National Hydro Network v2

Proposed Schema and Entity Catalogue

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Canada

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1   NHNv2 Introduction

1.1   Abstract

Natural Resources Canada (NRCan) has retained the services of Minerva Intelligence Inc. (Minerva) and 4DM Inc. (4DM) to design a new data model for the National Hydrographic Network (NHNv2). The objectives of the project are to make a national-scale hydrographic data model that is more useful for hydrological practitioners across the country, easier to maintain, and consistent with the Open Geospatial Consortium's (OGC) international standard on surface hydrology features (HY_Features). To accomplish these tasks, Minerva and 4DM have reviewed existing similar hydrographic data models to identify optimal concepts and elements that can be applied to the NHNv2.

Recently developed data models such as CHyF (NRCan), the FWA (British Columbia) and NHDPlus HR (United States Geological Survey) are the most comprehensive in their design and are largely compatible with the HY_Features conceptual model, however, only CHyF is explicitly compliant. While the CHyF conceptual model does not present a complete logical data model, it represents a solid conceptual foundation from which a simpler (but still HY_Features-compliant) hydrographic data model can be constructed. The NHNv2 presents both conceptual and logical data models, based on the CHyF conceptual data model, that remains simple by minimizing the number of features and properties.

The NHNv2 data model is founded on the OGC's WaterML 2: Part 3 Surface Hydrology Features (HY_Features) conceptual model and specifies a logical data model making use of the CHyF Conceptual Model. Understanding the concepts presented and detailed in HY_Features and CHyF will aid one's understanding of the NHNv2 data model, but is not required.

Where HY_Features outlines a conceptual data model for digital representations of hydrological processes, and the CHyF conceptual model refines that for a Canadian context and applies graph theory for a specialized application delineating upstream and downstream catchments and flowpaths, the NHNv2 model further specializes and presents a single data storage format, and mode of representation for the purpose of hosting a national-scale hydrological dataset for Canada. While this document provides a conceptual data model, it is provided to assist readers in better understanding the model and not to provide a model that could be implemented in many different ways (as is the case in the HY_features and CHyF conceptual models). In addition to the conceptual diagram, this document provides a formal UML logical data model, and a feature catalogue.

1.2   Scope

This document describes the proposed NHNv2 data model. It has been designed by considering the recommendations set forth in the NHNv2 Workshops Report published in December 2020 by the Canadian Centre for Mapping and Earth Observation (CCMEO) and NRCan as well as the ranked requirements as established in the "Buy-A-Requirement" game which was circulated in early 2021 within the NHNv2 - Hydro Community of Practice newsletter.

1.3   Conformance

NHNv2 conforms to the CHyF and HY_Features conceptual models, with some exceptions. The table below clarifies the relationship through provision of a CHyF – HY_Features Crosswalk. Similar mappings can also be found at the following URL to Canada's National Hydro Network (NHN) and the NHDPlus model of the United States:

https://docs.opengeospatial.org/is/14-111r6/14-111r6.html#_hy_features_nhdplus_mapping

HY_Features Name	NHNv2 Name	NHNv2 Comment
HY_Catchment	ElementaryCatchment and/or CatchmentAggregate	NHNv2 proposes that Canada produces drainage areas that are roughly comparable to the NHD+ HUC system.
HY_DendriticCatchment	CatchmentAggregate	NHNv2 catchments that are realized by primary elementary flowpaths.
HY_InteriorCatchment	CatchmentAggregate	CatchmentAggregate with TRUE "interior" property
HY_CatchmentAggregate	CatchmentAggregate	CatchmentAggregates are collections of ElementaryCatchments
HY_HydroNexus	HydroNode	HydroNodes are the start and end of flowpaths as well as the outflow of elementary catchments

HY_HydroLocation	HydroLocation	The HydroLocation feature is a point feature related to the specific elementaryflowpath on which it is located.
HY_CatchmentRealization	ElementaryFlowpath, ElementaryCatchment, CatchmentAggregate	All three features are different geometric realizations of the catchment concept as per the definitions in HY_Features.
HY_CatchmentArea	Not represented	While the polygon representing a catchment might be thought of as an area, the subset of a DEM or another land cover dataset would be more in line with the meaning of CatchmentArea.
HY_CatchmentDivide	ElementaryCatchment and/or CatchmentAggregate	The polygon representing the ElementaryCatchment or CatchmentAggregate should be thought of as a CatchmentDivide
HY_CartographicRealization	A map of a CatchmentAggregate	Cartographic realization applies to maps of work units or Water Survey of Canada hierarchical drainage areas or the newly defined drainage areas that will be similar to the NHD+ HUC system.
HY_HydrographicNetwork	Collection of flowpaths and waterbodies	The waterbodies and single-line watercourses all have corresponding network linear flows (double-line streams and lakes are waterbodies that are also realized by skeleton lines, which are considered as inferred network linear flows).
HY_WaterBody	Waterbody	Waterbody is equivalent with more specialized types than in HY Features.
HY_ChannelNetwork	FlowpathNetwork and Permanence	While NHNv2 doesn't have an explicit channel concept, intermittent flowpaths can be thought of as a channel in that they indicate that water can flow there, but may not be present in the ElementaryFlowpath container, and related Flowpath Network at all times.
HY_Depression	Not represented	
HY_Channel	ElementaryFlowpaths and Permanence	While NHNv2 doesn't have an explicit channel concept, intermittent flowpaths can be thought of as a channel in that they indicate that water can flow there, but may not be present in the ElementaryFlowpath container at all times.
HY_Reservoir	Waterbody	Waterbodies of type: reservoir
HY_FlowPath	ElementaryFlowpath	Elementary Flowpaths are the individual flowpathe segments between hydro nodes.
HY_LongitudinalSection	Not represented	
HY_CrossSection	Not represented	
HY_WaterBodyStratum	Not represented	
HY_Water_LiquidPhase	Not represented	
HY_Water_SolidPhase	Not represented	
HY_HydrometricNetwork	Collection of hydrolocations and hydronodes	Collections of hydrolocations that are hydrostations, and their associated hydronodes could be considered a hydrometric network.
HY_HydrometricFeature	Hydrolocations that are of type "hydrostation"	Hydrostations are represented as a type of hydrolocation.
HY_IndirectPostition	Not represented	

