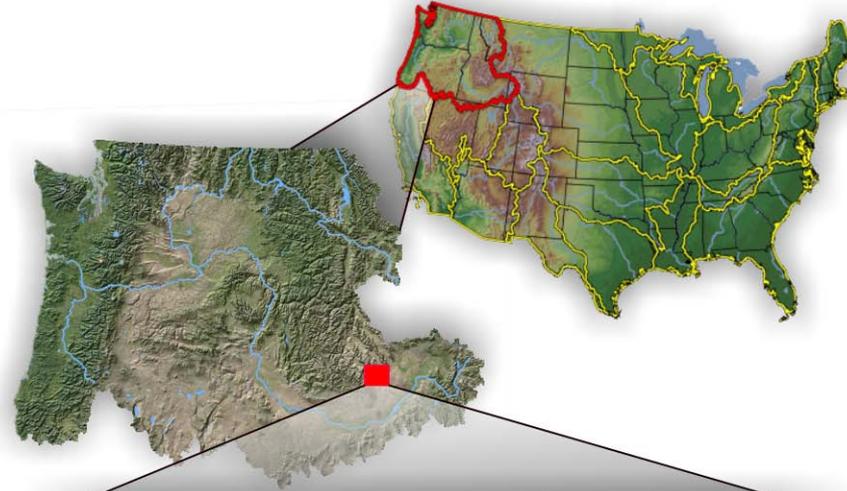
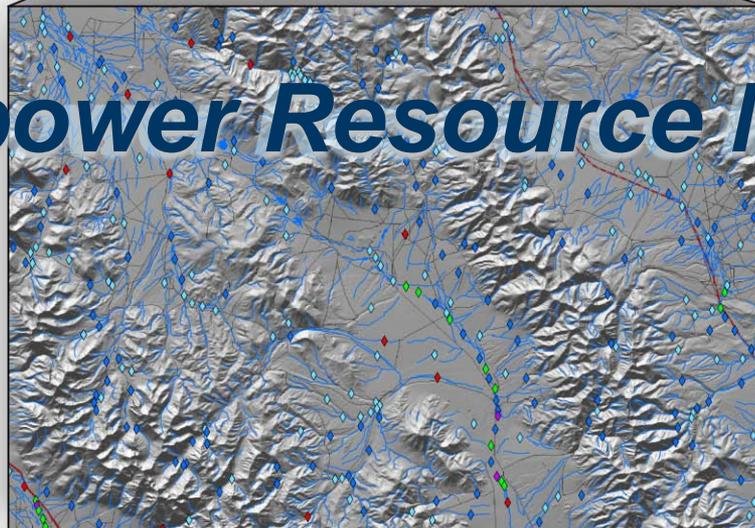


World Bank ESMAP Knowledge Exchange Forum



Hydropower Resource Mapping



www.inl.gov



*Doug Hall, Water Energy Technical Lead
INL Wind and Water Power Program
9 May 2012*

