

Protecting the Past Using Tools of the Future: Archaeology Predictive Modeling

A Presentation by:

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Beckett Point Example

A 10 • Wednesday, June 13, 2007

PUD: Septic project halted; ideas needed

Continued from Page 1

"I don't see how it can go forward," Parker said of a project that was...

the Monday session. King also said he appreciated the Monday meeting...

County Commissioner David Sullivan, a former PUD commissioner, suggested the county...

expected to finish a preliminary report this week on whether more remains could be found if digging continues. He declined comment...

Archaeology and Historic Preservation has advised the PUD that disturbing any Native American graves without a permit would be a felony.

ing together," Fischbach said. Commissioner Sullivan suggested that perhaps state officials could consider a solution to the Beckett Point problem that then could serve as a pilot project so that, should Native American remains be found in other areas...

5521 PUD stuck

Sensitive to tribal remains, financial reality

By Allison Arthur
Leader Staff Writer

Before gathering tomorrow to celebrate the renovation of the Jefferson Courthouse Clock Tower, state, county and tribal officials will take time to try to resolve how to respectfully treat human remains found at Beckett Point while moving forward with a sewer system to stop pollution in Discovery Bay.

The meeting is at 3 p.m. Thursday in the commissioners' chambers, an hour before the clock tower celebration.

The afternoon of recognizing history and working toward the future was suggested Monday by Je-Anne Rogers, a legis-

"We need a grant, and we need it now."

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natives range to work on the project and give level, to someg the project the site where d. More ideas ht.

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Beckett Point property in which human remains thought to be Native American were unearthed is cordoned off Wednesday. EVAN CAEL/PENINSULA DAILY NEWS

Human bones found at site

Archaeological discovery halts septic project

By EVAN CAEL
PENINSULA DAILY NEWS

DISCOVERY BAY — The discovery of buried bones and bone fragments — which were determined Wednesday to be an archaeological find — has halted construction part of a

Sheriff's Office detectives investigated the site on Tuesday and cordoned it off with yellow crime-scene tape. The department also issued an order that work be discontinued until an archaeologist could examine the site.

"We've shut down the project out at Beckett Point," Jefferson County Sheriff's Detective Joe Nole said Wednesday. The delay worries

Tacoma Convention Center



Impacts to Cultural Resources



Impacts to Cultural Resources



- Oil Spills
- Natural Disasters
- Wildfires

Regulatory Environment

- **Federal**
 - > Indian Graves and Records
 - > Archaeological Sites & Records
 - > Section 106 (Federal Nexus – Stimulus Money)

- **Washington State**
 - > State Environmental Policy Act SEPA
 - > Shorelines Management Act
 - > Forest Practices Act
 - > Growth Management Act
 - > Executive Order 0505

Washington State Laws

- Protects Native American graves on ALL non-federal lands: state/county/city/private lands
- Provides for penalties for knowing disturbance: Class C felony-
 - > Up to five years in prison &/or \$10,000 fine
 - > Provides for civil action by tribe for violations to include damage/ emotional distress

Managing These Risks

Issues

- Non-renewable resources
- Need to plan for projects costs
- Reduce in-the-field surprises
- Need to make technically sound, defensible decisions
- Emergency Management

Solution

- Predictive Modeling

Benefits

- Build more accurate budgets
- Reviews completed from Desktop
- Complete Section 106 requirements

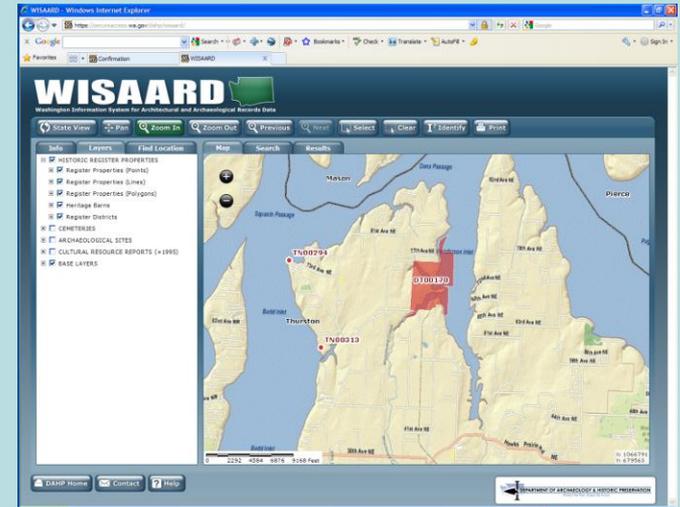
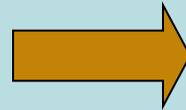


Preparing for Predictive Modeling



DAHP Records Room

> Manage over half-a-million paper documents and correspondence stored in multiple databases



Virtual Records Room

> Quickly and Efficiently Retrieve and Update Information

> Make technical, legally sound decisions

Archaeology Data

WISAARD
Washington Information System for Architectural and Archaeological Records Data