1.4   References

This document contains references to the following existing data standards and documentation:

[CHyF]   NRCan Common Hydrology Features
(https://github.com/NRCan/chyf/blob/master/docs/chyfConceptualModel.md)

[HY_F]   OGC® WaterML 2: Part 3 - Surface Hydrology Features (HY_Features) - Conceptual Model
(https://docs.opengeospatial.org/is/14-111r6/14-111r6.html)

[NHN]   Canadian National Hydro Network – Feature Catalogue
(https://ftp.maps.canada.ca/pub/nrcan_rncan/vector/geobase_nhn_rhn/doc/Publication/catalogue/)

[WMO]   WMO/UNESCO International Glossary of Hydrology
(https://library.wmo.int/index.php?lvl=notice_display&id=7394)

2 Diagrams

2.1 Conceptual Model

Figure 1 is a conceptual data model that is a simplified representation of the designed schema. The diagram shows all of the features and the relationships between them. The core features of the data model are: elementary flowpath, hydro node, elementary catchment and waterbody. These core features are aggregated to form larger, interconnected features such as catchment aggregate, flowpath network and main flowpath.
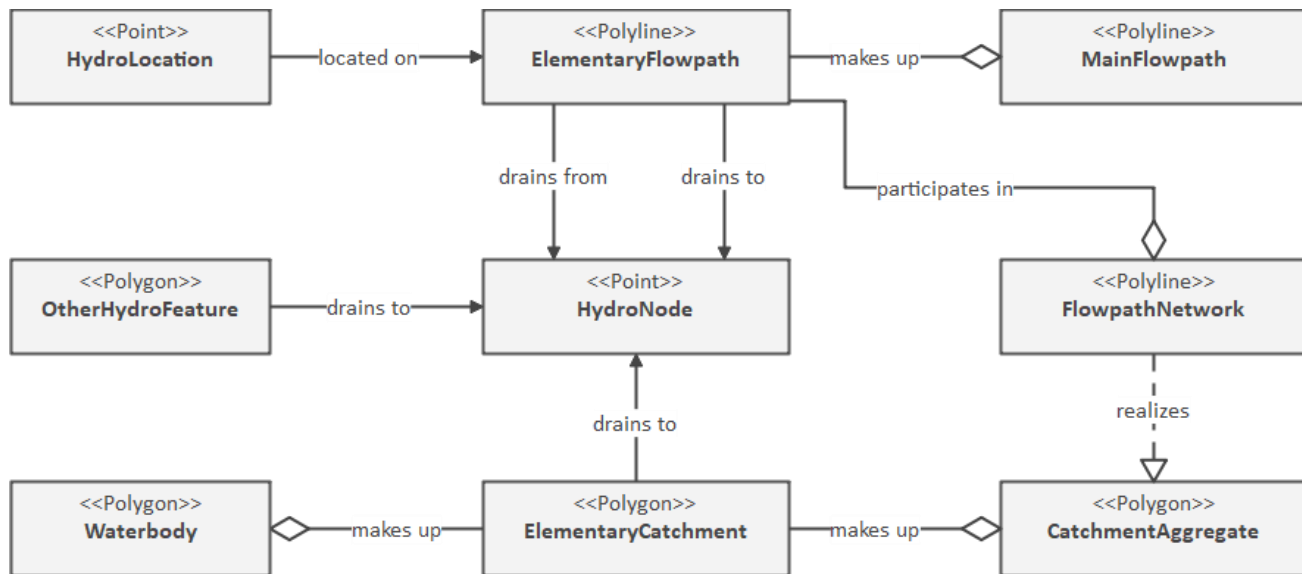

Figure 1: Conceptual Model

Elementary flowpath is a line feature that represents the movement of surface water through a catchment. The start and end of each flowpath are hydro node features. Hydro node features function as a connecting point between catchments, waterbodies and flowpaths, hydro nodes can be a nexus between other features, or the start or terminus of a flowpath network. In the NHNv2 model, each elementary flow path has a hydro node that it drains from (the start of that elementary flowpath) and the hydro node that it flows to (the end of that elementary flowpath). This relationship between hydro nodes and elementary flowpaths enables network connectivity within the flowpath network.

