

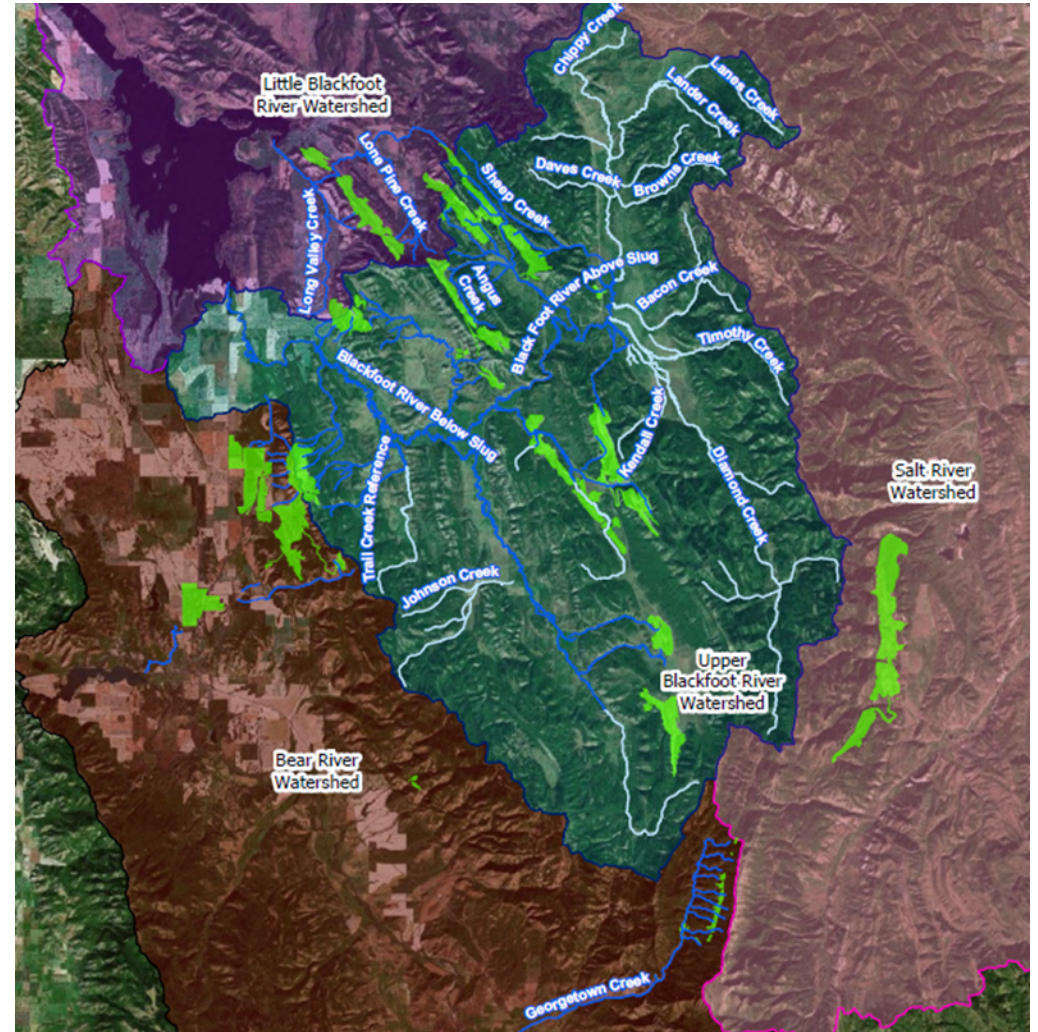
How Risk Assessment Avoids Unnecessary Reclamation

Anne Thatcher
**Annual Conference of American Society
of Reclamation Scientists**

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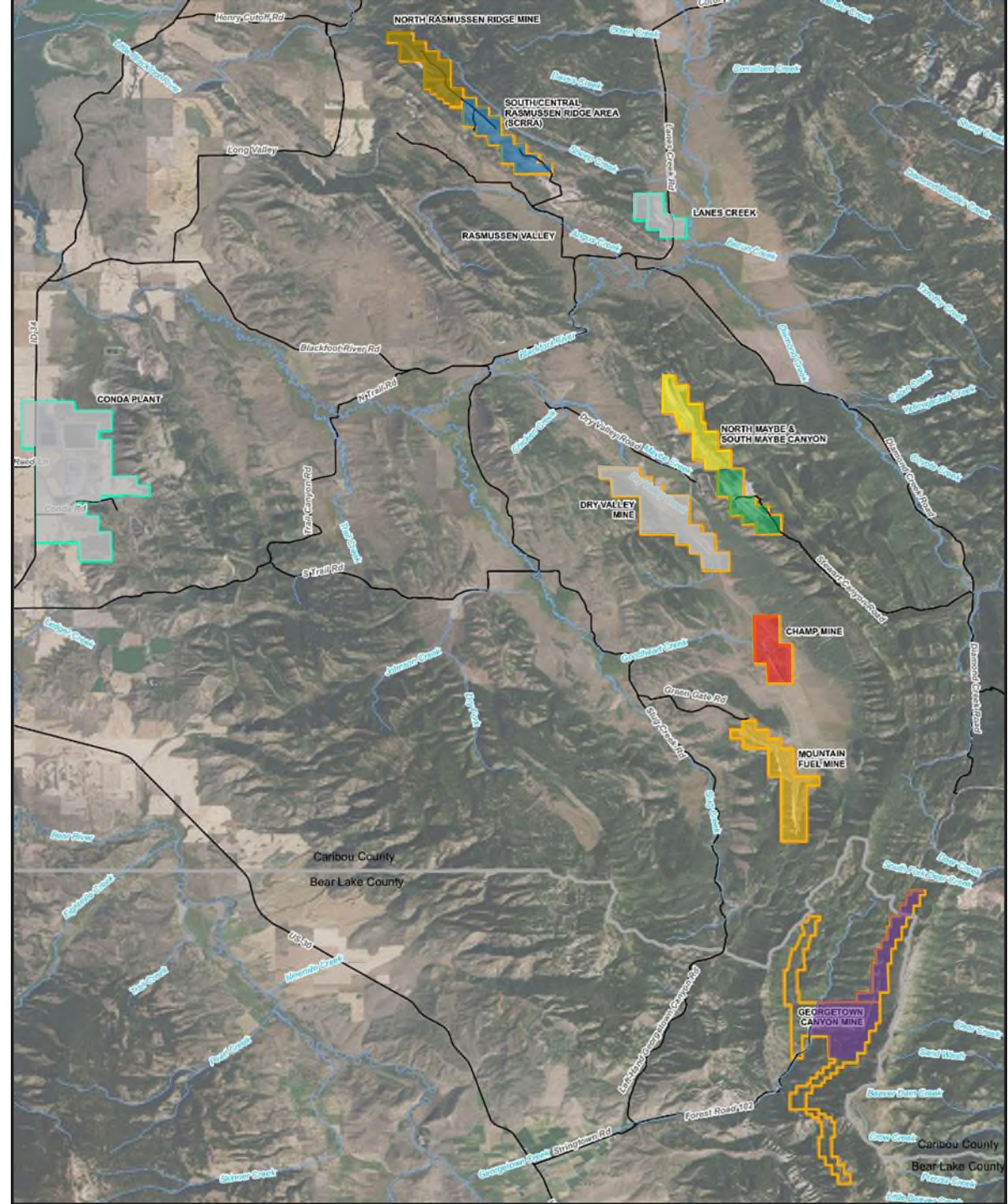
Outline