Large Hydro - Niagara Falls



Large Hydro – Robert Moses Plant & Lewistown Pumping Station



Small Hydro – distributed generation



Diversion weir – Canal Inlet



Fall River &
Canal



Canal End – Penstock Entrance

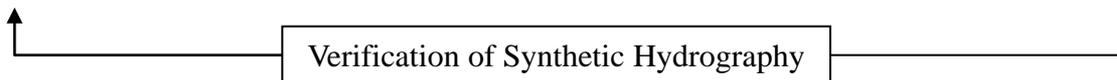
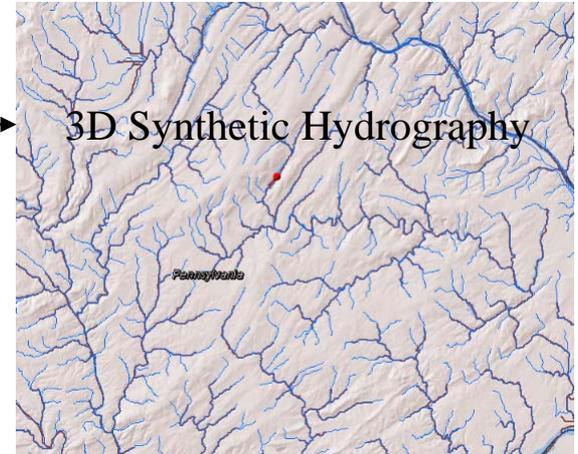
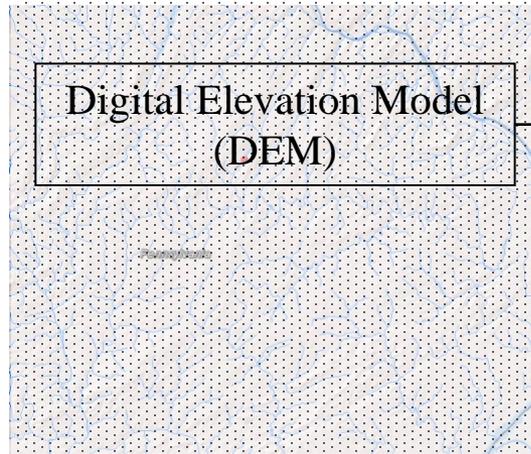
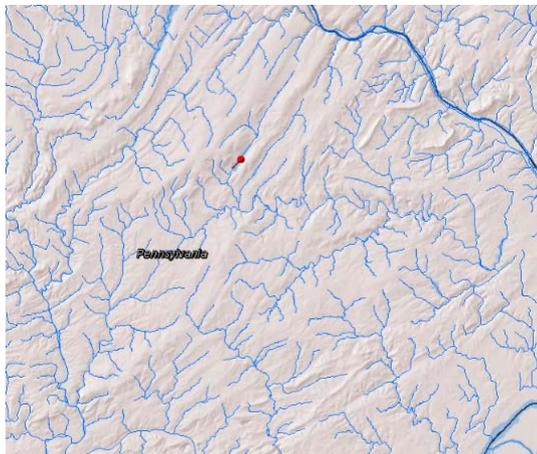
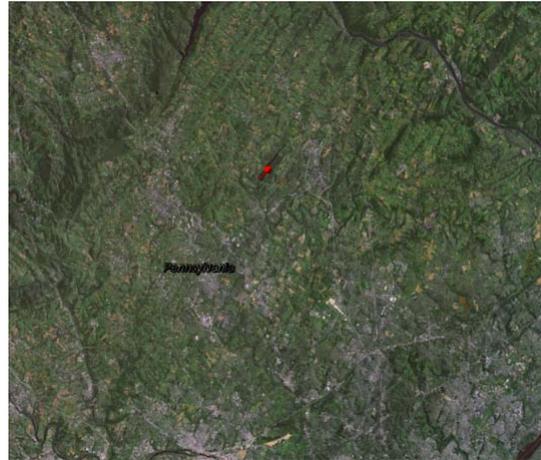


