



ICSE-6 2012

PARIS Aug. 27-31, 2012

6th International Conference on Scour and Erosion

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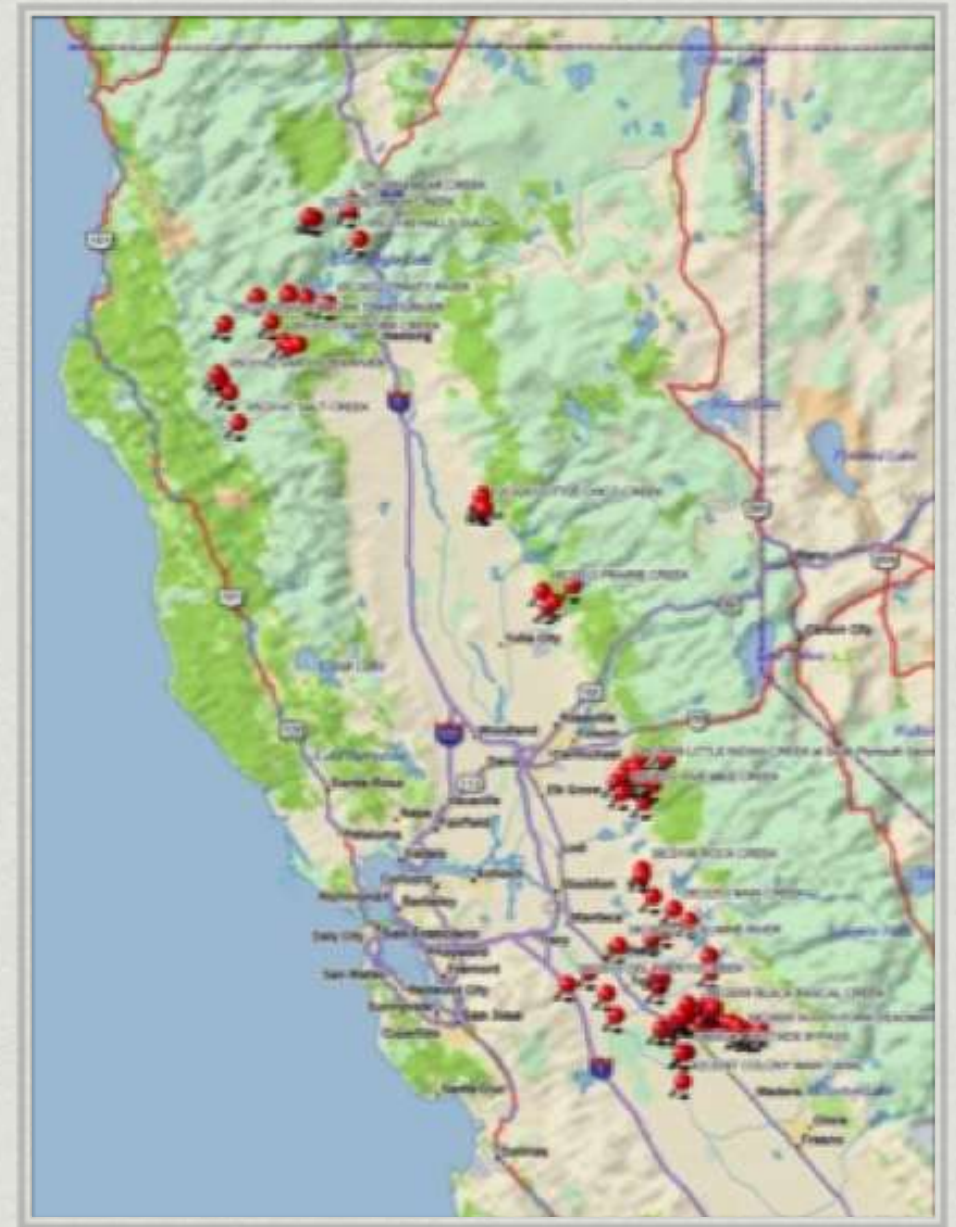
## Scour at Unknown Foundations

or What I Did on My Summer Vacation



# Scour Plans of Action (POAs)

- ✱ California (Caltrans) mandated that all Local Agencies (Cities and Counties) complete the POAs for “unknown foundations” by November 1, 2010.
- ✱ During the summer of 2010, we completed almost 100 POAs for bridges all over California



