National Hydro Network
(NHN)

2015-08-31

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Earth and Sciences Sector
Canada Centre for Mapping and Earth Observation

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RELEASES HISTORY

Date	Description
2015-08-31	Updating links
2015-02-10	Adding direct FTP link to download the data and updating links for partners.
2014-09-01	Original edition

TABLE DES MATIÈRES

What is GeoBase?

GeoBase is a federal, provincial and territorial government initiative that is overseen by the Canadian Council on Geomatics (CCOG). It is undertaken to ensure the provision of, and access to, a common, up-to-date and maintained base of quality geospatial data for all of Canada. Through GeoBase, users with an interest in the field of geomatics have access to quality geospatial information at no cost and with unrestricted use. More on GeoBase initiative.

Description

The National Hydro Network (NHN), for which the standard was officially adopted by the Canadian Council on Geomatics (CCOG) in August 2004, focuses on providing a quality geometric description and a set of basic attributes describing Canada's inland surface waters. It provides geospatial vector data describing hydrographic features such as lakes, reservoirs, rivers, streams, canals, islands, obstacles (e.g. waterfalls, rapids, rocks in water) and constructions (e.g. dams, wharves, dikes), as well as a linear drainage network and the toponymic information (geographical names) associated to hydrography.

The NHN forms the hydrographic layer of the GeoBase. The best available federal and provincial/territorial data are used for its production, which is done jointly by the federal government and interested provincial and territorial partners.

The modeling work of the NHN is based in part on Linear referencing System (LRS) concepts. This approach allows the management of geometric representations separately from attribute information (referred to as events in LRS). Unique identifiers (called National Identifiers - NID), associated to each NHN feature, allow for efficient management of updates. The NHN is a vector, topographic data product primarily designed to allow hydrographic network analysis. It is intented for water flow analysis, water and watershed management, environmental and hydrographical applications, as well as for a multitude of cartographic applications.

For more information on the NHN, you may refer to the following links:

- Why the NHN
- A Bit of History...
- Work Units
- NHN Implementation Strategy
- NHN Completeness Levels
- NHN Partners
- Differences in NHN Data
- NHN Fact Sheet [pdf 5.6 MB]

Documentation

NHN Standard (conceptual description)

For more information on the official National Hydro Network Standard approved by the CCOG in August 2004, you may refer to the following documents:

- National Hydro Network, Canada, Level 1, **Product Specifications**, Edition 1.0, 2004-08 [pdf 109 KB]
- National Hydro Network, Canada, Level 1, **Data Model**, Edition 1.0, 2004-08 [pdf 89 KB]
- National Hydro Network, Canada, Level 1, **Linear Referencing System (LRS), Data Catalogue**, Edition 1.0, 2004-08 [pdf 605 KB]

NHN Product (data description)

For more information on the National Hydro network distribution profile, you may refer to the following documents:

- National Hydro Network, **Data Product Specifications**, Distribution Profile, Edition 1.1, 2010-05-17 [pdf 164 KB]
- National Hydro Network, **Feature Catalogue, Distribution Profile**, Edition 1.0, 2007-06-01
- National Hydro Network, **Feature Catalogue, Distribution Profile**, Edition 1.0.1, 2008-06-01

National Vector Data

In GeoBase, documents found under the "National Vector Data" (NVD) label describe concepts which are potentially common to GeoBase vector products. The following document applies to the NHN:

- National Vector Data - **Identification Rules**, Edition 2.0, 2007-04 [pdf 44 KB]

Release Notes, [pdf file]

Metadata

Metadata are provided with each dataset. Among other, the validity date and the planimetric accuracy are shown in this file.

Use and Restrictions

Use of the GeoBase data is subject to the Open Government Licence – Canada.

Data Format

NHN datasets are available in ESRI File GeoDatbase, GML (Geography Markup Language) and ESRI Shapefiles.

A subset of NHN datasets is also distributed in the KMZ format, which is a compressed version of the KML (Keyhole Markup Language) format. This format allows for displaying NHN data using software such as Google Earth and Google Map. For the KMZ format, it should be noted that large size NHN datasets are divided into quadrants. They are split into four smaller files in order to be acceptable to the Google Earth application. A resulting KMZ file from such a division may nevertheless still happen to be too heavy for the Google Earth application.

Image maps are also available in Portable Document Format (PDF). They are created from NHN work units (drainage areas), a subset of NHN data and the Canadian Digital Elevation Data. They also contain names information to allow to position oneself and the water flow direction is symbolized by arrows. It thus becomes easy to view and to print the hydrographic data contained in a drainage area. Image maps are datasets available in May 2010. They provide easy way to view and print hydrographic data contained in a drainage area.

Note: Some image maps may contain some shortcomings. For example, the water flow direction represented by arrows may be missing where the hydrographic network is dense. In addition they have been designed to be

printed on a plotter 42 " wide. Since the width has been set, the length then becomes variable which makes some files too long to be printed at their planned level of details. This PDF format will be improved in future releases.

For more information on National Hydro Network data distribution formats, you may refer to the following document:

- National Hydro network, **Product Distribution Formats**, Edition 1.0.3, 2010-05-17 [pdf 122 KB]

Editing or Viewing Free Software

It is possible to see data using free software, see the question 'How can I open a raster or vector dataset if I do not have a GIS software?' in the GeoGratis FAQ section.

The following tools are all available on ESRI Development Network (EDN):

- Set Flow by Digitized Direction tool for ArcGIS Geometric Network
- Individual Flow Direction tool for ArcGIS Geometric Network
- Flip Direction tool for ArcGIS
- Generate Stream Order for ArcView GIS
- Watershed Delineation Tools for ArcGIS
- Hydrologic Modeling tool for ArcGIS

Take note that GeoBase does not endorse nor support any of these tools.

