

Restoring the Moonscapes of the Anaconda Uplands



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“As much as 59 pounds of arsenic and considerable quantities of sulfur dioxide, copper, antimony, lead, and zinc emanated daily from the stacks of the Washoe smelter.”

“After a few years of operation the company swept the denuded mountainsides immediately adjacent the smelters to retrieve over six million dollars worth of copper from the dust.”

- MacMillan, *Smoke Wars* (note10), 87-92



H. Shoebottom, *Anaconda: Life of Marcus Daly, The Copper King*, Harrisburg, 1956, 77.



- 1880's: 1st timber cut- McCune supplies ACM w/ 300,000 cords
- (1890's - early 1900's): 75000 cords of wood per year before coal

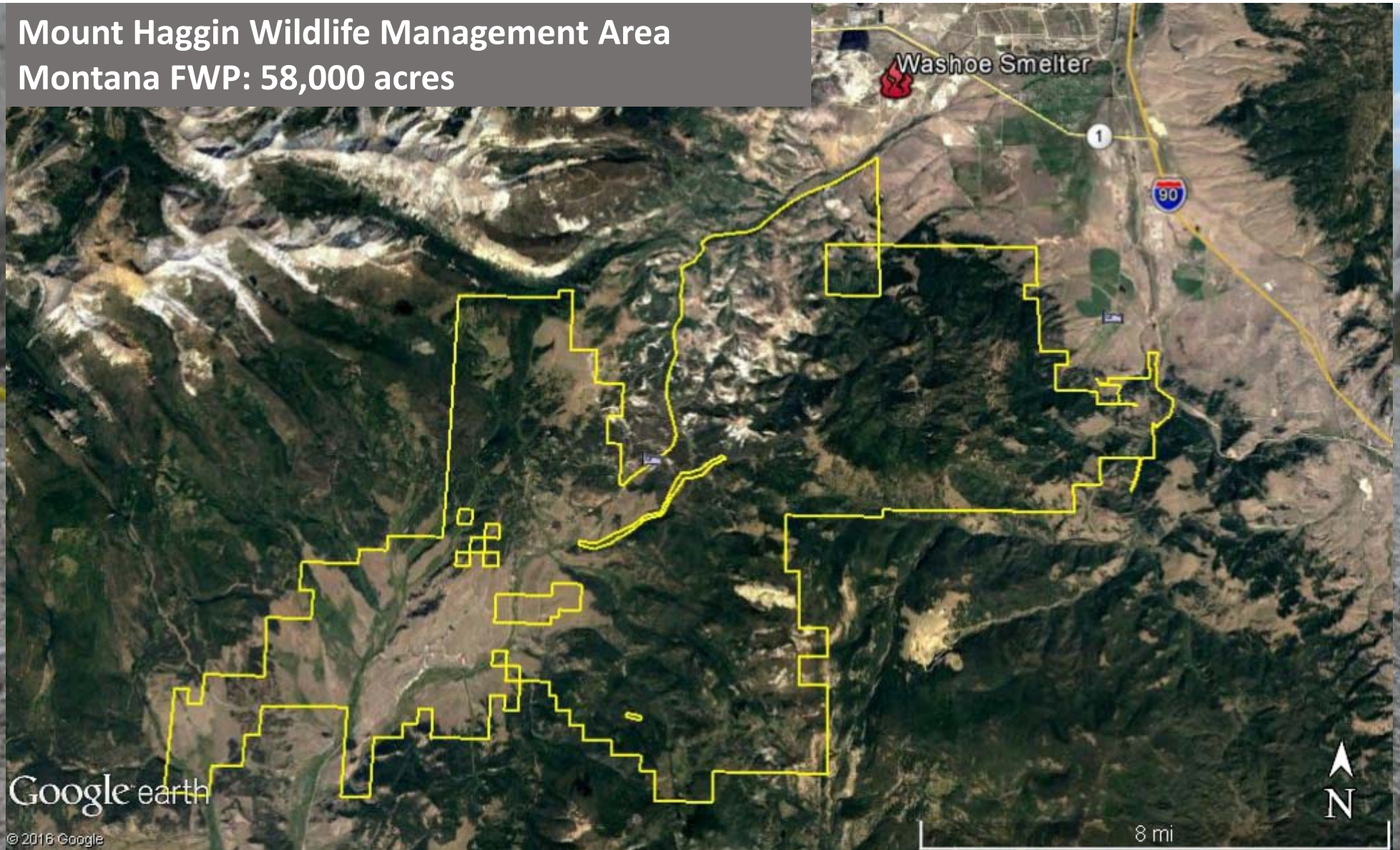


- **1906:** Big Hole Forest Reserve established (precursor to Beaverhead NF); French Gulch timber sale begins (lasts 10 years)
- **1908:** Gifford Pinchot visits sale

