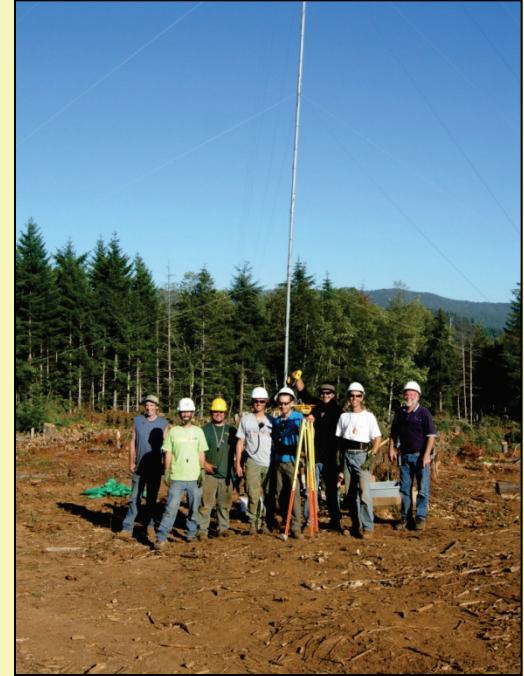




# Wind & Hydro Energy Feasibility Study for the Yurok Tribe



**DOE Tribal Energy Program Review Meeting**  
**Award #DE-FG36-07GO17078**  
**November 19, 2009**

**Presented By: Austin Nova, Yurok Tribe**

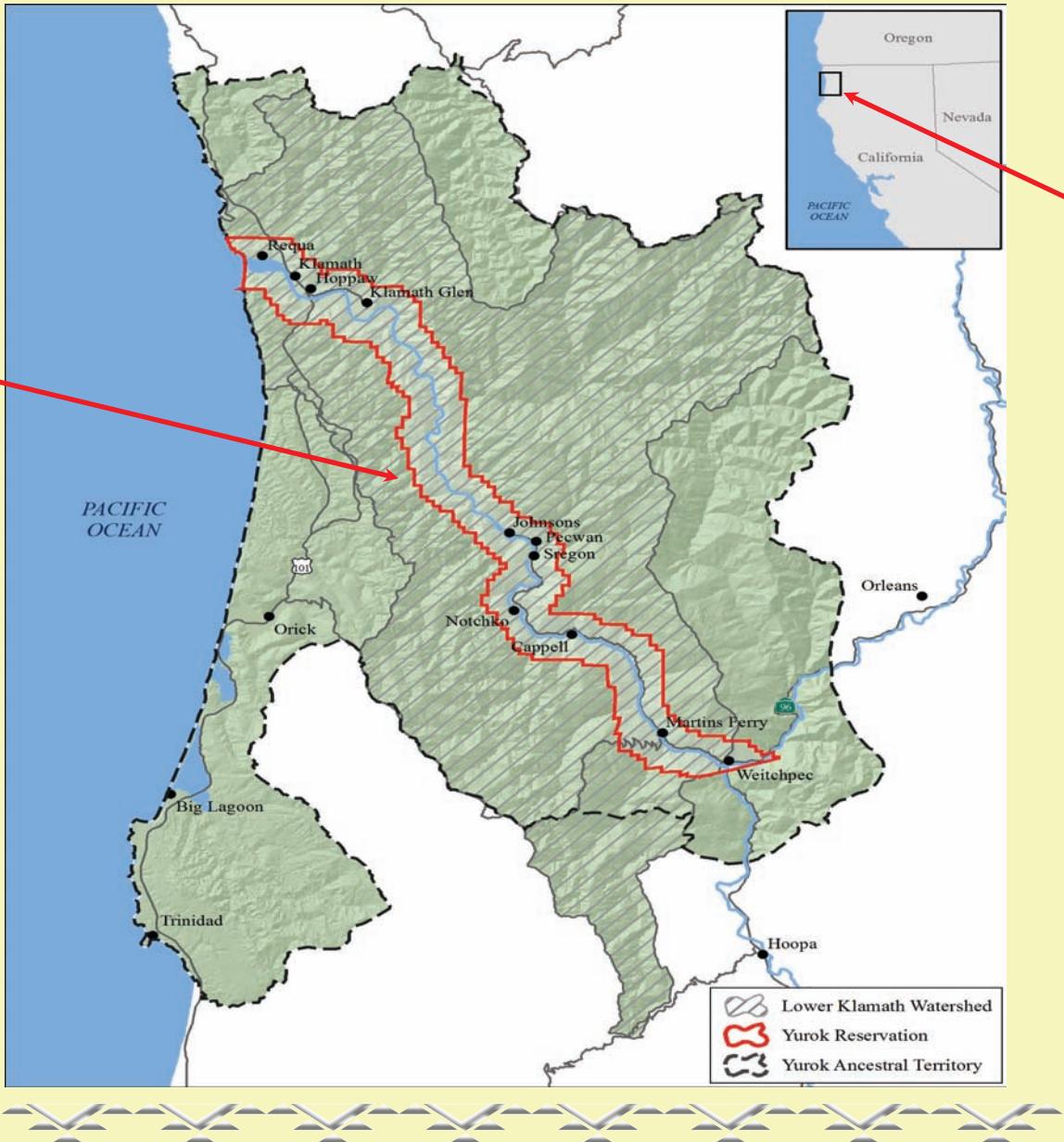




# Background/Location



**Yurok Reservation**  
Straddles the lower stem of the Klamath River, 2 miles wide and 44 miles long)

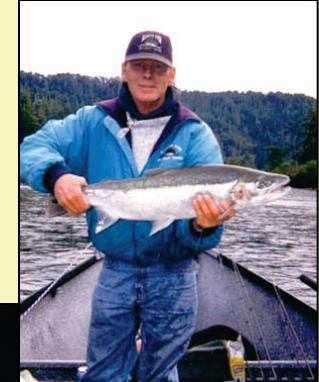


Located in northwest corner of California



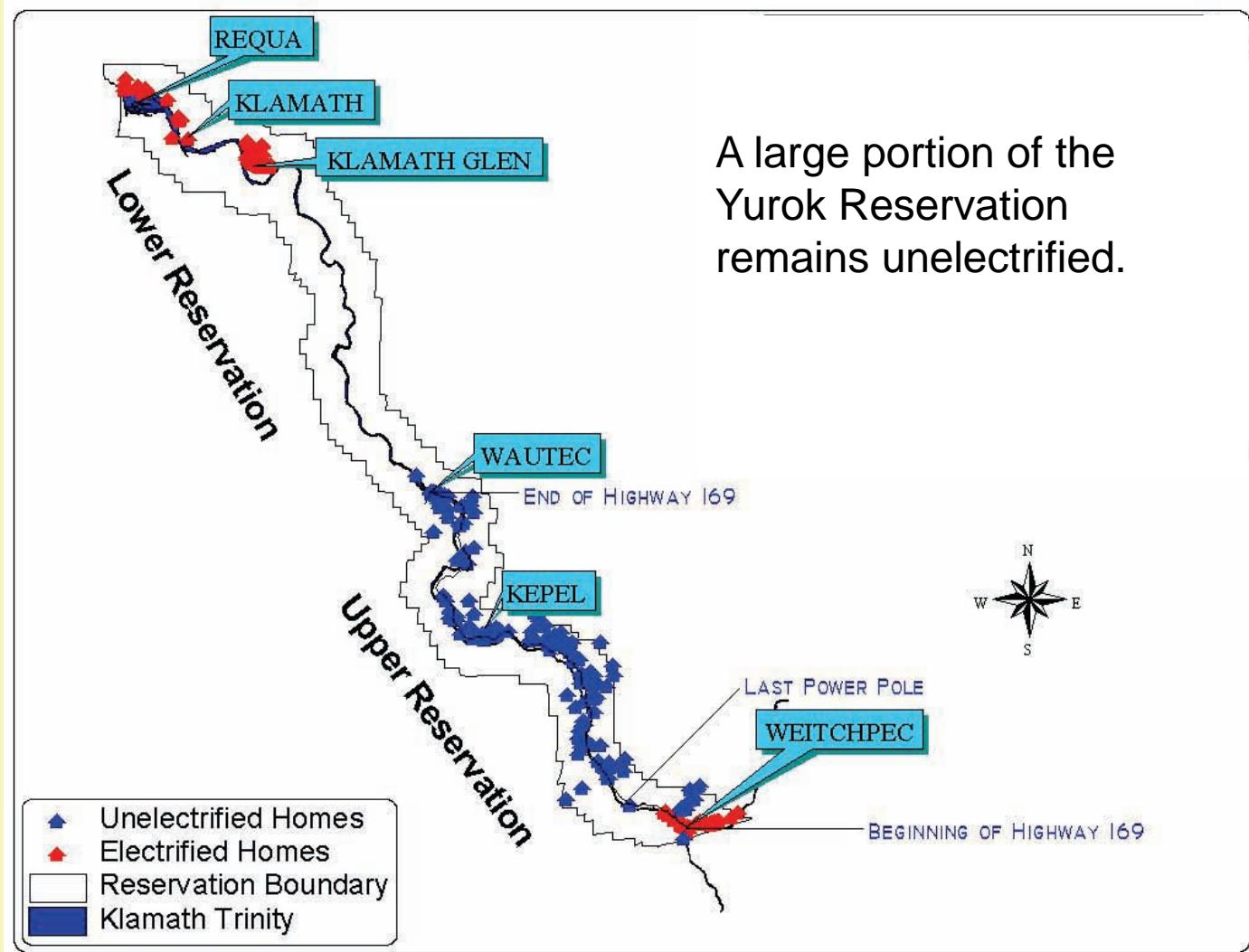
# Background

- Largest Indian Tribe in California
- Traditional livelihood on the Yurok Reservation is based upon subsistence harvest of salmon on the Klamath River





# Background





# Background

- A high percentage of residents on the Yurok Reservation **lack convenient access to power or phone**.
- Yurok Tribe members suffer from high energy cost to income ratios: one survey indicated **~40% of residents' income is spent on energy**.
- Because the Reservation straddles two counties and is located in the most remote corners of two large utility companies' service areas, **energy service programs are not readily accessible**.
- Facility scale **solar electric and microhydro electric systems** have been installed in the past. Some have not endured due to **lack of proper use and maintenance**.
- There are **additional renewable energy resources** on the Reservation that **can be developed**.





# Background

- Previous DOE funded work done for the Yurok Tribe by the Schatz Energy Research Center showed that wind, hydro, biomass and solar energy resources are available on the Reservation.
- Solar is appropriate only at the facility / household scale.
- Wind, hydro and biomass may also be suitable at a village scale or for sale to the grid.



DOE/NREL





# Project Overview

## Goals & Objectives:

- Assess the feasibility of developing hydro and wind energy resources on the Yurok Reservation
- Assess two hydro sites and one wind site
- Provide detailed, site specific information and comprehensive business plan sufficient to implement a favorable project

