GeoBC

Freshwater Atlas

User Manual

FRESHWATER WATER ATLAS
USER GUIDE

Contact:
Malcolm Gray
GeoBC
Integrated Land Management Bureau
P.O. Box 9355 Stn. Prov. Govt.
Victoria, BC
V8W 9M2

Document prepared by:
Caslys Consulting Ltd.
Unit 102A, 6683 Oldfield Road
Saanichton, B.C., V8M 2A1

~~September 25, 2009~~

January 12, 2010

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1.0 WHAT IS THE FRESHWATER ATLAS?

1.1 Overview

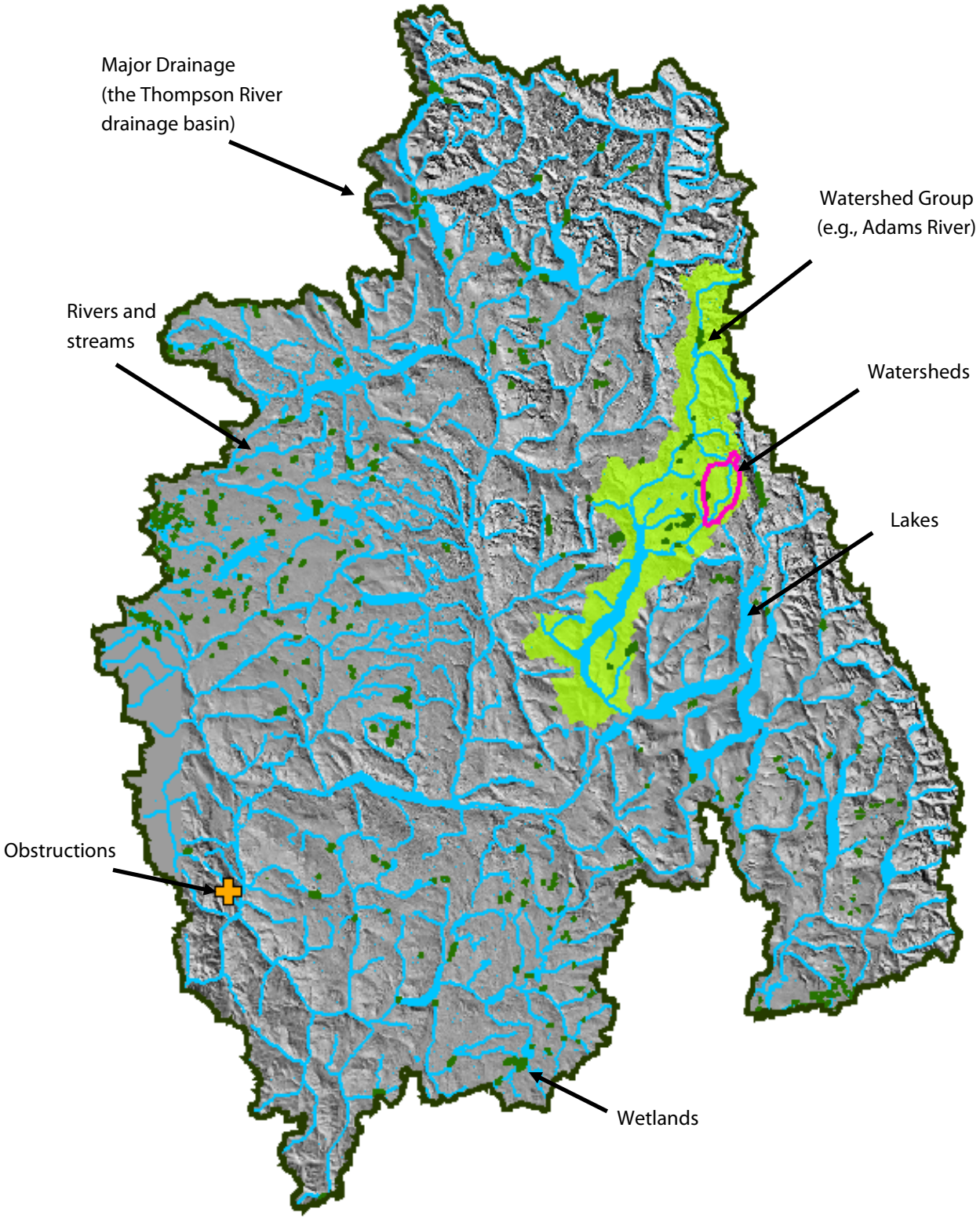
The Freshwater Atlas is a standardized dataset that seamlessly maps the province's hydrological features. It represents a significant improvement over the previous 1:50,000 scale Watershed Atlas because it is derived from the province's more detailed 1:20,000 scale topographic base maps – the Terrain Resource Information Management (TRIM) series. The atlas defines watershed boundaries by height of land and provides a connected network of streams, lakes and wetlands, linking each stream to the other streams and watersheds it flows to and from. This connected network defines stream systems – stream tributaries flow from a stream headwater to a mouth located on either another stream or some other waterbody (e.g., a lake or the ocean). Simply put, you could, conceptually, launch a paper boat in the headwaters of a small creek in the interior and trace its route to the sea. You could also identify all the wetlands, lakes and watersheds your boat passed through.

