

# NPD Explorer and NPDamCAT: web tools supporting analysis of non-powered dams

July 22, 2021 12-1pm ET

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# Workshop Agenda

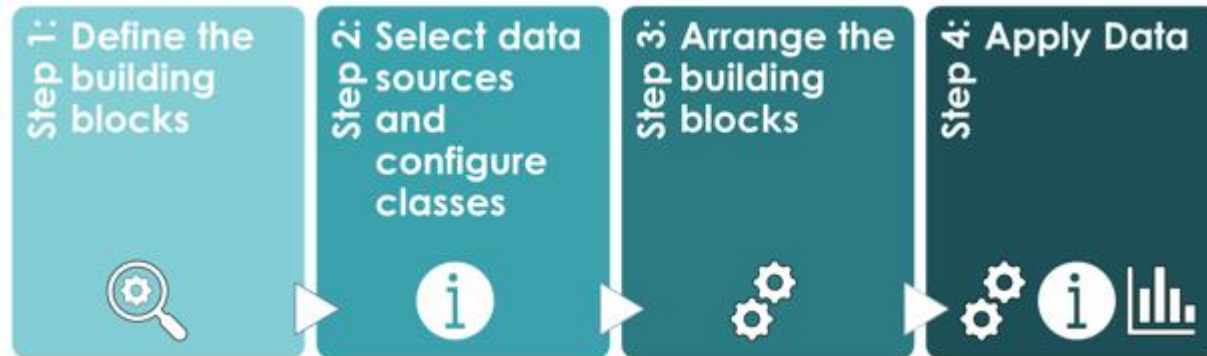
Presenter	Description	Time (ET)
C. Hansen and S. DeNeale	Introduction and kick-off	12:00-12:10pm
C. DeRolph	NPD Explorer App	12:10-12:25pm
F. Carter	NPDam Custom Analysis and Taxonomy App (NPDamCAT)	12:25-12:40pm
B. Saulsbury	Example of large-scale analysis of dams focused on environmental impacts	12:40-12:50pm
C. Hansen	Q&A, wrap-up	12:50-1:00pm

**Acknowledgements:** Colin Sasthav, Mirko Musa, Brennan Smith (ORNL SMH Team), Debjani Singh (ORNL HydroSource PI), Katie Jackson, Kyle Desomber, Tim Welch (DOE WPTO), Greg Baecher (University of Maryland) and Bo Saulsbury (PNNL), Workshop #1 participants

# Recap of Workshop #1 on NPDs

- Held on December 12, 2020
- Part of the Standard Modular Hydropower (SMH) project funded by the Department of Energy's Water Power Technologies Office
- Reviewed major challenges to analyzing non-powered dams:
  - Large and diverse population
  - Data availability/barriers to access
  - Data quality
  - Variety of interests involved

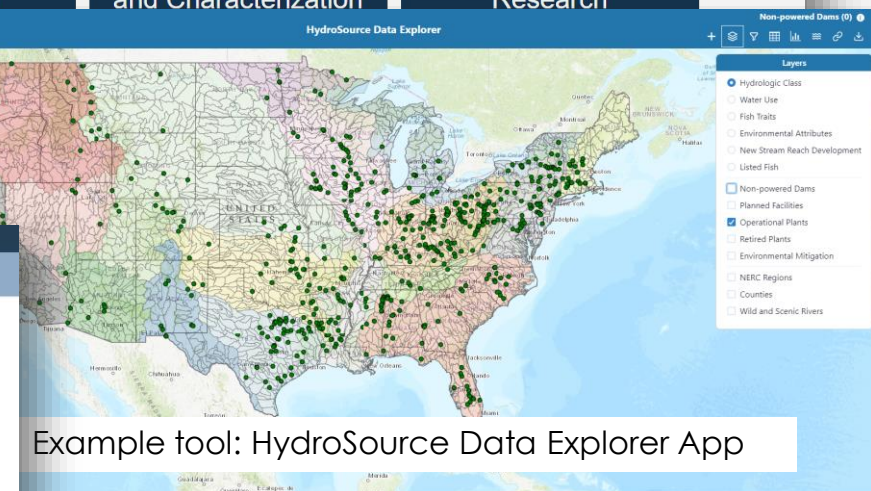
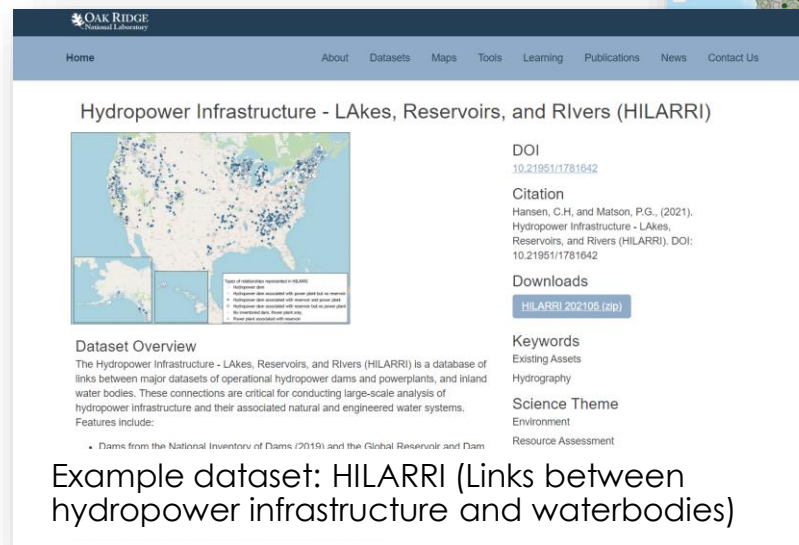
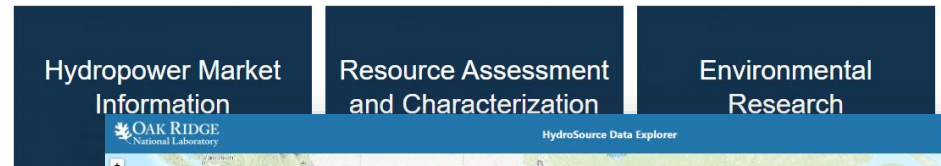
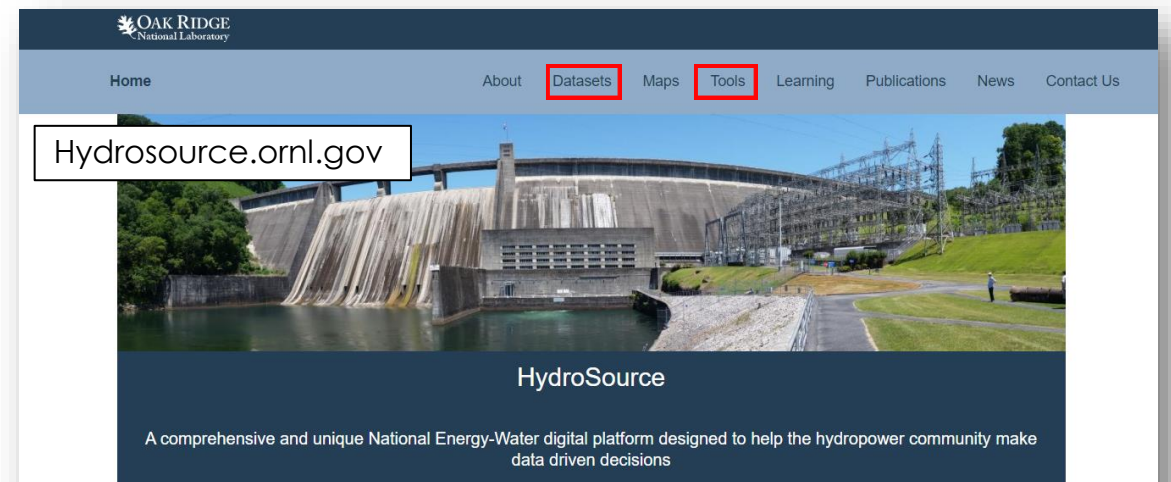
# Recap of Workshop #1 on NPDs



- Objectives:
  - Better understand the backgrounds, priorities, and needs of various stakeholders involved with non-powered dams
  - Present a vision and framework for tackling NPD classification
  - Solicit feedback from a diverse suite of potential users of classification research products and tools

# Workshop #2 Objectives

- Highlight data and tools available through the HydroSource initiative: “digital platform designed to help the hydropower community make data driven decisions”
- Introduce a suite of data and tools being developed to facilitate large-scale dam analysis and exploration of dam data
- Identify remaining features or data of interest to potential users

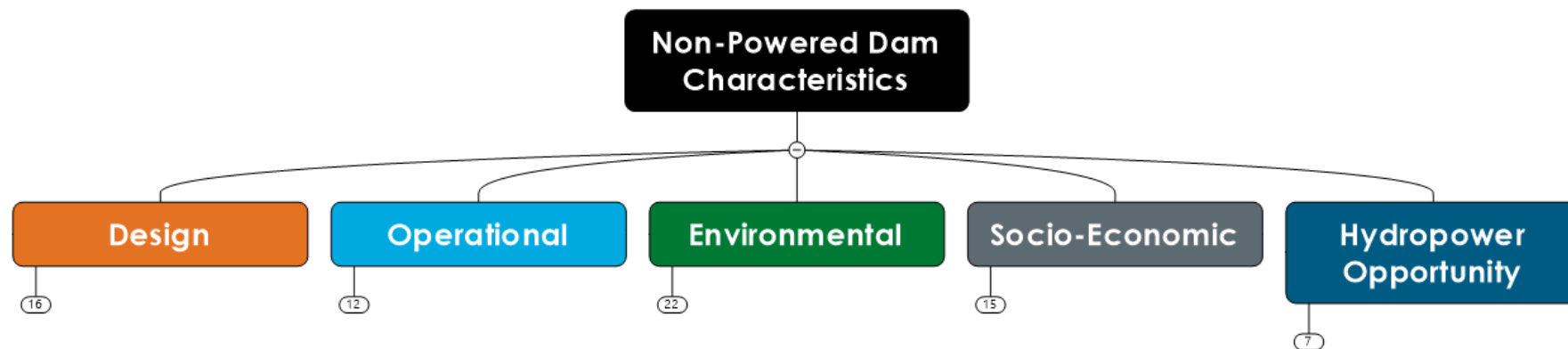


Example tool: HydroSource Data Explorer App

Example dataset: HILARRI (Links between hydropower infrastructure and waterbodies)