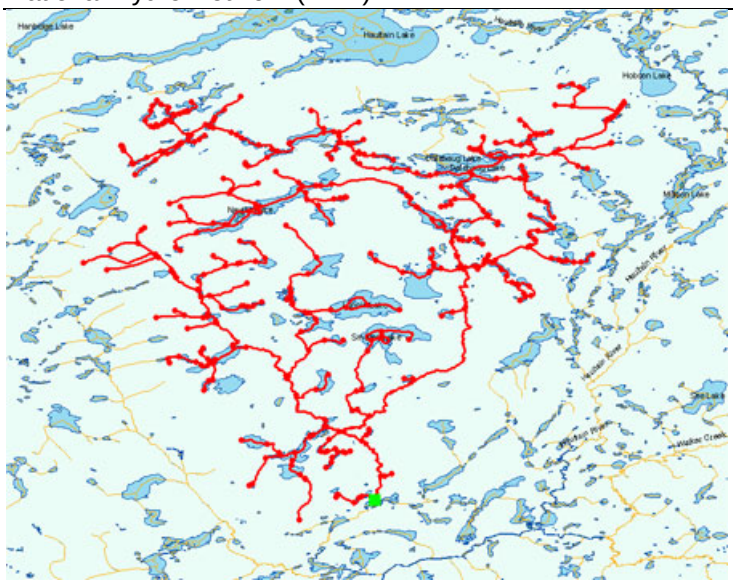
Why the NHN

Water is a priceless resource. It is essential to life and shapes the Earth as we know it. In addition to being essential to our fundamental needs, water creates electricity, enables water-transport, fire operations, agriculture, industry, tourism and recreational activities. It ensures biodiversity of plants and animal species. Canada's water supplies are abundant but not unlimited. Nothing can replace water.

Because water is available in limited quantities and used widely, one may question its consumption and the criteria and priorities for its sustainable use.

The National Hydro Network (NHN) is a water management tool that offers decision makers exact, reliable and current information related to Canada's surface water supplies. It allows managers to make knowledgeable decisions in regards to the use of this invaluable resource. The NHN contributes to Canada's commitment towards sustainable development.

Resource managers and industry leaders, including federal, provincial, territorial and regional government decision makers, as well as the private sector, use the NHN for water management. The NHN is also available to non-government agencies, environmental associations and the public for surveillance and information needs, as well as for individual decision making.



NHN data is used in water flow analysis, monitoring and watershed management. It is also useful for research needs and data manipulations. For example, in the event of a toxic spill, NHN data may be used within a geographic information system (GIS) in order to monitor the flow and extent of the contaminant discharge in surface waters, to determine how far it will carry and the affected areas and people. The NHN can also be used to help decision-makers in their evaluation of the required aid measures needed for agriculture or evacuation in case of drought or flooding.

Adapted for GIS, the NHN may be imported in more elaborate information systems to help represent relations between surface waters and other geographic features while preserving NHN data integrity. The NHN also facilitates water data sharing, making it a useful tool for a number of water management applications.

A bit of history...

The adoption of the NHN Standard by the Canadian Council on Geomatics (CCOG) is the result of an important partnership endeavour. Following several national meetings, the standard was conceived and finally approved.

At its fall 2001 meeting in Fredericton, the CCOG endorsed the GeoBase initiative in order to improve the quality of base geospatial data offered to Canadians. During this meeting, Nova Scotia Geomatics Centre (NSGC) and Natural Resources Canada (NRCan) were asked to demonstrate the feasibility of a distributed data base.

This demonstration was accomplished during a special meeting of the CCOG in Ottawa in the spring of 2002, and the definition of a unique standard for a National Hydro Network (NHN) appeared as the next logical step. This mandate was again given to the NSGC and NRCan team. Recognizing both the specific expertise and

experience of the British Columbia's Base Mapping & Geomatic Services (BMGSBC) with regards to hydrography, the partners invited the latter to contribute to efforts directed at defining an NHN standard. BC's representatives have since been highly involved in the NHN creation process.

At its fall 2002 meeting in Victoria, the CCOG recognized and praised the NRN (National Road Network) consultative approach in defining the National Standard. This approach was thus clearly recommended for the development of the NHN, as well.

Since the Victoria meeting, an impressive consultation work was achieved. In all, more than ten workshop meetings, gathering data producers and users, were held in regards to the development of the NHN standard. In addition, two national consultations involving federal, provincial and territorial stakeholders took place.

In February 2003, after nearly a year of shared work by NSGC, BMGSBC and NRCan to develop the NHN standard, a first national consultation was held. To that effect, two workshops held in Winnipeg and Halifax were organized and coordinated by NRCan. The objective of these workshops was to inform participants and also gather comments from federal and provincial/territorial stakeholders at the national scale.

A second national consultation was held in Montreal in March 2004. After nearly 2 years of development, the NHN model was fairly stable. The group then proposed a first NHN standard version. The NHN project presentation to federal and provincial/territorial stakeholders during this consultation allowed them to validate and support the approach.

Finally, in August 2004, the first NHN Standard version was endorsed by CCOG and thereby became a national standard.

After the NHN Standard was nationally adopted, the team from the Canada Centre for Mapping and Earth Observation (CCMEO) was given the mandate to implement the NHN. The latter is implemented under the leadership of the National Hydro Network Project from the NRCan Earth Sciences Sector Contribution to GeoBase Program. Discussions to produce NHN data in partnership were then engaged with some provincial/territorial partners. Agreements had been concluded with British Columbia, Manitoba and Yukon. On October 1st 2007, the day of the NHN product official launch, most of the 287 NHN datasets published resulted from those agreements.

However, the experience gained through this initial NHN data production questioned the prevailing approach to create the NHN data layer in Canada. A deep reflection led to the development of a new NHN Implementation Strategy. Since then, NHN data production is driven by this strategy.

The NHN Completeness Levels concept was born with this strategy. Direct results from this are NHN datasets now showing different completeness levels.

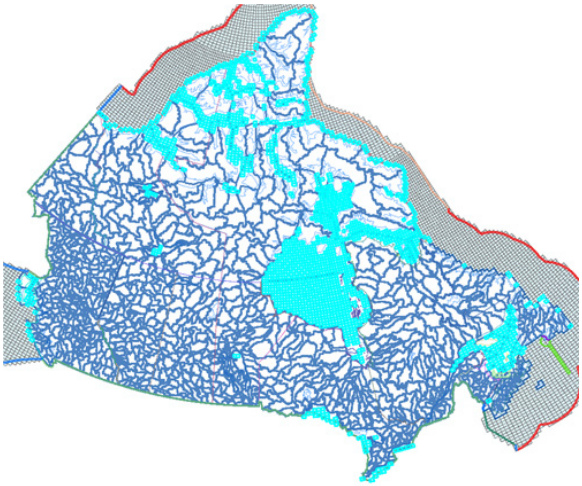
NHN Work Units

WARNING: NHN Work Unit Limits are not official boundaries for watersheds or drainage areas. For more information, please read the text below and the text box at the bottom of this page.

