

HILARRI V2 USER NOTES

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I. Introduction

The full HILARRI v2 dataset contains unique records for all dam–hydropower plant–river–waterbody matches to facilitate searching and linking between hydropower infrastructure and water resource data from a variety of perspectives. The different types of links are summarized in the “dataset” field, including:

- Hydropower dam associated with power plant and reservoir
- Hydropower dam associated with power plant; no reservoir
- Hydropower dam associated with reservoir; no power plant
- Hydropower dam only; no reservoir or power plant
- Power plant associated with reservoir; no inventoried dam
- Power plant only; no reservoir or inventoried dam

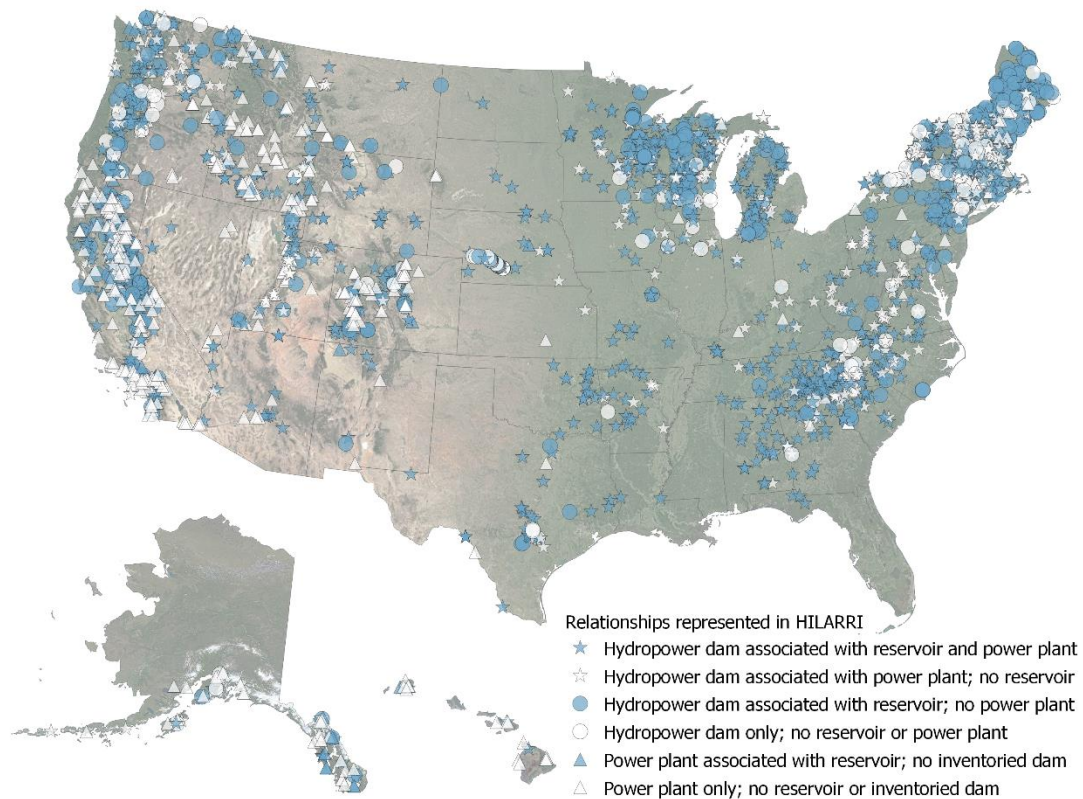


FIGURE 1 - LOCATIONS OF DAMS AND PLANTS INCLUDED IN THE HILARRI v2 DATASET

Note that the links or relationships in HILARRI are only among publicly inventoried dams, plants, rivers, or waterbodies. A dam may be known to be located on a reservoir, however, if the reservoir is not included in a public inventory of waterbodies, the dam will not be associated with any reservoir in the HILARRI dataset of linkages.

Details about the datasets used to create HILARRI are described in the HILARRIv2 README file.