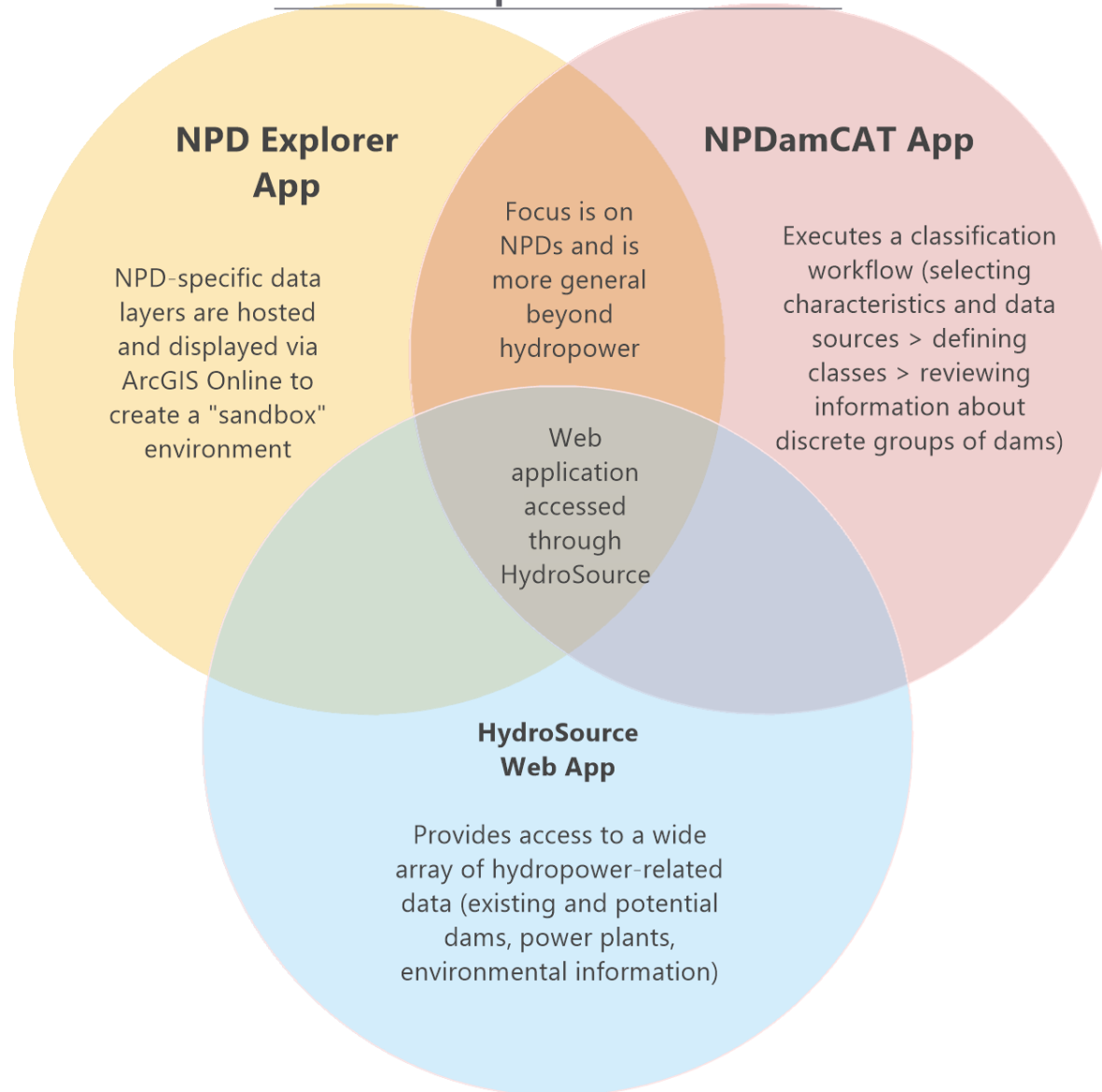
# NPD Characteristics Inventory

- Compilation of data from multiple sources is the fuel for the web apps
  - Address many of the challenges inherent to large-scale analysis of dams
  - Major “building block” used in exploring dams and creating taxonomies of dams



# Overview of Tools

## Tools that facilitate exploration and understanding of Non-powered Dams



# NPD Explorer

Sandbox environment for open-ended exploration of non-powered dams





# Functionality

The basic functionality of NPD Explorer falls into three categories:

- **Data layers** provide geospatial information about different NPD and landscape characteristics.
  - There are currently **10 data layers** in NPD Explorer
- The **user queries** function allows users to input specific search criteria, visualize results, and download data summaries.
  - There are currently **>120 attributes** that users can query in NPD Explorer
- **Data interactivity** is available to users through common map interactivity tasks like selections and identifying spatial features, as well as a series of **infographics and charts** that summarize query results

# User interface

Map navigation

Data layers

Project website

Overview map

The screenshot displays the NPD Explorer beta web application. The main map shows the United States with a blue overlay representing NPD locations. A layer list on the left includes options like 'Electric Substations', 'U.S. Electric Power Transmission Lines', 'USA States (Generalized)', and 'NPD locations'. The bottom toolbar contains icons for map navigation and data interaction. Below the map is a data table with columns for various attributes.

NST_TYPE	COMID	CORE_MTRL	COUNTY	CULTURE	DAM_HT	DAM_LEN	DAM_NAME	DAM_VOL	DRNG_AREA	ECOREGION	EST_HYD_HD	FED_OP	FED_OP_OWN	FED_REG	FEMA_HZRD	FND_MTRL	FTYPE	GATE	GEN_MWHA	HUC_12	HUC_2	HUC12_POP	HYD_HT	IMP303D_BIO	IMP303C
ravity	22,205,105.00		CLAY		7.62	52.12	LAKE CHINNABEE DAM		20.72	HUDSON PLAIN	5.33	Federal agency involved in operation	Federal agency owner is same as federal operating entity	Dam is under federal regulatory authority	Low		StreamRiver	Some type of gate/control structure reported		31,501,060,50	3	510.79		0.00	0.00
	22,201,475.00		CLEBURNE		9.75	62.48	COLEMAN LAKE		5.18		6.83	Federal agency involved in operation	Federal agency owner is same as federal operating entity	Dam is under federal regulatory authority	Low		StreamRiver	Some type of gate/control structure reported		31,501,060,50	3	155.88		0.00	0.00

Layer attributes

Map setup, querying, interactivity, and analytical tools

# Map tools

The screenshot displays the NPD Explorer beta web application interface. The main map area shows a satellite view of a region with red lines representing electric power transmission lines and blue dots representing NPD locations. Several tool panels are overlaid on the map:

- Basemap Gallery:** A panel on the left side showing various map styles such as Dark Gray Canvas, Imagery, Imagery with Labels, Light Gray Canvas, National Geographic, Oceans, OpenStreetMap, Streets, Terrain with Labels, and Topographic.
- Layer List:** A panel on the left side listing various layers, including Measurement, OR, WA, ID layer, Electric Substations, USA States (Generalized), NPD locations, U.S. Electric Power Transmission Lines, NHDPlus waterbodies, NHDPlus streams, Level I Ecoregions of North America, NHDPlus catchments, Watershed Boundaries, and USA Protected Areas - GAP Status 1-4.
- Legend:** A panel on the left side showing the legend for the U.S. Electric Power Transmission Lines layer, with color-coded lines representing different voltage levels: Under 100 (Kilovolts), 100-161 (Kilovolts), 220-287 (Kilovolts), 345 (Kilovolts), 500 (kilovolts), 735 and Above (Kilovolts), Not Available, and Other.
- Add Data:** A panel in the center showing options to add data from a file (CSV, KML, GPX, GeoJSON) or a URL.
- Bookmark:** A panel on the right side showing a list of bookmarks, including "OH River".
- Draw:** A panel on the right side showing drawing tools and options for selecting draw mode, color, transparency, outline color, and outline width.
- Measurement:** A panel on the right side showing measurement tools and options for showing area and perimeter measurements.

Green lines are drawn across the map, connecting the tool panels to the map area, indicating the interaction between the tools and the map data.

