

Great Lakes Hydrography Dataset v 1.0

Attribute Descriptions

This document describes the fields in the attribute tables of the finalized watershed layers in the GLHD_Final_Watershed_Layers feature datasets and the synthetic intermediate reference layers in the Synthetic_Intermediate_Layers feature dataset of the Great Lakes Hydrology Dataset (GLHD) v1.0 (2014). Please review the READ_ME_Great_Lakes_Hydrography_Dataset_v1 document for data package background information and methodology. This document is meant as a technical supplement to the READ_ME_Great_Lakes_Hydrography_Dataset_v1 document and outlines attribute tables for each layer in the data package, describing 1) the name of the field, 2) the meaning of the data in the field, 3) the source of the data contained in each field, and 4) the field format, which describes the geodatabase data type. (see ArcGIS help for more details) We separated all of the layers in the Synthetic_Intermediate_Layers and GLHD_Final_Watershed_Layers feature datasets into “mainland” and “island” layers, which is indicated in the layer name using either “_Mainland” or “_Island”. Mainland and Island layers in the Synthetic_Intermediate_Layers feature dataset have the same fields in the attribute tables, but attribute tables are slightly different for mainland and island layers in the GLHD_Final_Watershed_Layers feature dataset.

This document does not include field descriptions for the attribute tables of the modified hydrology data layers contained in the following feature datasets: 1) NHD_24K_Modified_Island_Hydrology, 2)NHD_Plus_100K_Modified_Hydrology, and 3) OIHD_10K_Modified_Hydrology. This is because the attribute field descriptions can be found in the original NHD+v2, OIHDv1.0, and NHD documentation. (see the READ_ME_Great_Lakes_Hydrography_Dataset_v1 document to find links to user guides or metadata) However, we added an additional field called GLHDID in all of the layers that links features in the NHD+v2, OIHDv1.0, and NHD layers to the GLHDID unique watershed IDs; for more details see the Base Data Layers section of this document.

GLHDID Finalized Watershed Layers

The layers that reside in the GLHD_Final_Watershed_Layers feature dataset are the finalized, edited watershed and interfluvial layers along with the associated pour point layers, which represent the point where the entire area of the watershed drains into the Great Lakes or a connecting channel. We attributed the pour point layers with additional data in five ways: 1) we added attributes from the most downstream reach on the NHD+v2, OIHDv1.0, and the NHD stream networks within 200m of the pour points, 2) we included names from the National Hydro Network (NHN) and the Geographic Names Extent (GEL) most downstream reaches within 200m of the pour point (Canadian pour points only since Geographic Names Information System (GNIS) were already included in NHD+v2 and NHD attributes), 3) we used the ArcGIS Stream Order tool to create Strahler and Shreve stream order values on the synthetic drainage network and attributed the pour points with stream order values from the nearest downstream reach within 100m, 4) created

unique identifiers (GLHDID) for each watershed, and 5) added descriptor attributes for the location and type of feature (watershed or interfluve). Note that any field in the attribute table that has a Data Source of the NHD+v2, the OIHDv1.0, or the NHD is an attribute that was transferred from the most downstream reach on the NHD+v2, the OIHDv1.0, or the NHD stream networks.

Once we attributed pour points with all of these fields, we then added those fields to watershed polygons associated with each pour point. Note that there are many empty (null) values in the attribute tables of the pour points and watersheds. This is because pour points and watersheds were linked to only one of three data sources: 1) the NHD+v2, 2) the OIHDv1.0, or 3) the NHD (not all three). Therefore, only a subset of the pour points and watersheds were attributed with data from each hydrology package drainage network. For more information on how these layers were created and why, please see the READ_ME_Great_Lakes_Hydrography_Dataset_v1 document.

A note on stream order:

Please note that there are up to five fields in each of the layers in GLHD_Final_Watershed_Layers that contain information on stream order: 1) StreamOrde, 2) STRAHLER, 3) SHREVE, 4) ShreveDL, and 5) StrahlerDL. The StreamOrde field is a modified version of the Strahler stream order that was attributed from the NHD+v2 Value Added Attribute (VAA) tables, and are only associated with features created from the NHD+v2 base data. The STRAHLER and SHREVE fields are part of the OIHDv1.0 stream network, and are therefore only associated with Canadian pour points and watersheds. However, note that the Strahler values are not directly comparable between the NHD+v2 and the OIHDv1.0 because 1) they were derived using different methodology (see original User Guides), and 2) values were derived on networks of differing scales.

