.shtml>. Much of my current work involves integrating urban water systems to incorporate water supply, wastewater, and wet weather flows with landscaping, water reuse, and building material choices.

The attached resume lists much of my accomplishments from the past 20 years, and my teaching and research web site contains many examples of my work.

If you would like any additional information, please do not hesitate to contact me at rpittal@charter.net.

Regards,
Bob Pitt

December 2007

Robert E. Pitt
Cudworth Professor of Urban Water Systems
Director of the Environmental Institute
Director of Environmental Engineering Programs

School of Engineering
Department of Civil and Environmental Engineering
University of Alabama, Box 870205
Tuscaloosa, Alabama 35487-0205

(205) 348-2684 (office and messages)
(205) 348-0783 (fax)

email address: rpitt@eng.ua.edu

Teaching and research web page: <http://unix.eng.ua.edu/~rpitt/>

Rank and Department

Cudworth Professor of Urban Water Systems, Department of Civil and Environmental Engineering, University of Alabama

Director of Environmental Institute, University of Alabama

Director of Environmental Engineering programs, University of Alabama

Education

Ph.D., Civil and Environmental Engineering, with major work in the areas of water resources, environmental chemistry and statistics, University of Wisconsin-Madison, WI, 1987

M.S.C.E., Environmental Engineering/Hydraulic Engineering, San Jose State University, CA, 1971

B.S. Engineering Science, Humboldt State University, Arcata, CA, 1970

Engineering Registrations

Professional Engineer, State of Wisconsin (No. 24044, 1984)

Diplomate, American Academy of Environmental Engineers (No. 93-20037, 1993)

Diplomate, American Academy of Water Resources Engineers (No. 00129, 2005)

Teaching, Research and Industrial Experience

Director, Environmental Institute, University of Alabama, Tuscaloosa, AL, 2004 – present.

Cudworth Professor of Urban Water Systems, Department of Civil and Environmental Engineering, University of Alabama, Tuscaloosa, AL, 2002 – present.

Professor, Department of Civil and Environmental Engineering, University of Alabama, Tuscaloosa, AL, 2001 – present.

Professor, Department of Civil and Environmental Engineering, with a secondary appointment in the Department of Environmental Health Sciences, University of Alabama at Birmingham, 1997- 2001.

Founding Director, Environmental Health Engineering Ph.D. program, University of Alabama at Birmingham, 1997– 2001.

Associate Professor, Department of Civil and Environmental Engineering, with a secondary appointment in the Department of Environmental Health Sciences, University of Alabama at Birmingham, 1993-1997.

Assistant Professor, Department of Civil and Environmental Engineering, with a secondary appointment in the Department of Environmental Health Sciences, University of Alabama at Birmingham, 1987-1993.

Environmental Engineer, Wisconsin Department of Natural Resources, Madison, WI, 1984-1987.
Consulting Environmental Engineer, Blue Mounds, WI, and Birmingham, AL, 1979-present.
Senior Engineer, Woodward-Clyde Consultants, San Francisco, CA, 1974-1979.
Environmental Engineer, URS Research Company, San Mateo, CA, 1971-1974.

Memberships in Professional Societies

American Society of Civil Engineers (ASCE), Member
Member, Urban Water Resources Research Council
Water Environment Federation (WEF), Member
Issue Area Team Member for WERF research
American Water Resources Association (AWRA), Member
Alabama Academy of Science, Member
Chair, Engineering and Computer Science Committee
Member, Carmichael Award Committee
Sigma Xi, Member

Journal Reviewer

Journal of Water Resources Planning and Management (ASCE)
Journal of Environmental Engineering (ASCE)
Water Environment Research (WEF)
Water Research (IAWQ)
Water Resources Bulletin (AWRA)
Water Science and Technology (IAWQ)
Watershed Protection Techniques (Center for Watershed Protection)

Past Reviews for State and National Agencies

National Academy Press (National Research Council)
Department of Ecology (Washington)
Wisconsin Water Resources Institute (University of Wisconsin)
Alabama Department of Environmental Management (Montgomery)
Computational Hydraulics Institute (Guelph, Ontario)
California Sea Grant Institutional Program (Univ. of Southern California)
Urban Waste Management and Research Center (Univ. of New Orleans)
Water Resources Division (Wisconsin Department of Natural Resources)
Baldwin County Public Works Department (Alabama)
Vermont Water Resources and Lake Studies Center (Univ. of Vermont)
Center of Environmental Research Information (U.S. Environmental Protection Agency)
Division of Water Quality (Minnesota Pollution Control Agency)
Watershed Evaluation Branch (U.S. Environmental Protection Agency)

Memberships on Professional Committees and Boards

U.S. Environmental Protection Agency, Science Advisory Board, *Homeland Security Advisory Committee*. 2005 – present.
Sustainable Sites Initiative of the American Society of Landscape Architects and the Lady Bird Johnson Wildflower Center, hydrology subcommittee to develop standards to guide and rate the environmental performance of landscapes. 2007.
Florida Stormwater Association, *Research Advisory Council*. 2007 – present.
University of New Hampshire, *Stormwater Center Technical Advisory Board*, 2007 – 2009.
National Research Council, National Academy of Science, *Committee on Reducing Stormwater Discharge Contributions to Water Pollution*. 2006 – present.

Auckland Regional Council, New Zealand, *Stormwater Projects Review Committee*. 2004 – present.

California Water Resources Board, *Setting Numeric Limits for Stormwater Discharges*. 2005 – 2006.

Framework Program for Global Health, University of Alabama at Birmingham and NIH, 2005 – 2006.

U.S. Environmental Protection Agency, National Risk Management Research Lab (NRMRL), *External Reviewer*, 2004.

State of Washington, Office of Salmon Recovery, *Independent Science Panel*, 2003 – 2004.

US EPA, *Experts Panel for the 2003 Report to Congress on Combined Sewer Overflows and Sanitary Sewer Overflows, Public Health Effects*. 2002 – 2003.

Water Environment Research Foundation, *Stormwater Advisory Board, Chairman*. 2001 – 2006.

American Society of Civil Engineers, *Urban Water Resources Research Council, Executive Committee Member*, 2001 – 2005.

Alabama Water Resources Research Institute, *Alabama Water Resources Council*. 2000 – 2001.

National Council of Examiners for Engineering and Surveying (NCEES). Clemson, S.C. *Fundamentals of Engineering (FE) Examination Development Committee for Environmental Engineering Exam.* 1999 – 2001.

U.S. Environmental Protection Agency, Washington, D.C. and the American Society of Civil Engineers, Reston, VA. Peer review committee on *Development of Performance Measures, National Stormwater Best Management Practices (BMP) Database*. 1998 – 2003.

U.S. Environmental Protection Agency, Washington, D.C. *Urban Wet Weather Federal Advisory Subcommittee on Revision of Water Quality Standards*. 1997.

Construction Industry Research and Information Association (CIRIA), London, steering committee member, *Management of Gully Pots for Improved Runoff Quality*. 1997.

New York City, Department of Environmental Protection, member of *Technical Advisory Committee on Combined Sewer Overflow Program*. 1997 – 2000.

Center for Watershed Protection - Editorial Board Member. 1995 – 2003.

Watershed Management Institute, Inc., Member of Board of Directors. 1995 – 2001.

International Association on Water Quality (IAWQ), London, member of Scientific and Technical Report group preparing: *Solids in Sewers: Characteristics, Effects, and Controls of Sewer Solids and Associated Pollutants*. 1995 – 2003.

Univ. of New Orleans, *Urban Waste Management & Research Center*, affiliate member. 1994 – 2000.

Center for Watershed Protection, member of *Work Group on Stormwater Indicators*. 1995.

The Rensselaerville Institute, NY, committee on evaluating *Phase II U.S. EPA Stormwater Discharge Permit Requirements*. 1995.

Cleveland *CSO Value Engineering Task Force*, 1993.

U.S. EPA “SWAT” Team member for assisting states in determining Total Maximum Daily Loads (TMDL), 1992 – 1995.

U.S. EPA Task Force on Phase II of the Stormwater Permit Program, 1992 – 1994.

U.S. DOE EPSCoR Alabama State Director for Energy and the Environment, 1992 – 1994.

Resource Conservation and Development Council, Jefferson County, Soil and Water Conservation District, 1992 – 1994.

Committee on Class V Underground Injection Control-Stormwater NPDES, U.S. EPA Groundwater Protection Division, 1992.

Committee on Augmenting Natural Recharge of Groundwater with Reclaimed Wastewater, Stormwater, and Irrigation Return Flows. National Research Council, National Academy of Science, 1991 – 1994.

Alabama Erosion and Sediment Control Manual Development Committee, U.S. Department of Agriculture, Soil Conservation Service, 1991-1994.

Chairman, Cahaba River Work Group, Alabama Environmental Management Commission, 1990 – 1994.

U.S. EPA Planning Committee on Pollution Prevention Research, Risk Reduction Engineering Laboratory, 1990.

Conference Program Committees

Ecology of Cities. Russian Academy of Sciences and the General Physics Institute of the RAS, Ministry of Ecology of Greece, and the Ministry of Culture of Greece. Rhodes, Greece, June 1998.

Effects of Watershed Development and Management on Aquatic Ecosystems. Engineering Foundation and ASCE. Snowbird, Utah. August 1996.

Honors, Awards and Listings

Technology Merit Award for Business Achievement, *Environmental Business Journal*. (member of Hydro International, Ltd., team). 2005.

Haywards Fellow, Manaaki Whenua - Landcare Research, New Zealand, 2005.

Editors Award, *Journal of Environmental Engineering*, for “outstanding service to ASCE and to the profession.” 2004.

Distinguished Service Citation, School of Engineering, University of Wisconsin, 2002.

Listed in:

Marquis' Who's Who in the World (12th edition 1995, to current).

Marquis' Who's Who in America (51st edition 1997, to current).

Marquis' Who's Who in American Education (5th edition 1996 – 1997, to current).

Marquis' Who's Who in the South and Southwest (24th edition 1995 – 1996, to current).

Marquis' Who's Who in Science and Engineering (2nd edition 1994 – 1995, to current).

Marquis' Who's Who in Finance and Industry (30th edition, 1998 – 1999, to current).

Guest Lecture at University of Tel Aviv, Israel, 2001.

Outstanding Student Chapter for 1997, American Water Resources Association, faculty advisor.

Board of Visitors Faculty Award for Distinguished Achievement, 1995.

Guest Lectureship, Universität Gesamthochschule Essen, Germany, 1994.

Ellen Gregg Ingals/UAB National Alumni Award for quality of teaching, finalist for 1994.

Excellence in Teaching Award, UAB School of Engineering, 1994.

Water Environment Federation, first place national award for combined sewer project (member of New York City project team), 1992.

North American Lake Management Society, professional presentation award, 1992.

Take Pride in America, first place Alabama environmental volunteer award, 1991.

Award of Recognition, U.S. Department of Agriculture, 1990.

U.S. Soil Conservation Service Earth Team, first place national award, 1989.

General Electric Engineering Education Fellowship, 1984 – 1986.

Federal Water Pollution Control Administration Fellowship, 1970 – 1971.

Representative Experience

Dr. Pitt has been the project manager and principal investigator for many urban water resources research projects. He has worked on lake management projects, environmental research projects, hazardous material management plans, facility location studies, and environmental assessments. His major area of interest is in stormwater management, especially the integration of drainage and water quality objectives.

Dr. Pitt has conducted research for the U.S. EPA, Environment Canada, Ontario Ministry of the Environment, states, and local governments concerning the effects, sources, and control of urban runoff for more than 35 years. He was also been involved in a number of projects that have used this research information to develop management plans, stormwater ordinances, and design manuals. As an example, he was a member of the technical advisory group for the EPA's Nationwide Urban Runoff Program (NURP). He also prepared the Source Loading and Management Model (SLAMM) and developed the watershed analysis procedures to investigate urban runoff for the priority watershed program of the Wisconsin Department of Natural Resources. These procedures are still being used as the basis for state cost-sharing for major runoff control retro-fitting programs. He has also prepared manuals of practice which contain design procedures and construction specifications for stormwater and erosion control practices and has supervised their construction.

Dr. Pitt has also conducted research for the EPA to develop and test procedures to recognize and reduce inappropriate discharges of wastewaters to separate storm drainages. These procedures are being used by municipalities involved in the Clean Water Act's stormwater permit program as a field screening technique to identify and quantify discharge sources. He has also directed a series of EPA research projects to investigate the sources and control of stormwater toxicants. As an example, he has found that combinations of sedimentation, aeration, and photo-degradation can significantly reduce stormwater toxicity. Automobile service facilities have

been identified as a significant toxic pollutant source and a specialized treatment system to be located at these sources has been designed and tested at several locations. He developed the Multi-Chambered Treatment Train (MCTT) for high level controls of stormwater toxicants at critical source areas, and also helped develop an upflow filter for high rate treatment in urban areas.

His research also examined stormwater effects on groundwater, and a book on this research was published by Ann Arbor Press. He has also evaluated the effects of separate sewage overflows on human health, especially considering toxic metal and organic pollutants and pathogens. Another EPA project directed by Dr. Pitt examined past drainage design procedures and recommends future approaches for drainage design. He has co-authored several books and numerous chapters based on this and related material, especially integrating stormwater modeling tools for water quality and drainage design objectives.

Current EPA – funded research includes developing a nationwide database of national stormwater permit information and conducting comprehensive evaluations of this data. He is also updating field screening procedures used for identifying inappropriate discharges to storm drainage systems. Recent research included investigating innovative heavy metal removal techniques for stormwater. He is currently investigating the sources and significance of stormwater bacteria and the transport and effects of stormwater gross solids. Other current projects are examining the presence and treatability of emerging contaminants in wet weather flows, the scour of sediment from stormwater control devices, and the development of rapid analysis methods for the detection of organic contaminants in sediments and water using laser spectrographic techniques.

He has also carried out a number of receiving water impact studies associated with stormwater. These studies have included a variety of field monitoring activities, including water and sediment quality, fish and benthos taxonomic composition, and laboratory toxicity tests. He is the co-author of a book (published by CRC/Lewis) detailing field, laboratory, and data analyses methods for use in examining stormwater effects on receiving waters.

Dr. Pitt was the project manager and principal investigator of a project with the telecommunications industry (sponsored by Bellcore, AT&T, plus many “baby Bells” from throughout the U.S.) to evaluate and develop methods that may be needed to treat stormwater that collects in telecommunication manholes. This water needs to be pumped before repair operations can be conducted and stormwater NPDES permits are typically required before its discharge to local drainage systems. He has worked with the industry and the EPA and conducted a comprehensive characterization and field evaluation program and developed protocols to examine potential treatment methods.

Dr. Pitt has helped prepare training manuals on the operation of sanitary wastewater treatment plants and on the clean-up of oil spills. He has evaluated the effects of municipal, industrial, and nonpoint water pollution discharges on receiving water quality and beneficial uses, including model development. He has also been involved in the preparation of contingency plans for spills of petroleum products and other hazardous materials, especially in the assessment of potential water and air quality problems. He has completed the noise, air and water quality assessments for a variety of projects; including nuclear and fossil fuel power facilities, oil refineries, oil fields, coal mines, uranium mines, gravel removal operations, airports, urban redevelopment projects, pipelines, and hazardous material transfer and storage facilities. Many of these studies involved field and laboratory work, as well as statistical analyses and modeling. These projects have been located throughout the United States (including Alaska and Hawaii), and in the Middle East. An experienced photographer, Dr. Pitt has used both aerial and underwater photography in conjunction with many projects. He has developed and managed water and air quality laboratories capable of monitoring a wide range of inorganic and organic pollutants.