II. Links between dams and power plants

The first relationship linked in HILARRI is between hydropower dams from various dam inventories and power plants listed in the Existing Hydropower Assets (EHA) dataset. The *ehadamflag* describes any issues linking between the dams and EHA plants, including:

- Dam consists of several structures listed separately in the NID.
 - o This occurs when the dam is made up of several separate structures (generally not including auxiliary structures).
- Dam removed according to American Rivers
 - o Some dams are still included in national or global inventories, even though they have been reported as “removed” by the American Rivers Dam Removal Database. There may be less confidence that the structure still remains (especially in the form that is reported the inventory).
- Multiple EIA records associated with this dam

- In rare cases, it may be possible that a power plant has multiple listings and IDs in the Energy Information Agency.
- EHA plant location may not be correct
 - While most locations for power plants are obtained directly from FERC license documents, there may be inaccuracies in the reported plant location. This flag is used where the locations have been updated or are believed to be inaccurate.
- Multiple power plants associated with this dam
 - Some dams are paired with multiple power plants, and even multiple complexes of power plants. This flag helps describe the “one to one or many” relationship between dams and power plants.
- Structure is listed multiple times in NID.
 - Because the NID reports dams from a variety of state and federal agencies, there are some instances where multiple reporting agencies have listed the same structure. This is particularly common along state borders, where two states will list a dam, assigning the same structure two separate NIDIDs. This flag can help identify instances where a dam is essentially being counted twice.
- Unable to add inventoried dam info
 - Notes where a power plant was unable to be paired to an existing publicly inventoried dam.

Beyond links for hydropower infrastructure, there are sometimes complex relationships and possible issues that arise from matching infrastructure features to waterbodies. Examples of these complex links and flags for how to understand complex relationships, duplicates, or quality of data are described in Section 2. HILARRI also includes a series of tables to facilitate exploration of unique dams, unique dam-plant pairs, etc. Those tables are described in the Section 3.

III. Linking HILARRI data to other datasets

HILARRI is limited to basic identifiers, and is designed to facilitate joining to other datasets to easily obtain more detailed attributes. This is a more sustainable practice to documenting these infrastructure and hydrologic features. As long as the unique identifiers remain constant, the underlying datasets could be updated or added to and a simple join to the most updated underlying dataset would provide the most complete and current information.

Examples of joining HILARRI to the full Existing Hydropower Assets (EHA) and National Inventory of Dams (NID) are provided in the R language:

With the tidyverse:

```
library(tidyverse)

#Load in the HILARRI dataset and EHA dataset

HILARRI <- HILARRI %>%
  rename(EHA_PtID = EHA_PTID)

HILARRI_withptinfo <- left_join(HILARRI, EHA, by = "EHA_PtID")
```

With base R:

```
#Load in the HILARRI dataset and NID dataset
NID$NIDIDFULL <- paste0(NID$NIDID,NID$OTHERSTRUCTUREID)
HILARRI_withdaminfo <- merge(HILARRI,NID, by = "NIDIDFULL" , all.x=
TRUE)
```

IV. Complex relationships between infrastructure and waterbodies

Possible flags describing issues with linking between the dams/plants and waterbodies include:

- Infrastructure matched to multiple waterbodies.
- Multiple infrastructure features matched to this waterbody.
- Waterbody is not accurate.

Multiple infrastructure features (dam or plant facilities) associated with one waterbody. If a user were searching for all the hydropower infrastructure associated with a particular waterbody in the NHD waterbodies or HydroLAKES dataset (e.g., Lower Sand Cove Reservoir, *nhdwbcomid* = 10022258), there would be three unique records because PACIFICORP – SAND COVE (LOW) Dam (*nididfull*=UT00266) is associated with three separate power plants (*eha_ptid*=*hc2061_p01*, *hc2016_p02*, and *hc2061_p03*). In these cases, the *nhdwbflag* and *hylakeflag* fields include notes to indicate when a waterbody has been matched with multiple features (e.g., “Multiple infrastructure features matched to this waterbody.”)

Multiple waterbody polygons associated with one infrastructure feature. A user may be interested in the surface area of the reservoir behind a dam. For example, on infrastructure feature St. Louis power plant, located at St. Louis dam (*nididfull* = MI00551, *eha_ptid*=*hc2139*) is associated with three NHD waterbody polygons: *nhdwbcomid* = 13040310, 13040298, 13040288). In these cases, the *nhdwbflag* and the *hylakeflag* will contain a note (e.g., “Infrastructure matched to multiple NHD waterbodies”)

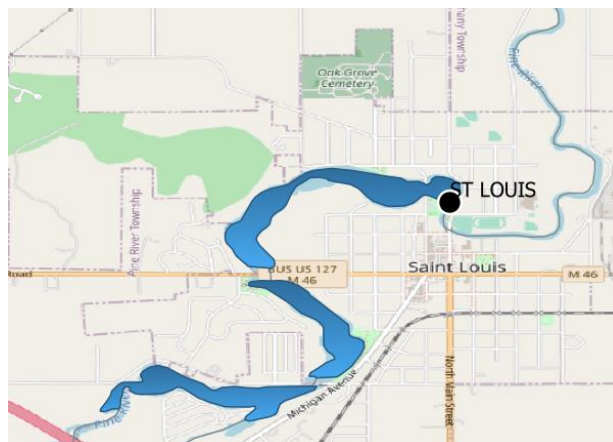


FIGURE 2 - EXAMPLE OF NHD WATERBODY SPLIT ACROSS MULTIPLE POLYGONS, EACH WITH A UNIQUE NHD ID

Waterbody polygon does not accurately represent the impounded area. Multiple features could be linked to a single waterbody (e.g., NHD Waterbody with *nhdwbcomid* = 166758705 returns three records: 1) Bartlett’s Ferry, Main Dam, 2) Goat Rock, and 3) Oliver Dams. In these cases, the polygon extends

