

Leona Heights Sulfur Mine Cleanup



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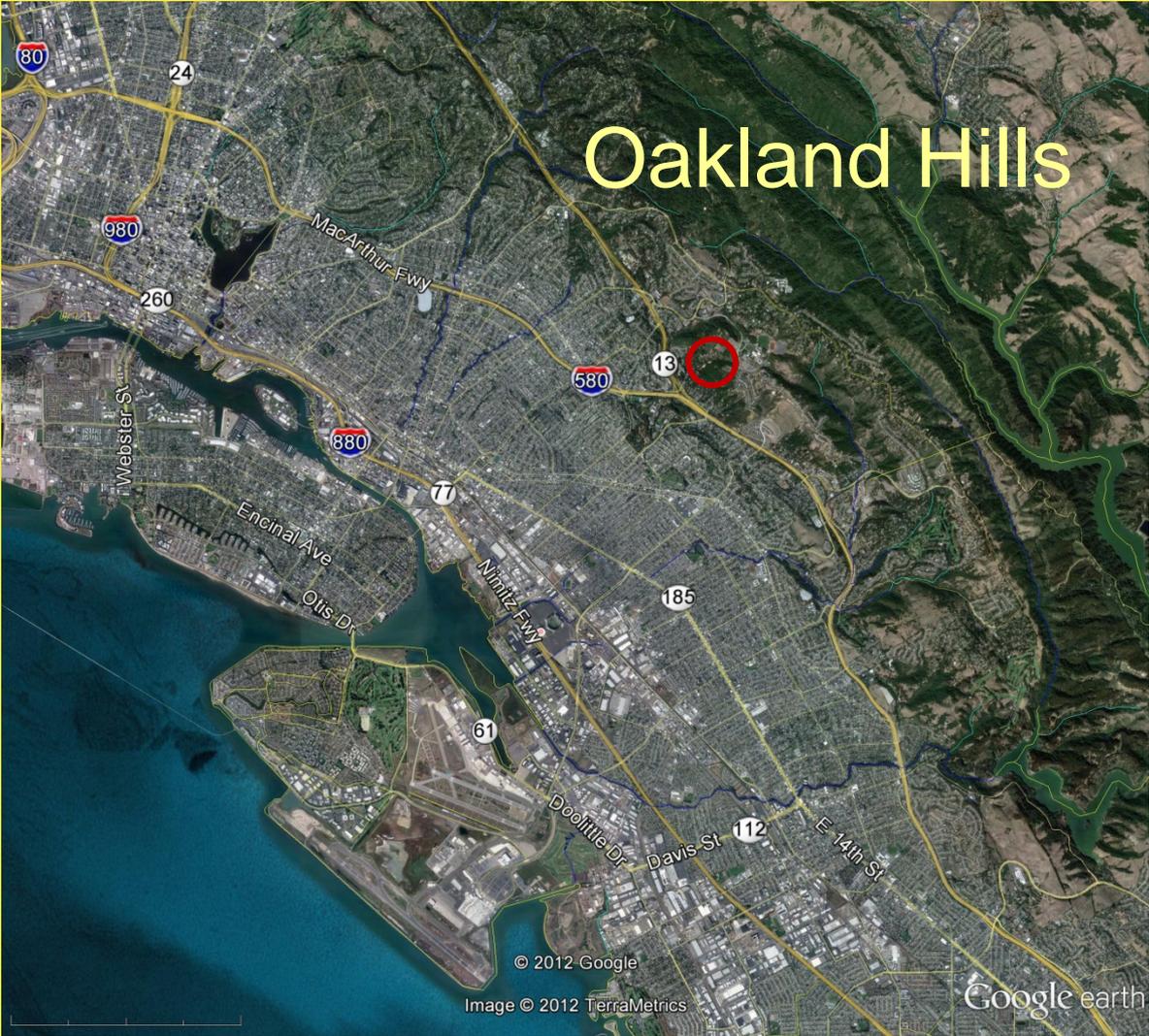
Leona Heights Sulfur Mine