The original NHN Work Unit Limits were created based on the Water Survey of Canada Sub-Sub-Drainage Areas (WSCSSDA) and Fundamental Drainage Areas (FDA) from the Atlas of Canada. They are being modified and refined as better provincial source data is brought into the data production process following NHN partnerships between federal and provincial/territorial agencies. Each NHN Work Unit Limit is adapted to fit the source data used to generate NHN data. Where applicable, they are stretched seaward from the Canadian coast. As a result, NHN Work Unit Limits no longer correspond exactly to those from the WSCSSDA or the FDA. Therefore, it is important not to mistake them as WSCSSDA or FDA boundaries. Moreover, although the naming convention used for NHN Work Units (e.g. 07LEA00) is inspired and derived from WSCSSDA (e.g. 07LE) and FDA (e.g. 07LEA) names, it does absolutely not refer to WSCSSDA or FDA hydrometric stations nor to their boundaries. It is expected that NHN Work Unit Limits will evolve over time as source data is replaced or updated.

NHN datasets are produced and distributed per NHN Work Unit. The NHN Work Unit is actually a drainage area. The NHN Work Unit Limit feature delimits the drainage area covered by a NHN dataset. This feature is not part

of the NHN Standard and Data Model. It has been created to define the NHN dataset's extent. It is distributed within NHN data products for reference purposes. This limit is actually a simple polygon (no hole), as opposed to a complex polygon. Apart from Sable Island (01EQ002) located offshore from the Nova Scotia coast, NHN Work Unit Limits (polygons) are contiguous between them and make up a complete territorial coverage without any gap and overlap. Altogether they currently represent more than 1325 units or territorial divisions covering the entire Canadian landmass. This coverage stretches from the Canada/USA International Boundary up to the Canadian territorial sea or to the 1:50,000 scale National Topographic System (NTS) tile limits along the Canadian coastline, as shown in white and blue on the following figure.



The territorial sea mentioned above is an area of the sea that has an outer limit extending up to 12 nautical miles measured seaward from the Canadian coast.

For more information about NHN Work Units, refer to the National Hydro Network, Data Product Specifications, Distribution Profile, Edition 1.0, 2007-06-01, more specifically the *"Feature Information / Application Schema"* and the *"Data Maintenance / Description"* sections, as well as the NHN Index section.

WARNING: NHN Work Unit Limits are not official boundaries for watersheds or drainage areas.

Watershed and drainage area boundaries available in Canada can be downloaded from the following sites:

- GeoGratis portal for information on the Water Survey of Canada Drainage Areas and Drainage Areas from the Atlas of Canada. Search **Atlas of Canada 1,000,000 National Frameworks Data, Hydrology - Drainage Areas**.
- Open.canada.ca portal to get access to **PFRA Watershed Boundaries** .

NHN Implementation Strategy

After the NHN Standard was nationally adopted in August 2004, the team from the Canada Centre for Mapping and Earth Observation (CCMEO) was given the mandate to implement the NHN. The latter is implemented under the leadership of the National Hydro Network Project from the Earth Sciences Sector Contribution to GeoBase Program, Natural Resources Canada (NRCan). Discussions to produce NHN data in partnership were then engaged with some provincial/territorial partners. Agreements were then concluded with British Columbia, Manitoba and Yukon.

The agreement with British Columbia was assigning the responsability of the NHN data production to the province, whereas those with Manitoba and Yukon gave this responsibility to CCMEO. While British Columbia was developing its own NHN data production process based on using provincial source data, an initial production process was also developed and used by CCMEO to produce NHN data in about 40 drainage areas or NHN Work Units (WU) elsewhere in the country, of which 28 in northern Manitoba and 6 in the Yukon. It was realized during this initial production that it was difficult to process (assemble or update) all NHN data at once. The most

important problems noted were the large volume of features per WU, numerous references to other features (via identifiers), and the presentation of the same information/geometry in different features (e.g. banks vs waterbodies, obstacle features vs obstacle events).

Moreover, the emergence of new constraints required a review of the initial NHN Implementation Strategy, which led to the development of a **new NHN Implementation Strategy** based on the following elements:

- Availability of new SPOT imagery as a source for updating;
- Need for a simplified model to facilitate data updates and the implication of partners;
- Creation of NHN data by stages (completeness levels);
- Quick implementation of a first NHN national coverage.

The Medium Resolution Imagery (MRI/GeoBase) project launched in 2005 with the goal of covering the entire country in a five-year period (2005-2010) SPOT orthoimages (with a 10-metre resolution for the panchromatic band and 20-metre for multispectral bands), and the implementation of a simplified NHN model, called NHN-Hybrid, used as an intermediate model in the production of NHN data, enables meeting the NHN need for data updates.

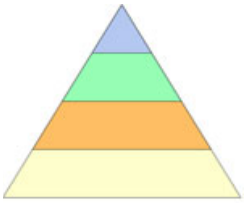
In order to quickly provide users with NHN data, an implementation-by-stage approach, developed in consultation with provincial and territorial partners across the country and called **Completeness Level (CL) Approach**, was developed. In this new approach, levels are defined and completed in successive production phases, thus making intermediary results available to users. According to this approach, each WU has its own specific completeness level. Each level is backward compatible regarding data content. This implies that a superior level contains all of the data content from a lower level and more. Thus, in regards to content, a lower level is always a subset of a superior one.

With this approach, users get a clear description of the completeness level status for each WU. Four Completeness Levels (CL1 to CL4) were defined under this approach. The new NHN Implementation Strategy progressively allows reaching the required content and structure of the NHN. The NHN Completeness Levels section describes the characteristics of the four NHN completeness levels distributed on GeoBase.

It is thus in early 2008 that re-started the NHN data production. The CCMEO then implemented an automatic NHN data production process using NRCan's digital topographic data. This process enables, depending on the source data content, reaching either the NHN Completeness Level 1 or 2 for each WU. This is how the initial NHN data production in Manitoba and the Yukon was completed. This same process was used to create the first national NHN data coverage, which has been complete in October 2013.

Since the application of the new NHN Implementation Strategy, 2 new partnership agreements have been concluded with the provinces of Ontario and Quebec. These provinces may then produce their NHN data according to the NHN completeness Level permitted by the content and data structure of their provincial data. They may also opt to produce their data in accordance with the NHN model or the NHN-Hybrid production model.

NHN Completeness Levels



NHN Completeness Levels realize the NHN Implementation Strategy which aims for a progressive creation of the National Hydro Network (NHN) in Canada. In the short term, its goal is to obtain a national coverage of basic NHN data, followed by an evolution through completeness levels and gradual updating of the product.

