

Iron King Mine / Humboldt Smelter Superfund Site
Dewey-Humboldt Town Council Study Session
July 13, 2021



Possible Topics for our Time This Evening...

- Overview of the site
- Discussion of questions provided By Town
 - Possibility of Coking Wastes at Smelter
 - Soil Background Concentrations
 - Dust and the Smelter
 - Sampling Commercial Properties
 - Buried Tailings, Etc.
 - Cancers
- Cleanup options we are evaluating for the whole site and where we are in the Superfund process

Topical Presentations

1

A Good Look At the Site

2

Defining the Problem

3

Options for Cleanup

4

Interim Dust Control, Fencing and Signs

5

Investigation and Cleanup of Residential Yards

6

Future Reuse of the Smelter Property

7

A Health Concern: Natural Arsenic in Private Drinking Water Wells



Iron King Mine/Humboldt Smelter Recorded Presentation Series

U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • June 2020

The U.S. Environmental Protection Agency (EPA) developed a seven-part recorded presentation series on the Iron King Mine/Humboldt Smelter Superfund site. We hope this information helps you understand the site, EPA's Superfund process, and how we study options to address the contamination. For EPA contacts or more information on the site, please visit our website: www.epa.gov/superfund/ironkingmine



[Presentation 1 – A Look at the Site \(with Photo Tour\)](#)

The former mine and smelter created more than 8 million tons of mine tailing and smelter wastes. Today, the site has many contaminated areas that need cleanup, including the mine and smelter properties and the drainage that lies between them.

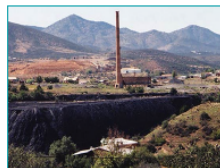


[Presentation 2 – Defining the Problem: The Remedial Investigation](#)

As part of the Superfund process, EPA conducted a comprehensive investigation of the contamination. During our remedial investigation, we studied what and where contamination is and what risks it may pose to human health and the environment. Over several years, we took thousands of samples and other measurements to complete this investigation.

[Presentation 3 – Options for Cleanup: The Feasibility Study](#)

As part of the Superfund process, EPA is doing a feasibility study that compares five cleanup options to address the contamination. When comparing the cleanup options, we consider the effectiveness of each alternative, the time it takes to complete, costs and how the options might affect the community, among other factors.



[Presentation 4 – Interim Dust Control, Fencing and Signs](#)

The Superfund process takes time. In 2019-2020, EPA took short-term actions to protect human health until we could select a final, long-term cleanup. These actions included dust control at the former smelter property. In addition, we placed many warning signs and added/upgraded fencing at or near both the former mine and smelter properties to warn people to stay away.

[Presentation 5 – Residential Investigation and Cleanup](#)

EPA studied the surface soils at almost 600 residential yards in Dewey-Humboldt and considered human health risk when choosing which yards to clean up. Between 2006-2017 EPA cleaned up surface soils at 50 yards.

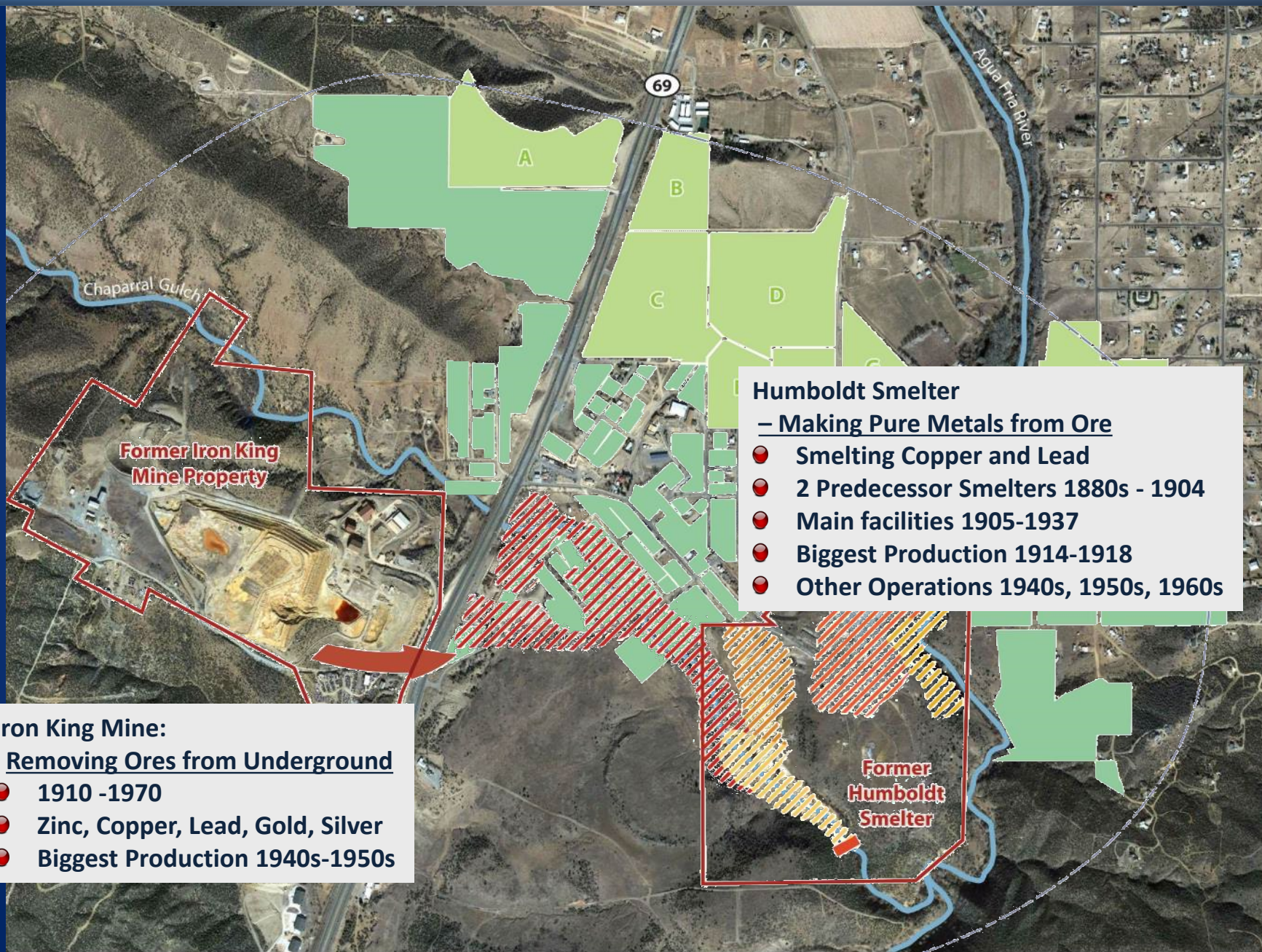
High levels of contami-

[Presentation 6 – Future Reuse of the Smelter Property](#)

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Site Overview: Iron King Mine / Humboldt Smelter



Humboldt Smelter

– Making Pure Metals from Ore

- Smelting Copper and Lead
- 2 Predecessor Smelters 1880s - 1904
- Main facilities 1905-1937
- Biggest Production 1914-1918
- Other Operations 1940s, 1950s, 1960s

Iron King Mine:

Removing Ores from Underground

- 1910 - 1970
- Zinc, Copper, Lead, Gold, Silver
- Biggest Production 1940s-1950s

Former
Humboldt
Smelter

Site Overview: Mine Wastes and How they Move



What was left behind?

- Mine tailings
- Waste rock
- Dross
- Slag
- Mixed up tailings, sediments & soils