Dr. Pitt moved to the University of Alabama campus in Tuscaloosa in 2001. Earlier, he had served on the School of Engineering faculty at the University of Alabama at Birmingham from 1987 to 2001. Prior to that, he was a senior engineer for 16 years in industry and government, and continues to consult to many municipalities and engineering firms. He has also taught workshops and has been a guest lecturer at several universities (including the Univ. of Wisconsin; the Univ. of Minnesota; Syracuse University, the University of Nevada, Tel Aviv University, Israel; the University of Guelph, Ontario, Canada; Singapore National University; and the Universität Gesamthochschule, Essen, Germany). He has published more than 100 chapters, books, journal articles, and major research reports. Dr. Pitt is a Diplomate of the American Academy of Environmental Engineers and a Diplomate of the American Academy of Water Resources Engineers (eminence), and is a registered engineer in the state of Wisconsin.

Research Funding Obtained as Principal Investigator

- Expansion of the Center for Optical Sensors and Spectroscopies* (NSF and the University of Alabama at Birmingham): \$625,000 (2008 – 2012); my portion of \$6.5 million award.
- Identification and Treatment of Emerging Contaminants in Wet Weather Flows* (US Environmental Protection Agency): \$349,958 (2007 - 2010).
- Verifying the Performance of the Full-Scale Upflow Filter at the Tuscaloosa City Hall* (Hydro-International): \$40,000 (2007).
- Developing Local Stormwater Indicator Monitoring Programs to Demonstrate Environmental Results*, with the Center for Watershed Protection (EPA Office of Wastewater Management 104(b)3 grant): \$175,040 (2006 – 2007).
- Development of the Center for Optical Sensors and Spectroscopies* (NSF and the University of Alabama at Birmingham): \$450,000 (2005 – 2008); my portion of \$5.3 million award.
- Measuring the Performance of the Upflow Filter Installed at the Tuscaloosa City Hall* (Hydro-International): \$17,765 (2005 – 2006).
- Alabama Highway Drainage Conservation Design Practices* (University Transportation Center for Alabama): \$120,819 (2004).
- Evaluation of Inlet Treatment Device, an EPA SBIR Phase 2 Demonstration Project*, with US Infrastructure, Edison, NJ. (US Environmental Protection Agency): \$16,968 (2004-2005).
- Evaluation of NPDES MS4 Stormwater Monitoring Data*, with the Center for Watershed Protection (EPA Office of Wastewater Management 104(b)3 grant): \$419,114 (2001-2004).
- Techniques for Identifying/Correcting Inappropriate Discharges*, with the Center for Watershed Protection (EPA Office of Wastewater Management 104(b)3 grant): \$477,231 (2001-2004).
- Erosion and Sediment Control for Highway Construction* (University Transportation Center for Alabama): \$119,239 (2001-2002).
- Environmental Health, Public Safety, and Social Impacts Associated with Transportation Accidents Involving Hazardous Substances*, with the Dept. of Government and Public Service, UAB (University Transportation Center for Alabama): \$121,580 (2000-2001).
- Evaluation of New Techniques for the Identification of Inappropriate Discharges into Storm Drainage Systems* (University of New Orleans, Urban Waste Management Institute and EPA): \$60,000 (1999).
- Guidance Manual for Integrated Wet Weather Flow Collection and Treatment Systems for Newly Urbanized Areas*, with the University of Alabama (U.S. Environmental Protection Agency, Cooperative Agreement): \$150,000 project (1996-1998).
- Characterization of Manhole Water and Sediment* (NYNEX, BellSouth, Bell Atlantic, GTE, SNET, Pacific Bell, US West, Ameritech and AT&T): \$400,000 (1996-1998).
- Development and Testing of a Methodology to Assess the Health Risks and Environmental Impacts from Separate Sanitary Sewer Overflows*, co-principal investigator, with UAB EARTH Center (U.S. Environmental Protection Agency): \$199,996 (cooperative agreement) (1996-1997).
- The Development of a Tunable Laser Spectrophotometric Method for the Analysis of Toxic Water Pollutants*, with UAB Dept. of Physics (National Science Foundation): \$580,587 (1995-1998).
- Effects, Sources and Treatment of Stormwater Toxicants* (U.S. Environmental Protection Agency): \$942,318 cooperative agreement (1992-1997).
- Evaluation and Treatment of Manhole Water* (Bellcore, Inc.): \$615,048 (1994-1997).
- Drainage of Water from Pavement Structures* (U.S. Transportation Research Board and Alabama Department of Transportation): \$111,520 (1993-1994).
- Demonstration of Investigation Procedures for the Control of Inappropriate Discharges into Storm Drainage Systems* (University of New Orleans, Urban Waste Management Institute): \$25,000 (1992).
- Modifications to the Source Loading and Management Model* (U.S. Environmental Protection Agency, Region V): \$21,050 (1992).
- Review of Existing Water Quality Data* (Torchmark Development Corp.): \$9,500 (1991).
- Identification and Control of Inappropriate Discharges into Storm Drainage* (U.S. Environmental Protection Agency, Office of Research and Development and Office of Water): \$101,048 cooperative agreement (1989-1992).
- Sources and Treatment of Stormwater Toxicants* (U.S. Environmental Protection Agency, Office of Research and Development): \$155,767 cooperative agreement (1989-1992).

Development of Model Watershed Protection Ordinance and Development Plan Reviews (Birmingham Water Works Board): \$53,785 (1988-1989).

Example Consultations

- ADS Environmental Services, Huntsville, AL. Verification of flow monitoring equipment performance. 1994-1995.
- Brown and Caldwell, Irvine, CA. Design of MCTT installations for testing by Caltrans. Los Angeles. 1998 – 1999.
- Brown and Mitchell, Inc., Gulfport, MS. Evaluation of detention pond design for shopping center development. 1995-1996.
- Caltrans, California transportation agency. Review of stormwater monitoring program. 2007 – 2008.
- C.M. Towers, West Caldwell, NJ. Design consultation for flow-balancing method installations for stormwater and CSO controls. 1993.
- Camp Dresser & McKee, Inc., Detroit, MI. Design work for multi-chambered treatment tank (MCTT) stormwater controls for public works yard in Detroit. 1995.
- CEDARS (Center for Economic Development and Resource Stewardship) and Tennessee Valley Authority, Nashville, TN. Conservation design for stormwater management at selected industrial and commercial development sites, 2005 – 2007.
- CH2M-Hill, Portland, OR. Training for use of SLAMM. 1992.
- City of New York, Division of Engineering, NY. Evaluation of Fresh Creek (Brooklyn) FBM installation for CSO controls, 1992-1994, and evaluation of litter and floatable debris control for New York City. 1997 – 2001.
- Earth Tech, Inc., Madison, WI. Stormwater treatment at foundry site. 2005 – 2006.
- Environment Canada, Ottawa, Ontario, Canada. Evaluation of bacteria sources and control in Ottawa. 1985-1987.
- Envirometrics Engineering, Inc., Birmingham, AL. Evaluation of stormwater filtration for the U.S. Army Corps of Engineers. 1995-1996.
- Foster Wheeler/Enviresponse, Inc. Edison, NJ. Treatment of stormwater toxicants. 1991-1993.
- Fresh Creek Technologies, Inc., West Caldwell, NJ. Evaluation of New York City EquaFlow CSO control system. 1993.
- GeoSyntec Consultants, Boston, MA. Enhanced phosphorus control in East of the Hudson watershed. 2005 – 2007.
- Havens and Emerson, Boston, MA. Value engineering evaluation of Cleveland CSO plan. 1993.
- HydroInternational, Ltd. Commercialization of the UpFlo™ filter. 2005 – 2006.
- Johnson, Johnson & Roy, Inc., Madison, WI. Review of commercial development stormwater control plan. 1994.
- K.B. Weygand and Assoc., Birmingham, AL. Preparation of erosion control plan for commercial development. 1995.
- Kurahashi & Assoc., Tigard, OR. Development of stormwater models and particle characterizations. 1994.
- Law Engineering, Birmingham, AL. Training for stormwater regulation compliance for industrial activities. 1992.
- Liesch Companies, Minneapolis, MN. Evaluation of the retention pond design for the Minneapolis-St. Paul International Airport. 1999.
- Loomis & Assoc., Austin, TX. Preliminary design for EquaFlow stormwater control program for Waller Creek watershed in Austin. 1995.
- Los Angeles County Department of Public Works, CA. Review of stormwater monitoring activities. 1996 - 1998.
- MARC (Metropolitan Area Regional Council), Kansas City, MO. Planning, training, and evaluation associated with 10,000 rain garden demonstration project for US EPA. 2007 – 2011.
- McGriffert and Assoc., LLC. Tuscaloosa, AL. Design of an industrial stormwater treatment system, 2007.
- Metcalf and Eddy, Inc., Wakefield, MA. Review of CSO guidance manual prepared for EPA. 1992.
- Moffa & Associates, Syracuse, NY. Decision criteria for CSO evaluations, and retrofitting water quality controls for wet weather flow conditions. 1997-1998.
- National Surveying and Engineering. R.A. Smith, Brookfield, WI. Training in the use of the Source Loading and Management Model. 1999.
- Natural Resources Defense Council, Los Angeles, CA. Evaluation of Los Angeles County stormwater plan. 1994-1998.
- Ontario Ministry of the Environment, Toronto and Ottawa, Ontario, Canada. Stormwater evaluations for industrial activities, and other critical source areas in the Humber River watershed, Toronto. 1985-1988.
- OTAK Engineering, Inc., Lake Oswego, OR. Development of joint training program for using stormwater models. 1991.
- P.E. LaMoreaux and Assoc., Tuscaloosa, AL. Evaluation of stormwater drainage design, Shelby Co. 1995-1996.

Santa Clara County Flood Control District, CA. Review of special metals control plan for South San Francisco Bay. 1996.

Southern Environmental Law Center, Charlottesville, VA. Evaluation of industrial effluent effects on the Cahaba River. 1992.

SWMA (Stormwater Management Authority), Jefferson County, AL. Modifications to WinSLAMM incorporating stormwater management costs and interfacing to receiving water models. 2005 – 2006.

Rensselaerville Institute, Rensselaerville, NY. Review of phase II EPA stormwater plan. 1994.

Robert Bein, William Frost & Associates, Irving, CA. Design review of multi-chambered treatment train (MCTT) stormwater installations for Caltrans. 1998 - 1999.

Urban Waste Management Center, Univ. of New Orleans, LA. Training of field personnel for screening testing of stormwater outfall. 1995-1996.

U.S. Environmental Protection Agency. Effects of compost amended soils on infiltration rates. 1997-1998.

U.S. Geological Survey, Madison, WI. Calibration of SLAMM for Wisconsin conditions. 1994-1995.

U.S. Infrastructure, Birmingham, AL. Wet weather flow consulting. 1998-2002.

Washington State Department of Ecology, Olympia, WA. Statistical guidance for the evaluation of stormwater control test protocols. 2002.

Wisconsin Dept. of Natural Resources, Madison, WI. Design of the multi-chambered treatment tank (MCTT) for Milwaukee public works area. 1995.

Woodward Clyde Consultants, Oakland, CA. Evaluation of field screening analysis methods for stormwater outfalls. 1991-1993.

Dissertation

Pitt, R. *Small Storm Urban Flow and Particulate Washoff Contributions to Outfall Discharges*, Ph.D. Dissertation, Civil and Environmental Engineering Department, University of Wisconsin, Madison, WI, November 1987.

Major Computer Programs

WinDETPOND. A Water Quality Detention Pond Analysis and Design Program. 1986-present (with J. Voorhees).

WinSLAMM. Source Loading and Management Model for Stormwater Quality Control. 1978-present (with J. Voorhees).

Books

James, W., K.N. Irvine, E.A. McBean, R.E. Pitt, and S.J. Wright (editors). *Contemporary Modeling of Urban Water Systems*. Monograph 15. ISBN-13: 978-0-9736716-3-6, ISBN-10: 0-9736716-3-7. Computational Hydraulics International. Guelph, Ontario. 2007. 578 pages.

Pitt, R., S. Clark, and D. Lake. *Construction Site Erosion and Sediment Controls: Planning, Design, and Performance*. ISBN 1-932078-38-X. DEStech Publications. Lancaster, PA. 2007. 370 pages.

James, W., K.N. Irvine, E.A. McBean, and R.E. Pitt (editors). *Intelligent Modeling of Urban Water Systems*. Monograph 14. ISBN 0-9736716-2-9. Computational Hydraulics International. Guelph, Ontario. 2006. 602 pages.

James, W., W.C. Huber, R.E. Dickinson, R.E. Pitt, R.C. James, L.A. Roesner, and J.A. Aldrich. *Water Systems Models: User's Guide to SWMM, 10th edition*. ISBN: 0-9736716-1-0. Computational Hydraulics International. Guelph, Ontario. Oct 2005. 802 pages.

James, W., K.N. Irvine, E.A. McBean, and R.E. Pitt (editors). *Effective Modeling of Urban Water Systems*. Monographs 13. ISBN 0-9736716-0-2. Computational Hydraulics International. Guelph, Ontario. 2005. 568 pages.

James, W., W.C. Huber, R.E. Dickinson, R.E. Pitt, R.C. James, L.A. Roesner, and J.A. Aldrich. *Water Systems Models User's Guide to SWMM, 9th edition*. Computational Hydraulics International. Guelph, Ontario. May 2003. 406 pages.

Durrans, S. R. with contributions from M. Ahmad, T.E. Barnard, P. Hjorth, and R. Pitt. *Stormwater Conveyance Modeling and Design*. ISBN 0-9657580-8-7. Haestad Methods. Waterbury, CT. 2003. 686 pages.

- James, W., W.C. Huber, R.E. Pitt, R.E. Dickinson, and R.C. James. *Water Systems Models [1]: Hydrology, User's guide to SWMM4 RUNOFF and supporting modules and to PCSWMM*. ISBN 0-9683681-0-7. Version 2.4. Computational Hydraulics International. Guelph, Ontario, Canada. October 2002. 311 pages.
- James, W., W.C. Huber, R.E. Pitt, R.E. Dickinson, L.A. Roesner, J.A. Aldrich, and R.C. James. *Water Systems Models [2]: Hydraulics, User's guide to SWMM4 TRANSPORT, EXTRAN and STORAGE modules and to PCSWMM*. ISBN 0-9683681-1-5. Version 2.4. Computational Hydraulics International. Guelph, Ontario, Canada. October 2002. 359 pages.
- Burton, G.A. Jr., and R. Pitt. *Stormwater Effects Handbook: A Tool Box for Watershed Managers, Scientists, and Engineers*. ISBN 0-87371-924-7. CRC Press, Inc., Boca Raton, FL. 2002. 911 pages.
- Heaney, J.P., R. Pitt, and R. Field. *Innovative Urban Wet-Weather Flow Management Systems*. ISBN 1-56676-914-0. Technomics, Lancaster, PA. June 2000. 535 pages.
- Pitt, R., with contributions from S. Clark, R. Field, and K. Parmer. *Groundwater Contamination from Stormwater*. ISBN 1-57504-015-8. Ann Arbor Press, Inc. Chelsea, Michigan. 1996. 219 pages.
- NRC (National Research Council), Groundwater Recharge Committee, National Academy of Science. *Ground Water Recharge using Waters of Impaired Quality*. ISBN 0-309-05142-8. National Academy Press, Washington, D.C. 1994. 284 pages.
- Pitt, R., M. Lalor, R. Field, D. Adrian, and D. Barbe'. *Investigation of Inappropriate Pollutant Entries into Storm Drainage Systems*, ISBN 0-7881-1359-3. Diane Press. Upland, Pennsylvania, 1994. 87 pages.
- Pitt, R., S. Clark, and K. Parmer. *Potential Groundwater Contamination from Intentional and Non-Intentional Stormwater Infiltration*. ISBN 0-7881-1059-4. Diane Press. Upland, Pennsylvania. 1994. 120 pages.