# Unknown Foundations

- \* A bridge has “unknown foundations” if there is insufficient information to complete a scour evaluation. For example, missing information might include:
  - \* A Lack of As-Built Drawings
  - \* Unknown Pile Length or Type
  - \* Unknown Scourability of the Foundation Material



# What is in the POA

- ✱ Background Information
- ✱ Structural, Hydraulic, Geotechnical Assessments
- ✱ Countermeasure Recommendations
- ✱ Monitoring Plans
- ✱ Bridge Closure Plan with Detour Routes

|  |                          |   |   |                             |
|--|--------------------------|---|---|-----------------------------|
| <b>Br. No.</b><br>39 0071                                      | <b>Owner</b><br>Caltrans | <b>Location</b><br>10-MER-059-<br>27.15 | <b>Facility Carried</b><br>STATE ROUTE 59 | <b>Name</b><br>MERCED RIVER |
| <b>Plan of Action</b><br>Completed By: Dordaneh Eslamian, SM&I |                          |   | <b>Date of</b><br>Completion: 9/16/05     |                             |

|   |  |
|---|--|
| <b>1. SCOUR VULNERABILITY RATING</b>  |  |
| <b>Scour Evaluation Summary:</b><br>The combination of calculated local scour and predicted future degradation will undermine the spreadfootings at multiple piers; thus, this bridge is coded as scour critical. The aggregate mining plant in operation just downstream from the bridge causes the channel to continue degrading. The channel improvements done by the Department of Water Resources have helped channel stability somewhat over the last two years. However, the channel instability caused by mining operations necessitates keeping the bridge coded as scour critical until the scour mitigation recommendations in STRAIN are completed. |  |
| <b>Scour History:</b><br>There has been a history of local scour and degradation at the bridge site. The streambed has dropped approximately 3.7 meters in elevation since 1953. Local pier scour has occurred at Piers 2,3 and 4. The aggregate mining downstream of the bridge likely contributes to degradation and channel migration at the bridge site. Long term degradation will likely continue as long as the aggregate mining plant continues to operate.   |  |
| a. <b>Foundation Type</b> <input checked="" type="checkbox"/> Spread footing <input type="checkbox"/> Pile Extension <input type="checkbox"/> Footing on Piles <input type="checkbox"/> Unknown   |  |
| b. <b>Foundation Material</b> <input checked="" type="checkbox"/> Known Gravel, cobbles <input type="checkbox"/> Unknown  |  |
| Scour Review:   | Done By: Cathy Avila      Date: 10/15/96   |
| Structural Assessment:  | Done By: Richard Le      Date: 1/23/97<br>Critical Elevation: Channel elevation of 172 feet or 1 foot above the spreadfooting. |
| Geotechnical Assessment:  | Done By: None performed      Date:   |
| Critical Elevation:   |  |

|                                   |                              |                    |
|-----------------------------------|------------------------------|--------------------|
| <b>2. NBIS CODING INFORMATION</b> |                              |                    |
|                                   |                              | <u>Most Recent</u> |
| Inspection date                   |                              | 7/12/05            |
| Item 113                          | Scour                        | 3                  |
| Item 60                           | Substructure                 | 7                  |
| Item 61                           | Channel & Channel Protection | 7                  |
| Item 71                           | Waterway Adequacy            | 7                  |