We used the ArcGIS Stream Order tool using the GLHD synthetic drainage network as input to create comparable Strahler and Shreve stream order values across the basin, derived from consistent methodology. We associated each pour point with the downstream most stream order values within 100m. The Stream Order tool created a uniform, basin wide network that was almost identical to the DrainageLine layer in the Synthetic_Intermediate_Layers feature dataset. The only differences between the DrainageLine layer and the network created by the Stream Order tool was that there were approximately 10 very small coastal streams did not show up on the network created by the Stream Order tool. In these areas, since there was no stream within 100m, the watershed pour point and watershed were attributed with the value -999. The Strahler stream order values created by the Stream Order tool are in the StrahlerDL field, and the Shreve stream order values created by the Stream Order tool are in the ShreveDL field.

Watershed_Interfluve_Altered_Attributed and WatershedPoint_Altered_Attributed

The Watershed_Interfluve_Altered_Attributed layers contain the final, post processed watershed and interfluve boundaries and the WatershedPoint_Altered_Attributed layers contain the final, post

processed watershed pour points that represent the most downstream point of each watershed. (See the READ_ME_Great_Lakes_Hydrography_Dataset_v1 document for more detail on how these layers were created and edited) All of the layers have been attributed with data from the most downstream reach on the OIHDv1.0, NHD+v2, or NHD stream networks, which is indicated in the Data Source column. Note that each individual feature in a feature class is only attributed with data from the stream network corresponding to the original source data. (For example, a watershed derived from OIHDv1.0 flow direction grids will only be attributed with fields from the most downstream reach on the OIHDv1.0 stream network)

The island feature classes include attributes from the most downstream reach in the OIHDv1.0, NHD+v2 and the NHD, because U.S. islands were derived from both the NHD+v2 (Drummond Island and Grand Island) and the NHD (the rest of the islands). Since the mainland feature classes did not include fields from the NHD and were only attributed with data from the OIHDv1.0 and the NHD+v2, they have fewer fields than the island feature classes. Additionally, in the mainland feature classes, the NHD+v2 date field is called FDate instead of FDate_NHDPlus. Fields that specify “NHD” in the Data Source column are only associated with U.S. island features.

Name of Field	Description	Data Source	Field Format
GLHDID	Unique ID created by the GLHD team that numbers all of the watersheds and interfluves sequentially counterclockwise across the basin, beginning with the mainland boundary water area between Minnesota and Ontario. Island numbers start at 10,000 and are also numbered sequentially counterclockwise across the basin.	GLHD	Long
HydroID	Unique identifier created using the “Assign HydroID” tool in ArcHydro. (Note that HydroID does not include interfluves, and so the number is not truly unique in the Watershed_Interfluve_Altered_Attributed layers because interfluve all have a value of -281)	ArcHydro	Long
W_Link	An ID that links each watershed feature in Watershed_Interfluve_Altered_Attributed_Island or Watershed_Interfluve_Altered_Attributed_Mainland to corresponding watershed pour points in Watershed_Altered_Attributed_Island or WatershedPoint_Altered_Attributed_Mainland. The number was originally derived in ArcHydro and was combined with the OrigUnit abbreviation along with an “I” for island features or an “M” for mainland features	ArcHydro/GLHD	String