Chaparral Gulch

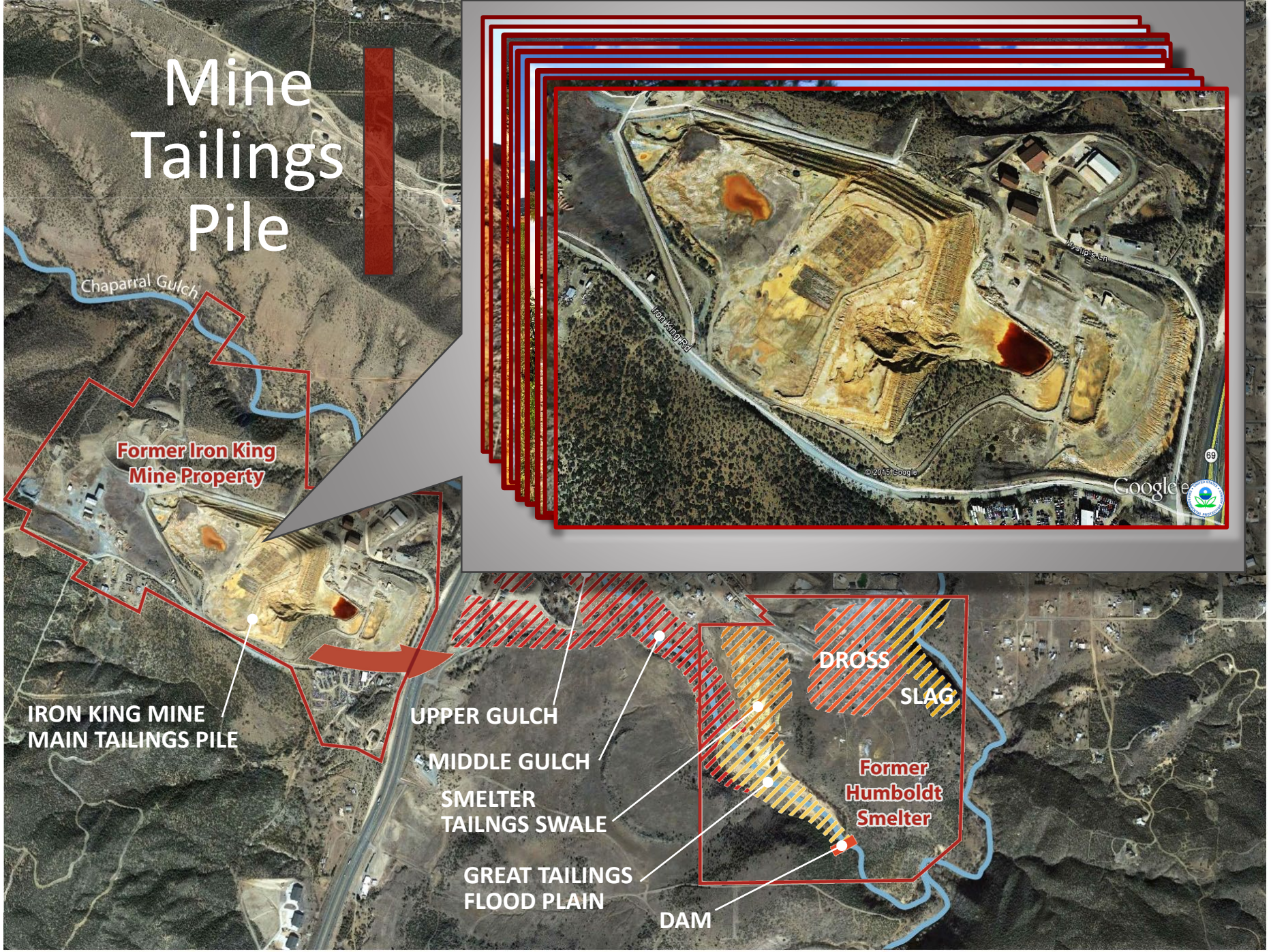
**Former Iron King
Mine Property**

**Former
Humboldt
Smelter**

The Site Isn't Simple: Contamination Is Present in Many Different Environments



Mine Tailings Pile



Chaparral Gulch

Former Iron King Mine Property

IRON KING MINE MAIN TAILINGS PILE

UPPER GULCH

MIDDLE GULCH

SMELTER TAILINGS SWALE

GREAT TAILINGS FLOOD PLAIN

DAM

DROSS SLAG

Former Humboldt Smelter

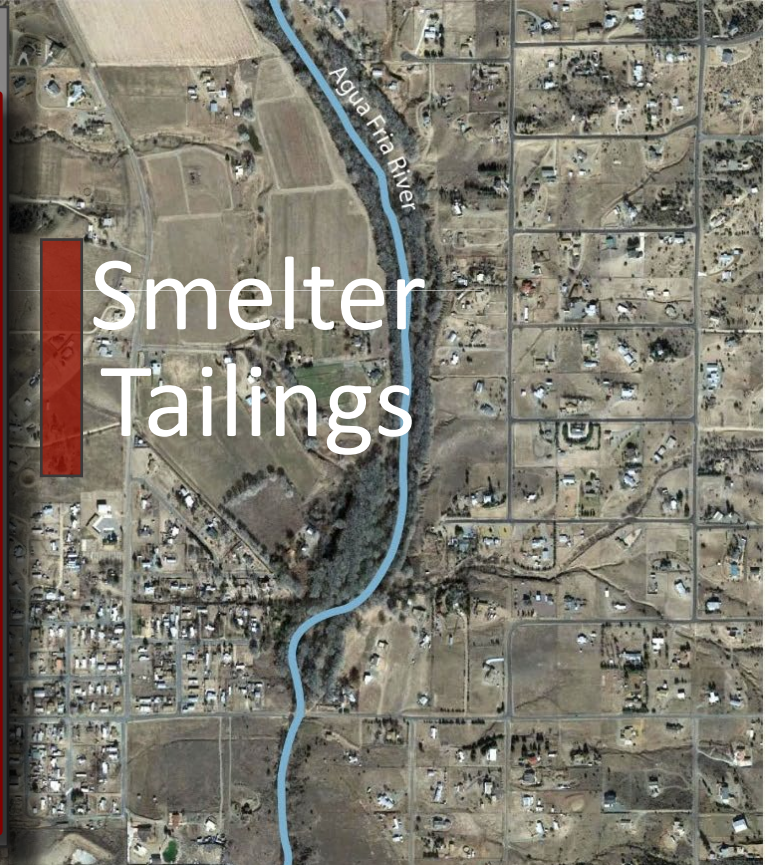


Iron King Rd

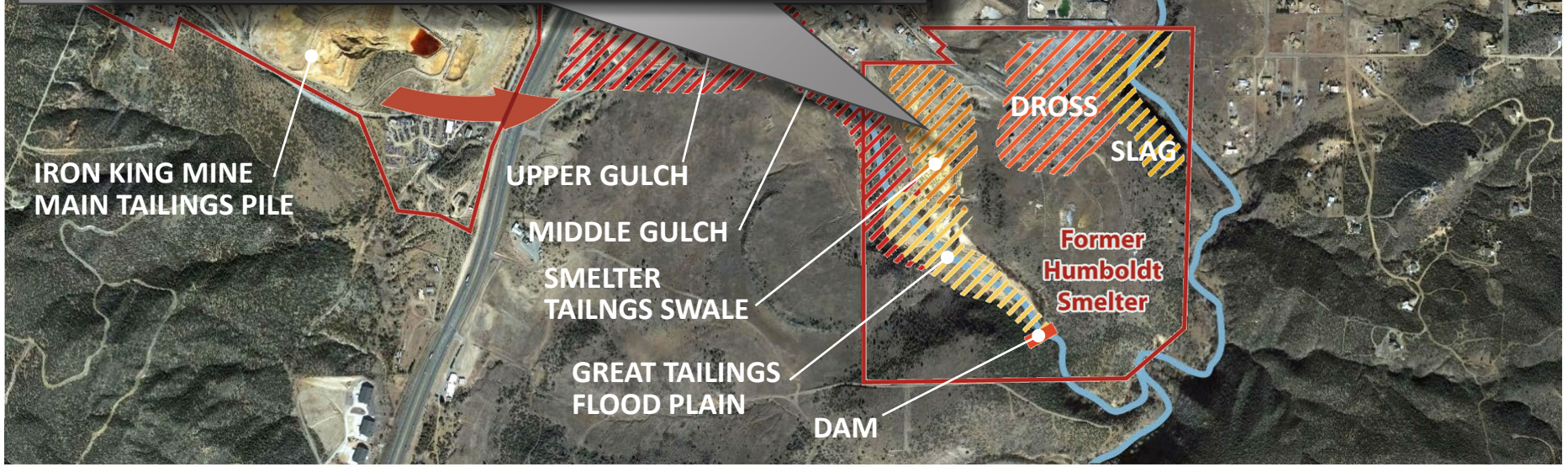
Google



69



Smelter Tailings





Tailings
Flood
Plain

IRON KING MINE
MAIN TAILINGS PILE

UPPER GULCH

SMELTER
TAILINGS SWALE

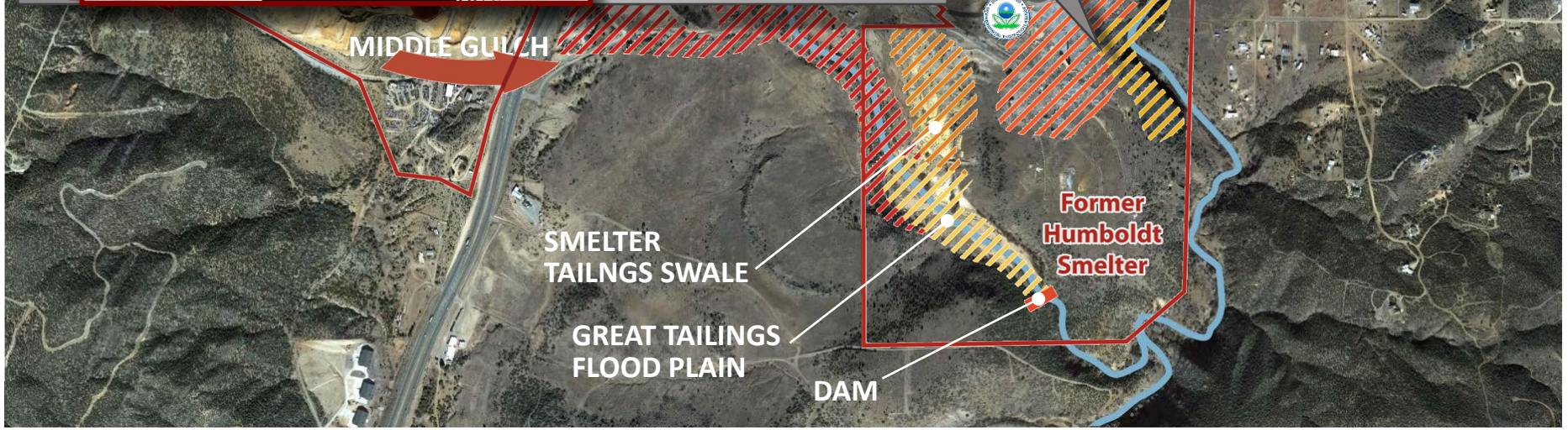
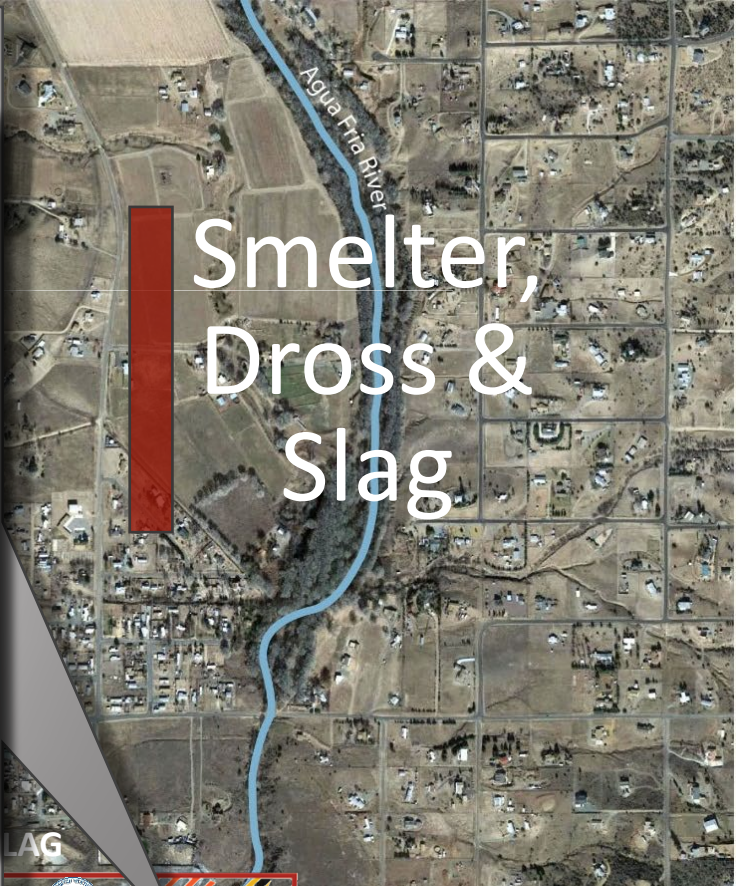
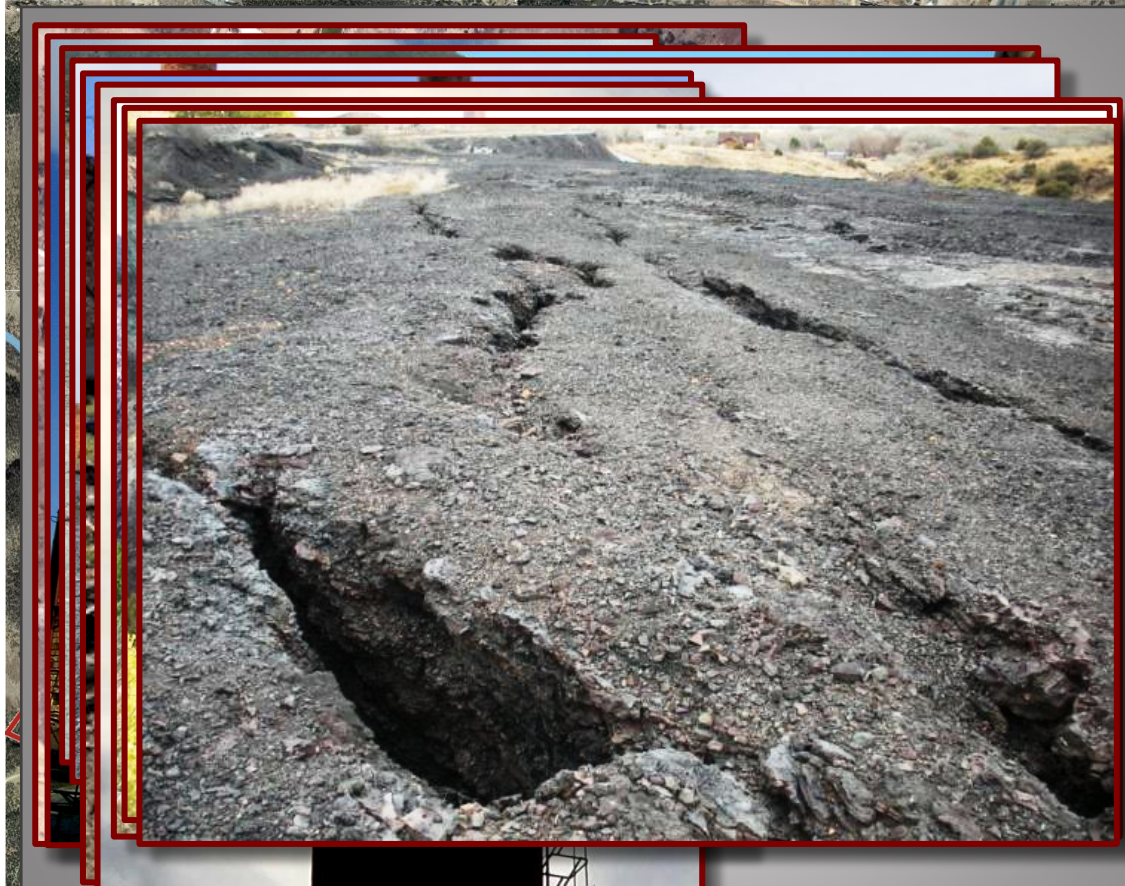
GREAT TAILINGS
FLOOD PLAIN

DAM

DROSS
SLAG

Former
Humboldt
Smelter







Former Iron King Mine Property

IKM Main Tailings Pile

Smelter Tailings Swale

Smelter / Dross

Smelter Slag

Blowout Path

Tailings Flood Plain

DROSS

SLAG

Former Humboldt Smelter

Tailings DAM

UPPER GULCH

MIDDLE GULCH

SMELTER TAILINGS SWALE

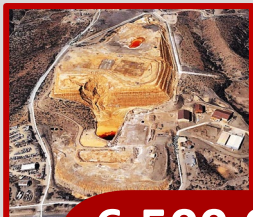
GREAT TAILINGS FLOOD PLAIN

DAM

IRON KING MAIN TAILINGS DAM

IKM Waste Rock

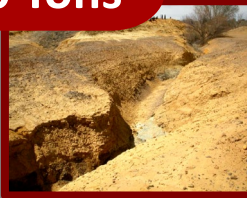




6,500,000 Tons



90,000 Tons



73,000 Tons



225,000 Tons



417,000 Tons



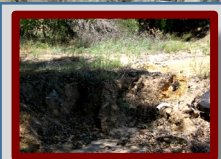
Former Iron King Mine Property

IKM Main Tailings Pile

Smelter Tailings Swale

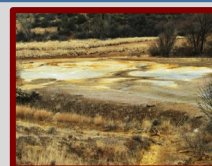
Smelter / Dross

Smelter Slag



Blowout Path

195,000 Tons



Tailings Flood Plain

398,000 Tons

**DROSS
SLAG**

UPPER GULCH

MIDDLE GULCH

SMELTER
TAILINGS SWALE

GREAT TAILINGS
FLOOD PLAIN

DAM

**Former
Humboldt
Smelter**

*Tailings
DAM*

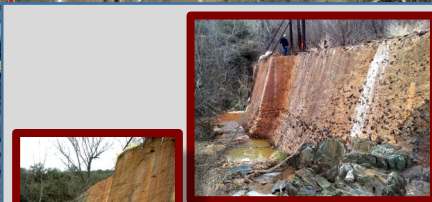


338,000 Tons



IRON KING
MAIN TA

IKM Waste Rock



*Tailings
DAM*



6,500,000 Tons



90,000 Tons



73,000 Tons

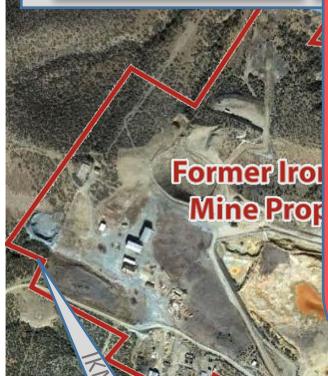


ons

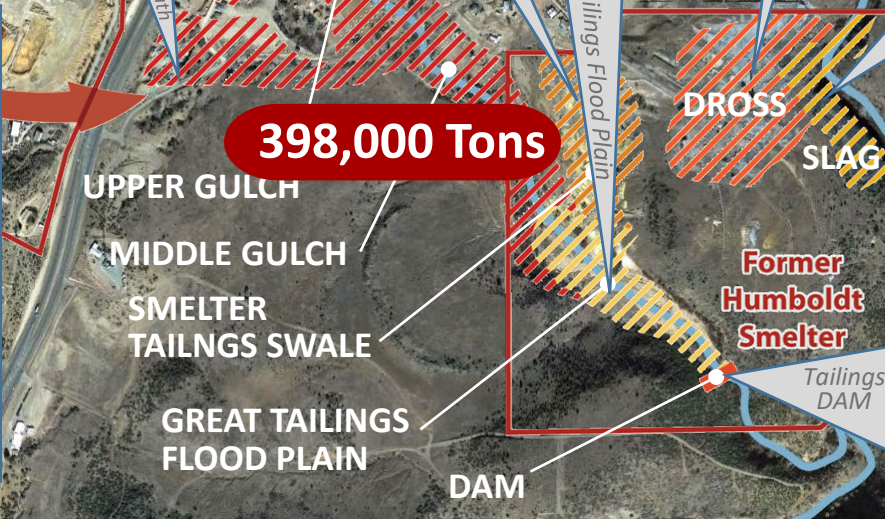
More than 8.2 MILLION TONS of Mine & Smelter Wastes



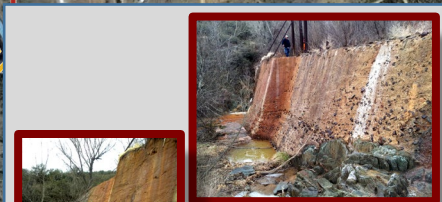
417,000 Tons



338,000 Tons



398,000 Tons



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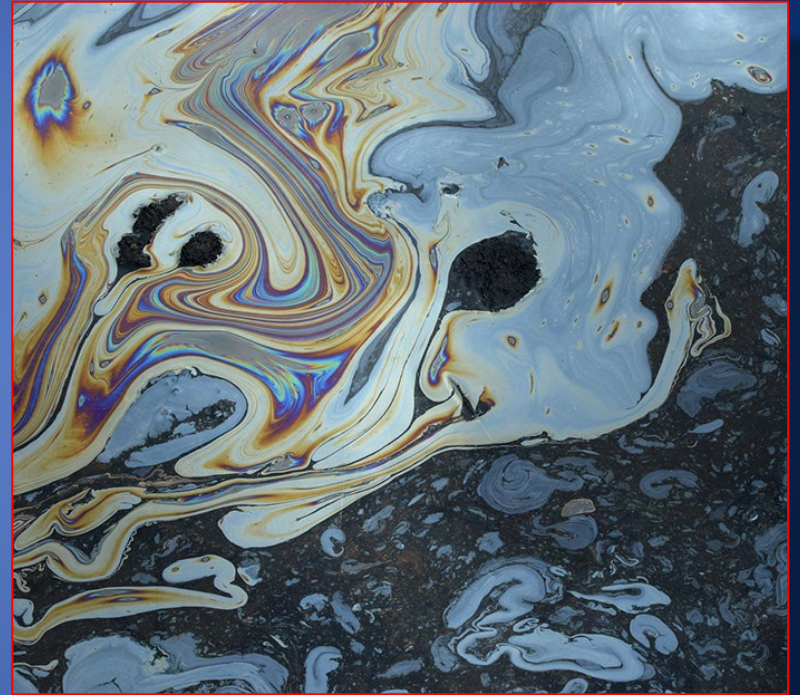


Q: Coking Wastes at Smelter?





Coal Coke



Coking Waste



Dross &
Contaminated Soil

Slag

Tailings

Plateau

Hillside

Val Verde Slag

© 2021 Google

Google



Smelter / Dross

Smelter Slag

Former Iron King Mine Property

IKM Main Tailings Pile

Smelter Tailings Swale

Blowout Path

Tailings Flood Plain

DROSS

SLAG

Former Humboldt Smelter

Tailings DAM

DAM

UPPER GULCH

MIDDLE GULCH

SMELTER TAILINGS SWALE

GREAT TAILINGS FLOOD PLAIN

IRON KING MAIN TAILINGS

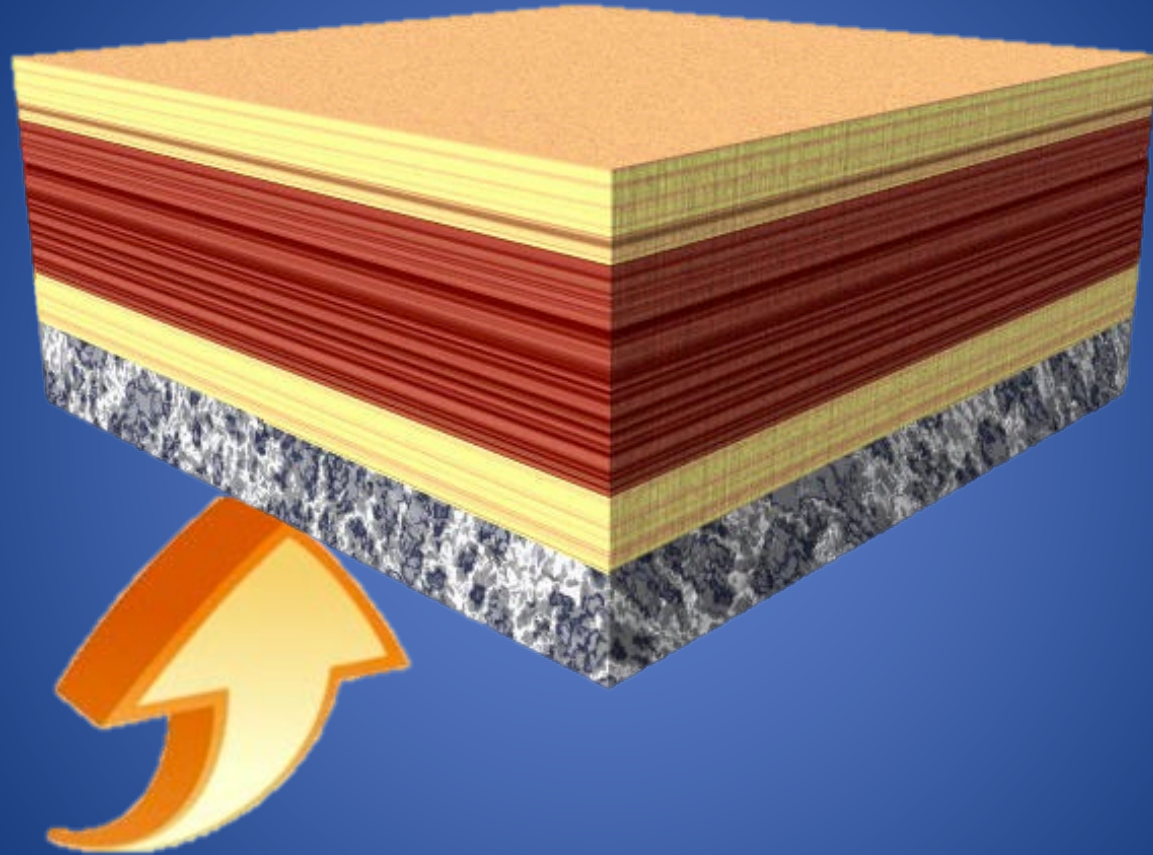


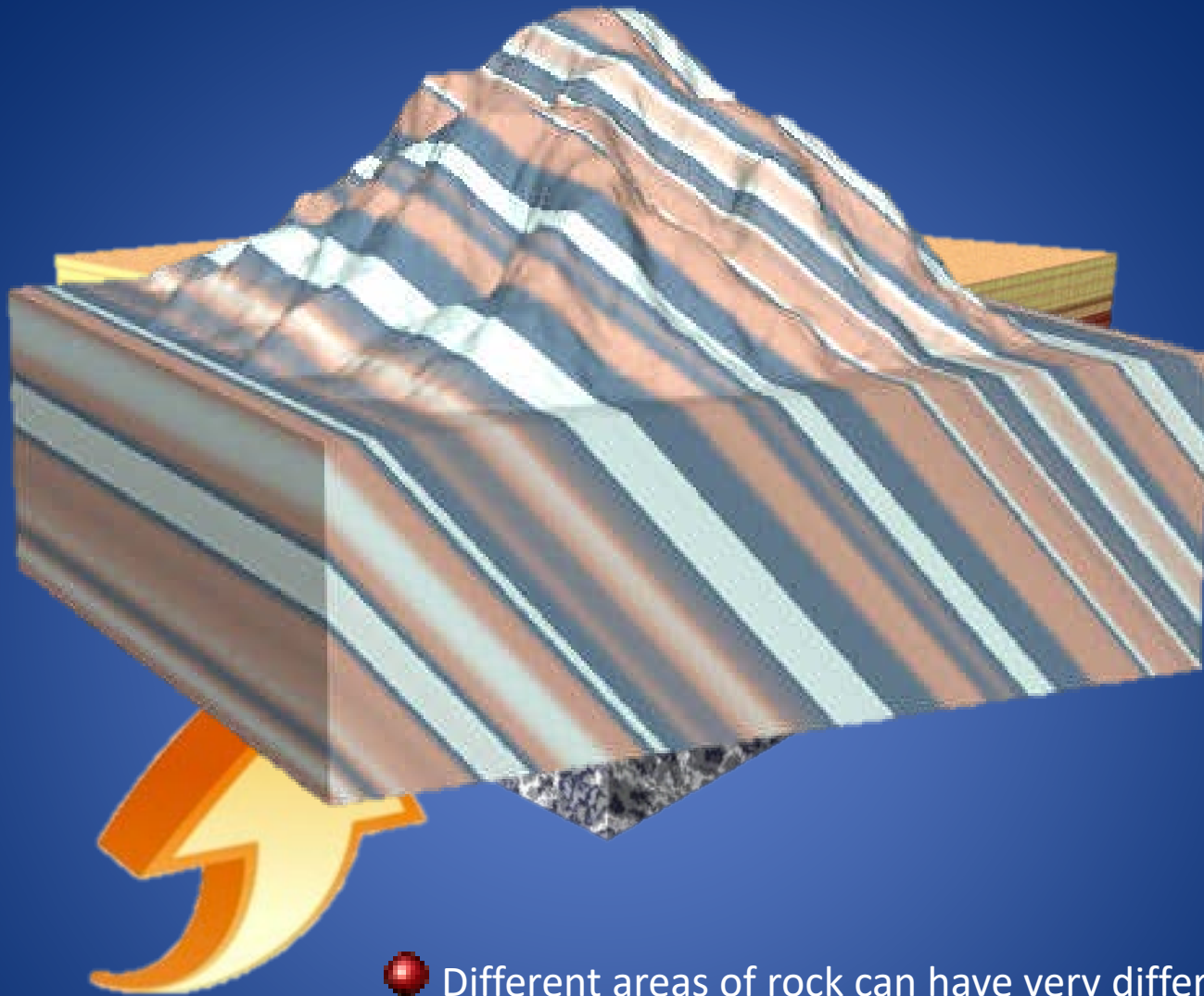
IKM Waste Rock

Q: Soil Background Concentrations



Over many millions of years...