# The Multi-disciplinary Team

Structural Engineer  
Hydraulics  
Engineer  
Geotechnical  
Engineer

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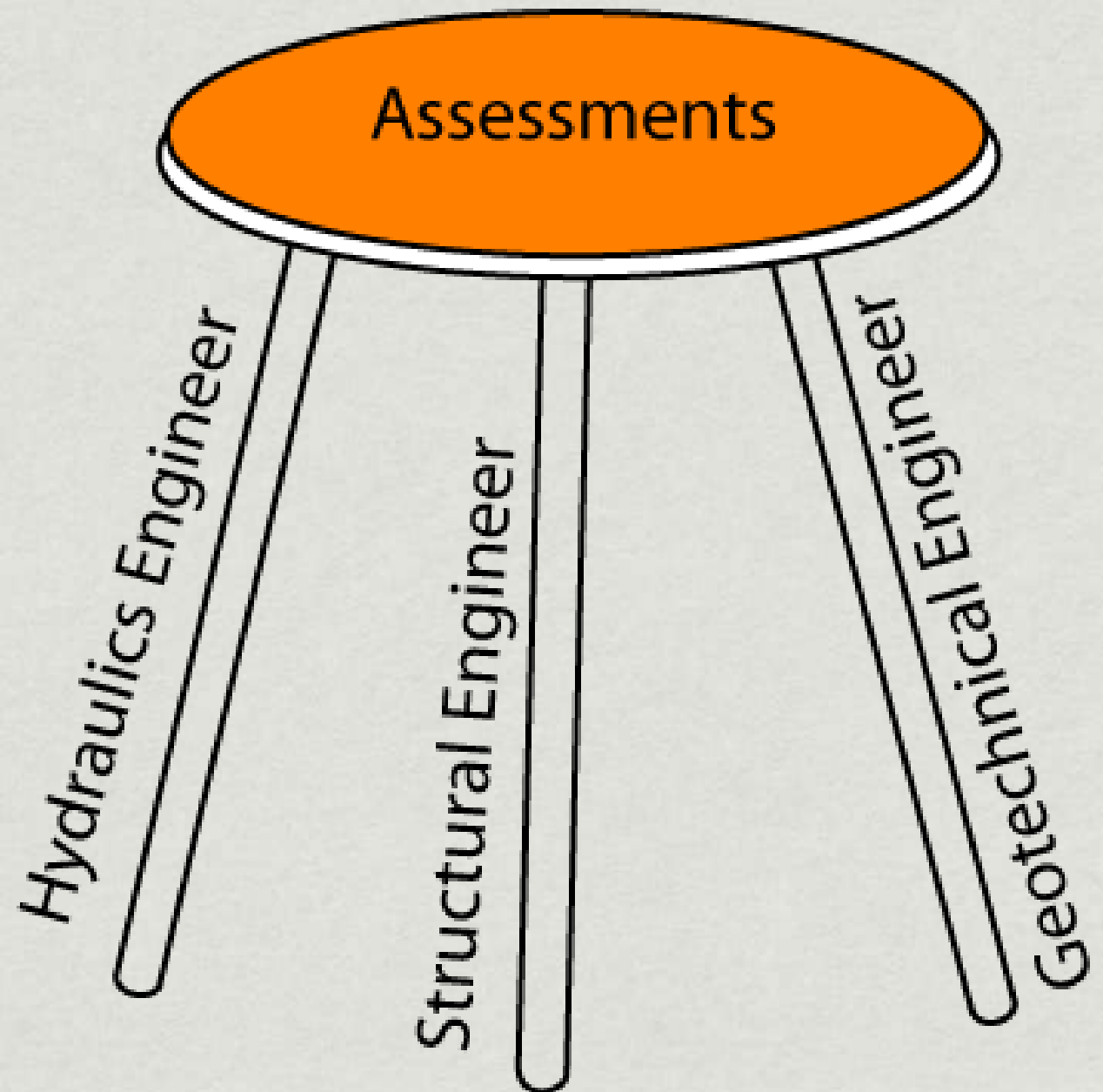


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# Three-leggedged Stool

- \* Structural Engineer
- \* Hydraulics Engineer
- \* Geotechnical Engineer
- \* Senior Level Field Assessments
- \* Local Agency Interaction
- \* Immediate Assessments



# Structural: Failure Mechanism

- ✱ What is the Structure Type?