Map Search Results

- HISTORIC REGISTER PROPERTIES
- CEMETERIES
- ARCHAEOLOGICAL SITES
 - Archaeology Sites (Points)
 - Archaeology Sites (Lines)
 - Archaeology Sites (Polygons)
 - Archaeology Districts
- Site Buffers
- CULTURAL RESOURCE REPORTS (+1995)
- BASE LAYERS
 - Roads
 - Railroads
 - City Boundaries
 - Township Range & Sections
 - Quad Boundaries
 - Water
 - County Boundaries
 - Federal Boundaries
 - State Parks
 - GLO Survey Plat Map Layer
 - Statewide Predictive Model
 - Imagery
 - Street Maps
 - USGS Quads

DAHP Home Contact Help



1 Map reference: GEN HWY TRANS WASH NAVA CITY #3

2 Type of site: 3 WINE TUNNELS (Reported to be on line)

3 Cultural affiliation on: _____

4 Location: South side Tunnel Road at west end of Washington, west 8 rods from N of Hwy 904 across RR tracks. SE 1/4 Sec 11 T. 9 N. R. 3 E

5 Owner and address: _____

6 Previous owners: _____

7 Tests: _____

8 Invariants: Abundant at Plaster for Beton, Waterbury

9 Previous designations for site: _____

10 Site description: Segment about 3' deep, 1' wide, all 3 about 4' high

11 Position of site and surroundings: In lower dip about 100' from about 100' from station. Soil is loose sandy, heavy rocks

12 Area of occupation: _____



WISAARD
Washington Information System for Architectural and Archaeological Records Data

Map Search Results

(2 records found)

Smithsonian Number	Field Temporary Number	Comments	Date Recorded	Listing Status
P100221	Not Provided	WVCA	01/01/73	Inventory
P100229	Not Provided	SHELL FRAGMENT, CHARCOAL, LENSES, BIVALVE FLINTS, TOOLS, BONE, HEARTH	05/26/1981	Inventory

DAHP Home Contact Help

Extend Protection of Resources Through Analysis

■ Issues

- Archaeology Resources Need to be Considered Everywhere
- Impossible (too expensive) to survey everything

■ Solution

- Predictive Modeling

■ Benefits

- Planning: Protect Resources by avoiding in the first place/ reduced need for mitigation
- Prioritize Surveying and Money
- Protect Additional Resources



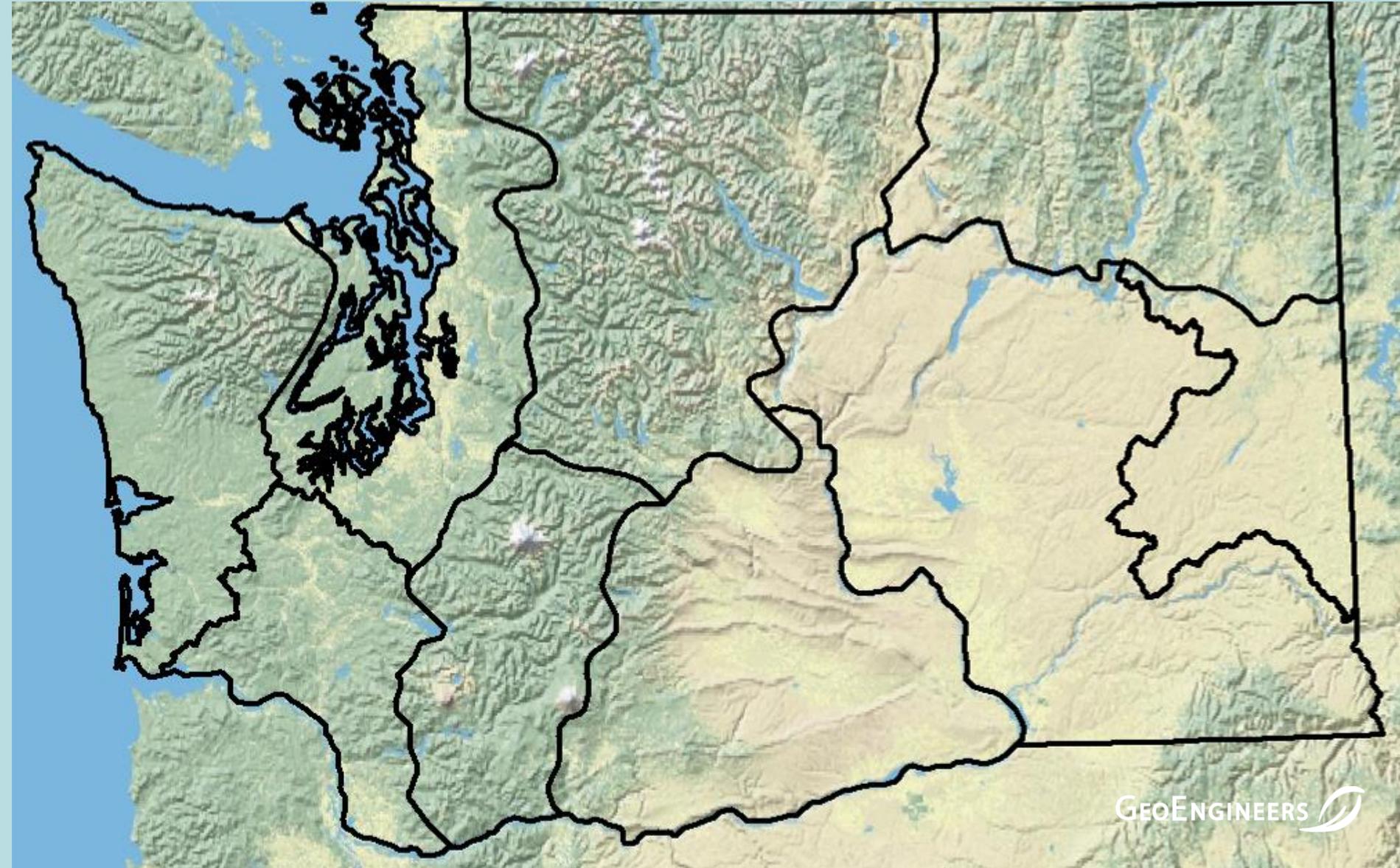
What is a Predictive Model?