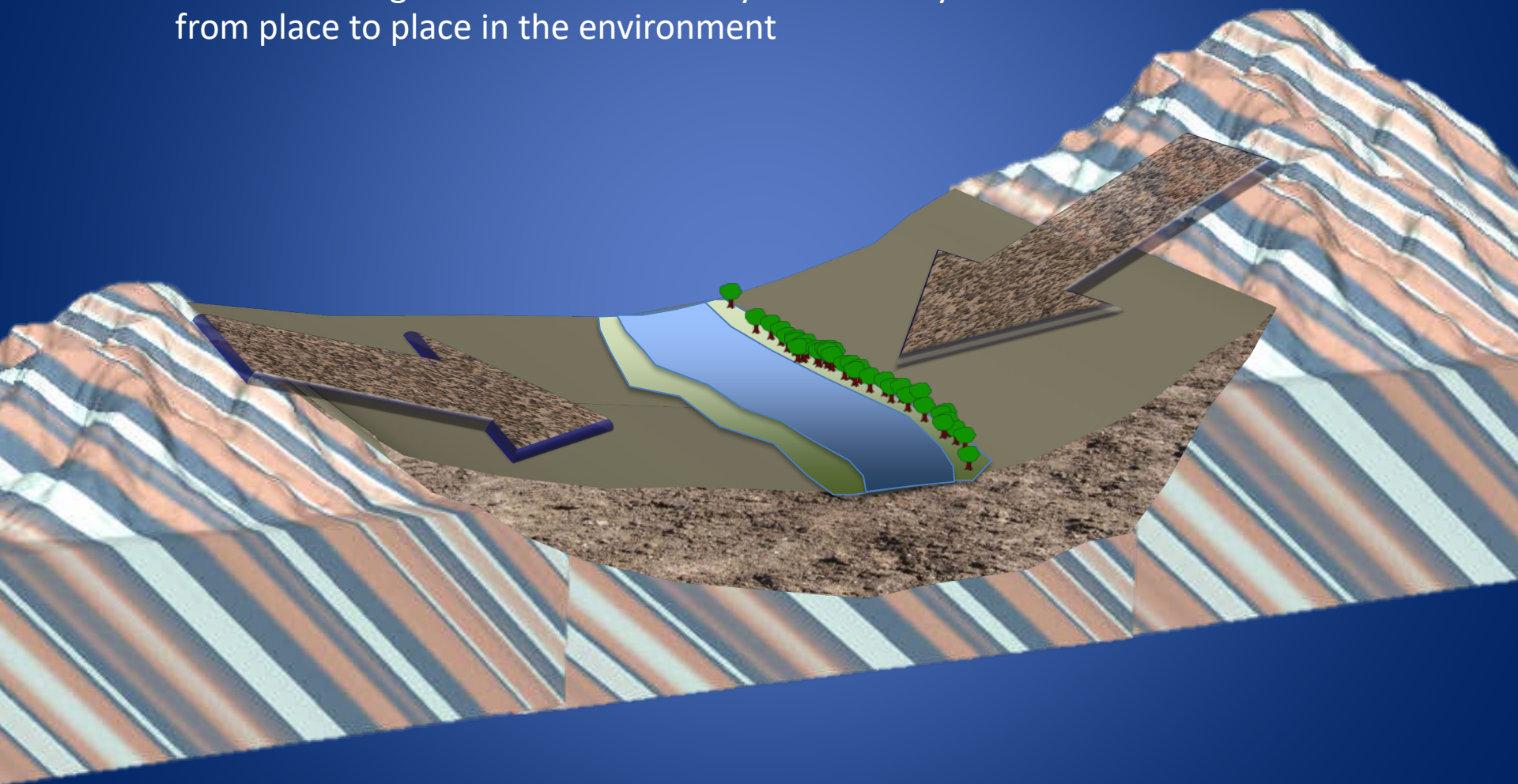


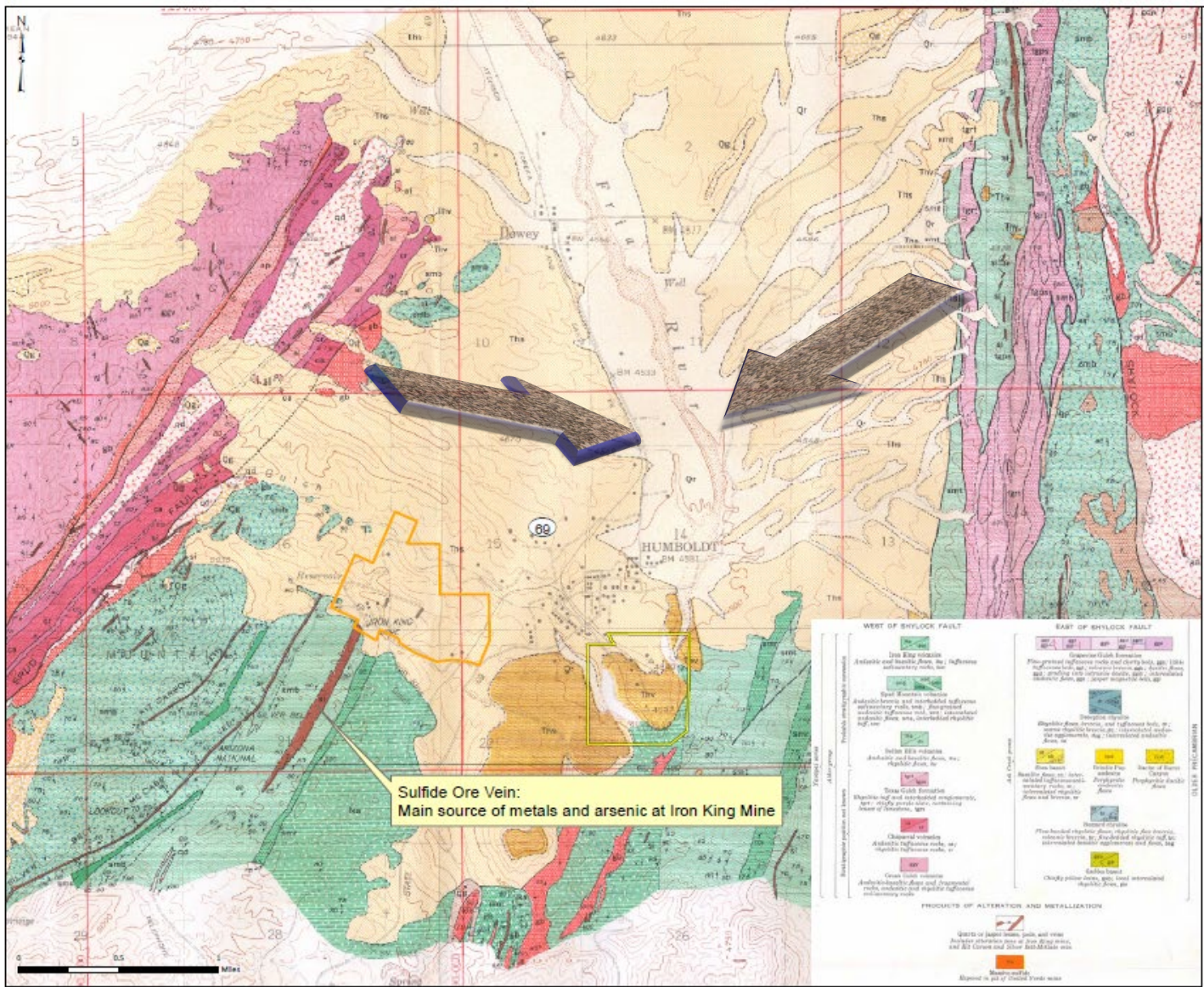


- Different areas of rock can have very different levels
- Only certain “veins” have elevated arsenic
- No single level of arsenic in rocks

Soils are formed as sediments wash in from the mountains over millions of years...

- Levels of background arsenic can vary dramatically from place to place in the environment





Sulfide Ore Vein:
Main source of metals and arsenic at Iron King Mine

Iron King Mine
Humboldt Smelter



Figure 3-2: Site Geology
Iron King Mine - Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona

● **BACKGROUND SOIL SAMPLES** (For Arsenic, Zinc, Copper, Lead, etc)

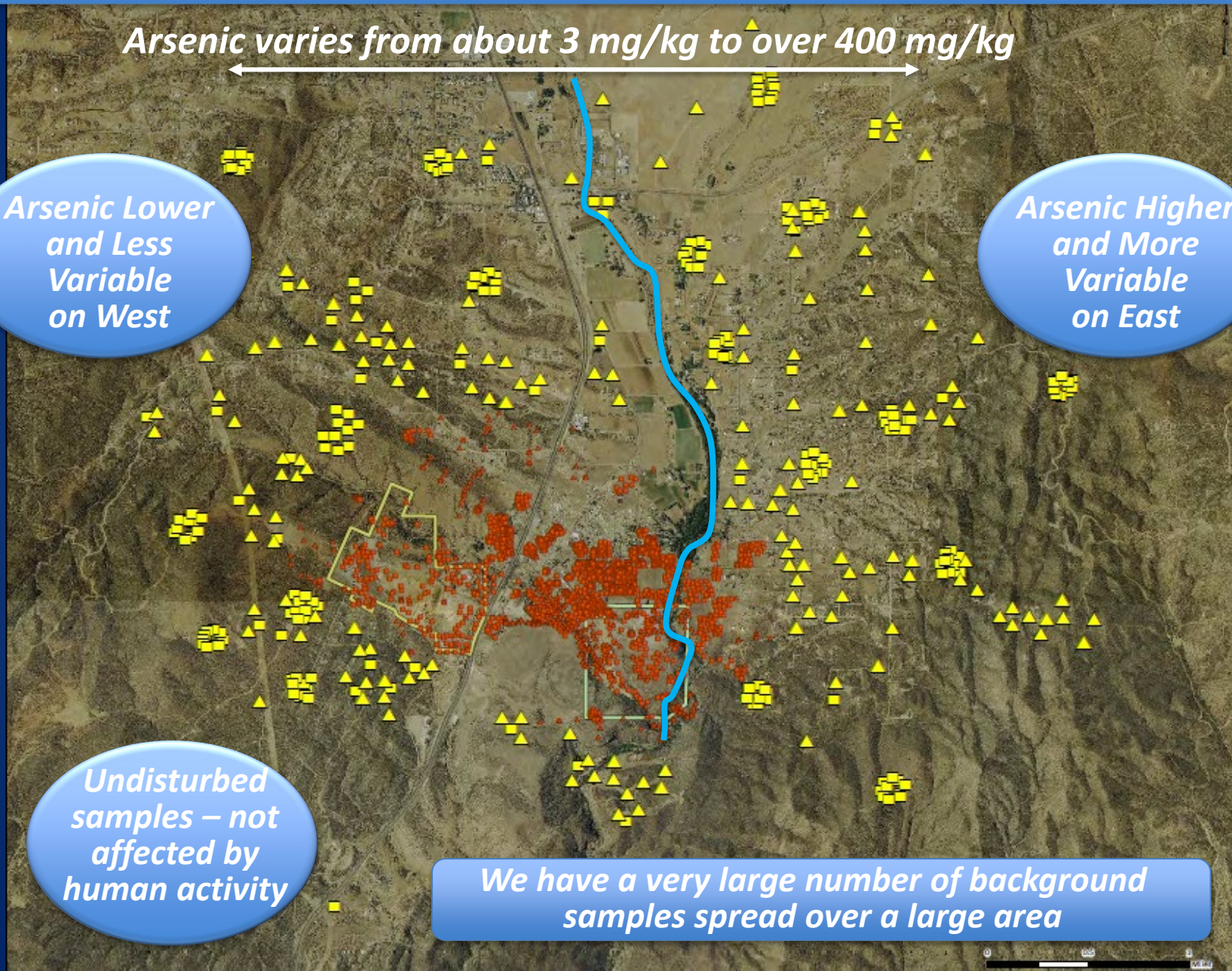
Arsenic varies from about 3 mg/kg to over 400 mg/kg

Arsenic Lower and Less Variable on West

Arsenic Higher and More Variable on East

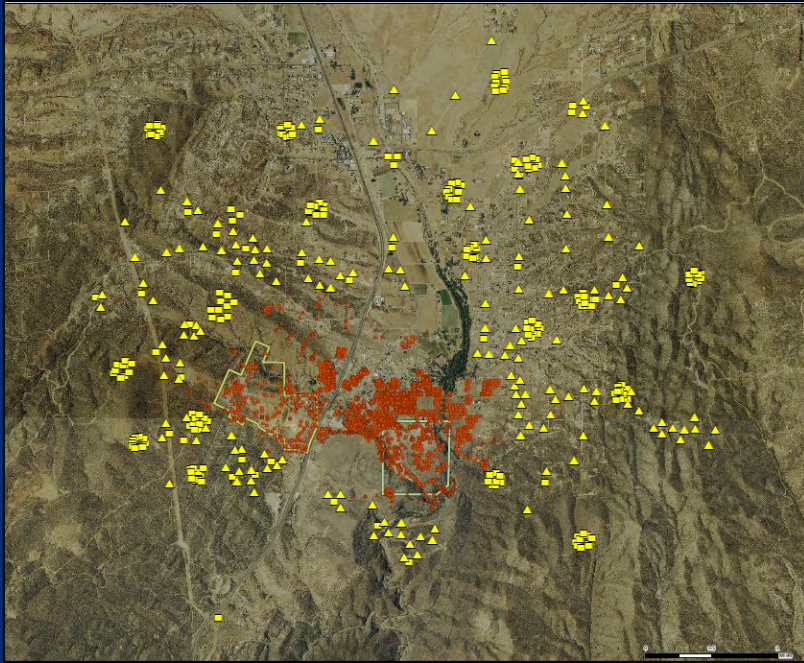
Undisturbed samples – not affected by human activity

We have a very large number of background samples spread over a large area



Getting to a Number for the Arsenic Soil Background

Which samples should be yellow?