Chapters in Books (peer-reviewed)

- Pitt, R. J. Voorhees, and S. Clark. "Evapotranspiration and related calculations for stormwater biofiltration devices: Proposed calculation scenario and data." In: *Stormwater and Urban Water Systems Modeling*, Monograph 16. (edited by W. James, E.A. McBean, R.E. Pitt and S.J. Wright). CHI. Guelph, Ontario, to be published in 2008.
- Bochis, C., R. Pitt, and P. Johnson. "Land development characteristics in the Southeastern United States." In: *Stormwater and Urban Water Systems Modeling*, Monograph 16. (edited by W. James, E.A. McBean, R.E. Pitt and S.J. Wright). CHI. Guelph, Ontario, to be published in 2008.
- Avila, H., R. Pitt, and S.R. Durrans. "Factors affecting scour of previously captured sediment from stormwater catchbasin sumps." In: *Stormwater and Urban Water Systems Modeling*, Monograph 16. (edited by W. James, E.A. McBean, R.E. Pitt and S.J. Wright). CHI. Guelph, Ontario, to be published in 2008.
- Maestre, A. and R. Pitt. "Stormwater databases: NURP, USGS, International BMP Database, and NSQD." Chapter 20 in: *Contemporary Modeling of Urban Water Systems*, ISBN 0-9736716-3-7, Monograph 15. (edited by W. James, E.A. McBean, R.E. Pitt, and S.J. Wright). CHI. Guelph, Ontario. pp 385 – 409. 2007.
- Pitt, R. and J. Voorhees. "Using decision analyses to select an urban runoff control program" Chapter 4 in: *Contemporary Modeling of Urban Water Systems*, ISBN 0-9736716-3-7, Monograph 15. (edited by W. James, E.A. McBean, R.E. Pitt, and S.J. Wright). CHI. Guelph, Ontario. pp 71 – 107. 2007.
- Khambhammettu, U. , R. Pitt, R. Andoh, and S. Clark "UpFlow filtration for the treatment of stormwater at critical source areas." Chapter 9 in: *Contemporary Modeling of Urban Water Systems*, ISBN 0-9736716-3-7, Monograph 15. (edited by W. James, E.A. McBean, R.E. Pitt, and S.J. Wright). CHI. Guelph, Ontario. pp 185 – 204. 2007.
- Pitt, R. "Coarse solids management." Chapter summary. *Best Management Practices (BMP) Technology Symposium: Current and Future Directions*, American Society of Civil Engineers. pp. 93 – 94. May 2006.
- Pitt, R. and S. Clark. "Interactions between catchbasin and street cleaning in urban drainages and sediment transport in storm drainage systems." Chapter 6, *Best Management Practices (BMP) Technology Symposium: Current and Future Directions*, American Society of Civil Engineers. pp. 94 – 125. May 2006.
- Clark, S.E., R. Pitt, P.D. Johnson, S. Gill, and M. Pratap. "Media filtration to remove solids and associated pollutants from stormwater runoff." Chapter 7, *Best Management Practices (BMP) Technology Symposium: Current and Future Directions*, American Society of Civil Engineers. pp. 141 – 163. May 2006.
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- Avila, H. and R. Pitt. “Evaluation of parameters involved in sediment scour potential in stormwater catchbasin sumps Abstract.” Presented at *Alabama’s Water Environment Association 2007 Technical Conference*. Orange Beach, AL, April 15 – 18, 2007 (poster)

- Bathi, J. and R. Pitt. "Fate of emerging contaminants in stormwater: A case study of polycyclic aromatic hydrocarbons (PAHs)." Presented at *Alabama's Water Environment Association 2007 Technical Conference*. Orange Beach, AL, April 15 – 18, 2007 (poster)
- Hyche, S.H., R. Pitt, and A. Maestre. "National Stormwater Quality Database, version 3." Presented at *Alabama's Water Environment Association 2007 Technical Conference*. Orange Beach, AL, April 15 – 18, 2007 (poster)
- Narayanan, A, C. Bochis, and R. Pitt. "Modeled flow duration variations and costs for pollutant removal associated with different stormwater control practices." Presented at *Georgia Water Resources Conference 2007*. Athens, GA, March 27 – 29, 2007.
- Pitt, R., Y. Nara, J. Kirby, and S.R. Durrans. "Particle retention in grass swale systems." Presented at the *2nd National Low Impact Development Conference*. Wilmington, North Carolina. March 12-14, 2007 (invited)
- Pitt, R. J. Voorhees, and S. Clark. "Evapotranspiration and related calculations for stormwater biofiltration devices: Proposed calculation scenario and data." Presented at the *Conference on Stormwater and Urban Water Systems Modeling*. Computational Hydraulics, Inc., Toronto. February 22 and 23, 2007.
- Bochis, C., R. Pitt, and P. Johnson. "Land development characteristics in the Southeastern United States." Presented at the *Conference on Stormwater and Urban Water Systems Modeling*. Computational Hydraulics, Inc., Toronto. February 22 and 23, 2007.
- Avila, H., R. Pitt, and S.R. Durrans. "Factors affecting scour of previously captured sediment from stormwater catchbasin sumps." Presented at the *Conference on Stormwater and Urban Water Systems Modeling*. Computational Hydraulics, Inc., Toronto. February 22 and 23, 2007.
- Pitt, R. "Design/construction/maintenance techniques for successful stormwater bioretention and infiltration." Keynote speaker. Presented at the *American Society of Landscape Architects' Annual Meeting*. Atlantic City, NJ. January 28 – 30, 2007. (invited)
- Al-Faqih, L., R. Pitt, and P. Johnson. "Decision Analysis Applications for the Sustainability of Global Urban Water Resources and Drainage Systems." *79th Annual Water Environment Federation Technical Exposition and Conference*. Dallas, TX. Oct. 22 – 25, 2006. conference CD.
- Narayanan, A., C.Bochis, R. Pitt. "Modeled Flow Duration Variations of Stormwater Discharges, Pollutant Discharges and Costs Due to Different Control Practices." Presented at the *79th Annual Water Environment Federation Technical Exposition and Conference*. Dallas, TX. Oct. 22 – 25, 2006. conference CD (poster)
- Khambhammettu, U., R. Pitt, R. Andoh, and D. Woelkers. "Full Scale Evaluation of Upflow™ Filter - A Catch Basin Insert for the Treatment of Stormwater at Critical Source Areas." Presented at the *79th Annual Water Environment Federation Technical Exposition and Conference*. Dallas, TX. Oct. 22 – 25, 2006. conference CD.
- Glennon, L., R. Pitt, and S. Clark. "Verification of the UpFlo Filter: An upflow filter for stormwater treatment at critical source areas." Presented at *StormCon, The North American Surface Water Quality Conference & Exposition*, Denver, CO. July 24 – 27, 2006.
- Woelkers, D., R. Pitt, and S. Clark. "Use of filtration systems for control of pollutants in stormwater runoff." Presented at *StormCon, The North American Surface Water Quality Conference & Exposition*, Denver, CO. July 24 – 27, 2006.
- Pitt, R. "Potential Risks and Benefits of Stormwater Reuse" Keynote Address. Presented at *Why Water Suppliers Should Care about Stormwater Management* conference. New England Water and Wastewater Association, Durham, NH. October 12 – 13, 2006. (invited)
- Pitt, R. "Integrated Watershed Management in Urban Areas." Presented at the Environmental Engineering and Science Seminar Series, University of New Hampshire, Durham, NH. October 11, 2006. (invited)
- Pitt, R. "Identification of Inappropriate Discharges to Storm Drainage Systems (Field Screening)." Presented at the *20th Annual Alabama Water Resources Conference and Symposium*, Orange Beach, AL Sept. 7-8, 2006.
- Pitt, R. "Integrated Watershed Management," Urban Watershed Management Keynote Presentation, Presented at the *World Environmental and Water Resources Congress 2006*, Omaha, NE. May 21 – 25, 2006. (invited)
- Pitt, R. "UpFlow filtration for the treatment of stormwater." Presented at the *Florida Stormwater Research Symposium*. Orlando, FL. May 4 – 5, 2006. (invited)
- Pitt, R. "SUDS - the current US perspective: Integrated Storm Water Management in New Development Areas" Keynote Presentation, Presented at the *International Association of Hydrogeologists (Irish Group) Annual Meeting*. Tullamore, Ireland. April 25 – 26. 2006. (invited)
- Pitt, R. "Groundwater contamination potential associated with stormwater infiltration," Presented at the *International Association of Hydrogeologists (Irish Group) Annual Meeting*. Tullamore, Ireland. April 25 – 26. 2006. (invited)

- Maestre, A. R. Pitt, and D. Becker. "Stormwater conservation design case study." Presented at *Alabama's Water Environment Association 2006 Conference*. Orange Beach, AL. April 23 – 26, 2006.
- Maestre, A. and R. Pitt. "Identification of inappropriate discharges to storm drainage systems ("field screening")," Presented at *Alabama's Water Environment Association 2006 Conference*. Orange Beach, AL. April 23 – 26, 2006.
- Pitt, R. "Soils and swales research at the University of Alabama." Presented at *Swale Research at the US EPA symposium*, Edison, NJ. March 23, 2006. (invited)
- Pitt, R. "Stormwater treatment at critical source areas." Keynote Presentation. Presented at *The Changing Face of the Stormwater Industry*. Hydro International, Ltd. Portland, ME. March 16, 2006. (invited)
- Maestre, A. and R. Pitt. "Comparisons of stormwater databases: NURP, USGS, CDM, BMP Database, NSQD." Presented at the *Conference on Stormwater and Urban Water Systems Modeling*. Computational Hydraulics, Inc., Toronto. February 23 and 24, 2006.
- Pitt, R. and J. Voorhees. "Using decision analyses to select an urban runoff control program" Presented at the *Conference on Stormwater and Urban Water Systems Modeling*. Computational Hydraulics, Inc., Toronto. February 23 and 24, 2006.
- Khambhammettu, U. and R. Pitt "UpFlow filtration for the treatment of stormwater at critical source areas." Presented at the *Conference on Stormwater and Urban Water Systems Modeling*. Computational Hydraulics, Inc., Toronto. February 23 and 24, 2006.
- Bathi, J. and R. Pitt. "Sample preparation for GC/MS analysis to study the partition of organic contaminants in water," Presented at the *Alabama EPSCoR Annual Conference*, Talladega, AL, February 2006.
- Marquecho, R. and R. Pitt (2005). "Metal Associations with Stormwater Particulates," Presented at the *78th Annual Water Environment Federation Technical Exposition and Conference*. Washington, D.C. Oct. 29 – Nov. 2, 2005.
- Bochis-Micu, C. and R. Pitt (2005). "Impervious Surfaces in Urban Watersheds," Presented at the *78th Annual Water Environment Federation Technical Exposition and Conference*. Washington, D.C. Oct. 29 – Nov. 2, 2005.
- Clark, S.E., M.M. Lalor, R. Pitt, R. Field. "Stormwater pollution from common building materials." Presented at the *78th Annual Water Environment Federation Technical Exposition and Conference*. Washington, D.C. Oct. 29 – Nov. 2, 2005.
- Nara, Y., R. Pitt, S.R. Durrans, and J. Kirby. "Stormwater sediment transport in grass swales during small rains." Presented at the *78th Annual Water Environment Federation Technical Exposition and Conference*. Washington, D.C. Oct. 29 – Nov. 2, 2005.
- Pitt, R. and A. Maestre. "Stormwater quality as described in the National Stormwater Quality Database." Presented at the *10th International Conference on Urban Drainage*, Copenhagen, Denmark. August 21-26, 2005.
- Clark, S.E., M.M. Lalor, R. Pitt, and R. Field. "Wet-weather pollution from commonly-used building materials." Presented at the *10th International Conference on Urban Drainage*, Copenhagen, Denmark. August 21-26, 2005.
- Clark, S.E., P. Johnson, R. Pitt, S. Gill, and M. Pratap. "Filtration for metals removal from stormwater." Presented at the *10th International Conference on Urban Drainage*, Copenhagen, Denmark. August 21-26, 2005.
- Pitt, R., S. Chen, S. Clark, and J. Lantrip. "Soil structure effects associated with urbanization and the benefits of soil amendments." Presented at the *World Water and Environmental Resources Congress*. ASCE/EWRI. Anchorage, Alaska. May 2005.
- Clark, S., M.M. Lalor, and R. Pitt. "Wet-weather pollution from commonly-used building materials." Presented at the *World Water and Environmental Resources Congress*. ASCE/EWRI. Anchorage, Alaska. May 2005.
- Pratap, M., U. Khambhammettu, S. Clark, and R. Pitt. "Stormwater treatment using upflow filters." Presented at the *World Water and Environmental Resources Congress*. ASCE/EWRI. Anchorage, Alaska. May 2005.
- Morquecho, R. and R. Pitt. "Chemical forms and effects of heavy metals in stormwater." Presented at the *World Water and Environmental Resources Congress*. ASCE/EWRI. Anchorage, Alaska. May 2005.
- Maestre, A. and R. Pitt. "Observations from the National Stormwater Quality Database." Presented at the *Conference on Stormwater and Urban Water Systems Modeling*. Computational Hydraulics, Inc., Toronto. February 24 and 25, 2005.
- Nara, Y., R. Pitt, S.R. Durrans, and J. Kirby. "The use of grass swales as a stormwater control." Presented at the *Conference on Stormwater and Urban Water Systems Modeling*. Computational Hydraulics, Inc., Toronto. February 24 and 25, 2005.
- Pitt, R. "Review of current wet weather research being conducted at the University of Alabama." Presented at the *Auckland Regional Council Stormwater Research Symposium*. Auckland, New Zealand. Oct. 21-22, 2004. (invited)

- Pitt, R. and A. Maestre. "The National Stormwater Quality Database." Presented at the *Stormwater Management Research Symposium*. University of Central Florida, Stormwater Management Academy. Orlando, FL, Oct. 12, 2004. (invited)
- Pitt, R., S. Chaturvedula, Y. Nara. "Source verification of inappropriate discharges to storm drainage systems." Presented at the *77th Annual Water Environment Federation Technical Exposition and Conference*. New Orleans, LA. Oct 4 – 7, 2004.
- Pratap, M., S. Clark, R. Pitt, and P. Johnson. "WERF: Evaluation of upflow filtration for stormwater treatment at critical source areas." Presented at the *77th Annual Water Environment Federation Technical Exposition and Conference*. New Orleans, LA. Oct 4 – 7, 2004.
- Shergill, S. and R. Pitt. "Quantification of *Escherichia coli* and enterococci levels in wet weather and dry weather flows." Presented at the *77th Annual Water Environment Federation Technical Exposition and Conference*. New Orleans, LA. Oct 4 – 7, 2004.
- Pitt, R. "The National Stormwater Quality Database." Presented at the *Stormwater Management Symposium*. Orlando, FL, Oct. 12, 2004. (invited)
- Pitt, R. and J. Voorhees. "The use of WinSLAMM to evaluate the benefits of low impact development." Keynote Address presented at the *Low Impact Development Conference: Putting the LID on SWM*. College Park, MD. Sept. 21-23, 2004. (invited)
- Pitt, R. and S. Chen. "Land development effects on soil structure and the use of soil amendments." Presented at the *Low Impact Development Conference: Putting the LID on SWM*. College Park, MD. Sept. 21-23, 2004. (invited)
- Pitt, R. "Monitoring the effects of urbanization." Presented at the *Aquatic Restoration Workshop 2004*. Mobile River Basin Coalition. Birmingham, AL. Aug. 24 and 25, 2004. (invited)
- Pitt, R., A. Maestre, and R. Morquecho. "Stormwater characteristics as contained in the nationwide MS4 stormwater phase 1 database." Presented at the *Water World and Environmental Resources Conference 2004*, Environmental and Water Resources Institute of the American Society of Civil Engineers, Salt Lake City, Utah. July 27 – August 1, 2004.
- Pitt, R., S. Clark, P.D. Johnson, R. Morquecho, S. Gill, and M. Pratap. "High level treatment of stormwater heavy metals." Presented at the *Water World and Environmental Resources Conference 2004*, Environmental and Water Resources Institute of the American Society of Civil Engineers, Salt Lake City, Utah. July 27 – August 1, 2004.
- Pitt, R. and R. Field. "Catchbasins and inserts for the control of gross solids and conventional stormwater pollutants." Presented at the *Water World and Environmental Resources Conference 2004*, Environmental and Water Resources Institute of the American Society of Civil Engineers, Salt Lake City, Utah. July 27 – August 1, 2004.
- Pitt, R., R. Bannerman, and R. Sutherland. "The role of street cleaning in stormwater management." Presented at the *Water World and Environmental Resources Conference 2004*, Environmental and Water Resources Institute of the American Society of Civil Engineers, Salt Lake City, Utah. July 27 – August 1, 2004.
- Pitt, R., S. Clark, P.D. Johnson, R. Morquecho, and D. Williamson. "Treatability of stormwater heavy metals; or breaking the irreducible concentration barrier." Presented at *Watershed 2004*, Water Environment Foundation. Dearborn, MI. July 11 – 14, 2004. (invited)
- Pitt, R., A. Maestre, and R. Morquecho. "Nationwide MS4 stormwater phase 1 database." Presented at *Watershed 2004*, Water Environment Foundation. Dearborn, MI. July 11 – 14, 2004. (invited)
- Pitt, R. "The status of stormwater quality: What we have learned in the past few years." Keynote presentation. Presented at *Stormwater: Emerging Issues for Local Communities*. US EPA, Region IV and the North Carolina Dept. of Environmental Management. Asheville, North Carolina. April 19-22, 2004. (invited)
- Pitt, R. *Degradation of Urban Streams and Integrated Sampling Programs to Identify Possible Causative Factors*, Featured Keynote Speaker. Presented at the *Freshwater Mollusk Conservation Society and Water Quality and Freshwater Gastropod Workshop*. Tuscaloosa, AL. March 2004. (invited)
- Maestre, A., R. Pitt, S.R. Durrans, and S. Chakraborti. "Stormwater quality descriptions using the three parameter lognormal distribution." Presented at the *Stormwater and Urban Water Systems Modeling Conference*. Computational Hydraulics, Inc. Toronto. February 19-29, 2004.
- Pitt, R., D. Williamson, and R. Bannerman. "Sources of pollutants in urban areas." Presented at the *Stormwater and Urban Water Systems Modeling Conference*. Computational Hydraulics, Inc. Toronto. February 19-29, 2004.
- Pitt, R., D. Williamson, and J. Voorhees. "Review of historical street dust and dirt accumulation and washoff data." Presented at the *Stormwater and Urban Water Systems Modeling Conference*. Computational Hydraulics, Inc. Toronto. February 19-29, 2004.