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SITE DESCRIPTION

Site Description

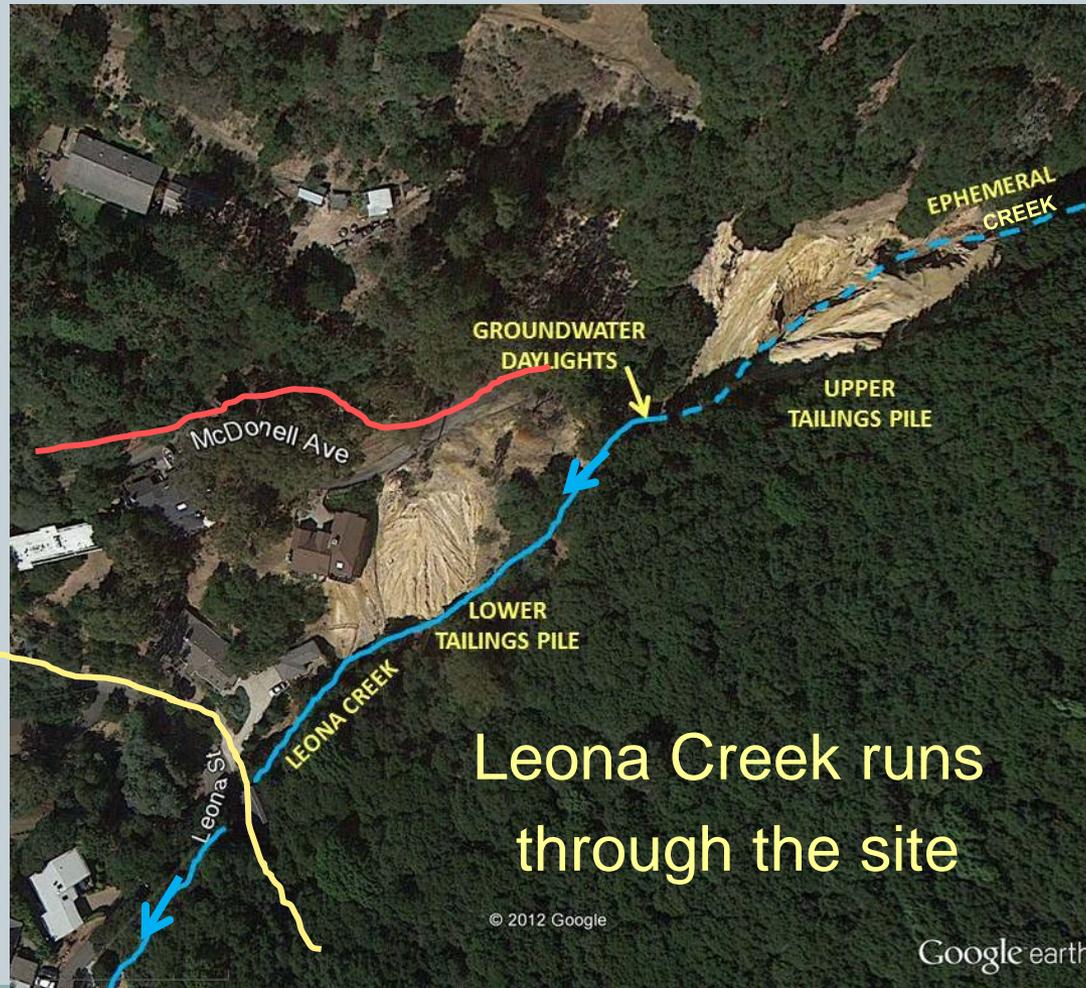


Site Description



Site Description

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Upper Tailings Pile

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Discharge of solid mining waste

Lower Tailings Pile

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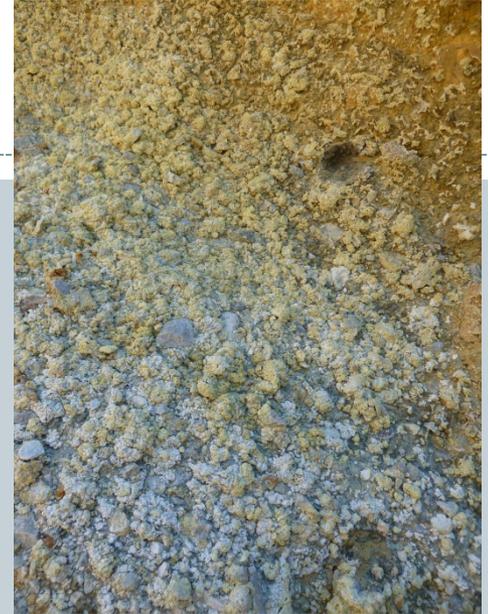
Discharge of solid mining waste

Acid Mine Drainage

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Sulfuric acid produced on contact of mining waste with water