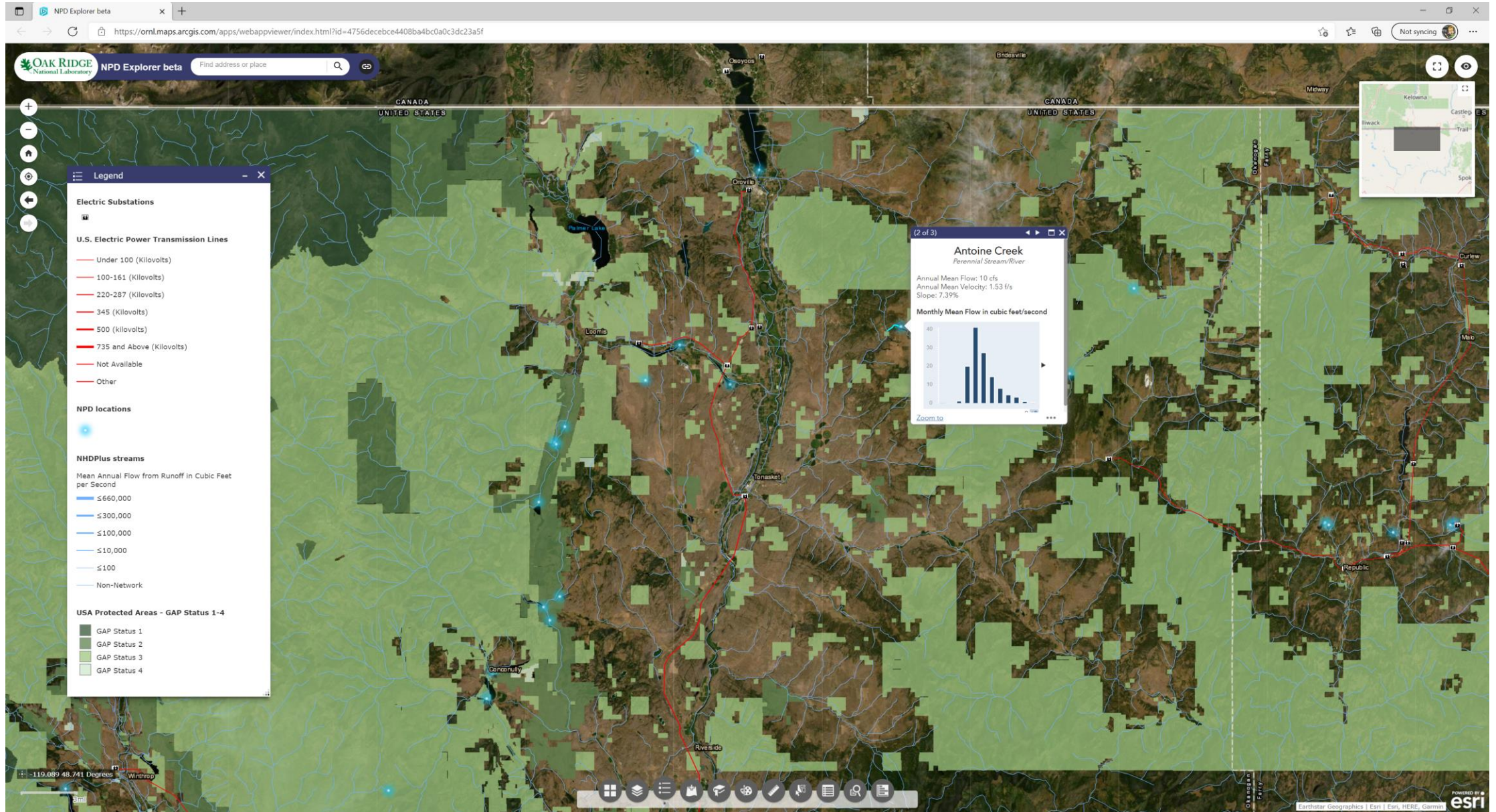
# Select, query, and infographics tools

The screenshot displays the NPD Explorer beta web application interface. The main map area shows a geographic region with numerous blue circular markers representing NPD locations. On the left, a 'Select' panel lists various layers, with 'NPD locations' checked. A 'Query' panel is open, showing a list of query criteria such as 'STATE is any of', 'PRMRY\_MTRL is any of', etc., with an 'Apply' button at the bottom. On the right, a 'Head and flow infographic' panel displays a horizontal bar chart titled 'Hydraulic head and 30% exceedance flow' for various WQID codes. Below the map, a 'Query infographics' panel is visible. At the bottom, a data table is shown with columns for various attributes like PERC90Q, PRMRY\_MTRL, and W\_AREA.

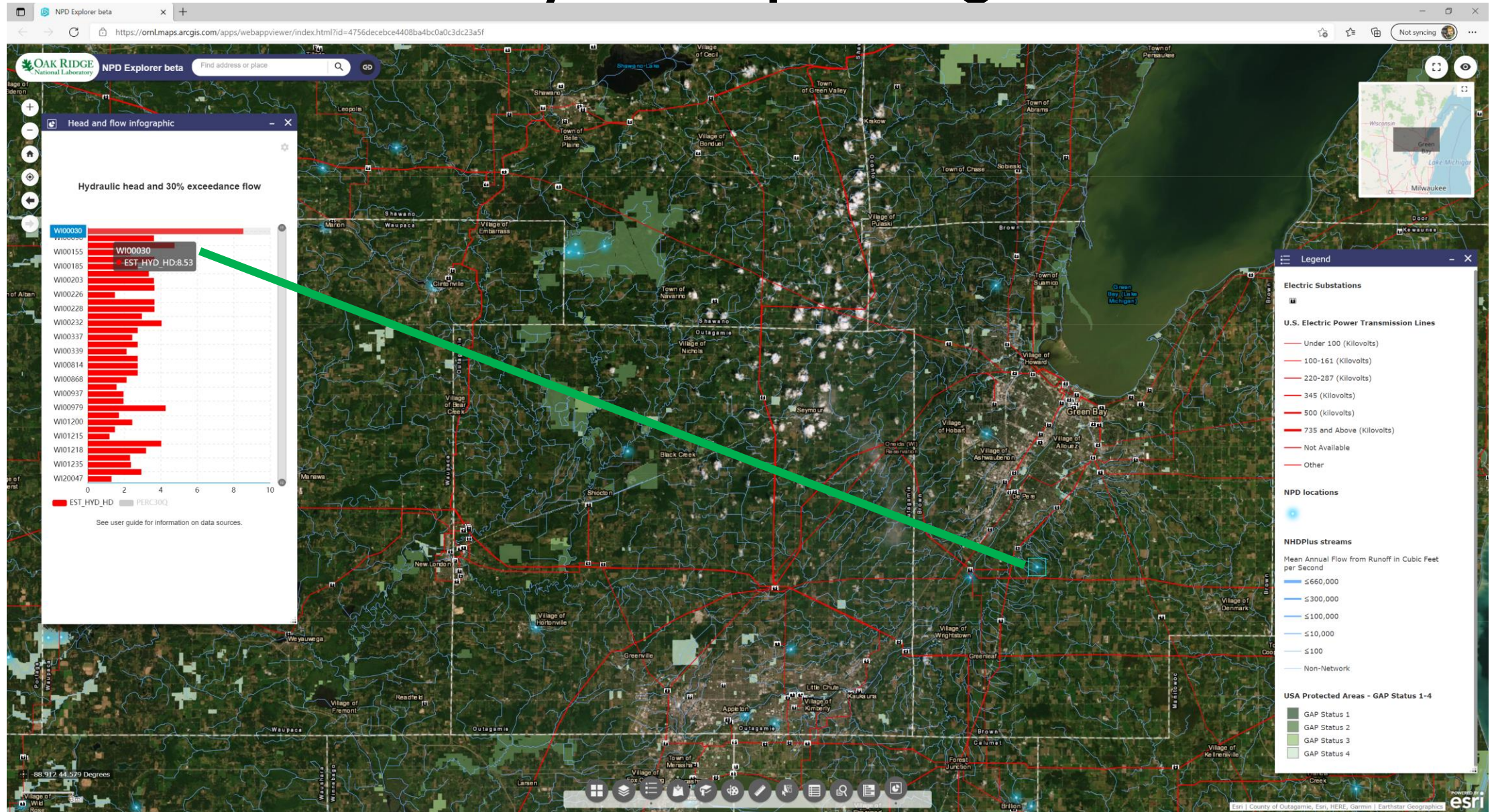
PERC90Q	PRMRY_MTRL	PROT_MGMT	PROT_TYPE	PROTSTATUS	PRPS_GEN	PRPS_PRMY	Q_EROM	RCRTN	RECORDID	REG_FERC	RIVER	SPLLWYTYPE	SRFC_AREA	STATE	STATUSFLAG	STR_HT	TRI_DENSC	TRI_DENSV	W_AREA	W_CHEMREG	W_CLAY	W_ELEV	W_HIURBAN	W_HMAXTEMP	W...
0.00	Masonry			Dam is not on protected land	Storage	Water Supply	12		7,413	Dam likely would fall under FERC regulatory authority	CRICKER BROOK		176.85	CT			0.00	0.00	15.30	0.93	6.19	105.81	0.33	15.92	-6.05
0.03	Concrete			Dam is not on protected land	Storage	Recreation	17		7,414	Dam likely would fall under FERC regulatory authority	SASCO BROOK		3.72	CT			0.00	0.00	23.35	0.91	5.21	62.16	0.40	16.21	-5.98

7743 features 0 selected

# Layer interactivity



# Dynamic panning



# Create new layers

The screenshot shows the NPD Explorer beta web application interface. A 'Create layer' dialog box is open over the map, with the text 'Muskingum Lock and Dam 11' entered in the input field. Below the map, a data table is displayed with the following columns and data:

CLIM_FUTD	CLIM_PRES	CLIM_PRESD	CNST_TYPE	COMID	CORE_MTRL	COUNTY	CULTURE	DAM_HT	DAM_LEN	DAM_NAME	DAM_VOL	DRNG_AREA	ECOREGION	EST_HYD_HD	FED_OP	FED_OP_OWN	FED_REG	FEMA_HZRD	FND_MTRL	FTYPE	GATE	GEN_MWHA	HUC_12	HUC_2	HUC1
Temperate, no dry season, hot summer	Dfa	Cold, no dry season, hot summer		15,379,475.00		MUSKINGUM		4.66	103.63	MUSKINGUM RIVER LOCK AND DAM NO. 11	6,575.17	15,633.18	TUNDRA	3.26	No federal agency involved in operation	No federal agency involved in operation	Dam is not under federal regulatory authority	Significant	ArtificialPath	Some type of gate/control structure reported	37102.67502	50,400,040,30	5		11,715