## Project Team:

- Yurok Tribe (Planning, Environmental, and Fisheries Departments)
- Schatz Energy Research Center
- Humboldt State University (Engineering, Biology, & Economics Departments)

## Project Schedule:

- Start Date: October 2007
- Initially a 2 year project, extended to 3.5 years





# Project Tasks

1. Select project sites
2. Install data monitoring equipment and collect data
3. Assess availability of appropriate energy conversion technologies
4. Analyze data, determine energy production potential
5. Assess on-Reservation loads that could be served
6. Assess off-Reservation sales opportunities
7. Assess electrical grid access
8. Develop preliminary design specifications
9. Conduct economic analysis
10. Identify preferred alternatives
11. Conduct preliminary environmental assessment
12. Assess permitting requirements
13. Conduct stakeholder analysis
14. Develop preliminary O&M plan
15. Outline a community education plan
16. Develop business plan and financing options
17. Provide training/professional development to Tribal staff & government





# Progress

## Year 1:

- Select project sites
- Specified and obtained data monitoring equipment
- Filed NEPA EF1 Environmental Checklist

## Year 2:

- Installed stream gauging stations
- Began collecting stream stage and stream discharge data
- Finalized MET tower location for wind site
- Determined soil classification and required tower anchoring methods
- Cleared trees and brush from site
- Assembled and erected 50-meter MET tower
- Began collecting wind speed and direction data





## Site Selection - Hydro

- Nearly 50 creeks enter Klamath River within Reservation boundaries
- Key issues regarding development on tributary streams includes:
  - hydropower potential (flow and head)
  - potential impacts to anadromous fish populations (shorter steeper drainages with natural fish barriers preferred)
  - impacts to cultural or sacred sites
  - proximity to electric grid or remote village
  - land ownership
  - road access
- Identified a few candidate streams and then chose two final sites