- A predictive model correlates the locations of known archaeological sites, and “negative” locations of sites, with environmental characteristics.
- For this model we used environmental data, GIS and probability (Bayesian) statistics to determine the probability of finding a site within a 100 x 100 foot cell.

Benefits of Modeling

- Apply advanced planning in a regulatory setting
- Quicker access to additional archaeology information/ research for projects
- Consistent framework/approach using statistical methods
- Guides archaeological surveys and directs testing programs

Statewide Study Areas



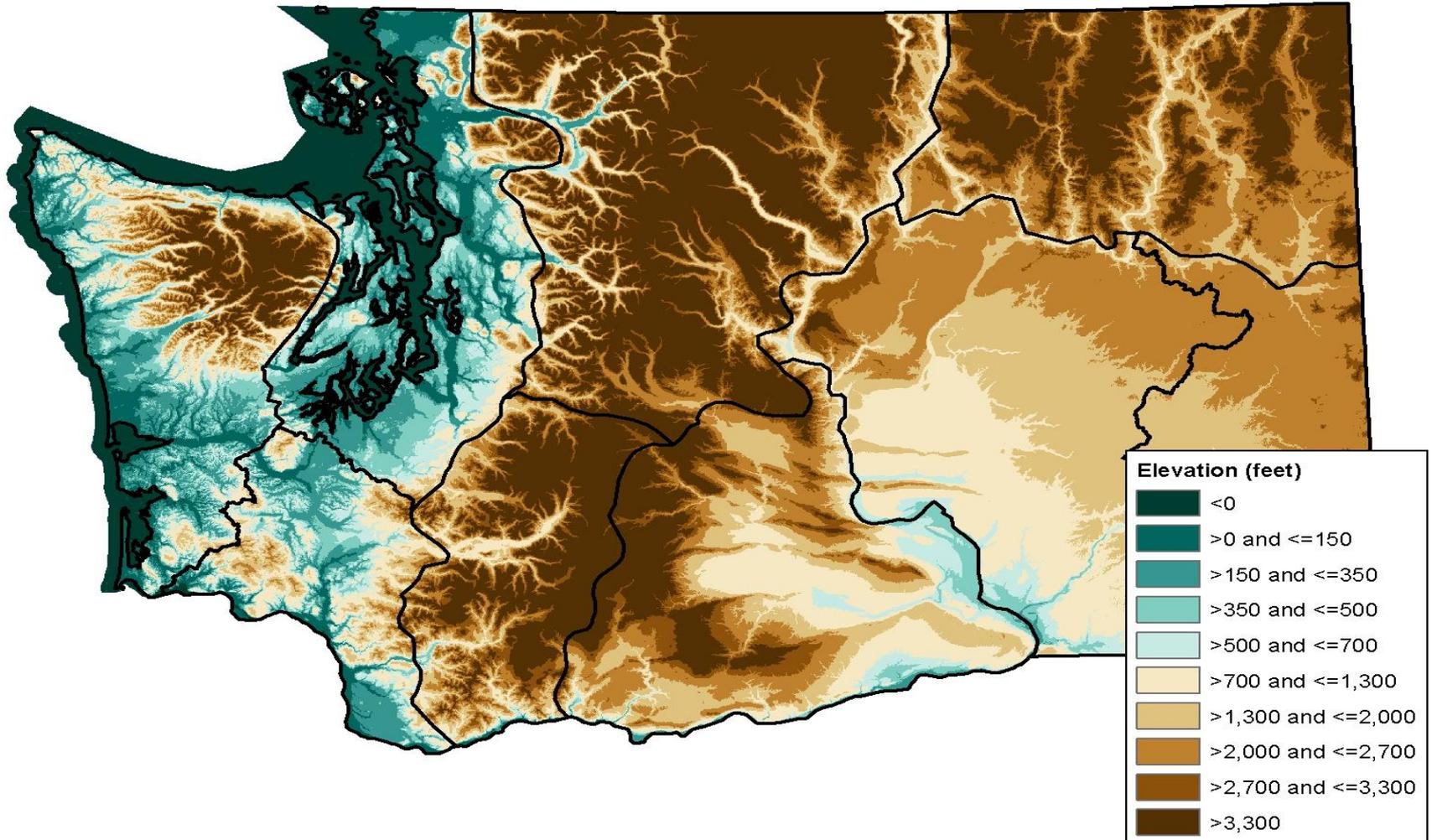
Key Criteria for Selecting Data

- Available in GIS format or available for conversion to GIS format
- Easily obtainable from public sources
- Available for the entire state
- Available at a reasonable scale or resolution for the model
- Identified by archaeologists as relevant

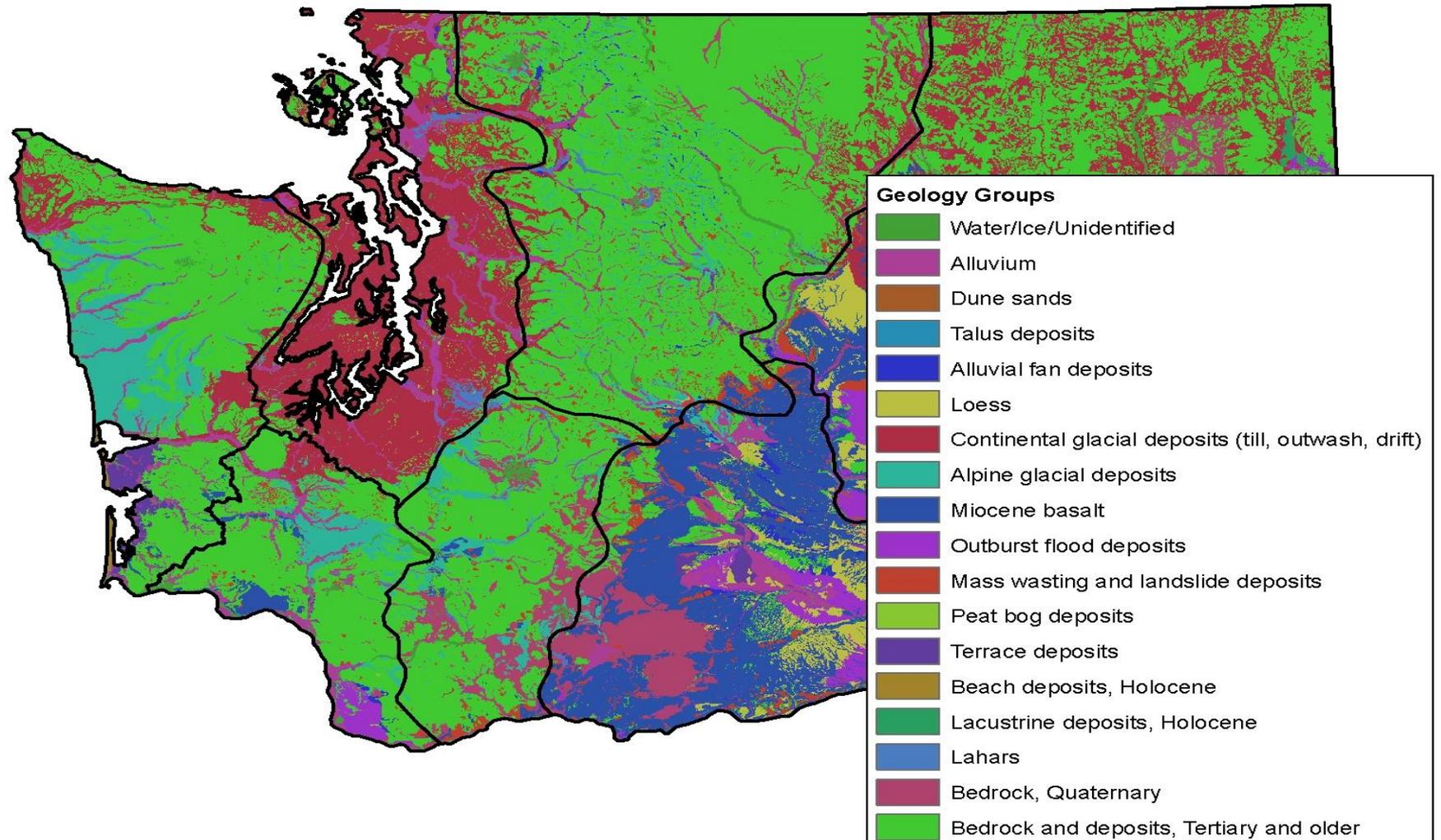
Environmental Data Used for Modeling

- Value Data
 - Elevation
 - Slope Percent
 - Aspect
 - Distance to Water
- Categorical Data
 - Soils
 - Geology
 - Landforms