The NHN creation through completeness levels aims at:

- Simplifying the data creation processes;
- Getting maximum benefit from automatic processes;
- Facilitating the use of provincial/territorial data and capabilities;
- Providing users with useful intermediate products while building the NHN.

Four completeness levels, from CL1 to CL4, define the content of the NHN product. The first level, Completeness Level 1, presents a version of the NHN product generated exclusively from an automated process. It targets a quick coverage of the country with minimal NHN data content. The last level, Completeness Level 4, presents a full NHN data content. Each completeness level meets the NHN product standards and specifications.

- National Hydro Network - Completeness Level 1 (NHN-CL1)
- National Hydro Network - Completeness Level 2 (NHN-CL2)
- National Hydro Network - Completeness Level 3 (NHN-CL3)
- National Hydro Network - Completeness Level 4 (NHN-CL4)

Tabular documents describing in detail the NHN completeness levels are also available and directly accessible through the following links:

- NHN Completeness Levels Main Characteristics, 2012-04-27 [pdf 15 KB]
- Detailed View of NHN Completeness Levels, 2012-04-27 [pdf 15 KB]

Finally, NHN data at various completeness levels can be subject to some particularities, deviations or differences compared to NHN standards and specifications. For more information on this matter, please refer to the Differences in NHN Data section.

Completeness Level 1 (NHN-CL1) - Network

Network Linear Flow Construction

The first completeness level is defined by the NHN's automatic construction using Geospatial Data Base from Natural Resources Canada. These data will gradually be replaced by current federal, provincial or territorial data in a subsequent completeness level.

The objective set out at this level is to produce the NHN using a fully automated process and make it available to the public within a one-year period (2008). At this level, some concepts are partially implemented. For example, Network Linear Flows are created for the entire NHN Work Unit, but their continuity is not assured between the source data's cartographic map sheets or tiles. The hydrographic network directionality (flow direction) is only partially built-in, especially in flat areas. Toponymy (geographical names) is mainly supported by a point type geometry and not necessarily linked to features via toponymic attributes. A fraction of the named NHN features will bear toponymic information in attribute. Subsequent completeness levels will enable the completion of features and concepts not dealt with at this level.

NHN-CL1 data may show particularities, deviations or differences as opposed to the National Hydro Network standards and specifications. For more information, refer to the Differences in NHN Data section.

Completeness Level 2 (NHN-CL2) – Waterbody definition

Waterbody Definition by Adding Delimiters

The second completeness level defines waterbody areas. The main objective consists at delimiting the various types of Waterbodies by adding Delimiters, for example between lakes and area type watercourses. Network Linear Flows created at the previous level (NHN-CL1) are segmented by the newly added Delimiters. The updating process that usually follows the NHN-CL2 should minimally affect Network Linear Flows or network segments within waterbody areas. Completeness Level 2 stabilizes the hydrographic network since the majority of Network Linear Elements are present.

NHN-CL2 data may show particularities, deviations or differences as opposed to the National Hydro Network standards and specifications. For more information, refer to the Differences in NHN Data section.

Completeness Level 3 (NHN-CL3) – Data continuity

Hydrographic Network Structuring by *NHN Work Unit*

The third completeness level aims at completing the hydrographic network structuring within a drainage area or NHN Work Unit.

Three main factors must be assured within a NHN Work Unit in order to comply with the NHN-CL3, namely:

- Assure the linear network global continuity (Network Linear Flow geometric continuity);
- Validate/Correct the flow direction of network linear segments (Network Linear Flow directionality);
- Assure geometric continuity of toponymy (geographical names) provided as feature attributes

Even though it is preferable to update an NHN Work Unit before completing the NHN-CL3, this level can nevertheless be reached without data being updated. The NHN-CL3 ensures that all features required for network analysis are completed and validated.

NHN-CL3 data may show particularities, deviations or differences as opposed to the National Hydro Network standards and specifications. For more information, refer to the Differences in NHN Data section.

Completeness Level 4 (NHN-CL4) – Toponymy upgrade

Toponymy Geometric Completion and Update

The last toponymy (geographical names) update in the National Topographic Data Base (NTDB) dates back to 1995. Completeness Level 4 (NHN-CL4) is intended for the completion of toponymy in NHN data. This operation consists in modifying the geometry of toponyms not yet associated with NHN features and updating toponymic information using an official geographical names database. Official geographical names databases are from a province/territory or lacking these, the Canadian Geographical Names Data Base (CGNDB) 1997. This last step in building the NHN provides a full NHN content that meets the National Hydro Network Standard adopted by the CCOG in August 2004.

NHN-CL4 data may show particularities, deviations or differences as opposed to the National Hydro Network standards and specifications. For more information, refer to the Differences in NHN Data section.

Differences in NHN Data

This section addresses known particularities, deviations or differences in NHN data as opposed to the initial National Hydro Network Standard. Since NHN data are produced using the best available source data - provincial data, for example - they de facto inherit from them. NHN data may, as a result, reflect source data limitations or constraints. In addition, all NHN data, produced via various NHN data production processes, inherit deviations introduced by the NHN Distribution Profile.

- NHN Distribution Profile Deviations
- Particularities in NHN data produced by Natural Resources Canada (NHN-CL4)
- Particularities in NHN-CL1 data produced by Natural Resources Canada
- Particularities in NHN-CL2 data produced by Natural Resources Canada
- Deviations in NHN data from British Colombia (NHN-CL4)
- Particularities in NHN Data from Ontario (NHN-CL2)
- Particularities in NHN Data located on the United-States territory

NHN Distribution Profile Deviations

NHN data is available according to the NHN Distribution Profile present some deviations (differences) compared with initial NHN Standard. These deviations are documented in the *National Hydro Network, **Distribution Profile Deviations**, 2010-11-18* [pdf 49 KB].

For more information on the initial NHN Standard and on the NHN Distribution Profile, please refer to the National Hydro Network data Description / Documentation section, respectively under sub-sections **NHN Standard (conceptual description)** and **NHN Product (data description)**.

Particularities in NHN data produced by Natural Resources Canada (NHN-CL4)

NHN data products produced by Natural Resources Canada (NHN-NRCan) following its initial NHN data production process (2007), namely NHN Completeness Level 4 (NHN-CL4) data, present the following particularities (in their Distribution Profile) compared with the initial NHN Standard:

1. **[Water Definition attribute]** Attribute values "DITCH" (3), "TIDAL RIVER" (7) and "SIDE CHANNEL" (10) are not present in NHN data initially produced by Natural Resources Canada (NRCan).