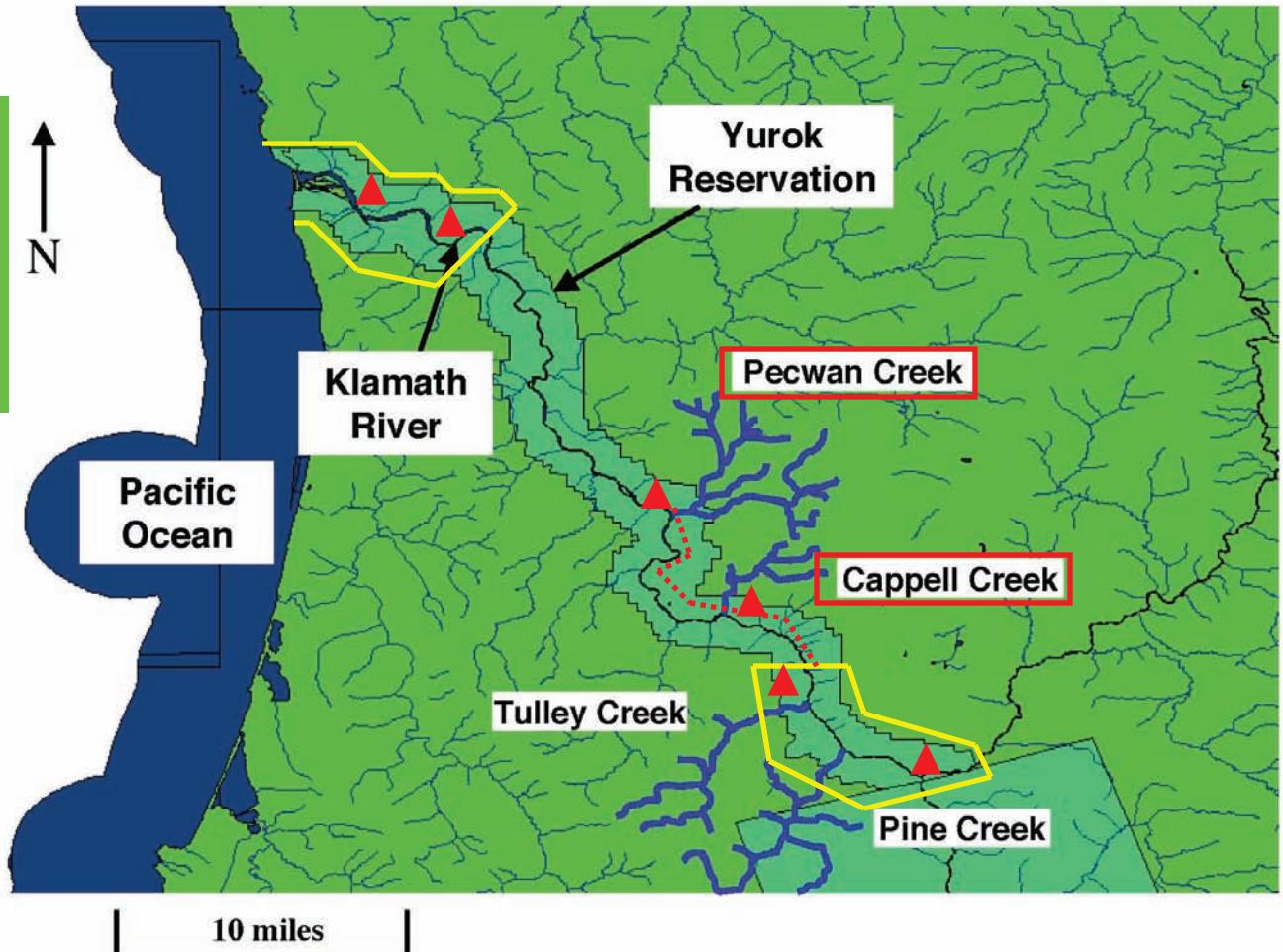


# Site Selection - Hydro



## Locations of Candidate Streams for Yurok Hydroelectric Study

- Electrified Area
- Planned Electrification
- Tribal Community





# Site Selection - Hydro



Ke'pel Creek

Pecwan Creek

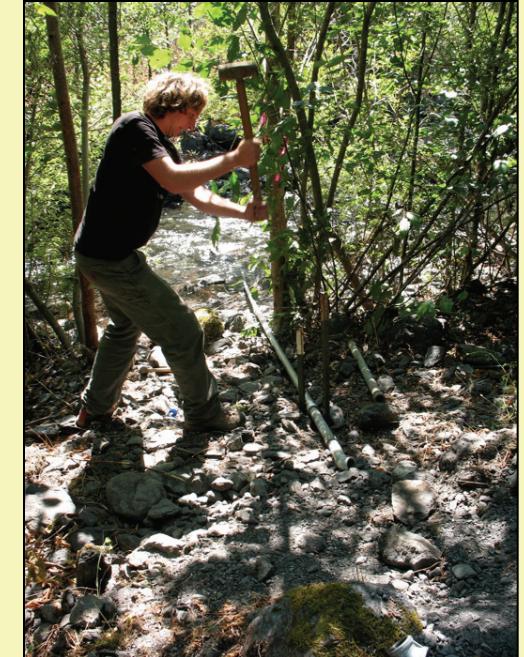




# Stream Gauging Station Installation



The Yurok Tribe Planning and Environmental Departments collaborated with SERC engineers to install the gauging stations.