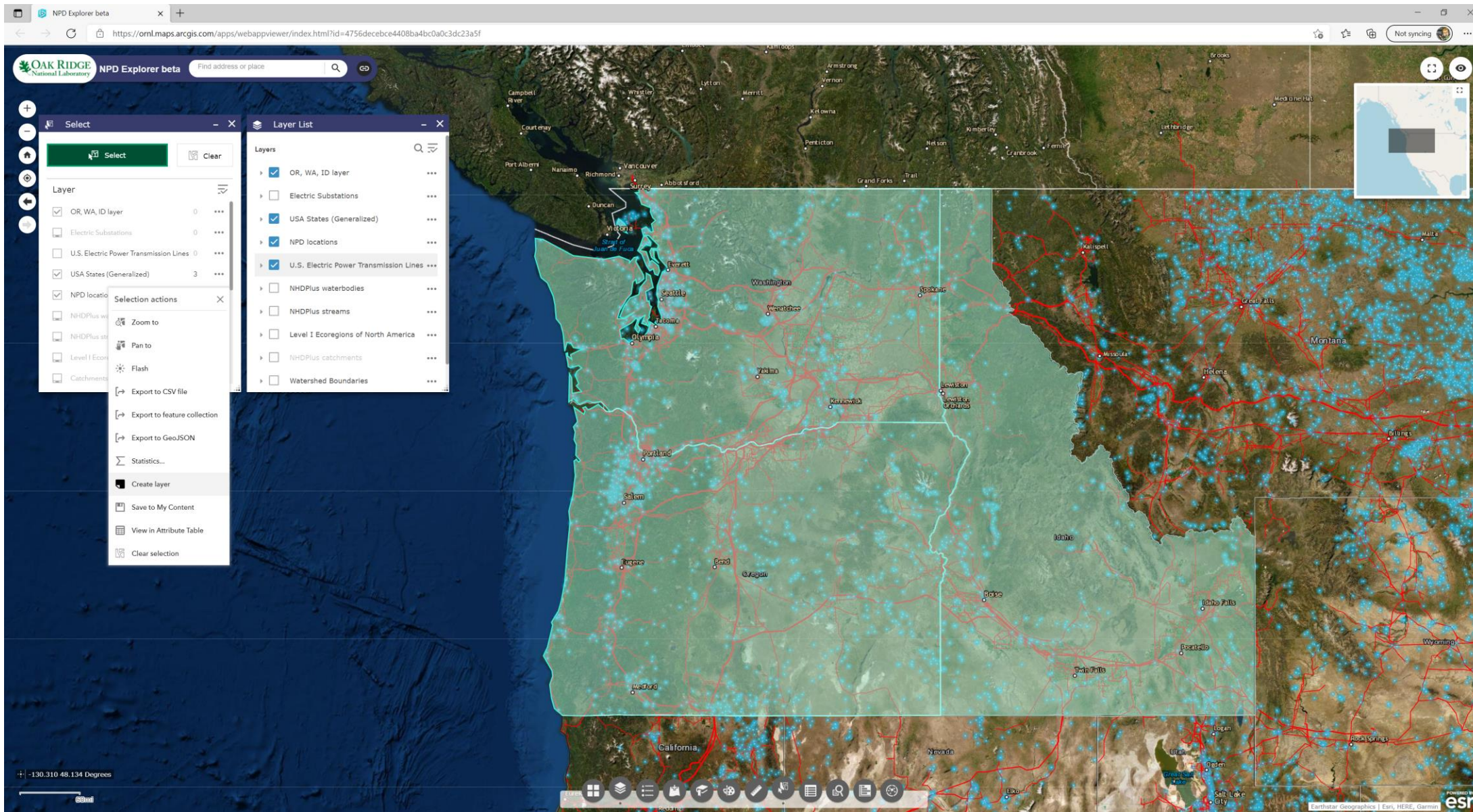
# Download data

The screenshot displays the NPD Explorer beta web application interface. The main map shows an aerial view of the Muskingum River Lock and Dam No. 11 area. A 'Select' popup menu is open on the left, showing a list of layers and selection actions. The attribute table at the bottom provides detailed metadata for the selected dam structure.

OBJECTID	60088	PRPS_PMRY	Recreation	C_HYDREG	0.9438879	W_SEDREG	0.9390892
RECORDID	61435	PRPS_GEN	Storage	W_HYDCON	0.9365236	C_SEDREG	0.9434728
NIDIDFULL	OH00701	EST_HYD_HD	3.264408	C_HYDCON	0.9633129	W_CLAY	23.95906
NIDID	OH00701	FED_OP	No federal agency involved in operation	W_HPRECIP	1010.348	C_CLAY	21.10114
DAM_NAME	MUSKINGUM RIVER LOCK AND DAM NO. 11	FED_OP_OWN	No federal agency involved in operation	C_HPRECIP	1008.772	W_SAND	20.64443
OTHER_DAM_NAME	ELLIS NO. 11	MAX_STRG	1802114.28	W_HMNTMP	10.20452	C_SAND	27.09883
OTHERSTRUCTUREID		NORM_STRG	1802114.28	C_HMNTMP	11.0305	W_OM	0.7523031
LATITUDE	40.0431508	MAX_DISCH	328.3055194	W_HMAXTEMP	15.71642	C_OM	0.3898104
LONGITUDE	-81.97698425	OWNER_TYPE	State	C_HMAXTEMP	16.87848	W_PERM	4.50814
LOC_FLAG	Coordinates based on update from 2012 NPD Resource Assessment	OWNER_GEN	Other	W_HMINTEMP	-7.60136	C_PERM	7.704147
STATE	OH	HUC12_POP	11715.64432	C_HMINTEMP	-7	W_RCKDEP	138.142
COUNTY	MUSKINGUM	CULTURE		CLIM_PRES	Dfa	C_RCKDEP	141.885
RIVER	MUSKINGUM RIVER	RCRTN	Dam serves some recreational purpose	CLIM_PRESD	Cold, no dry season, hot summer	x	-9125636.441
COMID	15379475	AGE	180	CLIM_FUT	Cfa	y	4872214.928
FTYPE	ArtificialPath	FEMA_HZRD	Significant	CLIM_FUTD	Temperate, no dry season, hot summer		
STATUSFLAG		FED_REG	Dam is not uner federal regulatory authority	ECOREGION	TUNDRA		
HUC_2	5	Q_EROM	7698	PROT_MGMT			
HUC_12	50400040305	MNANNAVQ	188.808	PROT_TYPE			
MTRL	Timber Crib	MAXDLYQ	1239.544	PROTSTATUS	Dam is not on protected land		
PRMRY_MTRL	Timber Crib	MINDLYQ	14.6188	ACCESS			
CORE_MTRL		PERC10Q	459.1549	BIODIV_LIM	Dam is not on protected land		
FND_MTRL		PERC20Q	300.9802	WSR	Not in W&S River protected area		
CNST_TYPE		PERC30Q	216.8622	W_IMPERV	6.88214		
HYD_HT		PERC40Q	161.84	C_IMPERV	5.466667		
DAM_HT	4.66344	PERC50Q	121.3832	W_RDDENS	2.614092		
STR_HT		PERC60Q	90.39061	C_RDDENS	2.640981		
MAX_HT	4.66344	PERC70Q	67.38931	W_HIURBAN	0.5247483		
DAM_LEN	103.632	PERC80Q	49.62475	C_HIURBAN	0		
DAM_VOL	6575.173	PERC90Q	34.95615	NPDES_DENS	0.002045242		
GATE	Some type of gate/control structure reported	DRNG_AREA	15633.18	NPDES_DENS	0		
NUM_LOCKS	0	W_AREA	15646.07	TRI_DENS	0.02908078		
LOCKS	No locks	C_AREA	1.899	TRI_DENS	0		
SPLLWYTYPE		W_ELEV	325.0485	IMP303D_TOT	26.39875444		
CAP_MWA	8.827624915	C_ELEV	235.0536	IMP303D_BIO	0		
GEN_MWHA	37102.67502	SRFC_AREA	142.4495	IMP303D_NUT	0.073256377		
CF_A	47.97966865	W_RUNOFF	385.525	IMP303D_T	0		
REG_FERC	Dam likely would fall under FERC regulatory authority	C_RUNOFF	399	W_CHEMREG	0.890954		
MULTI_PRPS	Single purpose	W_HYDREG	0.9275672	C_CHEMREG	0.9004055		



# Select Features



# Query features (1)

The screenshot displays the NPD Explorer beta web application interface. The main map shows a geographic area covering parts of Washington, Oregon, and Idaho, with numerous blue dots representing data points. Two query panels are open on the left side of the screen.

**Left Query Panel (NPD locations v23):**

- Tasks: NPD locations v23
- Query criteria:
  - STATE is any of: 0 selected
  - PRMRY\_MTRL is any of: 0 selected
  - CORE\_MTRL is any of: 0 selected
  - FND\_MTRL is any of: 0 selected
  - CNST\_TYPE is any of: 0 selected
  - LOCKS is: - empty -
  - SPLLVYTYPE is any of: 0 selected
  - REG\_FERC is: - empty -
  - PRPS\_PRIMARY is any of: 0 selected
  - PRPS\_GEN is any of: 0 selected
  - FED\_OP is: - empty -
  - FED\_OP\_OWN is any of: 0 selected
  - OWNER\_TYPE is any of: 1 selected
  - OWNER\_GEN is any of: 0 selected
  - CULTURE is: - empty -
  - RCRTN is any of: - empty -
- Buttons: Apply

**Right Query Panel (NPD locations v23):**

- Tasks: NPD locations v23
- Query criteria:
  - FED\_REG is: 2 selected
  - CLIM\_PRESD is any of: 0 selected
  - CLIM\_FUTD is any of: 0 selected
  - ECOREGION is any of: 0 selected
  - PROT\_MGMT is any of: 0 selected
  - PROT\_TYPE is any of: 0 selected
  - PROTSTATUS is: Dam is not on protected land
  - ACCESS is any of: 0 selected
  - BIODIV\_LIM is any of: 0 selected
  - WSR is: - empty -
- Spatial filters:
  - Only return features that have a spatial relationship with features in another layer
  - Spatial relationship: Intersect
  - Related layer: OR, WA, ID layer
  - Apply a search distance to selected features
  - Search distance: 0 Miles
- Result layer name: NPD locations v23 Query result
- Buttons: Apply

# Query features (2)

The screenshot displays the NPD Explorer beta interface. The main map shows the Pacific Northwest region with dam locations marked by yellow circles. A query results panel is open on the left, showing a list of dam features with their IDs and names. Below the map, a table displays the query results for the selected dam.