1½ mi. subterranean Penstock

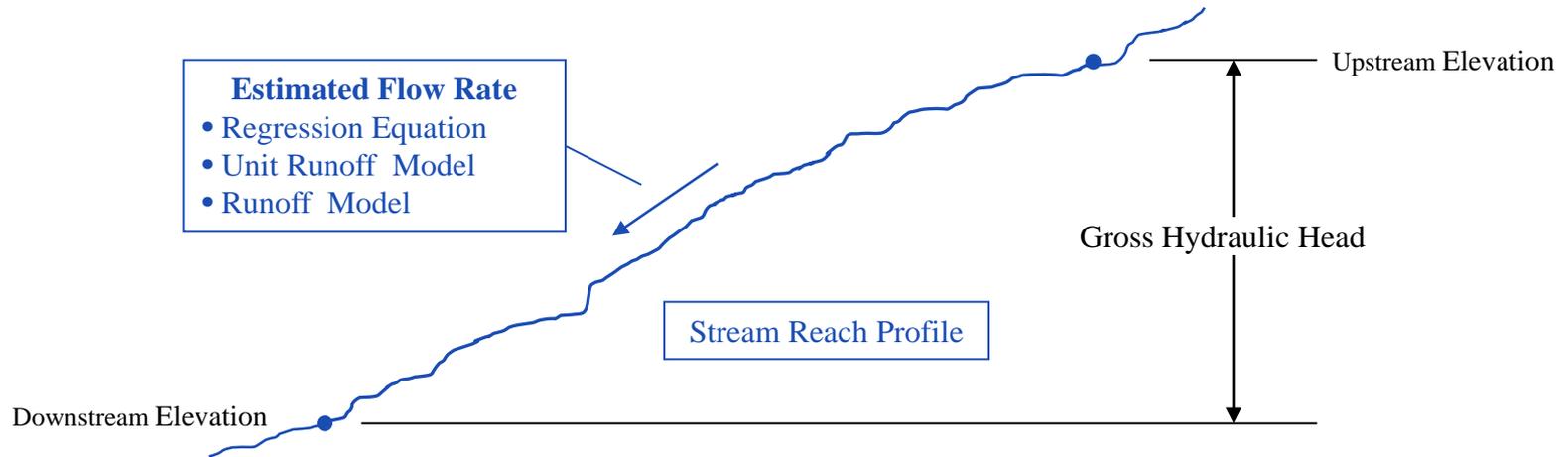


10 MW Fall River Plant in
Fall River Canyon

Virtual Hydropower Potential Mapping – Gross Hydraulic Head



