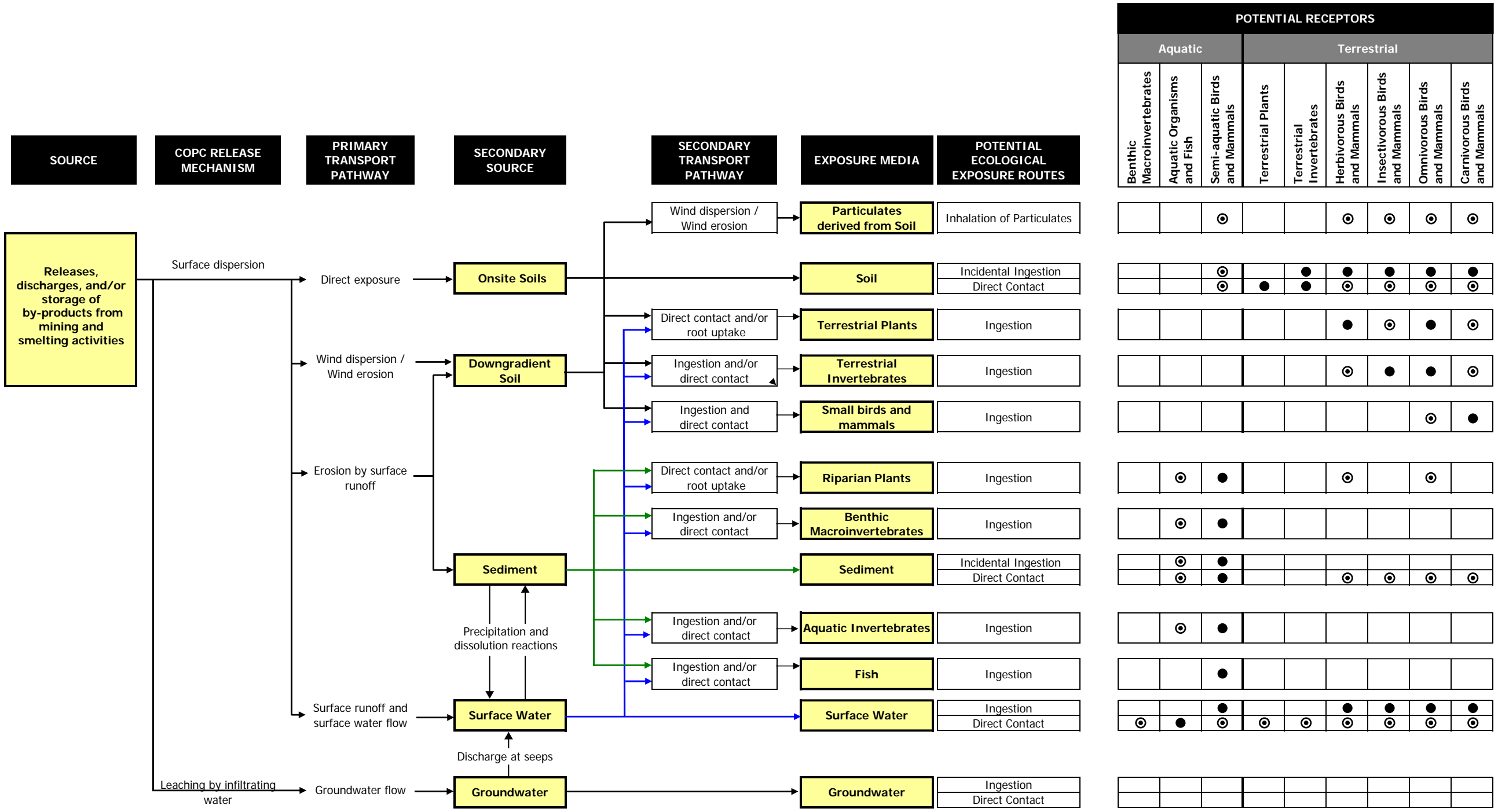


SMDP = Scientific Management Decision Point
DQO = Data Quality Objective

Adapted from Ecological Risk Assessment
Process for Superfund (EPA, 1997a)

Figure 10-1
EPA's Eight-step Ecological Risk Assessment Process for Superfund
Iron King Mine – Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona



Notes:
 Different line colors are only used to allow ease of reading

Upland Receptors:

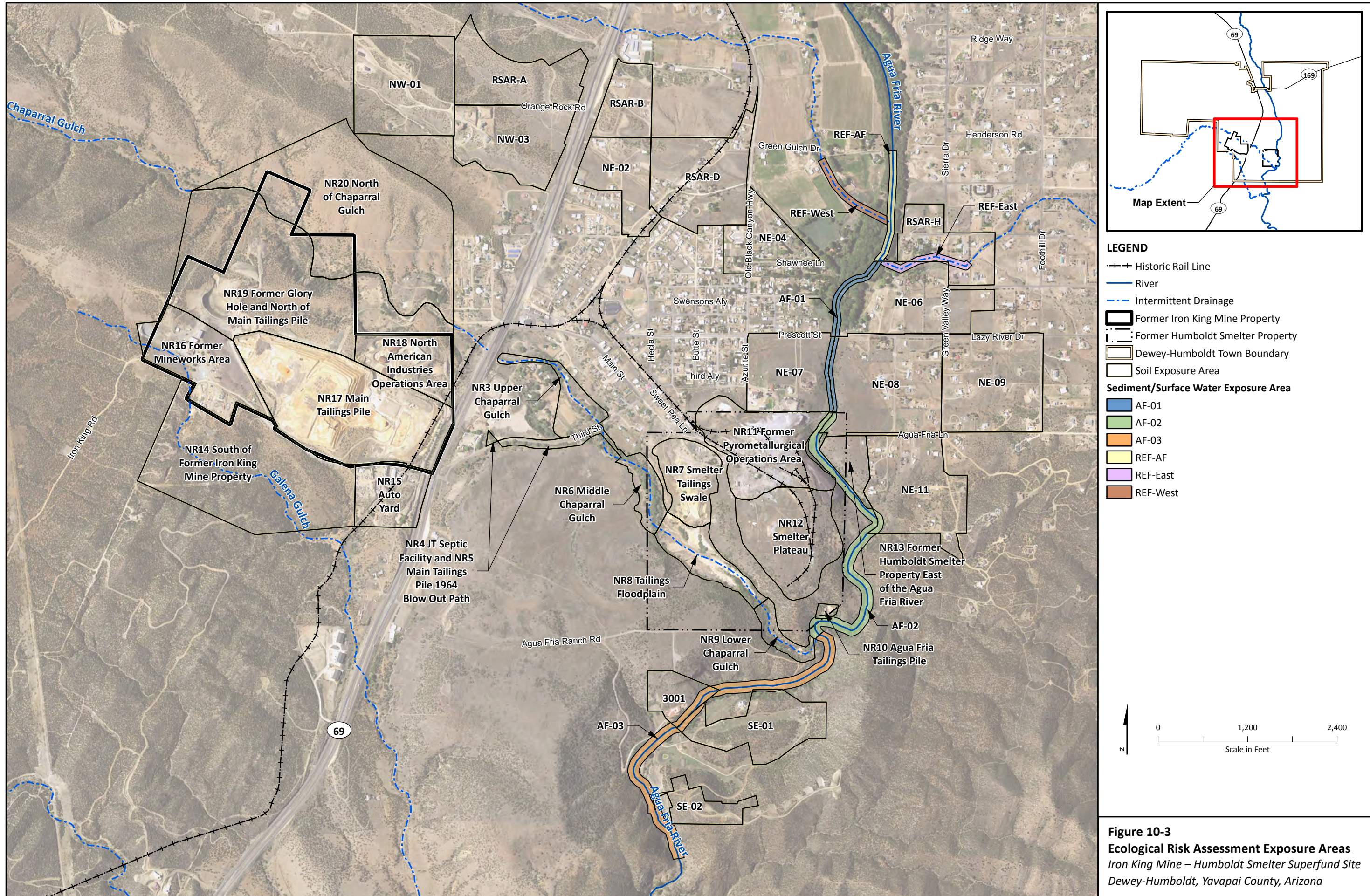
Primary producer	Terrestrial plants
Primary consumer	Soil invertebrates
Herbivore	Gambel's quail
Insectivore	Western kingbird
Omnivore	Song sparrow
Carnivore	Red-tailed hawk
Herbivore	Pocket gopher
Insectivore	Desert shrew
Omnivore	Raccoon
Carnivore	Coyote

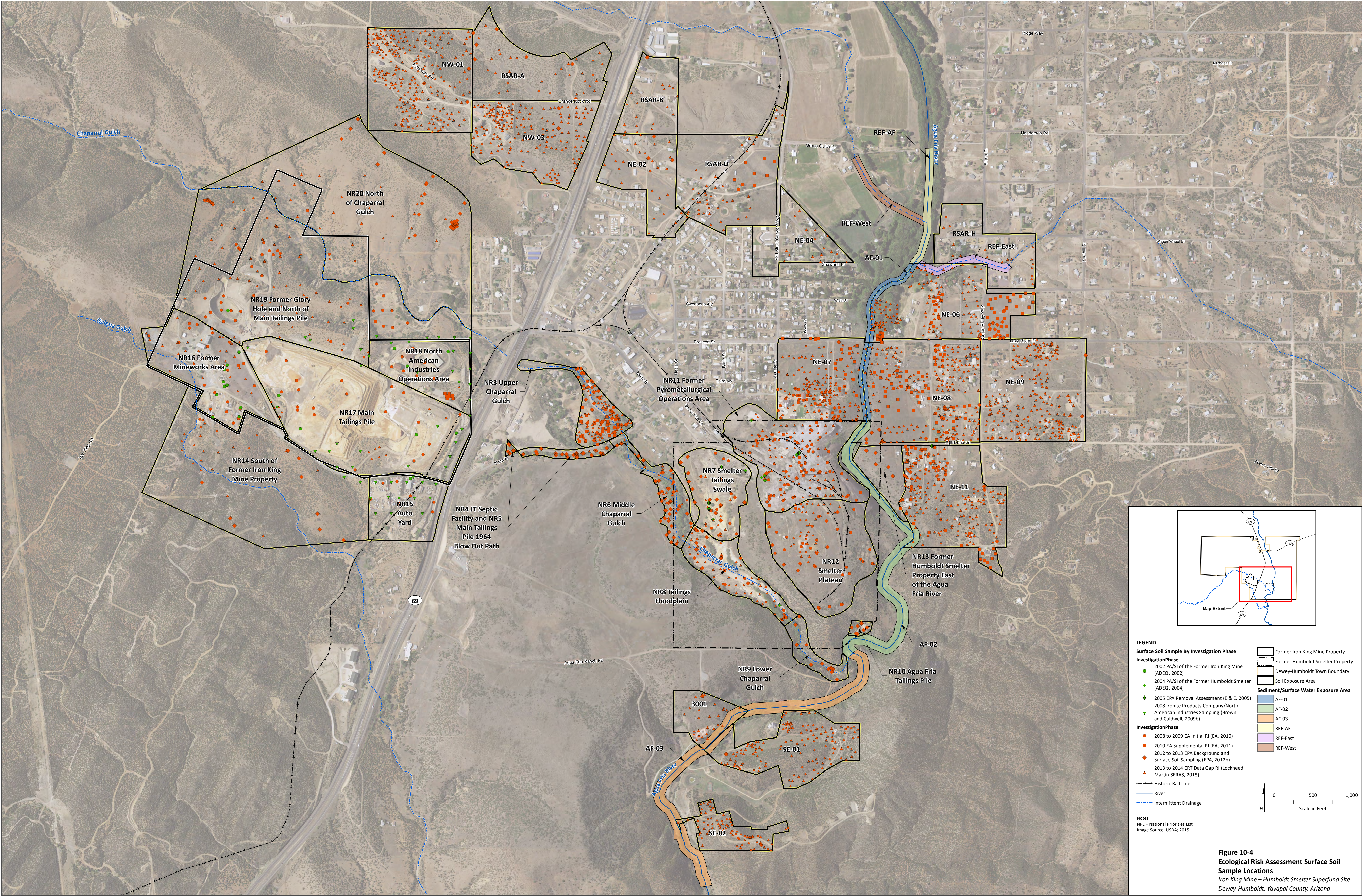
Aquatic/Semi-aquatic Receptors:

Primary producer	Aquatic plants
Primary consumer	Aquatic organisms (invertebrates and fish)
Primary consumer	Benthic macroinvertebrates
Omnivore	Mallard
Piscivore	Great blue heron
Omnivore	Raccoon
Piscivore	River otter

● Potentially complete pathway (quantitatively evaluated in this risk assessment)
 ⊙ Potentially complete minor pathway (not quantitatively evaluated in this risk assessment)
 □ Incomplete pathway

Figure 10-2
Ecological Conceptual Site Model
Iron King Mine – Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona





LEGEND

Surface Soil Sample By Investigation Phase

InvestigationPhase

- 2002 PA/SI of the Former Iron King Mine (ADEC, 2002)
- 2004 PA/SI of the Former Humboldt Smelter (ADEC, 2004)
- 2005 EPA Removal Assessment (E & E, 2005)
- 2008 Ironite Products Company/North American Industries Sampling (Brown and Caldwell, 2009b)
- 2008 to 2009 EA Initial RI (EA, 2010)
- 2010 EA Supplemental RI (EA, 2011)
- 2012 to 2013 EPA Background and Surface Soil Sampling (EPA, 2012b)
- 2013 to 2014 ERT Data Gap RI (Lockheed Martin SERAS, 2015)

Sediment/Surface Water Exposure Area

- AF-01
- AF-02
- AF-03
- REF-AF
- REF-East
- REF-West

InvestigationPhase

- 2008 to 2009 EA Initial RI (EA, 2010)
- 2010 EA Supplemental RI (EA, 2011)
- 2012 to 2013 EPA Background and Surface Soil Sampling (EPA, 2012b)
- 2013 to 2014 ERT Data Gap RI (Lockheed Martin SERAS, 2015)

Notes:

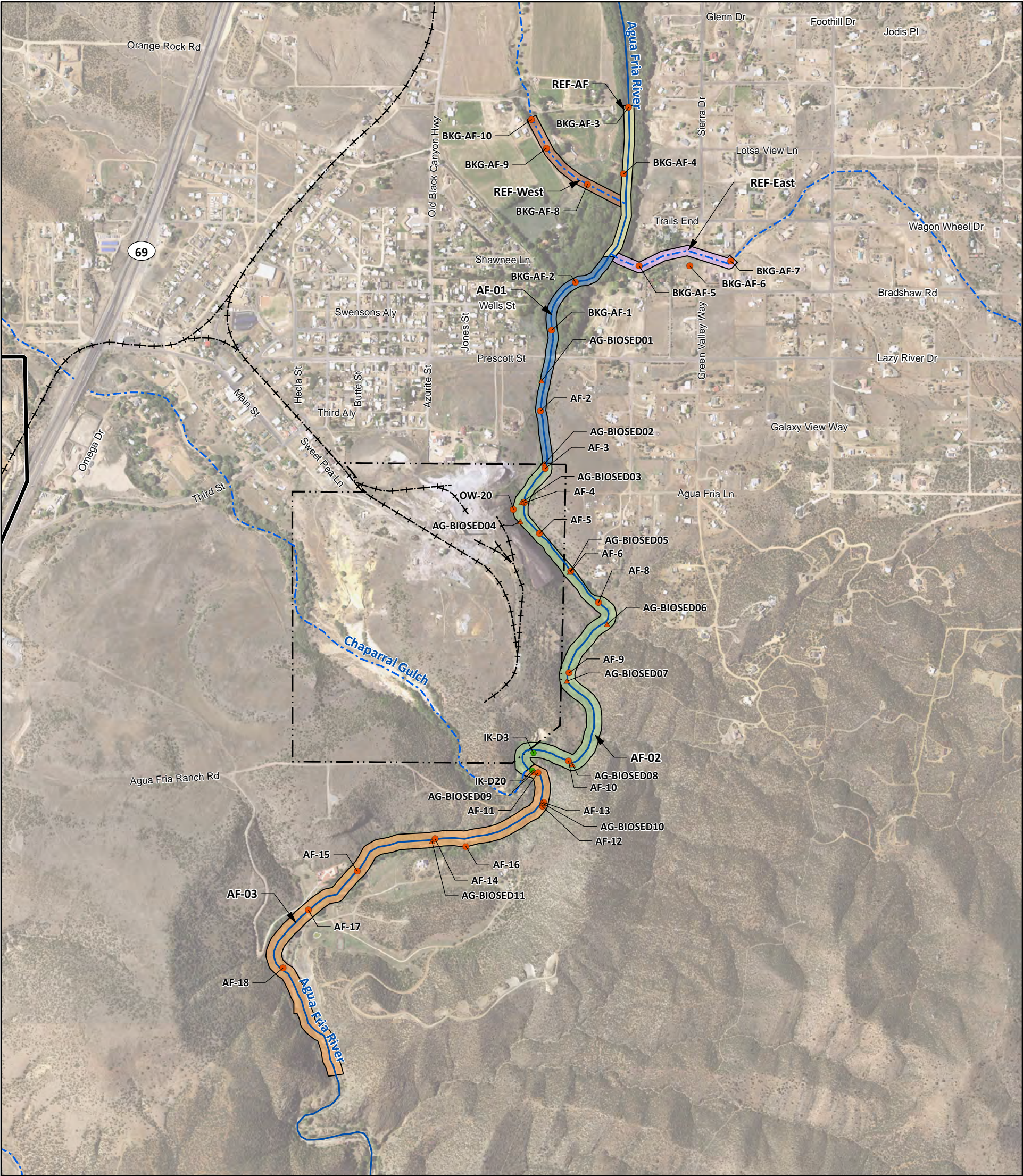
- NPL = National Priorities List
- Image Source: USDA, 2015.