- We look at the distribution of arsenic, copper, zinc levels in soil
- We don't want to use samples affected by the site – want natural metals
- Site-related arsenic, zinc and copper all came from the same places...so
- As you move out, farther from the site, arsenic, copper and zinc should get lower together until the soil levels are naturally occurring

ARSENIC was different than Zinc, Copper

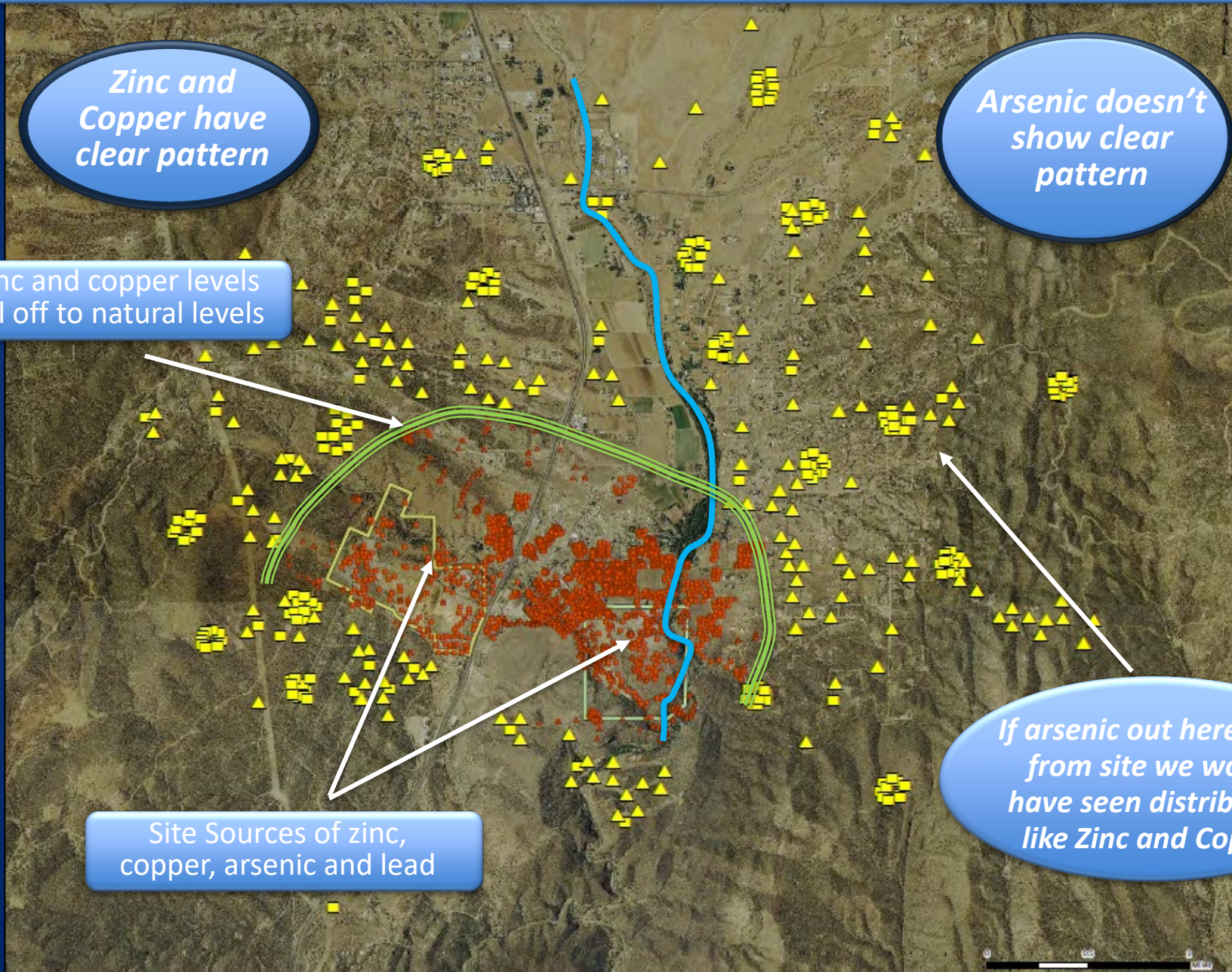
Zinc and Copper have clear pattern

Arsenic doesn't show clear pattern

Zinc and copper levels fall off to natural levels

Site Sources of zinc, copper, arsenic and lead

If arsenic out here were from site we would have seen distribution like Zinc and Copper

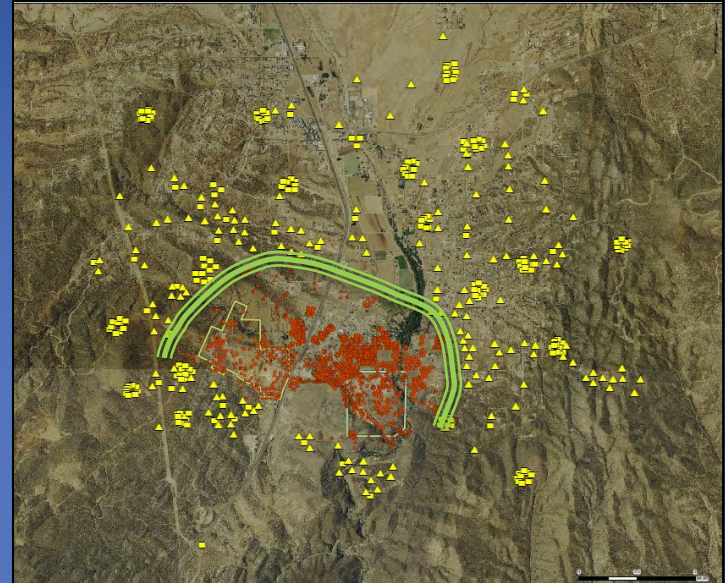


Picking the Samples to Use to Calculate a Number for Arsenic Background

We Used Two Strategies:

1

Use ZINC and COPPER background to show where ARSENIC background starts



2

Find where surface soils have consistently higher arsenic than soils one foot down.

Picking the Samples to Use for Calculating Arsenic Background

2

Find where surface soils have consistently higher arsenic than soils one foot down.

INDICATES NOT BACKGROUND

INDICATES BACKGROUND

Surface and 1 foot deep arsenic are significantly different

2 inches

Higher levels due to site air fallout

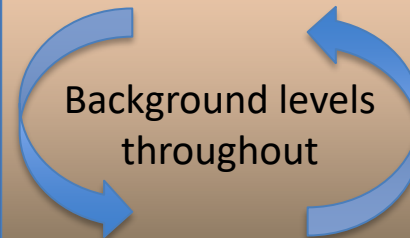


Background levels

1 foot

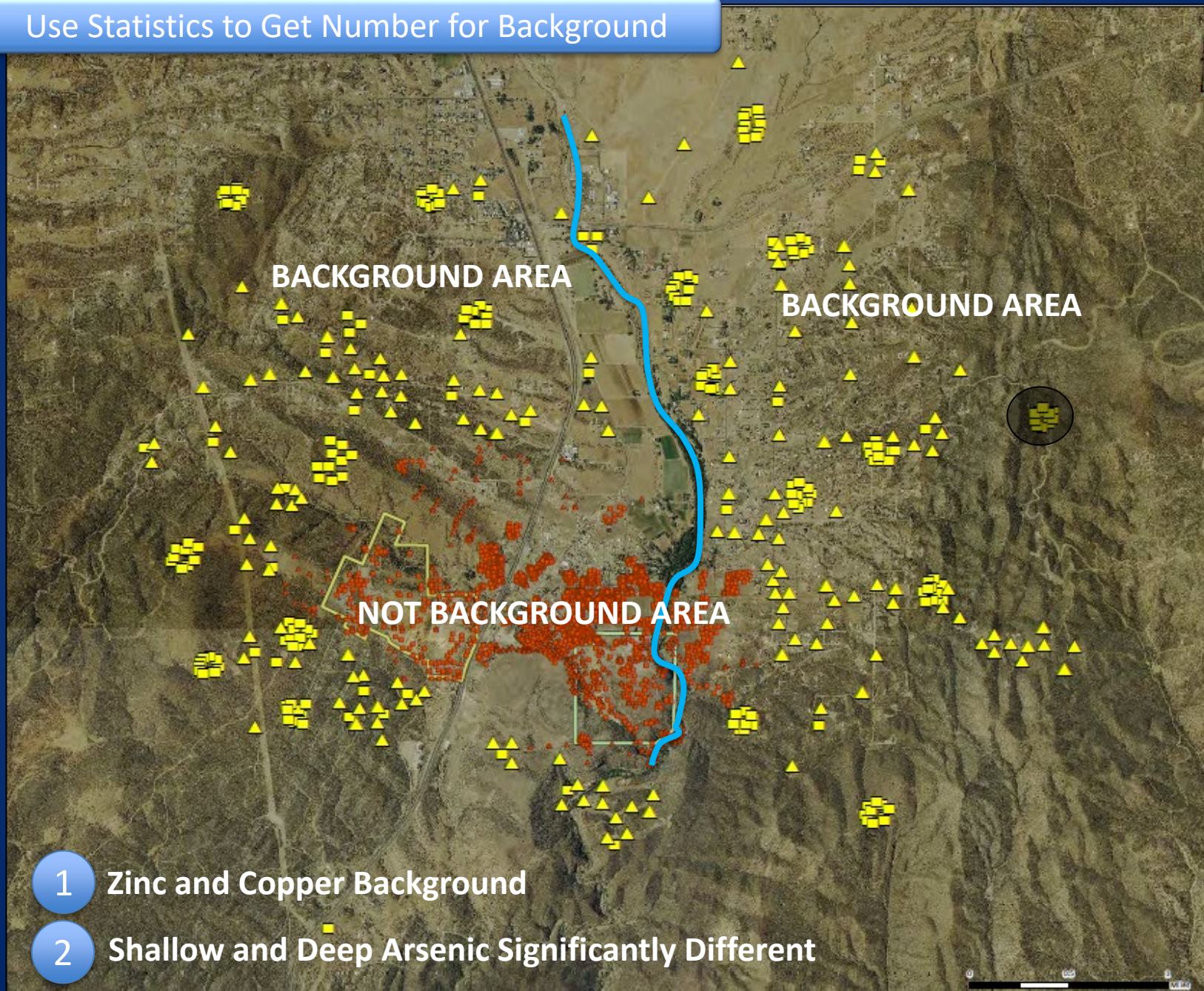
Deep levels different

Surface and 1 foot deep arsenic are similar



Background levels throughout

Use Statistics to Get Number for Background



**Soil Background Study Report
Iron King Mine – Humboldt Smelter
Superfund Site
Dewey-Humboldt, Yavapai County,
Arizona**

Prepared for
United States Environmental Protection Agency

Region 9

75 Hawthorne Street
San Francisco, California 94105

June 2015

CH2MHILL®

6 Hutton Centre Drive
Suite 700
Santa Ana, California 92707

Limiting exposure to background arsenic in soils



How to Reduce Your Exposure to Arsenic and Lead in Dewey-Humboldt, Arizona



This factsheet gives tips for protecting yourself and your family from coming into contact with arsenic and lead.

Why is exposure to arsenic and lead a concern in the Dewey-Humboldt area?

The Dewey-Humboldt area in Arizona has arsenic and lead from naturally occurring sources and from past mining and smelting activities. There is arsenic and lead in soil, dust and groundwater. Some foods can also contain arsenic.

Arsenic exposure at high doses can cause skin problems, stomach ache and nausea. Arsenic exposure over many years also raises the risk of bladder, lung, liver, and skin cancer. You can read more about the health effects of arsenic at: www.atsdr.cdc.gov/tfacts2pdf

Lead exposure at high doses can cause anemia, stomach ache, muscle weakness and damage to the brain and kidneys. In children, even low doses can affect IQ, ability to pay attention, and academic success, and cause behavioral problems.

You can read more about the health effects of lead at: www.atsdr.cdc.gov/facts13.pdf



How can I reduce my exposures to arsenic and lead?

Make sure your drinking water is safe

In some places, groundwater in the Dewey-Humboldt area contains arsenic and other contaminants at levels above federal and state drinking water standards.



If you have a private well that you use for drinking water, you should test it for arsenic and lead. ADHS can help you with testing, see the table below.

- ✓ If a first test of your well water shows arsenic above 10 parts per billion (ppb), or lead 15 ppb or higher, collect and test a second sample before making any decisions about water treatment.
- ✓ If a second test shows that your well has arsenic above 10 ppb, or lead 15 ppb or higher, you should install a water treatment system that removes arsenic and lead.
 - * Use a different water source for drinking and cooking until you are able to install a water treatment system.
- ✓ You may need to test your well for metals every three years. In addition, ADHS recommends you test your well water yearly for bacteria.

If you get your water from the Humboldt Water System, your water is already tested for arsenic, lead and other contaminants.

Q: Dust and the Smelter Property





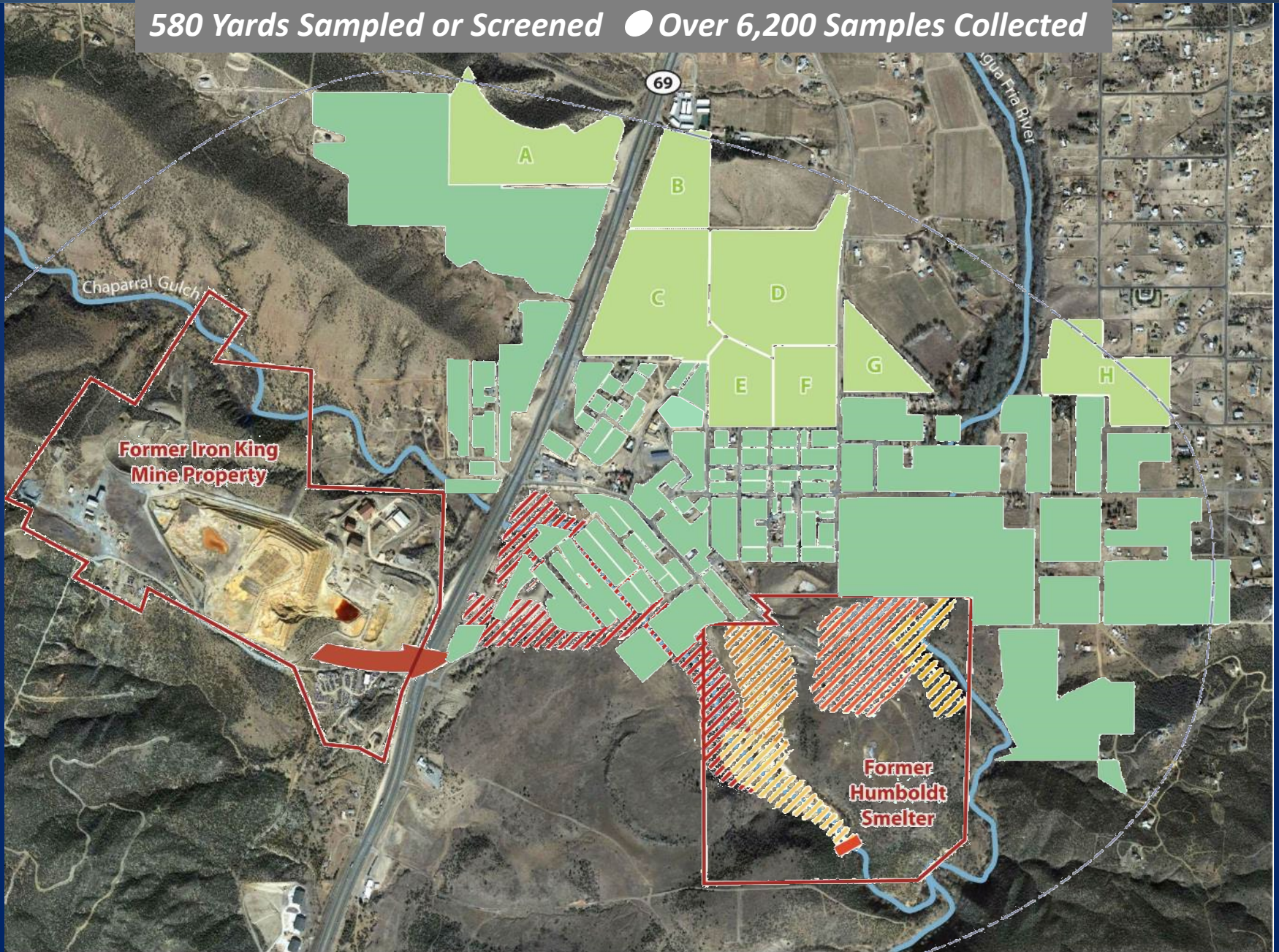


Q: Commercial Properties



Taking a Look at Where We Sampled in Town

580 Yards Sampled or Screened ● Over 6,200 Samples Collected



Main Street Near Smelter Gate



Q: Buried Tailings, Etc.



Example of Orange “Warning Barrier”



Q: Cancers



EPA Contacts



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Coordinator

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EPA Web Site for
Iron King Mine/ Humboldt Smelter Superfund Site

<http://www.epa.gov/superfund/ironkingmine>

Site Cleanup Options



The Superfund Process At Its Simplest...

Understand It
Investigate it

What Risk
Does It
Pose?

What are the
Options for it?

How do they
Compare?

Consider
Input

Selection:
Make an
Informed
Decision

- What is it and needs cleanup?
- What is its nature?
- Where is it?
How extensive?
- How did it get there?
- How is it moving?
- How could it get worse?

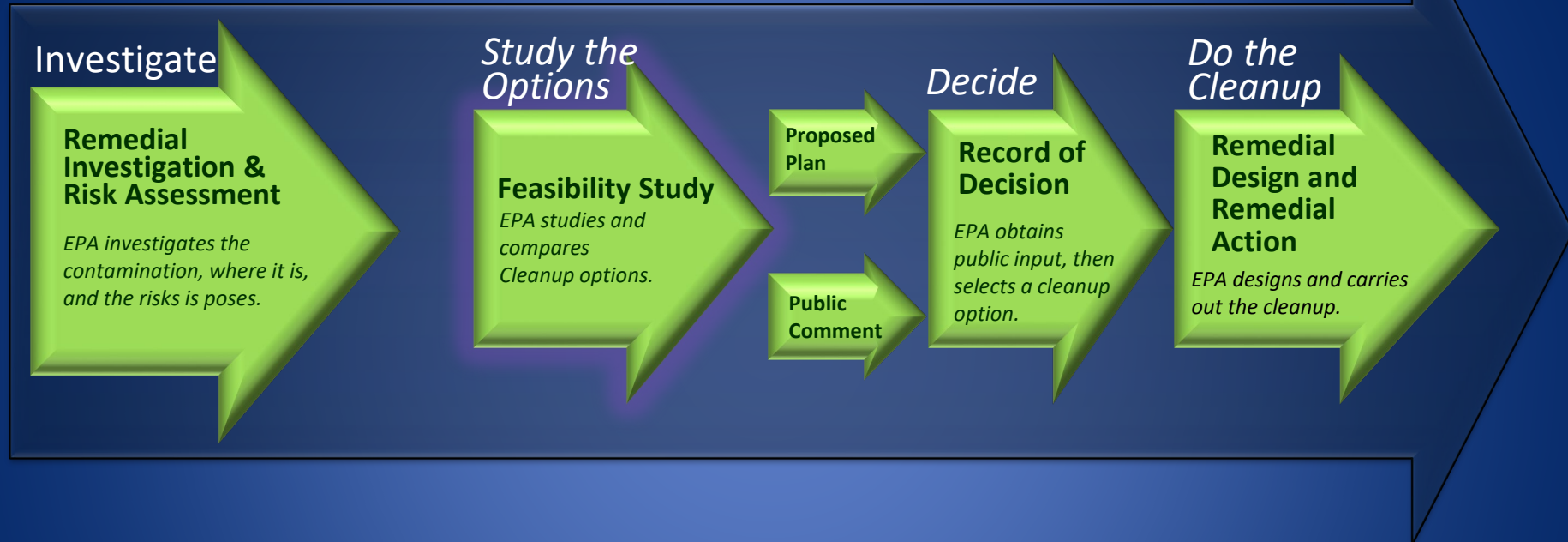
- How toxic is it?
- How can exposure occur?
- Who is exposed?
- Who might become exposed?
- How much exposure?
- What chance of health effects?
- What drives risk?