Leona Creek

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Evidence of Ongoing Discharge: Acid Mine Drainage

DRY SEASON

Concentration Range (µg/L)

	pH	As	Ni	Pb	Zn	Cd	Cu	Hg
Leona Creek	5 to 1.5	4 to 1,800	7 to 230	<2 to 110	2,400 to 14,500	7 to 57	5 to 34,000	<0.2 to 27
Water Quality Objectives	6.5 to 8.5	150	52	2.5	120	0.25	9	0.0025

10xWQO*

100xWQO

10,000xWQO

WET SEASON

* WQO = water quality objective to protect human and aquatic habitat health

Evidence of Ongoing Discharge: Tailings

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November 2012



April 2013



Dry Season – Baseline AMD

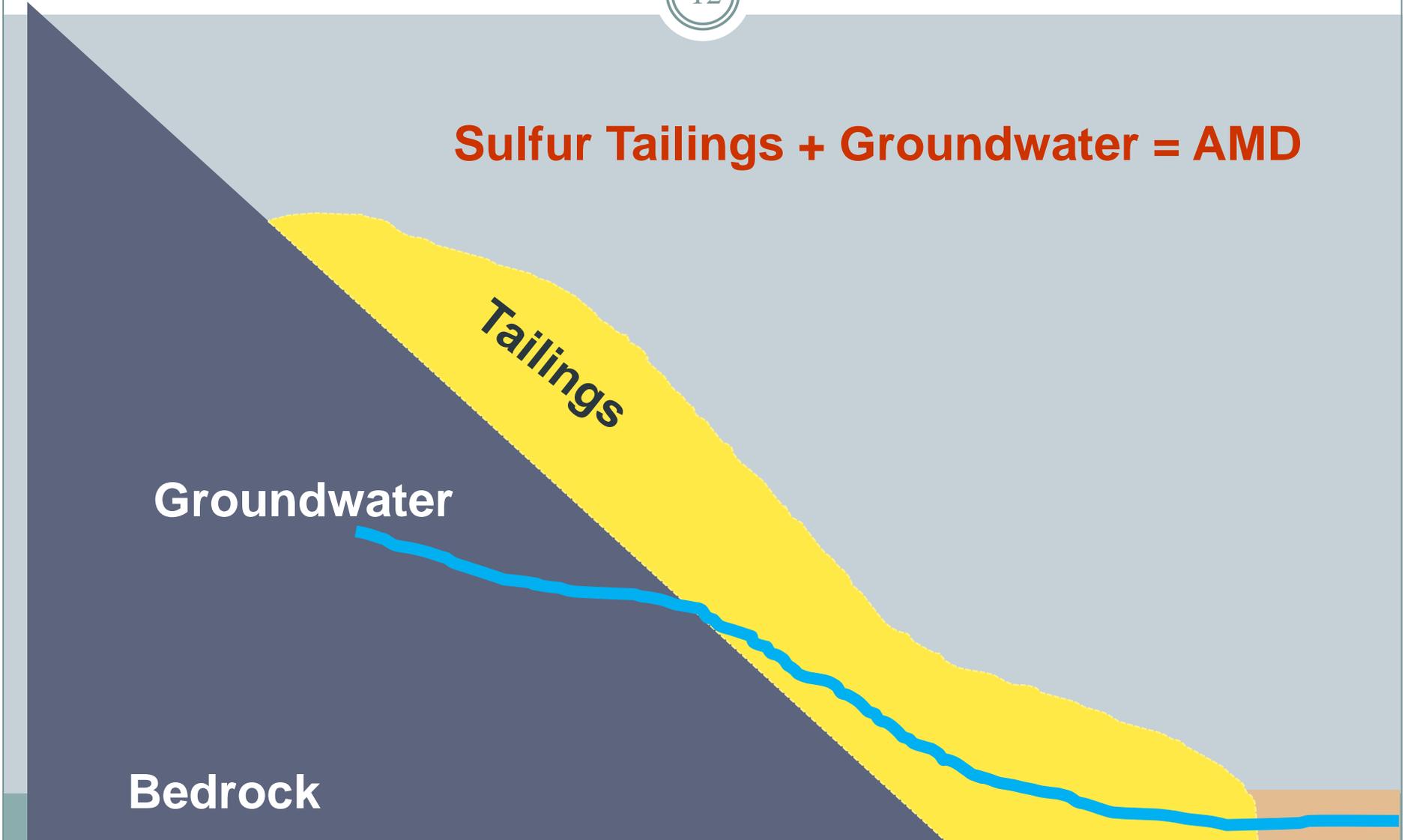
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Sulfur Tailings + Groundwater = AMD