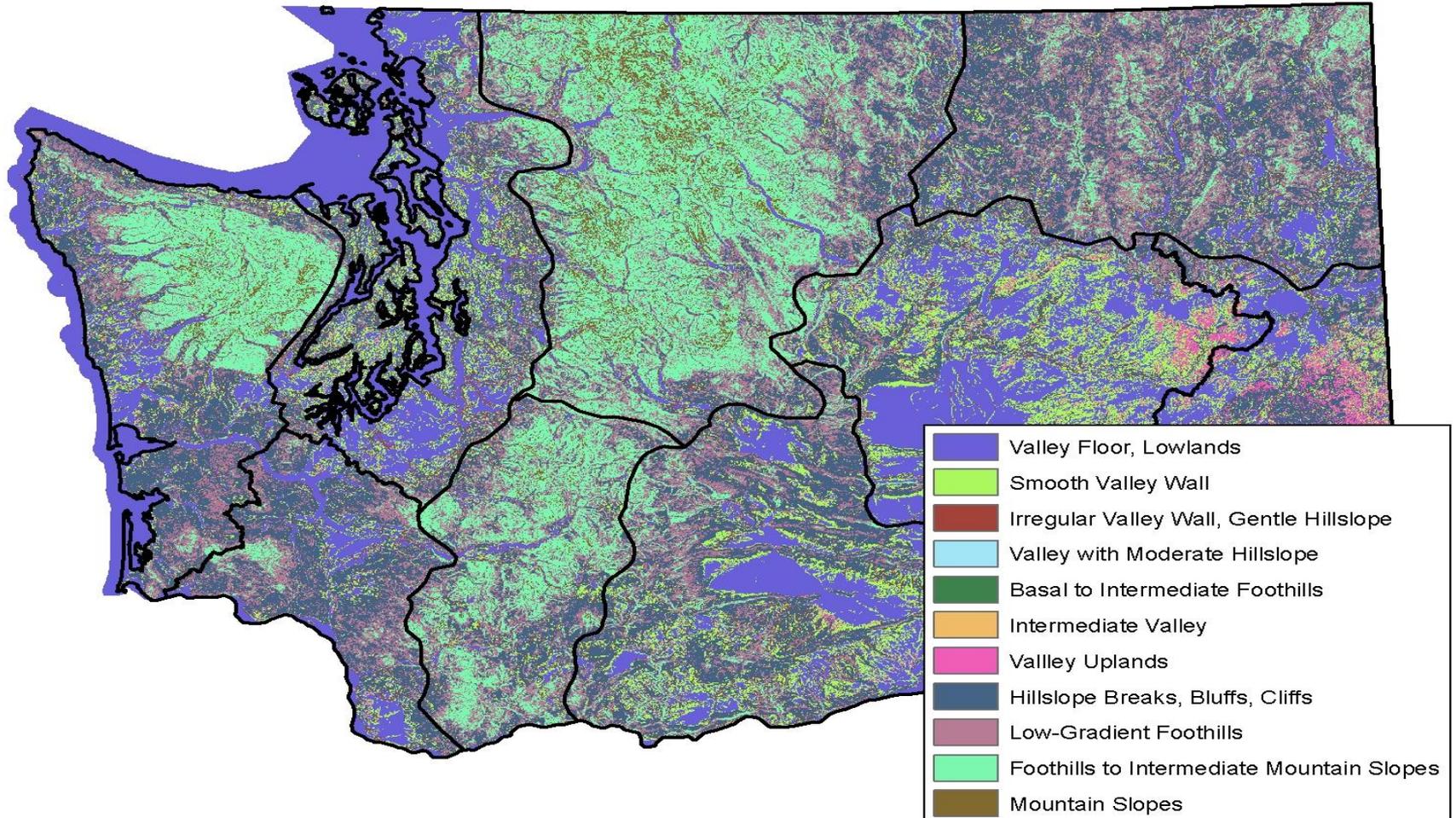
Elevation



Geology



Landforms



Summarize Groups to the Cell Level

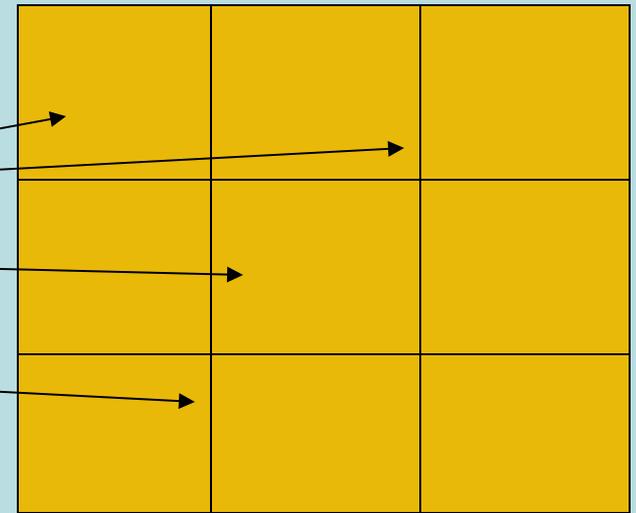
- Geology

- Alluvial Fans (Group 1)

- Basalt (Group 2)

- Rock Outcrops (Group 3)

- Etc.



- Each cell is assigned a group for each environmental data set

Assign Groups to Each Cell

Geology Group 1 Aspect Group 5 Soil Group 8 Slope Group 3	Geology Group 3 Aspect Group 2 Soil Group 5 Slope Group 7	

Calculate Probabilities

- Calculate Probabilities for each data group
 - Probability that it occurs throughout the Study Area
 - Probability that an archaeological site occurs within that data group
