

April 30 2008

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**Subject: Expert Panel Final Consensus Recommendation on a
Site Specific Design Storm for the SSFL**

Dear Paul:

Please find attached the final Expert Panel's recommendation on the Boeing Santa Susana Field Laboratory (SSFL) Site-Specific Design Storm (SSDS). As you are aware, Boeing asked Geosyntec to assist in forming an Expert Panel on stormwater to oversee the selection and design of Engineered Natural Treatment Systems for the 008 and 009 outfall watersheds and to make a recommendation regarding the design storm for the site.

The commitment for the Expert panel was made in Boeing's NPDES permit hearing in November of 2007. The Panel includes Dr. Robert Gearheart, P.E. of Humboldt State University, Dr. Richard Horner of the University of Washington, Jonathan Jones, P.E. of Wright Water Engineers, Dr. Michael Josselyn of WRA, Dr. Robert Pitt, P.E. of the University of Alabama, and Dr. Michael Stenstrom, P.E. of the University of California, Los Angeles.

Each of the Panel members contributed to the development of this consensus recommendation and have agreed to its contents as the document was developed. However, Dr. Richard Horner was on travel this last week and although his comments were incorporated, he did not review this final version which included some minor additional changes by the rest of the Panel. I will let you know the status of his final approval, upon his return from overseas. With the exception of awaiting Dr. Horner's final approval, the rest of the Panel members have approved the Recommendation.

Geosyntec is very pleased to have had this opportunity to assist you and the Boeing team and to work with the Expert Panel. We are looking forward to moving ahead with finalizing the design

of the ENTS and related activities to support Boeing in meeting its NPDES permit conditions and protecting the environment.

Sincerely,



Eric W. Strecker, P.E.
Principal

cc: Dr. Robert Gearheart, P.E.
Dr. Richard Horner
Jonathan Jones, P.E.
Dr. Michael Josselyn
Dr. Robert Pitt, P.E.
Dr. Michael Stenstrom

Attachment: Final Consensus Recommendation on a Site Specific Design Storm for the Santa Susana Field Laboratory

**Final Consensus Recommendation on a
Site Specific Design Storm
for the Santa Susana Field Laboratory**

**Prepared by the
Boeing Santa Susana Field Laboratory
Stormwater Expert Panel**

April 30, 2008

Expert Panel
Final Consensus Recommendation on a
Site Specific Design Storm for the SSFL

The Expert Panel (Panel) for the Santa Susana Field Laboratory (SSFL) Stormwater Engineered Natural Treatment Systems (ENTS) project was asked to review and provide recommendations for (a) the proposed site specific design storm (applicable to all NPDES compliance outfalls at the SSFL) and (b) the ENTS designs proposed for implementation in the Outfalls 008 and 009 watersheds. This Consensus Recommendation is intended to primarily address (a) above. This final design storm¹ recommendation was primarily based upon an evaluation of the types, locations, design sizing, and configuration of the proposed draft conceptual ENTS for the Outfall 008 and 009 watersheds. This design storm recommendation therefore also includes additional recommendations related to the selection and design of ENTSS and other BMPs for the Outfall 008 and 009 watersheds.

It is the Panel's intent that the resulting overall recommended stormwater program for the Outfall 008 and 009 watersheds will result in a sustainable set of controls that go far beyond the norm for stormwater treatment systems nationally, while also protecting the natural characteristics and values of the Outfall 008 and 009 watersheds. The Panel is working to develop a system of ENTSS/BMPs and a design storm that:

- Are protective to downstream residents and the environment
- Maintain the natural site conditions and ecological functions
- Maximize the spatial opportunities to construct ENTSS and BMPs based on the site's constraints and implementation feasibility considerations
- Are designed to come as close as feasible to meeting the numerical effluent limits set by the Board within the practical limits of the ENTSS technology by reducing both the mass loading and concentration of water quality constituents.