Groundwater

Tailings

Bedrock



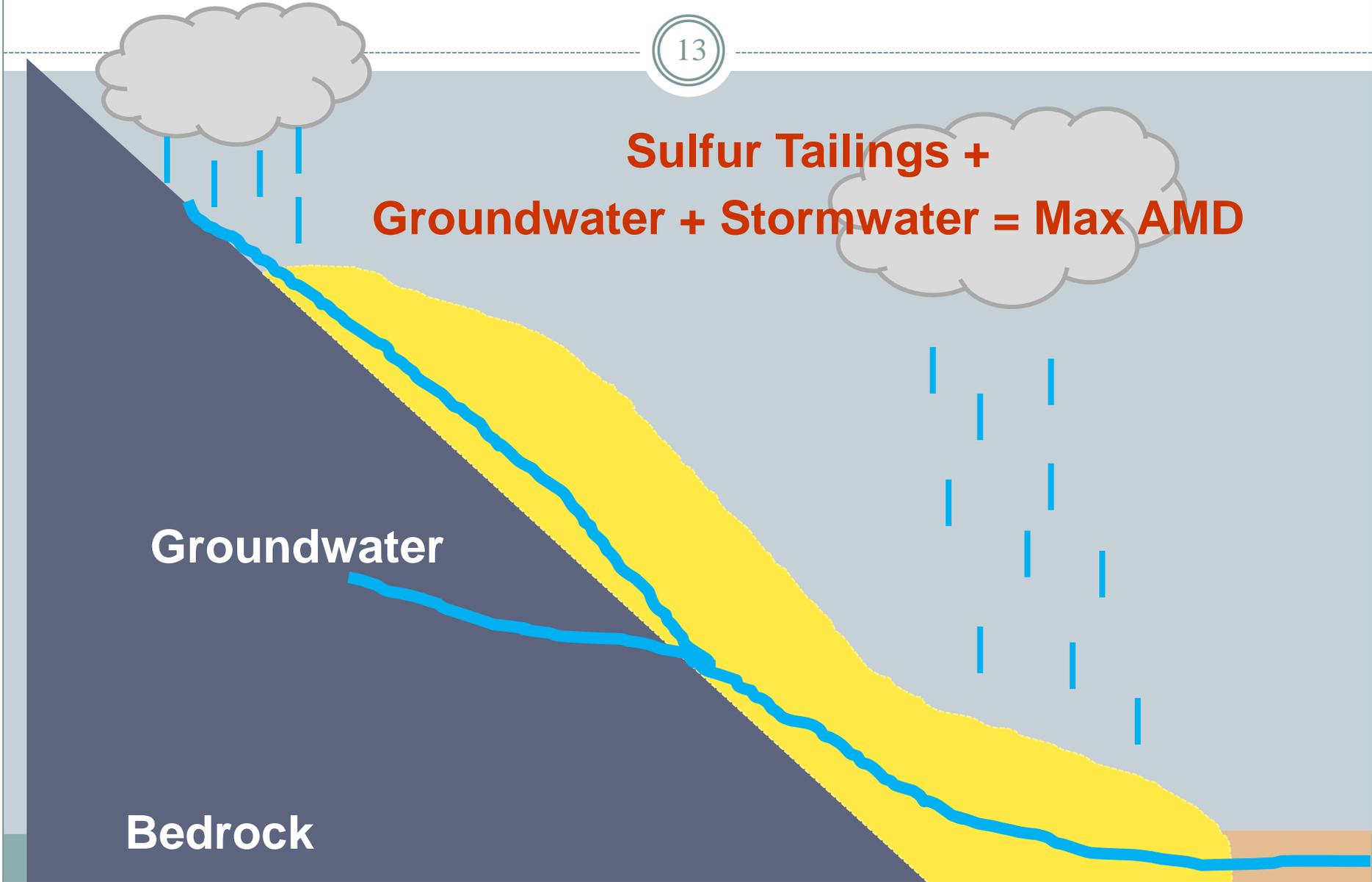
Wet Season – Maximum AMD

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**Sulfur Tailings +
Groundwater + Stormwater = Max AMD**