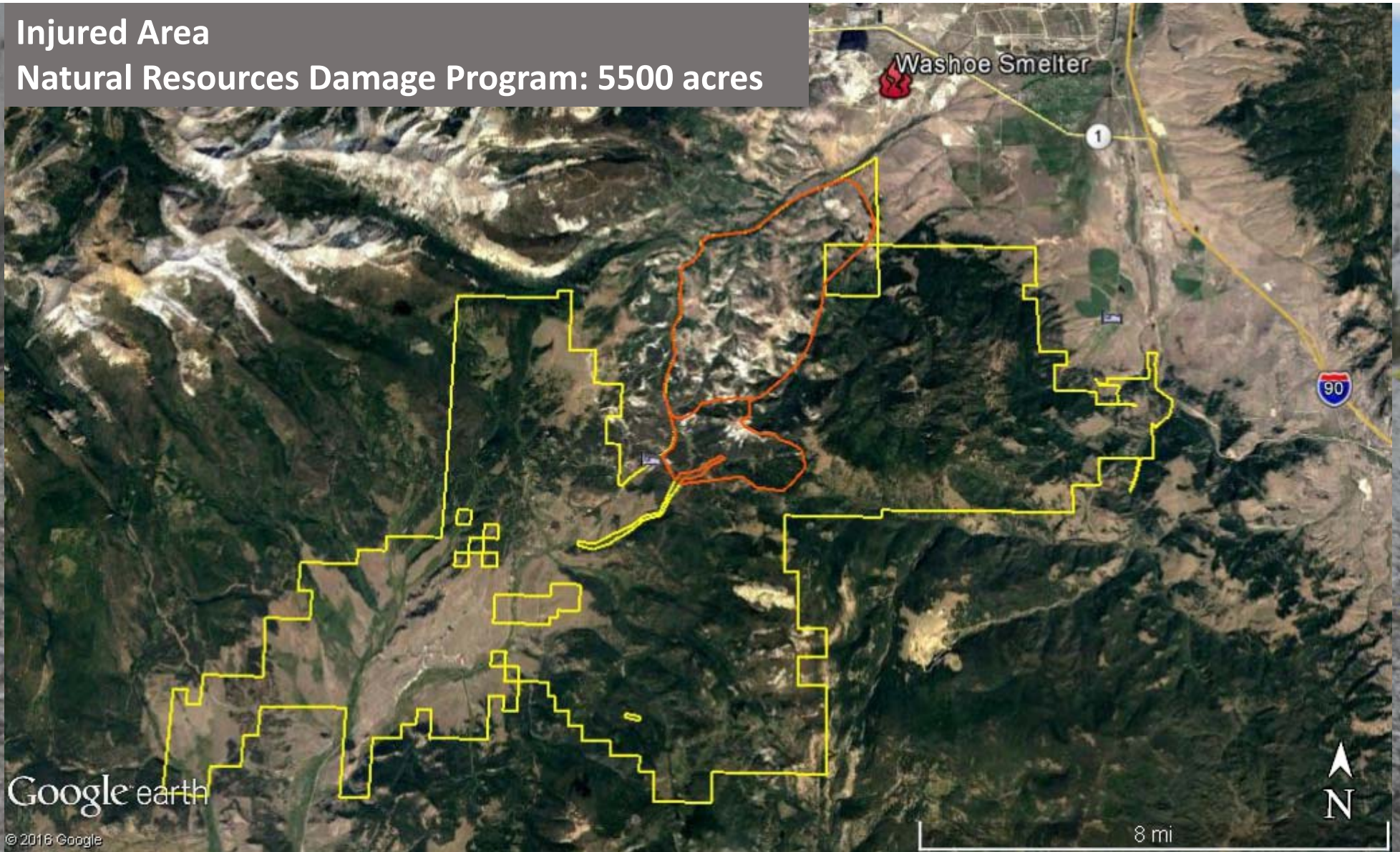


Logs transported by rail, sled and flume

Mount Haggin Wildlife Management Area
Montana FWP: 58,000 acres



Injured Area
Natural Resources Damage Program: 5500 acres





Google earth

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3 mi



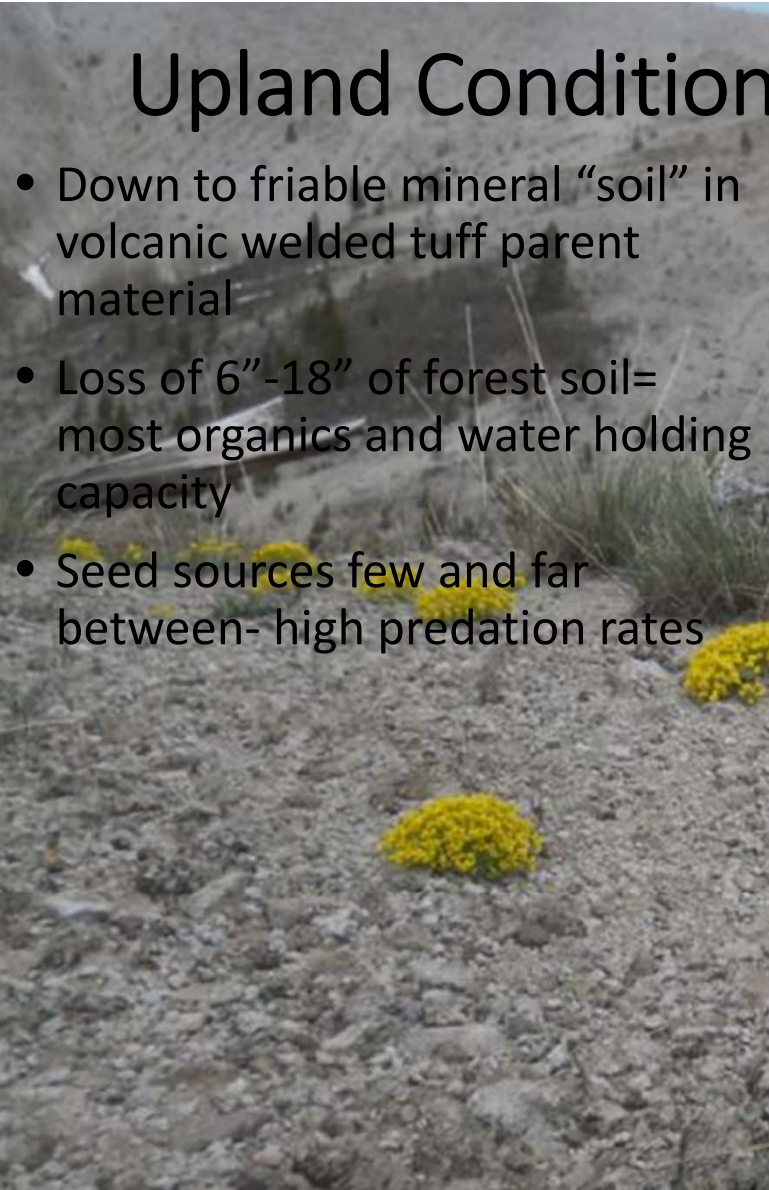
Upland Conditions: Past the Ecologic Tipping Point

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- Loss of 6”-18” of forest soil= most organics and water holding capacity
- Seed sources few and far between- high predation rates



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- Loss of 6”-18” of forest soil= most organics and water holding capacity
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- Extreme summer, winter climate + wind erosion
- Loss of most natural grade controls and riparian buffer = sediment superhighways