Map Extent

Scale in Feet

0 500 1,000

Figure 10-4
Ecological Risk Assessment Surface Soil Sample Locations
*Iron King Mine – Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona*



LEGEND

Sediment Sample by Investigation Phase

Pre-NPL Investigation

- 2002 PA/SI of the Former Iron King Mine (ADEQ, 2002)

EPA Remedial Investigation

- 2008 to 2009 EA Initial RI (EA, 2010)
- ▲ 2014 ERT Data Gap RI (Lockheed Martin SERAS, 2015)

--- Historic Rail Line

— River

- - - Intermittent Drainage



Former Iron King Mine Property



Former Humboldt Smelter Property



Dewey-Humboldt Town Boundary



AF-01



AF-02



AF-03



REF-AF



REF-East



REF-West

Notes:

NPL = National Priorities List

Image Source: USDA, 2015.

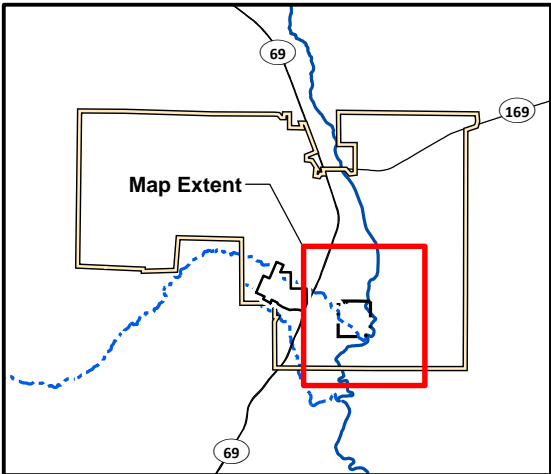
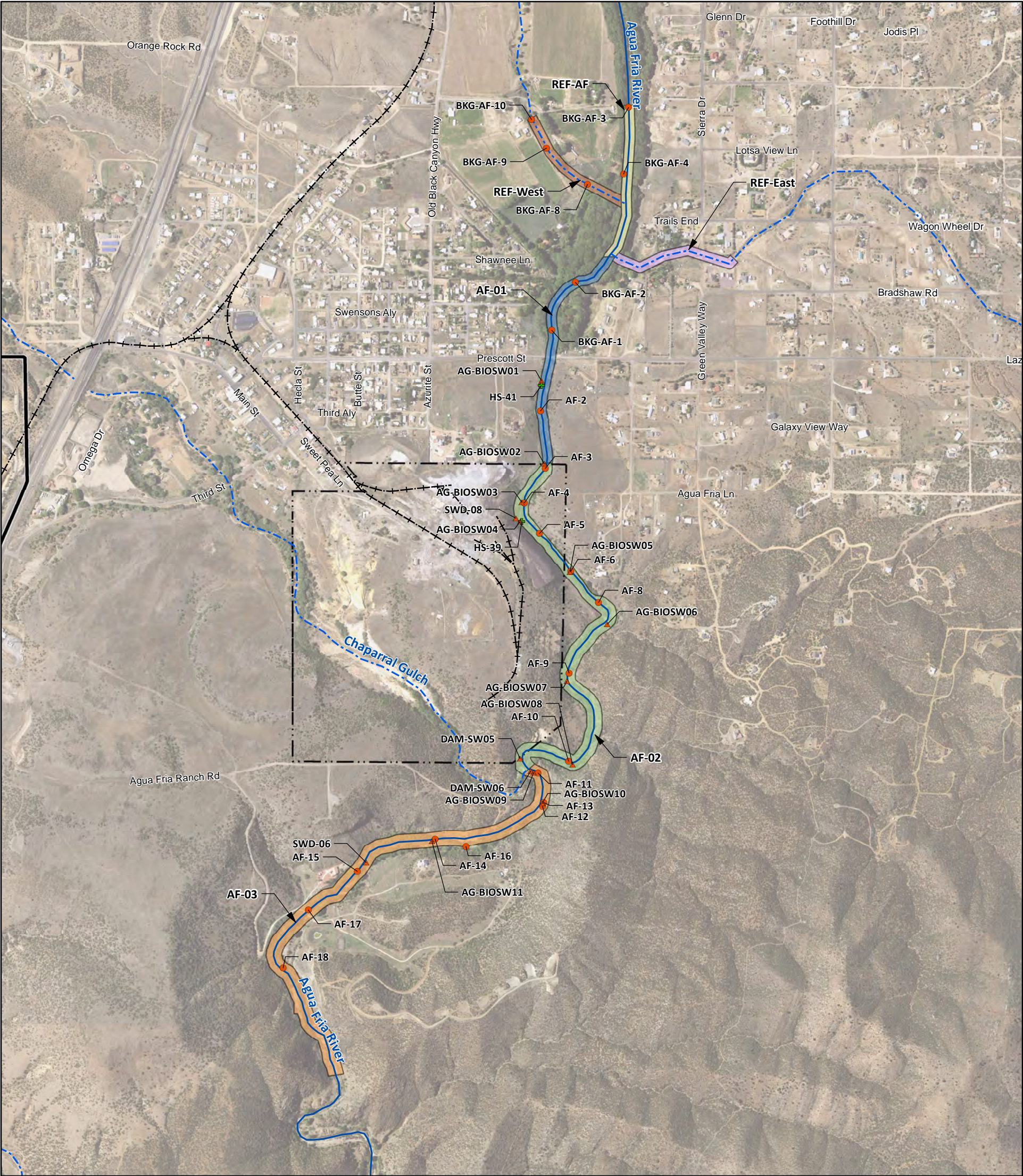