- Nu-West Site Overview (Jon Bronson's intro)
- CERCLA Process
- Risk Assessment Process for Eco
- Specific example for Champ Mine
- Punch Line
- Acknowledgements

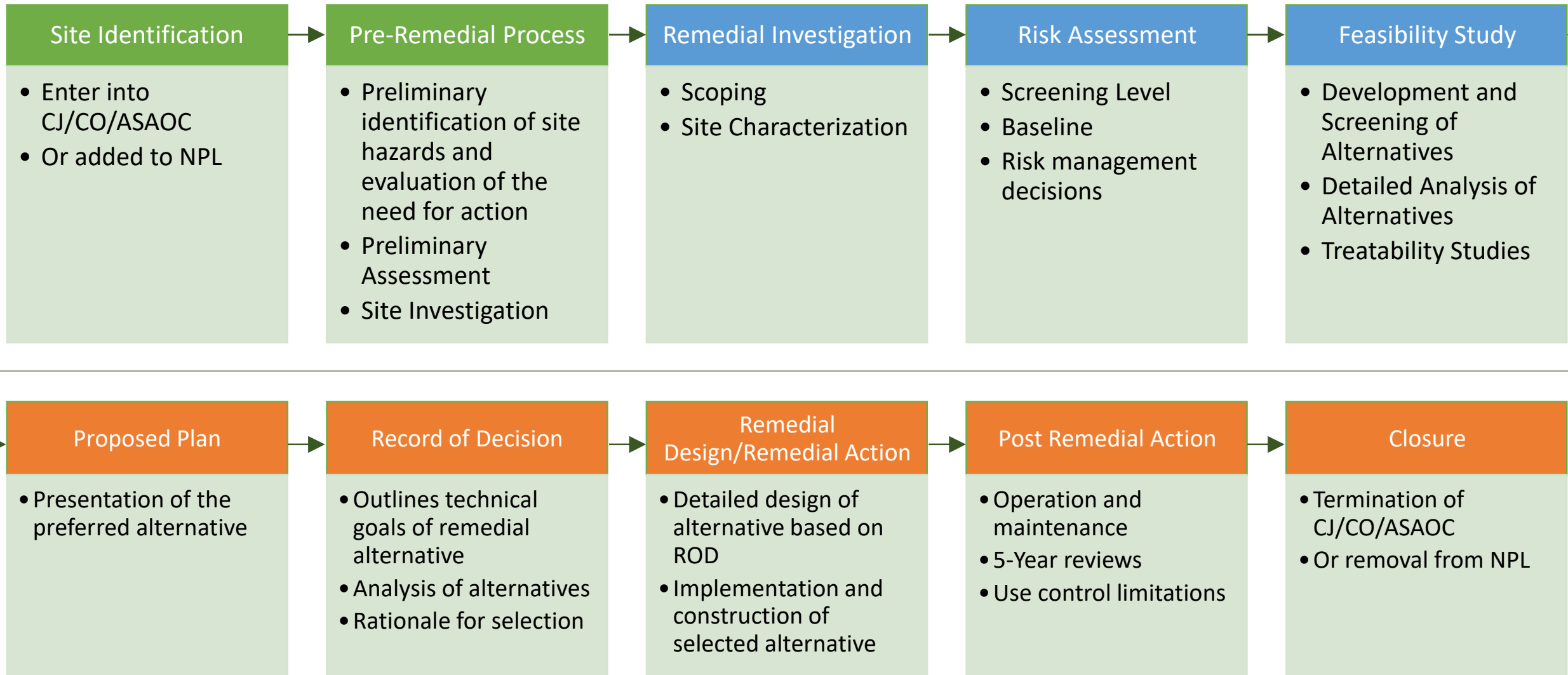


Nu-West Projects Overview

- CERCLA Sites
 - North Maybe Mine
 - South Maybe Canyon Mine
 - Champ Mine
 - Mountain Fuel Mine
 - Georgetown Canyon Mine (IDEQ Lead)
- Consent Judgement
 - South and Central Rasmussen Ridge Mine
 - Georgetown Canyon Plant
- Mine Closure
 - North Rasmussen Ridge Mine
 - Dry Valley Mine
 - Lanes Creek Mine

