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Adaptive Stormwater Management at an Industrial Site with Numeric Effluent Limits

Santa Susana Site

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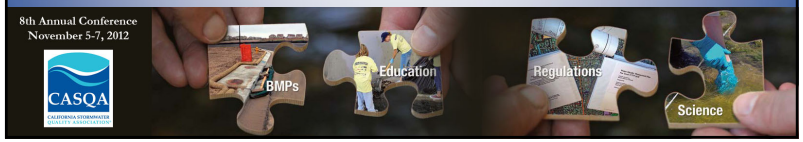

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Outline

- Santa Susana Site (SSS) introduction
- Regulation of SSS stormwater
- Outfalls 008 and 009
- Expert Panel scope of work
- BMP solutions
- **BMP Site Ranking Methodology**
- New BMP recommendations
- Lessons learned

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Site Introduction

- 2800-acre former federal government rocket engine testing and energy research facility (1950-1988)
- Owned by the Boeing Company (post-1966) and the U.S. Government
- Activities currently limited to demolition, remediation, and restoration
- Future parkland and open space

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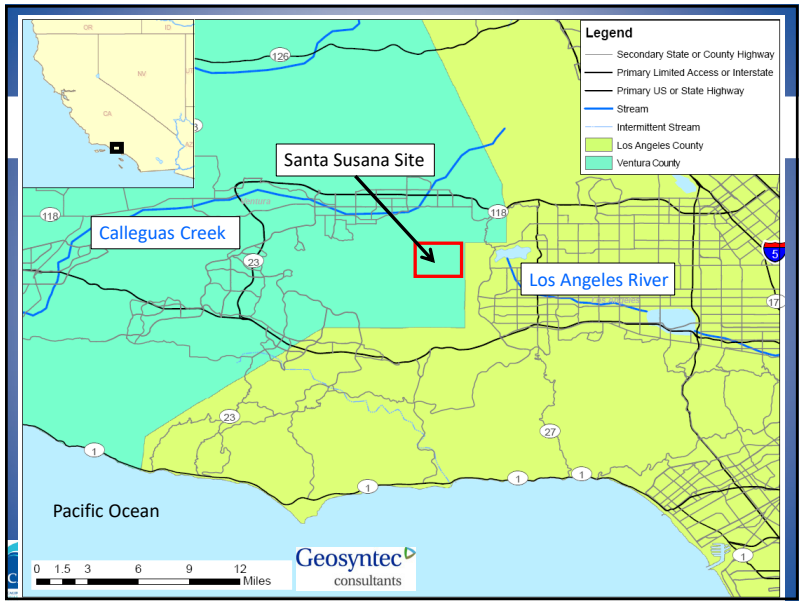

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Regulation of SSS Stormwater

- Stormwater discharges are regulated by the Los Angeles Regional Water Quality Control Board (LARWQCB) through an individual NPDES permit, which requires:
  - Composite discharge sampling during storms, and
  - Compliance with very protective Numeric Effluent Limits (NELs)
- NELs for a wide range of constituents including:
  - Dioxins (TCDD TEQ): 2.8×10^{-8} µg/L
  - Total Lead: 5.2 µg/L
  - Total Copper: 14 µg/L

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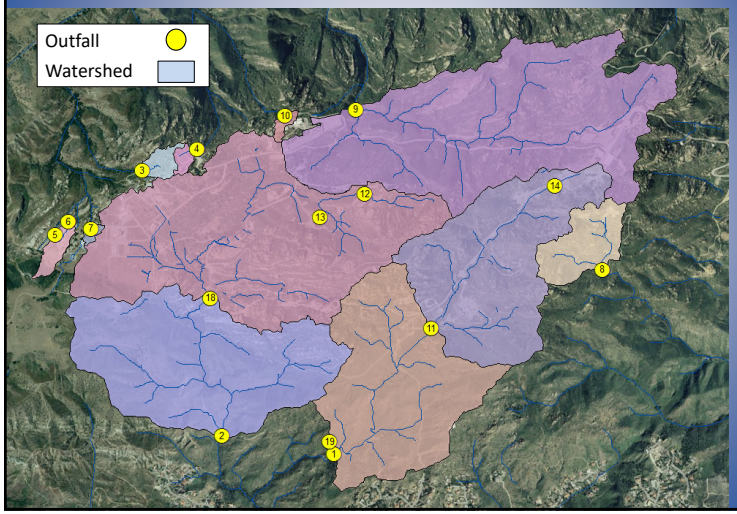
Outfalls 008/009