Virtual Hydropower Potential Mapping – Gross Power Potential



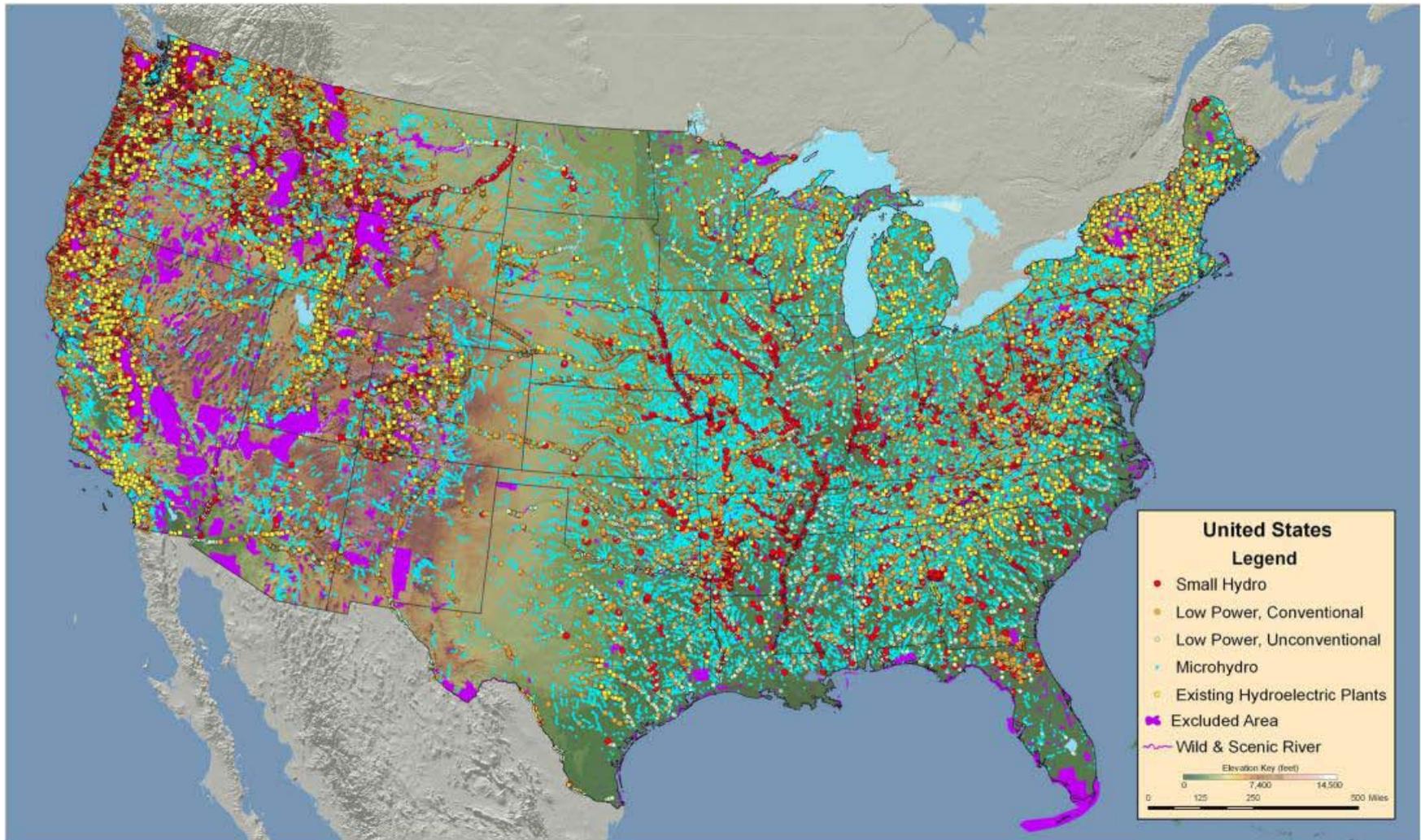
$$P \text{ (kW)} = \kappa Q \text{ (cms)} H \text{ (m)}$$