Particularities in NHN-CL1 data produced by Natural Resources Canada

NHN data products produced by Natural Resources Canada (NHN-NRCan) following its NHN-CL1 data production process, namely NHN Completeness Level 1 (NHN-CL1) data; fully comply with NHN-CL1 minimal requirements. Read more on NHN Completeness Levels Main Characteristics.

NHN-CL1 data present the following particularities compared with the initial NHN Standard:

1. **[Littoral, Bank]** NHN-CL1 data (Distribution Profile) do not contain the "Littoral" feature initially planned for in the NHN Hydro Network package. Actually, this feature has been replaced by the "Bank" feature for which the "WATER DEFINITION" attribute has the value "UNKNOWN" (-1).

2. **[Named Feature]** NHN-CL1 data only contain point-type geometric representation "Named Feature" features. These features convey toponyms for which an automatic correspondence could not be established with a geometric feature from the Hydrographic Package.

3. **[Waterbody]** NHN-CL1 data contains "Waterbody" entities located beyond the Canadian landmass where as the initial NHN Standard stipulates that they end at the coastline. The "WATER DEFINITION" attribute of such waterbodies then bears the value "UNKNOWN" (-1). This particularity results from the fact that at the Completeness Level 1, "WATER DEFINITION" attributes may be unknown. NHN-CL1 data progression to a higher level will establish "WATER DEFINITION" attributes for all "Waterbody" features and as a result, those located beyond the coastline will no longer be represented in the NHN.

4. **[Hydro Events package]** According to the initial NHN data model, NHN events are created from the geometric intersection or geometric projection of a "Manmade Hydrographic Entity" or "Hydrographic Obstacle Entity" with a network linear element (Network Linear Flow or Bank). However, in NHN-CL1 data, all events found result from a geometric intersection only.

5. **[Entity Type attribute]** The "Entity Type" attribute assigned to "Named Feature" entities from the Toponymic Package is always set to "Inland Water" (8) in the NHN. As a result, in NHN-CL1 data, it is possible that some "Named Features"" bearing this value may be located beyond the Canadian landmass as indicated above under [Waterbody]. As NHN-CL1 data progress to a superior completeness level, such "Named Features" will no longer be part of the NHN.

6. **[Flow Direction attribute]** In NHN-CL1 data, only "Network Linear Flow" features having the value "PRIMARY" (1) for the "Level Priority" attribute and the value "FALSE" (0) for the "Isolated" attribute are oriented (digitizing direction) downstream. They therefore bear the value "Same Direction" (1) for the "Flow Direction" attribute. All other "Network Linear Flow" features either bear the value "UNKNOWN" (-1) or "N/A" (3) for their "Flow Direction" attribute.

7. **[Level Priority attribute]** In NHN-CL1 data, the "PRIMARY" value for the "Level Priority" attribute which qualifies the main Network Linear Flow path within a hydro network is allocated based on the shortest path principle instead of the size and importance of the watercourse. Thus, in NHN-CL1 data, it is possible to have a narrow and shallow section of a watercourse be identified as "PRIMARY ", whereas a wider, deeper and longer alternate section is identified as "SECONDARY".

Particularities in NHN-CL2 data produced by Natural Resources Canada

NHN data products produced by Natural Resources Canada (NHN-NRCan) following its NHN-CL2 data production process, namely NHN Completeness Level 2 (NHN-CL2) data; fully comply with NHN-CL2 minimal requirements. Read more on NHN Completeness Levels Main Characteristics.

NHN-CL2 data present the following particularities compared with the initial NHN Standard:

1. **[Named Feature]** NHN-CL2 data only contain point-type geometric representation "Named Feature" features. These features convey toponyms for which an automatic correspondence could not be established with a geometric feature from the Hydrographic Package.

2. **[Hydro Events package]** According to the initial NHN data model, NHN events are created from the geometric intersection or geometric projection of a "Manmade Hydrographic Entity" or "Hydrographic Obstacle Entity" with a network linear element (Network Linear Flow or Bank). However, in NHN-CL2 data, all events found result from a geometric intersection only.

3. **[Flow Direction attribute]** In NHN-CL2 data, only "Network Linear Flow" features having the value "PRIMARY" (1) for the "Level Priority" attribute and the value "FALSE" (0) for the "Isolated" attribute are oriented (digitizing direction) downstream. They therefore bear the value "Same Direction" (1) for the "Flow Direction" attribute. All other "Network Linear Flow" features either bear the value "UNKNOWN" (-1) or "N/A" (3) for their "Flow Direction" attribute.

4. **[Level Priority attribute]** In NHN-CL2 data, the "PRIMARY" value for the "Level Priority" attribute which qualifies the main Network Linear Flow path within a hydro network is allocated based on the shortest path principle instead of the size and importance of the watercourse. Thus, in NHN-CL2 data, it is possible to have a narrow and shallow section of a watercourse be identified as "PRIMARY", whereas a wider, deeper and longer alternate section is identified as "SECONDARY".

Deviations in NHN-CL4 Data from British Colombia

British Colombia NHN Data (NHN-BC) present the following deviations compared with the initial NHN Standard:

1. **[Manmade Features]** The BC-NHN does not contain Lock Gate, Boat Ramp, or Fish Ladder manmade features.

2. **[Obstacles]** The BC-NHN does not contain Reef, Rocks, Exposed Shipwreck or Ford features obstacle features.

3. **[Network Linear Flow]** The BC-CWB dataset contains culverts, storm sewers, and other inferred edges used for stream connectivity. These features are not observed and will not be present in the NHN Hydrographic package, however these edges are present in the NHN Network Linear Flow Class with a Network Flow Type of Constructed.

4. **[Obstacles and Manmade Features]** The BC-NHN contains dam, falls, dock and wharf features which may exist as "Points" or "Lines" inside of a waterbody. They may also exist on isolated single line watercourse features.

5. **[Toponymy]** In BC-CWB the toponymic information of named streams is only captured on the stream network. However in NHN this information is captured on both the network and hydrographic packages. Because of the constructed features in the CWB dataset there is a many-to-many relationship between the network linear flow and single line watercourse features. This many-to-many relationship results in single line watercourse features that are comprised of multiple network linear flow features of which only parts may be named. In BC-NHN, however, the entire single line watercourse feature is named which results in toponymic inconsistencies. For accurate toponymic information, the network linear flow named features should be used.