- The probability of randomly finding an archaeological site

Assign Probabilities to Cells Based on Group

Geology Group 6

Study Area Probability (0.775000)

Archaeology Probability (0.806382)

Slope Group 2

Study Area Probability (0.360714)

Archaeology Probability (0.249387)

Elevation Group 4

Study Area Probability (0.330935)

Archaeology Probability (0.423274)

Etc....

Bayesian Probability Calculations

$$P(A/V_i) = \frac{P(V_i/A) P(A)}{P(V_i)}$$

$$= \frac{P[(E_1/A)(E_2/A)(E_3/A)(E_4/A)(E_5/A)] * P(A)}{P[E_1 * E_2 * E_3 * E_4 * E_5]}$$

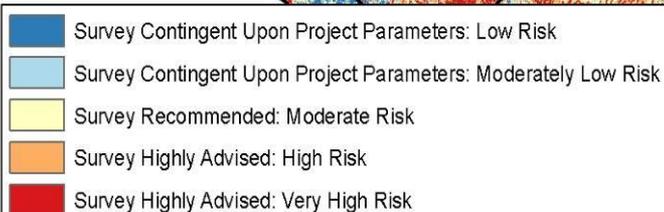
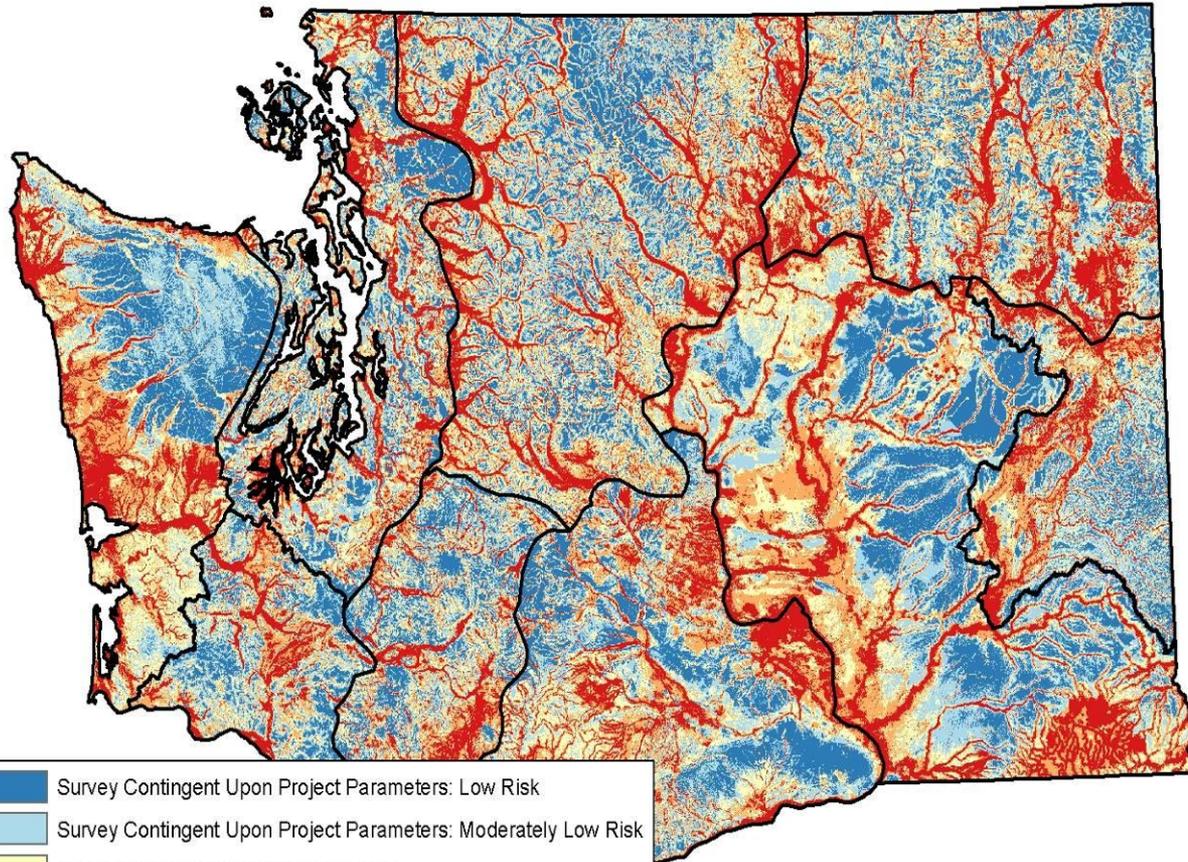
Example Conditions: Geol 6, Slope 2, Elev 4, Aspect 5, DTW 1