where P = annual average power

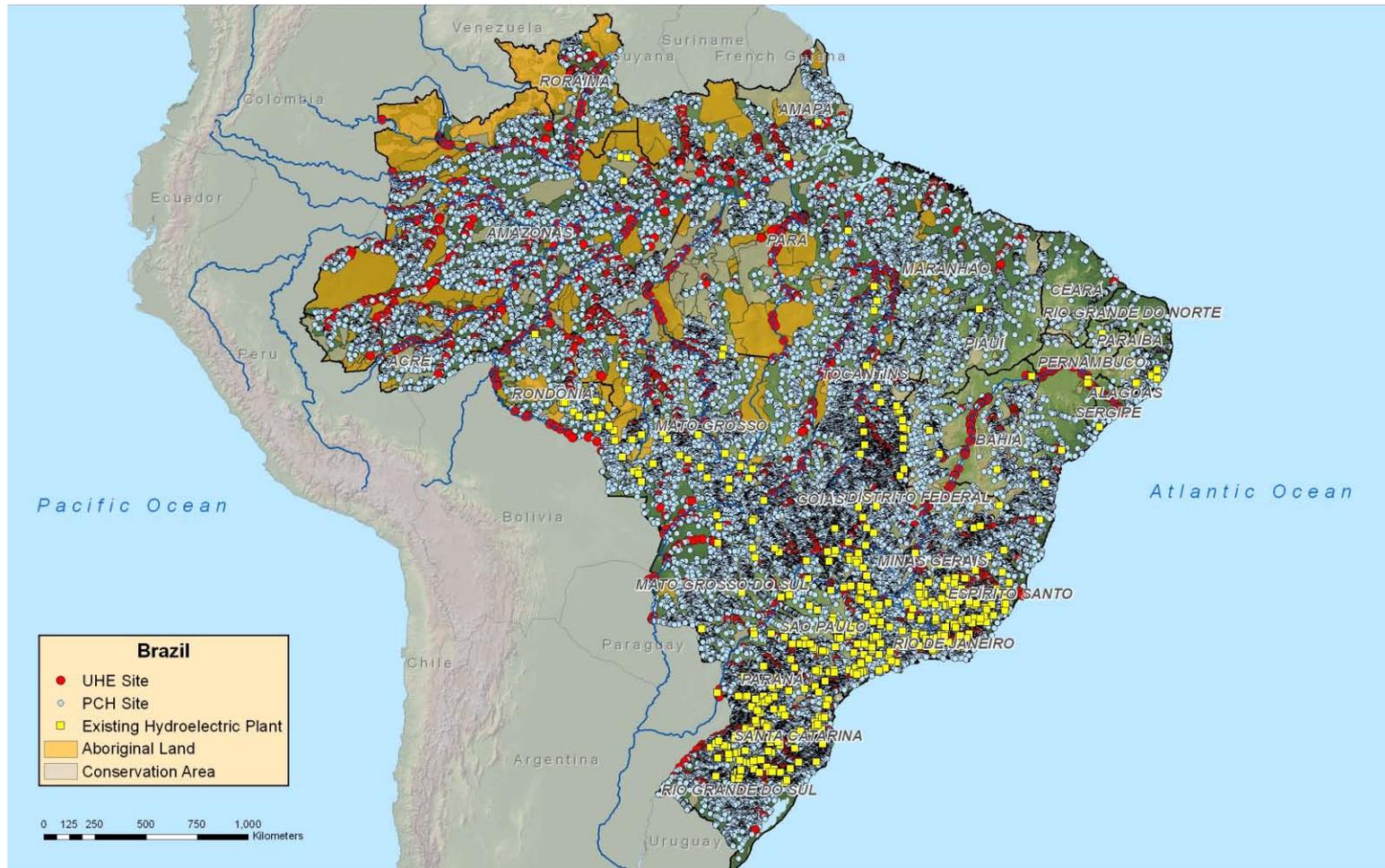
Q = annual average flow rate

H = gross hydraulic head

U.S. Feasible Potential Hydropower Sites



Brazilian UHE and PCH Potential Hydropower Sites