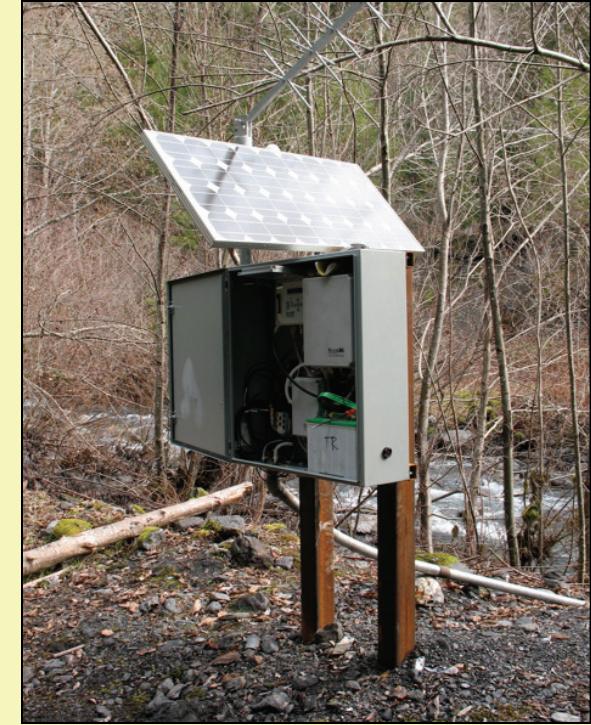
# Stream Gauging Station Installation



Ke'pel Creek



Ke'pel Creek



Pecwan Creek





# Stream Flow Measurement



Ke'pel Creek



Ke'pel  
Creek

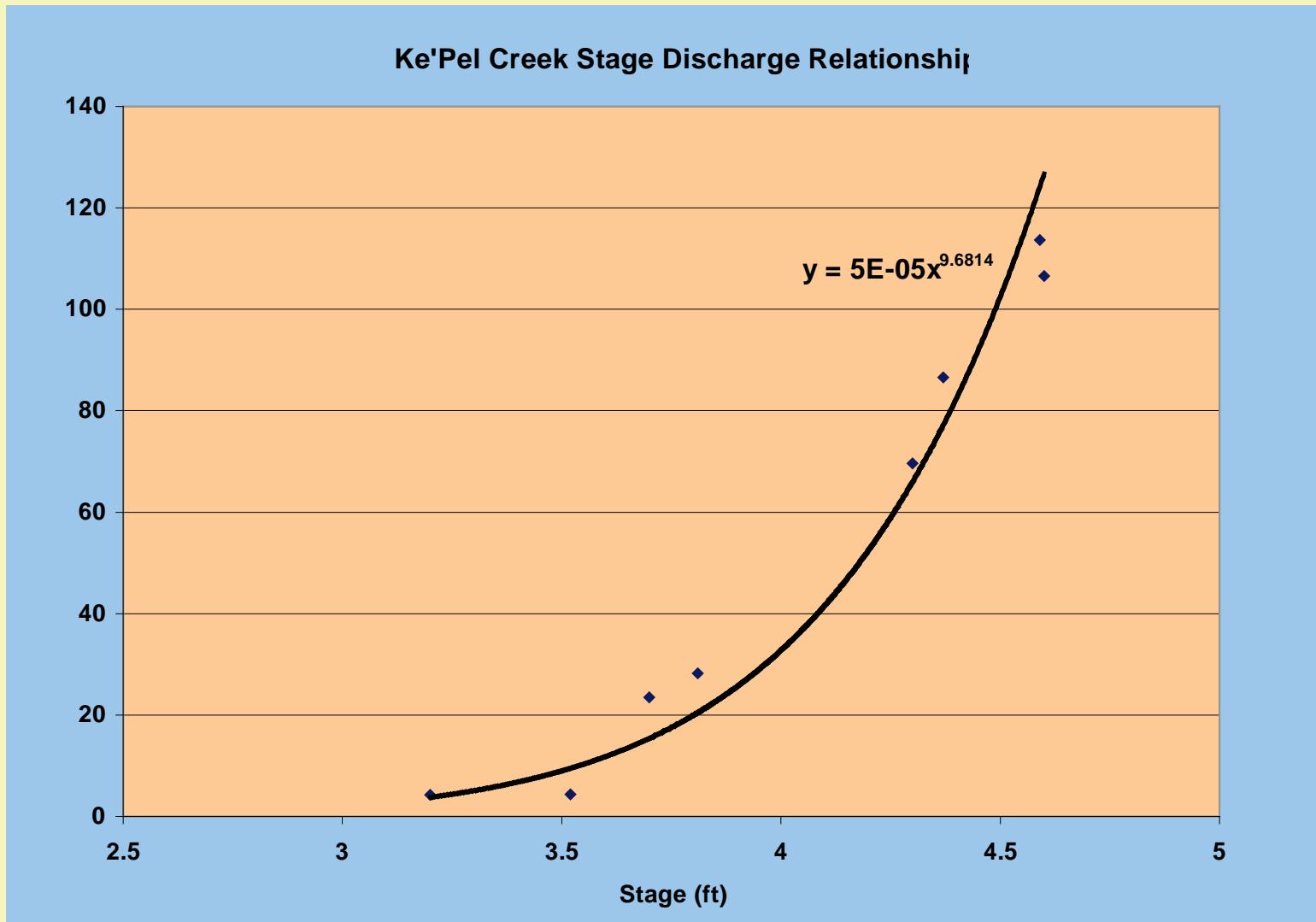


Pecwan  
Creek





# Stage Discharge Curve - Ke'Pel Creek

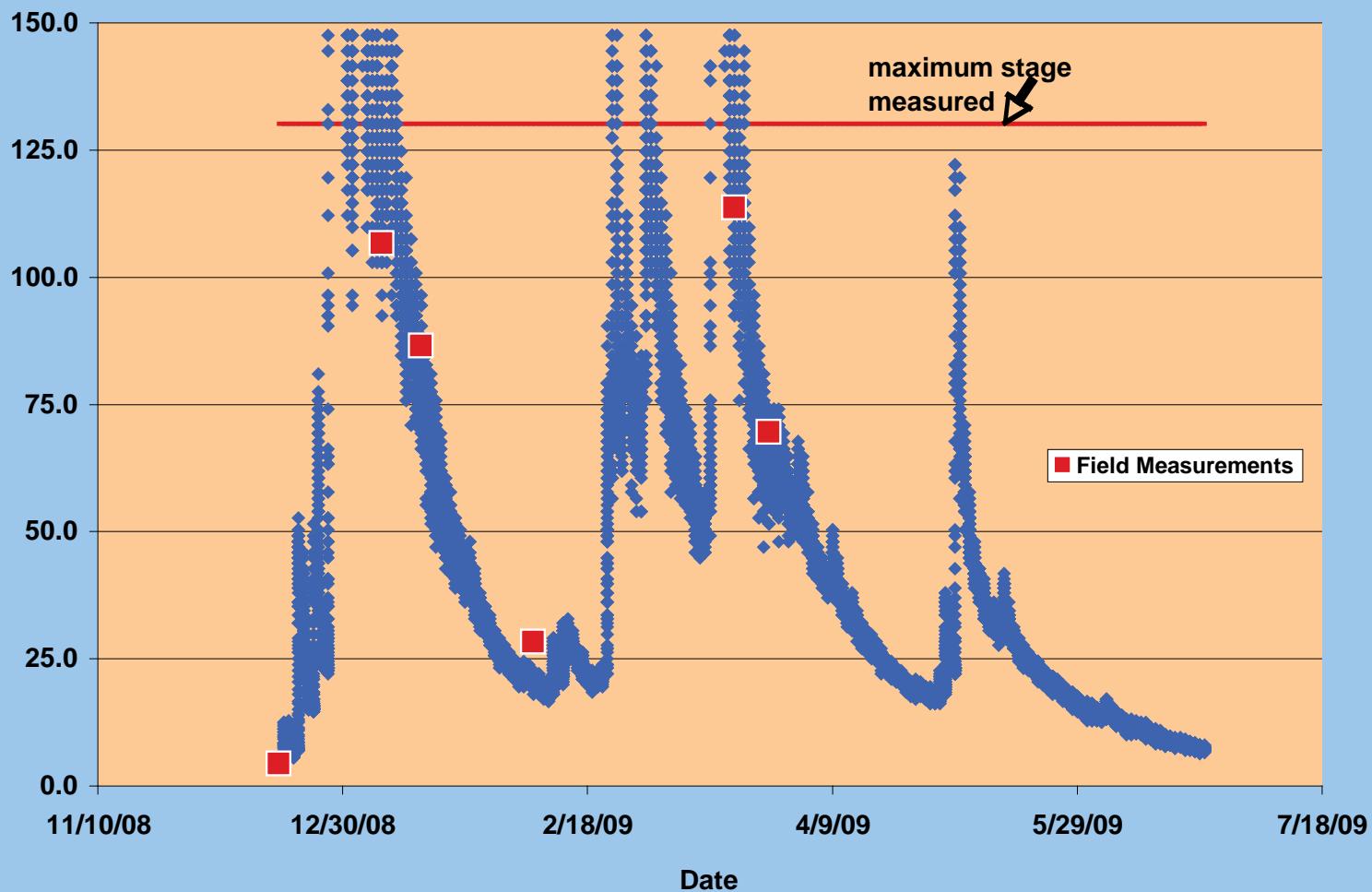