Figure 10-5
Ecological Risk Assessment Sediment
Sample Locations
Iron King Mine – Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona



LEGEND

Surface Water Sample by Investigation Phase

Pre-NPL Investigation

2004 PA/SI of the Former Humboldt Smelter (ADEQ, 2004)

EPA Remedial Investigation

2008 to 2009 EA Initial RI (EA, 2010)

2014 ERT Data Gap RI (Lockheed Martin SERAS, 2015)

Historic Rail Line

River

Intermittent Drainage

Former Iron King Mine Property

Former Humboldt Smelter Property

Dewey-Humboldt Town Boundary

Sediment/Surface Water Exposure Area

AF-01

AF-02

AF-03

REF-AF

REF-East

REF-West

Notes:
NPL = National Priorities List
Image Source: USDA; 2015.

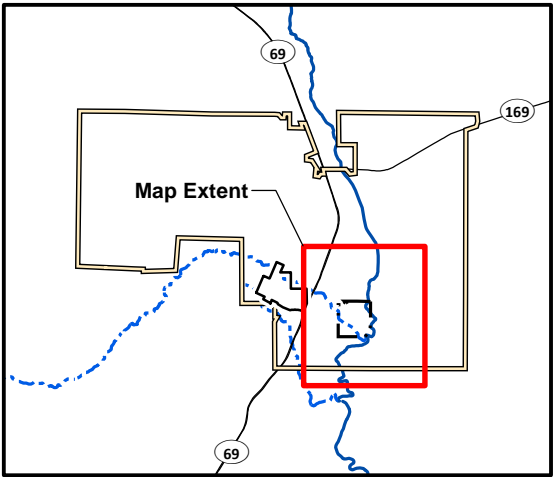
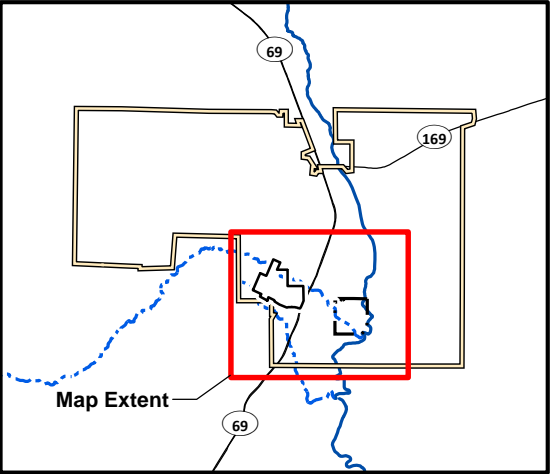
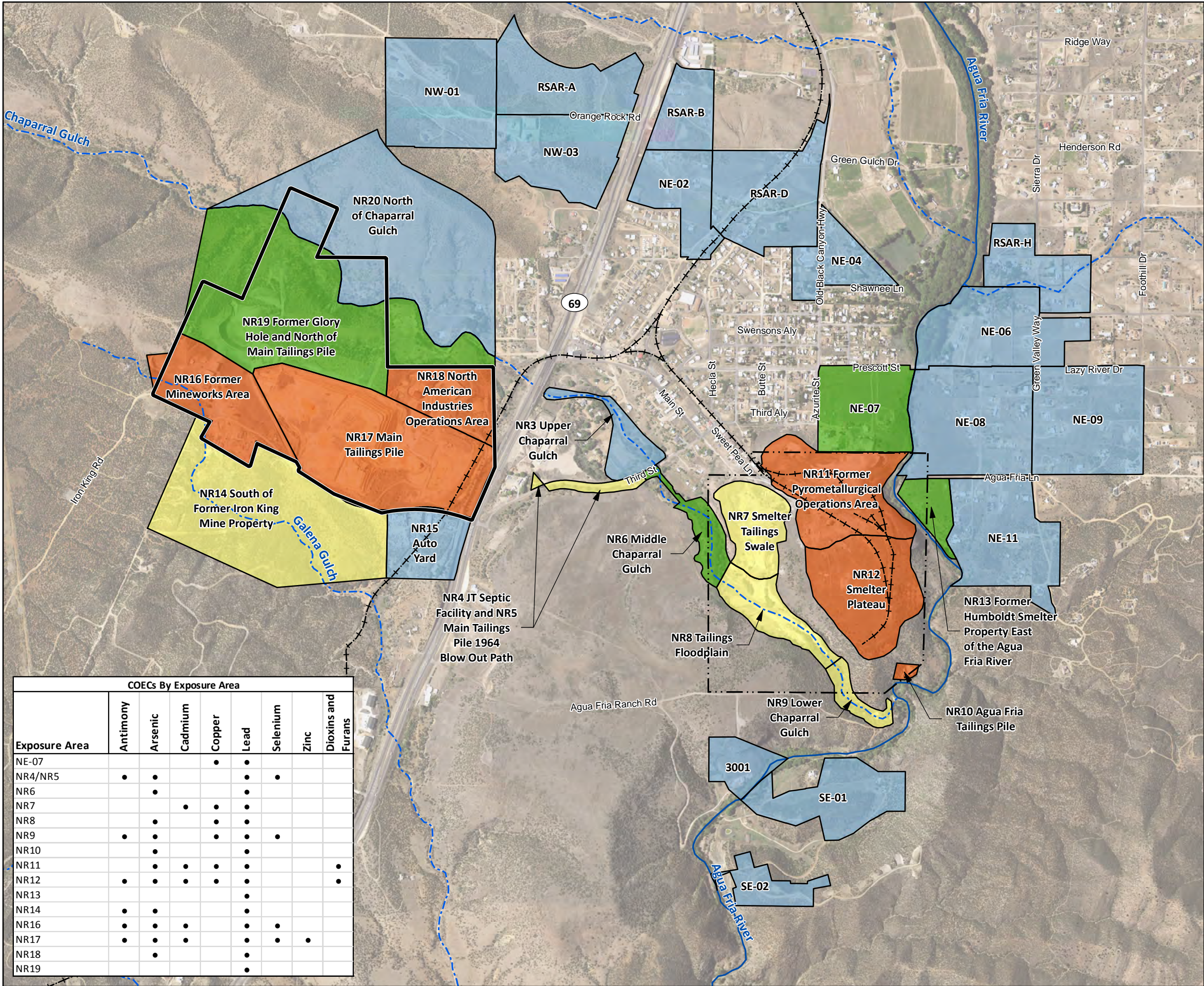