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Expert Panel Scope of Work

- **Independent Expert Panel** was engaged with Regional Board consent to oversee stormwater planning and design work, as well as provide input on monitoring, source removal activities, and various NPDES permit issues
- **Mission:** Improve stormwater quality at NPDES Outfalls 008 and 009
- Additional responsibilities include overseeing scientific studies and interfacing with the public on risk and science communication.

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Expert Panel Members

- Jonathan Jones, Wright Water Engineers
- Dr. Robert Pitt, University of Alabama
- Dr. Bob Gearheart, Humboldt State University
- Dr. Michael Josselyn, WRA Consultants
- Dr. Michael Stenstrom, University California, Los Angeles

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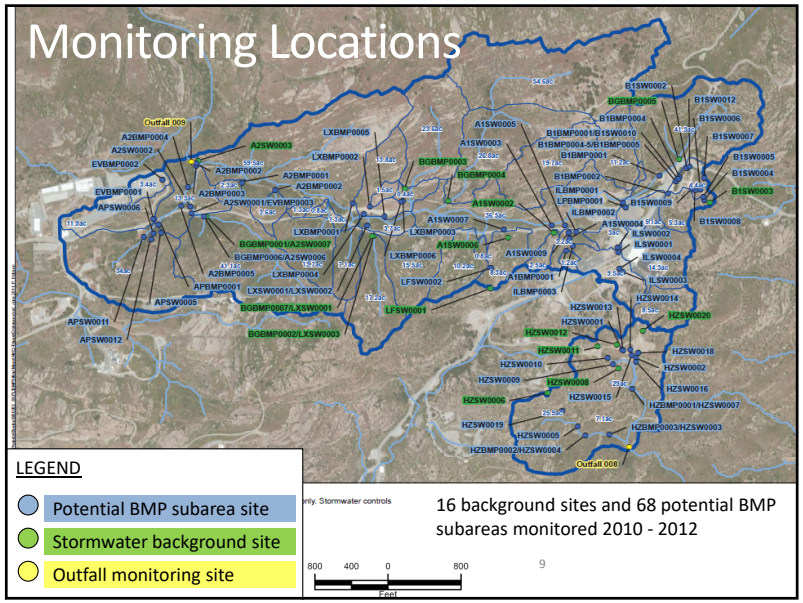
Monitoring Locations



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Expert Panel Developments

- Media Performance Testing – presented at CASQA 2009
- New Source, Erosion and Treatment Controls – presented at CASQA 2011
- Subarea monitoring and BMP siting prioritization methodology – presenting now!
  - First some treatment control performance monitoring results and progress on new treatment control installations

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Treatment Controls

13 culvert modifications

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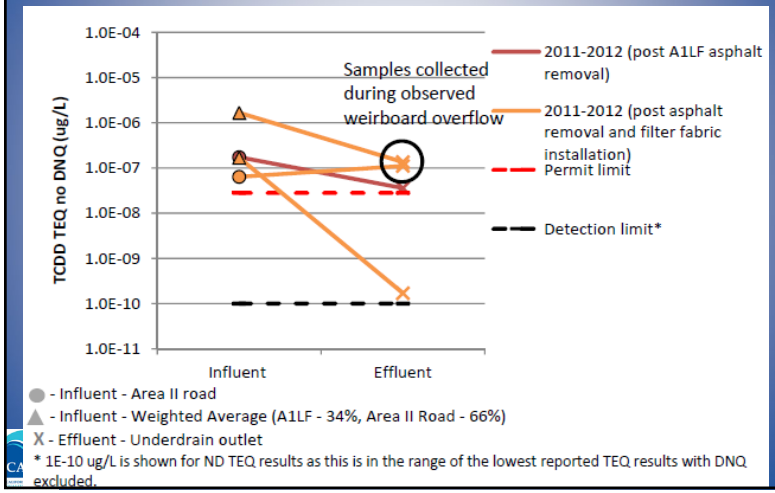
CM-9 Performance