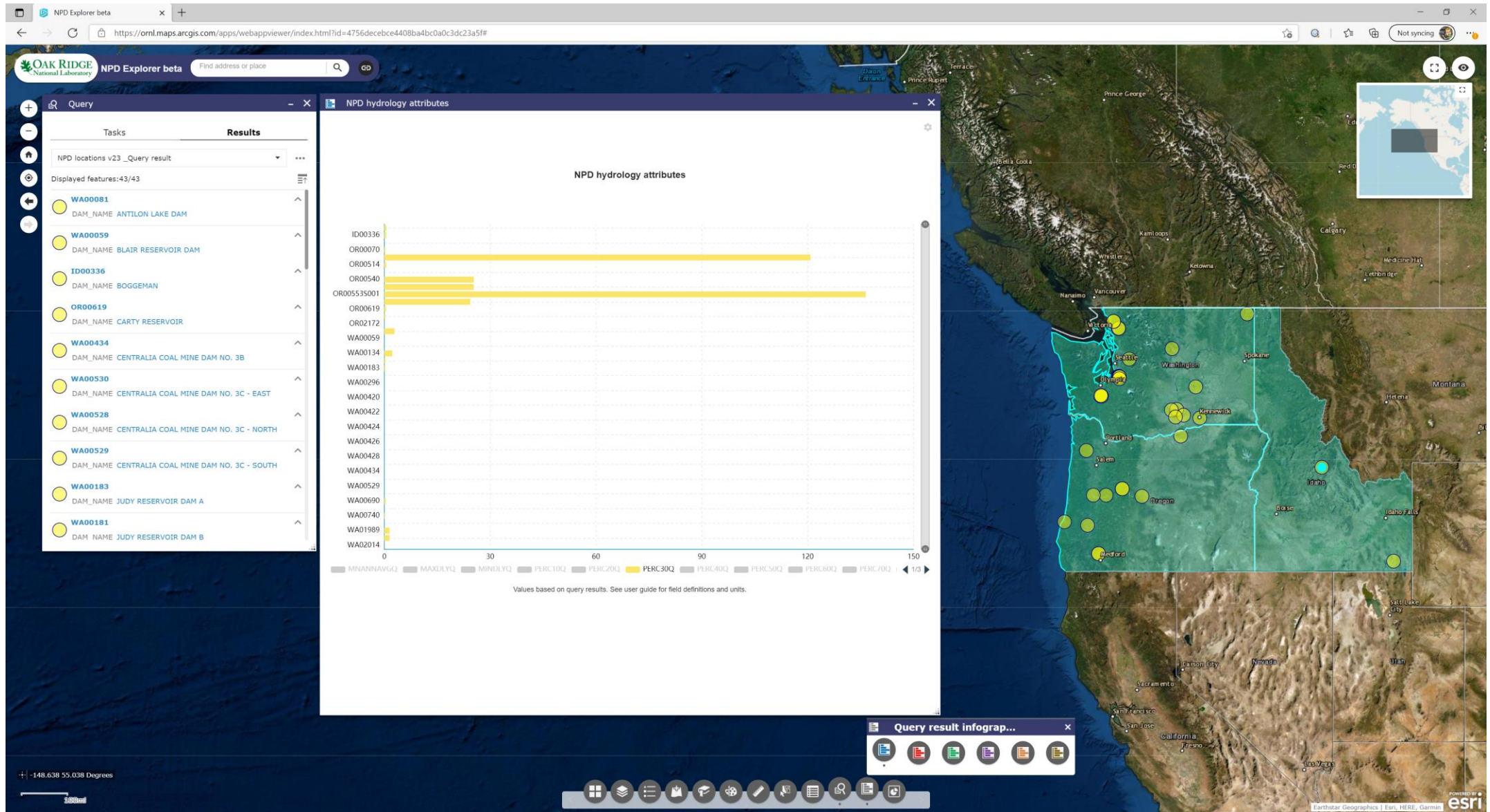
OBJECTID	RECORDID	NIDIDFULL	NIDID	DAM_NAME	OTHER_DAM_1	OTHERSTRUC	LATITUDE	LONGITUDE	LOC_FLAG	STATE	COUNTY	RIVER	COMID	FTYP	STATUSFLAG	HUC_2	HUC_12	MTRL	PRMRY_MTRL	CORE_MTRL	FND_MTRL	CNST_TYPE	HYD_HT	DAM_HT	ST
18719	19,155	ID00336	ID00336	BOGGEMAN			44.86	-114.45	ID	OR	LEMHI	SILVER CREEK	23,532,581.00	StreamRiver		17	170,602,000.0	Earth	Earth	Earth	Rock and Soil		5.18	7.35	
18842	19,281	ID00533	ID00533	ONEIDA DIKE			42.27	-111.75	ID	OR	FRANKLIN	BEAR RIVER	4,559,364.00	Pipeline		16	160,102,000.0	Earth	Earth	Earth	Rock and Soil		9.45	14.33	

# SQL filter

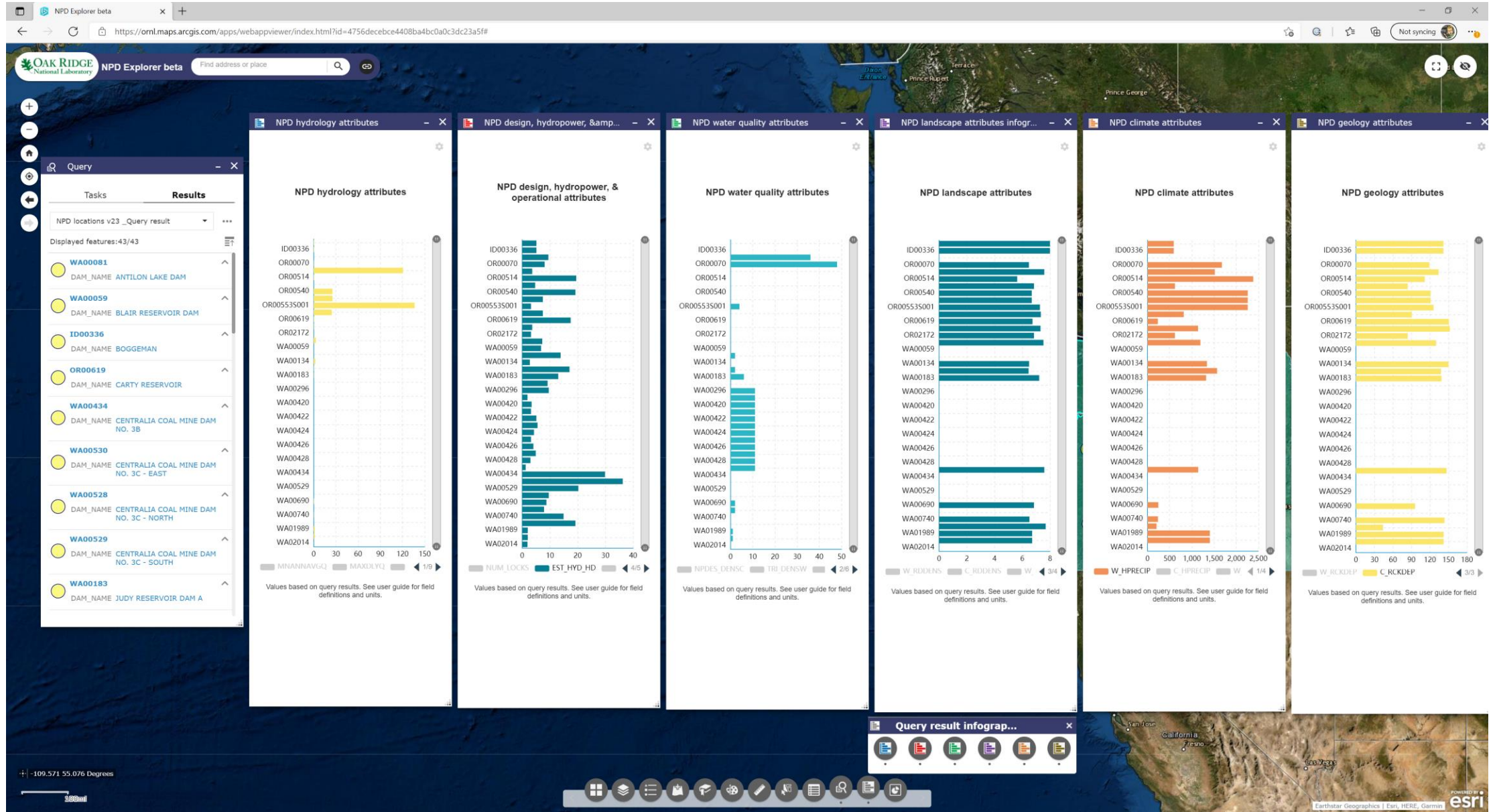
The screenshot shows the NPD Explorer beta web application interface. At the top, there is a search bar with the text "Find address or place" and a search icon. Below the search bar is a map of North America with a blue overlay indicating a selected area. A "Filter" dialog box is open in the center, displaying a list of fields and operators for filtering data. The dialog box has a title "Filter" and a close button "X". It contains two buttons: "+ Add expression" and "+ Add set". Below these buttons, it says "Display features in the layer that match the following expression". The main part of the dialog box is a table with three columns: Field Name, Operator, and Value. The first row is selected, showing "NORM\_STRG (N)" in the first column, "is" in the second column, and "- empty -" in the third column. The second column has a dropdown menu open, showing a list of operators: "is", "is not", "is at least", "is at most", "is less than", "is greater than", "is any of", "is none of", "is between", "is not between", "is blank", and "is not blank". The third column has a dropdown menu open, showing a list of values: "- empty -", "Search", "0.00", "12.33", "123.35", "172.69", "185.02", "246.70", "259.03", and "302.20".

Field Name	Operator	Value
NORM_STRG (N)	is	- empty -
EST_HYD_HD (Number)	is	Search
FED_OP (String)	is	- empty -
FED_OP_OWN (String)	is not	0.00
MAX_STRG (Number)	is at least	12.33
NORM_STRG (Number)	is at most	123.35
MAX_DISCH (Number)	is less than	123.35
OWNER_TYPE (String)	is greater than	172.69
OWNER_GEN (String)	is any of	185.02
HUC12_POP (Number)	is none of	246.70
CULTURE (String)	is between	259.03
RCRTN (String)	is not between	302.20
AGE (Number)	is blank	
FEMA_HZRD (String)	is not blank	
FED_REG (String)		