An attribute (or code) assigned to each tributary specifies a hierarchy that maintains stream connectivity and defines upstream and downstream locations relative to the other tributaries and hydrological features in the system. In addition, the relative position information allows the direction of flow to be identified, allowing upstream and downstream flow to be mapped. The code for a tributary is the code of the receiving stream, concatenated with a number indicating the distance upstream along the receiving stream from its mouth. Every tributary of a stream is associated with a unique watershed and therefore the key is called the Watershed Code. The same Watershed Code is assigned to both the stream tributary and the watershed it falls within, allowing the streams to be related to the land base. The Freshwater Atlas consists of over three million watersheds with an average area of 30 hectares.

A watershed is the drainage area associated with a single stream (a first-order watershed) or a stream system (a higher-order watershed). The Watershed Code attribute facilitates the division of the province into both major and minor drainage basins. Major drainages are subsequently divided into a hierarchy of watersheds. The atlas is capable of identifying and mapping the lower-order watersheds contained within a higher-order watershed or within a major drainage. The various hydrological features (e.g., lakes, wetlands, rivers, streams and obstructions) are all linked to one another and the watershed they fall within through the coding system. This capability allows drainage networks of varying scales to be mapped and the land base associated with them to be identified. In addition, the atlas stores the names of many water features.

As a convenience for downloading the information, the various data layers in the Freshwater Atlas have been grouped into contiguous collections of watersheds. These groupings are called Watershed Groups. Figure 1 details the extent of a major drainage – the Thompson River and illustrates some of the feature types in the atlas.

Figure 1. Features in the Freshwater Atlas[1]



[1] The image has been provided for illustrative purposes and does not reflect the level of detail present in the Freshwater Atlas.

The atlas is designed to be the authoritative source for mapping freshwater features in British Columbia. It provides a consistent base and coding system ensuring the province's various freshwater-related inventories are tied to a common base. Watersheds are bounded by heights of land and these heights of land provide the authoritative reference for many administrative boundaries and land tenures. In addition, the Freshwater Atlas's connected network provides the foundation for data inventories and sophisticated analysis and modelling. The information can also be used for cartographic purposes or for something as straightforward as identifying the location of a stream, lake or watershed.

1.2 Application Examples

1.2.1 Identifying a Feature by Name

Names are associated with many of the spatial features in the Freshwater Atlas . These attributes allow you to query the dataset to identify the locations of: streams, rivers, lakes, manmade waterbodies, islands and named features (e.g., points, capes and bays).

1.2.2 Cartography

The spatial features within the Freshwater Atlas can be used independently of their attributes for developing cartographic map products. For example, you could use just the stream, double-line river, wetland and lake features to develop a map as indicated in Figure 2. Alternatively, if you wanted to reduce the complexity of the stream network on your map you can use the stream order attribute to remove first order streams from your map. An example of this type of simple attribute query is depicted in Figure 3.

1.2.3 Inventory Frameworks

The coding system in the Freshwater Atlas, and the fact that it provides consistent coverage for the entire province, makes it an ideal framework for data inventories. By relating your data to the features in the atlas, via the Watershed Code, information is linked to both the stream network and the land base. For example, data concerning critical salmon spawning habitat can be related to a specific stream. Through the watershed code, you can then identify the lakes and streams that flow into this stream and the watersheds that potentially impact its hydrology. The atlas allows the fisheries manager to relate potential pollution sources, or other parameters, to assess the capability of the habitat. For example, if a chemical spill were to occur you could determine if the habitat was above, in, or below the area impacted by the spill.