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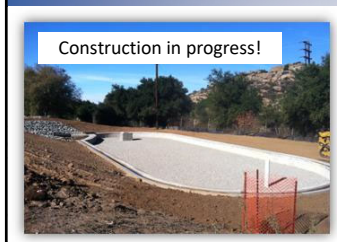
Lower Lot Biofilter

Construction in progress!



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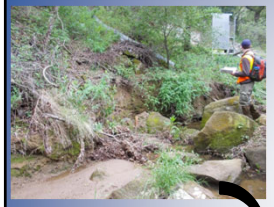
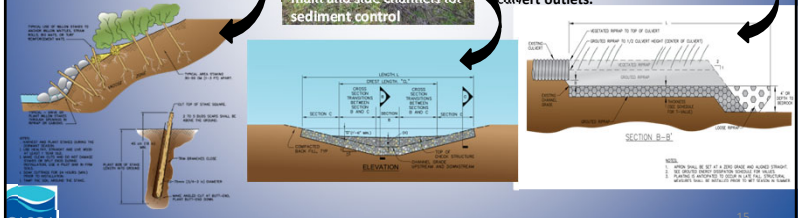
Northern Drainage Restoration, Mitigation & Monitoring Plan: Channel Stabilization Measures



Vegetated riprap suggested for locations where armored toe protection is necessary.

Check structures within main and side channels for sediment control

Energy dissipation aprons at erosive culvert outlets.



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BMP Subarea Ranking Methodology

- Innovative, statistically rigorous approach
- Rank potential BMP subarea monitoring sites based on comparisons of:
  - Stormwater subarea concentrations with NPDES permit limits
  - Stormwater subarea particulate strengths with stormwater background particulate strengths
- Monitoring locations were scored based on number and percent of samples above NPDES permit limits and/or background
- Locations then ranked based on scores, and top locations identified
- Best professional judgment for BMP recommendations
- Process to be repeated annually through 2014

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Example:

Site A: n = 10, m = 7 → $Weight_A$ = 0.83

Site B: n = 14, m = 2 → $Weight_B$ = 0.01

Based on weight alone, Site A would be prioritized over Site B.

Total Number of Observations (n)	Total Number of Critical Values in Data Set (m)													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	50													
2	50	5												
3	50	0	87											
4	31	0	69	94										
5	19	0	50	81	97									
6	11	4	50	66	89	98								
7	6	3	50	50	77	94	9							
8	4	4	36	50	64	86	3	99						
9	2	1	25	50	50	75	8	98	99					
10	1	1	17	33	50	50	83	95	99	99				
11	1	1	11	27	50	50	73	89	97	99	99			
12	0	1	7	19	39	50	63	81	93	98	99	99		
13	0	0	5	13	29	50	50	71	87	95	99	99	99	
14	0	1	3	9	21	40	50	61	79	91	97	99	99	99
15	0	0	2	6	15	30	50	50	70	85	94	98	99	99

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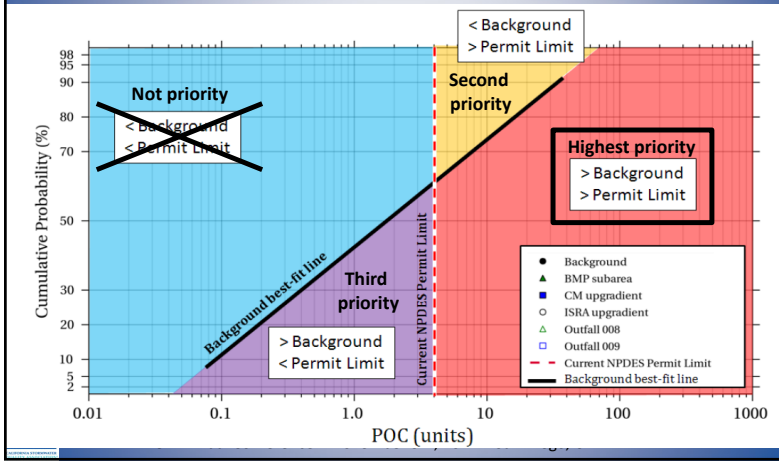
Basic Approach (example)