# Ke'Pel Hydrograph

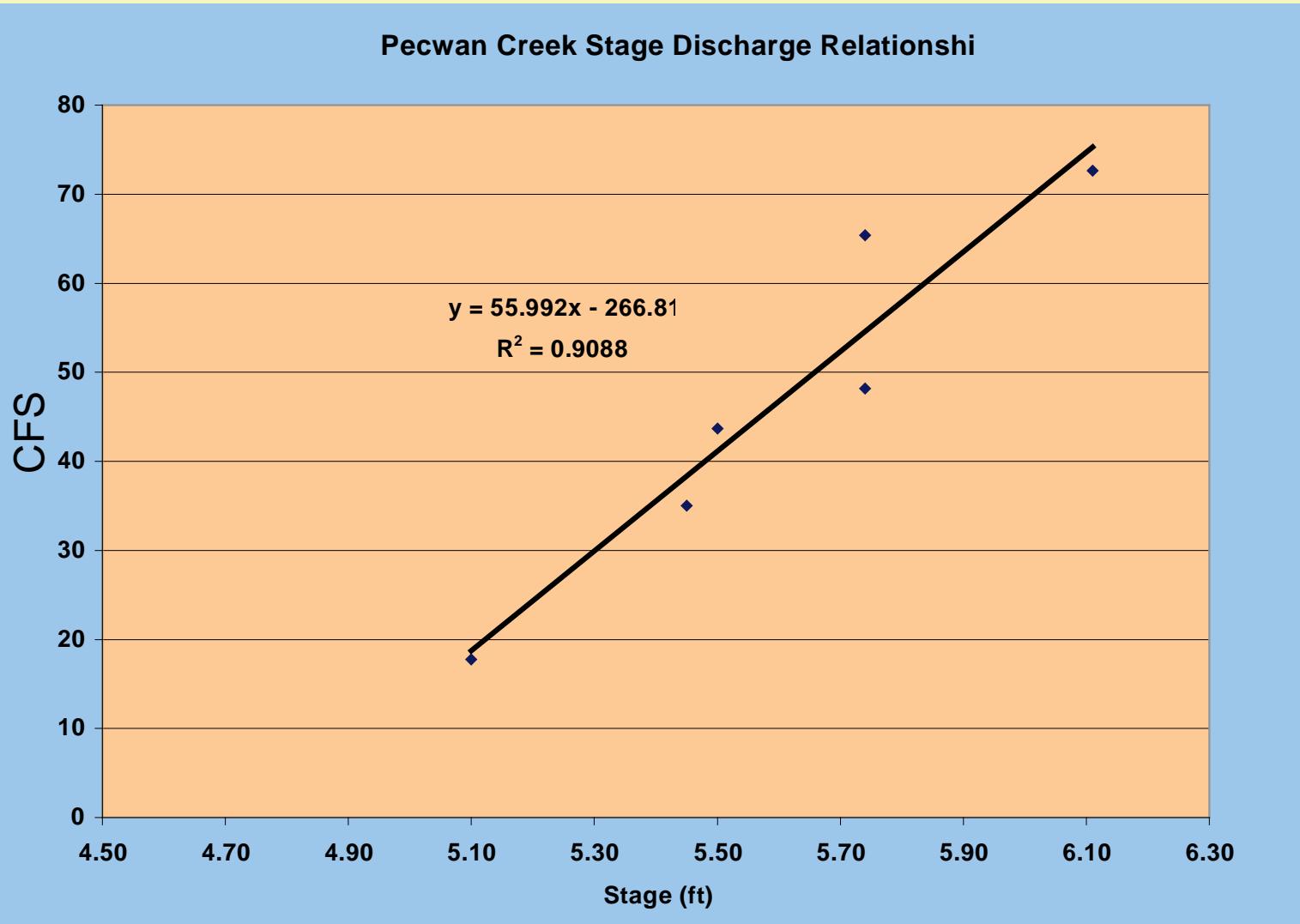


Ke'Pel Creek Hydrograph



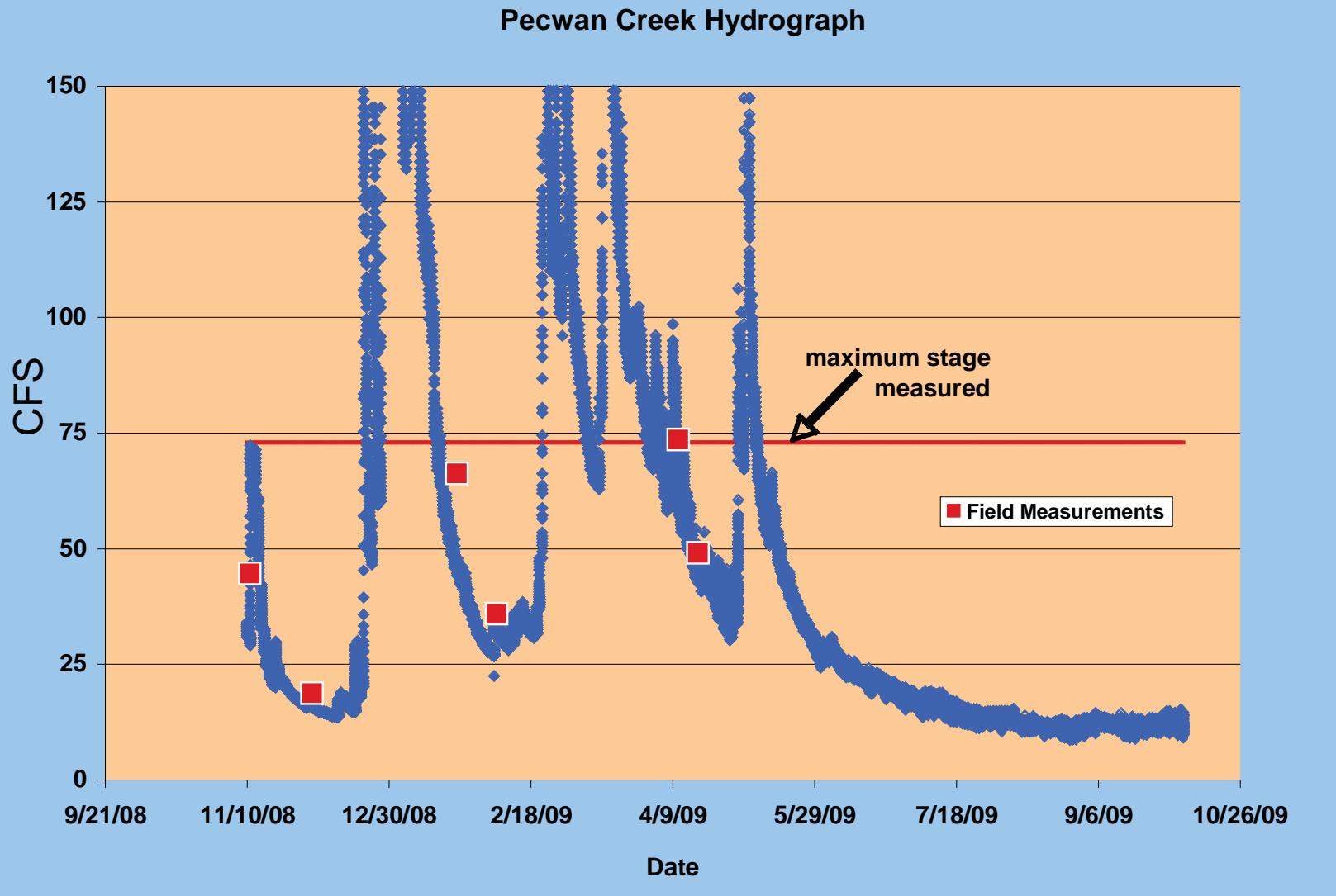


# Stage Discharge Curve - Pecwan Creek





# Pecwan Hydrograph





# Site Selection - Wind

- CA Energy Commission (CEC) and NREL data characterize the area surrounding the Yurok Reservation with class 1 to 4 wind power ratings (“poor” to “good” on a 7-point scale)