Figure 2. Using Spatial Features for Cartographic Purposes

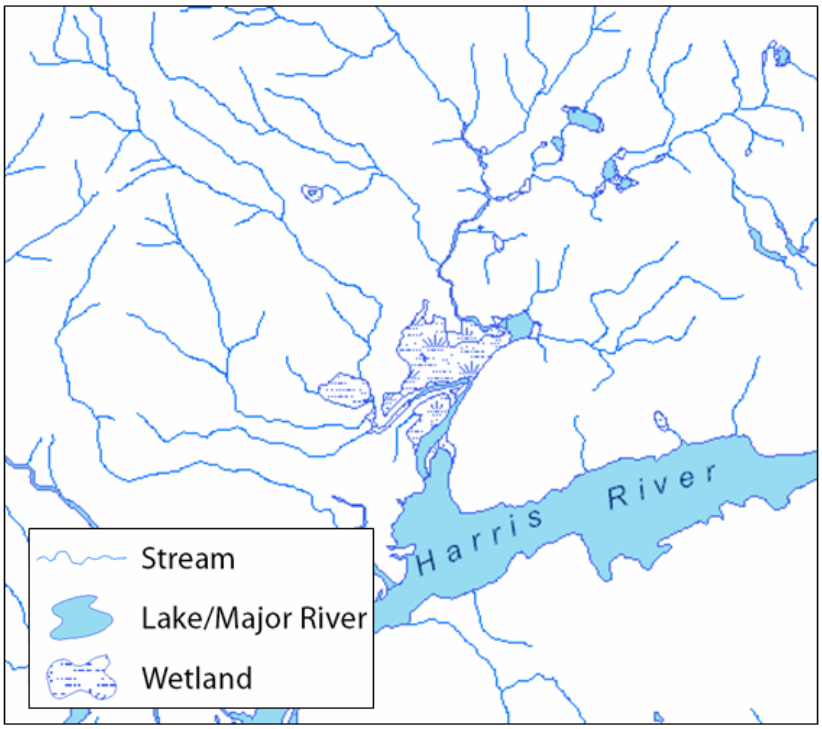
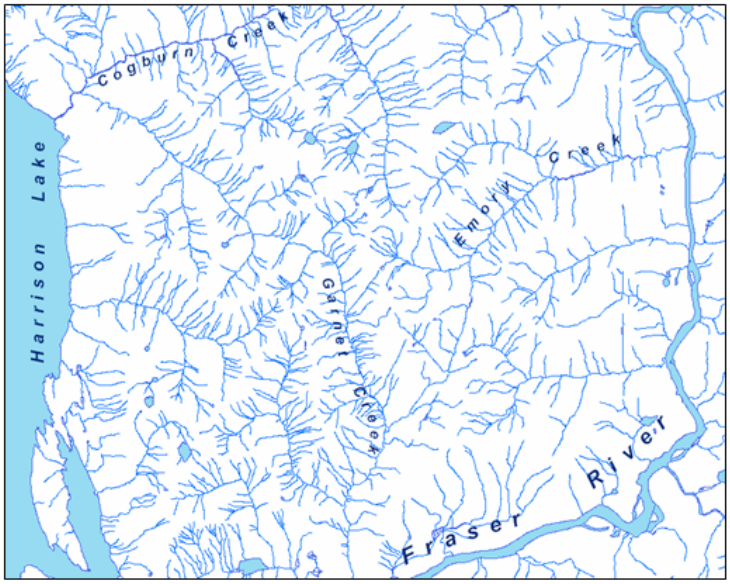
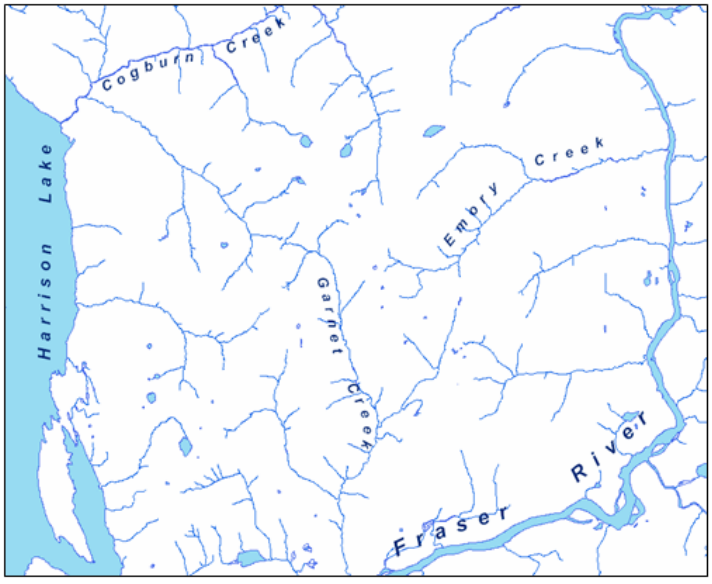