- Pitt, R. "Modeling stormwater controls in complex drainages." Invited Feature Speaker. Presented at the *Designing Sites for Water Quality: Active Construction & Post-Construction BMPs*. Michigan Water Environment Association. Battle Creek, MI. Dec 2 – 3, 2003. (invited)
- Clark, S.E., P. Johnson, R. Pitt. "Metals removal technologies for stormwater: Filtration." Presented at the *2003 Pennsylvania Stormwater Management Symposium*. Villanova, October 16-17, 2003.
- Pitt, R., A. Maestre and R. Morquecho. "Compilation and review of nationwide MS4 stormwater quality data." Presented at the *76th Annual Water Environment Federation Technical Exposition and Conference*. Los Angeles, CA. Oct 11 – 15, 2003.
- Pitt, R. and S. Clark. "Stormwater treatment at critical source areas: The Multi-Chambered Treatment Train (MCTT) and new upflow filters." Presented at the *76th Annual Water Environment Federation Technical Exposition and Conference*. Los Angeles, CA. Oct 11 – 15, 2003.
- Morquecho, R. and R. Pitt. "Stormwater heavy metal particulate associations." Presented at the *76th Annual Water Environment Federation Technical Exposition and Conference*. Los Angeles, CA. Oct 11 – 15, 2003.
- Pitt, R. "Urban sprawl: What we know and don't think about." Invited Keynote Address. Presented at the *Society of Woman Engineers 2003 National Conference*, Birmingham, AL. Oct 9 – 11, 2003.(invited)
- Pitt, R. "Stormwater quality database representing long-term U.S. regulatory monitoring: Do we know enough yet and can get on with it?" Invited Keynote Address. Presented at the *3rd South Pacific Conference on Stormwater*. Auckland Regional Council, New Zealand. May 14-16, 2003. (invited)
- Pitt, R. "Innovative metal control using grass swales and stormwater filters." Presented at the *3rd South Pacific Conference on Stormwater*. Auckland Regional Council, New Zealand. May 14-16, 2003. (invited)
- Pitt, R. "Overview of national stormwater needs and priorities." Invited Keynote Address. Presented at the *A National Stormwater Laboratory: Needs, Priorities and Funding*. University of Minnesota, Minneapolis, MN. May 1 – 2, 2003. (invited)
- Johnson, P.D., S. Clark, R. Pitt, S.R. Durrans, M. Urrutia, S. Gill, and J. Kirby. "Metals removal technologies for stormwater." Presented at the *9th Industrial Wastes Technical Conference*. Austin, TX. Water Environment Foundation. April 16, 2003.
- Clark, S., M. Lalor, R. Pitt, and R. Field. "Investigation of wet-weather pollution contributions from building materials commonly used at industrial sites." Presented at the *9th Industrial Wastes Technical Conference*. Austin, TX. Water Environment Foundation. April 16, 2003.
- Maestre, A., Pitt, R. E., and R. Morquecho. "Nonparametric statistical tests comparing first flush with composite samples from the NPDES Phase 1 municipal stormwater monitoring data." Presented at the *Stormwater and Urban Water Systems Modeling Conference*. Computational Hydraulics, Inc. Toronto, Canada, Feb. 2003.
- Pitt, R. E., A. Maestre, and R. Morquecho. "Collection and examination of a municipal separate storm sewer system database." Presented at the *Stormwater and Urban Water Systems Modeling. Stormwater and Urban Water Systems Modeling Conference*. Computational Hydraulics, Inc. Toronto, Canada, Feb. 2003.
- Pitt, R., A. Maestre, and R. Morquecho. "Evaluation of NPDES Phase 1 Municipal Stormwater Monitoring Data." Presented at *Urban Stormwater: Enhancing Programs at the Local Level*. Chicago Botanic Garden and the U.S. Environmental Protection Agency. Chicago, Illinois. February 17-20, 2003.
- Gabriel, M., D. Williamson, and R. Pitt. "Availability of atmospherically deposited mercury to runoff and receiving waters." Presented at the *TMDL Science and Policy Conference*. Water Environmental Federation. Phoenix, AZ. November 13-16, 2002.
- Pitt, R. "Land use features benefiting stormwater management." Presented at the *ACS Regional Conference: Campus as a Laboratory for Sustainability*. Birmingham Southern College. October 25-27, 2002. (invited)
- Pitt, R., S. Chen, and S. Clark. "Compacted urban soils effects on infiltration and bioretention stormwater control designs." Presented at the *9th International Conference on Urban Drainage*. IAHR, IWA, EWRI, and ASCE. Portland, Oregon, September 8-13, 2002.
- Burian, S.J., S.J. Nix, S.R. Durrans, and R.E. Pitt. "Analysis of the long-term performance of storage/release systems using linked watershed-water body modeling." Presented at the *9th International Conference on Urban Drainage*. IAHR, IWA, EWRI, and ASCE. Portland, Oregon, September 8-13, 2002.
- Clark, S., R. Pitt, and R. Field. "Wet-Weather Pollution Prevention by Product Substitution." Presented at the *United Engineering Conference on Linking Stormwater BMP Designs and Performance to Receiving Water Impacts*, August 19 – 24, 2001. American Society of Civil Engineers, 2002. (invited)
- Clark, S., R. Pitt, and P. Brown. "Effect of Anaerobiosis on Filter Media Pollutant Retention." Presented at the *United Engineering Conference on Linking Stormwater BMP Designs and Performance to Receiving Water Impacts*, August 19 – 24, 2001. American Society of Civil Engineers, 2002. (poster)

- Clark, S., R. Pitt, and A. Balakrishnan. "BMP Filters: Upflow vs. Downflow." Presented at the *United Engineering Conference on Linking Stormwater BMP Designs and Performance to Receiving Water Impacts*, August 19 – 24, 2001. American Society of Civil Engineers, 2002. (poster)
- Pitt, R., S. Chen, C.K. Ong, and S. Clark. "Measurements of Infiltration Rates in Compacted Urban Soils." Presented at the *United Engineering Conference on Linking Stormwater BMP Designs and Performance to Receiving Water Impacts*, August 19 – 24, 2001. American Society of Civil Engineers, 2002. (invited)
- Clark, S.E., M. Lalor, R. Pitt, and R. Field. "Wet-weather pollution prevention through materials substitution as part of industrial construction." Presented at the *8th Annual Industrial Wastes Technical and Regulatory Conference*, Water Environment Federation. Atlantic City, New Jersey, August 11 - 14, 2002.
- Pitt, R., S. Chen, S. Clark, and C.K. Ong. "Urbanization factors affecting infiltration." Presented at the *American Water Resources Association Summer Specialty Conference: Ground Water/Surface Water Interactions*. Keystone, Colorado, July 1-3, 2002.
- Pitt, R., S. Clark, and R. Field. "Groundwater contamination potential from stormwater infiltration." Presented at the *American Water Resources Association Summer Specialty Conference: Ground Water/Surface Water Interactions*. Keystone, Colorado, July 1-3, 2002.
- Pitt, R. "Water quality and hydrology interactions." Presented at the *California Stormwater Quality Task Force*, Sacramento, CA. June 2002. (invited)
- Pitt, R. "Stormwater treatment at critical source areas using the multi-chambered treatment train (MCTT)." Presented at the *2002 Borchardt Conference, A Seminar on Advancements in Water and Wastewater*. The University of Michigan, Ann Arbor, Feb. 2002. (invited)
- Pitt, R. C. Shen-En Chen, S. Clark, J. Lantrip, and C.K. Ong. "Infiltration through compacted urban soils and effects on biofiltration design." Presented at *Stormwater and Urban Water Systems Modeling*. Computational Hydraulics, Inc. Toronto, Canada, Feb. 2002.
- Pitt, R. "Stormwater control practices in cold climates." Presented at the *Stormwater Runoff in Vermont: An Educational Workshop*. Vermont Water Resources and Lake Studies Center, UVM and the Vermont Law School. Burlington, VT, Jan. 2002. (invited)
- Pitt, R. "Source tracking." NWRI, Presented at the *National Urban Watershed Conference*. Costa Mesa, CA, Oct. 2001. (invited)
- Pitt, R., S. Clark, and P. Brown. "Modeling of particulate removal in mixed media filters using power equation." Presented at Water Environmental Federation, *WEFTEC'01*. Atlanta, GA, Oct. 2001.
- Clark, S., R. Pitt, and P. Brown. "Stormwater filter performance under aerobic and anaerobic conditions." Presented at Water Environmental Federation, *WEFTEC'01*. Atlanta, GA, Oct. 2001. (poster)
- Pitt, R. "Source water protection." Presented at the *AL/MS AWWA Conference*. Biloxi. MS. Oct. 2001.
- Pitt, R. and G.A. Burton. "Methods for the assessment of urban wet-weather flow impacts. Presented at the Engineering Foundation and the American Society of Civil Engineers Conference on *Information & Monitoring Needs for Evaluating the Mitigating Effects of BMPs*. Snowmass, CO, August 2001. (invited)
- Clark, S., R. Pitt, and R. Field. "Wet-weather pollution prevention by product substitution." Presented at the Engineering Foundation and the American Society of Civil Engineers Conference on *Information & Monitoring Needs for Evaluating the Mitigating Effects of BMPs*. Snowmass, CO, August 2001. (poster)
- Clark, S., R. Pitt, and A. Balakrishnan. "Stormwater filters: Upflow vs. downflow." Presented at the Engineering Foundation and the American Society of Civil Engineers Conference on *Information & Monitoring Needs for Evaluating the Mitigating Effects of BMPs*. Snowmass, CO, August 2001. (poster)
- Clark, S., R. Pitt, and P. Brown. "Effect of anaerobiosis on filter media pollutant retention." Presented at the Engineering Foundation and the American Society of Civil Engineers Conference on *Information & Monitoring Needs for Evaluating the Mitigating Effects of BMPs*. Snowmass, CO, August 2001. (poster)
- Pitt, R. "Illicit discharge detection and elimination." Presented at the *National Storm Water Coordinators Conference*. U.S. Environmental Protection Agency. Orlando, FL. May 2001. (invited)
- Easton, J., M.M. Lalor, J.J. Gauthier, and R. Pitt. "Pathogen decay in urban streams." Presented at the *AWRA Specialty Conference*. San Antonio, TX. May 2001.
- Pitt, R. "Stormwater management for highway projects." Keynote presentation at the *Symposium on the Pollution of Water Sources from Road Run-Off*. Tel Aviv University, Israel, Sponsored by The Committee for Public Transportation, the Faculty of Life Sciences, The Institute for Nature Conservation Research, and the Porter School of Environmental Studies at Tel Aviv University. March 19, 2001. (invited)

- Pitt, R., and J. Lantrip. "The effects of urbanization on soil infiltration characteristics." Presented at *AIH's Conference on Atmospheric, Surface and Subsurface Hydrology Interactions*. Research Triangle Park, NC, November 2000.
- Pitt, R., S. Clark, and R. Field. "Potential groundwater contamination associated with stormwater infiltration." Presented at *AIH's Conference on Atmospheric, Surface and Subsurface Hydrology Interactions*. Research Triangle Park, NC, November 2000.
- Pitt, R. "Predicting changes in water quality resulting from changing land use." Presented at the *AWRA Alabama Section Symposium*, Gulf Shores, AL. September 2000.
- Pitt, R., J. Lantrip, and T.P. O'Connor. "Infiltration through disturbed urban soils." Presented at the *ASCE's 2000 Joint Conference on Water Resources Engineering and Water Resources Planning & Management*. Minneapolis, MN. July 2000.
- Pitt, R., M. Lalor, J. Harper, and C. Nix. "Potential new tools for indicating inappropriate dry weather discharges to storm drainage systems." Presented at *Tools for Urban Water Resource Management & Protection*. Chicago Botanic Garden, U.S. EPA, and Northeastern Illinois Planning Commission. Feb. 7-10, 2000. (invited)
- Pitt, R. and M. Lalor. "The role of pollution prevention in stormwater management." Presented at the *Conference on stormwater and urban water systems modeling*. Computational Hydraulics Institute. Toronto, Ontario. February 2000.
- Easton, J.H., M. Lalor, J.J. Gauthier, and R. Pitt. "*In-situ* die-off of indicator bacteria and pathogens." Presented at *AWRA's Annual Water Resources Conference: Watershed Management to Protect Declining Species*. Seattle, WA. December 1999.
- Pitt, R., R. Harrison, C.L. Henry, D. Xue, and T. O'Connor. "Enhanced infiltration performance of disturbed urban soils using compost amendments." Presented at the *Water Environment Federation 72nd Annual Conference & Exposition*. New Orleans. October 1999.
- Harper, J., C. Nix, J. Day, III, M. Lalor, R. Pitt, S. Clark, D. Barbe, D. Adrian, R. Field. "Detection of inappropriate sewage entries in stormwater drainage systems." Presented at the *Water Environment Federation 72nd Annual Conference & Exposition*. New Orleans. October 1999. (poster)
- Easton, J., M. Lalor, J.J. Gauthier, R. Pitt, D.E. Newman, S. Meyland. "Determination of survival rates for selected bacterial and protozoan pathogens from wet weather discharges." Presented at the *Water Environment Federation 72nd Annual Conference & Exposition*. New Orleans. October 1999.
- Mirov, S.B., R.E. Pitt, A. Dergachev, W. Lee, D.V. Martyshkin, O.D. Mirov, J.J. Randolph, L.J. DeLucas, C.G. Brouillette, T.T. Basiev, Y.V. Orlovskii, and O.K. Alimiv. "A novel laser breakdown spectrophotometer for environmental monitoring." Presented at the Society of Photo-Optical Instrumentation Engineers (SPIE) *Photonics East*, Boston, MA, September 1999.
- Pitt, R. "Small storm hydrology: Its importance for the design of stormwater control." Presented at the *5th New York Stormwater Management Conference and Trade Exposition*. Rochester, NY. Feb., 1999. (invited)
- Pitt, R., S. Nix, R. Durrans, R. Field, M. Lilburn and S. Burian. "Current and Future Drainage Design, Results of EPA-Funded Research." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.
- Pitt, R., S. Clark, and R. Field. "Groundwater Contamination Risk due to Stormwater Infiltration." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.
- Pitt, R. "Small Storm Hydrology's Impact on the Design of Stormwater Control Practices." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.
- Newman, D., J. Easton, R. Pitt, M. Lalor, and J. Gauthier. "Development of an *in-situ* method to determine the fate of bacterial pathogens discharged into urban receiving waters." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.
- Meyland, S., M. Lalor, and R. Pitt. "Environmental and public health impacts on sanitary sewer overflows." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.
- Easton, J., R. Pitt, M. Lalor, and D. Newman. "The use of a multi-parameter water quality monitoring instrument to continuously monitor and evaluate runoff events." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Harper, J., Clark, S., R. Pitt., J. Day, T. Roberts, and C. Nix. "Evaluating field test kits for citizen water quality monitoring." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Ellis, A., D. Newman, and R. Pitt. "The use of peepers to measure nutrient and bacteria stratification in urban sediments." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Lantrip, J. and R. Pitt. "Infiltration of stormwater through disturbed urban soils." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Easton, J., R. Pitt, and M. Lalor. "The effects of separate sanitary sewer discharges (SSOs) upon photosynthesis and respiration using a continuous monitoring instrument *in-situ*." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Clark, S., R. Pitt, P. Brown, and R. Field. "Stormwater runoff filtration prior to groundwater recharge." Presented at the *34th Annual American Water Resources Association Conference: Applications of Water Use Information*. Point Clear, AL. November 1998.