- ✱ Monolithic
- ✱ Robust System
- ✱ Redundant Systems

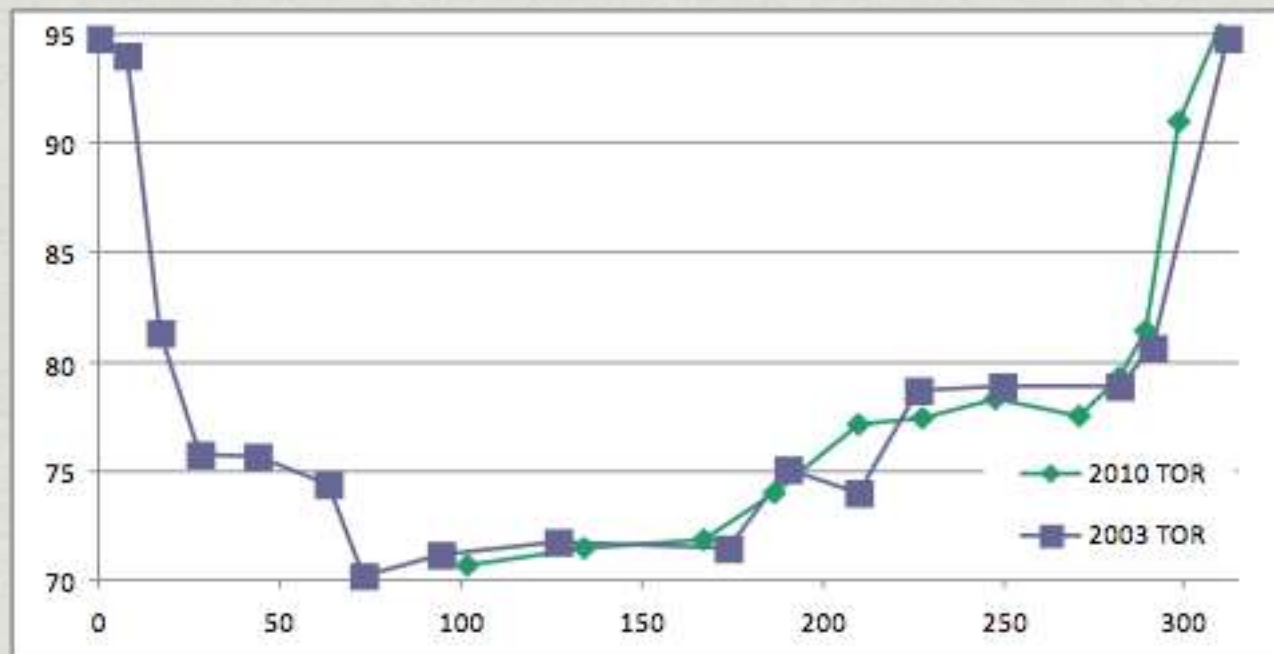
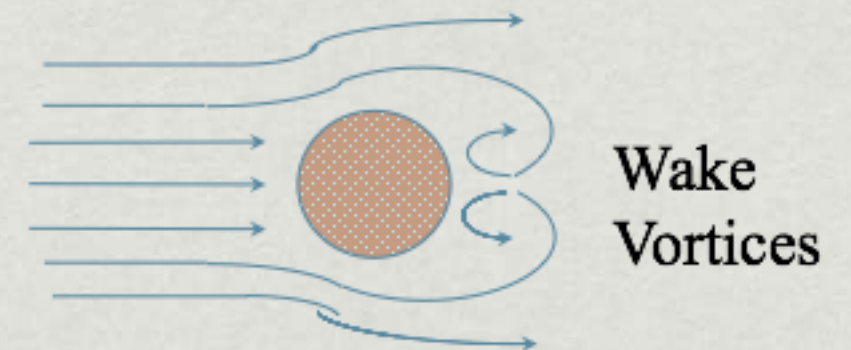
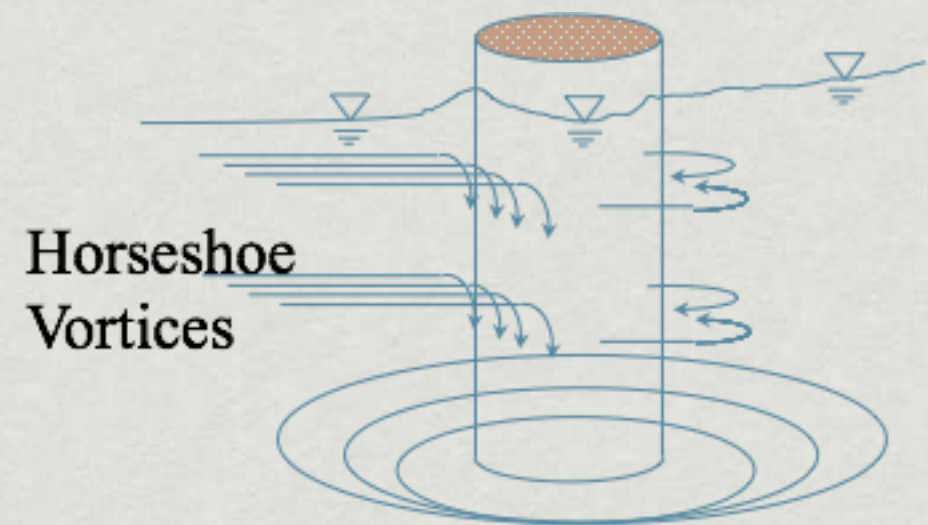
- ✱ Mechanism for Failure?

- ✱ Catastrophic Failure
- ✱ Deformational
- ✱ Slow Rotational





# Hydraulics: Classic Scour Analysis





# Geotechnical: Are you in rock?

- \* Alluvium
- \* In Rock vs. On Rock
  - \* Level of Security
- \* Joints
  - \* Adverse?
- \* Rock Quality
  - \* Erodible?