beyond the bounds of any of the individual dam impoundments. The *nhdwblag* and *hylakeflag* will include an additional note “NHD waterbody is not accurate.”

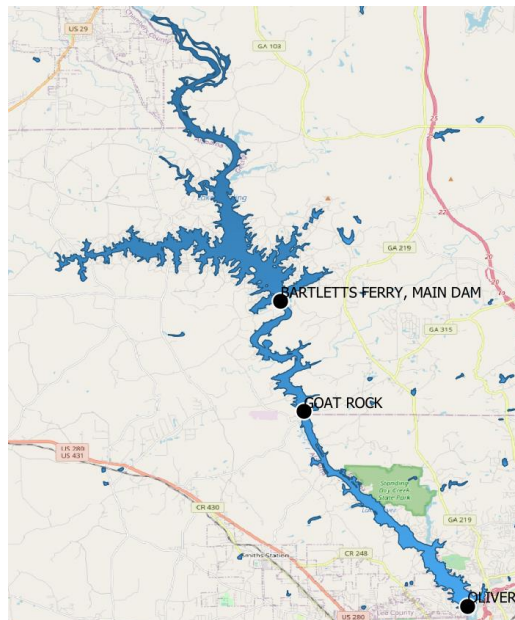


FIGURE 3 - EXAMPLE OF ONE NHD WATERBODY ENCOMPASSING THREE DAM STRUCTURES. IN REALITY, THERE ARE THREE DISTINCT, CASCADING WATERBODIES

In other cases, there may only be one infrastructure feature associated with a waterbody polygon, but that polygon is inaccurate in representing the impounded area. For example, the waterbody polygon from HydroLAKES associated with Superior Dam (*nididfull* = *MI00558*) includes the area upstream and downstream of the dam. In this case, the *hylakeflag* will contain a note, “HydroLAKE waterbody is not accurate.”

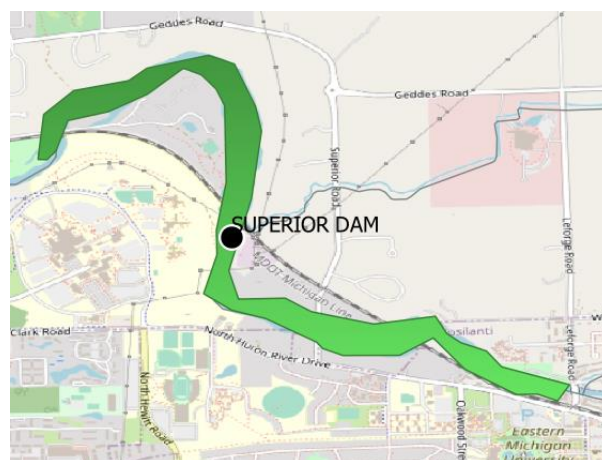


FIGURE 4 - EXAMPLE OF A SINGLE HYDROLAKES POLYGON, REPRESENTING WATER UPSTREAM AND DOWNSTREAM OF A DAM RATHER THAN ACCURATELY REPRESENTING ONLY THE IMPOUNDED WATER

V. Tables of feature subsets

To facilitate analyses that are more focused on specific subsets of the HILARRI dataset, a set of tables were created to describe unique infrastructure. In v2, the following are included:

- 1) HILARRI_v2_Subset_HydropowerDams
 - a. a table of unique operational hydropower dams; this would be of interest to users who would like to summarize characteristics of all hydropower dams, without interest to their impounded waterbodies or power plants. No facilities that are retired or are in the pipeline are included.
- 2) HILARRI_v2_Subset_HydropowerDamsPlants
 - a. a table of operational hydropower dam – power plant links; this would be of interest to users who need to explore generation information (which is provided at the individual plant level) but are not interested in the impounded waterbodies. This would include duplicates of dams where there are multiple power plants listed. No facilities that are retired or are in the pipeline are included.

If users are interested in only unique hydropower power plants, they are encouraged to use the most recent version of the [Existing Hydropower Assets Operational Plants dataset](#).