Elementary flowpaths can be designated as primary or secondary. Consider the flow of a river around an island where the main flow of the water on one side of the island would be primary and the small channel on the other side of the island would be secondary. The aggregation of connected primary flowpaths form the main flowpath feature.

Hydro location is a point feature that is of hydrological relevance that is located along a flowpath. Examples of hydro locations include hydrometric stations, waterfalls, or rapids.

The flowpath network is a line feature that is made up of a set of connected elementary flowpaths within a particular catchment aggregate, as described below.

The NHNv2 focuses on catchments and waterbodies, leaving room for other hydro features, such as wetlands and glaciers to be (possibly) included or linked to external databases at a later date. A catchment is a physiographic unit where hydrologic processes take place, which is defined by a hydrologically-determined outlet to which all waters flow [HY_F]. Elementary catchments are the fundamental subdivision of the landscape in which water can be modelled as draining to a single outlet [CHyF]; they are represented as polygons. The outlet of an elementary catchment is a hydro node, which would also be the end node of an elementary flowpath representing channelized surface flow through that elementary catchment. Elementary catchments can be of type "water" and would then make up waterbody features such as lakes rivers and ponds. Catchment

types have nested, hierarchical relationships which is exemplified in the NHNv2 data model by the catchment aggregate feature.

The catchment aggregate feature is made up of more than one adjacent elementary catchments and is realized by the flowpath network feature. A catchment aggregate is analogous to a watershed or drainage basin (e.g. the Fraser River Basin) and can occur at a variety of scales.

2.2   Logical Model

The logical data model takes the features described in the conceptual model and applies specific rules that guide the implementation of the schema in databases and other data structures. The logical model specifies entities, their property names, property data types and multiplicity. Type refers to the data type that can be used for the property (float, integer, string etc.) and multiplicity refers to the number of relationships an entity can participate in with respect to another entity (e.g. exactly one, at least one, none etc.). Descriptions of the attributes can be found below in Section 3.1, while relationships are defined in Section 3.2, and legal terms for coded value domains are provided in Section 3.3.
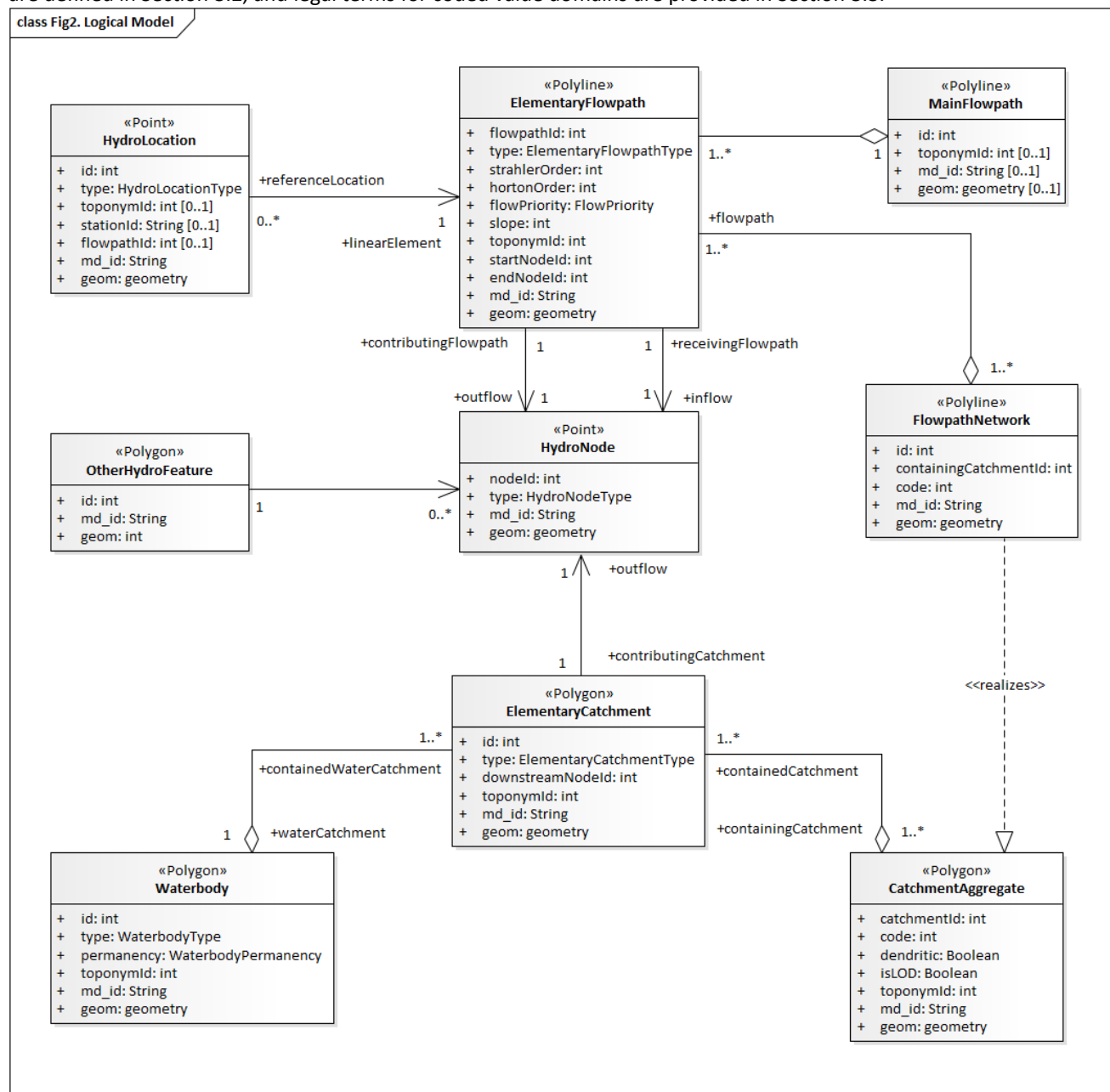