Potential Project Characteristics

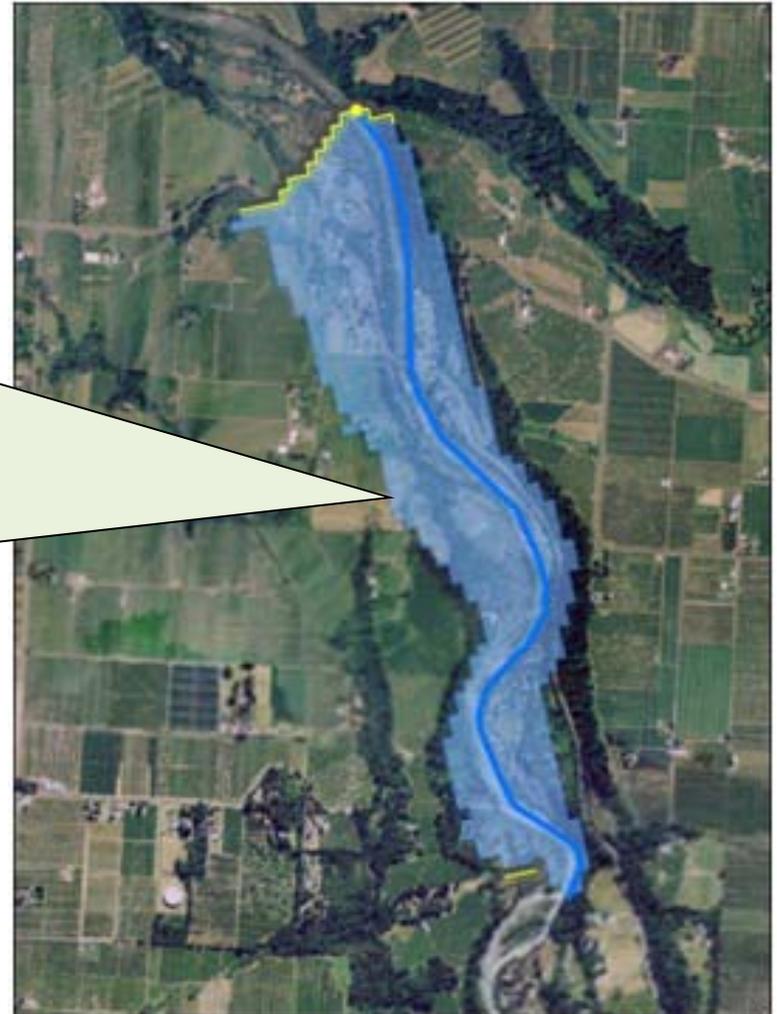
Hood River

Power Characteristics

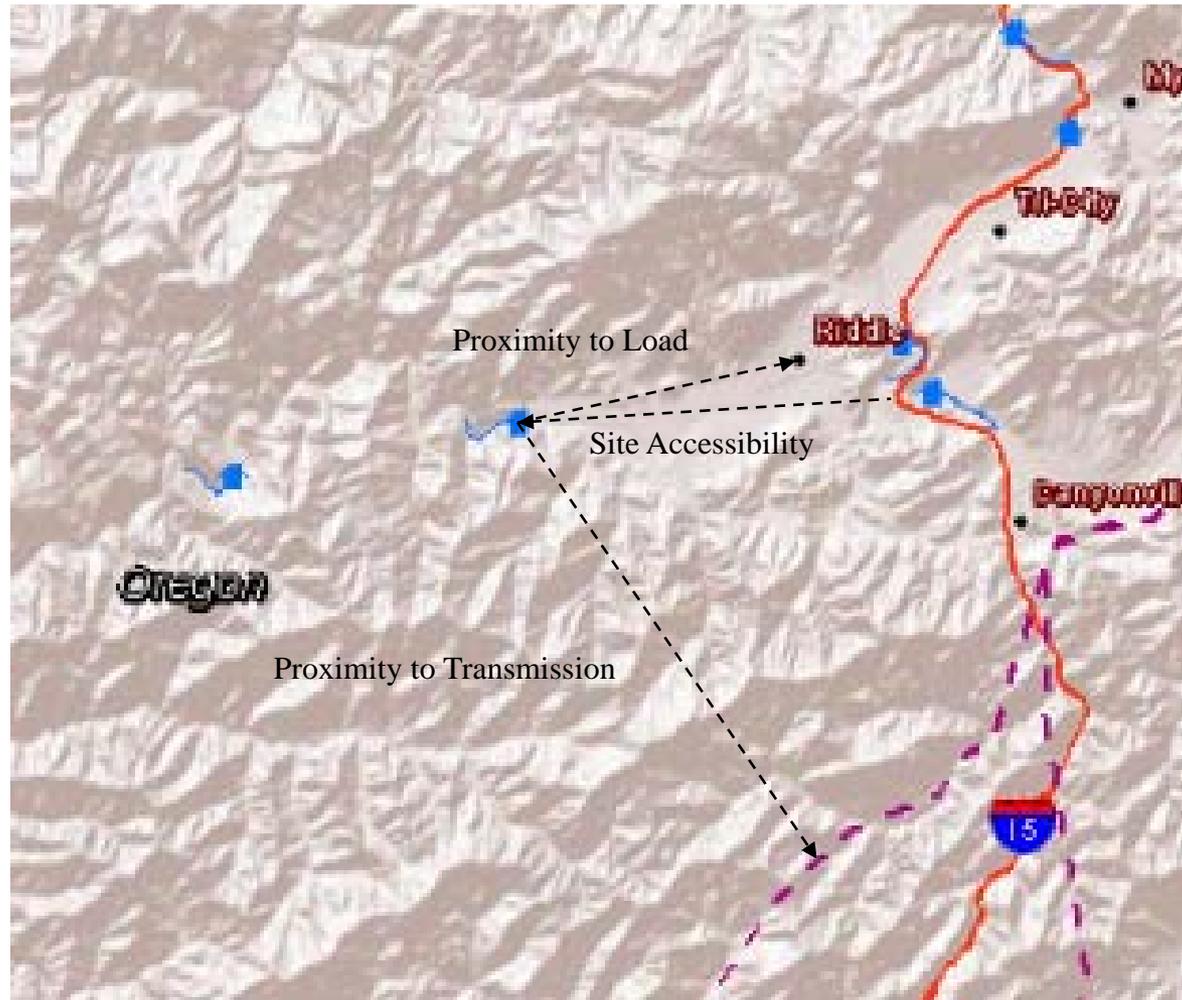
- Capacity potential: 10 MW
- Flow rate average: 459 cfs
- Hydraulic head: 122 ft