$$= \frac{(.775000)(.360714)(.330935)(.248200)(.453571)(.000445)}{(.806382)(.249387)(.423274)(.263093)(.091690)}$$

$$= 0.00225$$

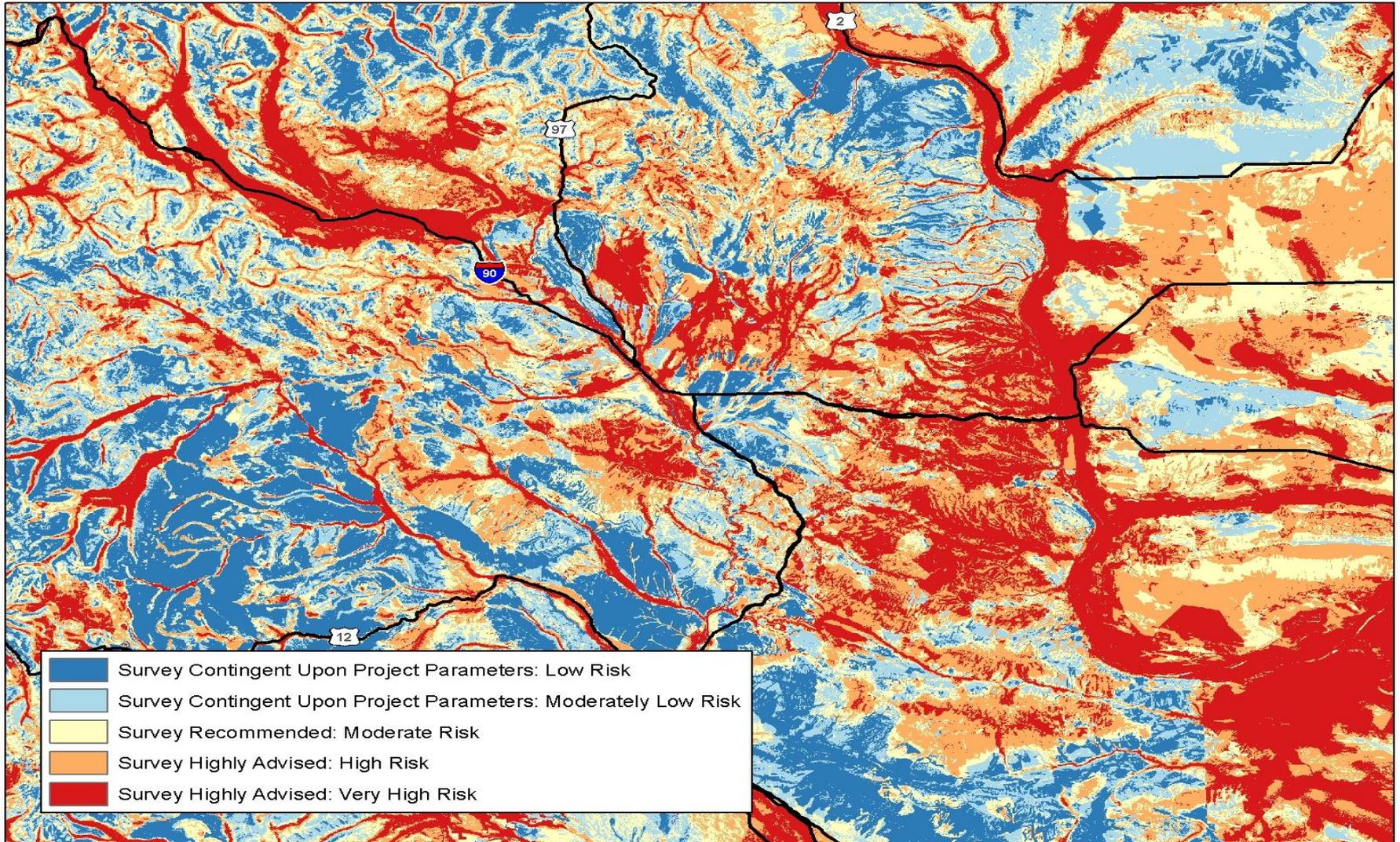
- Bayesian Probabilities Calculations do not require specialized statistical software – thereby making updating easier