- Key issues regarding wind power siting:
  - adequate resource, economic viability
  - access to the electric grid or proximity to remote village
  - environmental & cultural impacts
  - land ownership
  - road access

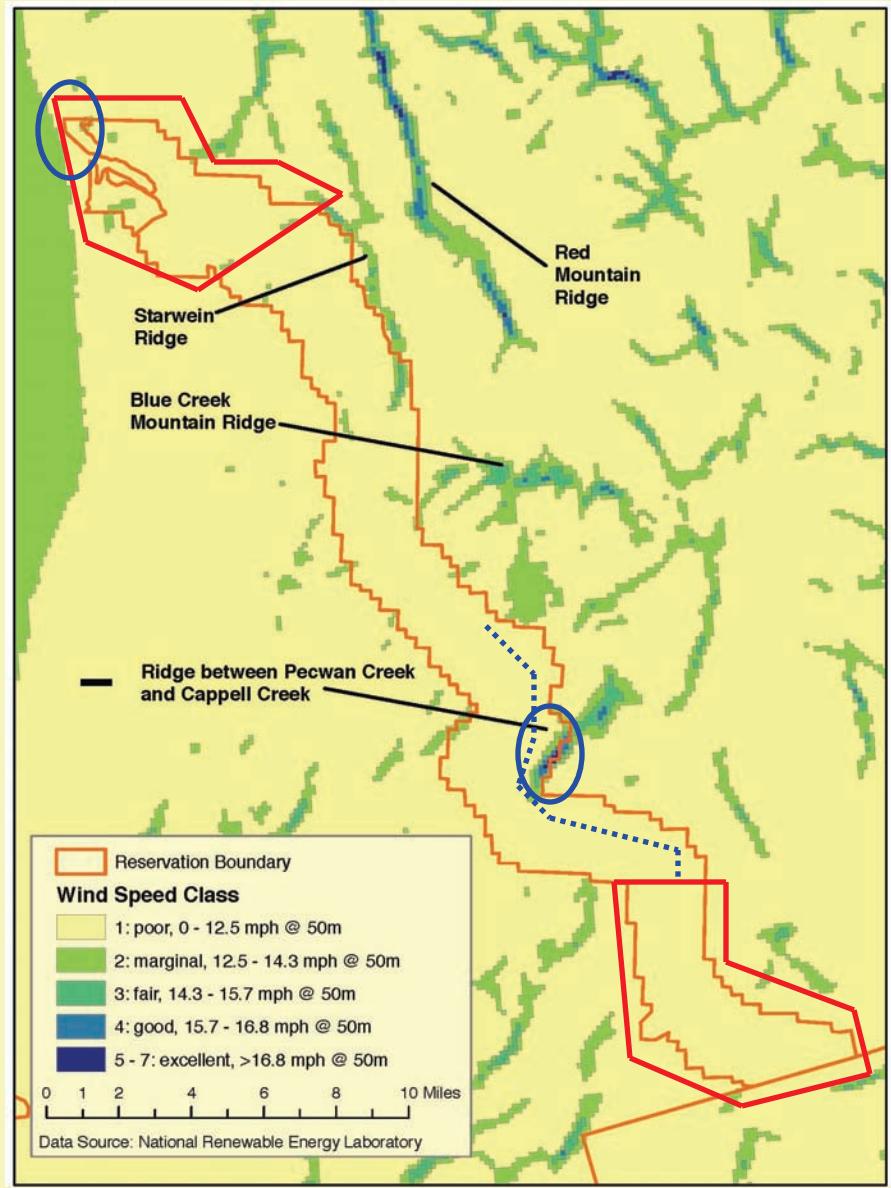
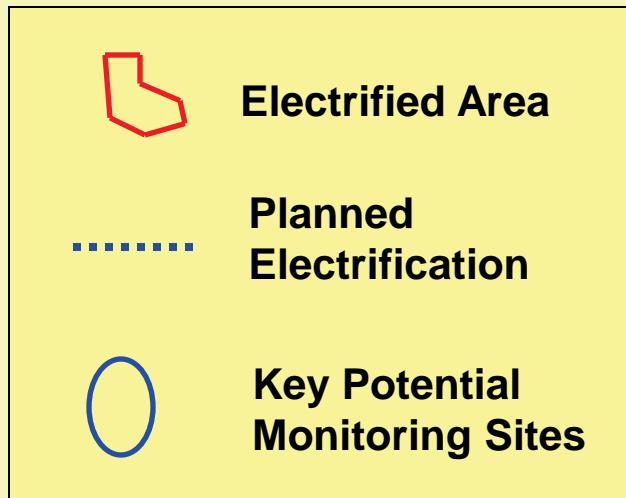