Site Characteristics

- Reach length: 1.6 mi
- Principal dam maximum height: 141 ft
- Principal dam length: 2,461 ft
- Number of impoundment boundary segments: 2
- Impoundment constructed boundary length: 2,756 ft
- Reservoir area: 191 acres



Basic Project Feasibility



Virtual Hydropower Prospector – U.S.

Map Navigation Tools

Map Print

Legend

Feature Selection Tools

Information Window

Geographic Coordinates Readout

LEGEND

- Water Energy Resource Site
 - High Head/High Power
 - Low Head/High Power
 - High Head/Low Power
 - Low Power Conventional
 - Low Power Unconventional
 - Microhydro
- Potential Projects
 - Small Hydro
 - SH: Powerhouse
 - SH: Penstock
 - Low Power Conventional
 - LPC: Powerhouse
 - LPC: Penstock
 - Low Power Unconventional
 - LPU: Powerhouse
 - LPU: Penstock
 - Microhydro
 - Micro: Powerhouse
 - Micro: Penstock
- BoR Assets
 - BoR Dams
 - BoR Canals
 - BoR Conduits
- Power System
 - Hydro Plants

LOCATION COORDINATES

Longitude: 74° 24' 8" W
Latitude: 39° 22' 15" N

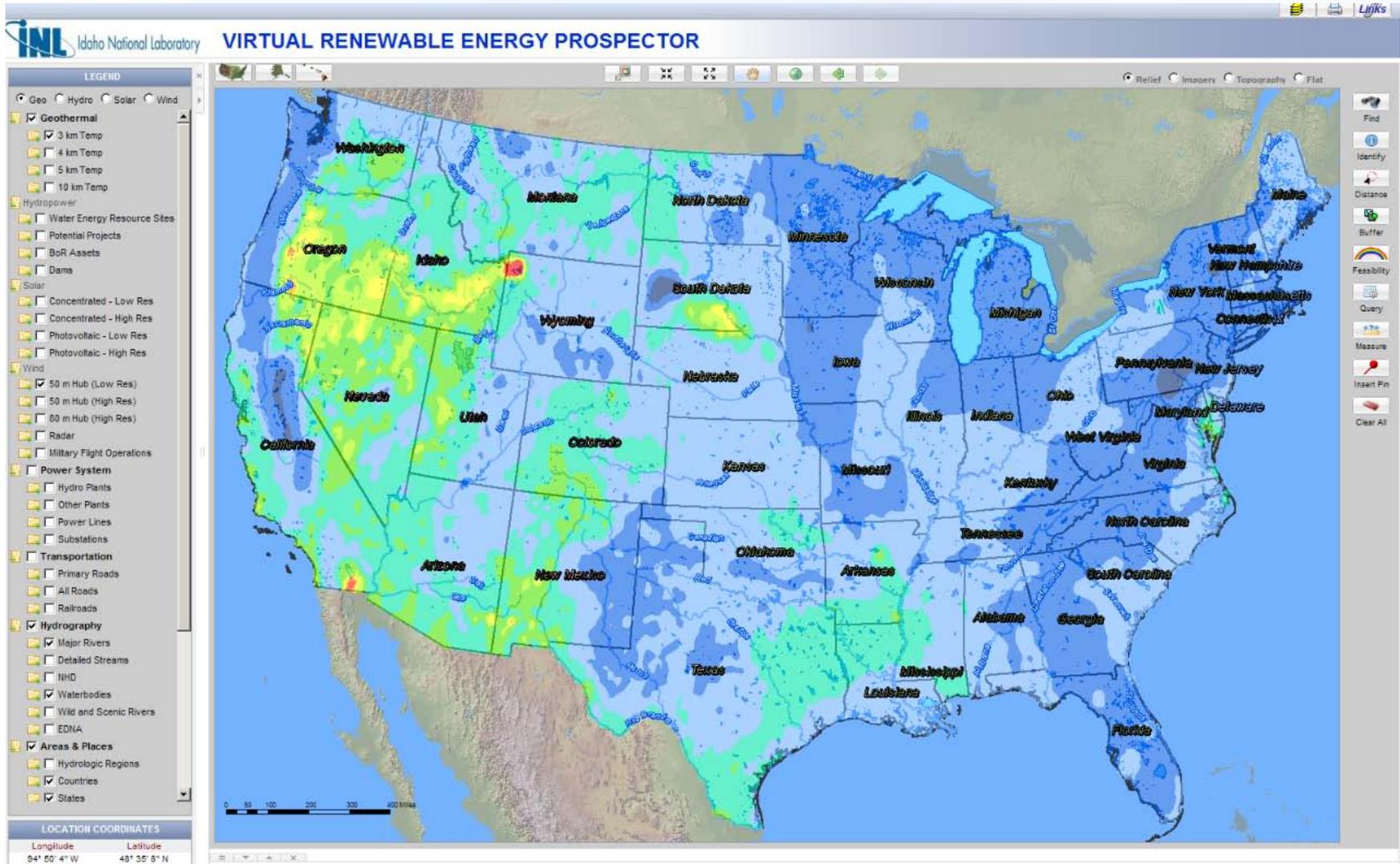
SH: Powerhouse : 116 features

Record #	Actions	Power Class	Candidate	Power (MW)	Working Flow Rate (cfs)	Working Head (ft)	Penstock Length (ft)	Federally Excluded	Environmentally Excluded	State	County	Reach Length (ft)	Reach Power Potential (MW)	Reach Head (ft)	Reach Flow Rate (cfs)	Nearest Road (mi)	Nearest Railroad (mi)	Nearest Population (mi)	Nearest Powerline (mi)	Nearest Substation (mi)	Nearest Plant (mi)
1		Small Hydro	Y	1.953	986.773	23.36	784.66	N	N	Colorado	Delta	9857.71	5.12	30.61	1973.545	0.973	1.091	1.22	2.837	4.626	6.074