- What would resolve the risks and threats?
- What would be feasible to do?
- How well could it be relied upon?
- How permanent?
- How much would it leave behind?
- What side effects?
- What would it cost?
- What do people think about it?

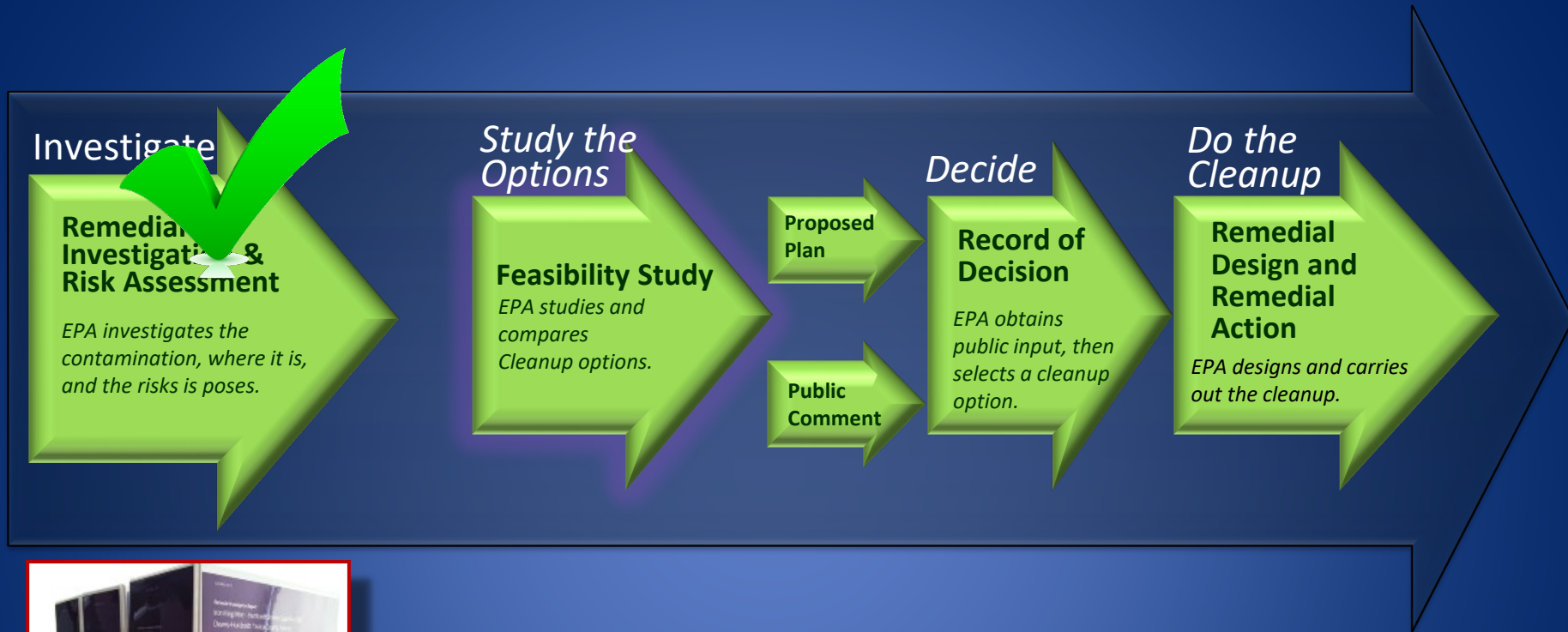
- Seek Input
- Consider Input
- Respond to Input
- Decide on Cleanup
- Document Decision

The Superfund Process

As it appears in the Superfund law...

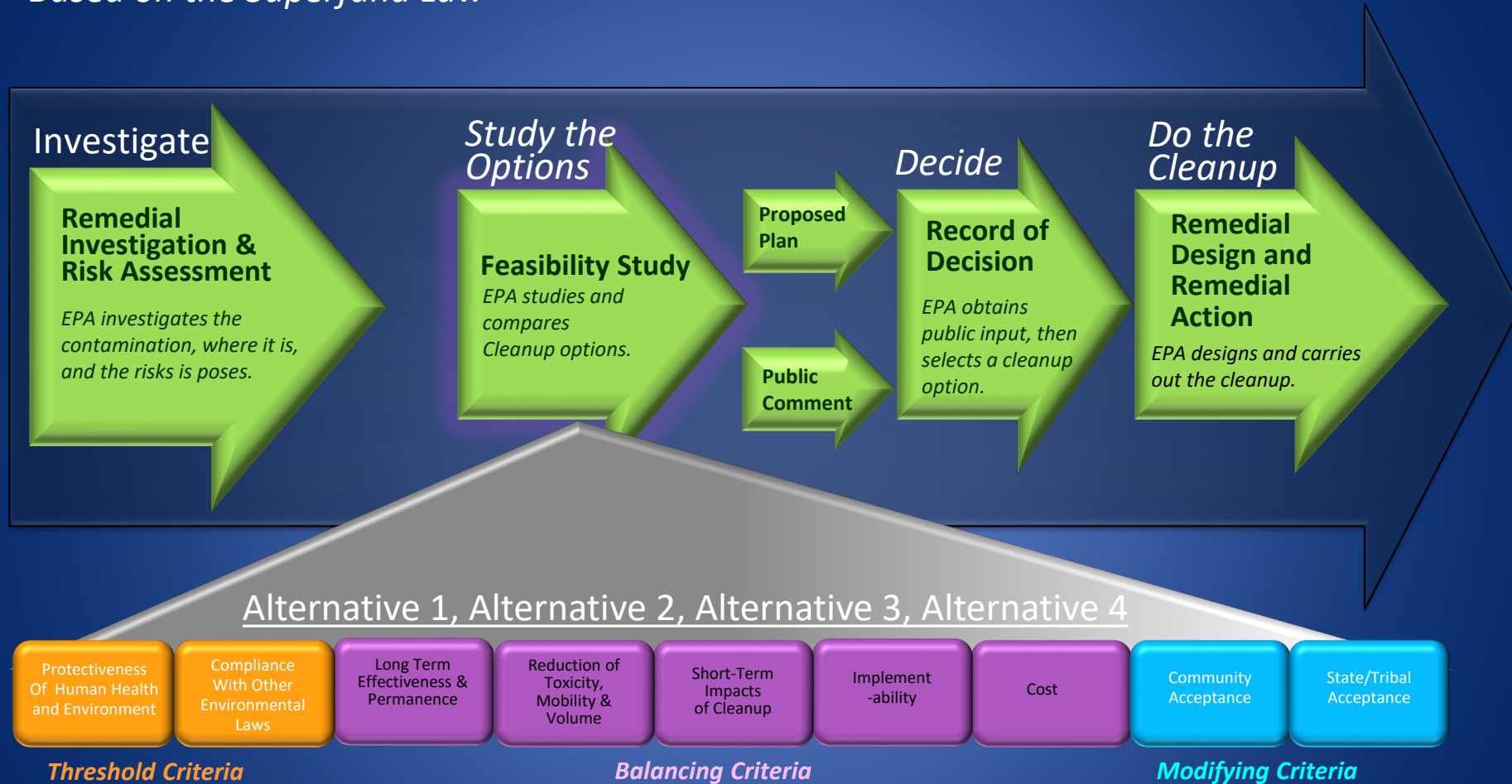


The Superfund Process... And This Evening's Discussion



The Feasibility Study and the Nine Decision Criteria

Based on the Superfund Law



Repository: Where Might Removed Wastes Go?

A repository is an engineered, consolidated, and permanently capped holding cell that keeps waste in and water out. Waste can no longer move or expose people or wildlife.



*Mine Tailings Pile
Possible Repository*



*Smelter Tailings Swale
Possible Repository*



*Smelter Plateau
Possible Repository*

- There is enough space for wastes in any of these locations
- There is enough borrow soil available to permanently cover them.

Alternative 1: Take NO ACTION

1

Wastes remain exposed in place, continue to move, no protection

Of course, we do plan to take action.

The Superfund law requires that we keep this alternative for purposes of comparison.



Alternatives 2, 3A, 3B and 4....

Community Considerations: Moving Waste, Trucks, and Time

- The alternatives require moving very large amounts of mine and smelter waste
- There will be large trucks and equipment needed
- The length of time trucks would be hauling differs among the alternatives.
- The hauling will have traffic and some noise impacts
- Some traffic safety impacts are possible depending on alternative
- Where hauling across the highway is needed, there are traffic impacts on Highway 69 as well

Haul Trucks and Equipment



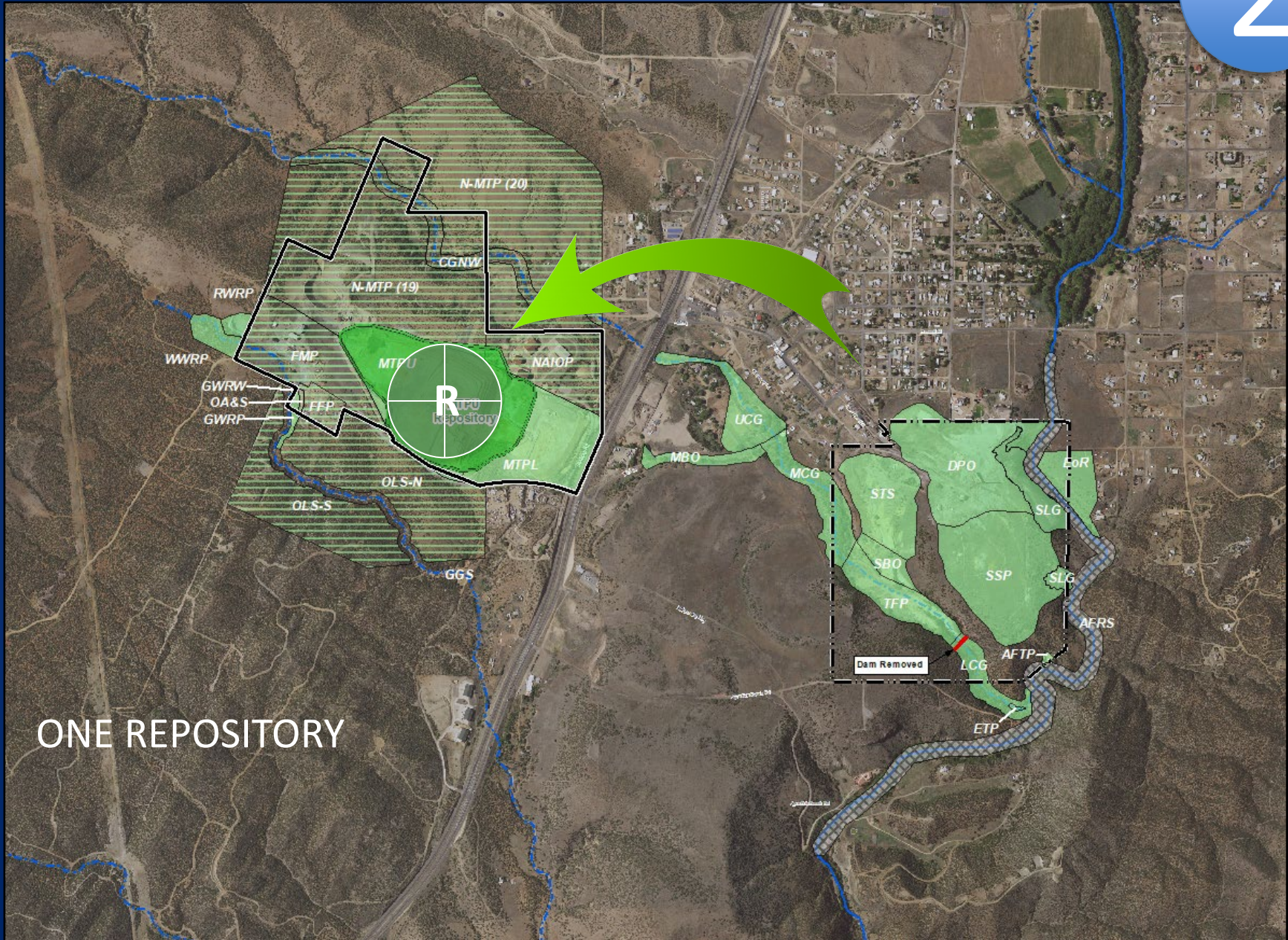
OFF-ROAD

ON-ROAD



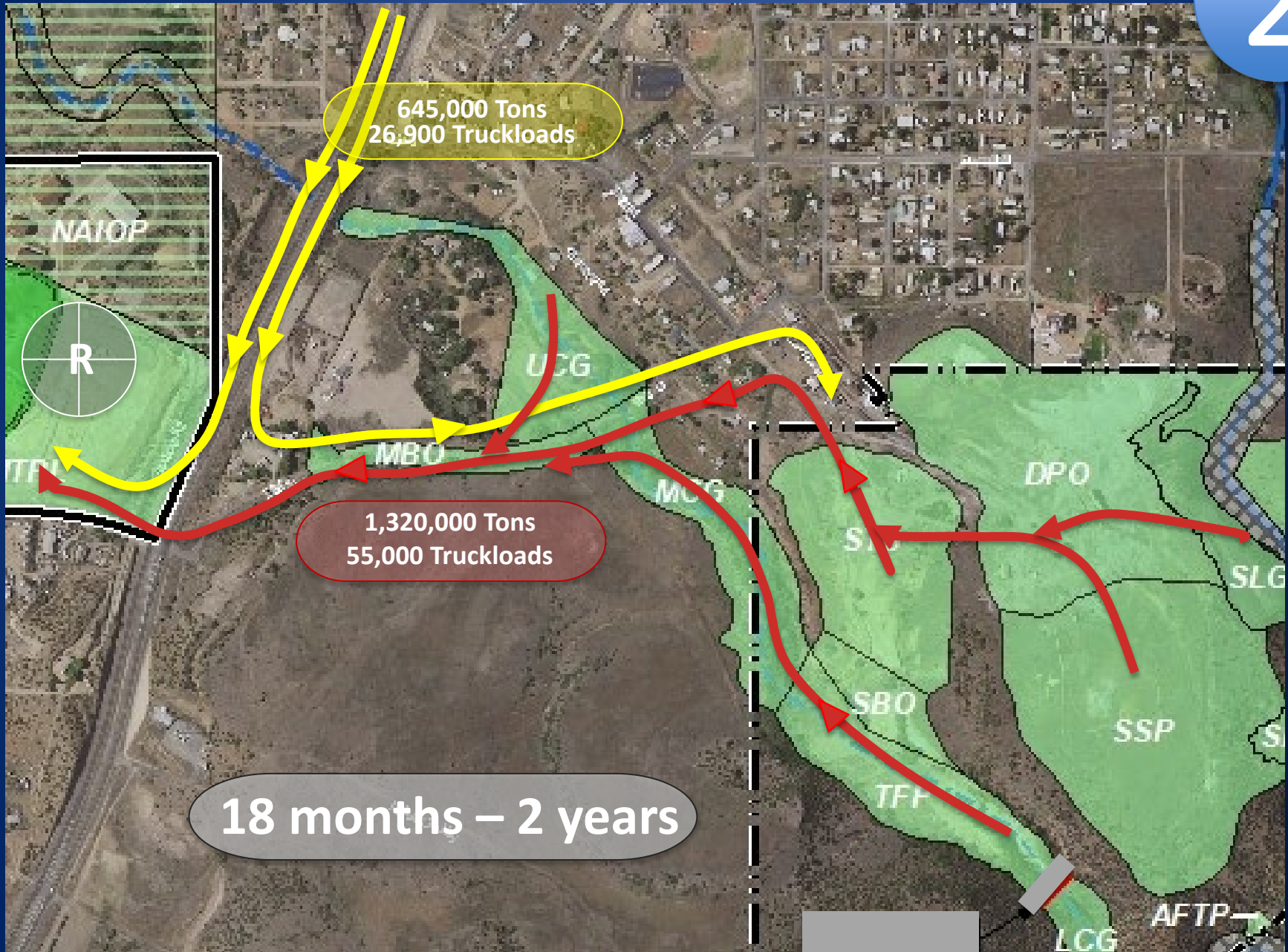
Alternative 2: All Waste Goes to the Mine Main Tailings Pile