# Lewiston Bridge - Trinity River, Trinity County, CA

Hydraulics Control



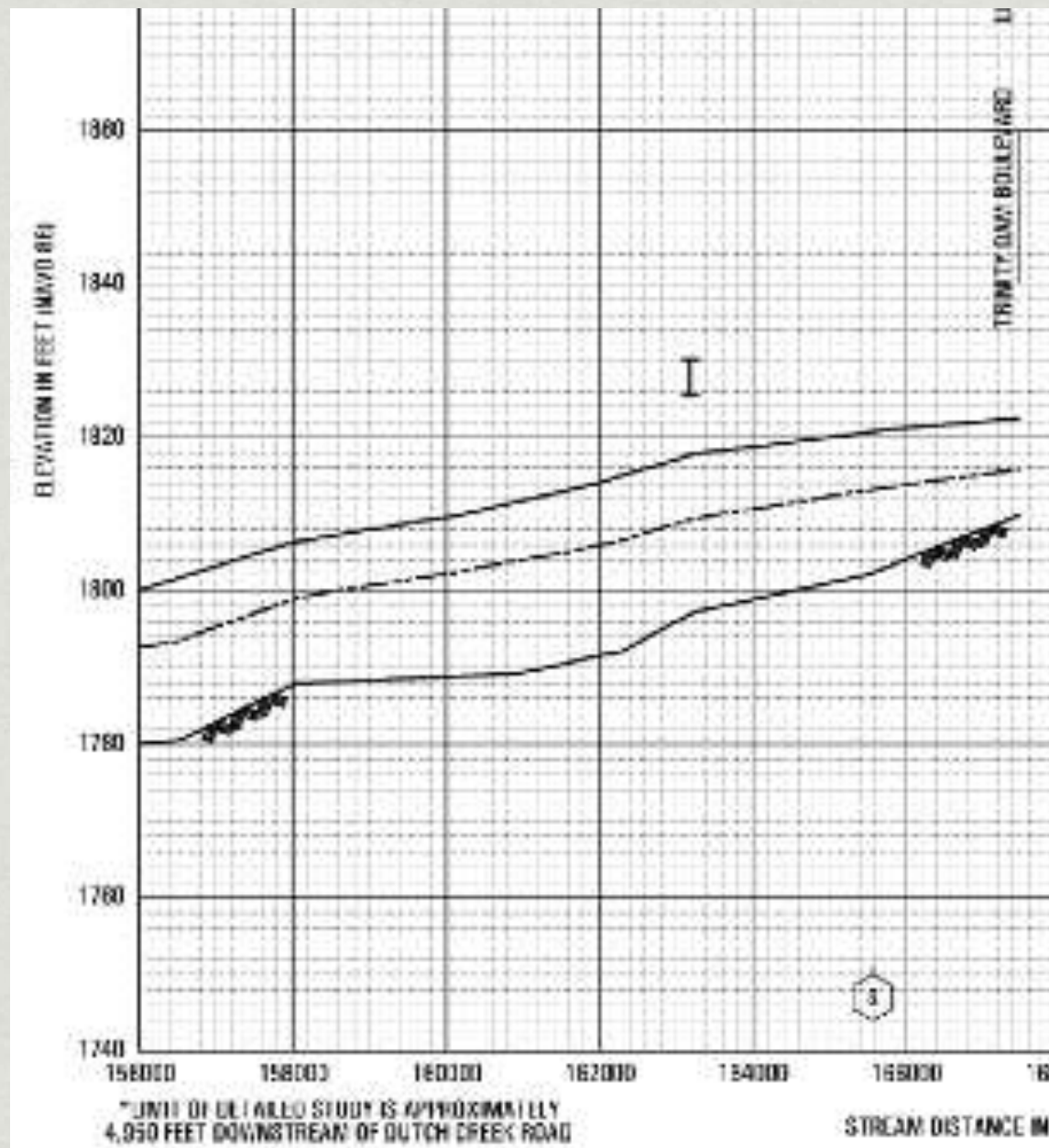
# Lewiston Bridge

- \* Built in 1901
- \* Columns Made from Mining Materials and Riveted
- \* Main Truss Survived 1952 Flood (200-yr?)
- \* Upstream Dam Started in 1954 Finished in Early 60s