# Site Selection - Wind



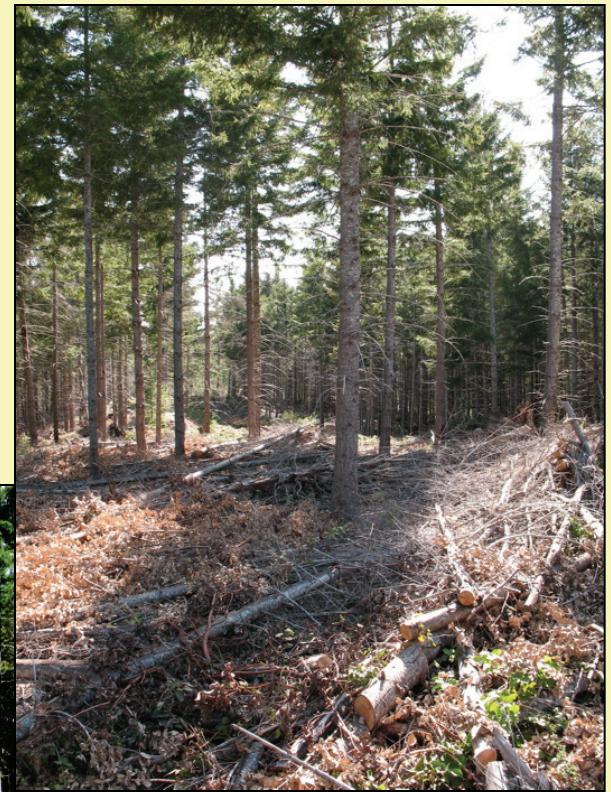
## Wind Speed Classes in the Vicinity of the Yurok Reservation





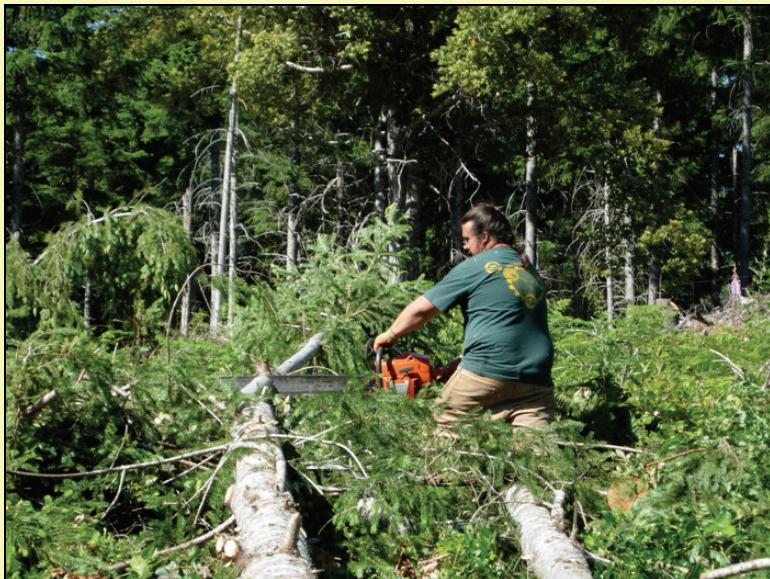
# Wind Site Preparation

The site was significantly wooded ...





# Wind Site Preparation



... and required  
substantial clearing.





# Wind Site Preparation



We surveyed the site and took soil samples to determine where the anchors should be set and what type of anchors should be used.





# MET Tower Installation



Tower assembly.

Lifting begins.





# MET Tower Installation



The tower going up.

The team celebrates.





# MET Tower Installation



The tower stands tall.

