



SANTA SUSANA

STORMWATER

Stormwater quality at the former Santa Susana Field Laboratory has been monitored since the 1970s. Stormwater follows the natural topography through a series of channels and ponds until it leaves the Santa Susana site. Certain points along these natural pathways, commonly referred to as “outfalls,” are selected by the regulatory authority as locations where monitoring and sampling should be performed to measure water quality.

Approximately two-thirds of the stormwater that leaves the site flows south towards Bell Creek, a tributary to the Los Angeles River, while approximately one-third of the stormwater flows north to Arroyo Simi, a tributary to Calleguas Creek.

REGULATIONS

Boeing instituted a rigorous monitoring program in order to meet stormwater quality regulatory standards. Stormwater at Santa Susana is covered by a site-wide permit issued and overseen by the Los Angeles Regional Water Quality Control Board.

Thirteen outfalls at Santa Susana are monitored under the guidelines of a National Pollutant Discharge Elimination System permit. Boeing collects stormwater samples when flow is observed in the outfalls.

These samples are analyzed for conventional pollutants including oil, grease and pH; a set of 126 chemical pollutants regulated by the Environmental Protection Agency; and non-conventional pollutants including acute/chronic toxicity, settleable solids and temperature. Some constituents present in stormwater, such as minerals and metals, occur naturally in

the local area or result from fires or other activities outside of the Santa Susana site. Over the years, Boeing has performed thousands of analyses on the stormwater leaving the site.

In many cases, the numeric limits in the Santa Susana permit are set below the levels that the state of California deems safe for the water that people drink. Boeing completed the following activities in an effort to meet these limits:



2 stormwater treatment systems built



1 biofilter installed



45,000 cubic yards of soil removed or treated

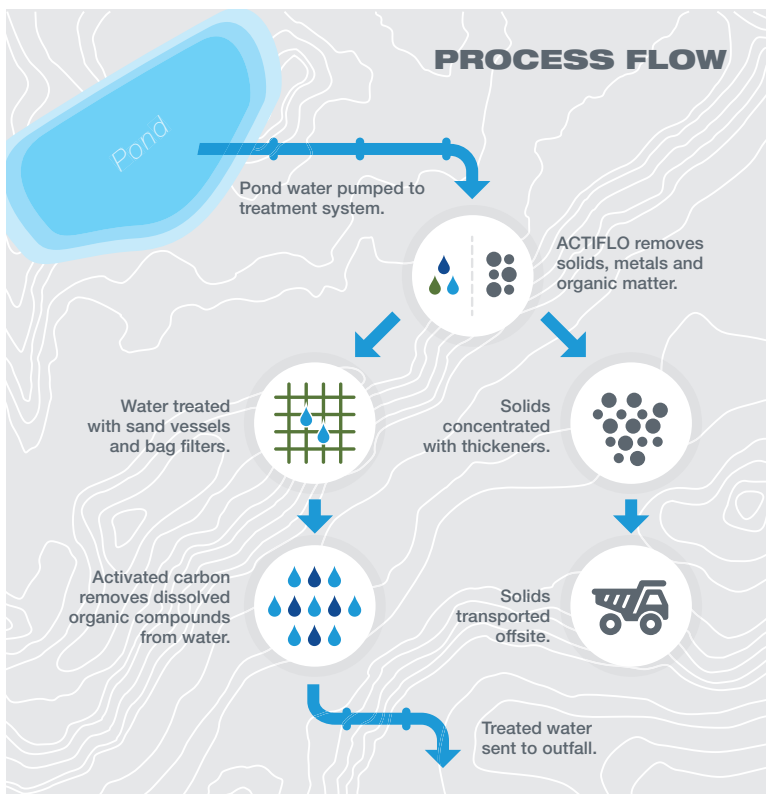
COMPLIANCE

Boeing has spent more than \$80 million to comply with the stringent permit limits and these efforts are making a difference. For the past four years, 2011 through 2014, Boeing has achieved a 97 percent compliance rate.

Between 2006 and 2009, stormwater contained a few individual constituents that were higher than the limits set in the permit, which Boeing reported to the Regional Board. In 2010, Boeing contributed \$300,000 to a program to develop a regional approach to stormwater management, selected by the Regional Board as part of a settlement for permit violations. Boeing also paid \$200,000 in fines.