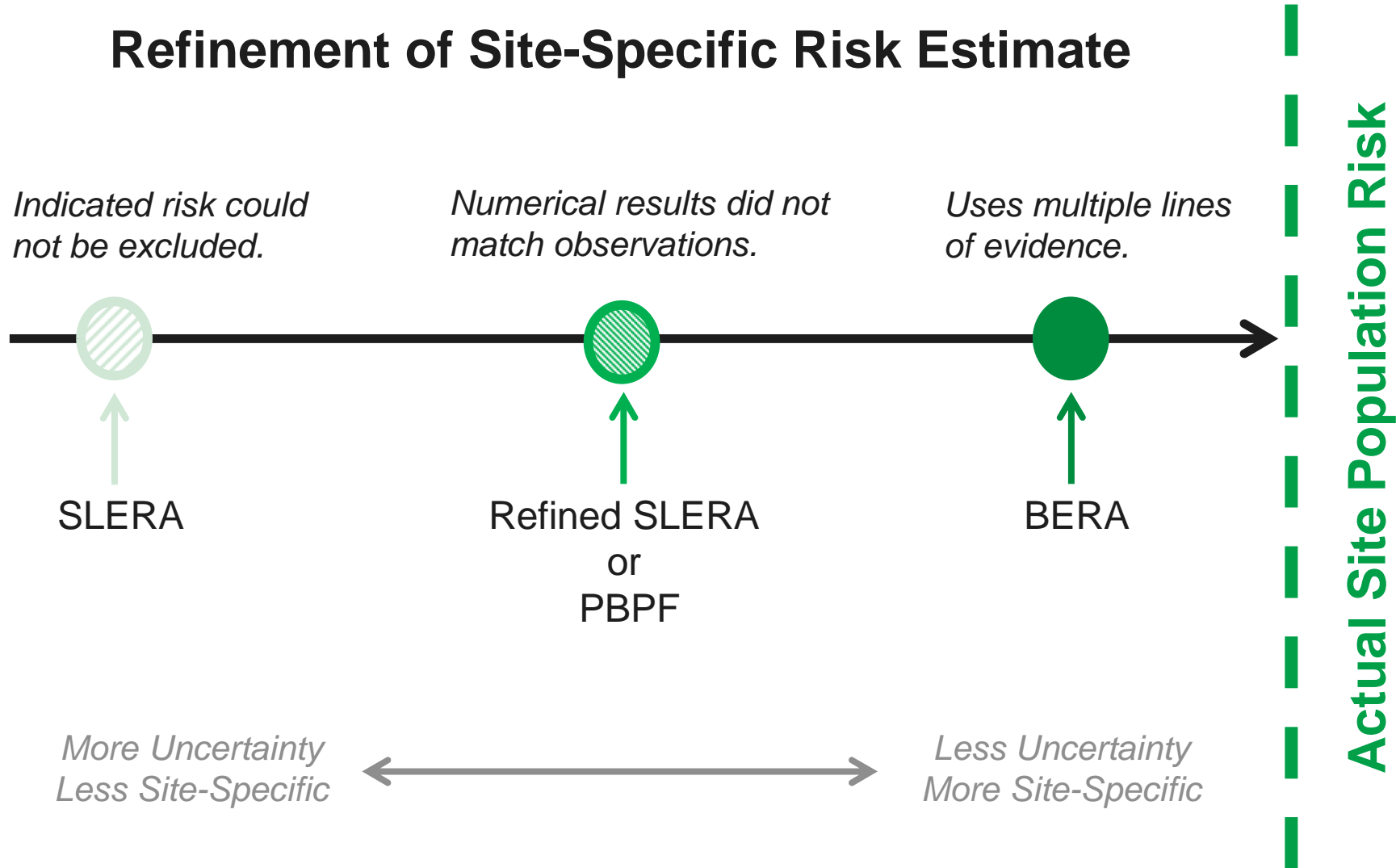


CERCLA Process



Risk Assessment Process for Eco

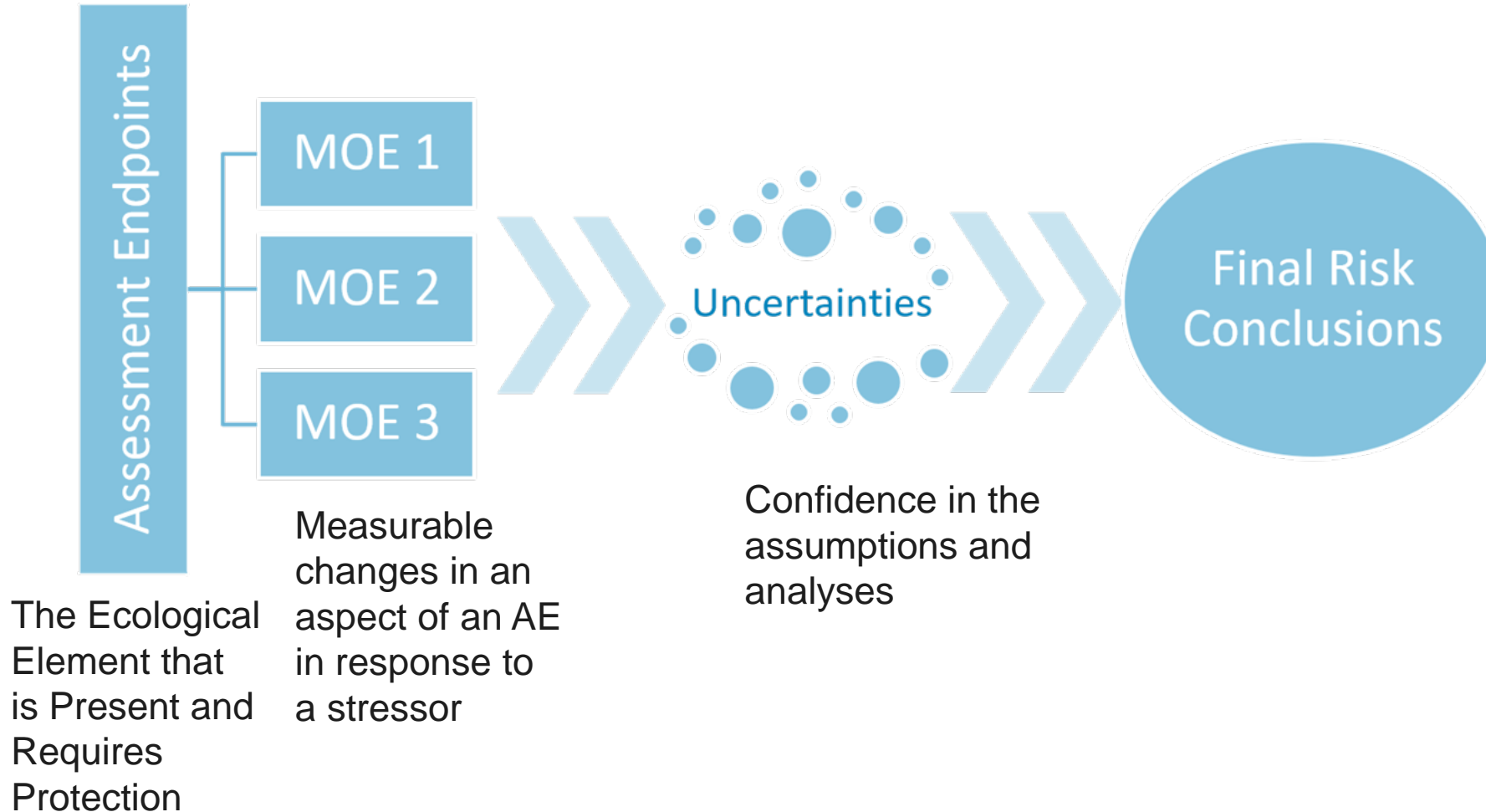
Refinement of Site-Specific Risk Estimate



A Few More Definitions...

Baseline Risk Assessment

Potential Remedy



- If risk indicated, evaluate remedial/reclamation alternatives in FS
- If no risk indicated, evaluate ARARs only – no risk-related remedy required

Magnitude of Remedy

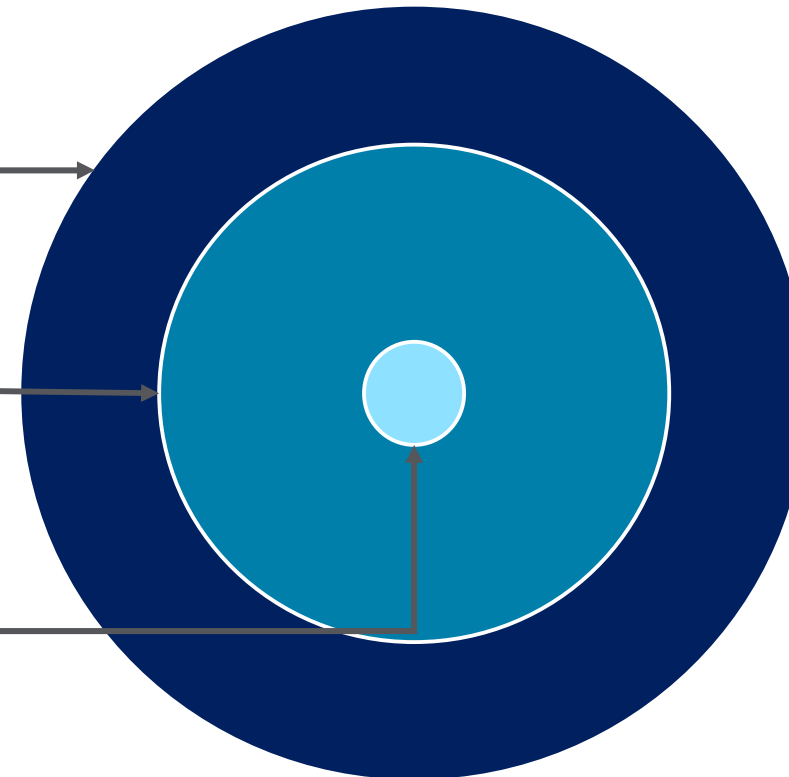
Risk Assessment Type/Level of Refinement