Figure 10-6
Ecological Risk Assessment Surface Water
Sample Locations
Iron King Mine – Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona



LEGEND

Ecological Weight of Evidence

- All LOAEL-based HQs <1
- Limited Potential for Adverse Effects^a
- Moderate Potential for Adverse Effects^b
- Higher Potential for Adverse Effects^c

— River

- - - Intermittent Drainage

▭ Former Iron King Mine Property

- - - Former Humboldt Smelter Property

▭ Dewey-Humboldt Town Boundary

^aTwo or fewer COECs or receptors with LOAEL-based HQs >1. LOAEL-based HQs 1 to 10.

^bThree or more COECs or receptors with LOAEL-based HQs >1. LOAEL-based HQs 1 to 50.

^cMultiple COECs and receptors with LOAEL-based HQs >1. LOAEL-based HQs 1 to 100+.

Notes:
COEC = Chemicals of Ecological Concern
HQ = Hazard Quotient
LOAEL = Lowest Observed Adverse Effect Level

Exposure areas are color coded by weight of evidence for potential risks to ecological receptors in each trophic level/feeding guild. Incremental risk is used as basis for coding where background data were available, otherwise site risks are used. Estimated risks to plants or soil invertebrates were not used as the sole determinant of overall potential for unacceptable risks and are not included in color coding. Image Source: USDA, 2015.

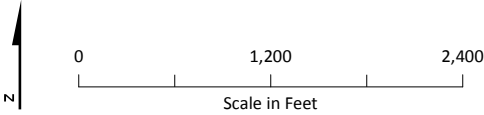
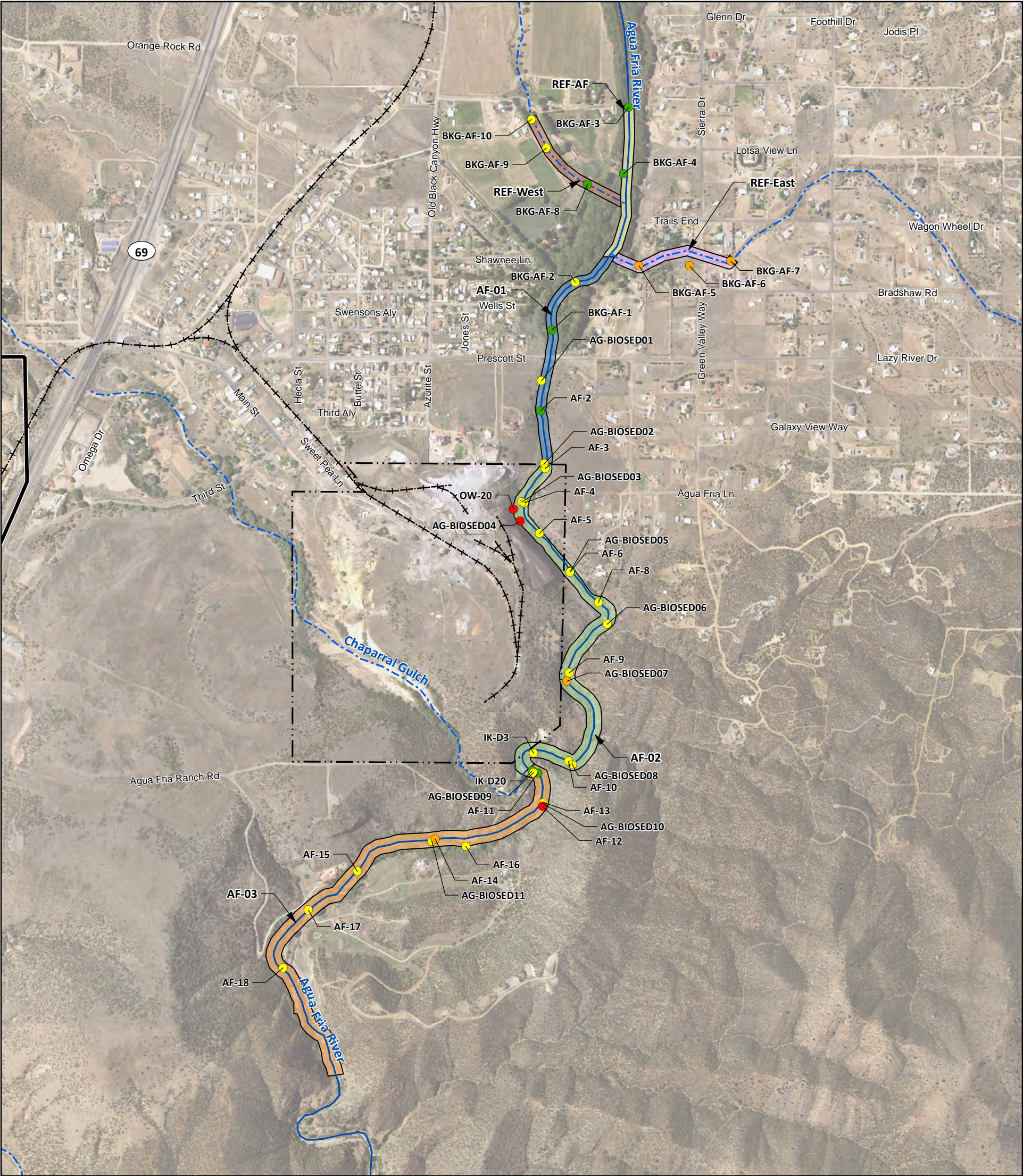