Improving Stormwater Quality

Boeing uses two methods for treating stormwater at Santa Susana: active and passive. This water management strategy is a hybrid approach that combines state-of-the-art and natural processes.



ACTIVE TREATMENT

Boeing designed and constructed advanced stormwater treatment systems at Outfalls 011 and 018. These systems employ water treatment processes and chemicals similar to those used by city and county municipalities to make drinking water. The stormwater treatment process flow is outlined here.

TREATMENT BY THE NUMBERS



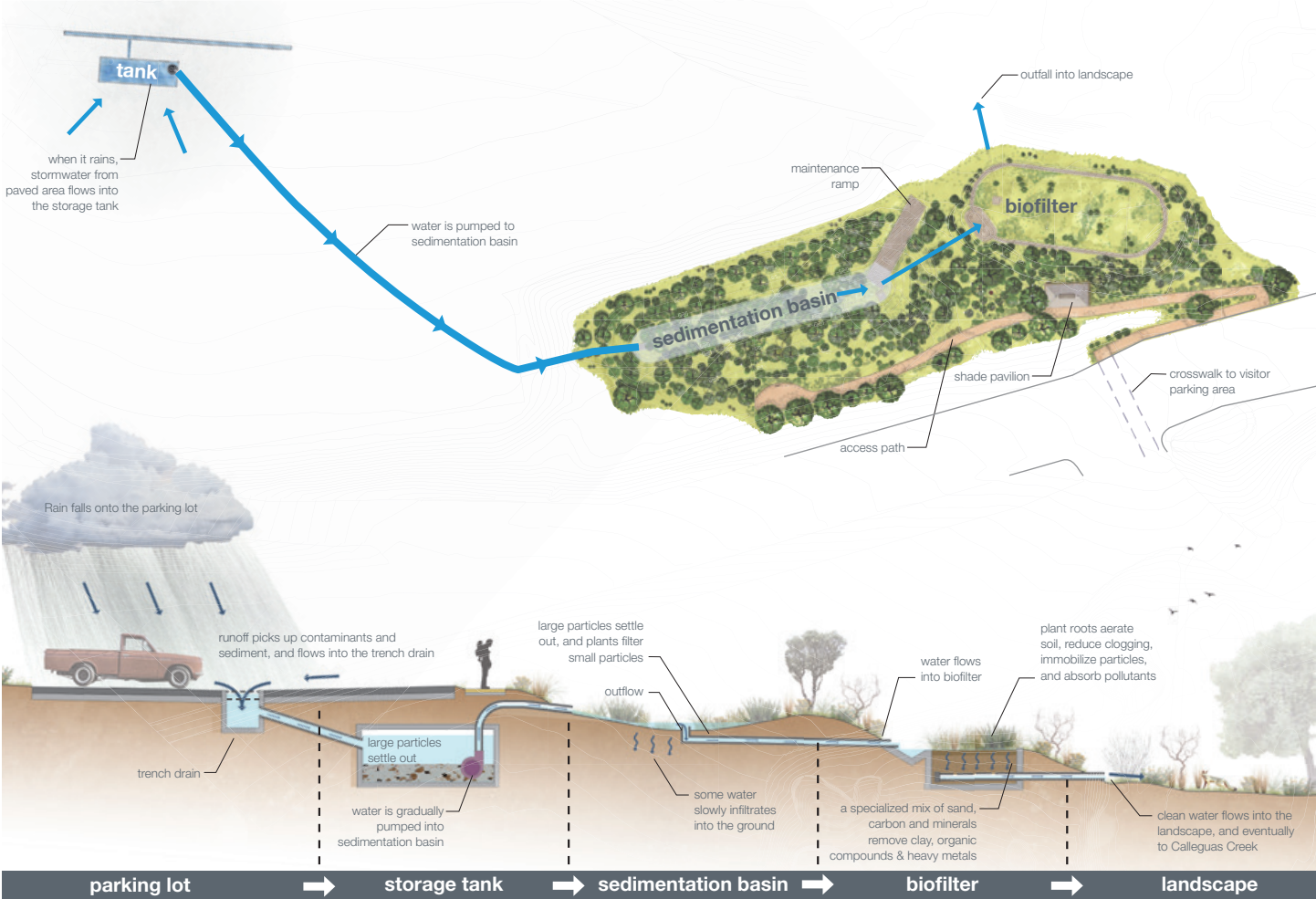
2.5 million gallons can be treated during rain events