Figure 2: Logical Model

3   Feature Types

3.1   Elementary Catchment (ElementaryCatchment)

«Polygon»

An elementary catchment defines a fundamental subdivision of the landscape in which water can be modelled as draining to a single outlet, to an adjacent waterbody, internally to an area devoid of waterbody features, or directly as a waterbody. Four types of elementary catchments are recognized: reach catchments, bank catchments, empty catchments, and water catchments. [CHyF]

Name	Description	Type	Multiplicity
id	The unique identifier for the feature.	int	1
type	Expresses the type of the elementary catchment, using a value from the ElementaryCatchmentType coded value domain	Elementary Catchment Type	1
downstreamNodeId	The identifier of the hydro node to which flow from this catchment flows to (i.e. outflow).	int	1
toponymId	The identifier to the name of this feature from the CGNDB toponym database, if applicable.	int	1
md_id	The unique identifier of a set of metadata in the federal metadata catalogue for this feature	String	1
geom	Geometric representation of the feature.	Geometry	1

3.2   Catchment Aggregate (CatchmentAggregate)

«Polygon»

A set of contiguous elementary catchments arranged in an encompassing catchment. This can be used to represent catchments at a larger geographic scale. [Hy_F]

Name	Description	Type	Multiplicity
catchmentId	The unique identifier for the feature.	int	1
code	Unique identifier to the catchment in given context. The code attribute should be implemented using a controlled classification or coding system. Example: WMO Basin Codes or USGS' NHDPlus Hydrologic unit Codes (HUC).	int	1
dendritic	Indicates whether the catchment aggregate is dendritic.	Boolean	1
isInterior	Indicates whether the elementary catchments that make up this aggregate form an interior catchment.	Boolean	1
isLOD	Indicates whether the feature is referenced by external agencies or included in linked data relations.	Boolean	1
toponymId	The identifier to the name of this feature from the CGNDB toponym database, if applicable.	int	1
md_id	The unique identifier of a set of metadata in the federal metadata catalogue for this feature	String	1
geom	Geometric representation of the feature.	Geometry	1

3.3   Elementary Flowpath (ElementaryFlowpath)

«Polyline»

A derived linear feature that realizes a catchment specifically as a path connecting the inflow or headwater (start) point with the outflow (end) point of the catchment. Elementary flowpaths are terminated at either end by a hydro node and

may be designated as having either primary or secondary flow priority. The direction of a flowpath is always downstream. Four types of elementary flowpaths are recognized: bank, constructed, observed and inferred [CHyF].

Name	Description	Type	Multiplicity
flowpathId	The unique identifier for the feature.	int	1
type	Expresses the type of the flowpath, using a value from the ElementaryFlowpathType coded value domain	Elementary Flowpath Type	1
strahlerOrder	See Strahler (1957)	int	1
hortonOrder	See Horton (1945)	int	1
flowPriority	Expresses the flow route classification within the hydrographic network, using a term from the FlowPriority coded value domain. Primary flowpaths are used to identify dendritic networks.	Flow Priority	1
slope	The average slope along the flowpath.	int	1
toponymId	The identifier to the name of this feature from the CGNDB toponym database, if applicable.	int	1
startNodeId	The unique identifier that references the inflow HydroNode feature.	int	1
endNodeId	The unique identifier that references the outflow HydroNode feature.	int	1
md_id	The unique identifier of a set of metadata in the federal metadata catalogue for this feature	String	1
geom	Geometric representation of the feature.	Geometry	1

3.4   Flowpath Network (FlowpathNetwork)

«Polyline»

The set of all elementary flowpaths forming a connected network within a catchment aggregate, thereby realizing that catchment. [CHyF]

Name	Description	Type	Multiplicity
id	The unique identifier for the feature.	int	1
containingCatchmentId	A unique identifier that references catchment aggregate to which this feature is associated with.	int	1
code	Unique identifier to the catchment in given context. The code attribute should be implemented using a controlled classification or coding system. Example: WMO Basin Codes, or USGS' Hydrologic Unit Codes (HUC).	int	1
md_id	The unique identifier of a set of metadata in the federal metadata catalogue for this feature	String	1
geom	Geometric representation of the feature.	Geometry	1