COMID	NHD+v2 identifier of downstream most reach	NHD+v2	Long
FDate_NHDPlus OR FDate	Currency date of NHD+v2 most downstream reach. (In the Island feature class, this field is called FDate_NHDPlus, in the Mainland feature class, this field is called FDate)	NHD+v2	Date
RESOLUTION	Text description of dataset resolution of the NHD+v2 most downstream reach	NHD+v2	String
GNIS_ID	Geographic Names Information System ID that corresponds to GNIS_Name of the NHD+v2 most downstream reach.	NHD+v2	String
LengthKM	The length in kilometers of the NHD+v2 most downstream reach	NHD+v2	Single
GNIS_NAME	GNIS name associated with the NHD+v2 most downstream reach	NHD+v2	String
REACHCODE	NHD+v2 code assigned to the NHD+v2 most downstream reach	NHD+v2	String
FLOWDIR	Used to indicate whether the NHD+v2 most downstream reach is included in the NHD+v2 DEM; "With Digitized" = included and "Uninitialized" = not included.	NHD+v2	String
WBAREACOMI	If the NHD+v2 most downstream reach is an artificial path that flows through a polygon water features, this is the associated ComID of the polygon water feature	NHD+v2	Long
FTYPE	Corresponds to the NHD Feature Type of the NHD+v2 most downstream reach	NHD+v2	String
FCODE	Code from NHD describing type of flow line of the NHD+v2 most downstream reach; corresponds to FTYPE.	NHD+v2	Long
ENABLED	Is "True" for both OIHDv1.0 and NHD+v2 derived data.	NHD+v2, OIHDv1.0	String
GNIS_NBR	GNIS number of NHD+v2 most downstream reach	NHD+v2	Long
StreamOrde	Modified Strahler stream order of the NHD+v2 most downstream reach; attributed from the NHD+v2 Value Added Attribute (VAA) table	NHD+v2 Value Added Attribute Table	String
Tertiary	Corresponding 3 digit Canadian tertiary watershed code of the OIHDv1.0 most downstream reach	OIHDv1.0	String
WRCS_TYPE	Watercourse type (default is Stream) of the OIHDv1.0 most downstream reach	OIHDv1.0	String
PERMANENCY	Permanency of the OIHDv1.0 most downstream reach	OIHDv1.0	String

FLOW_CLASS	Describes the route of water flow of the OIHDv1.0 most downstream reach. Two codes: Primary (main route) or secondary (alternate routes such as braided streams).	OIHDv1.0	String
STRAHLER	Strahler stream order of the OIHDv1.0 most downstream reach	OIHDv1.0	Long
SHEREVE	Shreve stream order of the OIHDv1.0 most downstream reach	OIHDv1.0	Long
CAN_Name	Names attributed from the nearest downstream reach in the National Hydro Network (NHN) or the Geographic Names Extent (GEL) layer within 200m (names are not included in the OIHDv1.0 drainage network)	NHN, GEL	String
Permanent_	NHD unique identifier of the NHD most downstream reach	NHD	String
FDate_NHD	Date assorted with the NHD most downstream reach that represents the date the feature was last modified	NHD	Date
Resoluti_1	Resolution of the feature source for the NHD most downstream reach	NHD	Long
GNIS_ID_1	Unique identifier from GNIS of the NHD most downstream reach	NHD	String
GNIS_Name_	GNIS name of the NHD most downstream reach	NHD	String
ReachCode_	Unique identifier for r the NHD most downstream reach	NHD	String
FlowDir_1	Direction of flow of the NHD most downstream reach	NHD	Long
WBArea_Per	WBD Unique identifier of the NHD most downstream reach	NHD	String
FType_1	A three-digit code which represents a specific feature type of the NHD most downstream reach	NHD	Long
FCode_1	Five-digit code for the NHD most downstream reach; Originally created using the feature type and other characteristics.	NHD	Long
Enabled_1	Whether or not the NHD most downstream reach was incorporated into the geometric network; this value is always true	NHD	Short
OrigUnit	Two digit code that corresponds to the original NHD+v2 (4A, 4B, 4C, 4D), OIHDv1.0 (NC, NE, SW, SE), or island (LE, LH, LM, LO, LS) processing unit of the flow direction grid used to delineate the layer.	NHD+v2, OIHDv1.0, NHD, GLHD	String