Figure 3. Using Stream Order to Simplify Cartographic Display



All streams displayed using the stream order attribute code



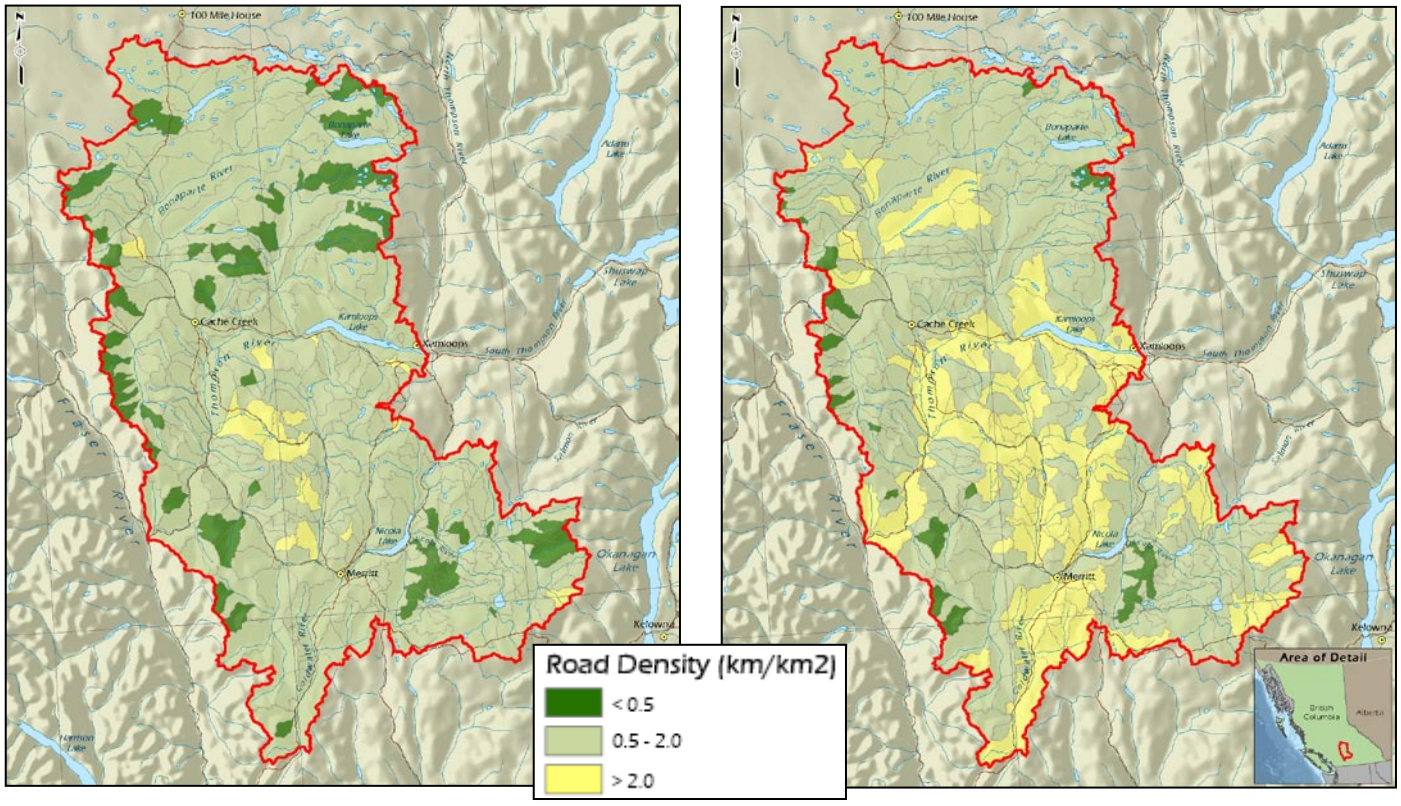
First order streams removed from display

1.2.4 Analysis

In its simplest application, a Geographic Information System (GIS) can be used to organize and edit datasets and display the results in the form of a map which can be viewed in digital format or output to hardcopy. However, the ability of a GIS to quantify relationships between multiple variables and generate models simulating real-world conditions is the true power of the software. GIS can be used to analyse multiple variables and then interpret these variables to simulate, or predict, potential events. The integration of other land use or land cover datasets together with the data in the Freshwater Atlas allows you to relate what is happening on the land base to the province's freshwater resources and related habitats. For example, you can answer questions such as:

- What is the total area of impervious surface in a stream's watershed and the watersheds that flow into the stream? This can then be used to investigate how urban run-off affects flow patterns.
- How many kilometres of stream flow through agricultural lands? Provides an indicator to assess the potential effects of agricultural run-off.
- What is the status and severity of mountain pine beetle infestation occurring in the watersheds that flow into a stream? This information can be used to examine how potentially increasing sedimentation levels might impact the stream.
- What is the total area of cut blocks and selective logging in the related riparian watersheds? This information can be used to examine how run-off from forest harvest activities impacts streams, lakes and wetlands.
- Where are cut blocks located in proximity to a stream? This information can be used to examine the potential loss of the stream's riparian habitat and tree cover to the water temperature of the stream.
- What is the density of roads in a watershed? Road density can be used as an indicator of the effects of human disturbance on the landscape. Figure 4 provides an example of road density values calculated for the watersheds in Lower Thompson drainage. The maps depict road density for two time periods 1986 and 2005.

Figure 4. Road Density in the Lower Thompson Drainage



1986 2005

2.0 WHAT TYPES OF DATA ARE IN THE FRESHWATER ATLAS?

The Freshwater Atlas is derived from the province's 1:20,000 scale topographic base maps – the Terrain Resource Information Management (TRIM) series and therefore it maintains the various features and many of the attributes present in the TRIM dataset. The coding system (described in detail in Section 2.5) specifies connectivity within the stream network and defines upstream and downstream locations relative to the other tributaries and hydrological features in the system. Construction lines are used to connect stream features as they pass through lakes and wetlands thereby maintaining the stream network. In addition, as mentioned above, relative position information allows the direction of flow to be identified, allowing upstream and downstream flow to be mapped. The following sections detail the specific features and attributes present in the atlas.