3.5   Main Flowpath (MainFlowpath)

«Polyline»

A linear feature defined as a series of connected flowpaths, upstream from a hydro nexus to a unary nexus at a headwater source. It aggregates flowpaths based on stream name. [CHyF]

Name	Description	Type	Multiplicity
id	The unique identifier for the feature.	int	1

toponymId	The identifier to the name of this feature from the CGNDB toponym database, if applicable.	int	0..1
md_id	The unique identifier of a set of metadata in the federal metadata catalogue for this feature	String	1
geom	Geometric representation of the feature.	Geometry	1

3.6   Hydro Node (HydroNode)

«Point»

A hydro node is a network construct equivalent to a node or a vertex, and existing at each endpoint of an elementary flowpath. Six types of hydro node are recognized: hydro nexus, bank nexus, flowpath nexus, water nexus, skeleton, headwater and terminal. [CHyF]

Name	Description	Type	Multiplicity
nodeId	The unique identifier for the feature.	int	1
type	Expresses the type of the hydro node, using a value from the HydroNodeType coded value domain	Hydro Node Type	1
md_id	The unique identifier of a set of metadata in the federal metadata catalogue for this feature	String	1
geom	Geometric representation of the feature.	Geometry	1

3.7   Hydro Location (HydroLocation)

«Point»

Any location of hydrologic significance located on a flowpath network [HY_F]. This can include both natural (e.g. waterfalls) and man-made (e.g. dams) features.

Name	Description	Type	Multiplicity
id	The unique identifier for the feature.	int	1
type	Expresses the type of the hydro location, using a value from the HydroLocationType coded value domain	Hydro Location Type	1
toponymId	The identifier to the name of this feature from the CGNDB toponym database, if applicable.	int	0..1
stationId	The station ID if the type of hydro location is a hydrometric station that is maintained by the Water Survey of Canada.	String	0..1
flowpathId	The flowpath ID for the elementary flowpath on which this hydro location is situated.	int	0..1
md_id	The unique identifier of a set of metadata in the federal metadata catalogue for this feature	String	1
geom	Geometric representation of the feature.	Geometry	1

3.8   Waterbody (Waterbody)

«Polygon»

A polygonal feature representing a mass of water that is distinct from other masses of water [WMO-No.385]. The term refers to lakes, rivers and other watercourses of any size, which may be permanent or ephemeral. [CHyF]

Name	Description	Type	Multiplicity
id	The unique identifier for the feature.	int	1

type	Expresses the type of the waterbody, using a value from the WaterbodyType coded value domain	Waterbody Type	1
permanency	Expresses whether the permanency of the waterbody, using a term from the WaterbodyPermanency coded value domain	Waterbody Permanency	1
toponymId	The identifier to the name of this feature from the CGNDB toponym database, if applicable.	int	1
md_id	The unique identifier of a set of metadata in the federal metadata catalogue for this feature	String	1
geom	Geometric representation of the feature.	Geometry	1

3.9   Other Hydro Feature (OtherHydroFeature)

«Polygon»

Placeholder feature for other types of hydro features (e.g. wetlands, glaciers, snowfields)

Name	Description	Type	Multiplicity
id	The unique identifier for the feature.	int	1
md_id	The unique identifier of a set of metadata in the federal metadata catalogue for this feature	String	1
geom	Geometric representation of the feature.	Geometry	1

4   Relationships

Relationship	Source	Relationship	Destination
Aggregation	ElementaryCatchment [1..*]	Makes up	Waterbody [1]
	Role: *containedWaterCatchment*		Role: *waterCathment*
	A catchment that is contained within a water catchment [HY_F].		A type of catchment that presents waterbodies as made up of one or more contained water catchments [HY_F].
Realization	ElementaryCatchment [1..*]	Makes up	CatchmentAggregate [1..*]
	Role: *containedCatchment*		Role: *containingCatchment*
	Catchment nested in a containing catchment [HY_F].		Identifies the catchment containing one or more elementary catchments contributing together flow to the common outlet [HY_F].
Association	ElementaryCatchment [1]	Drains to	HydroNode [1]
	Role: *contributingCatchment*		Role: *outflow*
	Identifies the catchment that contributes flow to this hydro node. This allows connection of a catchment's outflow to an identified inflow and to determine its position through referencing the inflow [HY_F].		Outflow point of the contributing flowpath. For a dendritic network of flowpaths, the outflow of a contributing flowpath coincides with the inflow to a receiving flowpath. This supports description of upstream-downstream relationships between flowpaths [HY_F].
Realization	FlowpathNetwork	Realizes	CatchmentAggregate