2



Alternative 2: All Waste Goes to the Mine Main Tailings Pile

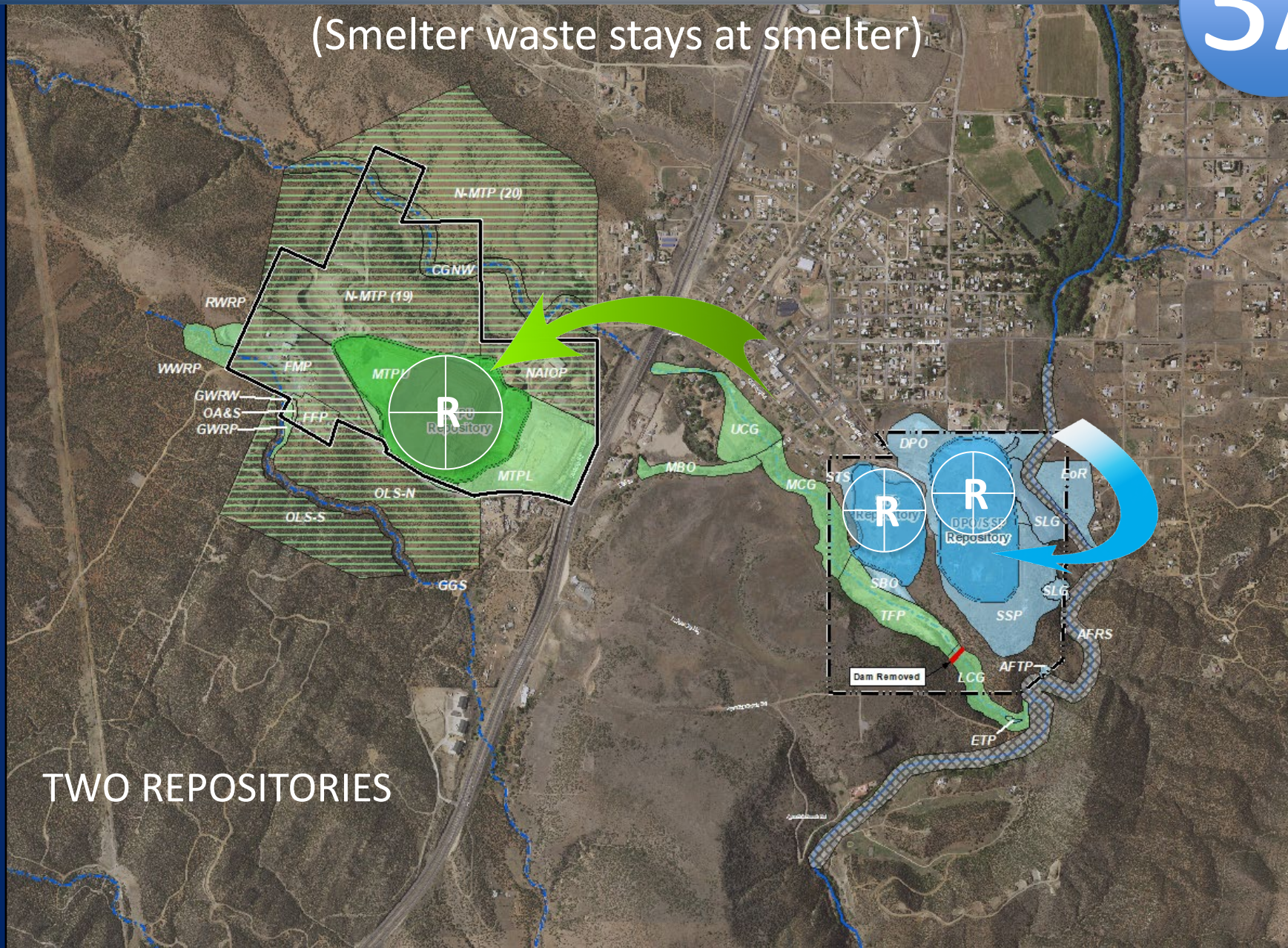
2



Alternative 3A: Chaparral Gulch Waste Goes to Mine Pile

3A

(Smelter waste stays at smelter)



TWO REPOSITORIES

Alternative 3A: Chaparral Gulch Waste Goes to Mine Pile

3A



Alternative 3B: East-West-Based Waste Repositories

3B

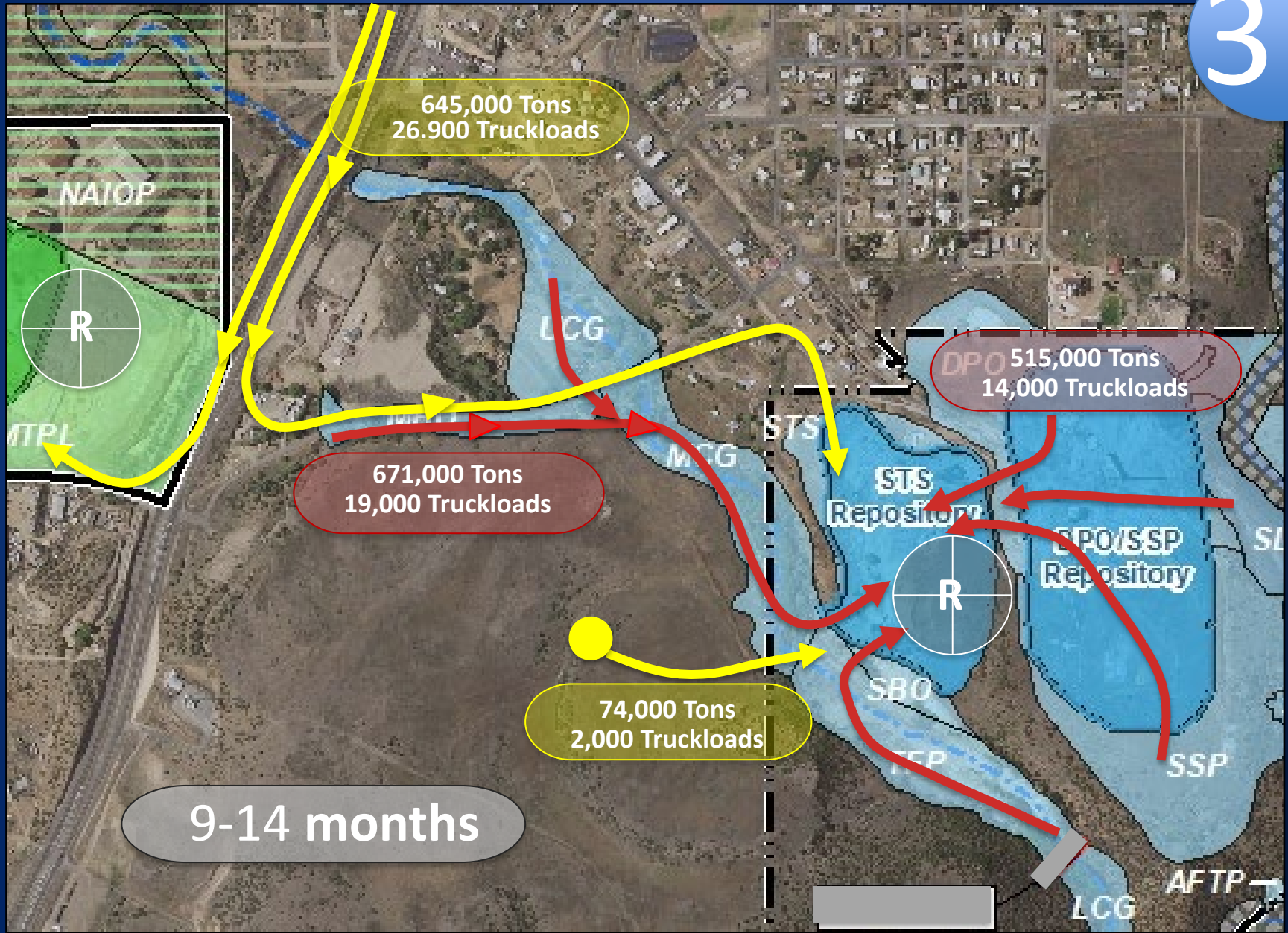
(Waste stays on its side of the highway)



TWO REPOSITORIES

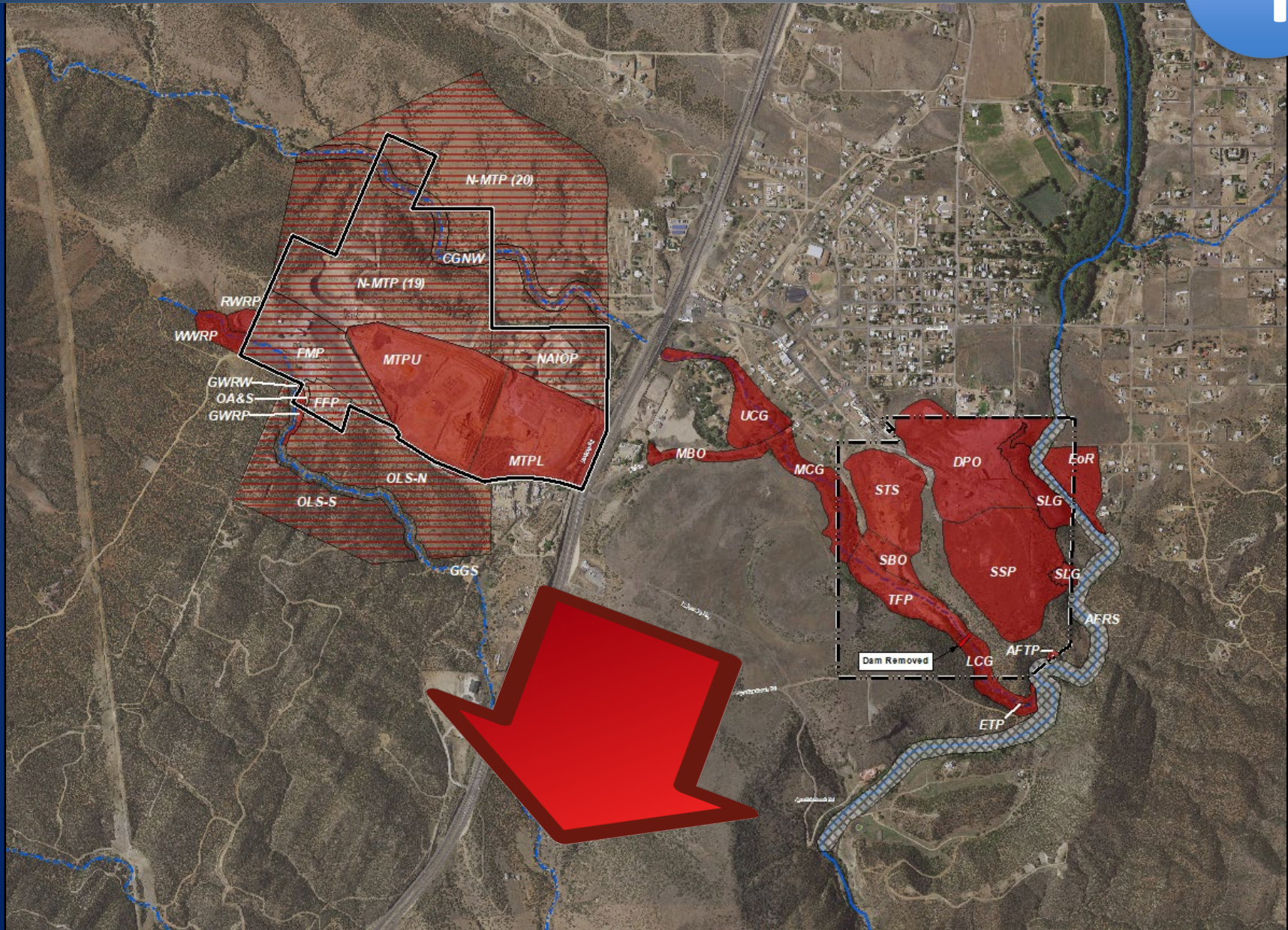
Alternative 3B: East-West-Based Waste Repositories

3B



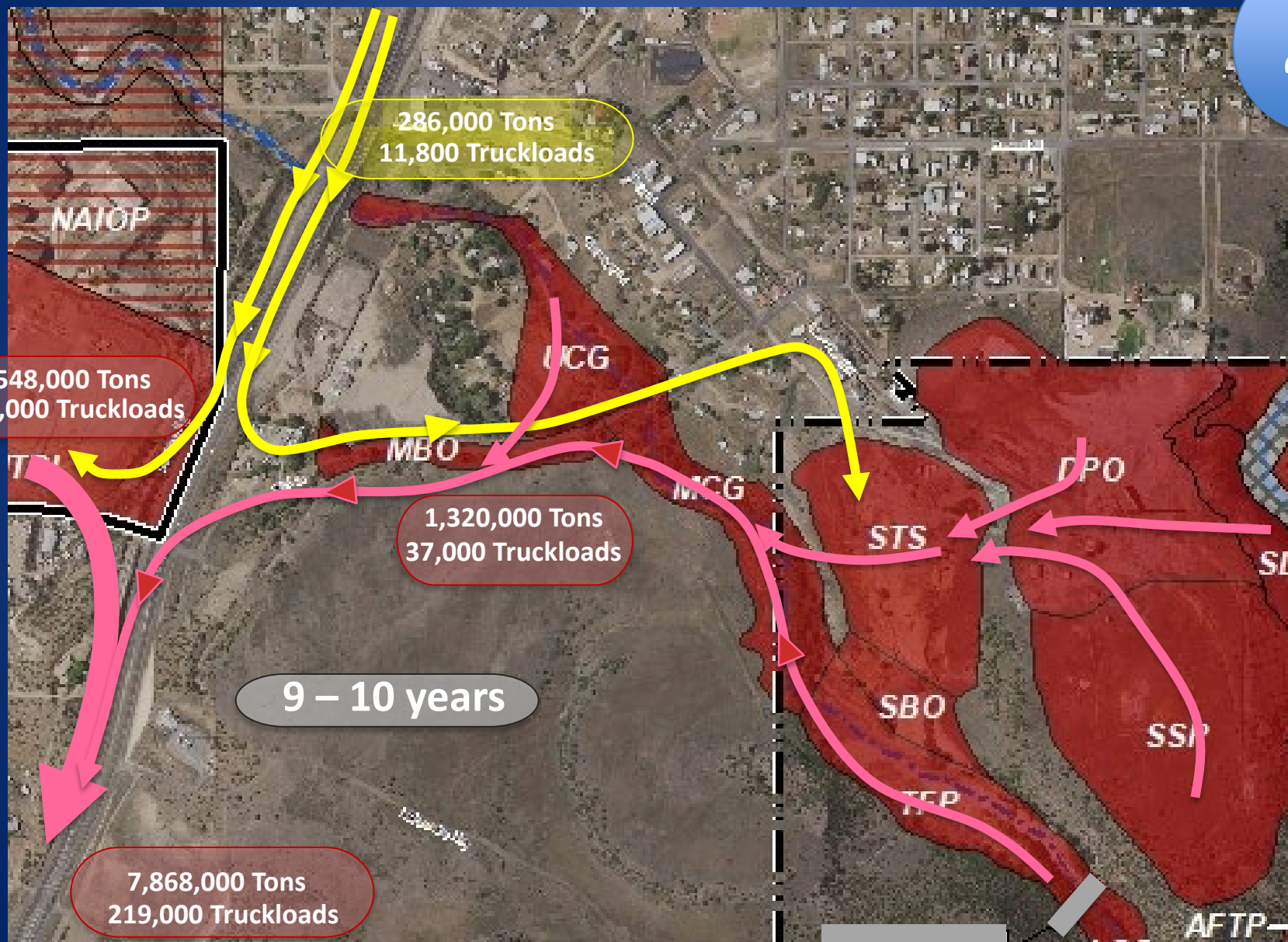
Alternative 4 : Haul All Waste Offsite to an Existing Off-site Permitted Landfill

4



Alternative 4 : Haul All Waste Offsite to an Existing Off-site Permitted Landfill

4



What Might the Mine Tailings Pile Look Like After Cleanup?



What Might the Smelter and Gulch Look Like After Cleanup?



Brief Summary of Cleanup Alternatives

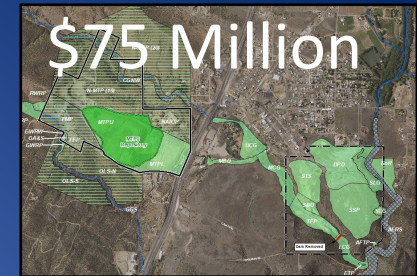
2

All Waste to
Mine Tailings Pile

2 – 2 ½ Years

18-24 Months Hauling

All waste crosses highway



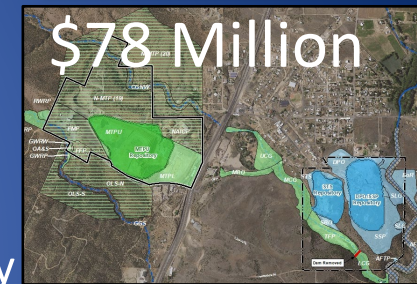
3A

Chaparral Gulch
Waste Goes to
Mine Tailings Pile

1 ½ -2 Years

11-17 Months Hauling

Some waste crosses highway



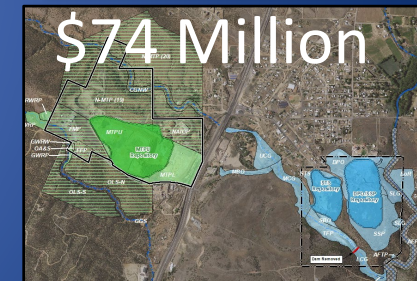
3B

East Waste Stays East,
West Waste Stays West

1 – 2 Years

9-14 Months Hauling

No waste crosses highway

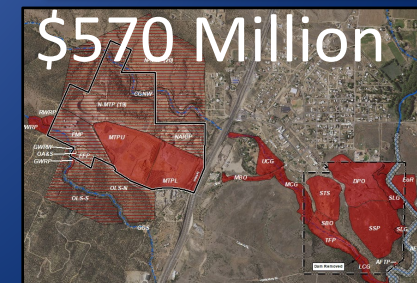


4

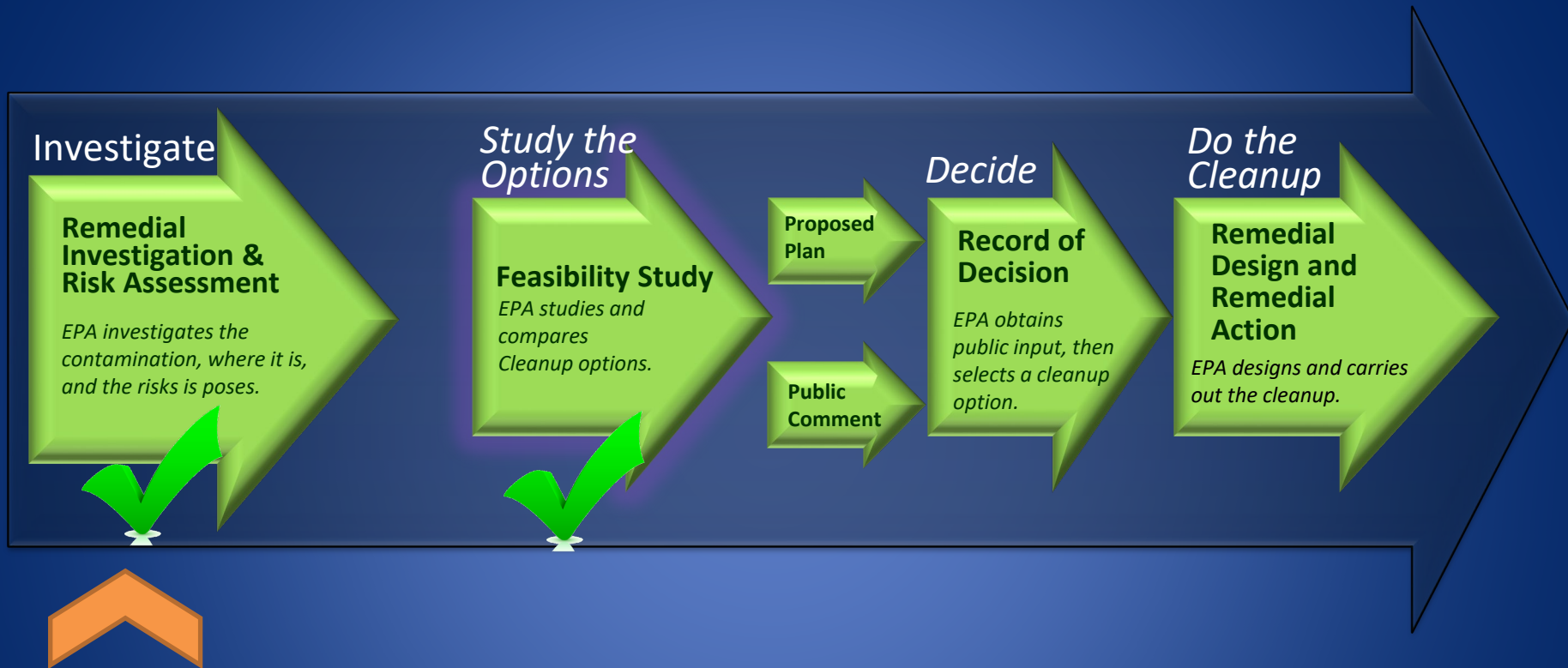
All Waste Hauled Away
Offsite

10 Years

9 ½ Years of Hauling



Next Steps after the Feasibility Study



In the proposed plan EPA identifies the cleanup alternative that it proposes to select. EPA invites public comment on the proposed plan, together with the investigations and studies.