¹ The Panel believes that a distinction needs to be made between the term *design* storm (i.e., basis for specific treatment BMP sizing) and the term *compliance assessment* storm (i.e., basis for assessing compliance with numeric effluent limits in the NPDES permit). Regarding the term design storm, ENTSS in the Outfall 008 and 009 watersheds will individually be sized to treat storms larger or smaller than what in effect would be a site compliance assessment storm based upon site constraints and opportunities; therefore the actual "design storm" for each ENTSS will vary. The compliance assessment storm would be used to determine when numerical effluent limits would apply as enforceable limits or as benchmarks as described herein. For purposes of using the same language as the Board, the Panel is using the term design storm throughout this document.

Key findings of the Panel are as follows:

1. Site Specific Design Storm - This storm would be used to assess when numeric effluent limits, as specified in the NPDES Permit, will apply. (The NPDES Permit does not currently specify an allowable frequency of exceedances.) For rainfall events less than or equal to the design storm, the NPDES limit will apply. However, the Panel recommends that when a rainfall event exceeds the design storm based on local gauge measurements, the NPDES permit limits should become non-enforceable “benchmarks,” as discussed in #7, below.
2. Site Specific Design Storm Recommendation - The panel recommends that the 1-year return interval storm event be used as the single site-wide design storm. The Panel reviewed the March 2007 technical memorandum by MWH that evaluated the existing proposed 1-year storm, using local rain gauges. The 1-year storm was originally proposed as the site specific design storm based upon the “full capture” storm in the trash Total Maximum Daily Load (TMDL) for the Los Angeles River. The panel requested a more detailed design storm evaluation using continuous long-term ENTS performance modeling to show the percentage of runoff that would be treated if a hypothetical single treatment system were built at an outfall and were designed to capture and treat runoff from the entire design storm using a range of storm sizes. This modeling approach is consistent with that used to evaluate various proposed alternative design storms by the Los Angeles TMDL Design Storm Task Force.

Based on a review of the long-term continuous ENTS performance modeling results, the Panel determined that with a single hypothetical ENTS facility designed to capture and treat a 1-year return interval storm, the resulting treatment system would achieve a desired target of approximately 90% runoff volume capture and treatment (i.e. flows are captured by the treatment system and not by-passed or overflowed) via a combination of evapotranspiration and/or surface discharge of treated runoff and, where appropriate given geotechnical and contaminated groundwater constraints, infiltration. It would also provide treatment of the entire runoff from 95 percent of storms that occur at the site and partial treatment of the remaining 5% of storms.

However, a single stormwater control facility cannot feasibly be constructed at a single downstream location because it would require a large dam and overflow structure and impose significant public safety and environmental impacts. For this reason, the Panel recommends that water quality control be achieved via multiple distributed ENTS and source control and channel stabilization BMPs. At other outfalls where existing flow-through BMPs are in place, it may be feasible to utilize the existing BMP as is, or if needed, expand the existing BMP, or build a new single BMP to meet this requirement. However, the Panel has not evaluated these other outfalls.

The Panel believes that requiring a larger design storm than a 1-year return period event is not justified based upon the modeling analyses of the 008 and 009 watersheds. A larger design storm would lead to ENTS footprints that would require significant additional impacts to the natural values of the site that are not warranted.

Specific elements of the design storm recommendation include:

- a. Based on site-specific long-term continuous hydrologic/hydraulic modeling, the Panel has confirmed that the Panel's 90 percent capture and treatment objective can be conceptually achieved when sizing a an outfall located ENTS (or other BMP) to the 1-year event for the site. This was assessed using an example ENTS system with upstream detention and media filtration with sufficient treatment times (i.e. settling and media/soil contact times). The Panel recommends a design storm of the 1-year return interval (interpreted as the 24-hour duration storm depth of 2.5 inches or 0.6 inches in an hour as measured at the Area 4 onsite rain gage) be selected for compliance assessment purposes.
- b. For the Outfall 008 and 009 watersheds, the Panel recommends that ENTS evapotranspire runoff to the maximum extent feasible. The panel also recommends that infiltration should be used where site conditions allow (i.e., in limited areas without contaminated groundwater adjacent or down gradient or sensitive habitat, and where it is feasible given infiltration potential, natural infiltration rates, and geotechnical suitability).

