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Attorneys for Respondents
The Pebble Beach Company, and
City of Carmel

STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

In the matters of:

MONTEREY REGIONAL STORM WATER MANAGEMENT PLAN,

Public Hearing for the Approval of a Storm Water Management Plan, General NPDES Permit No. CAS000004)

PROPOSED CEASE AND DESIST ORDERS,

Requiring The Pebble Beach Company, Monterey County, and City of Carmel, to Cease and Desist from Discharging Waste to Areas of Special Biological Significance (ASBS) in Violation of Prohibitions Prescribed by the State Water Resources Control Board

MONTEREY REGIONAL STORM WATER MANAGEMENT PLAN

PROPOSED CEASE AND DESIST ORDER NOS. R3-2005-0021 AND R3-2005-0022

AFFIDAVIT OF DR. SUSAN PAULSEN

Hearing Date: February 11, 2005
Time: 8:30 a.m.
Place: Richard W. Nutter Agricultural Conference Center
1432 Abbott Street
Salinas, CA 93901

I, Susan C. Paulsen, hereby declare and state as follows:

I. QUALIFICATIONS AND EXPERIENCE

1. I am a Senior Scientist and Vice President at Flow Science Incorporated, an engineering consulting firm with offices in Pasadena, CA, Harrisonburg, VA, Philadelphia, PA, and Mt. Pleasant, SC. Flow Science provides consulting services to industry, municipalities, and governmental agencies. I have specialized expertise in a variety of technical areas, including water quality analyses, design of mitigation measures for water quality concerns, turbulent mixing and diffusion in rivers, lakes, estuaries, the ocean and atmosphere, and related regulatory processes. I have studied and worked in these areas for over 15 years. I have authored or co-authored numerous scientific studies and water quality technical reports.

2. My academic education includes a Bachelor of Science with Honors in Civil Engineering (Stanford University, 1990), a Master of Science degree in Civil Engineering (California Institute of Technology, 1993), and a Ph.D. in Environmental Engineering Science (California Institute of Technology, 1997). Included in this formal education were courses in fluid mechanics, hydrologic transport processes, water treatment processes, and aquatic chemistry.

3. I am currently a member of the State Water Resources Control Board's Technical Advisory Committee for development of Sediment Quality Objectives. I am personally involved in several water quality projects in the jurisdiction of the Central Coast Regional Water Quality Control Board, and Flow Science Incorporated is handling a number of additional matters in the Region, so I am familiar with the watersheds and the water quality issues associated with this region.

4. Attached as Exhibit A is a true and correct copy of my Curriculum Vitae.

5. I have personal and firsthand knowledge of the facts stated in this affidavit. Though I am not personally able to appear at the RWQCB hearing on Friday, February 11, 2005, I can designate another Flow Science Incorporated employee to testify on my behalf, if necessary. Should the date of the hearing be changed, I could and would testify competently if called upon to do so. I am generally familiar with the Pebble Beach Company sites and the

adjacent Carmel Bay area, based on my review of the documents listed below, and from previous visits to the area.

6. This affidavit is submitted in support of the Pebble Beach Company and City of Carmel's opposition to the California Regional Water Quality Control Board's Cease and Desist Order Nos. R3-2005-0021 and R3-2005-0022 respectively.

II. DOCUMENTS EXAMINED AND KEY FINDINGS

7. During February 2005, I was asked by Latham & Watkins to review the following documents:

- Cease and Desist Order No. R3-2005-0021 (Pebble Beach Company) issued by the California Regional Water Quality Control Board, Central Coast Region, dated February 11, 2005.
- Letter from Celeste Cantu, State Water Resources Control Board to Roxayne Spruance, Pebble Beach Company, dated October 18, 2004.
- Letter from Sarah G. Newkirk, The Ocean Conservancy to Central Coast Regional Water Quality Control Board RE Proposed Cease and Desist Order R3-2005-0021 and others, dated January 10, 2005.
- Letter from David S. Beckman, NRDC RE: Cease and Desist Order R3-2005-0021 and others, dated January 25, 2005.
- Letter from Mark Stillwell to Central Coast Regional Water Quality Control Board RE: Draft Order R3-2005-0021 and others, dated January 24, 2005.
- Draft Environmental Impact Report: Pebble Beach Company's Del Monte Forest Preservation and Development Plan, dated January 2005, with emphasis on Chapter 3.4 Hydrology and Water Quality. (See, Respondents' Appendix of Evidence).
- Monterey Regional Storm Water Management Program (MRSWMP), revised draft dated December 8, 2004.
- Comment letter from Richard F. Horner (for NRDC) to State Water Resources Control Board and Central Coast Regional Water Quality Control Board RE:

MRSWMP, dated January 5, 2005.