2.1 Data Extent

The Freshwater Atlas provides coverage for the entire province of British Columbia. The current version of the dataset does not include data for watersheds outside the province that flow into the province. The dataset contains a B.C. border feature that defines the border of the province from the perspective of the Freshwater Atlas, however, this border is not the official surveyed B.C. border. It was derived from various data sources to provide a provincial polygon used to close off the features in the atlas:

- The southern border was created using the ends of the streams along the border as mapped by TRIM. The border line is formed by connecting stream ends in sequence.
- The eastern border through the Rockies (the Great Divide) is derived from the generated watershed boundary edges.
- The northeastern border, north of the Great Divide, is the eastern edges of the 1:20,000 scale TRIM map sheet tiles.
- The northern border is the northern edges of the 1:20,000 scale TRIM map sheet tiles.
- The Alaska border is the scanned boundary from the 1:50,000 scale mylar map sheets, extracted from the 1:50,000 scale Watershed Atlas product.

In most areas, the watersheds were clipped to, or closed by, the segments of the B.C. border feature. However, along the Great Divide the opposite is the case – the Freshwater Atlas B.C. border was derived from the computed watershed boundaries.

2.2 Features

The Freshwater Atlas contains data detailing the locations of:

- the stream network – streams, tributaries and major rivers, canals, and ditches
- waterbodies - lakes, ponds, reservoirs, wetlands, glaciers, and flooded land
- obstructions - dams, falls, and rapids
- coastal bays, channels, and named points
- islands and coastline
- watersheds – watersheds associated with individual streams to larger drainage basins

The information has been mapped at a scale of 1:20,000 and is projected to BC Albers NAD 83[2]. The various data types and features are stored in separate spatial layers as detailed in Table 1. Each spatial layer also has an attribute associated with it. The layers can be related to each other through a number of unique identifiers. In addition, features can be related to the province's 1:50,000 scale Watershed Atlas.

Table 1. Data Types and Layers in the Freshwater Atlas

Data Type	Layer	Description	File Name*
Point	Obstructions	Water obstacles - rapids, falls, artificial waterfalls, dams and sinkholes	WSG_PNT
	Named Point Feature	Contains point features (both freshwater and marine) and associated names (e.g., inlets and bays).	CST_Points
Line	Coastline	Contains all coastline edges including marine islands and the mainland coast.	WSG_CST
	Stream Network	Contains only flow network arcs (observed, inferred and constructed flows). Contains no banks, coast or watershed boundary arcs.	WSG_SS
	Linear Boundary	Contains all bank edges (of rivers, lakes and wetlands), delimiter edges, glacier edges and administrative boundary edges (e.g., the Freshwater Atlas provincial boundary).	WSG_LB
	Watershed Boundary	Contains all principal and non-principal watershed boundary lines.	WSG_WB
Polygon	Lakes	Contains all lake polygons for the province.	WSG_LW
	Rivers	Contains all double line river polygons for the province.	WSG_RW
	Wetlands	Contains all wetland polygons for the province.	WSG_WW
	Manmade Waterbodies	Contains all manmade waterbody polygons including reservoirs and canals.	WSG_MW
	Watershed Groups	Contains polygons delimiting the watershed group boundary which is a collection of drainage basins. In-land groups will contain a single polygon, coastal groups may contain multiple polygons (one for each island i.e., this is a multipart polygon feature).	WSG_GP
	Watersheds	Contains all polygons generated from fundamental watershed boundary lines. A fundamental watershed boundary line is a watershed boundary line that bounds two unit polygons with different watershed codes or is identified as isolated.	WSG_PWSH
	Island	Contains all island polygons. Islands may overlap as there are islands within islands.	Cst_islands

[2] The BC Albers projection is defined as follows: central meridian – 126.0°; standard parallel 1 – 50.0°; standard parallel 2 – 58.5°; latitude of origin – 45°; reference system – North American Datum 1983.

Data Type	Layer	Description	File Name*
	Bays and Channels	Contains bay and channel (fresh and coastal) features and associated names.	Cst_polygons
	Glaciers	Contains glaciers and ice masses as polygons.	Glaciers
Non-spatial layers	Edge Type Codes	Contains the type codes with an English description used to categorize linear features.	Edge_codes
	Waterbody Type Codes	Contains all waterbody type codes and an English description.	Wb_codes
	Waterbody 20K 50K	Contains all primary and secondary matches between 1:20K and 1:50K waterbody polygons.	20k50k_wbs
	Streams 20K 50K	Contains all primary and secondary matches between 1:20K and 1:50K stream edges.	20k50k_streams

* The WSG in the file name indicates the four-letter code used to designate the Watershed Group. These codes are detailed in Appendix A.