# Interactive infographics (1)



# Interactive infographics (2)



# NPDamCAT

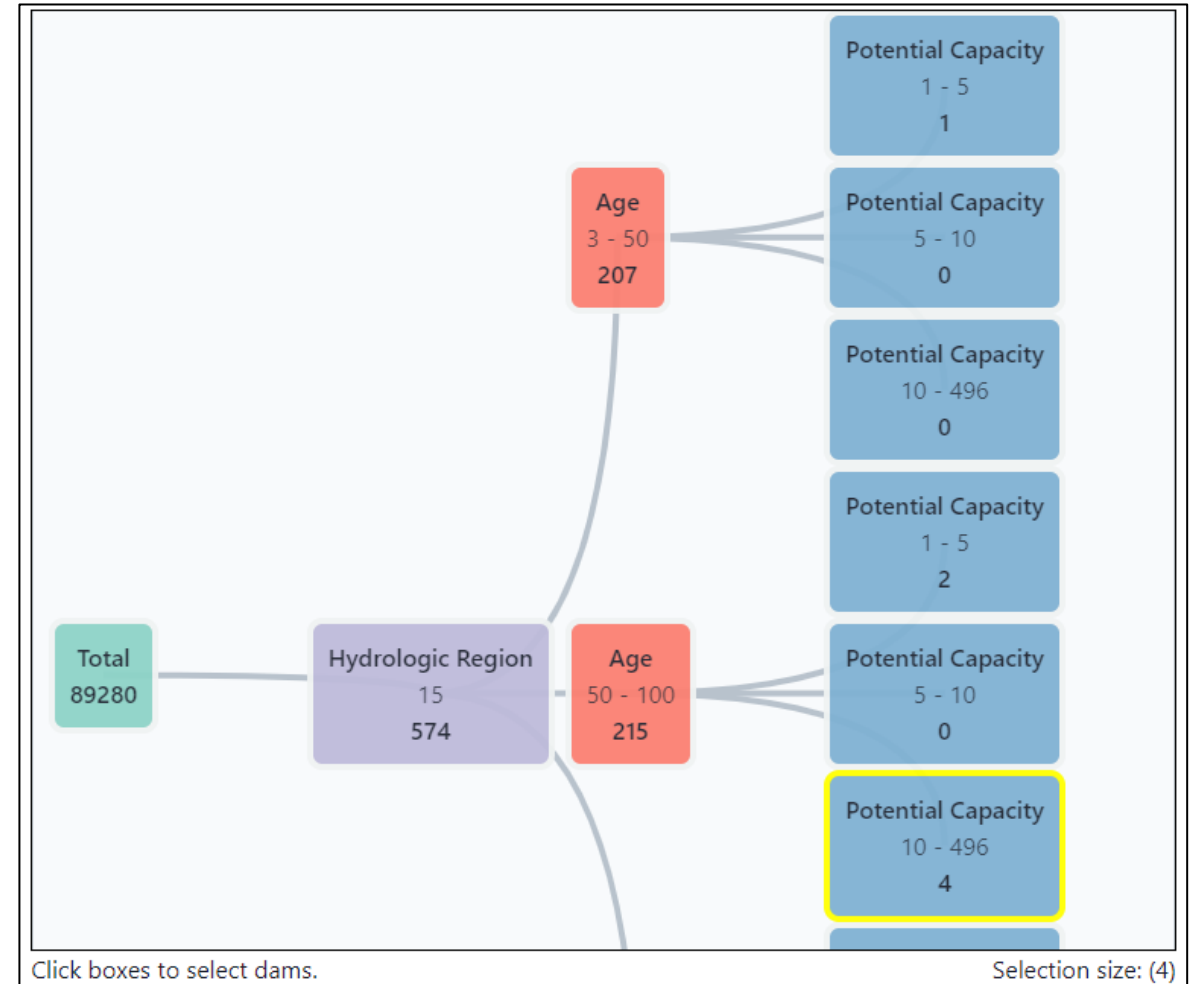
Web app that walks through classification process to group and analyze dams according to a user's interests



# NPDamCAT

This app centers around constructing a **taxonomy diagram**.

1. Choose characteristics
2. Specify classes
3. Select interesting groups in the taxonomy diagram
4. View maps, charts, and download selected NPDs





# Landing Page

First introduced  
in the previous  
workshop

**OAK RIDGE**  
National Laboratory

**NPDamCAT**


### NPDamCAT - Non-Powered Dam Custom Analysis and Taxonomy

The Non-Powered Dam Custom Analysis and Taxonomy (NPDamCAT) tool is being developed by the [Water Power Program](#) at [Oak Ridge National Laboratory \(ORNL\)](#). Funding is provided by the U.S. Department of Energy's [Water Power Technologies Office](#). The NPDamCAT tool facilitates the grouping and classification of Non-Powered Dams using user-defined criteria.

- Step 1: Review possible characteristics and available data sources (the building blocks of a taxonomy)**
- Step 2: Incorporate your preferences and priorities to select how to define your classification scheme**
- Step 3: The app will build a taxonomy structure according to your selections**
- Step 4: The app will retrieve data and create groups of dams**
- Step 5: View and download results**

[Back](#) [Continue](#)

# Characteristics selection

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**NPDamCAT**

Move characteristics to select them.

**Unselected**


- Dam Material (Core)
- Environmental**
  - Historical precipitation in the watershed
  - Hydrologic connectivity component score for catchment
- Hydropower Opportunity**
  - Potential Energy
  - Regional Capacity Factor
  - Regulatory Agency (Energy)
- Operational**

**Selected**

- Hydrologic Region
- Age
- Potential Capacity

[Back](#) [Continue](#)

# Classes

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**NPDamCAT**

Define classes for each characteristic selected in the previous step.

**Hydrologic Region**

huc\_2

- 10
- 11
- 12
- 13
- 14
- 15
- 16
- 17
- 18
- 19
- 20
- 21

**Age**

age +

- 3 - 128
- 128 - 252
- 252 - 381
- 3 - 50
- 50 - 100
- 100 - 381

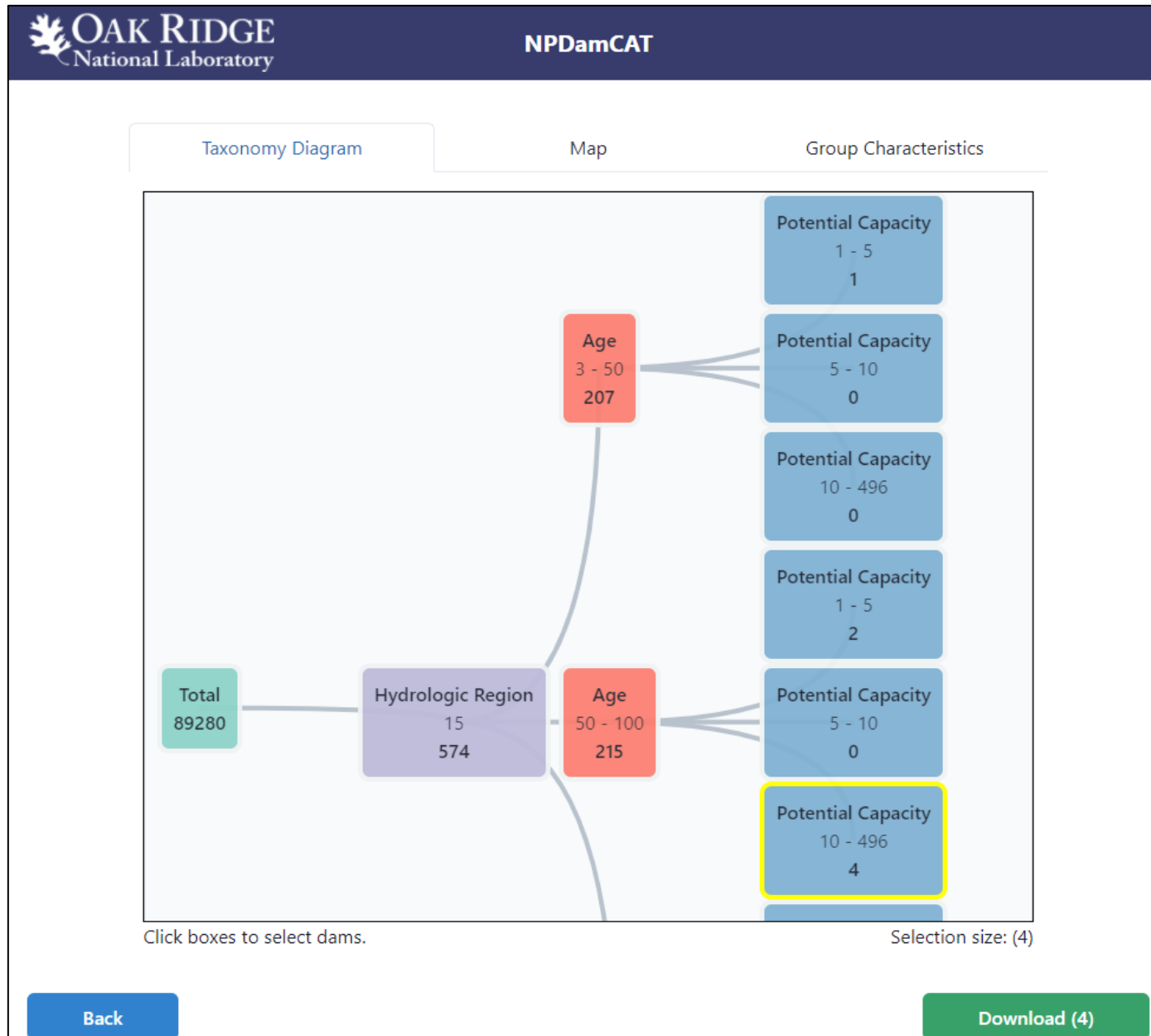
**Potential Capacity**

cap\_mwa +

- 1 - 164
- 164 - 328
- 328 - 496
- 1 - 5
- 5 - 10
- 10 - 496

[Back](#) [Continue](#)

# Taxonomy Diagram



# Map

OAK RIDGE National Laboratory

NPDamCAT

Taxonomy Diagram | **Map** | Group Characteristics

cap_mwa ▲	cf_a ▲	clim_fut ▲	clim_futd ▲	clim_pres ▲	clim_f
25.1665843	34.01330234	BWh	Arid, desert, hot	BWh	Arid, de
54.25971352	34.01330234	BWh	Arid, desert, hot	BWh	Arid, de
17.06880603	34.01330234	BSh	Arid, steppe, hot	BSh	Arid, st
11.12958189	34.01330234	BSh	Arid, steppe, hot	BSh	Arid, st

Leaflet | Tiles © Esri — Esri, DeLorme, NAVTEQ, TomTom, Intermap, IPC, USGS

Back

Download (4)