Aggregation	ElementaryFlowpath [1..*]	Participates in	FlowpathNetwork [1..*]
Aggregation	ElementaryFlowpath [1..*]	Makes up	MainFlowpath [1]
Association	HydroNode [1]	Drains to	ElementaryFlowpath [1]
	Role: *outflow*		Role: *contributingFlowpath*
	Outflow point of the contributing flowpath. For a dendritic network of flowpaths, the outflow of a contributing flowpath coincides with the inflow to a receiving flowpath. This supports description of upstream-downstream relationships between flowpaths [HY_F].		Identifies the flowpath that contributes flow to this hydro node. This allows connection of the flowpath's outflow to an identified inflow and to determine its position through referencing the inflow [HY_F].
Association	HydroNode [1]	Drains from	ElementaryFlowpath [1]
	Role: *inflow*		Role: *receivingFlowpath*
	Hydro node in terms of inflow to the receiving flowpath. For a dendritic network of flowpaths, the outflow of a contributing flowpath coincides with the inflow to a receiving flowpath. This supports description of upstream-downstream relationships between catchments [HY_F].		Identifies the flowpath that receives flow from this hydro node. This allows connection of a flowpath's inflow to an identified outflow and to determine its position through referencing the outflow [HY_F].
Association	HydroLocation [0..*]	Located on	ElementaryFlowpath [1]
	Role: *referenceLocation*		Role: *linearElement*
	Identifies the permanent reference location to which a position is assigned to a hydro location feature of interest.		Identifies a flowpath used as the linear element along which a position is assigned to a hydro-location, or any feature of interest.
Association	OtherHydroFeature [1]	Drains to	HydroNode [0..*]

5 Coded Value Domains

This section provides legal values and their associated definitions for coded-value domains. Most of the terms and definitions were derived from either HY_Features, CHyF, or the original NHN data model documentation.
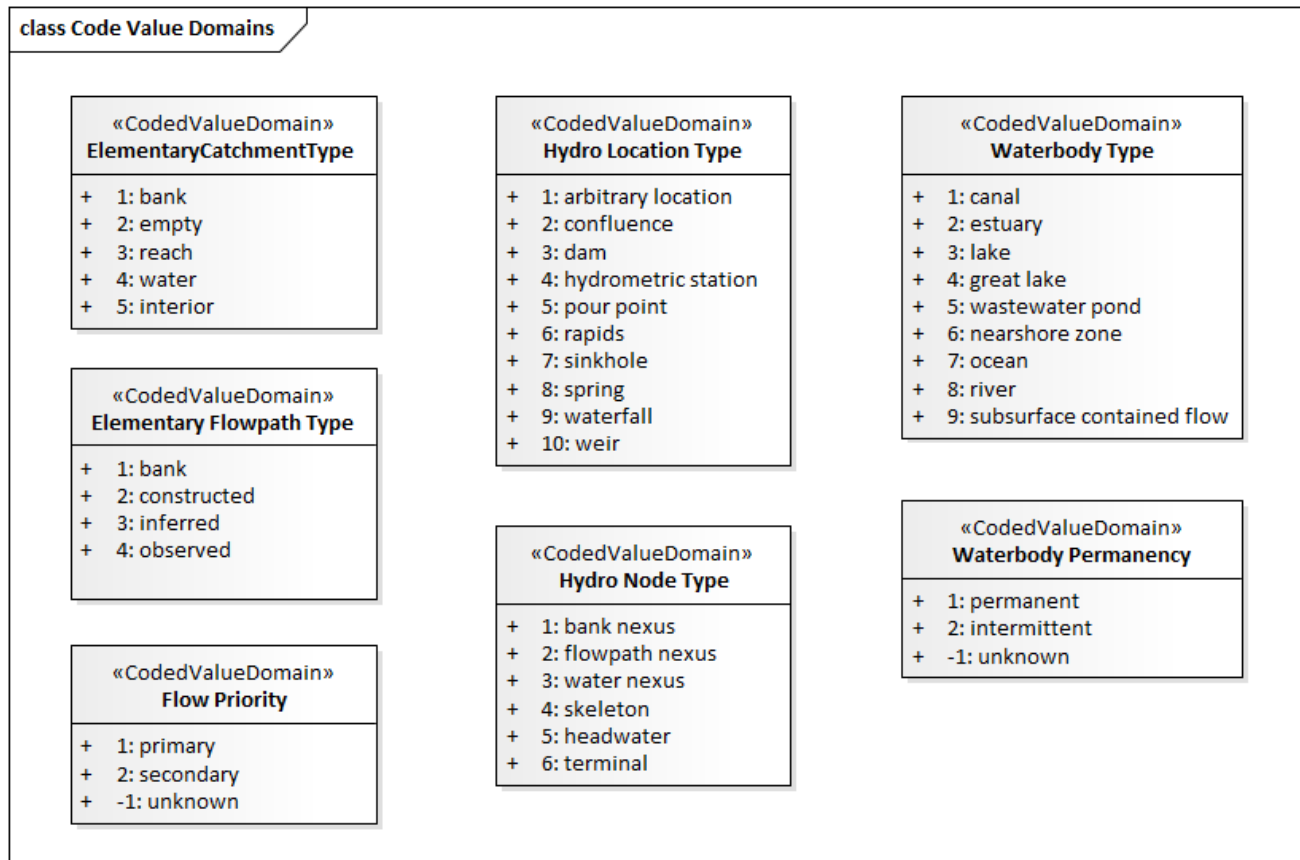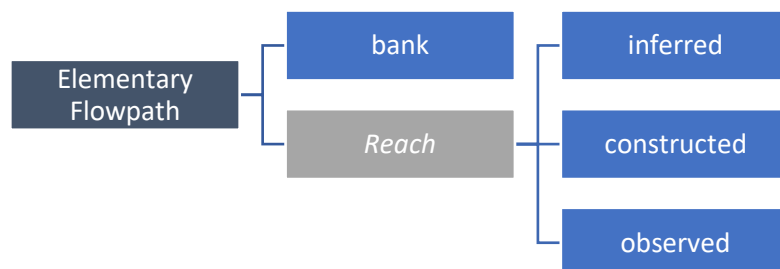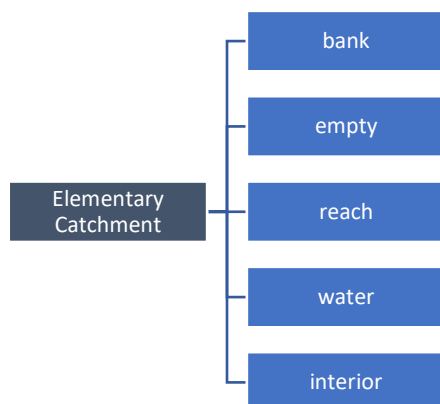