6. The BC international or provincial/territorial boundary does not match the GeoBase geopolitical boundaries along the BC-Alaska and BC-Washington, BC-Idaho, BC-Montana or BC-Alberta borders. The

differences vary on either side by up to 2 km with the largest differences occurring along the BC-Alaska and BC-Alberta Borders

7. **[Manmade Features]** The mapping of BC DryDock, FerryDock, MarinaDock, Pier/Wharf to NHN manmade features is as follows:
    - BC DryDock = NHN Slip
    - BC FerryDock = NHN Wharf
    - BC Marina Dock = NHN Wharf
    - BC Pier/Wharf = NHN Wharf
8. **[Manmade Features: Wharf]** The wharf manmade features were generated with the following additional spatial constraints: wharf CROSSES littoral OR relate (wharf, waterbody, FTT******).
9. **[Events]** The BC-NHN contains only events for manmade and obstacle features that are projected less than or equal to 10 metres.

BC manmade events for non-dike entities were generated by:

1. Creating events for intersections between manmade entities and associated network linear features:
    - A linear event was created for each network linear feature from the two further intersection points along the feature.
    - A point event was created if only a single intersection existed for the network linear feature (note that multiple point events will occur at the same x,y location if the entity intersects the network linear feature at a node (junction)).
2. Creating projected events for remaining entities.
    - For point entities, point events were created by using the nearest point along a network linear element within 10m.
    - For linear entities, the entities were intersected with all network linear features buffered by 10m. For each resulting intersecting feature, the start and end point of the geometry were projected back to the network linear feature and a linear event was created using the two point furthest away from each other on the network linear features. If the resulting linear event was less than 5m it was converted to point event (in an attempt to meet the requirement that entities that are perpendicular to network linear features create point events).
    - For polygonal entities, point events were created on the nearest network linear element within 10m of the polygon entity.
    - For all features if line events were created, point events were not created.
    - Dike events were generated using an intersection between 100m buffer around the dike and all associated network linear features within 100m. Next, cases where the entire network linear feature associated with the event was greater than 10m away from the dike entity were removed. This implies that a dike entity may have multiple events along multiple banks or littorals and dike events may be created along the network linear feature where part of the feature is greater than 10m from the dike entity; however, some other part of the feature must be within 10m. The reason for doing this was that there are many dikes that move in and out of the 10m range which would have resulted in many tiny linear events which is not representative of the data.

BC obstacles events were generated by:

3. Creating events for intersections between obstacle entities and associated network linear features:

- For linear intersections 2-vertex linear events were created.
- For point intersections point events were created.

4. Projected events were created for all entities without intersecting events and whose network linear element lies within 10m of the obstacle entity.
   - For point, line, and polygon entities, point events were created by using the nearest point along a network linear element within 10m

10. **[Manmade features]** The BC-NHN contains one Dam feature which is associated with an isolated Single line watercourse.
11. **[Obstacles]** The BC-NHN contains 11 Falls features that are associated with an isolated Single line watercourse.
12. **[Toponymy]** The BC-NHN has not attached river names to lake features as per the NHN model.
13. Along the BC / USA borders, BC has used extra-jurisdictional data when computing isolated attributes. Thus, some features along the border may be flagged as not isolated because data exists in the extra-jurisdictional regions.

The TRIM data product (which was used as input to the BC-NHN) contains the following specifications:

1. The TRIM dataset was captured from stereoscopic photo interpretation with a horizontal planimetric accuracy of +/- 10m, 90% of the time, and a vertical accuracy of +/- 10m, 90% of the time.
2. Any hydrographic feature is captured as linear when the feature is less than 20m wide, and polygonal when greater.
3. The minimum size of a lake is captured where the longest dimension is over 25 meters.
4. The maximum stream width at which the feature is captured as a line is 20 meters or less.
5. The maximum width at which the canal is captured as a line is 20 meters or less.
6. The coastline definition is captured at the high tide mark (high water level).
7. The maximum width at which a dock or wharf is captured as a line is 20 meters or less.

Particularities in NHN Data from Ontario (NHN-CL2)

NHN data created from Ontario provincial data (NHN-ON) were produced via the NHN-Hybrid model. This model which is a simplified version of the NHN model is used as an intermediate model to facilitate the creation of NHN data from provincial data. Read more on the NHN-Hybrid model in the NHN Implementation Strategy

NHN data produced following the NHN-ON production process fully comply with the NHN-CL2 minimal requirements. This data however presents some particularities compared with initial NHN Standard. These particularities either result from the content or data structure of the Ontario NHN-Hybrid data, or from final NHN data creation by Natural Resources Canada (NRCan).

1. **[Network Linear Flow]** The NHN-ON does not present "Network Linear Flow" features within headwater waterbodies, within some waterbodies with no outlet, nor in isolated waterbodies or waterbodies at the extremity of isolated networks. Also, a limited number of "Inferred/Secondary" types "Network Linear Flows" are present around islands. Such "Network Linear Flows" are only present when islands meet specified criteria established by the Land Information Ontario (LIO) division of the Ontario Ministry of Natural Resources (OMNR), which are described in the "Data Capture Specification for Hydrographic Features" document. All NHN-ON "Network Linear Flows" are however oriented, meaning that they all have the value "Same Direction" (1) for the "Flow Direction" attribute. These particularities result from Ontario NHN-Hybrid data content and structure.

2. **[Hydro Events package]** According to the initial NHN data model, NHN events are created from the geometric intersection or geometric projection of a "Manmade Hydrographic Entity" or "Hydrographic Obstacle Entity" with a network linear element (Network Linear Flow or Bank). However, in NHN-ON data, all events found result from a geometric intersection only. This particularity results from final NHN data creation by NRCan.

3. **[Toponymic Information]** Toponymic Information provided by the OMNR may be partial, which is why 2 toponymic data sources were used in the NHN-ON data creation; first geographical names from OMNR Geographic Named Extent Layer (GEL) files from the Ontario Geographic Names Data Base and those from the Canadian Geographical Names Data Base.

   The official toponymy of Ontario as authorized through the Ontario Geographic Names Board Act can be obtained from the Ontario Geographic Named Extent Layer which is available through the Land Information Ontario (LIO) warehouse.