The Panel recommends that control and treatment occur throughout the Outfall 008 and 009 watersheds, including off-site areas, such that all feasible areas that can be used for volume reduction and treatment are used to help ensure compliance at the outfall rather than relying solely on treatment at the outfall location. ENTS options should focus on load as well as concentration reductions. ENTS and BMP selection and design principles include:

- i. In general, ENTS that are sub-regional and at Outfall locations should be as large as feasible, given site constraints. Due to site constraints, some of these ENTS may, by necessity, be smaller in size than if they were if designed to fully capture and treat the runoff from the design storm.
- ii. Treatment controls ENTS and other BMPs for "Critical Source Areas" (e.g. developed RFI, and known contaminated surface soil/sediment areas) should be designed using storms larger than the design storm, when feasible. The Panel suggests no specific design storm in this regard, only that additional treatment volume should be provided, when feasible, for critical source areas.

3. Sample Collection. The Panel recommends that flow-weighted composite samples be collected and used to assess compliance with permit limits for constituents where this is appropriate. Flow-weighted composite samples provide a more accurate estimate of discharge water quality than is possible with the current method of manual grab sampling. For those parameters where composite sampling is not possible (e.g., VOCs and oil and grease), manual grab samples should still be collected as per the current permit requirements. In addition, the panel recommends that a discrete grab sample from the first hour of runoff or within some other suitable early part of the storm (e.g. runoff representing first 0.1 or 0.2 inches of runoff) also be collected and analyzed as an indication of how composite and “first-flush” concentrations vary. It is recommended that this additional sample should not be subject to compliance assessment, but be used to provide information to the Regional Board and Boeing.
4. Compliance Assessment with Flow-Weighted Composite Sampling. If flow-weighted composite sampling is allowed or required for assessing compliance with permit limits, then the Panel suggests the following proposed compliance assessment approach:

“If the total precipitation depth from the on-site precipitation gauge is equal to or greater than 2.5 inches for the first 24-hours of the storm for which a NPDES compliance flow-weighted composite sample is required to be collected or if the precipitation total for any hour of that storm prior to the end of the composite sample period is greater than 0.6 inches, then the permit effluent limit values for those parameters which can be collected as flow-weighted composites will function as benchmarks (i.e., triggering BMP evaluation and upgrade, as necessary) rather than enforceable numeric limits (where exceedances would be subject to a notice of violation and enforcement penalty).”

For those parameters which must be collected as grab samples, the Panel suggests that the existing grab sampling protocols be continued.

5. Compliance Assessment with Continued Grab Sampling. If grab sampling for permit compliance must remain as is or for those constituents for which composite samples cannot be collected, then the Panel suggests the following proposed compliance assessment approach:

“If the total precipitation depth from the on-site precipitation gauge is equal to or greater than 2.5 inches for the first 24-hours of the storm for which a NPDES compliance grab sample is required to be collected or if the precipitation total for any hour within 24 hours prior to the grab sample collection time is greater than 0.6 inches, then the permit effluent limit values will function as benchmarks (i.e., triggering BMP evaluation and upgrade, as necessary) rather than enforceable numeric limits (where exceedances would be subject to a notice of violation and enforcement penalty).”