Pitt, R. and R. Field. "An Evaluation of Storm Drainage Inlet Devices for Stormwater Quality Treatment." Presented at the *Water Environment Federation 71st Annual Conference & Exposition, WEFTEC Technology Forum*. Orlando, FL. October 1998.

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Clark, S., R. Pitt, R. Field, P. Brown, and R. Schulze. "Urban Runoff Filtration for Critical Source Areas." Presented at the *WEF Advances in Urban Wet Weather Wet Weather Pollution Reduction Specialty Conference*. Cleveland, OH. June 1998.

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Pitt, R. "Drainage Design for the Future." Presented at *CHI's Stormwater & Water Quality Management Modeling Conference*. Toronto, Ontario. Feb. 1998.

Pitt, R. "Sediment Control in Alabama." Presented at the *41st Annual Transportation Conference*. Montgomery, AL. February 1998 (invited).

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- Heaney, J.P., L. Wright, D. Sample, R. Pitt, R. Field, and C-Y. Fan. "Innovative Stormwater Management as a Subsystem of Total Urban Water Management." Presented at *Stormwater Management – Creating Sustainable Urban Water Resources for the 21st Century*. Engineering Foundation Conference. Malmo, Sweden. Sept. 1997. (invited)
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- Mirov, S. and R. Pitt "A Novel Laser Atomic Fluorescence Spectrometer for Environmental and Biomedical Analyses of Heavy Metals." Presented at *Photonics West*, San Jose, CA, Feb. 1997.
- Ashley, R., M. Verbanck, J-L Bertrand-Krajewski, T. Hvitved-Jacobsen, C. Nalluri, G. Perrusquia, R. Pitt, E. Ristenpart, and A. Saul. "Solids in Sewers - the State of the Art." Presented at the *Seventh International Conference on Urban Storm Drainage*. Hannover, Germany. Sept. 1996. (poster)
- Pitt, R. "Managing Critical Source Areas of Toxicants at the Watershed Level." Presented at the *Effects of Watershed Development and Management on Aquatic Ecosystems*. Engineering Foundation and ASCE. Snowbird, Utah. August 1996 (invited).
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- Pitt, R. and J. Voorhees. "Critical Source Area Controls in the SLAMM Water Quality Model." Presented at *A National Symposium: Assessing the Cumulative Impacts of Watershed Developments on Aquatic Ecosystems and Water Quality*. U.S. EPA and Northeastern Illinois Planning Commission. Chicago, Illinois, March 1996 (invited).
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- Clark, S., R. Pitt, and R. Field. "Stormwater Treatment Using Inlet Devices, Filter Media, and Filter Fabrics." Presented at the Engineering Foundation Conference on: *Stormwater NPDES Related Needs*. Mt. Crested Butte, CO, August 1994. (poster)
- Pitt, R. "Detecting Water Quality Trends from Stormwater Discharge Reductions." Presented at the Engineering Foundation Conference on: *Stormwater NPDES Related Needs*. Mt. Crested Butte, CO, August 1994 (invited).
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- Pitt, R. "Effects of Urbanization on Receiving Waters," *Urban Effects on Water Quality and Quantity Conference*, Urbana, IL. Proceedings published by the Illinois Department of Energy and Natural Resources, October 1983 (invited).
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Geothermal Resources Studies, for the Phillips Petroleum Company (Roosevelt Hot Springs, Utah), 1977.

Review of the San Desert Nuclear Power Plant Environmental Report, for the San Diego Gas and Electric Company, 1976.

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Crow Indian Reservation Coal Mining Lease, for Shell Oil Company (Big Horn County, Montana), 1976.

Water Quality and Biological Survey of the Zeyandeh Rud near Isfahan, Iran, for E. I. duPont de Nemours Company, 1976.

The Effects of Sand and Gravel Removal on Arctic and Subarctic Streams, for the U. S. Fish and Wildlife Service (Alaska), 1976.

Engineering Report for Air Quality Mitigation Measures, for the Southern California Gas Company, 1975.

Air Quality Effects of Oil Spills, Standard Oil Company of California (Santa Barbara), 1975.

Contingency Plan for a Proposed Ammonia and Urea Transfer and Storage Facility, for Collier Carbon and Chemical Corporation (Sacramento, California), 1975.

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Twin Creek Coal Mine, for the Rocky Mountain Energy Company (Lincoln County, Wyoming), 1974.

Monitoring of Oil Spill Waste Disposal Areas, for Standard Oil Company of California (San Francisco), 1973.

Oakland Airport Maintenance Facility Expansion, for the Port of Oakland (California), 1973.

Environmental, Social, and Economic Impact of the Proposed 1972-1977 Capital Improvement Program for the San Jose Municipal Airport, for the City of San Jose (California), 1972.

Industrial Waste Survey of the Northwest Fruit and Vegetable Canning Industry, for the Environmental Protection Agency (Washington, Oregon, and Idaho), 1972.

Oil Spill/Sorbent Harvesting Systems on Vessels of Opportunity, A motion picture, U.S. Environmental Agency, 1972.

Department of Civil, Construction, and Environmental Engineering Courses Taught:

CE 333 - Water Supply and Drainage Design

CE 335 - Water and Wastewater Treatment

CE 378 – Water Resources Engineering
<http://unix.eng.ua.edu/~rpitt/Class/Water%20Resources%20Engineering/WREMainPage.htm>
 CE 401 – Senior Design Project
 CE 435 - Environmental Engineering
 CE 484 - Hydraulic Engineering Systems
 CE 485 - Engineering Hydrology
 CE 499 - Senior Design
 CE 527 Urban Water Systems
<http://www.eng.ua.edu/~rpitt/Class/Computerapplications/MainCA.html>
 CE 544 - Engineering Statistical Analyses
 CE 636 - Stormwater Management
<http://www.eng.ua.edu/~rpitt/Class/StormWaterManagement/MainSWM.html>
 CE 637 - Experimental Design and Field Sampling
<http://www.eng.ua.edu/~rpitt/Class/ExperimentalDesignFieldSampling/MainEDFS.html>
 CE 638 - Chemical Processes and Pollutant Impacts in Water
 CE 485/685 – Construction Site Erosion Control
<http://www.eng.ua.edu/~rpitt/Class/Erosioncontrol/MainEC.html>
 CE 641 - Environmental Engineering and Water Resources Seminar
 CE 685 - Research Methods in Civil and Environmental Engineering
 CE 687 - Stormwater Detention Pond Design
<http://www.eng.ua.edu/~rpitt/Class/Detentionponddesign/MainDPD.html>
 CE 690 – Effects and Fates of Hazardous Materials
<http://www.eng.ua.edu/~rpitt/Class/EffectsandFates/MainEffectsandFates.html>
 CE 690 - International Internet based courses on Stormwater Modeling and Stormwater Management
<http://www.computationalhydraulics.com/Training/Courses/ISWM2004/>
 CE 691 –Internet based course on International Urban Water Systems
<http://unix.eng.ua.edu/~rpitt/Class/International%20urban%20water%20systems/IUWSMainPage.htm>
 HON 101-406 - Honors course: The Environment: The Earth in Our Shadow
 HON 107/407 - Honors course: The Environment: Earth, Air, Fire, and Water

Major Advisor for the Following Graduate Students:

Agnew, Frank. MSCE. *Performance of Inlet Treatment Devices*. 1996.
 Ayyoubi, Ali. MSCE. *Physical Treatment of Urban Storm Water Runoff Toxicants* (published thesis). 1993.
 Baker, Martin, R. III. MSCE. *Constructed Wetlands for the Treatment of Paper Mill Wastes*. 2001.
 Balakrishnan, Anitha C. MSCE. *Comparison of Upflow and Downflow Filtration on Clogging and Pollutant Removal Capabilities of Stormwater Filters*. 2001.
 Barron, Patricia. MSCE. *Characterization of Polynuclear Aromatic Hydrocarbons in Urban Runoff* (published thesis). 1990.
 Bochis, Elena-Celina. MSCE. *Magnitude of Impervious Surfaces in Urban Areas* (published thesis). 2007.
 Buford, Mark. MSCE. *Land Use Characteristics Affecting Baseflow Quality*. 1995.
 Burnett, David. MSCE. *Snowmelt Water Quality*. 1997.
 Chaturvedula Soumya. MSCE. *Watershed Investigation for the Identification of Sources of Inappropriate Discharges to the Cribbs Mill Creek* (published thesis). 2004.
 Clark, Shirley. MSCE. *Evaluation of Filtration Media for Stormwater Runoff Treatment* (published thesis). 1996.
 Clark, Shirley. Ph.D. *Urban Stormwater Filtration/Sorption: Optimization of Design Parameters and a Pilot-Scale Evaluation* (published dissertation). 2000.
 Creel, Robert. MSCE. *Evaluating Detention Pond Performance with Computer Modeling Verification* (published thesis). 1994.
 Day, James. MSCE. *Selection of Appropriate Analytical Procedures for Volunteer Field Monitoring of Water Quality* (published thesis). 1996.
 Delawadia, Naran. MSCE. *Validation of the DETPOND Model*. 1996.
 Dykes, William C. MSCE. *Water Pipeline Networks*. 1989.
 Echols, W.C. MSCE. *Calibration and Performance of Micro-Scale Peepers for High-Resolution Interstitial Water Sampling*. 1997.

El-Husari, Ayman. MSCE. *Rain Monitoring Options*. 1996.

Ellis, April. MSCE. *The use of Peepers to Measure Bacteria and Nutrient Gradients in Urban Pond Sediments*, 1998.

Farmer, Joseph. MSCE. *Oil and Grease Separators for Stormwater Control*. 1997.

Garrett, William. MSCE. *Control of Zebra Mussels in Power Plant Cooling Water Systems*. 1995.

Garrett, William. Ph.D. *Recirculating – Reducing and Alkalinity Producing System (RERAPS) for the Treatment of Acidic Coal Pile Runoff*. (published dissertation). 2002.

Goertz, Susan. MSCE. *Runoff Quality from a Xeroscaped Area*. 1996.

Hamrick, James. MSCE. *Drainage of Water from Pavement Structures* (published thesis). 1995.

Hosmer, Carla. MSCE. *Behavior of Stormwater Filtration Media under Aerobic and Anaerobic Conditions*, 2000.

Howser, John. MSCE. *Performance of Stormwater Detention Practices*. 1995.

Hyché, Hunter. MSCE. *Extensions to the National Stormwater Quality Database* (published thesis), 2007.

Karri, Verra. MSCE. *Monte Carlo Mixing Model to Identify Inappropriate Discharges to Storm Drainage Systems* (published thesis). 2004.

Khan, Mustaque. MSCE. *Organic Compound Automated Extraction Methods for Sediments*, 1999.

Kemp, Randall. MSCE. *Demonstration of Erosion Control Practices*. 1995.

Khambhammettu, Uday. MSCE. *Evaluation of Upflow Filtration for the Treatment of Stormwater* (published thesis). 2005.

Lalor, Melinda. Ph.D. (Vanderbilt Univ.) *Assessment of Non-Stormwater Discharges to Storm Drainage Systems in Residential and Commercial Land Use Areas* (published dissertation). 1993.

Lantrip, Janice. MSCE. *Infiltration through Disturbed Urban Soils*. 1999.

Lilburn, Melissa. MSCE. *Storm Drainage Design Practices* (published thesis). 1997.

Maestre, Alex. Ph.D. *Stormwater Characteristics as Described in the National Stormwater Quality Database* (published dissertation). 2005.

Morquecho, Renee. MSCE. *Sequential Extraction and Particle Size Associations for Stormwater Pollutants*. 2001.

Morquecho, Renee. Ph.D. *Pollutant Associations with Particulates in Stormwater* (published dissertation). 2005.

McConnel, Vic. MSCE. *Design of Detention Ponds for Commercial Development*. 1997.

McGill, Milan. MSCE. *Rainfall Distribution Analysis Options*. 1996.

McKell, Mitch. MSCE. *New Concepts in Wastewater Effluent Diffuser Design*. 1994.

Nara, Yukio. MSCE. *Sediment Transport in Grass Swales* (published thesis). 2005.

Narayanan, Arvind. MSCE. *Costs of Urban Stormwater Control Practices* (published thesis). August 2006.

Nelson, John. MSCE. *Characterizing Erosion Processes and Sediment Yields on Construction Sites* (published thesis). 1996.

Nix, Christy, M. MSCE. *Evaluation and Calibration of the Pastel UV for Detecting Sewage in Storm Water Drainage Systems*. 1999.

Nolen, Bobby. MSCE. *Hydraulic Models of the Transition Section of Laurel Lake Spillway*. 1989.

Panwhar, Samina. MSCE. *An Application of a GIS System for Risk Analysis and Routing of Hazardous Materials* (published thesis). 2001.

Peeples, Alan. MSCE. *Comparison of Rainfall Depth Calculation Procedures*. 1995.

Ponstein, Jonathan. MSCE. *Sources and Control of Tastes and Odors in a Public Water Supply*. 2001

Ray, Holly. MSCE. *Street Dirt as a Phosphorus Source in Urban Stormwater* (published thesis). 1997.

Revell, Edwin. MSCE. *Rainfall Measurements using Radar Systems*. 1995.

Richards, Michael. MSCE. *Arsenic Remediation Practices*. 1995.

Roberts, Timothy. MSCE. *Organochlorine Pesticide Detection Using a Compositing Scheme*. 1999.

Robertson, Brian. MSCE. *Evaluation of a Multi-Chambered Treatment Train (MCTT) for Treatment of Stormwater Runoff from Critical Pollutant Source Areas* (published thesis). 1995.

Shergill, Sumandeep. MSCE. *Quantification of Escherichia Coli and Enterococci Levels Wet Weather and Dry Weather Flows* (published thesis). 2004.

Summers, Harry. MSCE. *Upgrading of a Small Municipal Wastewater Treatment System*. 1991.