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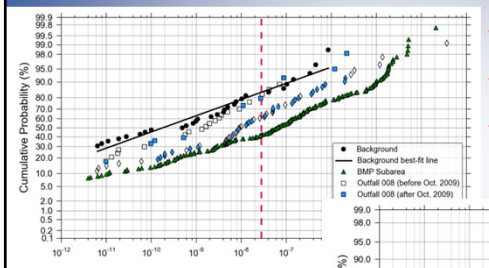
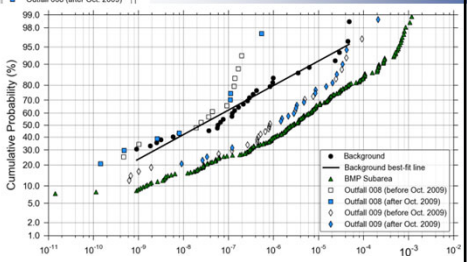
Dioxin (TCDD TEQ)

- Background subareas exceed NPDES Permit Limit
- BMP subareas greater than Outfalls
- TSS/erosion is not always the issue



TCDD TEQ (ug/L)



TCDD TEQ Particulate Strength (mg/kg)

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2011/2012 Ranking Results

Rank from Average Weights	Potential BMP Subarea (Co-location(s))	Watershed	Description	Approx. Upstream DA (ac)	Events Sampled	Multi-constituent Score	Rank from Max Metal Weight	Rank from Max Dioxin Weight	Rank from TSS Weight
1	EVBMP0003 (A2SW0001)[ab]	Outfall 009	ELV road runoff/CM-1 upstream west	11.8	14	0.94	1	1	32
2	B1BMP0004 (B1SW0015)[a]	Outfall 009	B-1 media filter inlet north	3.7	2	0.72	9	5	74
3	ILBMP0001[b]	Outfall 009	Lower parking lot 24" stormdrain	23	10	0.68	14	4	39.5
4	EVBMP0001-A[b]	Outfall 009	ELV culvert inlet (helipad road and ELV ditch, composite)	2.5	5	0.67	16.5	3	15
5.5	EVBMP0002[b]	Outfall 009	Helipad (pre-sandbag berms)	4.1	6	0.66	15	6	31
5.5	ILBMP0002[a]	Outfall 009	Road runoff to CM-9	2.5	7	0.66	3	12	15
7	A1SW0009-A	Outfall 009	CM-9 downstream-underdrain outlet (post-building 1324 parking lot asphalt removal, pre-filter fabric over weir boards)	16.4	1	0.63	2	19.5	74
8	APBMP0001	Outfall 009	Ashpile culvert inlet / road runoff	34	2	0.60	4	19.5	74
9	LPBMP0001-A[b]	Outfall 009	Lower Parking Lot sheetflow (post-gravel bag berms)	5.1	6	0.52	30	2	27
12.5	LPBMP0001[b]	Outfall 009	Lower Parking Lot sheetflow (pre-gravel bag berms)	5.1	2	0.50	9	19.5	15
15.5	A2SW0002-A	Outfall 009	CM1 effluent (post-filter fabric over weir boards)	52.8	4	0.43	18.5	19.5	28.5
15.5	A1SW0009-B	Outfall 009	CM-9 downstream-underdrain outlet (post-filter fabric over weir boards, post-building 1324 parking lot asphalt removal)	16.4	4	0.43	18.5	19.5	15
17	B1BMP0003 (B1BMP0002)	Outfall 009	B-1 parking lot / road runoff to culvert inlet	5.2	12	0.43	38	7	33
27	B1SW0014-B	Outfall 009	B-1 media filter effluent (post-media filter reconstruction)	4.7	4	0.27	32.5	19.5	74
28	LXBMP0004[b]	Outfall 009	LOX southwest downstream of sandbag berm	10.6	5	0.26	9	40.5	1
34	EVBMP0001[b]	Outfall 009	ELV culvert inlet (helipad road gutter)	1.8	3	0.11	25	31.5	15
36	EVBMP0002-A[ab]	Outfall 009	Helipad (post-sandbag berms)	4.1	5	0.09	40	29.5	74