The various attributes of the spatial data layers (point, line and polygon features) contained within the atlas are outlined in the following sections. In addition, the contents of the non-spatial data layers are detailed.

2.2.1 Point Features

The Freshwater Atlas contains two point-based data layers:

1. Obstructions – Obstructions features consist of:
    a. Falls - The water in a watercourse or a waterbody that follows a perpendicular or a very steep descent.
    b. Beaver dams
    c. Dams - A barrier built across a watercourse or waterbody to control the water flow.
    d. Rapids - A fast-flowing section of a watercourse or waterbody, generally with exposed rocks or boulders. Although many rapids have a linear extent, this feature is coded as a set of independent points. For double-line features, the location of each rapid is clearly delineated by a dashed symbol that spans the feature. A feature point is placed on the construction line at that location. For single-line features, the location of the rapid is placed at the x, y coordinates of the map location.
    e. Hot springs - A place where hot water naturally flows from the ground.
    f. Sinkhole – A natural hole or depression caused by the removal of soil or bedrock by water
    g. Artificial waterfalls – Situations where a steep drop occurs in the refined elevation which is not present in the original raw elevation. Artificial waterfalls can occur at both lake banks and stream confluences.
    h. Deleted waterfalls - Situations where a waterfall occurs in the raw elevation which does not occur in the refined elevation. Typically this occurs due to lake levelling or network monotonziation.
2. Named point features – (e.g., named inlets and bays)

2.2.2 Linear Features

The Freshwater Atlas contains five line-based data layers:

1. Coastline – Indicates the interface between land and the ocean.

2. Stream network – single-line streams and rivers with associated stream order and magnitude attributes.
3. Linear boundary – bank edges of double-line rivers, lakes and wetlands and administrative boundaries
4. Watershed boundary – boundary lines for all watersheds

2.2.3 Polygon Features

The Freshwater Atlas contains nine polygon-based data layers:

1. Lakes
2. Rivers – double-line rivers with associated stream order and magnitude attributes
3. Wetlands
4. Manmade waterbodies – (e.g., reservoirs)
5. Glaciers – indicates the boundary of a persistent or semi-permanent area of ice and snow
6. Watershed groups – a collection of drainage basins provided as a means to easily download the data
7. Watersheds
8. Islands
9. Bays and Channels

2.2.4 Non-Spatial Layers

The Freshwater Atlas contains four non-spatial data layers:

1. Edge type codes – identify the various types of linear features (e.g., lake shorelines)
2. Waterbody type codes – identify the waterbody type (e.g., lake, wetland)
3. Waterbody 20K 50K codes – unique identifiers that allow waterbody (polygon) features to be related to features in the 1:50,000 scale dataset
4. Streams 20K 50K codes – unique identifiers that allow stream (linear) features to be related to features in the 1:50,000 scale dataset

2.2.5 Construction Lines

Construction lines (e.g., through lakes and double-line rivers) are present throughout the Freshwater Atlas spatial data layers. They are lines which have been created to provide required topology and connectedness. There are no requirements for positional accuracy, however connection lines for tributary features should attempt to form a ninety (90) degree angle to the flow construction line. Three types of construction lines are added: closure lines; representation lines; and connection lines.

- ***Closure Lines***: Closure lines are added to complete lake shorelines, to complete the coastline (e.g., where double-line river mouths discharge to the ocean), and to identify (and close) major river channels. The objective of these construction lines is to establish identity for river channels that are relatively stable, are of importance, and potentially may have different fisheries or other information than other channels of the same river. Examples would be the north and south arms of the Fraser River.
- ***Representation Lines***: Representation lines are added through the length of 'double-line' rivers, lakes and wetlands. These lines designate primary flow. Where appropriate, this construction line would connect the main lake/wetland inlet to the main outlet. In rivers, this line would connect the head to the mouth. Construction lines are also required through the length of secondary flow river channels (i.e., channels that have been given identity through the addition of construction lines to close the feature).

- ***Connection Lines***: Connection lines must be added to ensure that tributaries and minor outlets of lakes, wetlands and double-line rivers are connected to the construction line that represents the mainflow through the polygon. This is to ensure connectivity in the stream network. Similarly, construction lines must be added to ensure that river channels are properly connected. In some cases, in order to maintain consistency, there is a need to connect isolated waterbodies that do not have a mapped outlet that is visible at the 1:20,000 scale. A connection line would be used to add a connection (second case: sinkhole - need to add connection line as well).

2.3 Coded Attributes

The features within the Freshwater Atlas have a number of attributes that allow the data to be related to the non-spatial data tables.

2.3.1 Edge Type

The Edge Type attribute is a coded value that provides the English description used to categorize different linear features. The code allows a relationship to be established between the Edge_Codes table. Table 2 details the valid values and feature names for this code.