# Lewiston Hydraulic Analysis







## Price Creek Bridge, Trinity County, California

Structural Controls



# Price Creek Bridge

- ✱ Monolithic Abutments
- ✱ Large Spread Footings
- ✱ Tall Abutments
- ✱ Short Bridge Span
- ✱ Multiple I-girders





# Price Creek Bridge

- ✱ Seat Abutments
- ✱ Structure Inertia
- ✱ Slow Rotation
- ✱ Pavement Distress
- ✱ Settlement







Price Creek Bridge, Trinity County, California

Geotechnical Controls

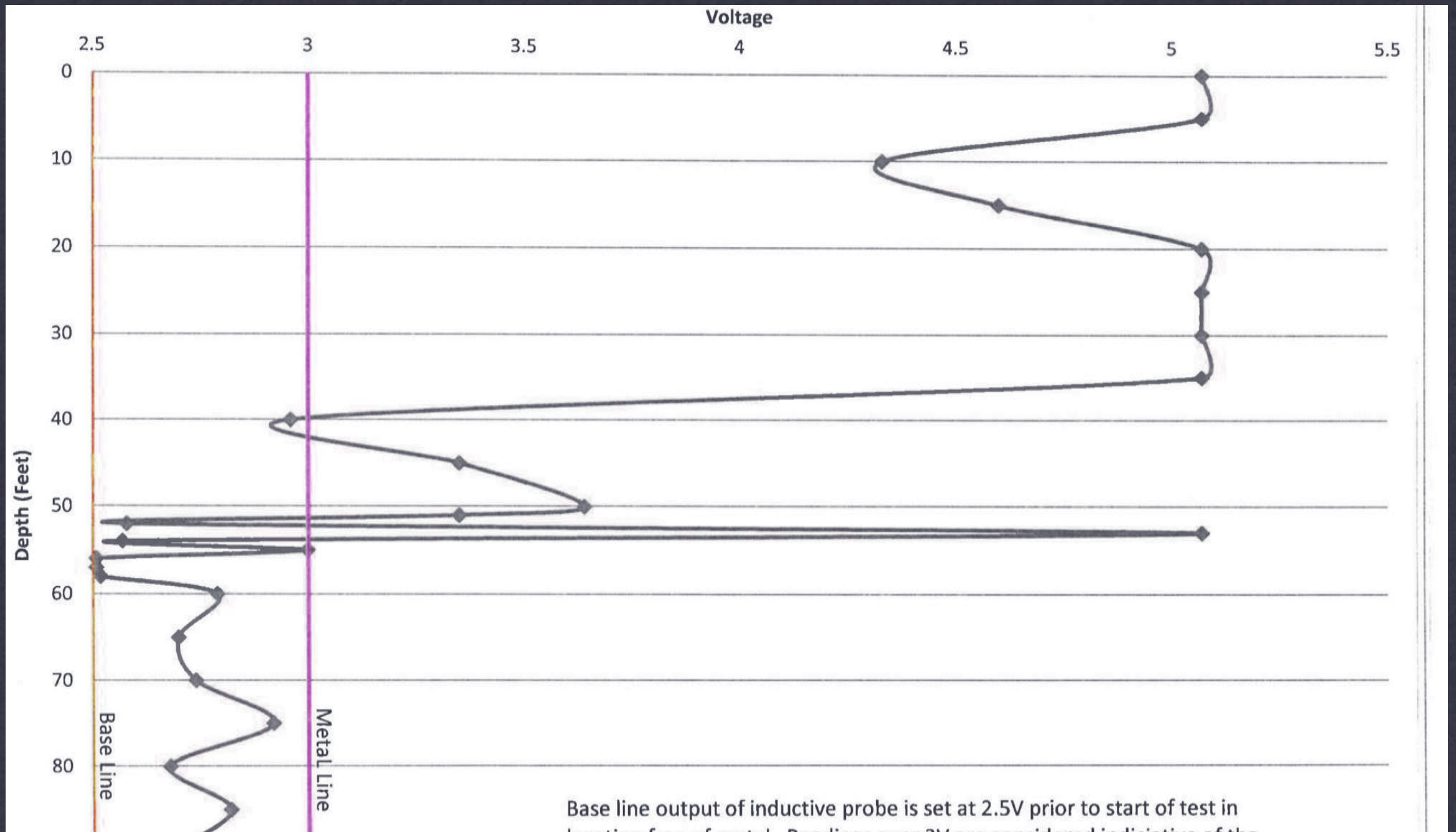


# Price Creek Bridge

- \* Pedestal Footings on Rock; Not in Rock
- \* Adverse Dipping Joints
- \* Plucking Apparent
- \* Secure the Footings