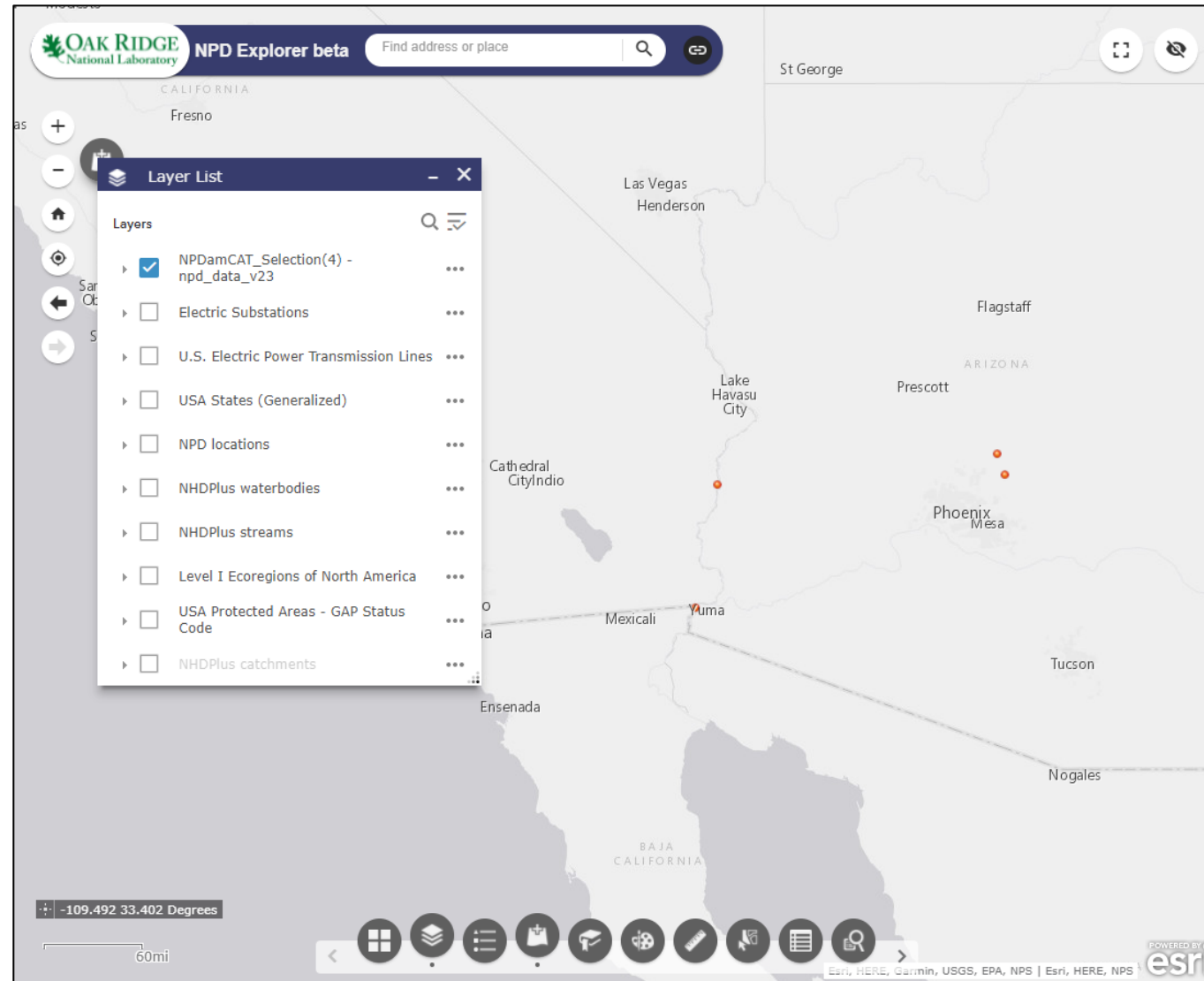
# Group Characteristics



# Download

The screenshot displays the NPDamCAT interface from Oak Ridge National Laboratory. The main content area is titled 'Group Characteristics' and features a bar chart with a single bar reaching a count of 4.0. Below the chart, an attribute dropdown menu is set to 'Access to land'. A modal dialog box titled 'Download Features (4)' is open, providing options for the download format: Shapefile (selected), CSV, JSON, and GML2. A green 'Download' button is located at the bottom of the dialog. At the bottom of the application, there are 'Back' and 'Download (4)' buttons.

# Load selection into NPD Explorer





# Spotlight on large-scale analysis of dam environmental impacts

Bo Saulsbury





**Pacific Northwest**  
NATIONAL LABORATORY

## Highlight of Analyses Supported by NPD Classification: Programmatic Environmental Review of Licensing NPDs

ORNL Workshop “NPD Explorer and  
NPDamCAT: Web Tools Supporting  
Analysis of Non-Powered Dams (NPDs)”

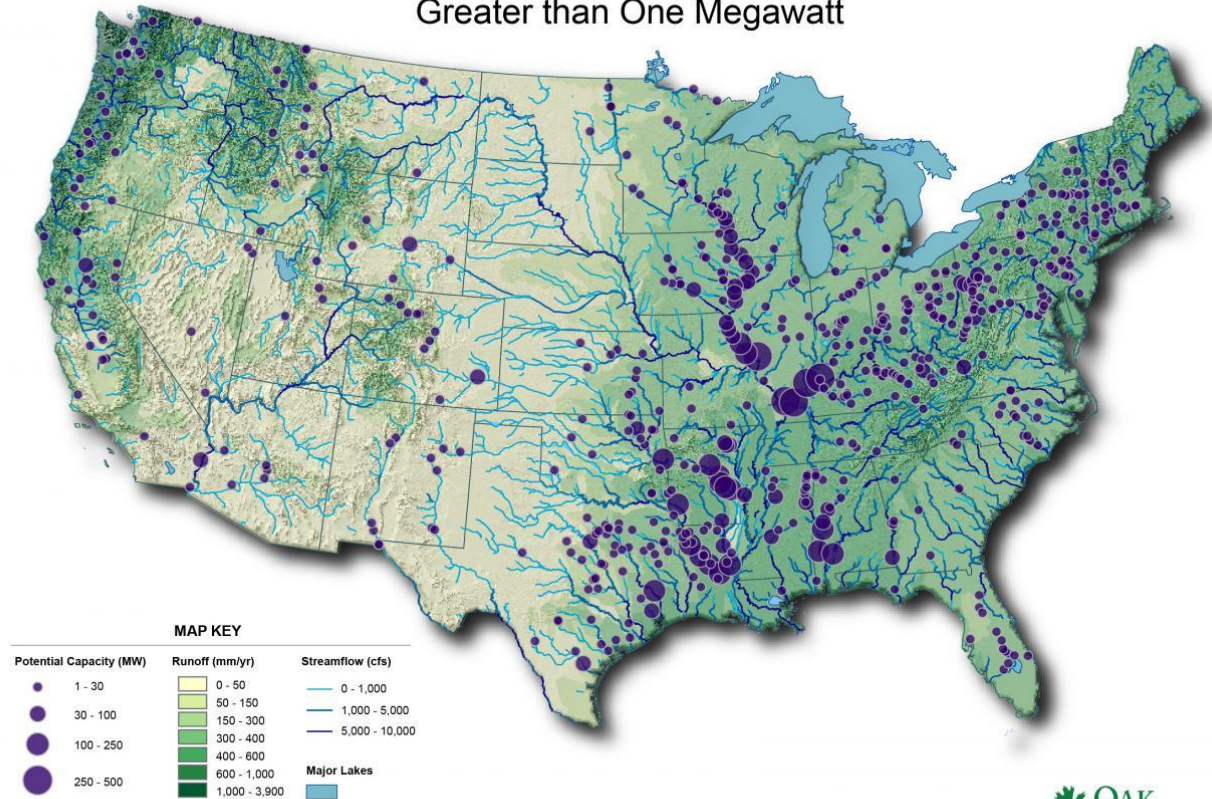
July 22, 2021

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U.S. DEPARTMENT OF  
**ENERGY** **BATTELLE**

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U.S. Non-powered Dams with Potential Capacity  
Greater than One Megawatt



Note: This map has been generalized for cartographic purposes and some streams associated with non-powered dams are not displayed.

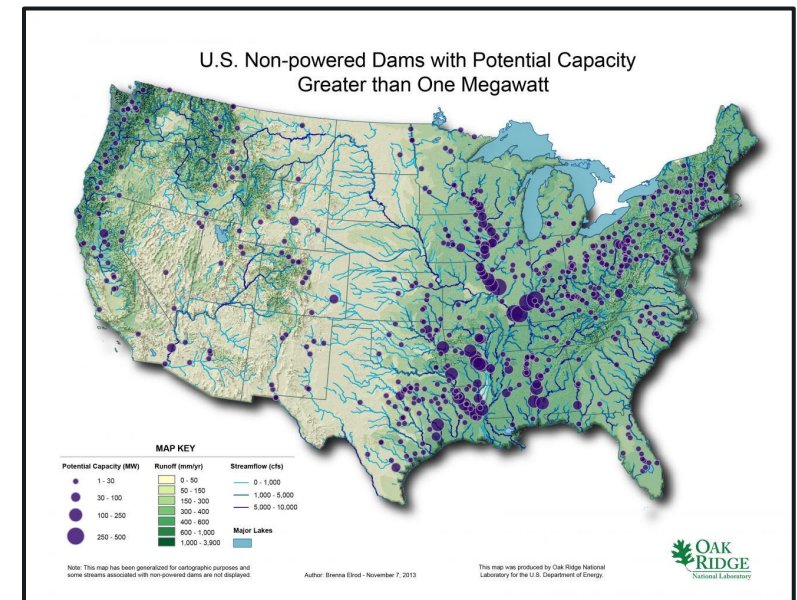
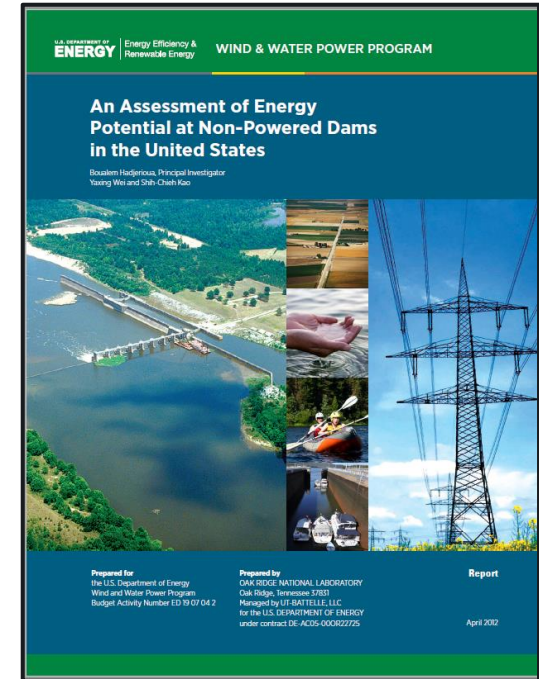
Author: Brenna Elrod - November 7, 2013

This map was produced by Oak Ridge National Laboratory for the U.S. Department of Energy.

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National Laboratory

# Potential

- [2012 ORNL report](#) analyzed 54K+ existing NPDs; adding hydropower facilities could add ~12 GW of new capacity.
- Since 2012: 16 NPDs listed have added hydropower, with total installed capacity of 343.2 MW.
- October 2019: Federal Energy Regulatory Commission (FERC) published list of 230 existing federal NPDs with total potential capacity of ~5.1 GW ([Nonpowered Federal Dams with Potential for Non-Federal Hydropower Development](#)).
- December 2019: NPD projects in the development pipeline had potential installed capacity of ~1.1 GW ([ORNL 2021 Hydropower Market Report](#)).