Table 2. Edge Type Code Table

Code	Feature Name
100	Coastline
150	Construction line, coastline
1000	Single line blueline, main flow
1050	Single line blueline, main flow through wetland
1100	Single line blueline, secondary flow
1150	Single line blueline, secondary flow through wetland
1200	Construction line, main flow
1250	Construction line, double line river, main flow
1300	Construction line, secondary flow
1325	Construction line, segment delimiter
1350	Construction line, double line river, secondary flow
1375	Construction line, river delimiter
1400	Construction line, other flow/inferred connection
1410	Construction line, network connector
1425	Construction line, subsurface flow
1450	Construction line, connection
1475	Construction line, lake arm

Code	Feature Name
1600	Island shoreline
1625	Island shoreline shared with a wetland
1700	Wetland shoreline
1800	Double line blueline, right bank
1825	Double line blueline, right bank shared with wetland
1850	Double line blueline, left bank
1875	Double line blueline, left bank shared with wetland
1900	Island in river, right bank
1925	Island in river, right bank shared with wetland
1950	Island in river, left bank
1975	Island in river, left bank shared with wetland
2000	Single line, Canal
2100	Double line, Canal or Reservoir bank
2300	Single-line, Canal, secondary flow
5000	Major watershed boundary
5100	Minor watershed boundary
5200	Watershed boundary (manually modified)

1500	Lake shoreline
1525	Lake shoreline shared with a wetland
1550	Construction line, lakeshore

5900	Isolated watershed boundary
6000	International/Provincial Boundary
6100	Non-BC International/Provincial Boundary (appears only in extra-jurisdictional data)
6010	Construction Line, connectors (for streams that leave and re-enter a watershed group)

2.3.2 Feature Code Attribute

The Feature Code attribute is the standard feature code as defined by the Geographic Feature Catalogue in accordance with the CCSM (Canadian Council on Surveys and Mapping) Classification System. Table 3 describes the valid values for the feature code attribute associated with arcs within the Freshwater Atlas. The feature code attribute allows a relationship to be established between the standard provincial feature codes table.

Table 3. Feature Code Attribute Table

Feature Code	Description
AP09200000	Dump
AP90300100	Mine – Tailing Pond
EA26700110	Settling Basin – Sewage
FA02650000	Boundary (International)
GA03950000	Canal
GA08800110	Ditch
GA24850000	River/Stream – Definite
GA24850140	River/Stream – Indefinite
GA24850150	River/Stream – Intermittent
GB11350110	Flooded Land – Inundated
GB15300000	Lake – Definite
GB15300130	Lake – Indefinite
GB15300140	Lake – Intermittent
GB24300000	Reservoir – Definite
GB90100000	Reservoir – Indefinite
GB90100110	Reservoir – Intermittent
GC17100000	Marsh
GC30050000	Swamp
GE14850000	Island – Definite
GG05800000	Coastline – Definite
WA11410000	Flow Connectors – Inferred
WA17100000	Frequently Flooded Land
WA21100111	Construction Line – Coastline
WA23111110	Construction Line – Lakeshore
WA24111110	Construction Line – Main Flow
WA24111111	Construction Line – Lake Arm
WA24111120	Construction Line – Main Connector
WA24111130	Construction Line – Secondary Flow

WA24111140	Construction Line – Segment Delimiter
WA24111150	Construction Line – Secondary
WA24111160	Construction Line – River Delimiter
WA24111170	Construction Line – Flow Inferred
WA24111180	Construction Line – Subsurface Flow
WA24111190	Construction Line – Flow Connector
WA24200110	Double-Line Blueline – Right Bank
WA24200120	Double-Line Blueline – Right
WA24200130	Double-Line Blueline – Left Bank
WA24200140	Double-Line Blueline – Left
WA24220110	Island in River – Right Bank
WA24220120	Island in River – Right Bank Shared with Wetland
WA24220130	Island in River – Left Bank
WA24220140	Island in River – Left Bank Shared with Wetland
WA25100110	Watershed Boundary – Major
WA25100120	Watershed Boundary – Minor
WA25100140	Watershed Boundary – (att) operator modified or added HOL
GA08450110	Dam – Beaver
GA23500110	Rapids
GA90002110	Falls
GA98450000	Dam
HB27550000	Sinkhole
GA10450200	Artificial Waterfall
GA10450300	Flattened Waterfall

2.3.3 Place Names

Where available, the tables for the various features (e.g., streams, waterbodies, and islands) are populated with the B.C. Geographical Names Information System (BCGNIS) feature identifier and associated place name.

2.3.4 Watershed Codes

The Watershed Code is a key that uniquely identifies the features within the Freshwater Atlas. A complete description of the coding system is provided in Section 2.5.