Virtual Hydropower Prospector do Brasil



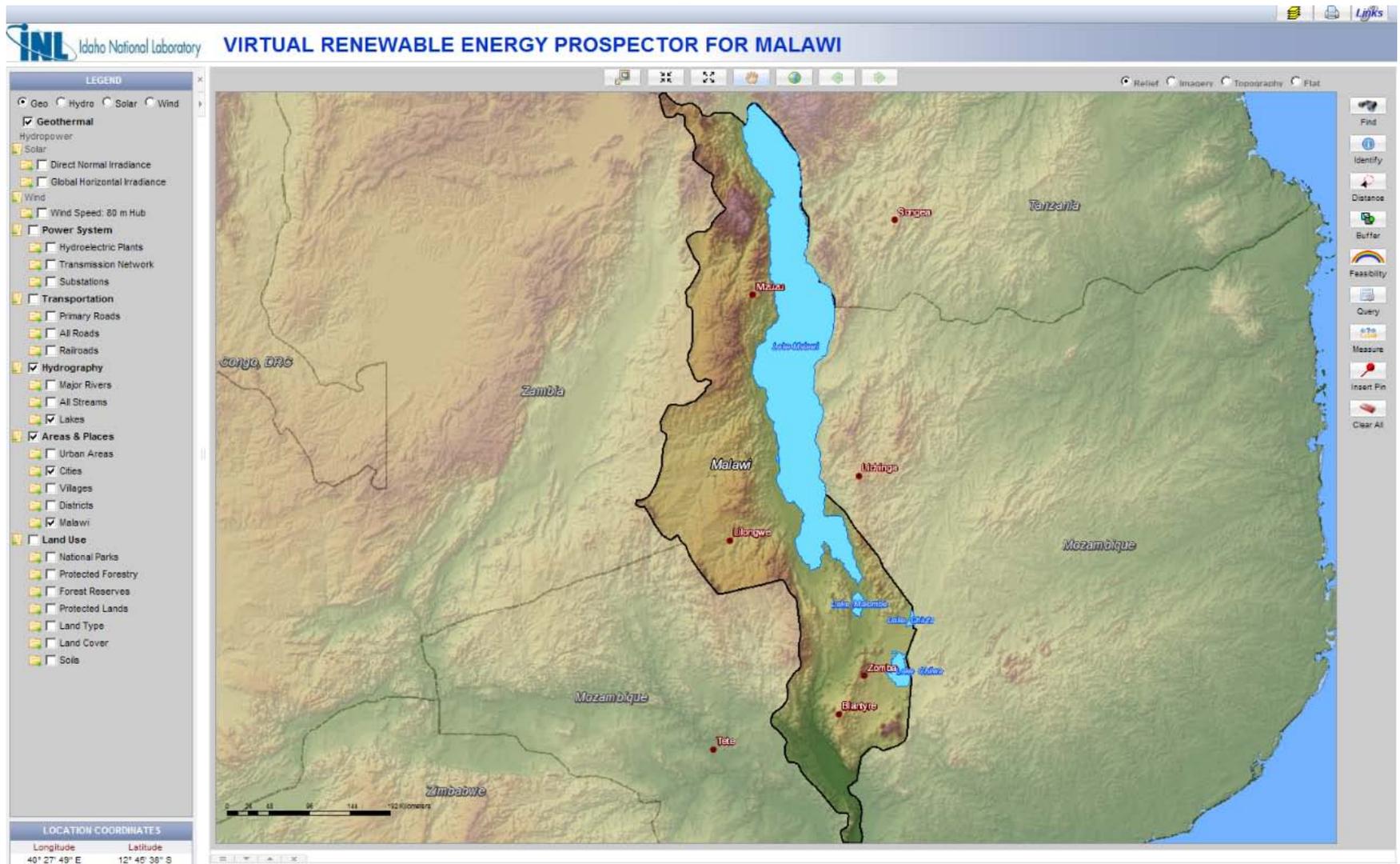
Virtual Renewable Energy Prospector – U.S.



Typical features displayed

- Renewable energy features
 - Geothermal
 - Hydropower
 - Solar
 - Wind
- Hydrography (5 feature sets)
- Power system
 - Hydro plants
 - Other plants
 - Power lines
 - Substations
 - Dams
- Transportation
 - Roads
 - Railroads
- Areas and places
 - Cities
 - Populated areas
 - County boundaries
 - State boundaries
 - Hydrologic region boundaries
- Land Use
 - **Excluded areas**
 - Federally designated
 - Environmentally sensitive
 - **Bureau of Indian Affairs (BIA)**
 - **Bureau of Land Management (BLM)**
 - **Bureau of Reclamation (BOR)**
 - **Department of Defense (DOD)**
 - **U.S. Forest Service (FS)**
 - **U.S. Fish & Wildlife Service (FWS)**
 - **U.S. National Park Service (NP)**

Virtual Renewable Energy Prospector for Malawi



Water Energy Resources to be Mapped

- **Natural streams**
 - Potential energy systems
 - Hydrokinetic technology
- **Constructed waterways** (canals, water supply, water treatment, industrial effluents)
 - Potential energy systems
 - Hydrokinetic technology
- **Tidal estuaries**
 - Hydrokinetic technology
- **Ocean currents**
 - Hydrokinetic technology
- **Waves**
 - Near-shore and off-shore

Hydrokinetic and Wave Technologies



Hydropower Resource Mapping & Renewable Energy Prospecting Tools

- *For more information contact:*

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Douglas.hall@inl.gov

208-526-9525

Access to INL Prospector applications

- *Virtual Hydropower Prospector – U.S.*
<http://hydropower.inl.gov/prospector/index.shtml>
- *Virtual Renewable Energy Prospector – U.S.*
<http://gis-ext.inl.gov/vrep>
- *Virtual Hydropower Prospector do Brasil*
<http://hydropower.inl.gov/prospector-brazil/index.shtml>
- *Virtual Renewable Energy Prospector for Malawi*
<http://arcgisserver.northwind-inc.com/vrepmalawi/>