6. Additional Controls. For the Outfall 008 and 009 watersheds, a combination of controls should be implemented that include the ENTS described above as well as multiple source controls (or pollution prevention techniques) such that the overall water quality protection will significantly exceed and be more sustainable than possible with single controls at the compliance points. The Panel will work with Boeing to select and implement multiple optimally-designed BMPs (to reduce pollutant discharges) throughout the outfall 008 and 009 watersheds. Source controls will include, where feasible, removal/covering of treated wood, galvanized metals, and other sources; removal of impervious areas; control of eroding areas; outfall protection; stream stability enhancements; and other source controls identified by the panel or Boeing.
7. Water Quality. The Panel believes that the ENTS together with erosion and source controls can significantly improve water quality in runoff discharges from Outfalls 008 and 009, leading to a reduction in the total load and concentrations of constituents listed in the permit. However, even with expected significant water quality improvements with the ENTS and other BMPs, the Panel believe that it may not be possible to consistently achieve compliance with the NPDES permit's numeric effluent limits for all constituents, including for storms that are smaller than the design storm.
 - a. Stormwater BMPs, including ENTS, of all types have an observed variability in performance, including values that would exceed the numeric limits in Boeing's permit. For example, the Panel believes that the dioxin limit ($2.80E-08$ $\mu\text{g/L}$ TCDD TEQ) is not consistently attainable, even for storms below the design storm, because the Panel estimates that to achieve this limit, total suspended solids (TSS) levels would need to be consistently below 1 mg/l. This value is not achievable as observed average effluent concentrations in BMPs are rarely below 10 mg/l. In addition, attempting to treat to this extremely low level could result in other unintended and significant environmental impacts (e.g., treatment systems would significantly alter habitat within their footprint areas, as well as starve downstream receiving waters of sediment, leading to increased stream erosion downstream).
 - b. The dioxin levels at the site in untreated runoff appear to be similar to dioxin levels measured in runoff from other areas that have been studied (for example in studies of runoff in other parts of the Los Angeles area). Therefore, the Panel is concerned that the permit limits may be too strict given background concentrations observed elsewhere. The Panel is aware that there are potential sources of dioxin at the site that need to be addressed, but, the permit levels for dioxin do not appear to be consistently achievable and are lower than observed in other studies of runoff.

- c. There are other pollutants where it may not be feasible to consistently meet the permit's numeric effluent limits based upon ENTS performance information from the International BMP Database and other sources (including information from Panel member conducted studies). ENTS have not typically been tested at sites with such large tributary natural open areas as are found at the SSFL. The parameters for which significant uncertainty on ENTS performance (particularly compared to the permit limits) exists include mercury, lead, zinc, cadmium, iron, and copper.

Given the above, the Panel recommends that the numeric effluent limits in the permit remain as benchmarks for those pollutants where significant ENTS performance uncertainty exists (i.e., dioxin, mercury, lead, zinc, cadmium, iron, and copper) until well-designed and implemented performance monitoring of the ENTS confirms their performance over a reasonable time period or number and types of storm events. The Panel has reviewed BMP/ENTS effluent quality and background data sufficient to reach the conclusions above. In addition, the Panel will be developing a more detailed white paper specifically concerning the effluent quality that can potentially be achieved with the ENTS and other BMPs in the 008 and 009 watersheds, including information on background levels and BMP effluent quality information.

8. Exceedance Frequency. If the current enforceable numeric effluent limits remain in place for storms equal to or smaller than the design storm, the Panel recommends that some recognition of the variability of the effluent quality from ENTS and other BMPs be included. This recognition could be in the form of an allowable exceedance frequency, or comparison of discharge quality with one or more reference watersheds, or some other comparable mechanism in the NPDES permit.
9. Natural Disasters. Because much of the site is in a natural vegetated condition it is (and has been) subject to wildfires and other natural factors, such as debris flows and earthquakes, that could significantly affect the treatment systems such as debris flows and earthquakes. For this reason, the Panel recommends that there be some recognition in the NPDES permit that there may periodically be an inability to achieve NPDES permit limits. For example, wildfires are a significant source of dioxin and sediment and other pollutants in stormwater runoff from open areas. The Panel believes that permit provisions should account for these types of uncontrollable events. Note that the ENTSs will be designed to protect the infrastructure and minimize the probability of the ENTS being a source of sediment and contaminants.
10. Design Storm Compliance Trigger. The Panel recommends that permit numeric effluent limits should be applied as benchmarks for storms larger than the design storm. These benchmarks would trigger a review of on-site BMPs and, if indicated over time, a

modification of BMPs as needed. The Panel believes that an additional option would be to temporarily apply benchmarks, not numeric limits to watersheds where a significant portion had been burned for some specified period of time and for all storms, with the provision that appropriate BMPs and re-vegetation efforts be implemented.

With the uncertainties, caveats, and recommendations as stated, the Panel believes that an ENTS program can be designed using the design storm methodology described above that will provide equivalent or better than treatment focused at the outfalls. The Panel recommends that the Board consider these recommendations in its evaluation of the ENTS program as the most sustainable and effective means to be protective of public health, aquatic life, and receiving water quality and other beneficial uses.

Prepared by:

Boeing Santa Susana Stormwater Expert Panel

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