Bayesian Scores

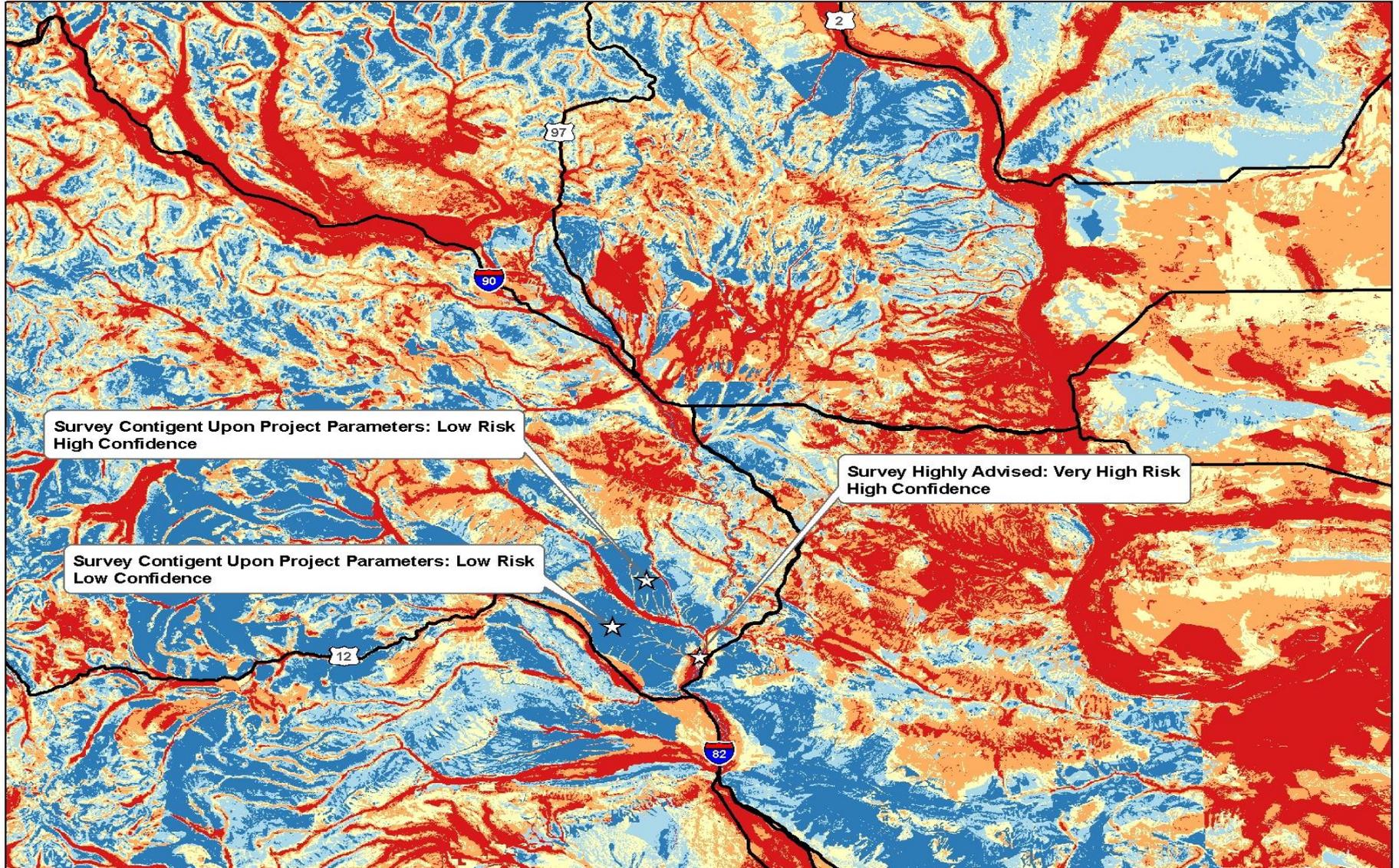


- Important to note that Low or Very Low still have potential to have sites, simply a lower potential.

Evaluate Projects



Adding Confidence to Predictions



Conclusions

- Plan ahead, undiscovered sites are out there
- Does NOT replace ground surveys, but does help prioritize surveys and density of surveys
- Augments archaeologist's knowledge of area prior to surveys being conducted

Collaboration

- Washington Department of Archaeology and Historic Preservation
- Washington Public Works Board
- Washington Department of Transportation
- Washington Department of Natural Resources
- Yakama Nation
- Suquamish Tribe

THANKS!!

Questions / Comments?

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