EPA Contacts



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Environmental Scientist

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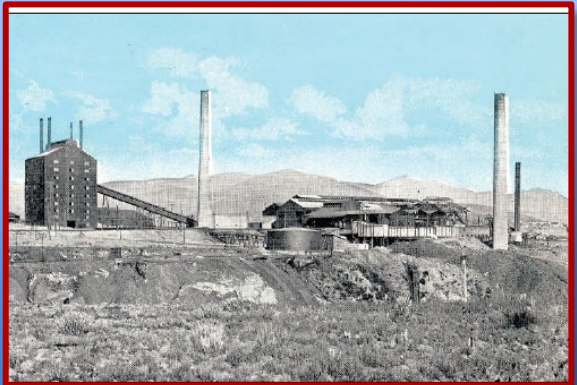
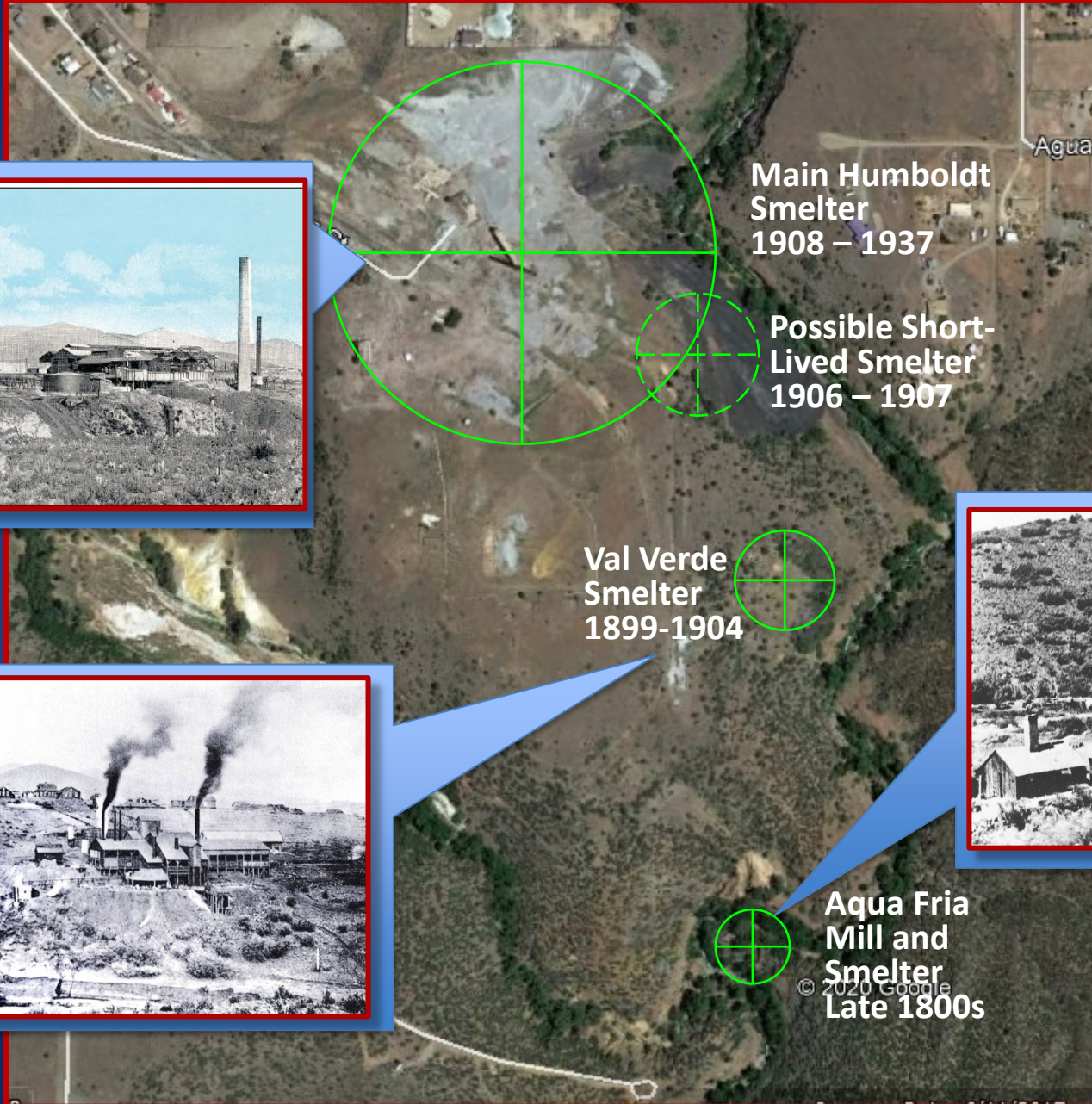
Yolanda Sanchez
Community Involvement
Coordinator

(415) 972-3880
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EPA Web Site for
Iron King Mine/ Humboldt Smelter Superfund Site

<http://www.epa.gov/superfund/ironkingmine>

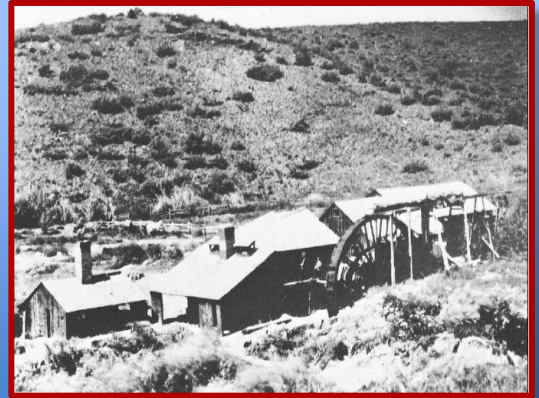
Smelter Operations: Predecessors & the Main Humboldt Smelters



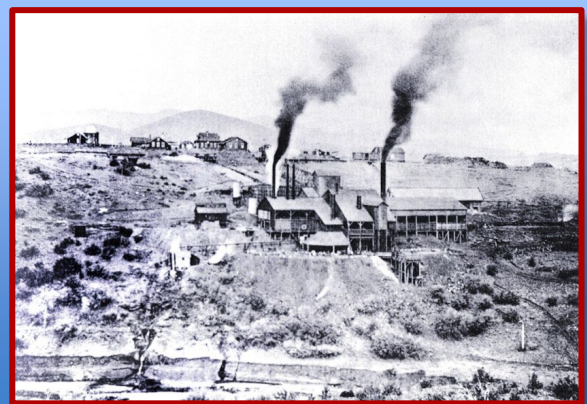
Main Humboldt Smelter
1908 – 1937

Possible Short-Lived Smelter
1906 – 1907

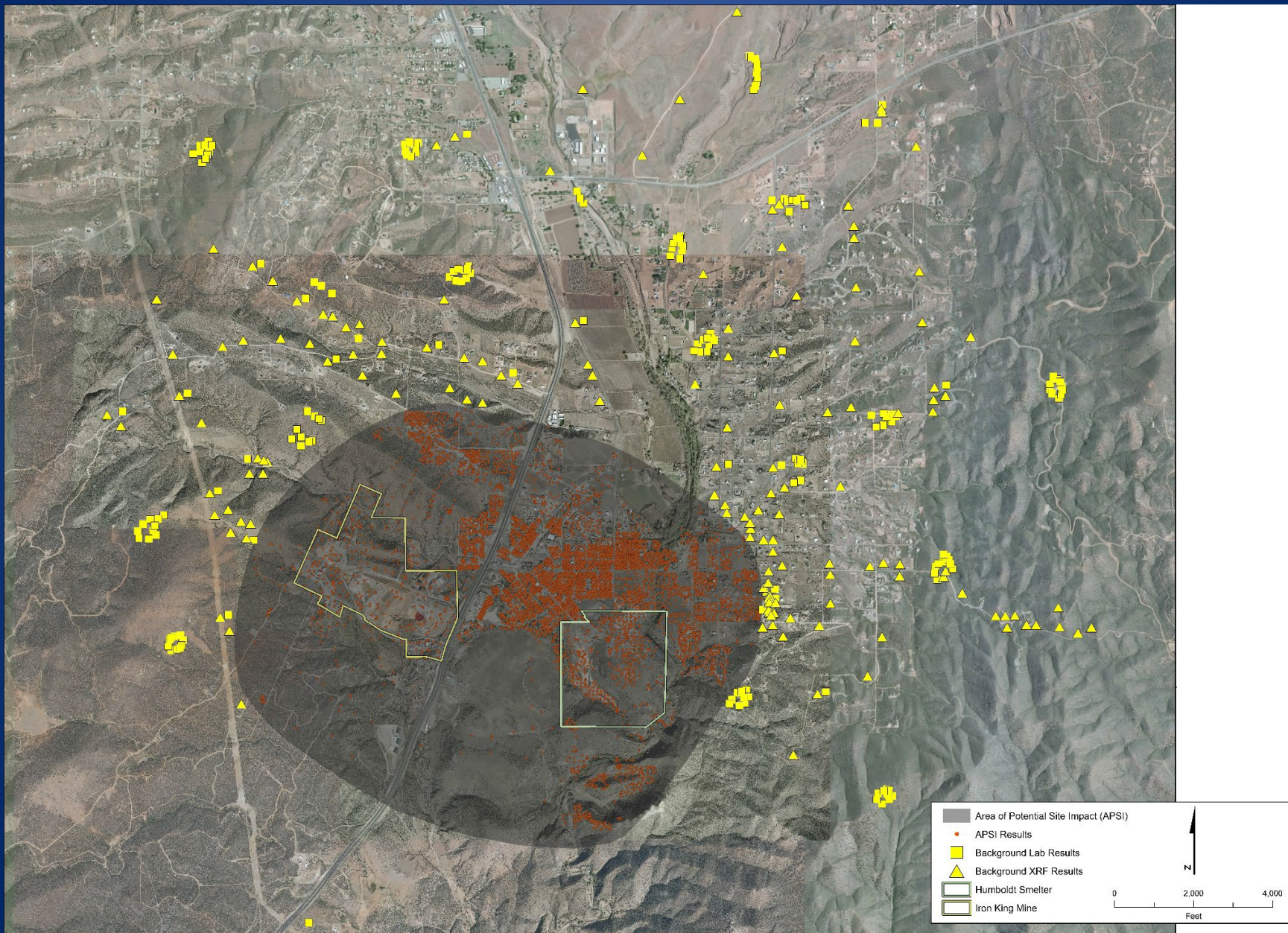
Val Verde Smelter
1899-1904



Aqua Fria Mill and Smelter
Late 1800s



Where did we sample for background?

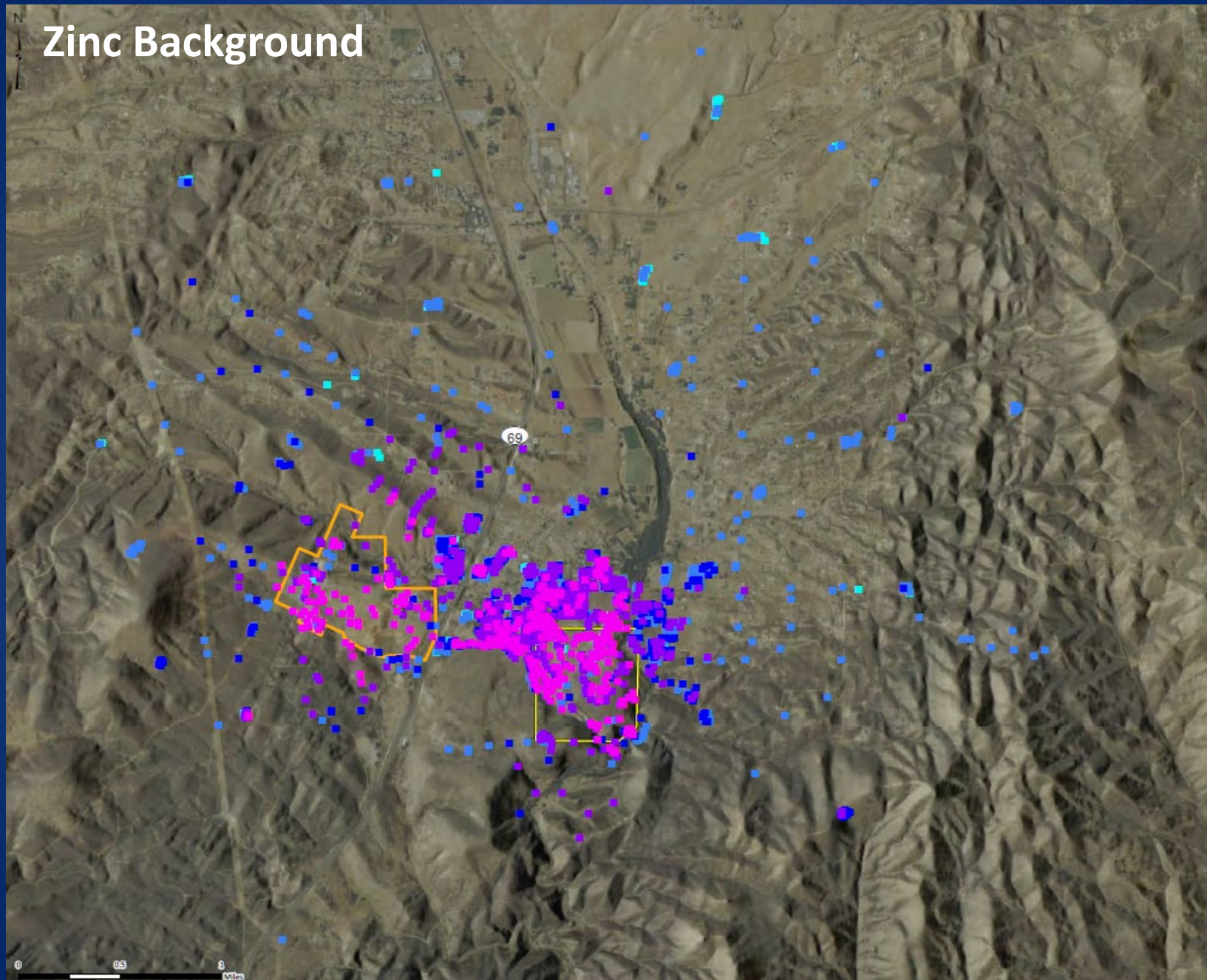


Statistical Background Values for Important Metals in Soils

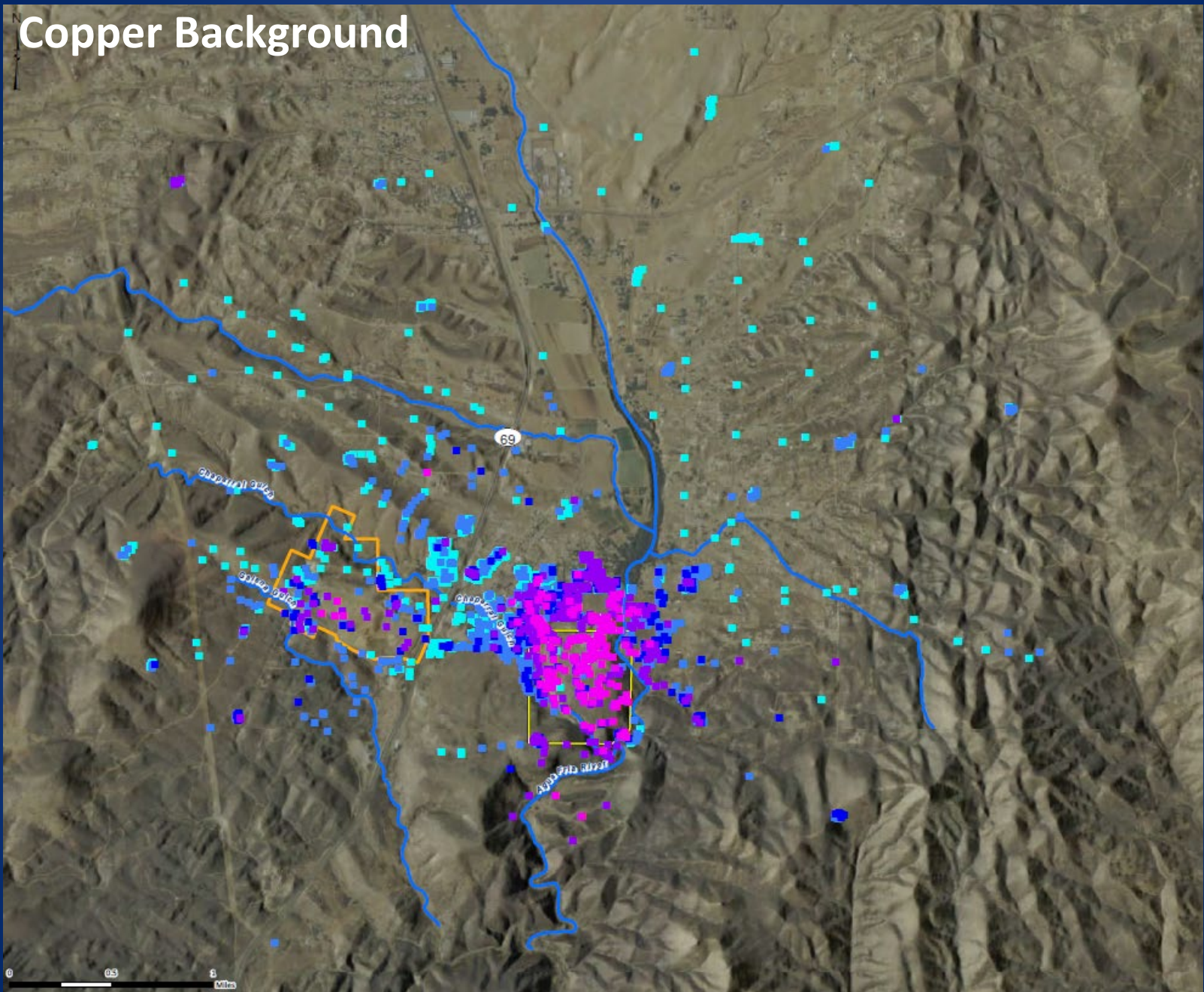
- Arsenic: 112 milligrams per kilogram
- Lead: 35 milligrams per kilogram
- Zinc: 136 milligrams per kilogram
- Copper: 182 milligrams per kilogram