Lake	Abbreviated name of Lake Basin in which the feature resides (Erie, Huron, Michigan, Ontario, or Superior).	GLHD	String
Main_Island	Describes whether the feature is part of the mainland (Mainland) or islands (Island).	GLHD	String
Type	Original name of layer assigned by ArcHydro.	ArcHydro, GLHD	String
Country	Name of the country that contains the feature. (Binational, Canada, US) If the feature is located within both the US and Canada, this field is populated with "Binational."	GLHD	String
Interfluve	Identifies the features as either a watershed feature (blank) or an interfluve feature ("Interfluve").	GLHD	String
ShreveDL	Shreve stream order of the most downstream reach within 100m of a pour point of the network created using the Stream Order tool (This network was roughly equivalent to the network in the DrainageLine feature class in the Synthetic_Intermediate_Layers feature dataset)	GLHD/ Stream Order Tool (ArcGIS Spatial Analyst)	Short
StrahlerDL	Strahler stream order of the most downstream reach within 100m of a pour point of the network created using the Stream Order tool (This network was roughly equivalent to the network in the DrainageLine feature class in the Synthetic_Intermediate_Layers feature dataset)	GLHD/ Stream Order Tool (ArcGIS Spatial Analyst)	Short

GLHD Intermediate Synthetic Layers

The layers contained in the Synthetic_Intermediate_Layers feature dataset are the intermediate data layers that were created in the ArcHydro process flow that was used to delineate watersheds and pour points for the Great Lakes. The layers in the Synthetic_Intermediate_Layers feature dataset are provided for user references, and we recommend that whenever possible, for applications requiring reach catchments or drainage networks, users utilize the modified drainage networks or catchments provided in the NHD_24K_Modified_Island_Hydrology, NHD_Plus_v2_100K_Modified_Hydrology, and OIHD_v1_10K_Modified_Hydrology feature datasets instead of the layers in the Synthetic_Intermediate_Layers feature dataset. Please see the READ_ME_Great_Lakes_Hydrography_Dataset_v1 document more details on how the layers were created.

DrainageLine

This layer contains the synthetic drainage network that was created from the flow accumulation and flow direction grids, using a 3,000 cell (equivalent to 2.7km²) flow accumulation threshold. If a cell on the flow accumulation grid had 3,000 cells emptying into it, then a drainage line was created in this layer.

Name of Field	Description	Source	Field Format
HydroID	Unique identifier created using the “Assign HydroID” tool in ArcHydro.	ArcHydro	Long
NextDownID*	HydroID of the next down segment in the network. If none, NextDownID = -1.	ArcHydro	Long
from_node*	HydroID of the directly upstream drainage line that flows into the current segment.	ArcHydro	Long
to_node*	HydroID of the next stream line in the network that the current stream line will flow into.	ArcHydro	Long
CD_Link	Code linking each reach catchment to the reach and drainage point within each catchment. Originally created by ArcHydro as “GRIDID”, we added the original processing unit code and “I” for islands or “M” for mainland to keep values unique.	ArcHydro, GLHD	String
OrigUnit	Two digit code that corresponds to the original NHD+v2 (4A, 4B, 4C, 4D), OIHDv1.0 (NC, NE, SW, SE), or island (LE, LH, LM, LO, LS) processing unit of the flow direction grid used to delineate the layer.	GLHD	String
Lake	Abbreviated name of Lake Basin in which the feature resides (Erie, Huron, Michigan, Ontario, or	GLHD	String

	Superior).		
Main_Island	Describes whether the feature is part of the mainland (Mainland) or islands (Island).	GLHD	String
Type	Original name of layer assigned by ArcHydro.	ArcHydro/ GLHD	String
Country	Name of the country that contains the feature. (Binational, Canada, US) If the feature is located within both the US and Canada, this field is populated with "Binational."	GLHD	String

DrainagePoint

This layer contains the drainage outlet point for every catchment in the Reach_Catchment layer, where the water drains from the upstream limit to the downstream limit of a reach.

Name of Field	Description	Source	Field Format
HydroID	Unique identifier created using the "Assign HydroID" tool in ArcHydro.	ArcHydro	Long
CD_Link	Code linking each reach catchment to the reach and drainage point within each catchment. Originally created by ArcHydro as "GRIDID", we added the original processing unit code and "I" for islands or "M" for mainland to keep values unique.	GLHD/ ArcHydro	String
OrigUnit	Two digit code that corresponds to the original NHD+v2 (4A, 4B, 4C, 4D), OIHDv1.0 (NC, NE, SW, SE), or island (LE, LH, LM, LO, LS) processing unit of the flow direction grid used to delineate the layer.	GLHD	String
Lake	Abbreviated name of Lake Basin in which the feature resides (Erie, Huron, Michigan, Ontario, or Superior).	GLHD	String
Main_Island	Describes whether the feature is part of the mainland (Mainland) or islands (Island).	GLHD	String
Type	Original name of layer assigned by ArcHydro.	ArcHydro/ GLHD	String
Country	Name of the country that contains the feature. (Binational, Canada, US) If the feature is located within both the US and Canada, this field is populated with "Binational."	GLHD	String

Reach_Catchment

Every reach catchment in this layer corresponds to a single reach on the synthetic DrainageLine network. The reach catchments represent the area of land draining into each reach.