Figure 10-7
Estimated Risks for Terrestrial Receptors – Food-chain Uptake from Soil
Iron King Mine – Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona



LEGEND

Arsenic Concentration in Sediment (mg/kg)

- 4.2 to <9.79 (TEC)
- 9.79 to 33 (PEC)
- >33 to 66 (2x PEC)
- >66 to 206 (Highest Detection)

- River
- Intermittent Drainage
- Former Iron King Mine Property
- Former Humboldt Smelter Property
- Dewey-Humboldt Town Boundary

Sediment/Surface Water Exposure Area

- AF-01
- AF-02
- AF-03
- REF-AF
- REF-East
- REF-West

Notes:
NPL = National Priorities List
PEC = Probable Effect Concentration
TEC = Threshold Effect Concentration
Image Source: USDA, 2015.

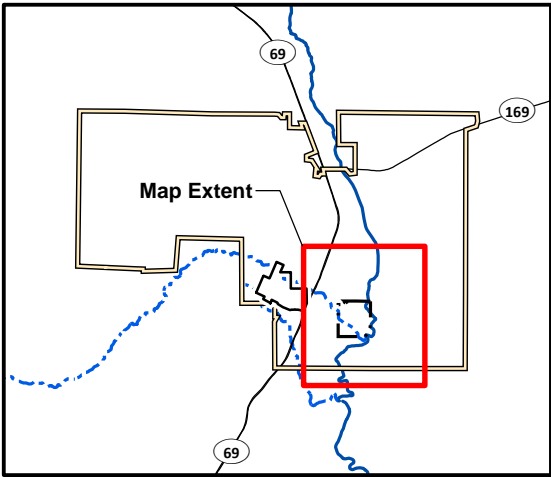
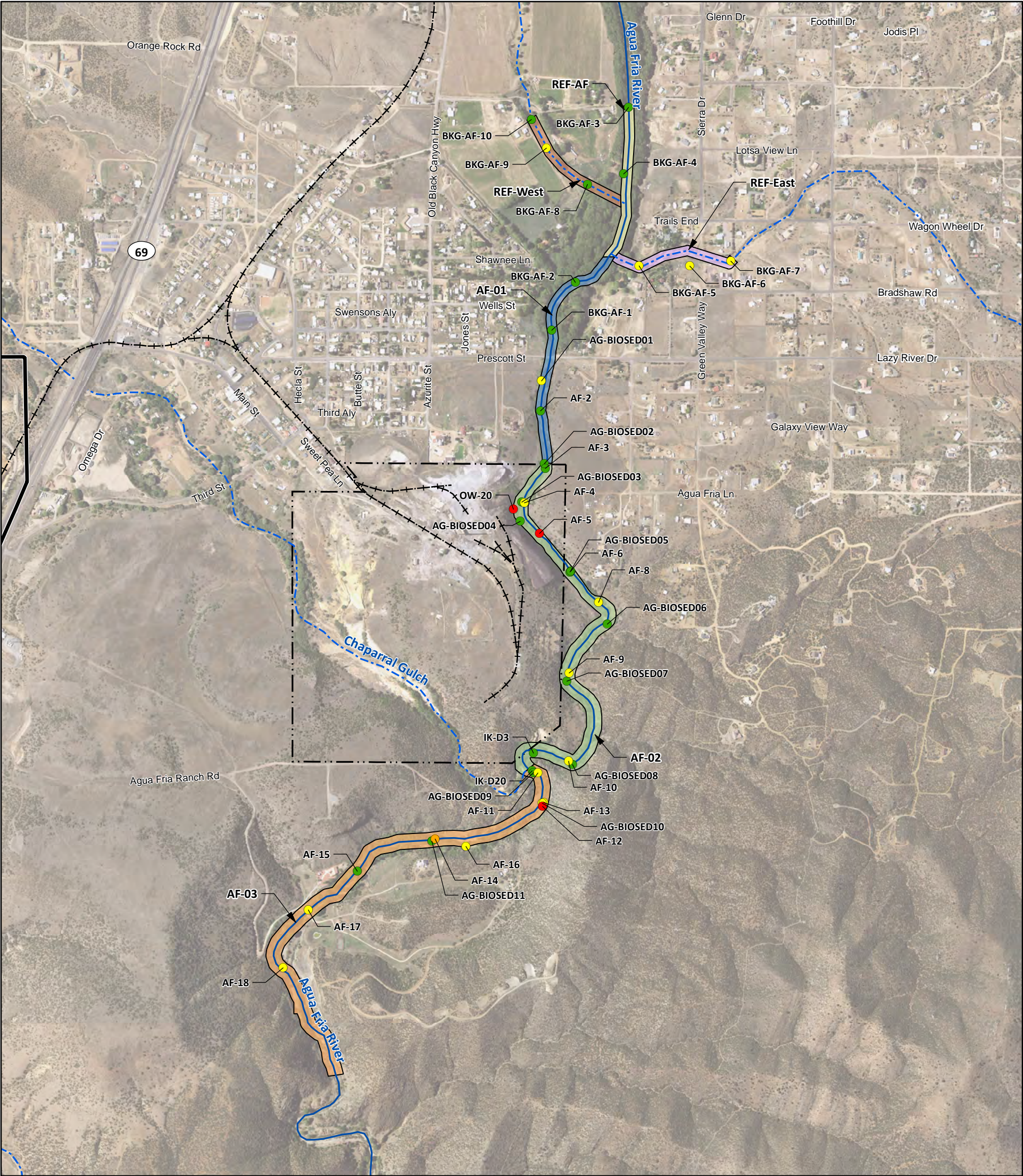