2.5 swimming pools of water per hour can be treated by Outfall 018 system



BIOFILTER



PASSIVE TREATMENT

Boeing utilizes an array of passive stormwater treatment technologies, including drainage culvert modifications, stream bank stabilization, revegetation of disturbed soil areas, installation of detention bioswales and placement of smaller-scale erosion control measures.

For example, Boeing installed a biofilter that treats stormwater runoff by harnessing natural processes. Stormwater is collected in a cistern, pumped to a sedimentation basin and allowed to flow into the adjacent biofilter, which functions as a natural ecosystem where constituents in stormwater are filtered through soil, naturally occurring bacteria and native plants.

Boeing collaborated with the Santa Susana Stormwater Expert Panel, Pollinator Partnership and the Los Angeles Conservation Corps to design the biofilter as part stormwater treatment, part wildlife habitat. It also serves as an educational tool for area schools. The California Stormwater Quality Association recognized the Santa Susana biofilter as a creative solution with an Outstanding BMP Implementation Award in 2013.

BIOFILTRATION BY THE NUMBERS



3,200 square foot biofilter



1,800 gallons of runoff per minute



2,000 native plants prevent water pollution



INTERIM SOURCE REMOVAL ACTION

In 2013, Boeing completed its Interim Source Removal Action to improve water quality in two drainage locations in the northern and southeastern portions of the Santa Susana site. This effort involved identifying, evaluating and remediating areas of soil to remove constituents believed to be affecting stormwater runoff.

Boeing minimized the potential impact on streambeds and habitats by conducting biological surveys before targeted field work began in 2009. The Santa Susana Stormwater Expert Panel developed stabilization measures to prevent rainy season erosion and enhance long-term restoration.

Before any soil was removed from the site, it was sampled and characterized to determine the presence of any chemical or radiological constituents. All excavated soil was transported by trucks, using appropriate protective measures, to facilities that are legally permitted to dispose of such soils.

While the Regional Board oversaw the ISRA activities, it worked closely with the agency responsible for the final site-wide cleanup, the California Department of Toxic Substances Control, as well as Ventura County, California Fish and Wildlife and the U.S. Army Corps of Engineers.

ISRA BY THE NUMBERS



Over **25,000** cubic yards of soil excavated from 35 acres



Over **200** monitoring samples collected and analyzed

MEET THE EXPERTS

The Santa Susana Stormwater Expert Panel is an independent committee of five internationally recognized experts who have been providing guidance to Boeing and the Regional Board since 2008. Their recommendations have included best management practices and measures that include the biofilter and bioswales, culvert modifications, soil and pavement removal, erosion controls and channel restoration.

Robert Gearheart, Ph.D., Humboldt State University

Professor Emeritus Bob Gearheart's professional interests focus on water quality management and hazardous waste management, and more specifically on water treatment through constructed wetlands.

Jonathan Jones, P.E., D.WRE, Wright Water Engineers

CEO Jonathan Jones has extensive experience working on projects involving stormwater quantity and quality, floodplain management, surface water hydrology and watershed modeling.

Michael Josselyn, Ph.D., Wetlands Research Associates

Co-founder and President Mike Josselyn manages wetland restoration and mitigation projects, land use planning studies, federal and state permitting projects, and remedial action plans for wetlands in hazardous waste sites. He is a Professor Emeritus at San Francisco State University.

Robert Pitt, Ph.D., P.E., D.WRE, BCEE, University of Alabama

Bob Pitt, professor of Civil and Environmental Engineering, 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.

Michael Stenstrom, Ph.D., P.E., BCEE, UCLA

Mike Stenstrom, professor in the Civil and Environmental Engineering Department, conducts research focused on process development for water and wastewater treatment systems, including mathematical modeling and optimization.

For more information, please visit www.boeing.com/santasusana