Figure 3: Summary of coded value domains

5.1 Elementary Flowpath Type

Code	Value	Description
1	bank	A flowpath that connects a bank catchment to other skeletal elements (inferred flowpaths) in a waterbody with polygonal geometry. It is otherwise similar to an inferred flowpath.
2	constructed	A flowpath that appears to traverse the land but was not visible when mapped. Flowpaths through dams or through heavily forested terrain are examples.
3	inferred	A flowpath that exists as a skeletal element in a waterbody with polygonal geometry. It is similar to a bank flowpath, but does not connect to a bank catchment.
4	observed	A flowpath corresponding to a section of a river with linear geometry.

5.2   Elementary Catchment Type

```
                                 ┌──────────────┐
                                 │     bank     │
                                 └──────────────┘
                                 ┌──────────────┐
                                 │    empty     │
                                 └──────────────┘
        ┌─────────────┐          ┌──────────────┐
        │ Elementary  │──────────│    reach     │
        │ Catchment   │          └──────────────┘
        └─────────────┘          ┌──────────────┐
                                 │    water     │
                                 └──────────────┘
                                 ┌──────────────┐
                                 │   interior   │
                                 └──────────────┘
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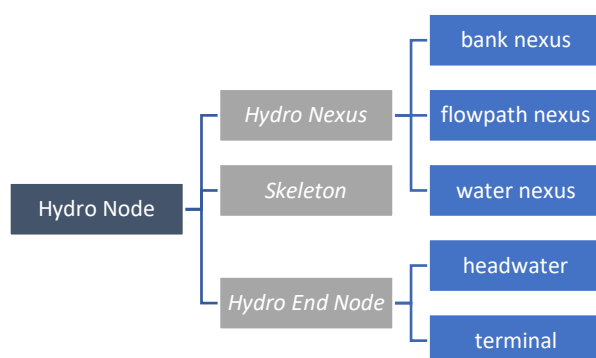| Code	Value	Description
1	bank	An elementary catchment consisting of land that drains to a section of a river represented geometrically as a polygon in 2D. It does not contain a waterbody, although it is adjacent to one. For example, if two streams drain into a lake, the remnant area between the catchments for the two streams also drains into the lake; it defines a bank catchment.
2	empty	An elementary catchment consisting of internally drained land that does not touch a waterbody. In 2D the ring defining its boundary does not surround any waterbodies.
3	reach	An elementary catchment consisting of land that drains to a section of a river represented geometrically as a linear element in 2D. The river feature is contained in the catchment.
4	water	An elementary catchment consisting entirely of a waterbody of a portion of a waterbody, where the geometry of the feature is a polygon in 2D. A single small lake may be geometrically equivalent to a water catchment. A larger lake or a river sufficiently large to have polygonal geometry may be broken into a series of areas, each defined as a water catchment.
5	interior	An interior catchment defines a basin with no flowpath connections on the surface to flowpaths outside of the catchment.

5.3   Flow Priority

Code	Value	Description
1	primary	main route [NHN]
2	secondary	alternate route [NHN]
-1	unknown	impossible to determine [NHN]

5.4   Hydro Location Type

Code	Value	Description
1	arbitrary location	An arbitrary location is a hydro location of indeterminate type. It may be used to reference other phenomena not included in the other code list values.
2	confluence	Joining, or the place of junction, of two or more streams. [HY_F, WMO]
3	dam	Barrier constructed across a valley for impounding water or creating a reservoir. [HY_F, WMO]
4	hydrometric station	Station at which data on water in rivers, lakes or reservoirs are obtained on one or more of the following elements: stage, streamflow, sediment transport and deposition, water temperature and other physical properties of water, characteristics of ice cover and chemical properties of water. [HY_F, WMO]

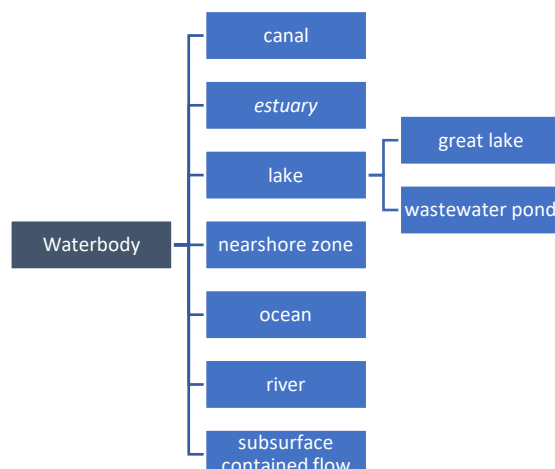| 5 | pour point | "Specified catchment outlet defined to delineate a catchment upslope from that point." [HY_F] Pourpoint (or pour point) is not listed in the WMO glossary, but it is a very useful concept. CHyF provides a service that allows for various ways of specifying a pourpoint. |
6	rapids	Reach of a stream where the flow is very swift and shooting, and where the surface is usually broken by obstructions, but has no actual waterfall or cascade. [HY_F, WMO]
7	sinkhole	Place where water disappears underground in a limestone region. It generally implies water loss in a closed depression or blind valley. [HY_F, WMO]
8	spring	Place where water flows naturally from a rock or soil onto land or into a body of surface water. [HY_F, WMO]