Magnitude of Remedy

Screening Level Risk Assessment Only

Refined Screening Level Risk Assessment

Site-Specific Refined Baseline Risk Assessment



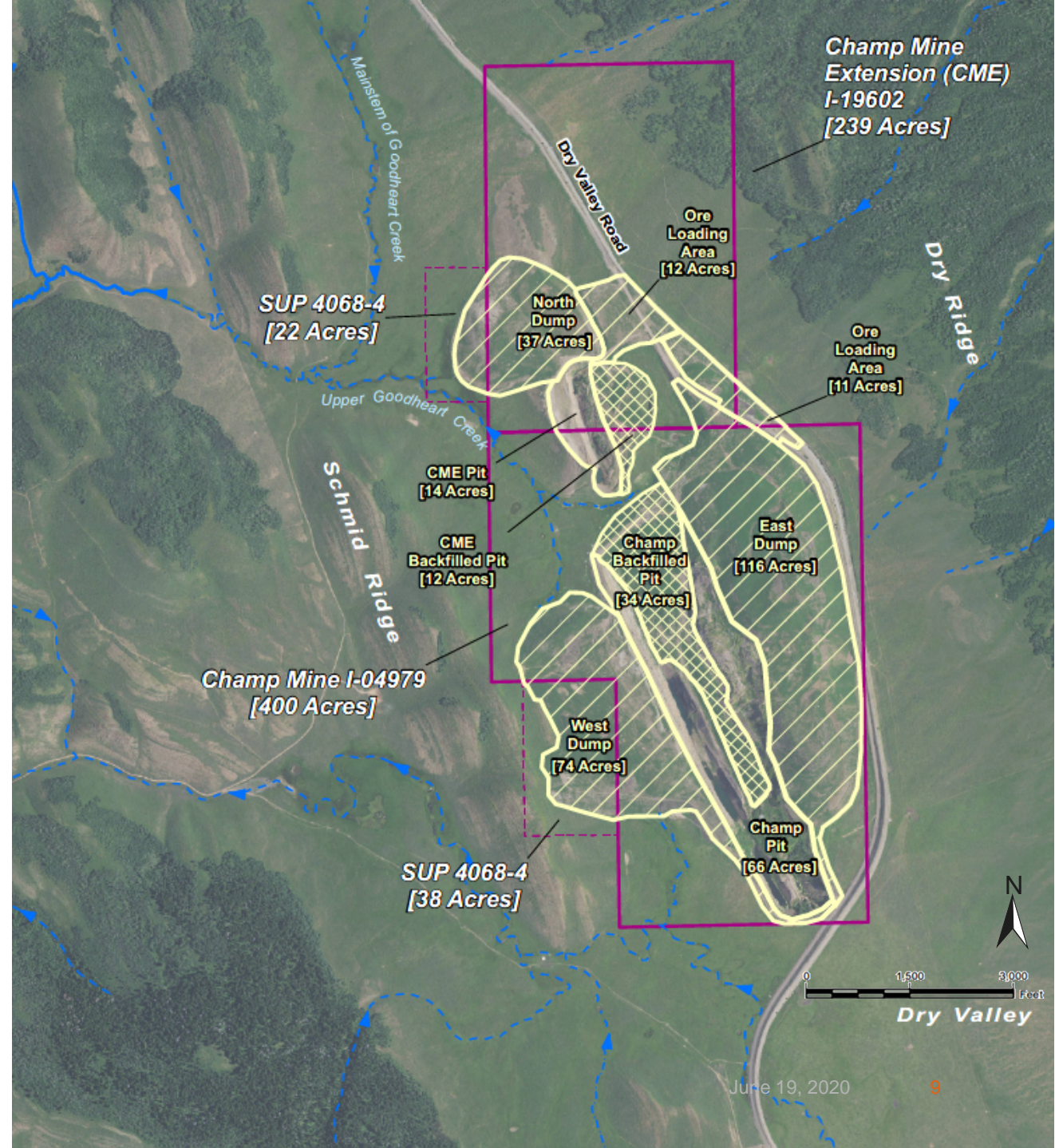
CHAMP MINE



Site Features

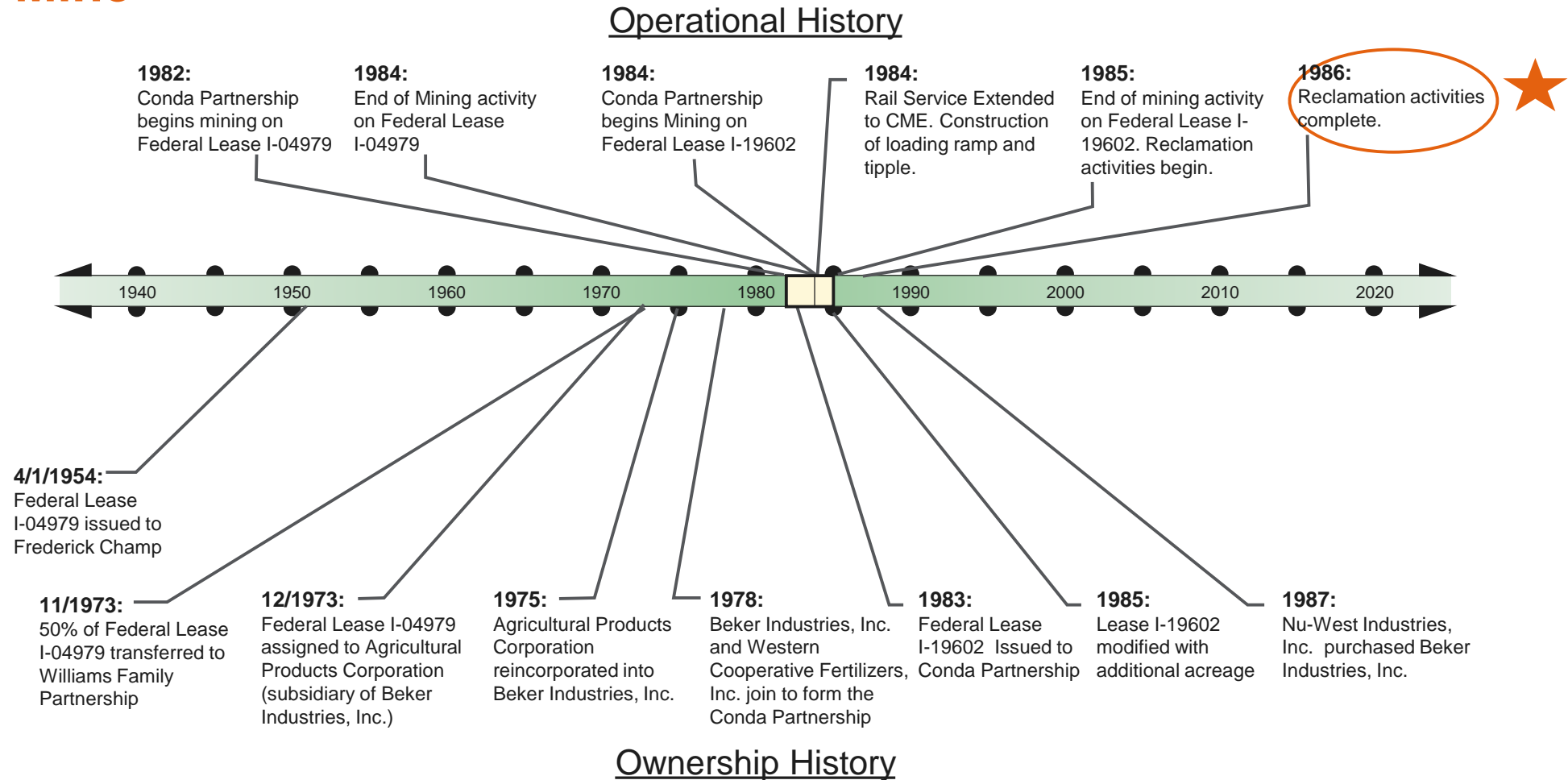
Champ Mine

- Lease Areas (2, ~639 acres)
- SUP (1, ~60 acres)
- Overburden Piles (3)
- Open Pits (2)
- Backfilled Areas (2)
- Pit Lakes (7)
- Surface Water Ponds (12)
- Ore Loading Areas (2)



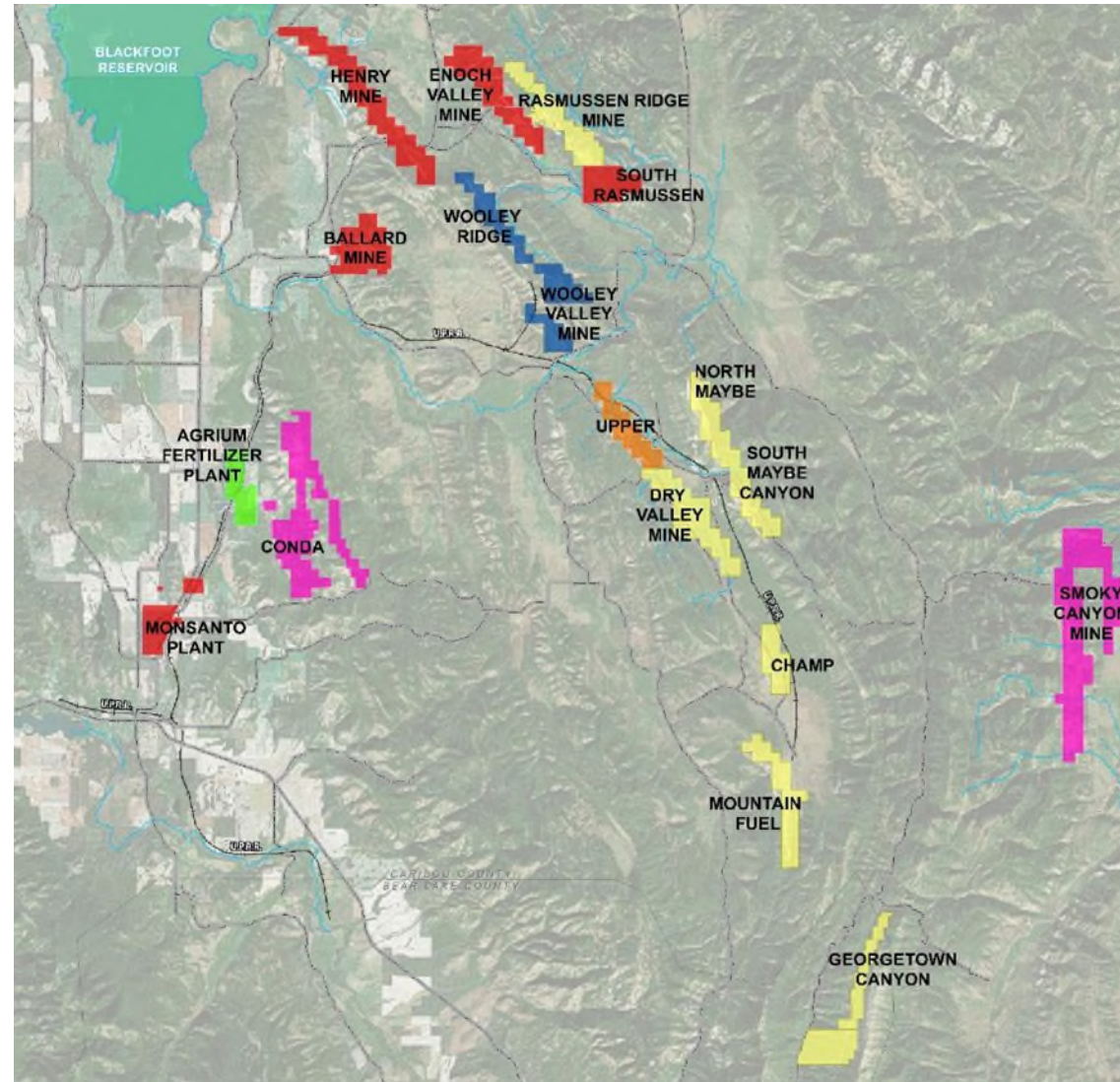
Site Ownership and Operational History

Champ Mine



Nu-West Approach is Distinctive

- Distinctive differences in Nu-West risk assessments
- Multiple measures of effect
- Community surveys
- Habitat characterization
- Refined toxicity reference values
- Updated foodweb modeling



A lot of Supporting Information!!

Patch-Specific Data: Four Studies* from 1999-2001

*Body of evidence supports conclusion:
Refined TRVs are reasonable and conservative under site-specific conditions.*