Name of Field	Description	Source	Field Format
HydroID	Unique identifier created using the “Assign HydroID” tool in ArcHydro.	ArcHydro	Long
CD_Link	Code linking each reach catchment to the reach and drainage point within each catchment. Originally created by ArcHydro as “GRIDID”, we added the original processing unit code and “I” for islands or “M” for mainland to keep values unique.	GLHD / ArcHydro	String
OrigUnit	Two digit code that corresponds to the original NHD+v2 (4A, 4B, 4C, 4D), OIHDv1.0 (NC, NE, SW, SE), or island (LE, LH, LM, LO, LS) processing unit of the flow direction grid used to delineate the layer.	GLHD	String
Lake	Abbreviated name of Lake Basin in which the feature resides (Erie, Huron, Michigan, Ontario, or Superior).	GLHD	String
Main_Island	Describes whether the feature is part of the mainland (Mainland) or islands (Island).	GLHD	String
Type	Original name of layer assigned by ArcHydro.	GLHD / ArcHydro	String
Country	Name of the country that contains the feature. (Binational, Canada, US) If the feature is located within both the US and Canada, this field is populated with "Binational."	GLHD	String
GLHDID	Unique identifier of the watershed in which the catchment resides. We created the Unique ID for each watershed by numbering all of the watersheds and interfluves sequentially counterclockwise across the basin, beginning with the mainland boundary water area between Minnesota and Ontario. We stated the ID number for island watersheds and interfluves at 10,000 and numbered them sequentially, counterclockwise across the basin.	GLHD	Long

Sub_Watershed

This layer represents the boundary for the group of upstream catchments that drain into each individual catchment.

Name of Field	Description	Source	Field Format
HydroID	Unique identifier created using the “Assign HydroID” tool in ArcHydro.	ArcHydro	Long

CD_Link	Code linking each reach catchment and/or sub catchment in in this layer to either the reach and drainage point within each catchment or the most downstream reach and drainage point in the subwatershed. Originally created by ArcHydro as "GRIDID", we added the original processing unit code and "I" for islands or "M" for mainland to keep values unique.	GLHD/ ArcHydro	String
OrigUnit	Two digit code that corresponds to the original NHD+v2 (4A, 4B, 4C, 4D), OIHDv1.0 (NC, NE, SW, SE), or island (LE, LH, LM, LO, LS) processing unit of the flow direction grid used to delineate the layer.	GLHD	Long
Lake	Abbreviated name of Lake Basin in which the feature resides (Erie, Huron, Michigan, Ontario, or Superior).	GLHD	String
Main_Island	Describes whether the feature is part of the mainland (Mainland) or islands (Island).	GLHD	String
Type	Original name of layer assigned by ArcHydro.	GLHD/ ArcHydro	Long
Country	Name of the country that contains the feature. (Binational, Canada, US). If the feature stretches across the US and Canada, this field is populated with "Binational."	GLHD	String

Watershed_Original

Each polygon in this layer represents the area of land draining from the headwaters to the terminal outlet point in the Great Lakes or the connecting channels. This dataset remains as it was originally delineated in ArcHydro, before post processing.