Weygand, Kenneth. MSCE. *Current Practices in Hydraulic Modeling*. 1996.

Wilson, Robert. MSCE. *Effluent Nitrate Reduction in Onsite Systems through Effluent Recycle* (published thesis). 1992.

Engineering Professional Development Courses and Workshops Taught:

Stormwater Management:
and Conservation Design

Albany, NY, 2000, 2008
Appleton, WI, 2005
Birmingham, AL, 1989 - 1998
Boston, MA, 1993
Chicago, IL, 1992, 1993, 1998
Edison, NJ, 2001, 2003, 2005, 2008
Essen, Germany, 1994
Fair Hope, AL, 1995, 1997
Fishkill, NY, 2002 – 2004, 2007
Guelph, Ontario, 1995
Huntsville, AL, 1999
Las Vegas, NV, 2001, 2003
Madison, WI, 1991 - 2007
Milwaukee, WI, 1990, 1999
Minneapolis, MN, 2005, 2007
Montgomery, AL, 1999, 2000
Niceville, FL, 2006
Portland, OR, 1989, 1992
Portland, ME, 1994
Seattle and Olympia, WA, 2003
Singapore, 1991
Syracuse, NY, 2002, 2003
St. Paul, MN, 1993
Vancouver, BC, 2003

Bioretention Control Practices: Birmingham, AL, 1993 – 1995
Madison, WI, 2005 – 2007

Construction Site Erosion Control: Birmingham, AL, 1989 – 2005
Guntersville, AL, 2003
Mobile, AL 2003, 2005

Detention Pond Design: Albany, NY, 2008
Birmingham, AL, 1989 - 1997
Boston, MA, 1993
Chicago, IL, 1998
Edison, NJ, 2001, 2003
Fishkill, NY, 2002, 2004, 2006, 2007
Guelph, Ontario, 1995
Las Vegas, NV, 2001, 2003
Madison, WI, 1991 – 2006
New York City, 2001
Portland, OR, 1993
Portland, ME, 1994
Rochester, NY, 2001
Syracuse, NY, 2001
St. Paul, MN, 1993 - 1998

PE Exam Review: Birmingham, AL, 1988 - 1993
FE Exam Review: Tuscaloosa, AL, 2002

University Committee Assignments and other Intramural Activities:

School of Engineering Service:
ABET Accreditation Committee

Computer Network Committee
Strategic Planning Committee
Faculty Affairs Committee
Academic Misconduct Advisory Panel
Nonacademic Discipline Committee
Selected speaker for 1999 UAB Day for perspective engineering students
EGR100 Pre-College Summer Program keynote speaker, 1990
Selection committee for Presidential Award for Excellence in Teaching
Faculty advisor to student chapter of the American Water Resources Association (joint with Univ. of Alabama, Tuscaloosa and UAB campuses) (first place national chapter for 1997)
Faculty advisor to student chapter of the Water Environment Federation
Graduate Program Committee Chair

University Service:

Director, Environmental Institute, UA, 2004 – present.
Research Grants Committee, UA, 2006 – present.
Institutional Biological Safety Committee, UA, 2004 – present.
Developed new Departmental Honors Program, UAB, approved February 1999.
Developed new Ph.D. program in Environmental Health Engineering, UAB, approved December 1996.
Honors Council, 1997 – 2002.
UAB Faculty Senate, 1996 - 1997.
9 and 12 Month Conversion Committee, 1996.
Graduate Student Research Day Committee, 1996.
EARTH Center Executive Board, 1994 - 1995.
Center for Telecommunications, Director of Environmental Factors, UAB, 1994 - 2001.
Southern Association of Colleges and Schools Self-Study accreditation committee for professional and graduate schools, 1993.
Minority Initiative for High School Students Program mentor, 1992 – 1997.
UAB Summer Research Program mentor, 1995 – 2001.
Howard University/NIOSH/MOTTEP Program mentor, 2000.
National Institute of Health Summer Program mentor, 1996, 2000, 2001.
Coca-Cola Summer Scholars program mentor, 1993 – 1995.
Chemical Safety Committee, 1993 – 1996.
EPSCoR statewide Energy and the Environment Director, 1992 - 1994.
Teacher Education Council (School of Education), 1990 - 2001.
Task Force on Quality of Teaching, School of Arts and Humanities, 1994.
Environmental Education Committee, 1990 - 2001.
Summer Scholar Program mentor, 1990.

Office of Technology Assessment, US Congress, Review of Water Resources Models for Use by Federal Agencies, 1980-81
Analysis of Agricultural Development in Upper St. Johns River Basin, 1981
Breedlove Associates, Hydrologic Modeling of Phosphate Mines, 1981-82
Water and Air Research, River Basin Modeling, Lake Destratification, 1981-82
Paul Larsen Associates, Flooding in South Dade County, 1984
CH2M-Hill, Recharge/Recycling for the Peace River Water Supply, 1983-84
Orange County, Florida, Waste Load Allocation Study, 1984
Tennessee Eastman Company, SWMM Seminar, 1985
Citrus County, Florida, Review of Small Hydropower Development, 1986
Holland and Knight, Peace River Hydrology, 1986-88
Woodward-Clyde, Inc., Nonpoint Source Pollution of San Francisco Bay, 1987-91
Mann and Davis, Flooding of Lake Floyd, Orange County, 1988
Chain of Lakes Property Owners Assn., Lake Kissimmee Hydrology, 1988
West Coast Regional Water Supply Authority, Tampa, FL, Hydrologic Impact of Pumping, 1988-89
International Institute for Hydraulic and Environmental Engineering, Delft, Netherlands, Urban Drainage Workshop, 1988-91
Woodward-Clyde, Inc., EPA Nationwide Nonpoint Source Analysis, 1988-91
Camp, Dresser and McKee, Inc., Review of Urban Drainage Studies, 1989-91
EPA, Review of Urban Nonpoint Source Modeling, 1989-90
Cohen, Milstein and Hausfeld, Pollution Assessment, 1989-90
Rose, Sundstrom and Bentley, Lake Hydrology, 1989-90
Roy F. Weston, Inc., NOAA Nonpoint Source Assessment Review, 1990-91
South Florida Water Management District, Hydrologic Review, 1991
Louis Berger and Assoc., Narragansett Bay CSO Study Review, 1992-93
Woodward-Clyde, Inc., Stormwater Quality Evaluation Review, 1992-93
Camp, Dresser and McKee, Inc., Detroit-Rouge River Review, 1993
Kennedy/Jenks Consultants, Sacramento Stormwater Management Modeling Review, 1994-95
Kent, Ridge and Crawford, Jacksonville Superfund Site Evaluation, 1994-95
McNamee, Porter & Seeley, CSO Impact Modeling Review, Lake St. Clair, MI, 1994
Woodward-Clyde, Inc., Stormwater Modeling Review, Eugene, 1995-98
Camp, Dresser and McKee, Inc., Massachusetts NPS Model Review, 1996
Environmental Protection Agency, Planning for EPA Modeling Activities, 1997-99
Phillip Williams and Associates, Johnson Creek Modeling, 1999
University of Georgia, SWMM and TMDL Modeling, 1999
Hardin-Davis, HSPF Modeling Review, 2003
GeoSyntec Consultants, Salt Water Marsh Modeling, 2004
Brake Pad Institute, Evaluation of SF Bay Cu loadings, 2004-07
TetraTech, CSO modeling in Louisville, 2005-06.
University of Florida, Bird hazards at airports, 2006.
Water Environment Research Foundation, Stormwater Modeling Project Review, 2007.

FIELDS OF SPECIALIZATION

Urban hydrology and stormwater management
Engineering hydrology
Pollutant transport
Nonpoint source water quality control
Mathematical modeling of surface water quantity and quality

Application of hydrology and hydrodynamics to environmental problems

PROFESSIONAL ACTIVITIES

Registration

Professional Engineer, State of Florida

Professional Societies

Life Member, American Society of Civil Engineers
Diplomate, American Academy of Water Resources Engineers
Member, ASCE Environmental and Water Resources Institute
Member, American Geophysical Union
Member, International Association for Hydraulic Research
Member, American Water Resources Association
Member, Tau Beta Pi

Committees

Member, Watershed Council, ASCE EWRI, Chair 1999-00
Member, Awards Committee, ASCE EWRI, 1999-03, 2007-2010
Chair, Executive Committee, ASCE Water Resources Engineering Division, 1998-99
Member, ASCE Urban Water Resources Research Council, Chair 1990-92
Member, ASCE-USGS Task Committee on Urban Gaging Networks, 1990
Member, ASCE Committee on Mgmt. Group D Reorganization, 1992-93
Member, ASCE Planning Committee for 2009 Joint ASCE-IAHR Congress
University of Florida Science Representative, Intercollegiate Alliance for Undergraduate Education, 1990-91
Member, City of Corvallis, Stormwater Planning Committee, 1998-02
Member, National Research Council, Committee on the Causes and Management of Coastal Eutrophication, 1998-00
Member, National Research Council, Committee on Restoration of the Greater Everglades Ecosystem, 1999-05
Member, National Research Council, Committee to Review Florida Keys Carrying Capacity Study, 2001-02. Member follow-up review committee for The Nature Conservancy, 2002-03.
Co-chair, Ninth International Conference on Urban Drainage, Portland, OR, ASCE/IAHR/IWA, September 2002.
Working Group Member, Implementation of Total Maximum Daily Loads (TMDLs) through Municipal Separate Storm Sewer System (MS4) Permits in Oregon, Oregon Dept. of Environmental Quality, 2002.
Panel Member for Engineering Awards, EPA Science Achievement Awards, 1999-2007.
Adjunct Advisor, Independent Science Panel, Washington State Department of Ecology, Review of *Stormwater Management Manual for Western Washington*, 2003.
Project Advisor, University of Illinois Stormwater Project, 2004.
Member, ASCE EWRI Conference Planning Committee for IAHR International Conference, Vancouver, BC, 2009.
Chair, National Research Council, Committee on Independent Scientific Review of Everglades Restoration Progress, 2004-06; member 2006-2008.
Chair, Engineering Conferences International, Intelligent Modeling to Improve Stormwater Management, Arcata, CA, July 2007.

Honors and Awards

National Science Foundation Trainee, 1965-66
Lorenz G. Straub Award from University of Minnesota for “Outstanding Thesis in Hydraulic Engineering,” 1969
ASCE Hilgard Hydraulic Prize for technical paper in Hydraulics, 1973
1981-1982 President, Gainesville Branch ASCE
Outstanding Dept. of Env. Eng. Sci. Professor, 1982 (by student vote)
Florida Engineering Society, Outstanding Technical Achievement Award, (for EPA Storm Water Management Model), North Central Chapter Award, 1984, FES State Award, 1985.
Engineer of the Year, 1986, Gainesville Branch, ASCE
Eminent Speaker and Invited Lecture Tour, Institution of Engineers, Australia, February 1992
Invited Speaker and Lecturer, Kyoto and Tokyo Universities, October 1998
Kennison Lecturer, Boston Society of Civil Engineers, May 2000
Oregon Section ASCE Engineer of the Year, September 2005
ASCE Life Member, January 2006
Invited lecturer, University of Florida, November 2006
ASCE/EWRI Julian Hinds Award, May 2007

PUBLICATIONS

Books and Book Chapters

Huber, W.C. and J.P. Heaney, “Drainage, Flood Control and Navigation,” Chapter 9 in *Water Resources Atlas of Florida*, E.A. Fernald and D.J. Patton, eds., Florida State University Press, Tallahassee, 1984, pp. 116-121.
Bedient, P.B., W.C. Huber and B.E. Vieux, *Hydrology and Floodplain Analysis*, Prentice-Hall Publishing Co., Upper Saddle River, NJ, First Edition, 1988; Second Edition, 1992; Third Edition, 2002; Fourth Edition, 2008.
Huber, W.C., “Modeling,” Chapter 4 in *Combined Sewer Overflow Pollution Abatement*, Manual of Practice No. FD-17, Water Pollution Control Federation, Alexandria, VA, 1989.
Huber, W.C., “Contaminant Transport in Surface Water,” Chapter 14 in *Handbook of Hydrology*, D.R. Maidment, ed., McGraw-Hill, New York, 1993.
Huber, W.C., “EPA Storm Water Management Model -- SWMM,” Chapter 22 in *Computer Models of Watershed Hydrology*, V.P. Singh, ed., Water Resources Publications, Highlands Ranch, CO, 1995, pp. 783-808.
Donigian, A.S., Jr., Huber, W.C., and T.O. Barnwell, Jr., “Modeling of Nonpoint Source Water Quality in Urban and Nonurban Areas,” Chapter 7 in *Nonpoint Pollution and Urban Stormwater Management*, V. Novotny, ed., Technomic Publishing Co., Inc., Lancaster, PA, 1995, pp. 293-345.
Committee on the Causes and Management of Coastal Eutrophication, *Clean Coastal Waters: Understanding and Reducing the Effects of Nutrient Pollution*, Ocean Studies Board, Water Science and Technology Board, National Research Council, National Academies Press, Washington, DC, 2000. [Contributing author.]
James, W., Huber, W.C., Pitt, R.E., Dickinson, R.E. and W.R.C. James, *Hydrology, A Guide to the Rain, Temperature, Runoff, Combine and Statistics Modules of the USEPA SWMM4*, CHI Publications, Guelph, ON, 2002.
James, W., Huber, W.C., Pitt, R.E., Dickinson, R.E., Roesner, L.A., Aldrich, J.A. and W.R.C. James, *Hydraulics, A Guide to the Extran, Transport, and Storage Treatment Modules of the USEPA SWMM4*, CHI Publications, Guelph, ON, 2002.

- Huber, W.C., Rossman, L.A. and R.E. Dickinson, "EPA Storm Water Management Model, SWMM5," Chapter 14 in *Watershed Models*, V.P. Singh and D.K. Frevert, eds., CRC Press, Boca Raton, FL, 2006.
- James, W., Huber, W.C., Rossman, L.A., Dickinson, R.E., Pitt, R.E., W.R.C. James, W.R.C., Roesner, L.A., and J.A. Aldrich, *User's Guide to SWMM*, CHI Publications, Guelph, ON, 2005.
- Committee on Independent Scientific Review of Everglades Restoration Progress, *Progress Toward Restoring the Everglades, The First Biennial Review – 2006*, Water Science and Technology Board, National Research Council, National Academies Press, Washington, DC, 2007. [W.C. Huber chaired the Committee.]