## Making Unknown Foundations Known

Induction Probe - Alamo Pintado Bridge



# Induction Probe

- \* Alamo Pintado Bridge
- \* Steel H-pile Sections
- \* Scour Issues
- \* Needed Pile Depth Information
- \* Large Metal Detector





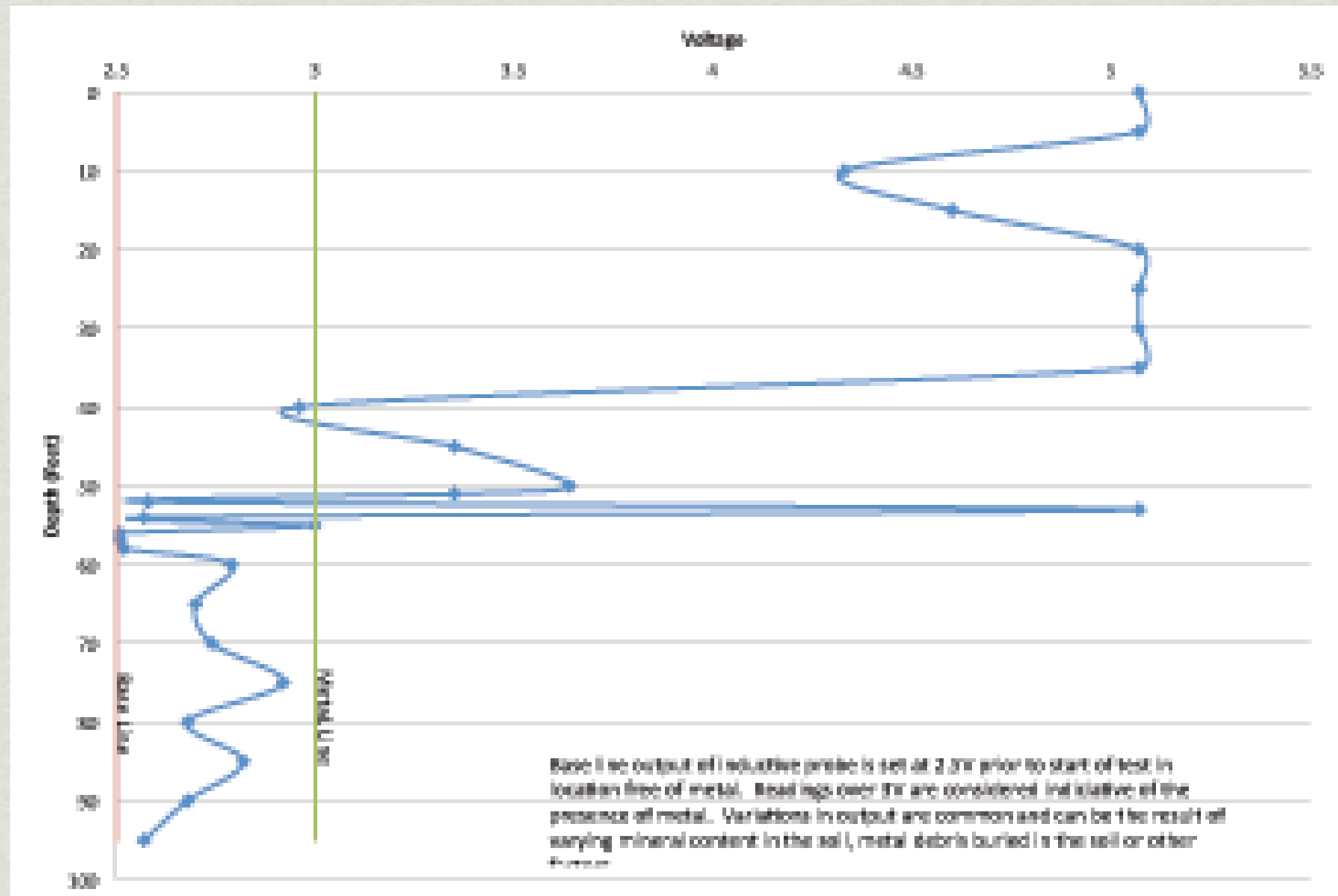
# Induction Probe



- \* Borehole with Plastic Pipe
- \* Horizontal induced field
- \* Maximum 18-in (45 cm)
- \* Field 24-in (60 cm)
- \* Seismic Refraction