Figure 10-8
Estimated Ecological Risks from Arsenic in Sediment
Iron King Mine – Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona



LEGEND

Copper Concentration in Sediment (mg/kg)

- 12.4 to <31.6 (TEC)
- 31.6 to 149 (PEC)
- >149 to 289 (2x PEC)
- >289 to 8,030 (Highest Detection)

- River
- Intermittent Drainage
- Former Iron King Mine Property
- Former Humboldt Smelter Property
- Dewey-Humboldt Town Boundary

Sediment/Surface Water Exposure Area

- AF-01
- AF-02
- AF-03
- REF-AF
- REF-East
- REF-West

Notes:
NPL = National Priorities List
PEC = Probable Effect Concentration
TEC = Threshold Effect Concentration
Image Source: USDA, 2015.

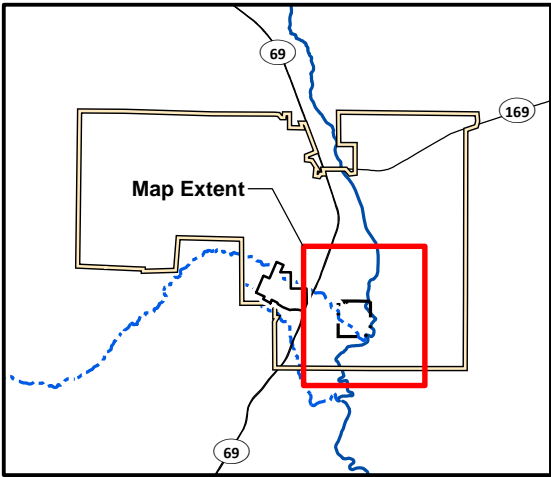


Figure 10-9
Estimated Ecological Risks from Copper in Sediment
Iron King Mine – Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona



LEGEND

Lead Concentration in Sediment (mg/kg)

- Not Detected
- 3.1 to <35.8 (TEC)
- 35.8 to 128 (PEC)
- >128 to 256 (2x PEC)
- >256 to 709 (Highest Detection)
- River
- - - Intermittent Drainage
- ▭ Former Iron King Mine Property
- ▭ Former Humboldt Smelter Property
- ▭ Dewey-Humboldt Town Boundary

Sediment/Surface Water Exposure Area

- AF-01
- AF-02
- AF-03
- REF-AF
- REF-East
- REF-West

Notes:
NPL = National Priorities List
PEC = Probable Effect Concentration
TEC = Threshold Effect Concentration
Image Source: USDA, 2015.

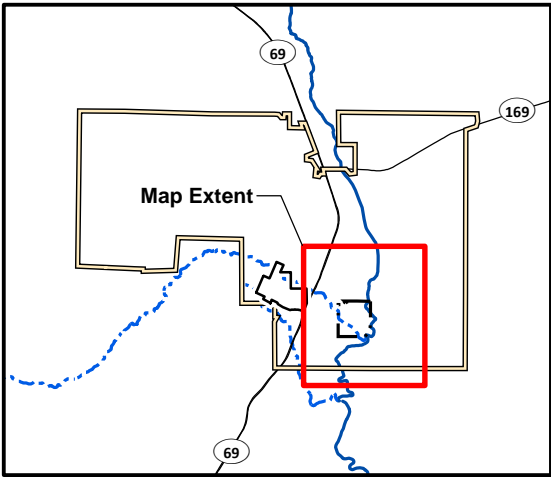


Figure 10-10
Estimated Ecological Risks from Lead in Sediment
Iron King Mine – Humboldt Smelter Superfund Site
Dewey-Humboldt, Yavapai County, Arizona