Technical Journals (Refereed)

- Huber, W.C., Harleman, D.R.F. and P.J. Ryan, "Temperature Prediction in Stratified Reservoirs," *J. Hydraulics Division, Proc. ASCE*, Vol. 98, No. HY4, April 1972, pp. 645-666.
- Perez, A.I., Huber, W.C., Heaney, J.P. and E.E. Pyatt, "Water Quality Model for a Conjunctive Surface-Groundwater System," *Water Resources Bulletin*, Vol. 8, No. 5, October 1972, pp. 900-908.
- Huber, W.C., "Modeling for Storm Water Strategies," *The APWA Reporter*, Vol. 42, No. 5, May 1975, pp. 10-14.
- Bedient, P.B., Huber, W.C. and J.P. Heaney, "Application of a Hydrologic Model for Land Use Planning in Florida," *Water Resources Bulletin*, Vol. 11, No. 3, June 1975, pp. 469-482.
- Bedient, P.B., Huber, W.C. and J.P. Heaney, "Environmental Model of the Kissimmee River Basin," *Journal of Water Resources Planning and Management Division, Proc. ASCE*, Vol. 103, No. WR2, November 1977, pp. 241-256.
- Heaney, J.P., Huber, W.C., Sullivan, R.H. and R. Field, "Nationwide Cost of Controlling Combined Sewer Overflows and Urban Stormwater Discharges," *Journal of Water Pollution Control Federation*, Vol. 51, No. 8, August 1979, pp. 2043-2053.
- Bedient, P.B., Huber, W.C. and J.P. Heaney, "Drainage Density as an Index of Watershed Development," *Journal of Water Resources Planning and Management Division, Proc. ASCE*, Vol. 104, No. IR4, December 1978, pp. 373-387.
- Scholl, J., Heaney, J.P. and W.C. Huber, "Water Quality Analysis of the Halifax River, Florida," *Water Resources Bulletin*, Vol. 16, No. 2, April 1980, pp. 285-293.
- Medina, M.A., Huber, W.C., Heaney, J.P. and R. Field, "River Quality Model for Urban Stormwater Impacts," *Journal of Water Resources Planning and Management Division, Proc. ASCE*, Vol. 107, No. WR1, March 1981, pp. 263-280.
- Medina, M.A., Huber, W.C. and J.P. Heaney, "Modeling Stormwater Storage/Treatment Transients: Theory," *Journal of Environmental Engineering Division, Proc. ASCE*, Vol. 107, No. EE4, August 1981, pp. 781-797.
- Medina, M.A., Huber, W.C. and J.P. Heaney, "Modeling Stormwater Storage/Treatment Transients: Applications," *Journal of Environmental Engineering Division, Proc. ASCE*, Vol. 107, No. EE4, August 1981, pp. 799-816.
- Ammon, D., Huber, W.C. and J.P. Heaney, "Wetlands' Use for Water Management in Florida," *Journal of Water Resources Planning and Management Division, Proc. ASCE*, Vol. 107, No. WR2, October 1981, pp. 315-327.
- Goforth, G.F., Heaney, J.P. and W.C. Huber, "Comparison of Basin Performance Modeling Techniques," *Journal of Environmental Engineering, ASCE*, Vol. 109, No. 5, October 1983, pp. 1082-1098.
- Heaney, J.P. and W.C. Huber, "Nationwide Assessment of Urban Runoff Impact on Receiving Water Quality," *Water Resources Bulletin*, Vol. 20, No. 1, February 1984, pp. 35-42.

- Aldrich, J.A. and W.C. Huber, Discussion of "Transient Mixed-Flow Models for Storm Sewers" by C.S. Song et al., *Journal of Hydraulic Engineering, ASCE*, Vol. 111, No. 3, March 1985, pp. 555-557.
- Huber, W.C., Discussion of "Estimating Urban Time of Concentration," by R.H. McCuen et al., *Journal of Hydraulic Engineering, ASCE*, Vol. 113, No. 1, January 1987, pp. 122-124.
- Maalel, K., Huber, W.C. and J.P. Heaney, "Generalization of an Optimal Decision Rule to the Box-Cox Transformation for ARMA Models," *Hydrosoft*, Vol. 1, No. 3, 1988, pp. 152-154.
- Nix, S.J., Heaney, J.P. and W.C. Huber, "Suspended Solids Removal in Detention Basins," *Journal of Environmental Engineering, ASCE*, Vol. 114, No. 6, December 1988, pp. 1331-1343.
- Miller, W.L., Foran, J.A., Huber, W.C., Davidson, J.M., Moye, H.A. and D.P. Spangler, "Ground Water Monitoring for Temik (Aldicarb) in Florida," *Water Resources Bulletin*, Vol. 25, No. 1, February 1989, pp. 79-86.
- Marsalek, J., Barnwell, T.O., Geiger, W., Grottker, M., Huber, W.C., Saul, A.J., Schilling, W., and H.C. Torno, "Urban Drainage Systems: Design and Operation," *Water Science and Technology*, Vol. 27, No. 12, 1993, pp. 31-70.
- O'Loughlin, G., Huber, W.C., and B. Chocat, "Rainfall-Runoff Processes and Modelling," *Journal of Hydraulic Research*, Vol. 34, No. 6, 1996, pp. 733-751.
- Huber, W.C., Nelson, P.O., Eldin, N.N., Williamson, K.J., and J.R. Lundy, "Environmental Impact of Runoff from Highway Construction and Repair Materials: Project Overview," *Transportation Research Record 1743*, National Academies Press, Washington, DC, 2001, pp. 1-9.
- Nelson, P.O., Williamson, K.J., Azizian, M.F., Thayumanavan, P., Huber, W.C., and N.N. Eldin, "Environmental Impact of Runoff from Highway Construction and Repair Materials: Screening and Evaluation Methodology," *Transportation Research Record 1743*, National Academies Press, Washington, DC, 2001, pp. 16-24.
- Schmitt, T.G. and W.C. Huber, "The Scope of Integrated Modelling: System Boundaries, Sub-systems, Scales and Disciplines," *Water Science and Technology*, Vol. 54, No. 6-7, 2006, pp. 405-413.
- Huber, W.C., Wells, W.J., Besaw, I.K. and M.A. Leisenring, "Hydrologic Regionalisation Impacts on Wet-weather Control Selection," *Water Science and Technology*, Vol. 54, No. 6-7, 2006, pp. 485-492.

Conference Proceedings Edited

- Strecker, E.W. and W.C. Huber, eds., *Global Solutions for Urban Drainage*, Proc. Ninth International Conference on Urban Drainage, Portland, Oregon, September 2002, American Society of Civil Engineers, Reston, VA, 2002 (CD-ROM). Similar citation for printed volume of Extended Abstracts.

Conference Proceedings Papers (Refereed)

- (Asterisk means only the abstract is refereed. Final, completed paper subject to minimal or no review).

- Harleman, D.R.F., Holley, E.R. and W.C. Huber, "Interpretation of Water Pollution Data from Tidal Estuary Models," Proc. Third International Conference on Water Pollution Research, Sec. III, Paper No. 3, Munich, Germany, September 1966, Pergamon Press, pp. 1-11.
- Harleman, D.R.F. and W.C. Huber, "Laboratory Studies on Thermal Stratification in Reservoirs," Proc. of the ASCE Specialty Conference on Current Research into the Effects of Reservoirs on Water Quality, Portland, Oregon, January 1968, Vanderbilt University, Department of Env. and Water Res. Eng., Tech. Rept No. 17, Nashville, TN, pp. 1-29.*

- Huber, W.C., Russell, L.W. and E.E. Pyatt, "Routing Model for Combined Sewage," Preprint No. 1108, ASCE National Water Resources Engineering Meeting, Memphis, TN, January 1970, 24 pp.*
- Huber, W.C., Heaney, J.P. and S.M. Hasan, "The EPA Storm Water Management Model: A Current Overview," in Combined Sewer Overflow Seminar Papers, EPA-670/2-73-077, Environmental Protection Agency, Cincinnati, OH, November 1973, pp. 181-216.*
- Huber, W.C., Medina, M.A., Hasan, S.M. and J.P. Heaney, "The EPA Storm Water Management Model (SWMM) - An Introduction," Proc. Storm-Water Management Workshop, Gainesville, M.P. Wanielista, ed., Florida Technological University, Orlando, February 1975, pp. 199-226.*
- Huber, W.C. and J.P. Heaney, "The Storm Water Management Model" in Proc. Applications of Stormwater Management Models, F.A. DiGiano and P.A. Mangarella, eds., EPA-670/2-75-065, (NTIS PB-247163), Environmental Protection Agency, Cincinnati, OH, June 1975, pp. 242-246.*
- Doyle, J.R., Heaney, J.P., Huber, W.C. and S.M. Hasan, "Efficient Management of Urban Storm Water Runoff," Proceedings, EPA Conference on Environmental Modeling and Simulation, Cincinnati, Ohio, April 1976, W.R. Ott, ed., EPA-600/9-76-016 (NTIS PB-257142), Cincinnati, OH, July 1976, pp. 139-143.
- Heaney, J.P., Huber, W.C., Murphy, M.P. and S.M. Hasan, "Generalized Method for Evaluating Urban Storm Water Quality Management Storage/Treatment Alternatives," Proceedings, EPA Conference on Environmental Modeling and Simulation, Cincinnati, April 1976, W.R. Ott, ed., EPA-600/9-76-016 (NTIS PB-257142), Cincinnati, OH, July 1976, pp. 358-361.
- Bedient, P.B., Huber, W.C. and J.P. Heaney, "Modeling Hydrologic Land Use Interactions in Florida," Proceedings, EPA Conference on Environmental Modeling and Simulation, Cincinnati, April 1976, W.R. Ott, ed., EPA-600/9-76-016 (NTIS PB-257142), Cincinnati, OH, July 1976, pp. 362-366.
- Huber, W.C. and J.P. Heaney, "Introduction to the EPA Stormwater Management Model (SWMM)," in Proceedings of Applications of Stormwater Management Models-1976, DiGiano, F.A., Adrian, D.D. and P.A. Mangarella, eds., EPA-600/2-77-065 (NTIS PB-265321), Environmental Protection Agency, Cincinnati, OH, March 1977, pp. 34-73.*
- Medina, M.A., Huber, W.C. and J.P. Heaney, "Impact of Urban Water Pollution Control on Receiving Water Quality," Preprint No. 2859, ASCE Spring Convention, Dallas, April 1977, 29 pp.*
- Ammon, D.C., Huber, W.C. and J.P. Heaney, "Multipurpose Storage Treatment Analysis," *Proceedings, Stormwater Retention/Basins Seminar*, Y.A. Yousef, ed., Report ESE1. 77-9, Florida Technological University, Orlando, July 1977, pp. 70-89.*
- Huber, W.C., "Use of the EPA SWMM for Continuous Simulation," *Proc. Symposium on Urban Watershed Management: Flooding and Water Quality*, Rice University, May 1978, Rice University Studies, Houston, Vol. 65, No. 1, Winter 1979, pp. 43-51.
- Huber, W.C. and J.P. Heaney, "Urban Rainfall-Runoff-Quality Data for Hydrologic Model Testing and Urban Runoff Characterization," in *Urban Storm Drainage, Proceedings of the International Conference* held at the University of Southampton, April 1978, P.R. Helliwell, ed., Pentech Press, London and J. Wiley, New York, 1978, pp. 138-148.
- Huber, W.C., Heaney, J.P. and H.C. Torno, "Computer Impact on Environmental Runoff and Wastewater Studies," Preprint 3106, ASCE Fall Convention, San Francisco, CA, October 1977, 30 pp.*
- Ammon, D.C., Huber, W.C. and J.P. Heaney, "Use of Wetlands for Water Resource Management in Florida's Kissimmee River Basin," Preprint 3394, ASCE Fall Convention, Chicago, IL, October 1978, 17 pp.*

- Huber, W.C., Nix, S.J., Peltz, W.A. and J.P. Heaney, "Overview of November 1977 Release of SWMM," in *Urban Stormwater Management Workshop Proceedings*, R. Field, ed., EPA-600/9-78-017 (NTIS PB-288801), Environmental Protection Agency, Cincinnati, OH, August 1978. pp. 33-39.*
- Nix, S.J., Heaney, J.P. and W.C. Huber, "Revised SWMM Storage/Treatment Block," *Proc., Storm Water Management Model Users Group Meeting*, Annapolis, Maryland, November 1978, H.C. Torno, ed., EPA-600/9-79-003 (NTIS PB-290742/6BE), Environmental Protection Agency, Washington, DC, November 1978, pp. 1-27.*
- Heaney, J.P., Huber, W.C. and M. Lehman, "National Assessment of Receiving Water Impact from Urban Stormwater Pollution," *Proceedings, National Conference of Urban Stormwater and Combined Sewer Overflow-Impact on Receiving Water Bodies*, Orlando, Florida, November 1979, Yousef, Y.A., Wanielista, M.P., McLellon, W.M. and J.S. Taylor, eds., EPA-600/9-80-056 (NTIS PB81-155426), Environmental Protection Agency, Cincinnati, OH, December 1980, pp. 407-436.
- Huber, W.C., Discussion in *The Design Storm Concept*, G. Patry and M.B. McPherson, eds., EP 80-R-8, GREMU-79/02, Civil Engineering Department, Ecole Polytechnique de Montreal, Montreal, Quebec, December 1979, pp. 58-59.*
- Huber, W.C., "Urban Wasteload Generation by Multiple Regression Analysis of Nationwide Urban Runoff Data," in *Workshop on Verification of Water Quality Models*, R.V. Thomann and T.O. Barnwell, eds., EPA-600/9-80-016, Environmental Protection Agency, Athens, GA, April 1980, pp. 167-174.
- Huber, W.C. and J.P. Heaney, "Operational Models for Stormwater Quality Management," in *Environmental Impact of Nonpoint Source Pollution*, M.R. Overcash and J.M. Davidson, eds., Ann Arbor Science Publishers, Ann Arbor, MI, 1980, pp. 397-444.
- Huber, W.C. and J.P. Heaney, "The USEPA Storm Water Management Model, SWMM: A Ten Year Perspective," in *Urban Stormwater Hydraulics and Hydrology*, Proceedings of the Second International Conference on Urban Storm Drainage, University of Illinois, Urbana, June 1981, B.C. Yen, ed., Water Resources Publications, Littleton, CO, 1982, pp. 247-256.
- Huber, W.C. and P.L. Brezonik, "Water Budget and Projected Water Quality in Proposed Man-Made Lakes Near Estuaries in the Marco Island Area, Florida," *Proc. of the National Symposium on Freshwater Inflow to Estuaries*, R.D. Cross and D.L. Williams, eds., FWS/OBS-81/04, US Department of Interior, Fish and Wildlife Service, Washington, DC, October 1981, Vol. I, pp. 241-251.
- Huber, W.C. and D.F. MacIntyre, "Receiving Water Quality Data Base for Model Testing," *Proceedings, Stormwater and Water Quality Model Users Group Meeting*, Dept. of Civil Engineering, University of Ottawa, Ontario, October 1982, pp. 203-211.*
- Huber, W.C., "The EPA Storm Water Management Model: Documentation and Maintenance," *Proc. of the Conf. on Frontiers in Hydraulic Engineering*, Cambridge, MA, Hydraulics Division, ASCE, New York, August 1983, pp. 312-317.
- Huber, W.C., Gancarz, D.H. and R.E. Dickinson, "Apple SWMM -- A Possibility?," *Proc. ASCE Engineering Foundation Conf. on Emerging Computer Techniques in Stormwater and Flood Management*, Niagara-on-the-Lake, Ontario, November 1983, ASCE, New York, pp. 366-372.
- Maalel, K. and W.C. Huber, "SWMM Calibration Using Continuous and Multiple Event Simulation," *Proceedings of the Third International Conference on Urban Storm Drainage*, Chalmers University, Gothenburg, Sweden, June 1984, Vol. 2, pp. 595-604.
- Huber, W.C., Discussion of papers on "Special Model Studies," *Proceedings of the Third International Conference on Urban Storm Drainage*, Chalmers University, Gothenburg, Sweden, June 1984, Vol. 4, pp. 1564-1577.*