- Comment letter from David S. Beckman and Anjali I. Jaiswal, NRDC, to State Water Resources Control Board and Central Coast Regional Water Quality Control Board RE: MRSWMP, dated January 10, 2005.
- Comment letter from Sarah G. Newkirk, The Ocean Conservancy, to Central Coast Regional Water Quality Control Board RE: MRSWMP, dated January 10, 2005.
- Comment letter from Holly Price, NOAA Monterey Bay National Marine Sanctuary, to Central Coast Regional Water Quality Control Board RE; MRSWMP, dated December 29, 2004.
- Comment letter from Dan Albert, City of Monterey, to Central Coast Regional Water Quality Control Board RE: MRSWMP, dated January 24, 2005.
- Comment letter from Ken Anderson et al, City of Santa Cruz, to Central Coast Regional Water Quality Control Board RE: MRSWMP, dated January 2005.

8. In addition, in the preparation of this affidavit I have referenced the following documents:

- Flow Science report entitled, "Review of Bacteria Water Quality Objectives and Bacteria Data for Coastal Watersheds," dated April 30, 2004. (See, Respondents' Appendix of Evidence).
- Los Angeles County 1994-2000 Integrated Receiving Water Impacts Report. (See, Respondents' Appendix of Evidence).
- Michael K. Stenstrom and H. Lee, "Final Report, Industrial Storm Water Monitoring Program, Existing Statewide Permit Utility and Proposed Modifications," dated January 2005. (See, Respondents' Appendix of Evidence).

9. Order II(3) of the Pebble Beach CDO requires Pebble Beach to implement measures to reduce storm water discharges or reduce pollutants so that receiving water quality improves each year. It is my opinion that it will be difficult to demonstrate consistent or continual improvement because of the inherent variability in storm flows and pollution

concentrations.

10. Available data clearly demonstrate that concentrations of pollutants in storm water can vary by more than an order of magnitude during and between storms. For example, a recent review of storm flow concentration data revealed that even runoff from vacant land (open space) can exhibit concentrations that vary by more than an order of magnitude. Runoff from other land uses exhibits even greater variations. (See, Stenstrom, 2005; LACDPW 2002). Other data reviewed by Flow Science demonstrate that concentrations of metals in storm water from industrial sites varies by more than an order of magnitude on timescales of less than an hour.

11. Storm water discharge volumes also vary greatly during a storm, between storms, and from season to season. In California, very wet years often result in a succession of storms that arrive to the Pacific Coast and drop large volumes of rainfall. Dry years may result in very low rainfall volumes. Rainfall amounts may also vary from location to location over relatively short distances within a watershed. Variations in both pollutant concentrations and flow volumes depend upon a wide variety of factors, including time since the previous storm, rainfall amounts, soil saturation levels, location within a watershed, and direction from which a storm arrives.

12. For these reasons, assessing improvement in discharges on a single-year (or year-by-year) basis is infeasible. A very wet year will result in a large volume of storm water discharge, while a very dry year may result in almost no runoff to the ocean, and respondents obviously have no control over the volume of rainfall arriving to their property. In addition, it will be very difficult to determine if storm water quality is improving over time because of the inherent variability in storm flow pollutant concentrations. Because storm flow pollutant concentrations vary over very short timescales, grab samples are not appropriate for assessing improvement. (See, Stenstrom, 2005).

13. Runoff into the ocean occurs at many locations, and sampling such runoff (e.g., sheet flow, runoff from a beach) can be very difficult. Thus, the monitoring requirements implied by this provision of the CDO could be resource-intensive, technically difficult, and costly.

14. Water quality standards consist of two parts: designated beneficial uses and water

quality criteria or objectives. Beneficial uses describe the various uses of waters, while criteria describe the water quality conditions that are necessary to support or maintain a specified use. Water quality criteria may be either numeric or narrative. Priority pollutant criteria established by the California Toxics Rule (CTR) are intended to involve consideration of frequency, magnitude, and duration. These criteria clearly specify the magnitude (level) of a constituent concentration that is acceptable based upon the exposure duration (1 hour or 4 days) and the exceedance frequency (once-in-three-years). Criteria were developed in this manner in recognition of the inherent variability in effluent concentrations, receiving water conditions, sampling protocols, data availability, and laboratory analyses, among other factors. Moreover, evaluating receiving water impacts (where the beneficial use actually occurs) must involve consideration of dilution and mixing, not just rely upon an end-of-pipe measurement.