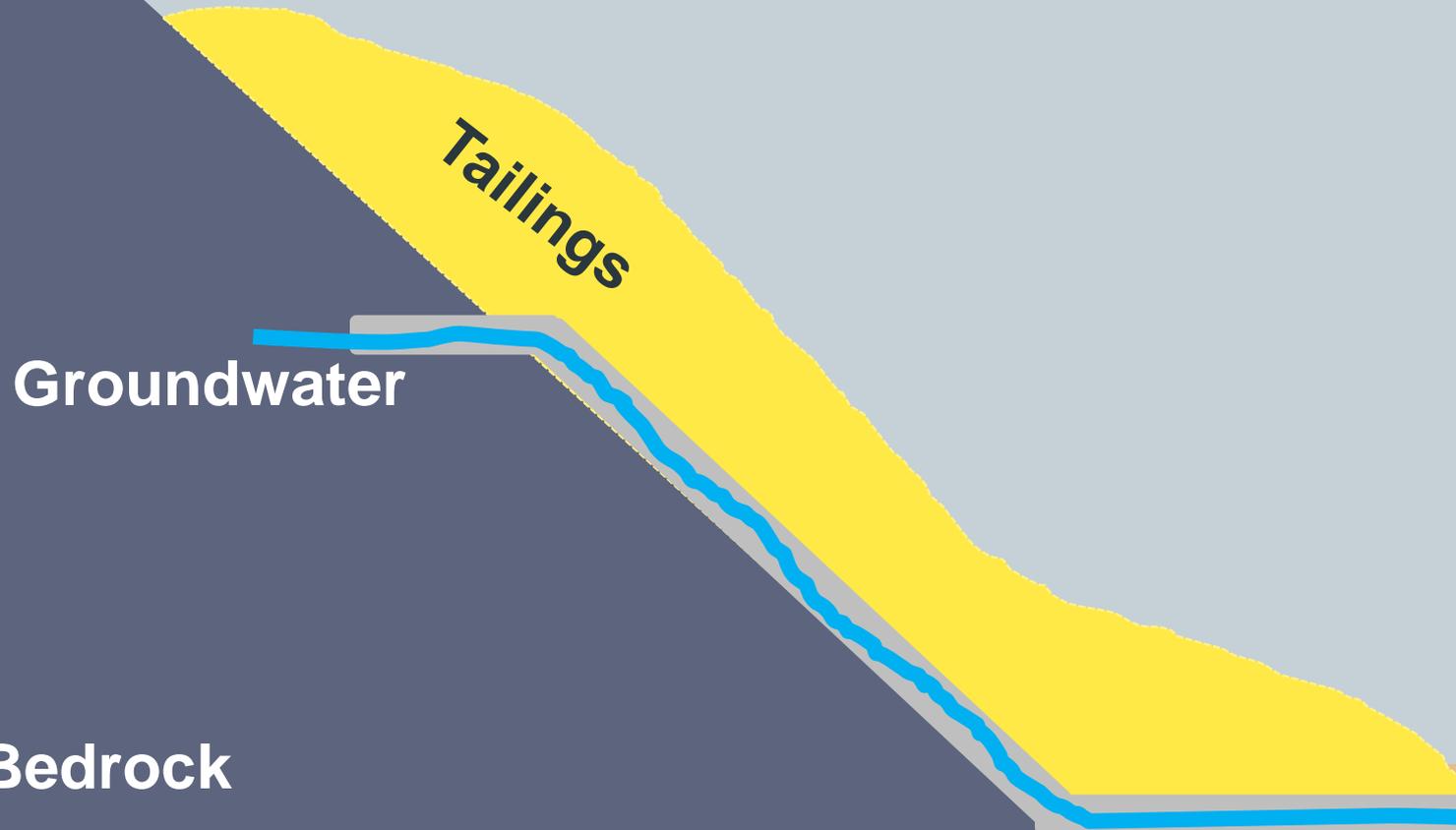
Groundwater

Bedrock



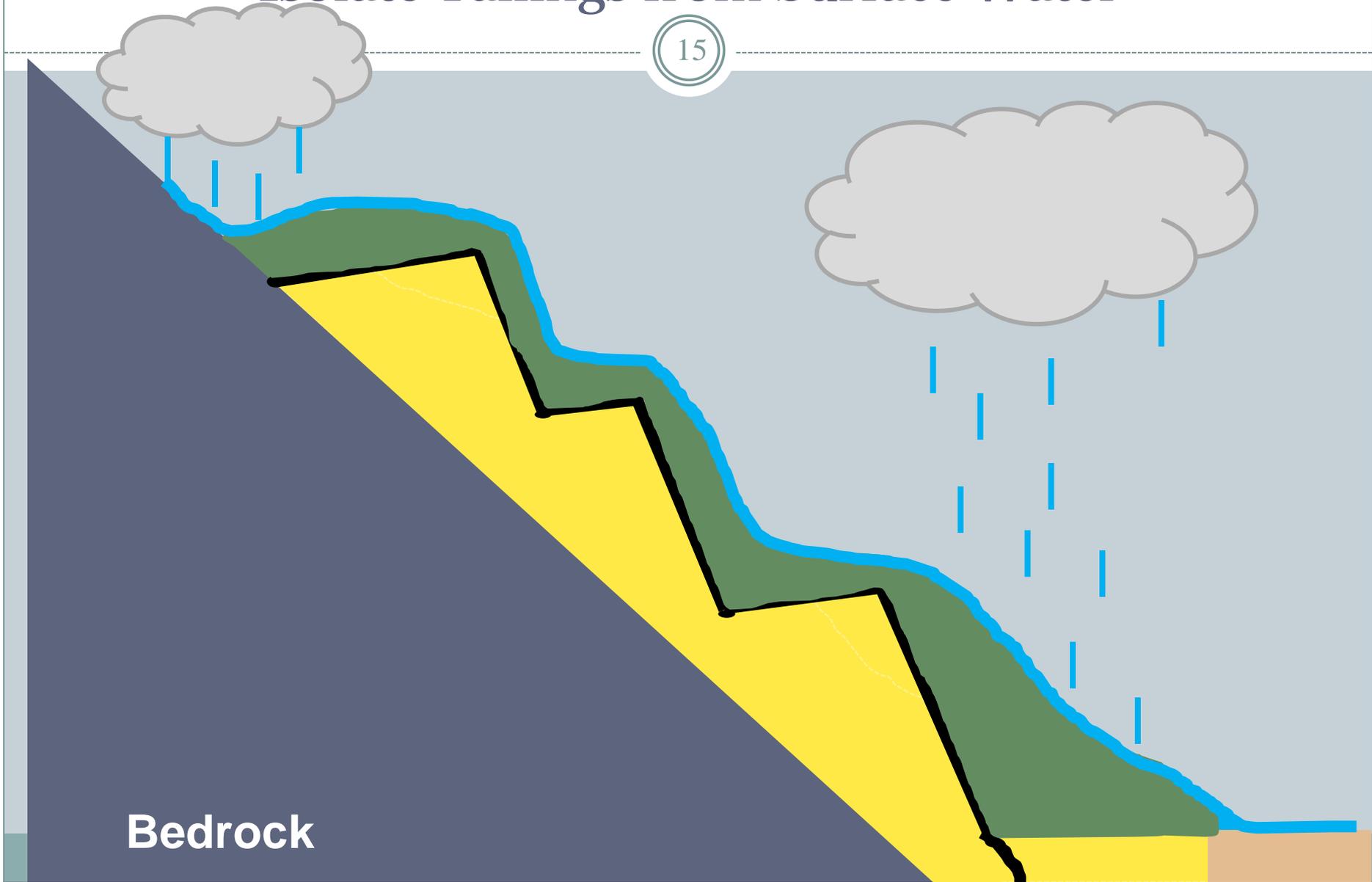
Approved Remedial/Restoration Design: Isolate Tailings from Groundwater

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Approved Remedial/Restoration Design: Isolate Tailings from Surface Water

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Bedrock

Leona Heights Sulfur Mine

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PERMITTING

Permitting

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- **City of Oakland**
 - Mitigated Negative Declaration (CEQA)
 - Creek Protection Permit
 - Grading Permit
 - Tree Protection Permit
 - Temporary Traffic Control Plan
 - Erosion Control Plan
 - Construction Management Plan
 - Alternative Materials and Methods
 - Wet season construction
- **Alameda County**
 - Well Destruction Permit
- **Army Corps of Engineers**
 - Clean Water Act Section 404 (Nationwide Permit)
- **San Francisco Bay Water Board**
 - Remedial Design/Construction Plan Approval
 - Monitoring and Maintenance Plan
 - 401 Water Quality Certification
 - Storm Water Pollution Prevention Plan
- **California Department of Fish and Wildlife**
 - Streambed Alteration Agreement
 - Incidental Take Permit (Alameda Whipsnake)