- Gancarz, D.H. and W.C. Huber, "The SWMM Storage/Treatment Block for the IBM-PC," *Proceedings of the Conference on Stormwater and Water Quality Management Modeling*, Burlington, Ontario, E.M. James and W. James, eds., Dept. of Civil Engineering, McMaster University, Hamilton, Ontario, September 1984, pp. 53-58.*
- Hicks, C.N., Huber, W.C. and J.P. Heaney, "Simulation of Possible Effects of Deep Pumping on Surface Hydrology Using HSPF," *Proceedings of the Stormwater and Water Quality Management Modeling User's Group Meeting*, Gainesville, Florida, EPA/600/9-85/016 (NTIS PB85-228302/AS), Environmental Protection Agency, Athens, GA, January 1985, pp. 144-156.*
- Huber, W.C., "Deterministic Modeling of Urban Runoff Quality," in *Urban Runoff Pollution*, Proceedings of the NATO Advanced Research Workshop on Urban Runoff Pollution, Montpellier, France, August 1985, H.C. Torno, J. Marsalek, and M. Desbordes, eds., Springer-Verlag, New York, Series G: Ecological Sciences Vol. 10, 1986, pp. 167-242.
- Gagliardo, V.A. and W.C. Huber, "A Subsurface Drainage Module for the SWMM Runoff Block," *Proceedings of the Conference on Stormwater and Water Quality Management Modeling*, Toronto, Ontario, E.M. James and W. James, eds., Computational Hydraulics Report R149, Dept of Civil Engineering, McMaster University, Hamilton, Ontario, December 1985, pp. 1-7.*
- Huber, W.C., Cunningham, B.A. and K.A. Cavender, "Use of Continuous SWMM for Selection of Historic Design Events in Tallahassee," *Proceedings of Stormwater and Water Quality Model Users Group Meeting*, Orlando, Florida, EPA/600/9-86/023 (NTIS PB87-117438/AS), Environmental Protection Agency, Athens, GA, March 1986, pp. 295-321.*
- Huber, W.C., Cunningham, B.A. and K.A. Cavender, "Continuous SWMM Modeling for Selection of Design Events," in *Urban Drainage Modelling*, Proceedings of the International Symposium on Comparison of Urban Drainage Models with Real Catchment Data, Dubrovnik, Yugoslavia, C. Maksimovic and M. Radojkovic, eds., Pergamon Press, New York, April 1986, pp. 379-390.
- Huber, W.C., "Modeling Urban Runoff Quality: State-of-the-Art," *Proceedings of Conference on Urban Runoff Quality, Impact and Quality Enhancement Technology*, B. Urbonas and L.A. Roesner, eds., Engineering Foundation, ASCE, New York, June 1986, pp. 34-48.
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- Oregon State University, GeoSyntec Consultants, University of Florida, University of Colorado and Low Impact Development Center, *Highway BMP Evaluation Methodology*, Task 2/3 Report to National Cooperative Highway Research Program, Project 25-20, Oregon State University, December 2003. 149 pp.
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- Oregon State University, GeoSyntec Consultants, University of Florida, University of Colorado and Low Impact Development Center, *Hydrologic Screening for Task 5 BMP and LID Regionalization: Planning the Analysis, Addendum A: SWMM Simulation Parameters*, Technical Memorandum No. 3-A, NCHRP Project 25-20, Oregon State University, October 2004. 15 pp.
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- University of Florida, University of Colorado, Oregon State University, GeoSyntec Consultants, and Low Impact Development Center, *Hydrologic Screening for Task 5 BMP and Task L2.2 LID Regionalization: Scheme 1b Results for Infiltration-Type BMPs*, Technical Memorandum No. 6, NCHRP Project 25-20, Oregon State University, January 2005. 45 pp.

RESEARCH

(PI = Principal Investigator, Co-PI = Co-Principal Investigator, Co-I = Co-Investigator)

Current Research

Decentralized Stormwater Controls for Urban Retrofit and Combined Sewer Overflow Reduction, Co-PI, Water Environment Research Foundation through subcontract from Low Impact Development Center, 2004-2005 (\$29,500). Phase II: 2006-2007 (\$24,000)

Prior Research

- Storm Water Management Model, Co-I, FWQA, 1969-1970 (\$125,000)
- Prediction of Solar and Atmospheric Radiation for Energy Budget Studies of Lakes and Streams, PI, OWRR, 1969-1970 (\$10,800)
- Decision Model for Stormwater Management, Co-PI, EPA, 1971-1973 (\$105,000)
- A Water Quality Control Strategy for a Conjunctive Surface-Groundwater System, PI, EPA, 1970-1971 (\$48,000)
- Comprehensive Procedure for Socio-Economic Analysis in Upper St. Johns River Basin, Co-I, Corps of Engineers, 1972-1973 (\$60,000)
- Data Collection Strategy for Water-Quality Studies, Co-PI, NSF, 1972-1974 (\$45,000/yr)
- An Environmental Study of the Gordon River, Naples, Florida, Co-I, Collier County, 1972 (\$5,000)
- Environmental Resources Management Studies in the Kissimmee River Basin, Co-PI, Central and Southern Florida Flood Control District, 1973-1975 (\$76,000)
- Nationwide Characterization of Stormwater Discharges (with American Public Works Association), Co-PI, EPA, 1973-1976 (\$100,000)

Decision Model for Stormwater Management, Co-PI, EPA, 1973-1975 (\$100,000)
Analysis of Storm Water Recharge Basin, Co-I, OWRR, 1974-1976 (\$32,000)
Establishment of an Urban Rainfall-Runoff-Quality Data Base, Co-PI, EPA, 1974-1975 (\$48,000), 1976-1977 (\$14,000), 1977-1978 (\$50,000)
Impact on the Great Lakes of Wet Weather Flows from Urban Areas in Canada, Co-PI, Environment Canada, 1974-1975 (\$25,000)
Urban Stormwater Management Model, Co-PI, EPA, 1975-1977 (\$120,000) and Urban Runoff Analysis Methodology, 1976 (\$25,000)
Model Watershed-Water Quality Management Program for the Chandler Slough Area, Kissimmee River Basin, Co-PI, Central and Southern Florida Flood Control District, 1976-1977 (\$28,000)
Multipurpose Stormwater Management, Co-PI, EPA, 1977 (\$59,000)
Urban Rainfall-Runoff-Quality Data Base, Co-PI, EPA, 1978-1979 (\$51,000)
General Methodology for Evaluating Urban Stormwater Quality Management Alternatives, Co-PI, EPA 1978-1980 (\$73,000)
Assessment of Receiving Water Impacts from Urban Stormwater Pollution, EPA, Co-I, 1978-1979 (\$79,000)
Evaporation Estimates Based on Surface Temperature and Net Radiation, Co-I, OWRT, 1979-1981 (\$18,000)
Urban Rainfall-Runoff-Quality Data Base, PI, EPA, 1980-1982 (\$20,000)
Dynamics of Nutrient Cycles in Lake Okeechobee: Development of Spatially Resolved Models for Nitrogen and Phosphorus, Co-I, South Florida Water Management District, 1979-1980 (\$47,000)
Hogtown Creek Environmental Study, Co-PI, Florida Department of Environmental Regulation and UF Engineering and Industrial Experiment Station, 1980 (\$20,000)
Receiving Water Quality Data Base and Model Review, PI, EPA, 1980-1983 (\$94,000)
Development of Classification Systems for Florida Lakes, Co-PI, Florida Department of Environmental Regulation, 1981-1982 (\$65,000)
Water Demand During the 1981 Drought in South Florida, Co-I, South Florida Water Management District, 1982-1983 (\$39,000)
Computerized Data Base Integration for a Major Command Environmental Planning Office, Co-PI, U.S. Air Force, 1983 (\$61,000)
Impacts of Development on the Water Resources of Cypress Creek North of Tampa, Co-PI, Southwest Florida Water Management District, 1984-1986 (\$113,000)
Florida Temik Study, Co-I, EPA, 1984-1985 (\$341,800)
Storm Water Management Model: Maintenance and User Support, PI, EPA, 1984-1987 (\$94,700)
Design Procedure to Estimate Pollutant Loadings from Highway Stormwater Runoff, PI, FHWA (Subcontract through Woodward-Clyde Inc.), 1984-1987 (\$30,000)
Computer-Aided Engineering Approach to Urban Flood Hazard Management in Florida, PI, USGS, 1985-1987 (\$34,400)
Multi-purpose Management of Mosquito Control Impoundments in Coastal Areas, Co-I, Sea Grant, 1985-1986 (\$29,000)
Phosphorus Dynamics in Lake Okeechobee, Co-PI, South Florida Water Management District, 1988-1991 (\$100,000 out of \$1,500,000)
Formulation of New Hydrologic Methodologies, PI, Florida DOT, 1988-1990 (\$100,000)
State of the Art Review for Urban Stormwater and Combined Sewer Overflow Modeling Needs, Co-PI, EPA, 1989-1991 (\$27,500)

- Modeling Assistance for Barton Creek Watershed, PI, Espey-Huston and Associates, 1990-1991 (\$14,000)
- Review of Water Quality Standards for the Suwannee River Basin, Co-PI, Suwannee River Water Management District, 1990-1991 (\$100,000)
- Stormwater Runoff from Landfills, Co-PI, Florida Center for Solid Wastes, 1990-1991 (\$45,000)
- Tualatin River Basin Study, Co-I, Oregon Dept. of Environmental Quality, 1992-1993 (\$204,000)
- SWMM-ARC/INFO AML Development, PI, Delaware Dept. of Natural Resources and Environmental Quality, 1993-1994 (\$100,000)
- Environmental Impact of Construction and Repair Materials on Surface and Ground Waters, Co-PI, National Cooperative Highway Research Program, 1994-2000 (\$1,355,373)
- Evaluate/Improve SWMM Modeling Techniques for Stormwater, Sanitary Sewer Overflow, and Combined Sewer Overflow Management, PI, Environmental Protection Agency, 1997-2001 (\$49,000)
- SWMM Water Quality Enhancements for Coastal Areas, PI, University of New Orleans (funds from Environmental Protection Agency STAR grant), 2000-2001 (\$76,354)
- Using GIS Databases to Estimate Stormwater Runoff, Co-I, US Geological Survey, Oregon Water Resources Research Institute, 2000-2001 (\$6,615)
- Sustaining Multiple Functions for Urban Wetlands, Co-I, National Science Foundation, 2001-2003 (\$70,000)
- Optimization of Urban Sewer Systems During Wet-Weather Periods, Co-PI, Environmental Protection Agency through subcontract from University of Colorado, 2001-2004 (\$54,793)
- Environmental Impact of Construction and Repair Materials on Surface and Ground Waters – Outreach and Training, Co-PI, National Cooperative Highway Research Program, 2002-2004 (\$99,957)
- Water Quality Facility Investigation, PI, Oregon Department of Transportation, 2002-2005 (\$94,931)
- Technical Services for Storm Water Management Model (SWMM) Redevelopment, PI, Environmental Protection Agency, 2002-2005 (\$25,000)
- Evaluation of Best Management Practices for Highway Runoff Control, PI, National Cooperative Highway Research Program, 2002-2006 (\$699,826)
- Critical Assessment of Stormwater Treatment and Control (BMP) Selection Issues, Co-PI, Water Environment Research Foundation through subcontract from GeoSyntec, 2003-2005 (\$52,000)

ATTACHMENT 3

November 16, 2007

Bob Gearheart, Ph.D.
Humbolt State
1 Harpst St., House 18
Arcata, CA 95521

SUBJECT: Request for Interest in Participating on an Expert Panel for Design Storm
and BMP Selection at the Santa Susana Field Laboratory

Dear Dr. Gearheart:

The purpose of this letter is to inquire about your willingness to participate as an Expert Panel member in overseeing the selection and design of engineered natural treatment systems (ENTS) to meet NPDES permit specified numerical limits for stormwater run-off at Boeing's Santa Susana Field Laboratory (SSFL) located in Southern California. The Facility is a 2,800 acre site that includes a combination of undeveloped land with unlined ephemeral streambeds and developed areas that many of which have surficial and subsurface contamination due to past experimental testing activities in support of the U.S Space program and the U.S. Department of Energy's research in nuclear power systems. The following links will provide more information on the past activities at SSFL:

Boeing Website

http://www.boeing.com/aboutus/environment/santa_susana/programs.html

Cal-EPA Dept of Toxic Substance Website

<http://www.dtsc-ssfl.com/>

U.S. Department of Energy Website

<http://www.ete.energy.gov/>

SSFL has an NPDES permit that regulates stormwater discharges issued by the Regional Water Quality Control Board – Los Angeles Region (Regional Board). The permit contains enforceable numeric effluent limits based on California Department of Health Services drinking water Maximum Contaminant Levels (MCLs), California Toxics Rule criteria, and Total Maximum Daily Load waste load allocations for the various receiving streams that SSFL discharges to. Since 2004, the facility has achieved a 97% compliance rate with the numeric limits, but the NPDES permit requires compliance at all times.

At their public hearing on November 1, 2007, the Regional Board adopted modifications to the permit (with changes to the monitoring program) and approved a Cease and Desist order that will require, among other things, an expert panel to be formed that will have a

twofold mission. The first is to oversee the development of a site specific design storm¹ to be proposed for the use in the sizing of existing and new treatment systems as well as assessing compliance, and the second is to provide technical expertise in the selection and design of engineered natural treatment systems (ENTS) to meet the water quality limits in the permit. The Expert Panel will be comprised of three to five scientists or engineers with expertise in the area of natural treatment of stormwater discharges and/or stormwater hydrology and it is expected that final selection of the panel members will be made in consultation with the staff of the Regional Board.

A copy of the tentative draft permit and Cease and Desist Order (CDO) may be found at: http://www.waterboards.ca.gov/losangeles/html/permits/tentative_order/Individual/Boeing/theBoeing.html.

Due to the strict limits and requirements of the permit, including a short implementation schedule, there will be significant challenges in selecting and designing the ENTS. Boeing is working with a team that includes Geosyntec Consultants, Montgomery-Watson Harza, and Flow-Science to prepare preliminary conceptual designs of proposed ENTS for review by the Expert Panel. It is anticipated that the panel would review and assist with the revision of the conceptual plans to come up with the best technical solution for meeting the permit limits taking into account environmental considerations as well as sustainability.

The Boeing Company has agreed to donate the land to the State of California for parkland after clean-up activities are completed, so the implemented ENTS must work on a long-term sustainable basis and fit within the natural setting of the site. ENTS are the preferred approach by Boeing, although it is acknowledged that one of the key challenges will be selecting and designing ENTS that will have reasonable likelihood of achieving the NPDES permit numeric effluent limits, which include TCDD and Mercury near lab detection limits.

The schedule will be fast-track. Pursuant to the draft permit and CDO, Boeing is required to submit a work-plan to the Regional Board by December 15th that includes a schedule of when activities are to be performed and the expected completion dates as well as a schedule for the Expert Panel activities. The goal is to install the ENTS during the summer of 2008. The draft CDO requires that the systems will be operational and able to meet permit limits by June 10, 2009, with a final report on the results of the BMP implementation and evaluation and final recommended BMPs due August 15, 2009.

The panel may also be asked to assist with post-construction review of the ENTS as well as oversight of a monitoring and evaluation program that would determine if potential alterations to the ENTS (adaptive management) are warranted.

¹ For reference, Regional board staff originally suggested that the design storm from the Los Angeles River Trash TMDL be used at the site – i.e., the 1-year 24-hour storm event, or 2.3 inches at the site. This design storm was used for sizing the existing stormwater filtration systems currently in use at the site.

It is expected that the majority of the effort would occur between December 2007 and June 2008, with additional effort at a reduced intensity after that. As the work-plan has not been prepared, it is difficult to determine the number of meetings, but it could include monthly in-person meetings to visit the site, review plans and designs, with additional conference call meetings. It would also involve review time outside of the meetings. It is expected that there will be a public involvement portion of this plan and as such the panel may be asked to participate in questions and answers on the planned approach.

If you are selected to participate on the panel, your efforts would be compensated on an hourly basis and expenses would be reimbursed. We believe the Regional Board staff intends to keep the panel to 3 to 5 experts with some overlapping and distinct areas of expertise. Selection will be based on the concept of having members with one or more areas of expertise in the various aspects of this project so that each area will be adequately addressed. As such, it is not expected that each member be an expert in all areas of this project rather that just each be able to serve as an expert in one area (or more) and be able to complement other members who have expertise in other areas. We look forward to hearing about your interest in serving on such a panel. If you wish to have more information on this project, please feel free to call me at 503.222.9518, Paul Costa of the Boeing Company at 818.466.8778, or Cassandra Owens of the Regional Board at 213.575.6750 with any questions that you may have.

If you are interested in participating on this panel, please provide a statement of qualifications and areas of expertise (either e-mail or mail is fine) to Cassandra Owens of the Los Angeles Regional Board and me **by the 30th of November** at:

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Los Angeles Regional Water Quality Board
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213.575.6750

Cowens@waterboards.ca.gov

We look forward to hearing from you.

Sincerely,



Eric W. Strecker, P.E.

Principal, Geosyntec Consultants