15. For this reason, a statistical or modeling approach is required to properly apply water quality criteria as permit limits and to evaluate compliance with water quality criteria. Because water quality criteria are statistically-derived limits, they are clearly not intended to apply as never-to-be-exceeded values. Water quality standards need to be determined in terms of frequency, magnitude and duration. Interpreting water quality criteria as never-to-be-exceeded values is inappropriate.

16. I have had the opportunity to examine data on the concentrations of bacteria in storm water runoff from a number of watersheds that drain into the Pacific Ocean along the California coast. Much of the available data demonstrates that concentrations of indicator bacteria (e.g., fecal coliform, *E. coli*) are similar in magnitude in storm water runoff from developed and undeveloped watersheds, indicating that the presence of development does not necessarily increase bacteria concentrations in storm water runoff. Additionally, indicator bacteria result from a number of sources, including birds and wildlife, and bacteria can reside in sediments and be released from those sediments during storm events. Therefore, with specific regard to bacteria indicators in the Carmel Bay ASBS, the RWQCB has not offered and could not offer evidence that elevated bacteria indicators are a result of Respondents' activities.

17. Measurements of indicator bacteria are not direct measurements of pathogens, and

many epidemiological studies have found conflicting results, often failing to indicate a consistent relationship between a given bacteria indicator and human illness. In fact, the US EPA has indicated that, under certain circumstances, non-human sources of bacteria need not be considered in determinations of water quality standard attainment when non-human sources are shown to be minimal and exposure to such sources does not appear to result in human health risks (See 69 Fed Reg 67218 (2004)). The World Health Organization (WHO) has adopted a similar approach, recognizing that "due to the 'species barrier,' the density of pathogens of public health importance is generally assumed to be less in aggregate in animal excreta than in human excreta which may therefore represent a significantly lower risk to human health. (See generally, Pelican Hill Bacteria Study)

18. Rain falling on coastal watersheds has always resulted in fresh water storm runoff to the ocean, regardless of the state of local development. Runoff to the ocean carries a number of substances that may be important to local processes and ecosystems. For example, fresh water flows are necessary for the establishment of estuaries, areas of mixing of fresh and saline ocean waters. Runoff carries sediments, which are necessary for beach maintenance and replenishment. Runoff also carries nutrients that may be important to local productivity. Because the process by which rainfall becomes runoff from reaching the ocean is a natural one, changing this process and attempting to prevent all runoff to the ocean would be exceedingly difficult technically and would require engineered solutions (e.g., channelization, detention basins, etc.). Introducing engineered solutions to the coastal environment to prevent fresh water storm flows from reaching the ocean could also produce a number of unintended consequences, such as affecting the availability of beach sand and the health of local ecosystems.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Executed this February 6, 2005, in Pasadena, California

By Susan C. Paulsen
Susan C. Paulsen

SUSAN C. PAULSEN

Vice President and Senior Scientist, Flow Science Incorporated
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EDUCATION

Ph.D., Environmental Engineering Science 6/97
California Institute of Technology, Pasadena, California
Thesis: A Study of the Mixing in Natural Waters Using ICP-MS and the Elemental Composition of Waters
Advisor: Dr. E. John List

M.S., Civil Engineering 6/93
California Institute of Technology, Pasadena, California

B.S., Civil Engineering (Environment and Water Studies) with Distinction 12/90
Stanford University, Stanford, California.

PROFESSIONAL AFFILIATIONS

Registered Professional Civil Engineer in California, C66554; American Society of Civil Engeers (ASCE); National Ground Water Association; American Water Resources Association

PROFESSIONAL EXPERIENCE

Senior Scientist, Flow Science Incorporated; Pasadena, California. 8/97 - present

- Provided litigation support for major Superfund-related projects involving analysis of fate and transport of chemical compounds; evaluated sampling programs and possible remedial measures
- Provided technical analysis and testimony in support of NPDES permits, permit appeals, TMDL processes, and water quality regulation
- Conducted analyses relating to water flow, water quality, and mixing patterns and conducted field studies in the San Francisco Bay-Delta estuary
- Designed and implemented modeling and field studies in reservoir, river, estuarine, and ocean environments using both dye and elemental tracers to evaluate the impacts of treated wastewater, agricultural, and industrial discharges on receiving waters and drinking water intakes
- Participated in an intensive study of the mixing of copper in the upper Sacramento River
- Authored a review of the Administrative Record of the Los Angeles Basin Plan
- Provided technical support and policy analysis in the development of sediment quality objectives, storm water policy, TMDL and listing policies, and water quality and water rights issues