Permitting

City of Oakland saves ~ 85 Oak Trees

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- Original design footprint
- Revised design footprint

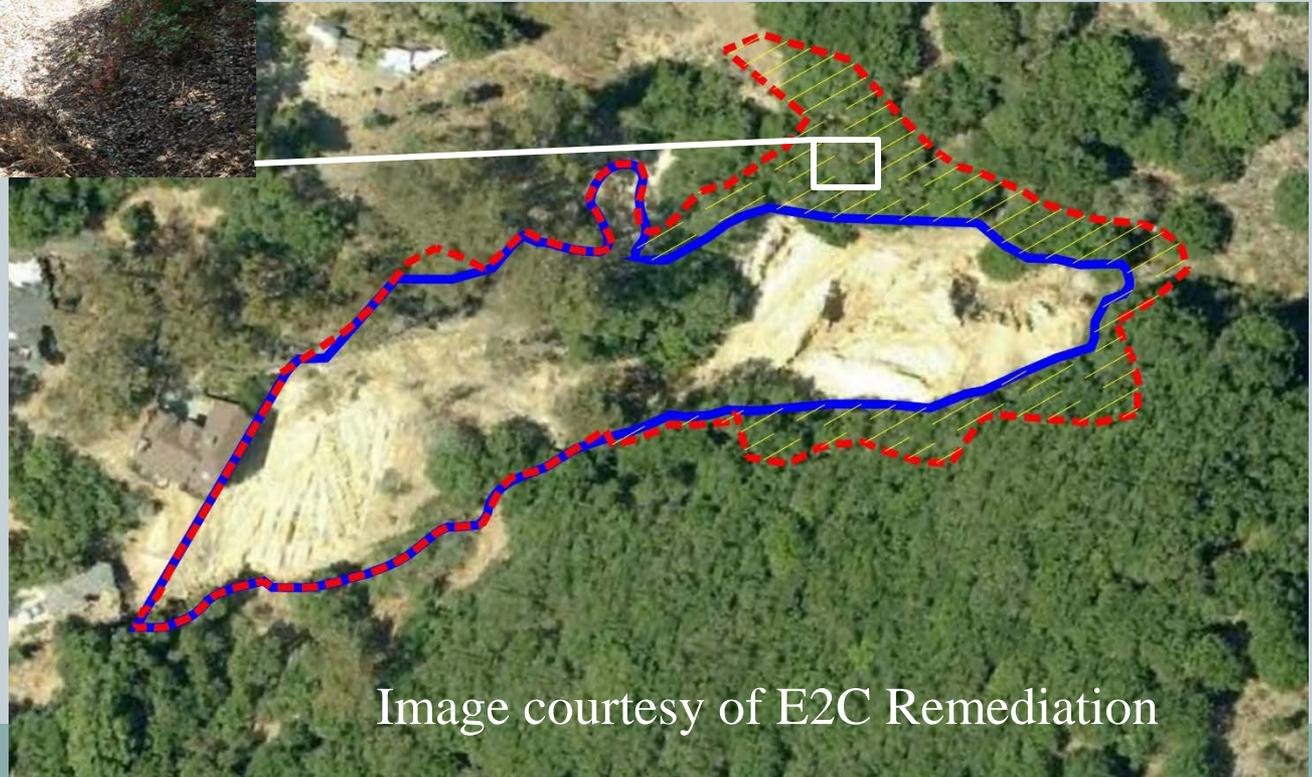


Image courtesy of E2C Remediation

Leona Heights Sulfur Mine

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**REMEDY & RESTORATION
DESIGN AND CONSTRUCTION**

Remedial Design Construction

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Grading of tailings, preparation for slope and cap



Images courtesy of E2C Remediation

Remedial Design Construction

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Slope reinforcement (Geogrid) layer installation