Notes

1) Potential BMP subareas sorted by multi-constituent score, computed as described in Section 5.
2) ([a]) These potential BMP subarea monitoring subareas are upstream of existing stormwater quality treatment controls.
3) ([b])These potential BMP subarea monitoring subareas have new planned (i.e., designed and ready for construction) stormwater quality treatment controls.
4) (**) NPDES outfalls are included for comparison and method testing purposes only, stormwater controls are not being contemplated at these locations.
5) The rounding of weights may account for similar weights being ranked differently
6) Approximate drainage areas based on the cumulative drainage area of the SWMM catchment in which the monitoring location is located (Geosyntec, 2011). At locations where the monitoring point is upstream of the catchment outfall a "<" sign is used.
7) Bolded locations indicate that both the NPDES permit limit and 95th percentile background particulate strength threshold were exceeded for any one COC

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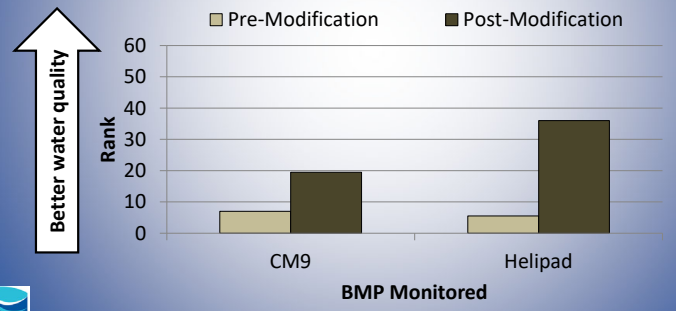
Water Quality Improvements

- Demonstrated by ranks, pre- and post-BMP modification (filter fabric added to CM weir boards; helipad sand bag berm constructed)
- Limited to sites with at least 2 samples



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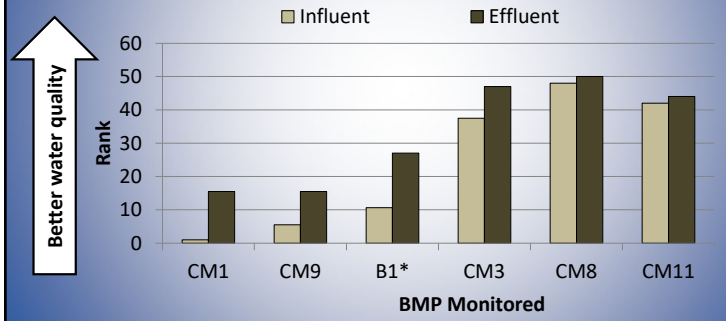
Water Quality Improvements

- Demonstrated by ranks, comparing influent and effluent.
- Limited to sites with at least 2 samples.



*Average of impacted B1 influent streams

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New BMP Recommendations

- BMPs were chosen for implementation at six of the top seven highest ranked subareas, with multi-constituent scores ranging from 0.63 to 0.94.
- Selected sites were included among the top-ranked sites that were:
  - **Ranked first through fourth** for metals and dioxins;
  - Had **detections of the 2,3,7,8-TCDD** dioxin congener, which is typically associated with anthropogenic sources; and
  - Had the **highest observed dioxin concentrations** (noting that the scores do not explicitly account for concentration *magnitudes*, but rather account for *frequency* of exceeding the concentration-based background and permit limit thresholds).