Consultant to Flow Science Incorporated; Pasadena, California. 1/94 - 6/97

- Analyzed samples collected in the Napa River estuary to determine tidal flushing based upon water signatures; analysis resulted in conversion of 16,000 acres to wetland habitat
- Assisted the development and successful implementation of a plan to add a rare earth tracer to a major drinking water reservoir to determine mixing and residence times
- Assisted the development and implementation of a program to analyze samples and add a tracer to a major California river to determine the impact of acid mine drainage
- Field tested a new method for removal of bacteria-induced iron oxide precipitates in groundwater wells
- Participated in the implementation of a program of tracer addition, field sampling, and analysis to determine tidal mixing and dilution of a wastewater effluent in the San Joaquin Delta

Staff Engineer, Dames & Moore; San Francisco, California. 6/90 - 9/92
Conducted hydraulic and hydrologic analyses and assisted design for water development

projects; conducted water quality analyses for stormwater runoff, NPDES permitting, irrigation, and wastewater and industrial process water treatment facilities; provided design, cost estimate, and construction management services for remedial measures for reservoirs and a Superfund site.

SUSAN C. PAULSEN

RESEARCH EXPERIENCE

Ph.D. Thesis research; California Institute of Technology, Pasadena, CA. 4/93 - 6/97
The goal of this work was to delineate the distribution of chemical constituents and flow patterns in natural waters to understand and solve specific environmental problems. Conducted extensive sample collection within the San Francisco Bay-Delta System and within the streams and ocean of Oahu, with sample analysis by ICP-MS; established the elemental "signatures" of sources, selected tracers based upon conservative mixing demonstrated by laboratory and field work, and determined temporal and spatial variation of tracers.

Research Engineer, Fraunhofer Institute for Atmospheric Environmental Research; 1/89 - 4/89
Garmisch-Partenkirchen, Germany (West).
Researched, designed, and fabricated apparatus to sample, record, and analyze effects of pollutants in the ecosystem; designed and fabricated a chamber to control and measure the effects of plant exposure to atmospheric contaminants.

TEACHING EXPERIENCE

Teaching Assistant, California Institute of Technology, Pasadena, California.
Hydrologic Transport Processes. Delivered occasional lectures and conducted review sessions, provided individual instruction, graded problem sets and examinations. 9/95 - 6/97
Fluid Mechanics. Prepared materials, designed and conducted laboratory demonstrations, provided individual instruction, and graded problem sets for graduate level course. 9/93 - 6/94

Instructor, ASCE High School Outreach Program; San Francisco, California. 3/91 - 5/91
Designed and taught a four-day interactive water resources unit to high school students.

Instructor, Technical Communications Program; Stanford University, Stanford, California. 9/89 - 6/90
Taught public speaking course oriented toward professional speaking situations; lectured, demonstrated speaking styles, provided individual instruction, evaluated student speeches.

HONORS

Walter L. and Reta Mae Moore Fellowship (California Institute of Technology)
Earle C. Anthony Graduate Fellowship (California Institute of Technology)
Krupp Scholarship in Engineering (Germany)

SELECTED PUBLICATIONS AND PRESENTATIONS

Paulsen, S.C., E.J. List, and P.H. Santschi. Modeling variability in ^{210}Pb and sediment fluxes near the Whites Point Outfalls, Palos Verdes Shelf, California. Environmental Science & Technology 33:3077-3085, 1999.

Paulsen, S.C., E.J. List, and P.H. Santschi. Comment on "In situ measurements of chlorinated hydrocarbons off the Palos Verdes Peninsula, California." Environmental Science & Technology 33:3927-3928, 1999.

Paulsen, S. C. and E. J. List. A study of transport and mixing in natural waters using ICP-MS: Water-particle interactions. Water, Air, and Soil Pollution 99:149-156, 1997.

Paulsen, S. C. and E. J. List. Tracing discharges in ocean environments using a rare earth tracer. Presented at the 27th IAHR Congress, August 1997, San Francisco, California.

Paulsen, S. C. and E. J. List. Delineation of estuarine mixing using elemental tracers and numerical modeling. In review.