4. **[Hydrographic Obstacle Entity: Dam]** The NHN-ON presents "Hydrographic Obstacle Entities: Dam" sometimes positioned outside of waterbodies or not on single line watercourse features. Some Dams may be found within Lake type waterbodies. It is also possible that some Dams may not be position on a Network Linear Flow network even if adjacent to a waterbody. These particularities result from Ontario NHN-Hybrid data content.

Particularities in NHN Data located on the United-States territory

NHN data located on the United-States territory were created using NHD high resolution data (National Hydrography Dataset from USGS). Once aligned to Canadian NHN data, they were correlated to the NHN-Hybrid production model (simplified version of the NHN model), then they were used in the creation of trans-boundary Canada/USA NHN data. Read more on the NHN-Hybrid model in the NHN Implementation Strategy.

NHN data located on the American territory present some particularities compared with initial NHN Standard. These particularities either result from the NHD content or structure or from final NHN data creation by Natural Resources Canada (NRCan).

1. **[NHN Completeness Level]** The NHN Completeness Level definition does not apply to the American portion of NHN trans-boundary Canada/USA NHN Work Units as the NHN Completeness Level Approach is designed to allow a progressive creation of the NHN in Canada only, thus the Completeness Level was not established for the American portion of the data. Read more on the NHN Completeness Levels.

2. **[Network Linear Flow]** NHN data located on the American territory does not present "Network Linear Flow" features within headwater waterbodies nor within isolated waterbodies. Also, no "Network Linear Flows: Secondary" are present around islands; only "Network Linear Flows: Primary" are represented within waterbodies. These particularities result from NHD data content.

3. **[Hydro Events package]** According to the initial NHN data model, NHN events are created from the geometric intersection or geometric projection of a "Manmade Hydrographic Entity" or "Hydrographic Obstacle Entity" with a network linear element (Network Linear Flow or Bank). However, in NHN data produced via the NHN-trans-boundary process, all events found result from a geometric intersection only. This particularity results from final NHN data creation by NRCan.

4. **[Toponymy Package]** NHN data located on the American territory does not present any "Named Feature" features except for a few area type ones originating from named "NHD Area Bay/Inlet" polygons features. This particularities result from NHD data content.

5. **[Toponymic Information]** "Island" and "Waterbody: Watercourse" entities do not bear names in NHN data located on the American territory. This particularities result from NHD data content.

6. **[Data Structure]** NHN data structure of features located on the U.S. territory was not subject to a detailed spatial constraint validation; the objective being to mainly ensure the continuity of the hydro network on both sides of the international boundary. NHD data thus was correlated to the NHN model without modifying excessively its data structure.

NHN Index

WARNING: The NHN Work Unit Limit Index (**NHN Index**) provided below is not an official product. It is provided for information to delineate the territory covered by each NHN dataset.
NHN Work Unit Limits are not official boundaries for watersheds or drainage areas.

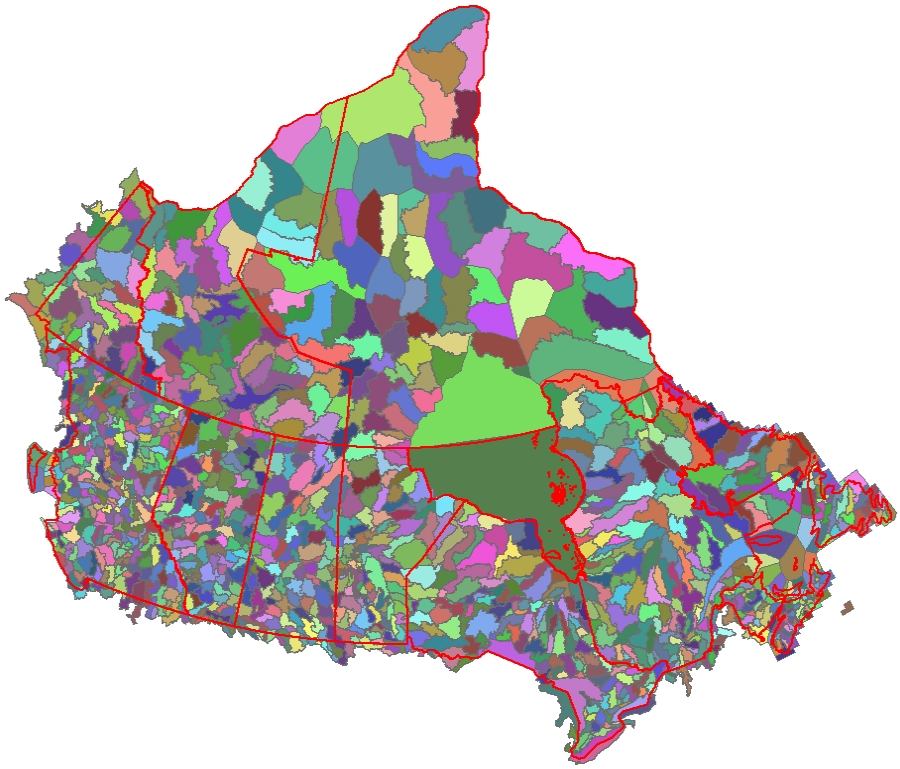
The **NHN Index** is a national index that groups together all NHN Work Unit (WU) limits covering the entire Canadian landmass. Its update is coordinated with NHN data publications.

NHN WU limits, primarily based on the Water Survey of Canada Sub-Sub-Drainage Areas (WSCSSDA) and the Fundamental Drainage Areas (FDA) from the Atlas of Canada, define the delineation from which are produced and distributed NHN datasets. Each NHN dataset thus corresponds to a NHN Work Unit Limit that delimits the territory covered by the NHN data.

The **NHN Index** is as vector geospatial data in the SHAPE (ESRI™) format. The **NHN Index Description** document hereafter describes the **NHN Index**, and for quick reference, a text file in the CSV format (Comma separated values) provides a tabular subset of the **NHN Index** attributes.

- NHN Index in SHAPE (ESRI™) format, Edition 15.0 [260 MB]
- National Hydro Network, **NHN Index Description**, Edition 1.2, 2012-02-13 [pdf 53 KB]
- Tabular subset of NHN Index, Edition 14.0 [csv 66 KB]

Although each NHN dataset (in all of the NHN distribution formats) includes its WU limit, the WU limit is not part of the NHN model. A description of the 'NHN Work Unit Limit' feature class is all the same provided in the NHN Feature Catalogue, Distribution Profile.