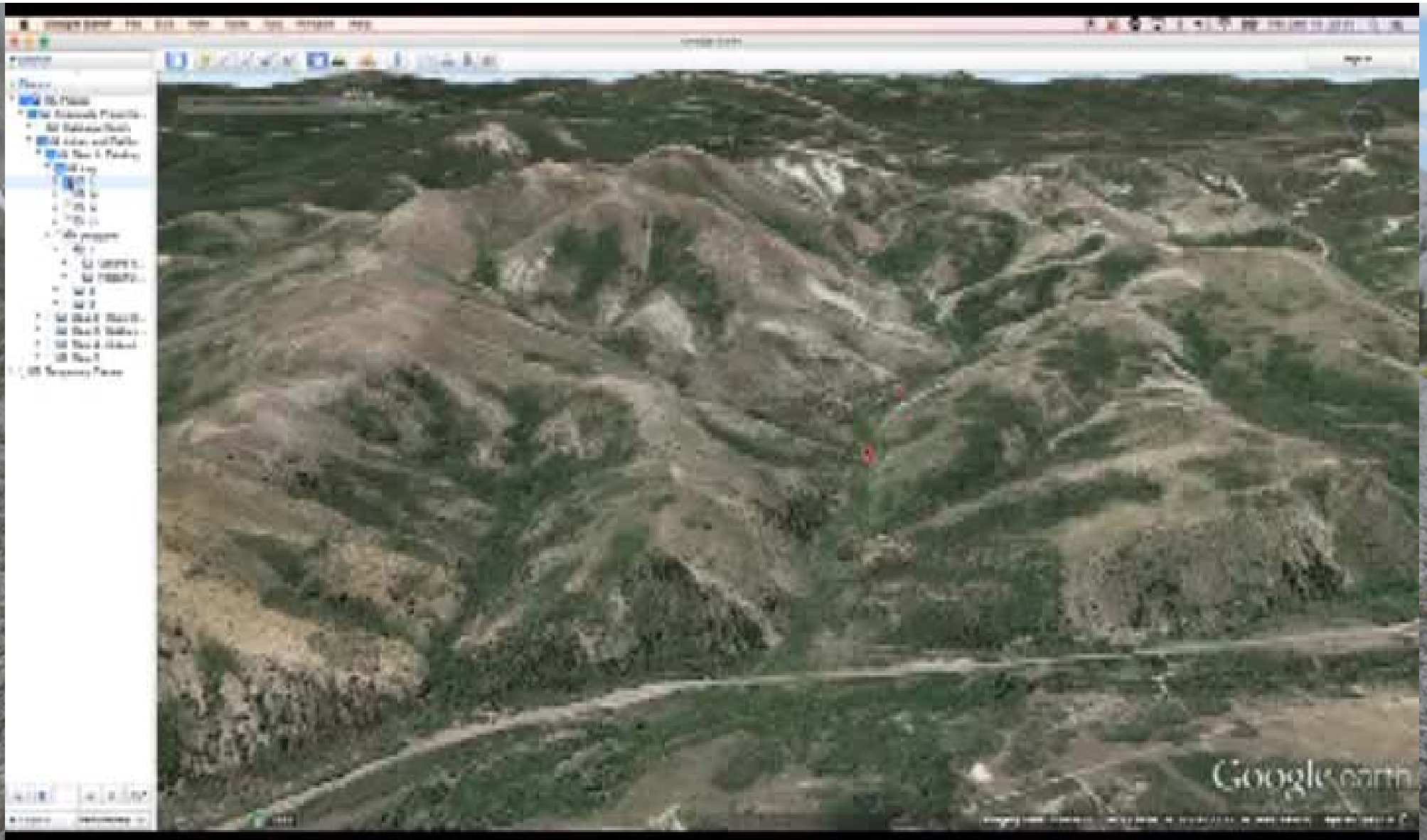
1995

Imagery Date: 8/18/2013 46°00'36.12" N 112°58'36.49" W elev 6556 ft eye alt 7094 ft

Riparian Conditions

- Incised streams associated with sediment plumes
- Loss of hydrologic connectivity and “Perched” riparian
- Beaver activity and habitat drastically reduced
- Herbivory
- Big Hole Landowners say California Creek “running white”
- Significant natural regeneration since 1980 from bottom up





Framework for Remediation/Restoration

- ARCO Remedial Action Work Plan (RAWP) and Final Design Report (FDR)
 - Stucky Ridge (RDU 1): 2005
 - Mt Haggin Uplands (RDU 15): 2007
 - Sediment detention ponds to capture COCs

Steep Slope Reclamation

- SSR I (planting, broadcast seeding)
- SSR II (+ non-mechanized on-slope BMPs)
- SSR III (+ mechanized on-slope BMPs)
- SSR IV (+ slope re-grade)