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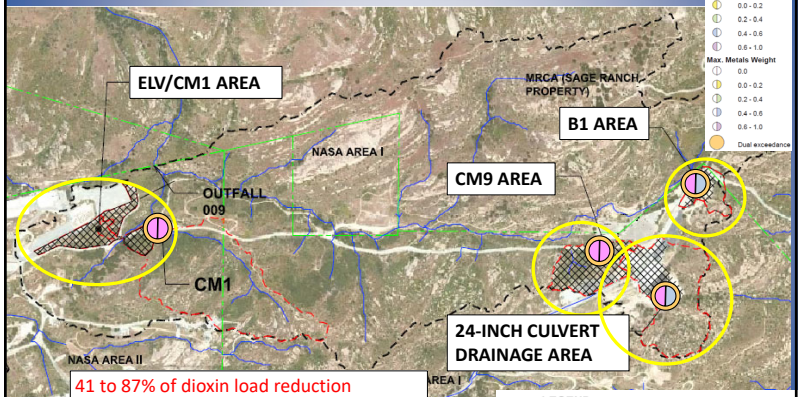
New BMP Recommendations



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Public Involvement Process

- Boeing and Panel are committed to public involvement and transparency through regular meetings and tours
- Panel has been open to direct communication, thus building confidence and trust
- Last public tour: April 2012
- Last Board staff tour: August 2012

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Lessons Learned

- Robust statistical BMP ranking methodology applicable to other sites!
- NEL compliance is a significant challenge with complications
  - Ubiquitous background sources (atmospheric inventory and soils)
  - Multiple landowners (NASA & Boeing)
  - Multiple jurisdictions & agency involvement (often hinders progress)
  - Unknown/variable performance of passive treatment systems
  - Implementability at point of compliance

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On the other hand…

- NELs may have a positive side (assuming limits are scientifically based and achievable)
  - They provide certainty in the measurement metric
  - But if you have NELs, why is a SWPPP also necessary?
  - Why tell dischargers WHAT they need to meet as well as HOW they need to do it?

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Acknowledgements

- The Boeing Company
  - Debbie Taege, Environment, Health & Safety – Environmental Remediation
  - Paul Costa, Environmental Protection Manager
- NASA
  - Pete Zorba
- Geosyntec Consultants
  - Paul Hobson
  - Dan Bourdeau
  - Judd Goodman

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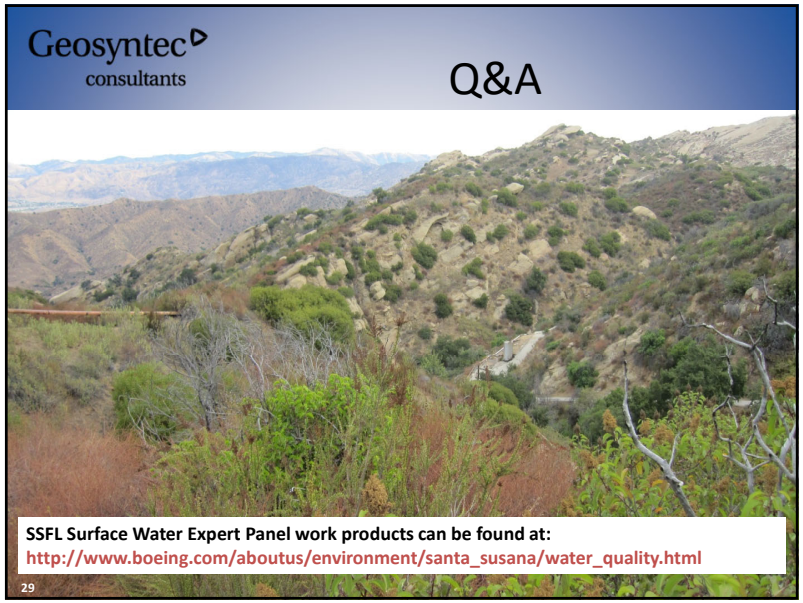
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Q&A
SSFL Surface Water Expert Panel work products can be found at:
http://www.boeing.com/aboutus/environment/santa_susana/water_quality.html
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