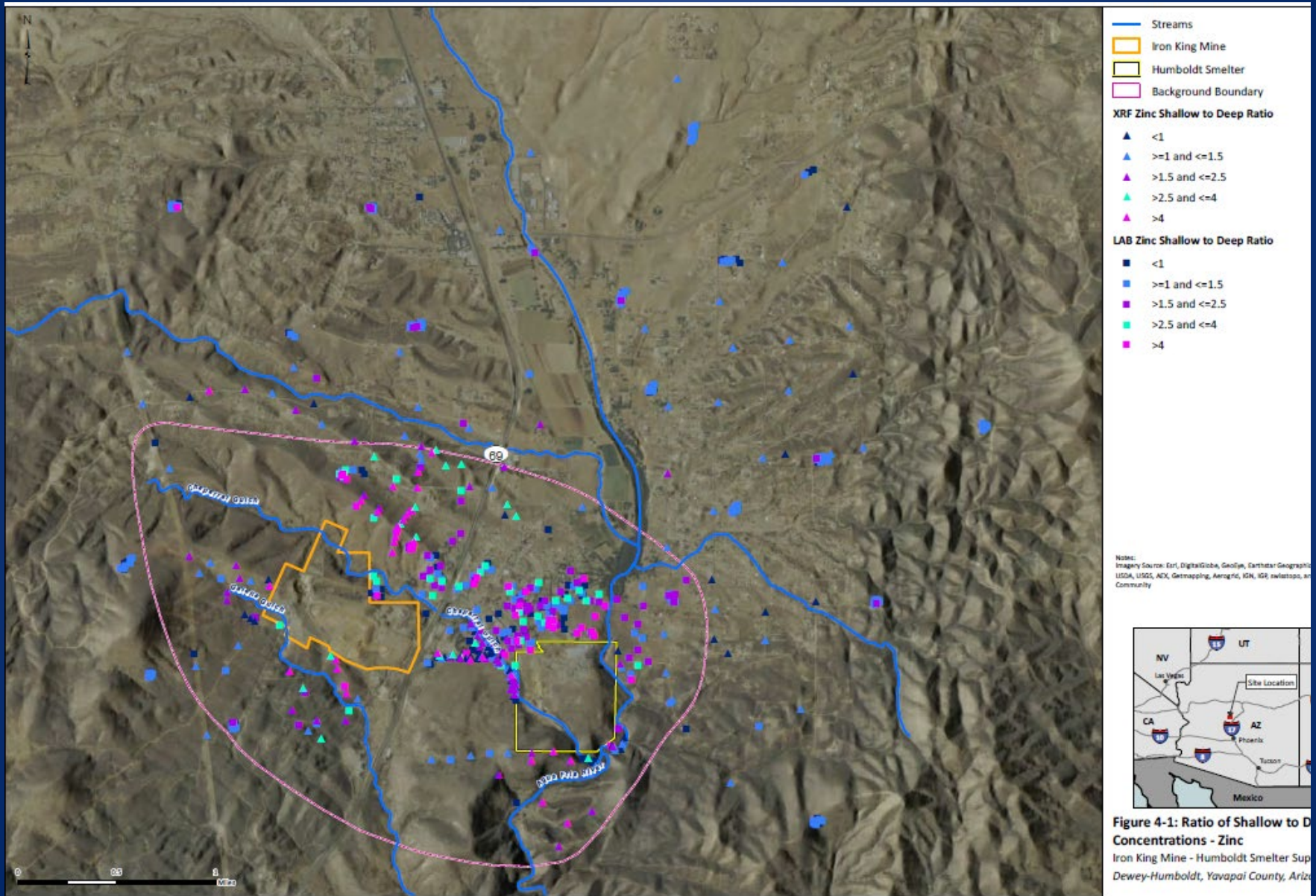
Zinc Background



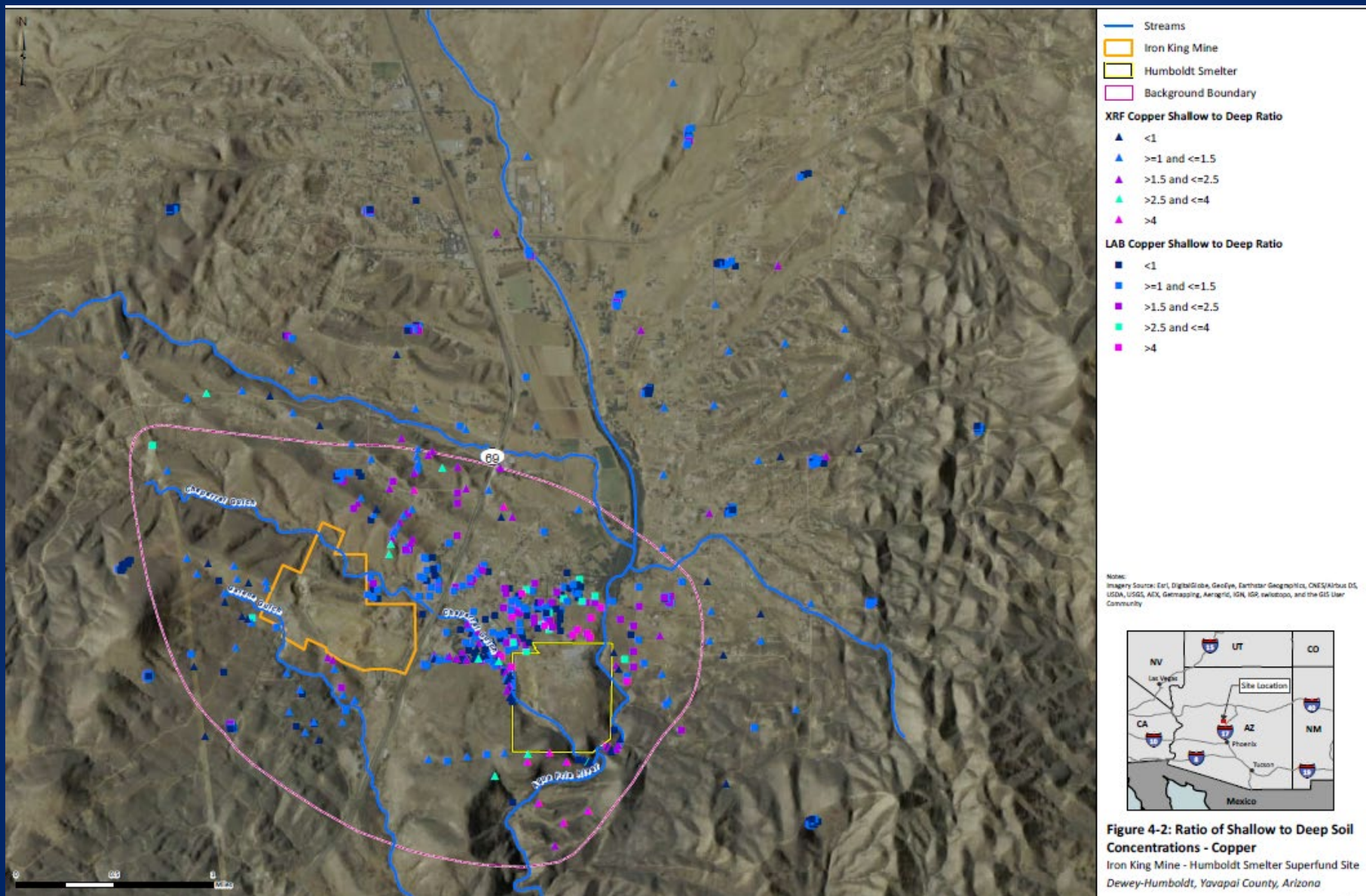
Copper Background



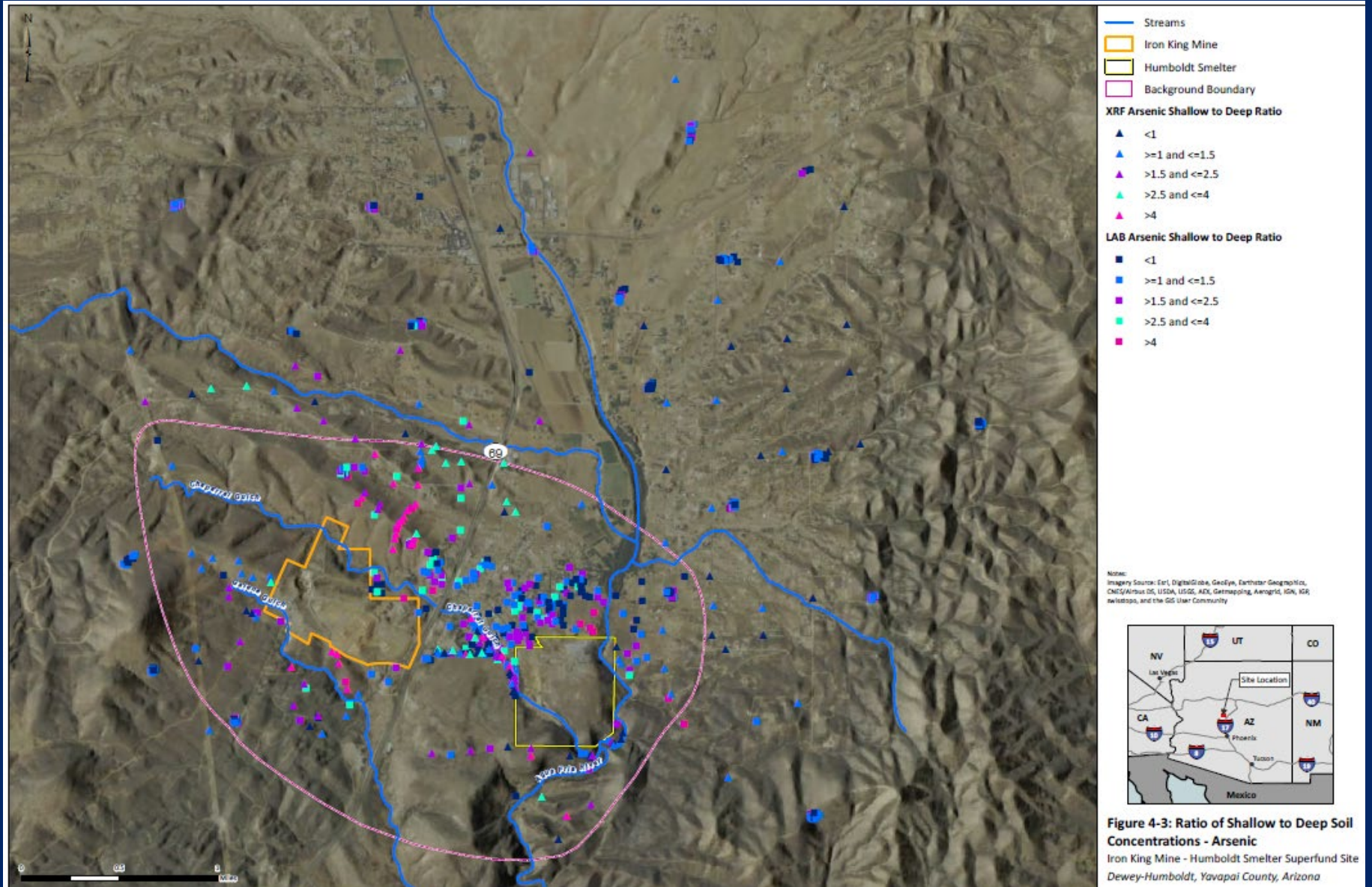
Surface to 1 foot samples Zinc



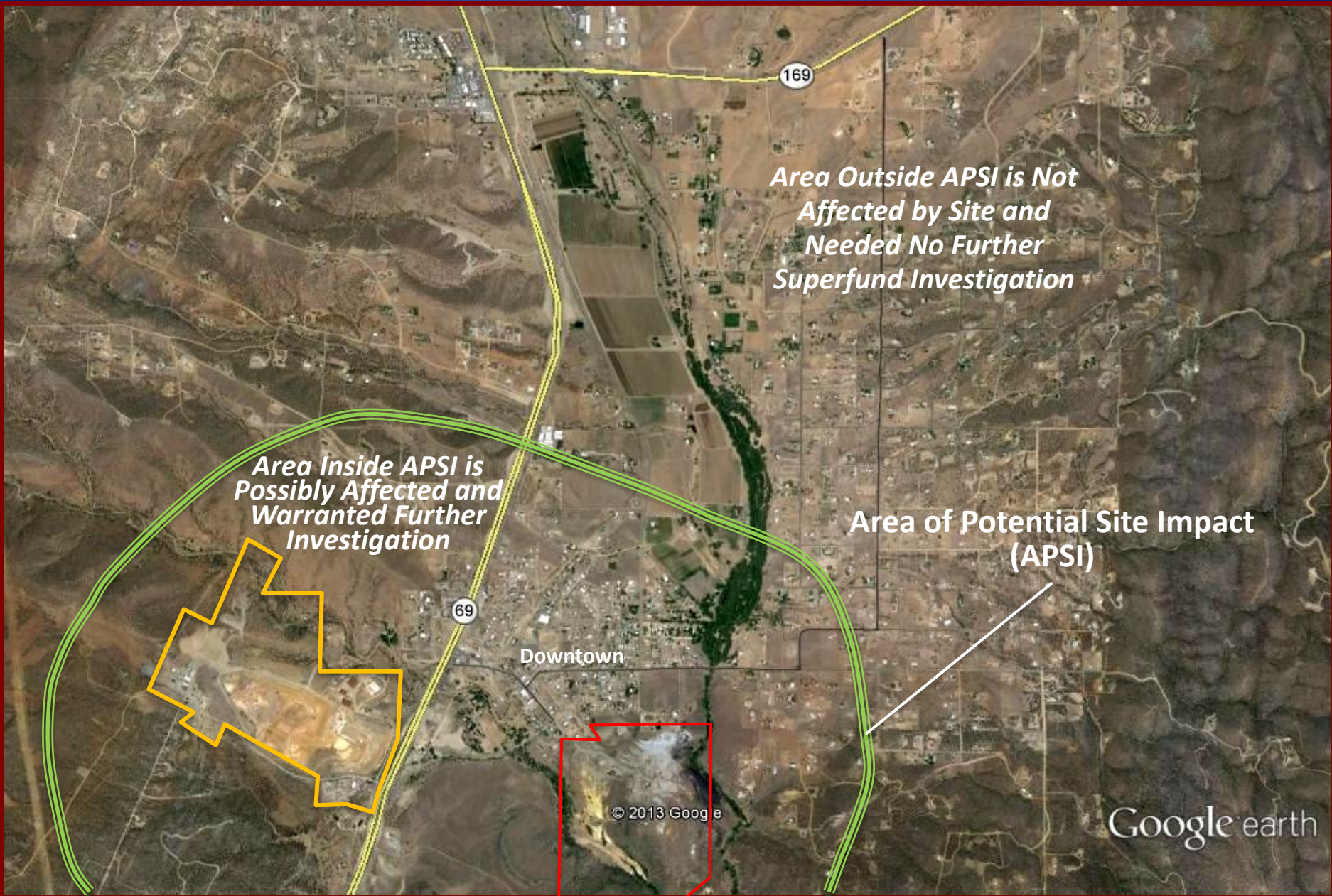
Surface to 1 foot samples Copper



Surface to 1 foot samples Arsenic



The Area of Potential Site Impact (APSI)



Area Outside APSI is Not Affected by Site and Needed No Further Superfund Investigation

Area Inside APSI is Possibly Affected and Warranted Further Investigation

Area of Potential Site Impact (APSI)

Downtown

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Residential Soils Investigation and the Area of Potential Site Impact

580 Yards Sampled or Screened ● Over 6,200 Samples Collected