Framework for Remediation/Restoration

- NRDP Restoration Objectives (Sediment, Vegetation)
- MT FWP Landowner Objectives
 - **Long-term stewardship and habitat improvement**
 - Long-term maintenance considerations
- Roadless area and WMA character
 - No plastic, no roads
- Multi-stakeholder TWG since 2010
 - Vegetation mapping and erosion source assessment (2011-2013)
 - Demonstration projects (2012-2016)



Conceptual Plan and Design Principles

- Iterative and adaptive approach- NOT one and done
 - Demonstrate and scale up what works



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- **Capture and hold sediment on landscape**
 - **Uplands- grow grass, forbs**
 - **Capture sediment in gullies**
 - **Riparian- slow the water, connect floodplain**



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- More nuanced SSR system- match technique to location
- Weed treatment



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= MORE catchment than proposed sediment ponds with LESS long-term maintenance and MORE habitat values

SSR I

SSR-1a	Broadcast Seeding
SSR-1b	Broadcast Seeding with Fertilization
SSR-1c	Soil Scarification/Trenching
SSR-1d	Woody Plant Establishment
SSR-1e	Other Soil Amendment





June 2014



July 2015



SSR-1b Broadcast Fertilization and Seeding- Oct 2014



SSR-1b Broadcast Fertilization and Seeding-July 2015



SSR-1c: 3 acre upland amendment fertilization
- Oct 2015



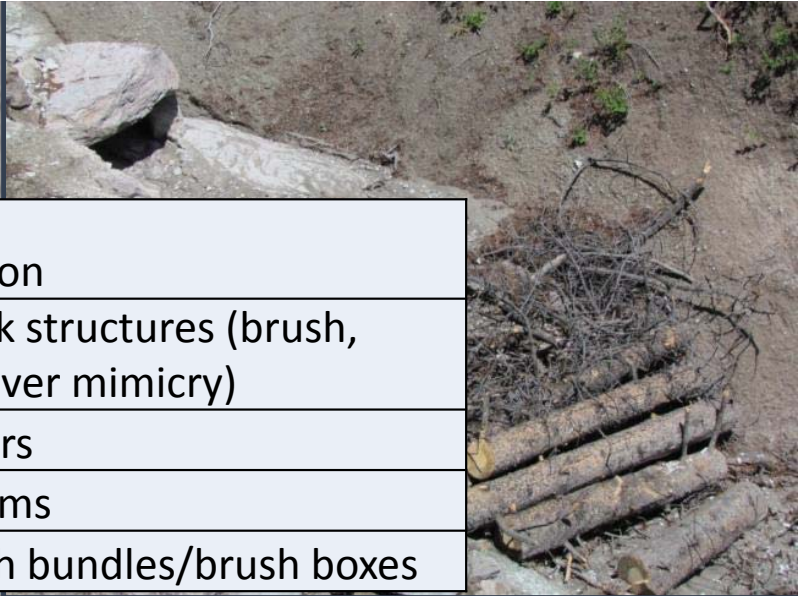
SSR-1c: 3 acre upland amendment fertilization
- June 2016





SSR II

SSR-2a	Slope stabilization
SSR-2b	In-stream check structures (brush, straw bale, beaver mimicry)
SSR-2c	Gully slash filters
SSR-2d	Gully Check Dams
SSR-2e	Anchored brush bundles/brush boxes