# Process

- Most NPDs are located on federal lands and/or owned by federal agencies; private developers install hydropower under license issued by FERC.
- In licensing process, FERC conducts environmental review of NPD applications under the [National Environmental Policy Act of 1969 \(NEPA\)](#) (42 USC 4321-4347).
- [America's Water Infrastructure Act of 2018 \(AWIA\)](#) directed FERC to establish *expedited* licensing process for qualifying facilities at NPDs; final FERC decision  $\leq$  **2.0 years** after receipt of completed application.
- April 2019: FERC issued regulations for [NPD expedited licensing process](#).



# Programmatic Environmental Review

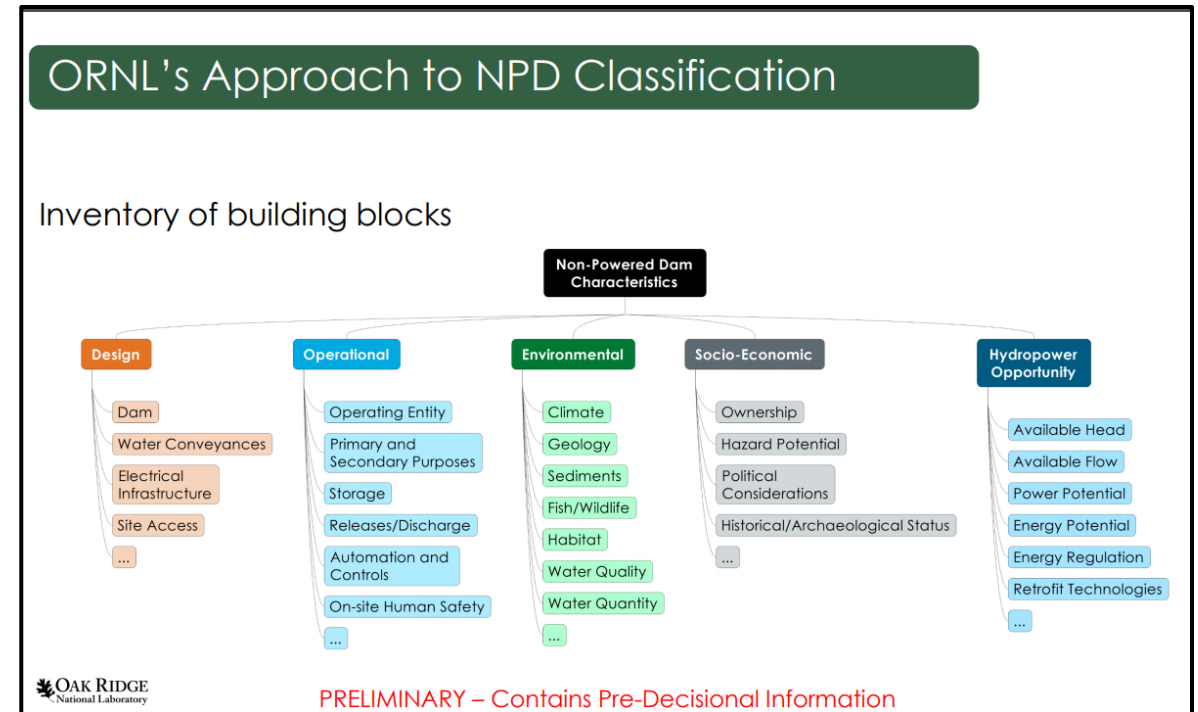
- What could further expedite the FERC NPD licensing process? A **programmatic environmental review** of licensing NPDs nationwide.
- Programmatic review: assess environmental impacts of **broad** federal agency programs or projects under which **subsequent** actions will be implemented.
- Site-specific reviews tier from programmatic review for most resources; focus on distinct site-specific issues.
- NPD licensing is well-suited because:
  - NPDs have many **common characteristics**.
  - NPD development has many **common issues/impacts**.
- Most NPDs can be **classified** (as ORNL is doing) and impacts evaluated as suggested by [CEQ NEPA regulations](#):
  - ✓ **Geographically:** Common locations—on rivers or in basins that can be classified by geographic region.
  - ✓ **Generically:** “Relevant similarities”—common timing, impacts, alternatives, methods of implementation, and subject matter.
  - ✓ **By stage of technological development:** Common technologies—some established, others are demonstrations of new technologies to reduce environmental impacts.



# NPD Programmatic Environmental Review

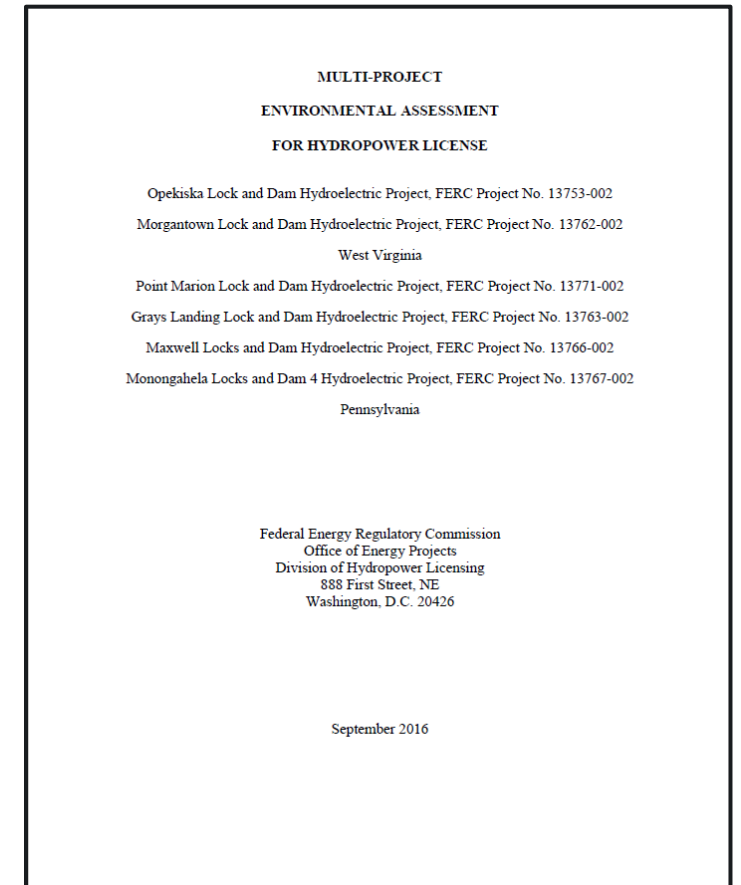
- NPD programmatic review would be based on classification of common characteristics and common issues/impacts into categories for analysis:
  - affected environment (e.g., data on dam locations, types, and sizes; data on potentially affected water bodies and environmental resources);
  - proposed actions (e.g., data on types and sizes of turbines and other equipment proposed; data on proposed project operations and existing operational constraints, environmental and otherwise); and
  - alternatives (e.g., data on alternatives to proposed hydropower equipment and operations).

- ORNL has started this “building blocks” work (from December 2020 workshop).



# NPD Programmatic Environmental Review

- Classification of “Environmental” resources could mirror those typically included in FERC NEPA reviews:
  - Geologic and Soil Resources (“Geology” and “Sediments”)
  - Water Resources (“Water Quantity” and “Water Quality”)
  - Fisheries Resources (“Fish”)
  - Terrestrial Resources (“Wildlife”)
  - Threatened and Endangered Species (“Fish/Wildlife” and “Habitat”)
  - Recreation and Land Use
  - Aesthetic Resources
  - Cultural Resources (“Historical/Archaeological Status”)
  - Socioeconomics
  - Environmental Justice
  - Air Quality and Noise (“Climate”)
- Conclusion: Classification and data available from NPD Explorer and NPDamCAT could serve as the basis for a programmatic review of environmental impacts of licensing NPDs nationwide.
- Benefit: Could help further expedite the NPD licensing and development process.



# Wrap-up





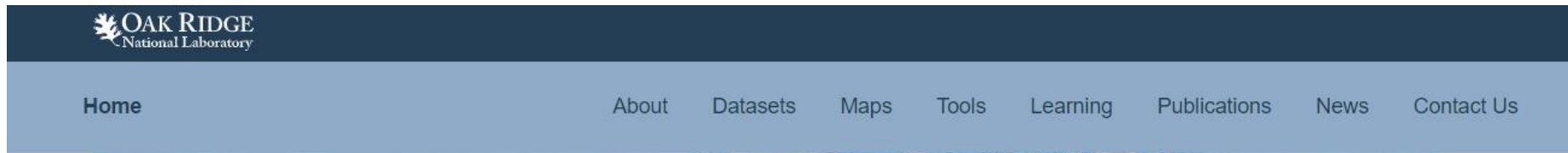
# Additional Resources for Large-scale Dam Research

- National Performance of Dams Program (Stanford University)
  - Basic filtering/selection of dams from NPDP database
  - Explore dam incidents, consequences, failure modes
  - [http://npdp.stanford.edu/dams\\_database](http://npdp.stanford.edu/dams_database)
- Regional Aquatic Barrier Prioritization Tools
  - Freshwater Network
    - <https://freshwaternetwork.org/projects/aquatic-barrier-prioritization/>
  - Southeast Aquatic Resources Partnership
    - <https://connectivity.sarpdata.com/>

# Next steps

- All registrants will receive an email with link to materials
  - Slides and user guide for public review on the SMH project website ([smh.ornl.gov/media](http://smh.ornl.gov/media))
  - Beta version of apps will be made available to workshop participants
    - Will ask for feedback on:
      - features that work well, don't work
      - suggestions for additional characteristics to include in NPD characteristics inventory

# Next steps



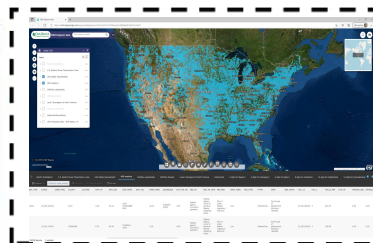
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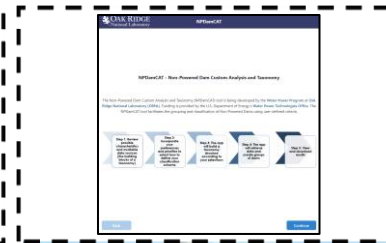
## Tools



The U.S. Stream Classification System (USSCS) is a tool to group 2.6 million stream reaches of the Conterminous



Beta version of NPD Explorer



Beta version of NPDamCAT



The HydroSource Web Application is a geo-spatial platform that enables hydropower data exploration

# Questions and Discussion

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