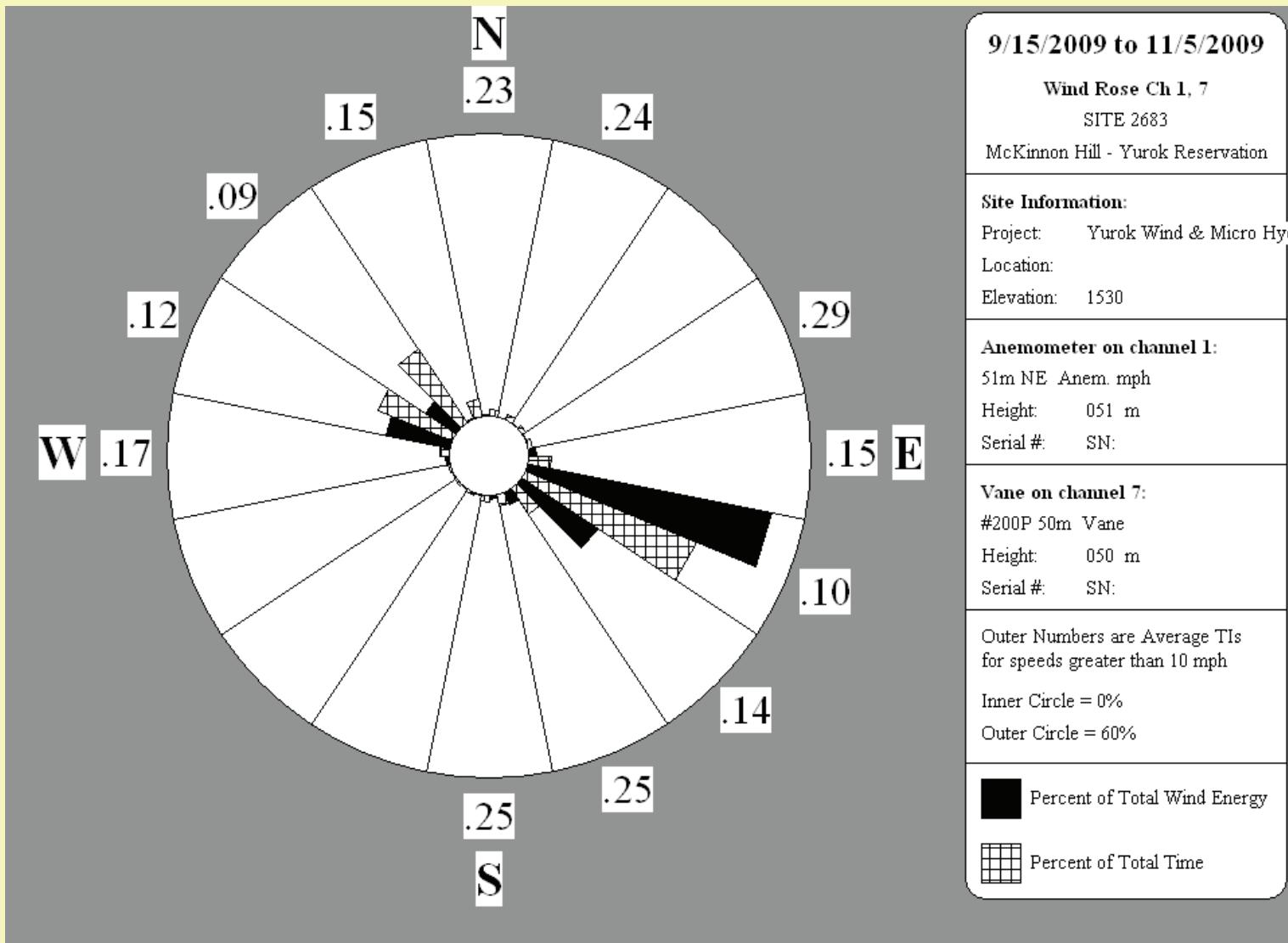


Data collection begins.





# Preliminary Wind Data - Wind Direction at 50 m



Generated Tuesday, November 10, 2009

Total 10-minute intervals: 7488 Intervals used in calculations: 7312 Percent data used: 97.6

NRG Systems SDR Version 6.00



# Preliminary Wind Data - Wind Speed at 50 m

**Site Information:**

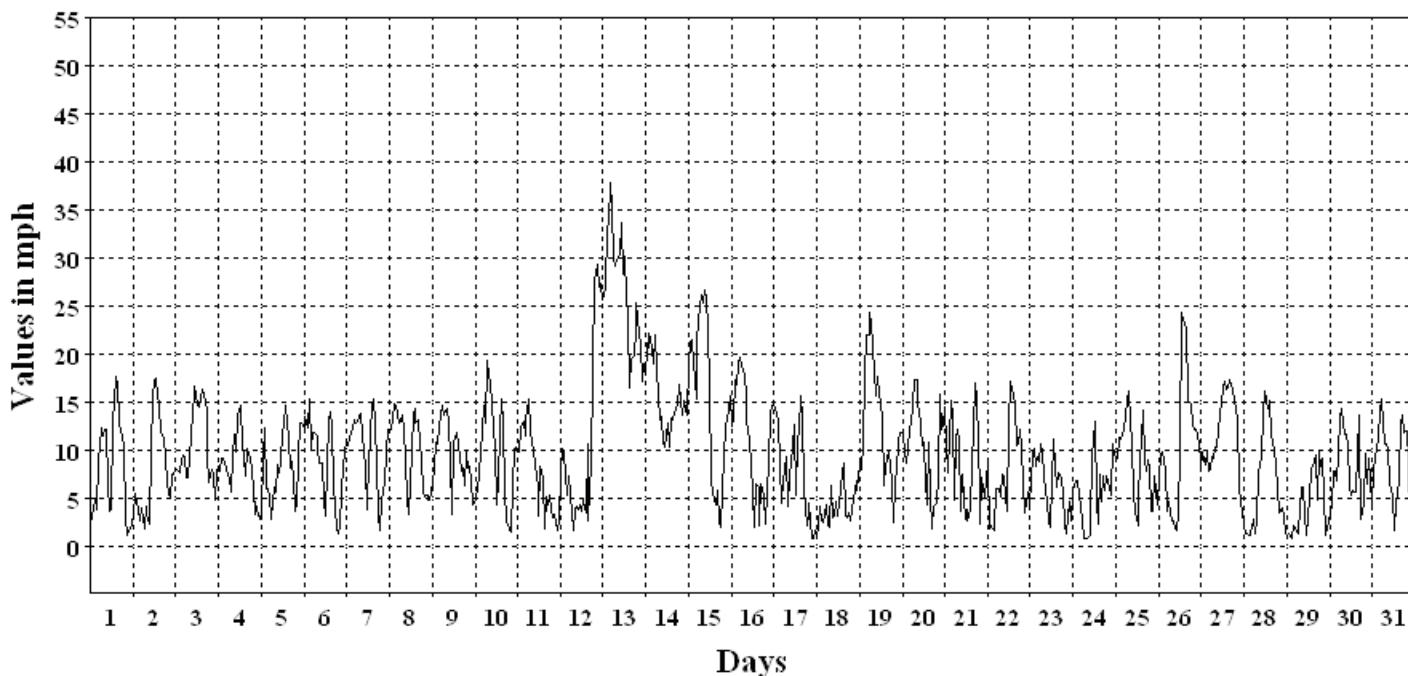
Project: Yurok Wind & Micro Hydro Project  
Location:  
Elevation: 1530

**Sensor on channel 1:**

51m NE Anem. mph  
Height: 051 m  
Serial #: SN:

**October 2009****Hourly Averages Graph Ch 1**  
SITE 2683

McKinnon Hill - Yurok Reservation

**Average Hourly Values****Average Value: 9.7**



# Key Remaining Tasks (through March 2011)

- Collect more data
- Assess energy resource potential
- Develop preliminary design specifications for power conversion systems
- Conduct economic analyses
- Identify preferred alternatives
- Conduct preliminary, “show-stopper” environmental assessment
- Assess stakeholder issues
- Develop business plan and financing options
- Present results to Tribal staff and government with recommendations for next steps





# Thank You