# Induction Probe







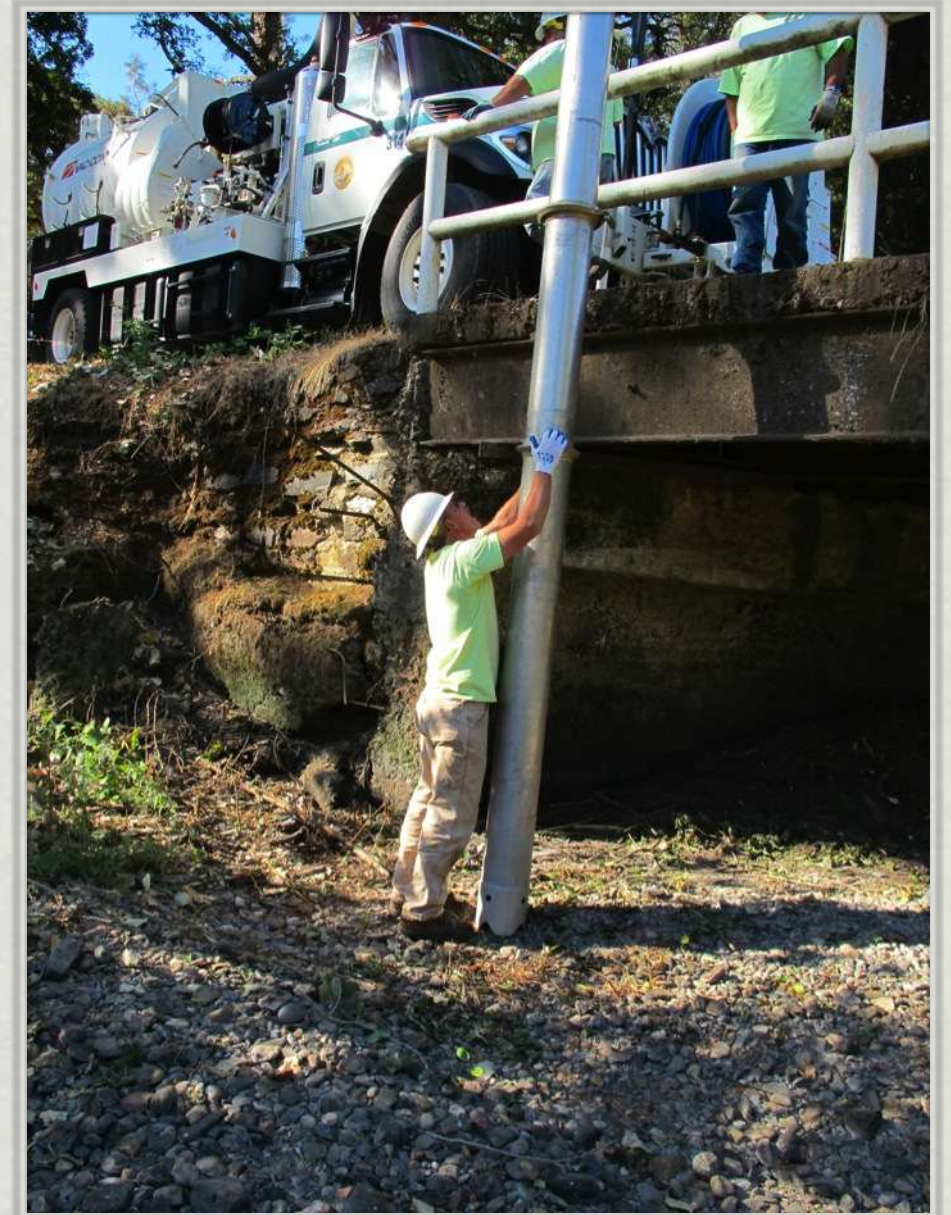
## Making Unknown Foundations Known

Vacuum Truck - Rancheria Creek on Old Amador Road



# Vacuum Truck

- ✱ Verify Depth of Footings
- ✱ Is There Shallow Rock?
- ✱ Within Scour Depths?
- ✱ Quick, Easy Excavation
- ✱ Completed Next Day
- ✱ Enhanced Assessment





# Vacuum Truck

- In/On Rock or Alluvium
- Foundations were scour critical?
- Developed Monitoring Plan or Recommended Replacement



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# Acknowledgements

AMADOR COUNTY  
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YUBA COUNTY  
CITY OF CHICO  
CITY OF BENECIA



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