Data Collected

Hatching Success

Check for deformities:
3,461 egg embryos
from 31 species and
1,155 nestlings

Analyzed for selenium:
1,436 eggs

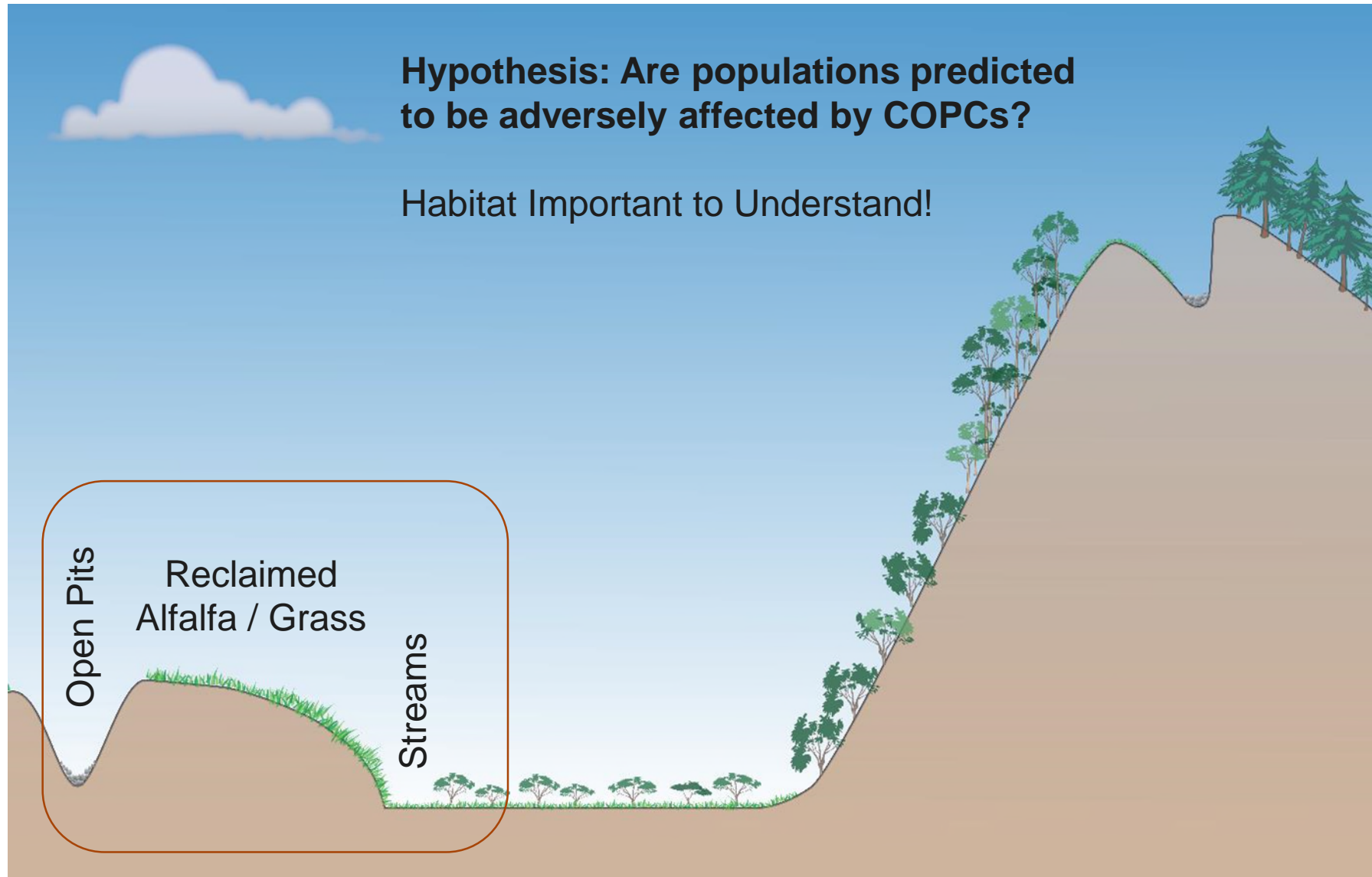
1,507 nests
monitored

No differences
observed for
American robin or red-winged
blackbird eggs

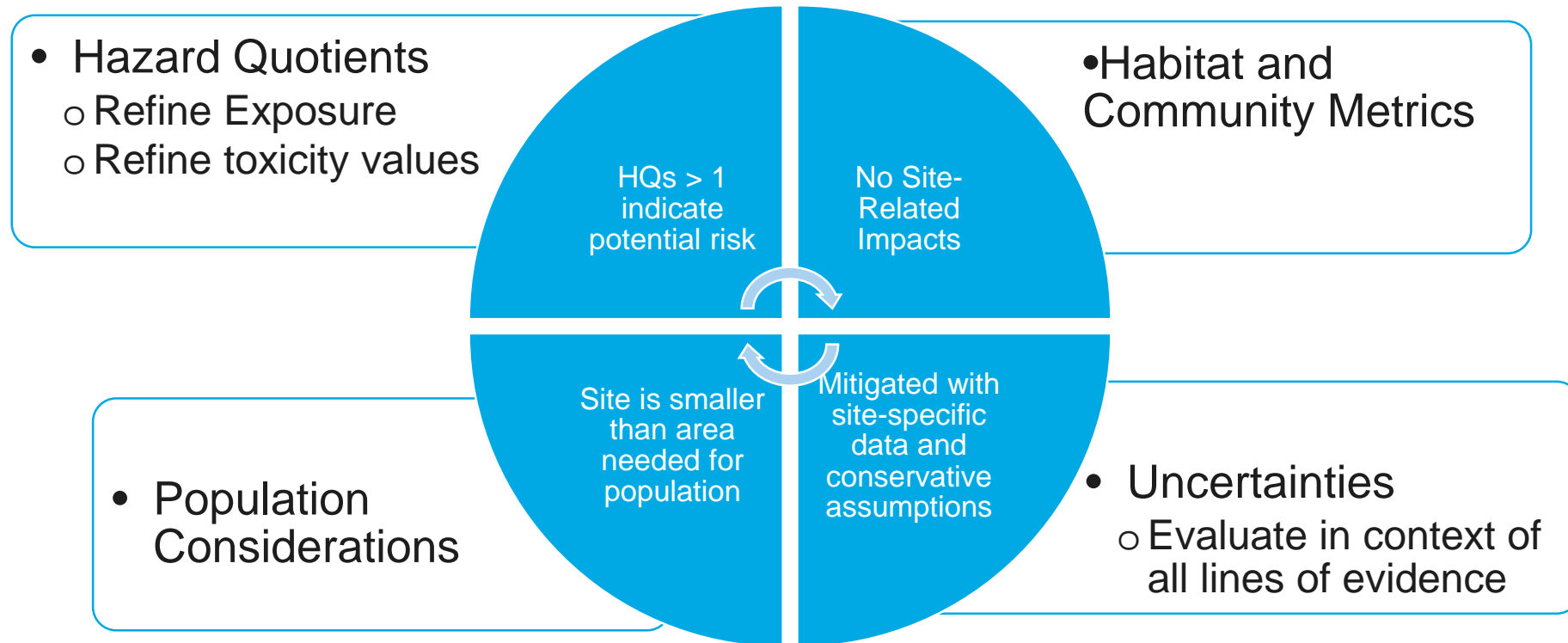
Range not statistically
different than background

* Vasterling 2003; Ratti et al. 2002; Ratti et al. 2006; MWH 2011

Conceptual Site Model



Integrate Multiple Lines of Evidence to Formulate BERA Conclusions



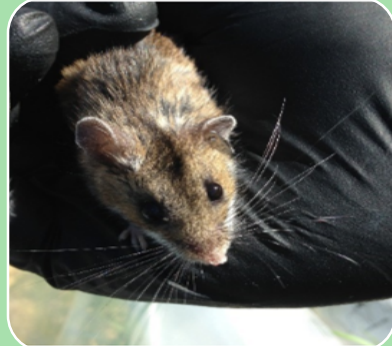
Understand Communities: Field Work



Birds

Surveys:

Avian Point Count
Visual Encounters
Wildlife Habitat



Mammals

Surveys:

Small Mammals
Trapping
Visual Encounters
Wildlife Habitat
Acoustic Bat



Invertebrates

Survey:

Aquatic Community

Tissue Sampling:

Aquatic Inverts
Terrestrial Inverts
Aerial Insects

Assessment:

Aquatic Habitat



Upland and Riparian Vegetation

Survey:

Community

Tissue Sampling:

Vegetation

Assessment:

Biomass

Bird Community Fieldwork

Species observations
and habitat surveys



- ✓ Completed 81 point count surveys
- ✓ Observed 1,600 birds of 59 species
- ✓ Conducted cliff swallow nest surveys



Bird Community Evaluation

Extensive
literature review
conducted

Compared
literature to site
survey metrics

*No significant
difference
between
literature and
site*

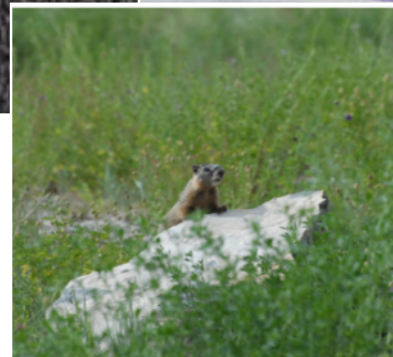
Bird species present at the sites match dominant habitat (grassland species). Bird communities are abundant and thriving.

Small Mammal Community Fieldwork

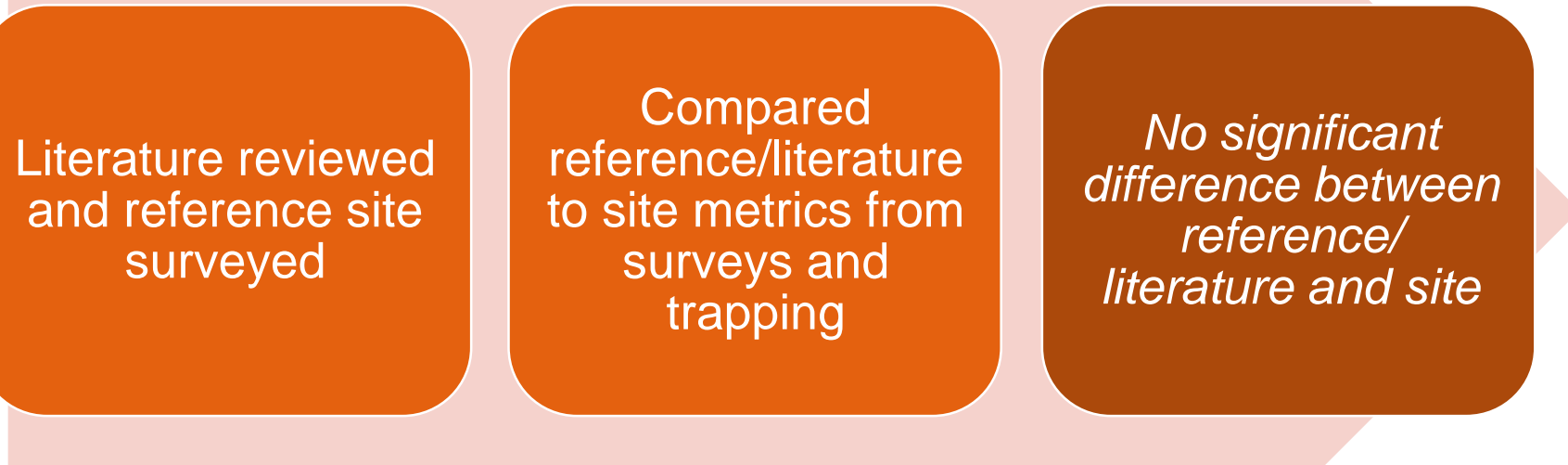
Species observations
and habitat surveys
onsite and at reference
location



- ✓ Completed 3,115 trap-nights
- ✓ Observed 590 unique captures of 6 species
- ✓ Collected metrics on 590 individuals (site and reference)



Small Mammal Community Evaluation



Small mammal species are dependent on localized dominant upland vegetation. Even the mammals with small home ranges are abundant and thriving.

Lower Trophic Community Fieldwork

Species observations,
habitat surveys, and
tissue sampling



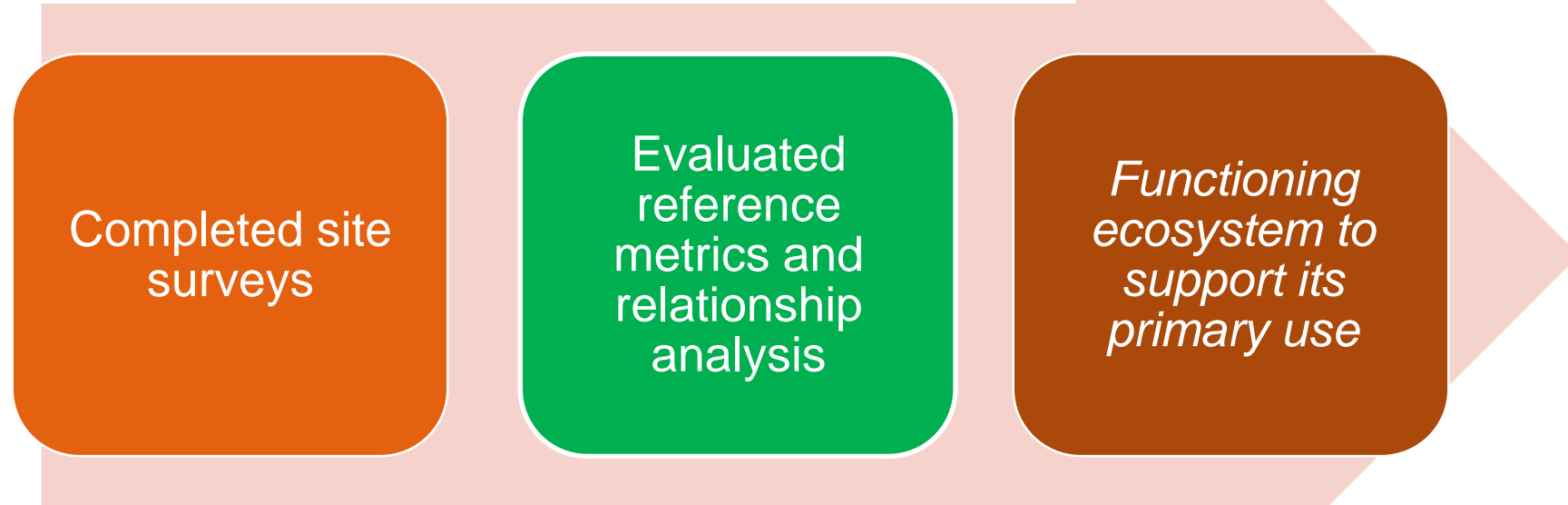
- ✓ Collected aquatic invertebrate community and habitat data
- ✓ Sampled and inventoried vegetation species



- ✓ Documented amphibians and terrestrial invertebrate surveys



Lower Trophic Receptor Community Evaluation



Habitat influences presence of species.