9	waterfall	Vertical fall or the very steep descent of a stream of water. [HY_F, WMO]
10	weir	Overflow structure which may be used for controlling upstream water level or for measuring discharge or for both.[HY_F, WMO]

5.5 Hydro Node Type

Code	Value	Description
1	bank nexus	A bank nexus is a point representing the interface between a bank catchment and a water catchment. A bank nexus is equivalent to the upstream endpoint of a bank flowpath.
2	flowpath nexus	A flowpath nexus is a point representing the interface between a reach catchment and either another reach catchment or a water catchment.
3	water nexus	A water nexus is a point representing the interface between two water catchments.
4	skeleton	A confluence point on a flowpath network that does not represent the interface between catchments. It occurs in lakes, rivers, and estuaries as a means of establishing network connectivity. It is always coincident with an endpoint of one or more inferred flowpaths.
5	headwater	A graph endpoint hydro node used to specify the start of a flowpath, where there does not exist any inflowing flowpath. It corresponds to the the start of a headwater (first order) stream. A flowpath exists downstream of the headwater point, but none is defined upstream of it. A headwater node usually has a valence of 1.
6	terminal	A graph endpoint hydro node used to specify the end of a flowpath that is not connected to any further downstream flowpath. It acts as the terminus of a flowpath network. A terminal node usually has a valence of 1.

5.6 Waterbody Permanency

Code	Value	Description
1	permanent	A waterbody which exists for a long, indefinite period [NHN]
2	intermittent	A waterbody that contains water flow only at certain times
-1	unknown	Impossible to determine

5.7   Waterbody Type

Code	Value	Description
1	canal	A body of surface water, participating in a hydrographic network, special due to its artificial origin (man-made) and its permanent or temporary flow. Artificial waterway for navigation and for the transport of water are canals. Ditches and drainage channels that typically contain water are also included [after HY_F].
2	estuary	A body of surface water, participating in a hydrographic network, made special due to branching and its interaction with the open sea. [HY_F] Estuaries are characterized by tidal waters and are often associated with deltas.
3	lake	A body of surface water, participating in a hydrographic network; it is special due to its considerable size and the lack of significant observable flow except at inflows and outflows. A lake may or may not be anthropogenic in origin and may or may not be regulated. [after HY_F] It usually contains freshwater, but may also contain salt water, as with the Dead Sea, Lake Assal and the Great Salt Lake.
4	great lake	One of the Laurentian Great Lakes of North America or other very large lakes. They are conceptualized as a specialization of the general notion of a lake, with potentially specific associated methods and attributes that may for example be derived from ocean models.
5	wastewater pond	A pond or lagoon designed to contain wastewater for treatment, they are conceptualized as a specialization of the general notion of a lake [after EPA-2011].
6	nearshore zone	The zone extending from the edge of an ocean or a large lake or a large river or a large estuary, where the edge is defined as the limit of land as found on topographic mapping, to an arbitrary distance that may be related by bathymetry, littoral characteristics including wave activity, coastal currents, or a buffer zone of a given dimension. A river emptying into the ocean or a large lake may be said to be emptying into the nearshore zone.
7	ocean	A large body of saline water that composes much of the earth's hydrosphere and that is not situated inland. Seas and bays that extend to the open ocean are classed as ocean. The Caribbean and Mediterranean Seas and the Bay of Bengal are considered as ocean, whereas the Caspian Sea in Asia is a lake.
8	river	A body of surface water, participating in a hydrographic network; it is special due to its property of permanent or temporary flow. [HY_F] In common parlance, streams and rivers of any size fall under this class.
9	subsurface contained flow	A body of subsurface flow contained in a conduit, participating in a hydrographic network. This relates to water flow through a dam or industrial complex or as part of an urban infrastructure. Storm drains and sanitary sewers fall into this class.