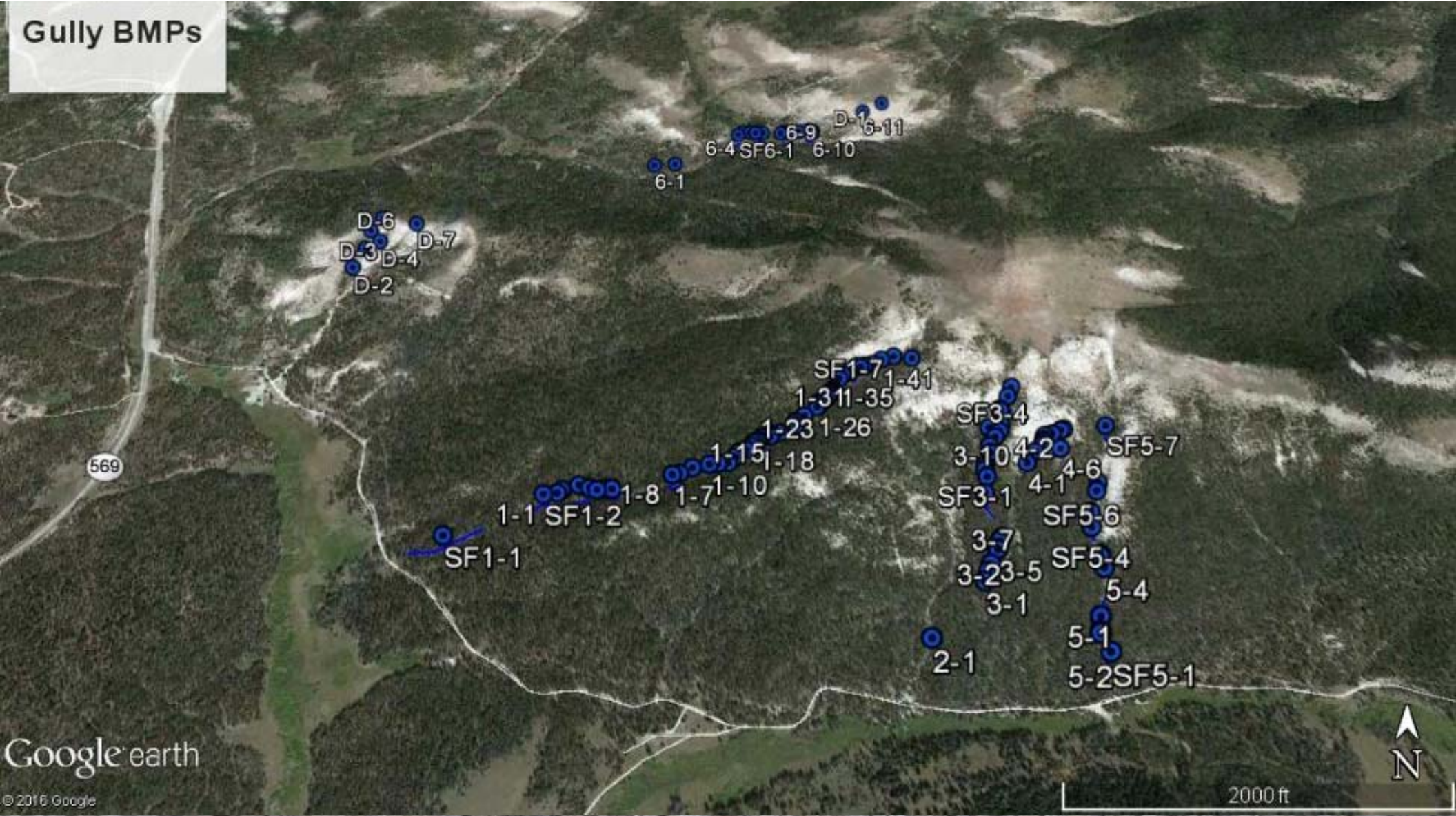


Filled structures:

- Widen gully bottom/floodplain
- Allow seed to settle and germinate in captured fines
- Can be built on again decreasing sidewall slope length
- Hold back moisture