Upper trophic

- Birds

Observed species list, density, and diversity are comparable for evaluated species to expected conditions for similar habitats

- Mammals

Mammal population and community characteristics onsite are as expected based on reference areas and/or literature values from similar habitats

- Apparent differences between observed and expected results are due to habitat quality differences

Lower trophic

- Vegetation and invertebrates are part of functioning ecosystem
- Supports healthy mammal and bird communities via their forage

Populations are not predicted to be adversely affected by COPCs

Hazard Quotients

Hazard Quotient [HQ]

Comparison of exposure estimates to toxicity values in literature

Upper trophic:

$$\text{EPC} \times \text{Diet} \div \text{TRV}$$



Lower trophic:

$$\text{EPC} \div \text{ESV}$$



Site-Specific Dose Inputs

- Exposure point concentrations
- Small mammal bioaccumulation factor
- Body weight
- Food ingestion rate
- Diet composition
- Incidental soil ingestion

Toxicity Reference Values and Ecological Screening Values

- TRVs: Selenium is primary driver
 - Refined avian Se TRV using phosphate patch specific field studies and literature studies
 - Refined Mammal Se TRV using large selenium multi-year field study from CA
 - Used more sophisticated and accurate dose-response approach rather than bright lines
 - **Invested heavily in agency education and buy in on these values**

Population Considerations – 2 Tools

Minimum Viable Population

- MVP is the number of birds that are needed for a self-sustaining population
- Evaluated site area with bird home ranges
- MVP area is much larger than site area, especially when habitat quality is incorporated
- Demonstrated populations would not be adversely affected

Population Modeling

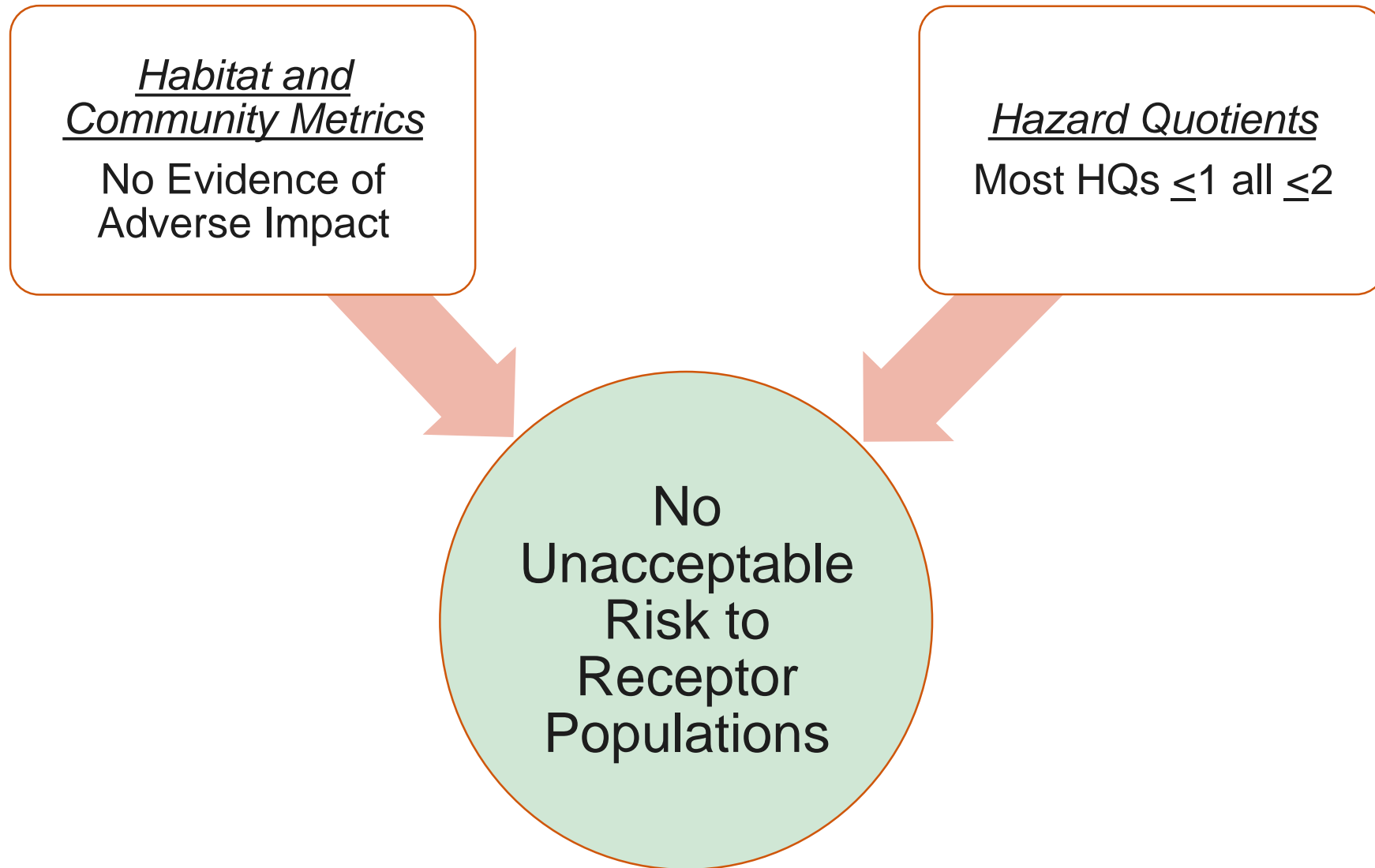
- Developed a population model for amphibians (Tiger Salamander)
- Incorporated larval and juvenile stages
- Incorporated salamander-specific physiology and breeding behavior
- Found possible individual effects, but no adverse effects on site metapopulation

CERCLA specifies protection of ecological receptors at the Population Level

Summary of Results

Receptor Group	Summary of Risk Assessment Conclusions
Upper Trophic	<p>Birds <u>Community Health:</u> No adverse impacts (compared to expected) <u>Risk Calcs:</u> All LOAEL HQs ≤ 1 (except Se tree swallow = 2)</p>
	<p>Mammals <u>Community Health:</u> No adverse impacts (compared to reference) <u>Risk Calcs:</u> All LOAEL HQs ≤ 1</p>
	<p>Amphibians <u>Community Health:</u> <i>Dead salamanders observed on site</i> <u>Population Modeling:</u> No selenium related impact to site population</p>
Lower Trophic	<p>Forage for birds and mammals is the primary consideration <u>Community Health:</u> No adverse impacts on aquatic inverts and vegetation communities <u>Benchmark Ratios:</u> COPCs exceed benchmarks in localized areas for sediment for aquatic inverts and amphibians, terrestrial inverts and vegetation do not show impacts</p>

Risk Evaluation



Punch Line!

- **Acres not carried into FS**
- **Ultimately saved potential cost of remedy**
- **Savings of up to \$100M**
- **Also, net environmental benefit – remedy would have completely disrupted existing habitats and species**
- **Ability to leverage to other sites, including Georgetown**
- **Ability to support technical understanding of selenium in the environment**



A Huge Thank You...

- ***Jon Bronson & Nu-West***
- ***Jenny Phillips, TRC***
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- ***Alissa Weaver***
- ***Sara Boone***
- ***Amber Stojak***
- ***And a few others too!***

Questions?