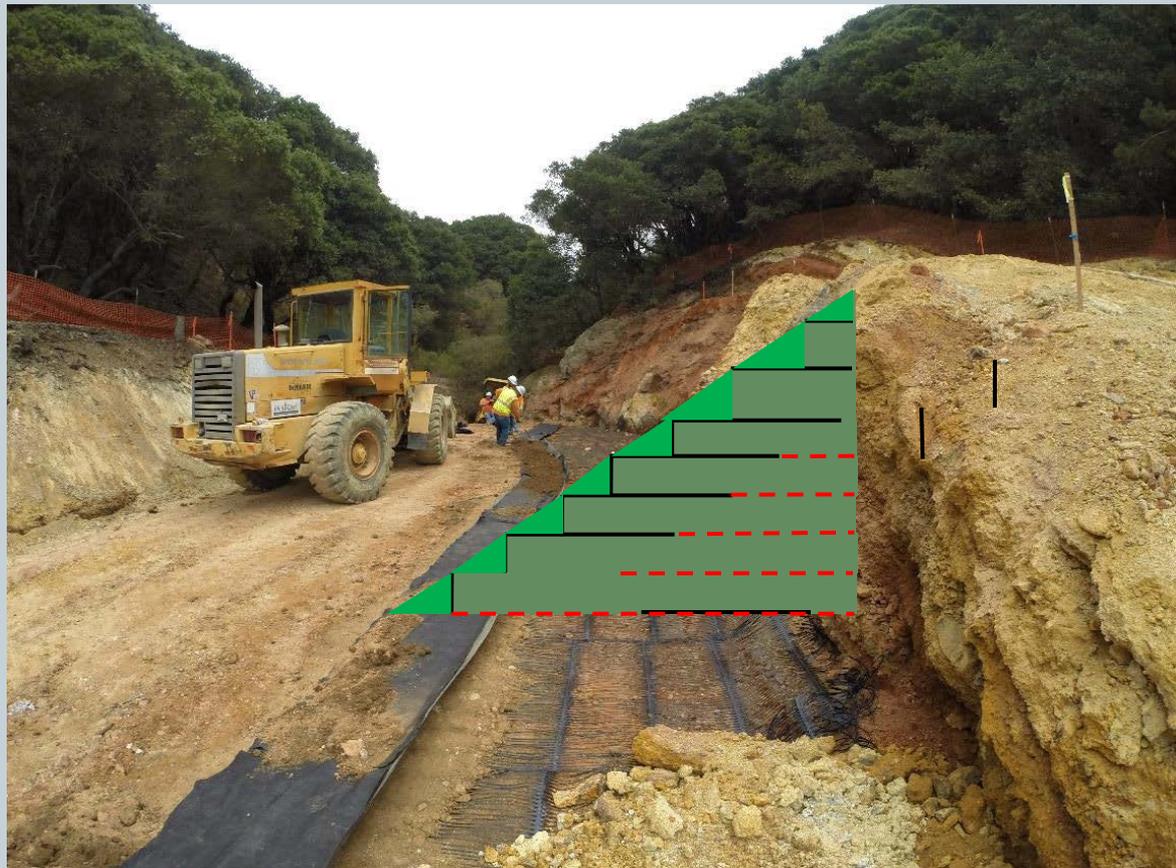


Images courtesy of E2C Remediation

Remedial Design Construction

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Slope construction and liner installation, terraces for stability



Images courtesy of E2C Remediation

Remedial Design Construction

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Next terrace constructed, topsoil over exposed liner



Images courtesy of E2C Remediation

Restoration Design Construction

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Creek reconstruction, armoring rock placement



Restoration Design Construction

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Creek step-pools sedimenting in
Slopes hydroseeded
with natives



Images courtesy of E2C Remediation

Leona Heights Sulfur Mine

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PROJECT STATUS

It's Done! - Upper Pile

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Pre-Construction



Post-Construction



Images courtesy of E2C Remediation

It's Done! - Lower Pile

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Pre-Construction



Post-Construction



Images courtesy of E2C Remediation

It's Done! - McDonnell View

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Pre-Construction



Post-Construction



Images courtesy of E2C Remediation

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NEXT STEPS

What comes next...

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- **Deed Restriction**
 - Due 180 Days after construction completion ✓ (completed 9/15)
- **Monitoring and Maintenance** (in progress w/ permitting agencies)
 - Post construction finishing touches
 - Slope stability
 - Creek stability
 - Native vegetation
 - Post earthquake inspections
 - Post large rain event inspections
 - Water quality improvement

It took a village...

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- City of Oakland – Darin Ranelletti, Rebecca Tuden, Ed Manasse, Bill Quesada, Dave Mog, & Lesley Estes, David Harlan...
- CDFW – Marcia Grefsrud, Annee Ferranti, & Craig Weightman
- USACE – Greg Brown
- Project Design Team:
E2C Remediation (especially Phil Goalwin and Aiguo Xu),
Environmental, Olberding Environmental, LSA Associates