WSCSSDA and FDA limits on which are primarily based NHN WU limits, may be downloaded from the GeoGratis Web portal. Search for the **Atlas of Canada 1,000,000 National Frameworks Data, Hydrology - Drainage Areas** product and download the following datasets:

- Drainage area definitions from Water Survey of Canada (WSC) Sub-Sub-Drainage Area; and
- Fundamental Drainage Area.

NHN Implementation

Although the NHN is implemented under the leadership of the National Hydro Network Project from the Earth Sciences Sector Contribution to GeoBase Program, Natural Resources Canada, its production relies on a national effort that involves many partners, both federal and provincial/territorial.

The questioning and review of the NHN implementation approach that followed the initial NHN data production in Canada, led to the development of a new NHN Implementation Strategy. This new strategy aims for a progressive creation of the NHN in Canada. In the short-term, its goal is to obtain a national coverage of basic NHN data, followed by a gradual evolution of the product with regard to data content and structure, as well as data updating. This evolution now passes through the concept of NHN completeness levels, which realize the new NHN Implementation Strategy.

For more information regarding the NHN implementation, please refer to the following links:

- NHN Implementation Strategy
- NHN Completeness Levels
- NHN Partners

User Guides

This section aims at facilitating and promoting the use and exploitation of National Hydro Network data. It includes user guides, use cases and other information, as well as links towards systems and tools allowing NHN data to be fully exploited.

- Creating a Geometric Network in ArcGIS using NHN data, Edition 1.0, 2008-12-01 [pdf 1,22 MB]

  From the NHN User Guide Series, this document describes Geometric Network concepts in the ArcGIS (ESRI) environment and a methodology to create one from NHN data using ArcGIS.
- From the NHN User Guide Series, this document is about using NHN data in FGDB format in an ArcGIS (ESRI) version 9 environment. It describes how to rapidly use and exploit NHN data with the ArcMap Project (".mxd" file) suggested below, which is specifically designed to facilitate working with NHN data in FGDB format according to a turnkey system approach.
    - Suggested ArcMap Project : NHN-FGDB_ArcMap_Project.mxd [374 Ko]

  Note: For ArcGIS (ESRI) versions 10 and higher, see the tool available in Water Utilities Gallery folder: http://help.arcgis.com/en/waterutilities/gallery.html (Infrastructure Network Editing)

NHN Data Use Cases

- Canada-U.S. Transboundary Hydrographic Data Harmonization Efforts Gain Momentum, December 2010, By Michael Laitta, GIS Coordinator and Physical Scientist for both the Canadian and U.S. Sections of the for the International Joint Commission (IJC)
- Geomatics to the Rescue of the American Eel, December 2010, By Sonia Trentin, Natural Resources Canada and Patrick Dupont, Fisheries and Oceans Canada
- *Evaluating the propensity of saturation excess runoff using a topographic index (wetness index) with NHN and DEM GeoBase data*, December 2008, Agriculture and Agri-food Canada and l'Institut national de la recherche scientifique [pdf 523 KB].

- *Using RivEX and National Hydro Network Data to Classify Water Quality Stations by Strahler Stream Order*, January 2009, Government of Newfoundland and Labrador [pdf 408 KB].
- *River profile and kilometre points created using NHN data*, February 2009, Hydro-Québec [pdf 1.62 MB]
- *Using the National Hydro Network for watershed-based water management*, September 2009, Conseil de gouvernance de l'eau des bassins versants de la rivière Saint-François (COGESAF) [pdf 4.03 MB].
- *Canadian Environmental Sustainability Indicators, Water Quality Index Representivity Report*, April 8, 2009, Statistics Canada [pdf 303 Ko].

You wish to publish a NHN data Use Case, contact us!

Data Discrepancies

You do have suggestions or comments to make regarding the National Hydro Network (NHN) product. You wish to flag a potential discrepancy observation on NHN data or metadata or consult logged discrepancies on the product. This section is there for you.

Before proceeding, please consult the section dealing with Differences in NHN Data first.

The NHN product is subject to a discrepancy detection process endorsed by contributing members of the Canadian Council on Geomatics (CCOG) and Natural Resources Canada (NRCan). A discrepancy observation results from a difference detected between NHN data or metadata and the NHN product standards and specifications. You have any suggestions or comments regarding the National Hydro Network (NHN) product, please send it at: geoginfo@NRCan.gc.ca. You can also verify if they are discrepancies currently logged on the product.

Download datasets available

More than 1,300 datasets available

In the GeoGratis search tool, insert, if you know, the location in the “Geographic Location” section, insert in the “Subject Keywords” section “nhn”, click on “Data (vector, tabular, etc.)”, and finally click on “Search”. You can reduce the number of products found by zooming on the map in the area of interest and click on the “Redo Search with Map Extent” option available under the map. You can also go directly to the list of datasets in the National Hydro Network GeoGratis API. Direct FTP link: National Hydro Network. For more information about the GeoGratis Search tool, see the question “How do I conduct a search in the GeoGratis tool? ” in the GeoGratis FAQ.

View

Navigate through Toporama tool to create your own views of the data.

National Hydro Network Partners

With funding support from GeoConnections, the following federal and provincial/territorial agencies jointly contributed to the production of the NHN.

Provincial and Territorial Agencies

British Columbia

Integrated Resource Operations - GeoBC

Ontario

Ministry of Natural Resources and Forestry

Quebec

Ministère de l'Énergie et des Ressources naturelles

Yukon

Geomatics Yukon

Federal Agencies

Natural Resources Canada

Earth Sciences
GeoConnections

Contact us

For answers to technical questions, please consult the Frequently Asked Questions section. In addition, the content of metadata files delivered with digital data can provide answers to most of your questions.

If you do not find answers to your questions or to submit your comments, suggestions and ideas about **GeoGratis**. Please contact us using one of the methods below:

- **By email at:** geoginfo@nrcan.gc.ca
- **By telephone: +01-819-564-4857 / 1-800-661-2638 (Canada and USA)**

Service Standards

The service standards are guidelines intended to ensure a uniform service to our customers. Service must be fast, reliable and of quality. The service is examined and improved regularly, based on customers' feedback.

We are committed to:

- Answer to users during business hours: from 8:30 AM to 12:00 PM and from 1:00 PM to 4:30 PM (Eastern Time).
- Respond to inquiries within 2 working days. When applicable, follow up on request within the period agreed with the user.
- Insure the availability of our website 90% of the time on a monthly basis, 24 hours a day, 7 days a week.