Name of Field	Description	Source	Field Format
HydroID	Unique identifier created using the "Assign HydroID" tool in ArcHydro. (Note that HydroID does not include interfluves, and so the number is not truly unique in this layer because interfluve all have a value of -281)	ArcHydro	Long
W_Link	An ID that links each watershed feature in Watersheds_Original to corresponding watershed pour point WatershedPoint_Original. The number was originally derived in ArcHydro and was combined with the OrigUnit abbreviation along with an "I" for island features or an "M" for	ArcHydro/ GLHD	String

	mainland features		
OrigUnit	Two digit code that corresponds to the original NHD+v2 (4A, 4B, 4C, 4D), OIHDv1.0 (NC, NE, SW, SE), or island (LE, LH, LM, LO, LS) processing unit of the flow direction grid used to delineate the layer.	GLHD	String
Lake	Abbreviated name of Lake Basin in which the feature resides (Erie, Huron, Michigan, Ontario, or Superior).	GLHD	String
Main_Island	Describes whether the feature is part of the mainland (Mainland) or islands (Island).	GLHD	String
Type	Original name of layer assigned by ArcHydro.	ArchHydro/ GLHD	String
Country	Name of the country that contains the feature. (Binational, Canada, US) If the feature is located within both the US and Canada, this field is populated with "Binational."	GLHD	String

WatershedPoint_Original

This layer contains points that correspond to the outlet point for each watershed in Watershed_Original into the Great Lakes or the connecting channels. This dataset remains as it was originally delineated in ArcHydro, before post processing.

Name of Field	Description	Source	Field Format
HydroID	Unique identifier created using the "Assign HydroID" tool in ArcHydro.	ArchHydro	Long
W_Link	An ID that links each watershed feature in Watersheds_Original to corresponding watershed pour point WatershedPoint_Altered_Attributed. The number was originally derived in ArcHydro and was combined with the OrigUnit abbreviation along with an "I" for island features or an "M" for mainland features	GLHD/ ArchHydro	String
OrigUnit	Two digit code that corresponds to the original NHD+v2 (4A, 4B, 4C, 4D), OIHDv1.0 (NC, NE, SW, SE), or island (LE, LH, LM, LO, LS) processing unit of the flow direction grid used to delineate the layer.	GLHD	String
Lake	Abbreviated name of Lake Basin in which the feature resides (Erie, Huron, Michigan, Ontario, or Superior).	GLHD	String
Main_Island	Describes whether the feature is part of the	GLHD	String

	mainland (Mainland) or islands (Island).		
Type	Original name of layer assigned by ArcHydro.	GLHD/ ArcHydro	String
Country	Name of the country that contains the feature. (Binational, Canada, US) If the feature is located within both the US and Canada, this field is populated with "Binational."	GLHD	String

Base Data Layers

This data package contains three feature datasets with the modified drainage networks and/or reach catchments from the NHD+v2 (NHD_Plus_v2_100K_Modified_Hydrology), OIHDv1.0 (OIHD_v1_10K_Modified_Hydrology), and the NHD (NHD_24K_Modified_Island_Hydrology). We mainly modified these layers to better reflect the flow direction grids used to delineate the watersheds and to mirror the spatial extent of the watershed boundaries. (For further details on how these layers were modified, see the READ_ME_Great_Lakes_Hydrography_Dataset_v1 document.) Since we mostly altered the spatial components of these layers, and only modified the attributes by adding one field called GLHDID, we did not include tables explaining all of the attributes in each table. Users can either refer to the original NHD+v2, OIHDv1.0, or NHD User Guides (see the READ_ME_Great_Lakes_Hydrography_Dataset_v1 document for links), or look up basic descriptions for the attributes in the NHD+v2, OIHDv1.0, and NHD drainage networks in the table provided in the GLHD_Finalized_Watershed_Layers section of this document. Since we associated pour points and watersheds with attributes from the most downstream NHD+v2, OIHDv1.0, and NHD reaches on the drainage networks, users can match the field name and data source to find descriptions for each field in all of the drainage network fields from the NHD+v2, OIHDv1.0, or NHD.

We added one field to the attribute table of every of the layers in all three feature datasets called GLHDID. This field contains the unique GLHDID of the watershed with the highest percent overlap with each feature on the NHD+v2, OIHDv1.0, and NHD original networks. Since a number of catchments and drainage lines were coincident with more than one watershed, we determined which watershed had the greatest percent overlap by: 1) determining how many and which watersheds each feature overlapped with, 2) calculating the percentage overlap for each drainage line length or each reach catchment area with all overlapping watershed, 3) recording the GLHDID of the watershed with the highest percentage overlap.