Gully BMPs



569

Google earth

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2000 ft



SSR 2-c: Beaver Mimicry



SSR 2-c: Beaver Mimicry

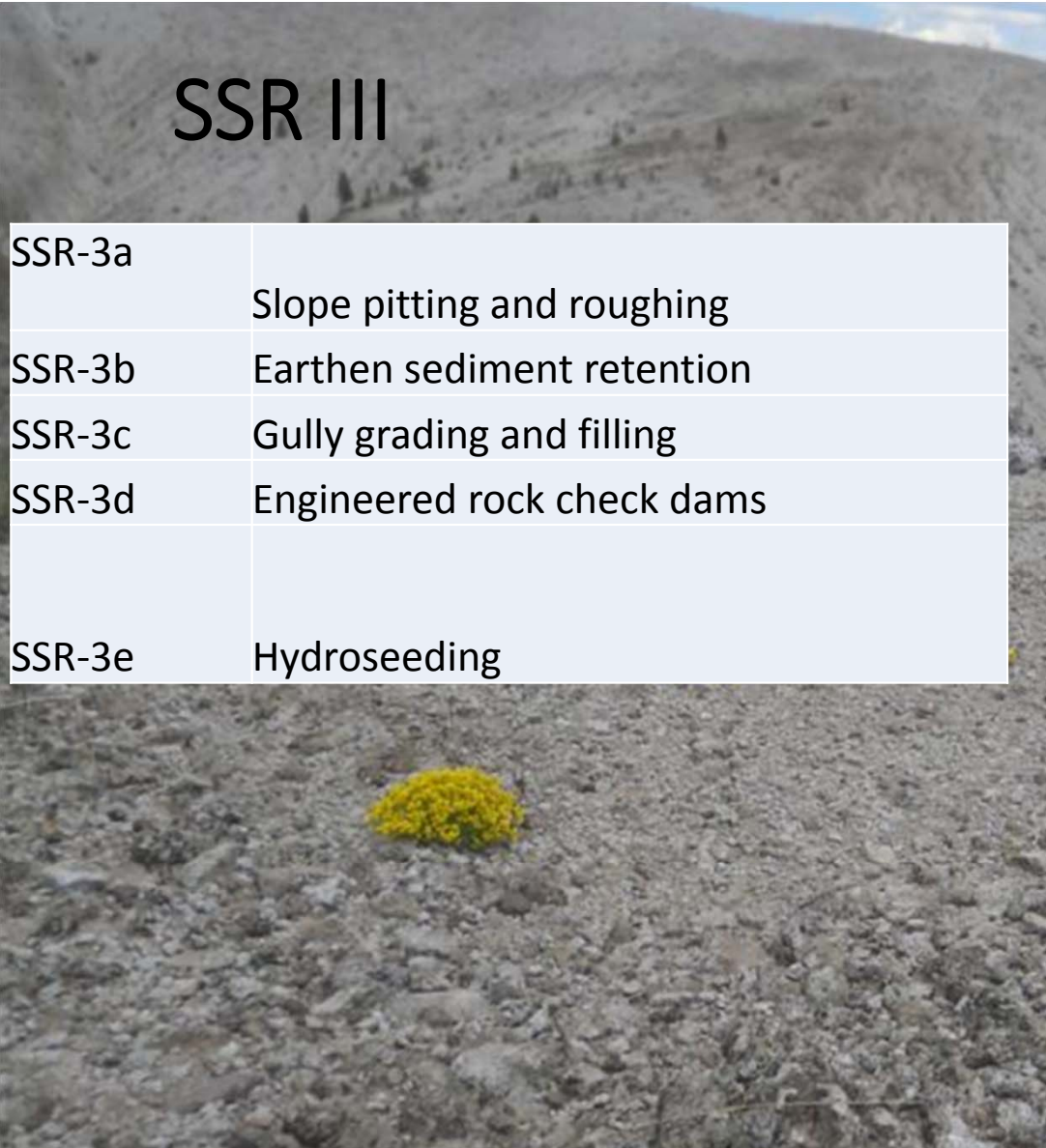


California Creek

- > 300 structures installed
- Avg. 0.2 T/ structure; 20.3 Tons sediment captured (oct. 2015)
- Restoring function for desired habitat

SSR III

SSR-3a	Slope pitting and roughing
SSR-3b	Earthen sediment retention
SSR-3c	Gully grading and filling
SSR-3d	Engineered rock check dams
SSR-3e	Hydroseeding











Cut -off gully, 2 years after 1st structure



July 2014



Google earth

200 ft

September 2014



Google earth

200 ft





2012



2014





2012

2013

2014

2016





2010



2014





2016

Muddy Gulch

2017



2016



2017



2016



2017



2016



2017





2016



2017

2012-2016 Work Summary

• NRDP/FWP

- 120 acres aerial fertilization
- Cabbage Gulch CCR draft delivered
- 6 engineered rock check dams- California Ck.
- Joiner Gulch- >150 gully BMPs
- Muddy Gulch- 3 miles of new channel

• DEQ 319 (California Ck)

- 11 exclosures
- 2200 shrubs and trees
- 1 Culvert removal and regrade
- 2 new culverts and ditch relief
- 300 Beaver Mimic Structures
- 1400 ft. Bank fascines
- 1 mile slash filters
- 4 miles gully BMPs

• DNRC RDGP (California Ck. and Joiner Gulch)

- 6 acres upland vegetation enhancement with 30-80% vegetation improvement
- 400 ft. Gully BMPs





Thank you



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