2.4 Stream Attributes

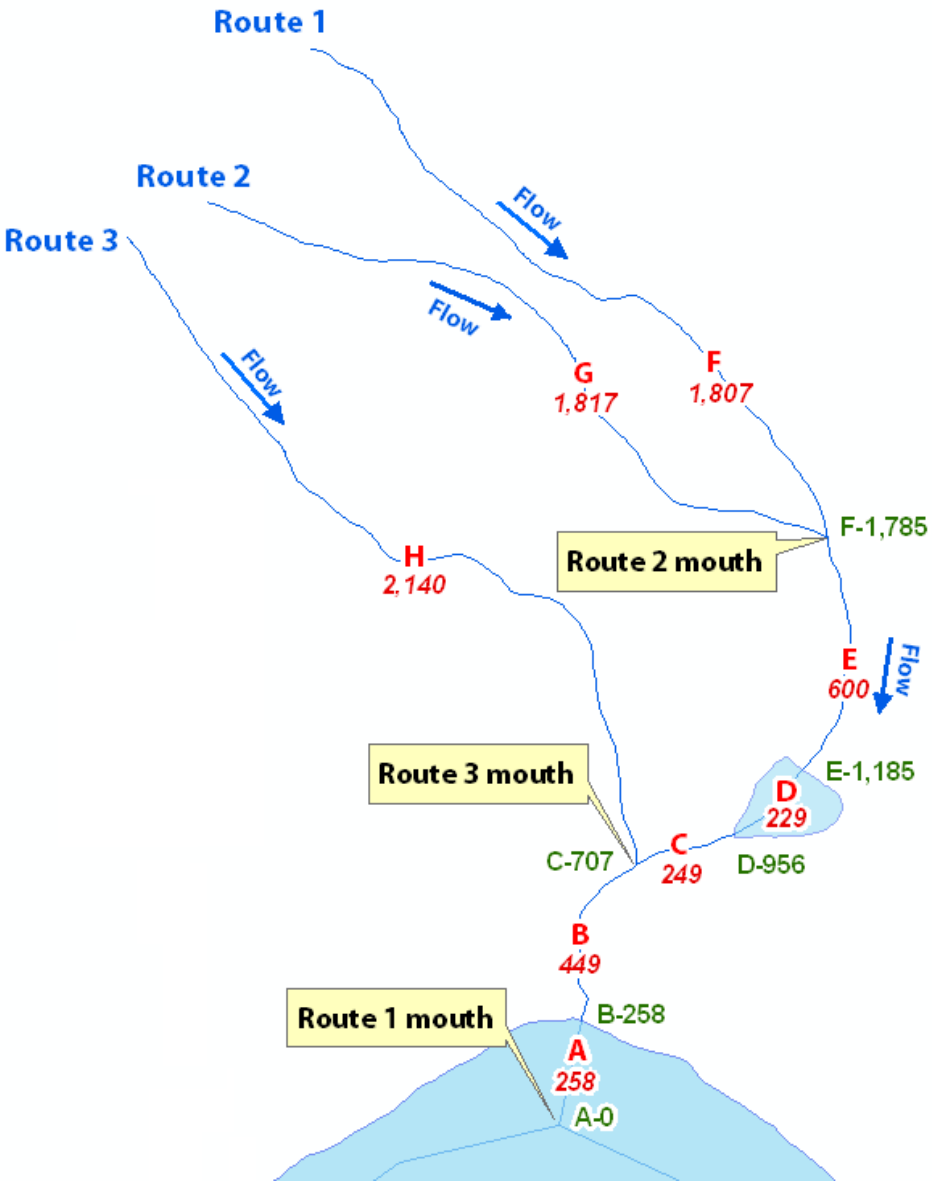
2.4.1 Stream Lengths

The atlas stores the length of each stream segment along with a Downstream Route Measure for the segment. Both attributes are in metres. The Downstream Route Measure (DRM) is the distance along the stream (i.e., the route) from the mouth of the stream segment to the most downstream part of the feature. Figure 5 illustrates how the DRMs are based on the stream segment lengths. In the figure, stream segments are designated by the letters, stream lengths are in red and the DRMs for each segment are in green:

- Routes 2 and 3 each consist of 1 stream segment (segments G and H respectively), as a result, the downstream route measure attribute for both of these segments equals 0.

- Segment A is 258 metres long and, as the first segment of Route 1, has a downstream route measure of 0. This segment is a construction line connecting the stream to the centreline of the double-line river it flows into.
- Segment B is 449 metres long. Its downstream route measure is the length of Segment A (258 metres) because its most downstream point is 258 metres from the mouth of Route 1.
- The downstream route measure of Segment C is 707 m - the sum of the lengths of segments A and B (258 + 449 = 707).
- Segment D is a construction line connecting the flow between segments C and E through a small lake.
- As we progress upstream along Route 1 we can see that the downstream route measure for each segment is the sum of the previous segments' lengths.

Figure 5. Stream Segment Lengths and Downstream Route Measurements



2.4.2 Stream Order and Magnitude

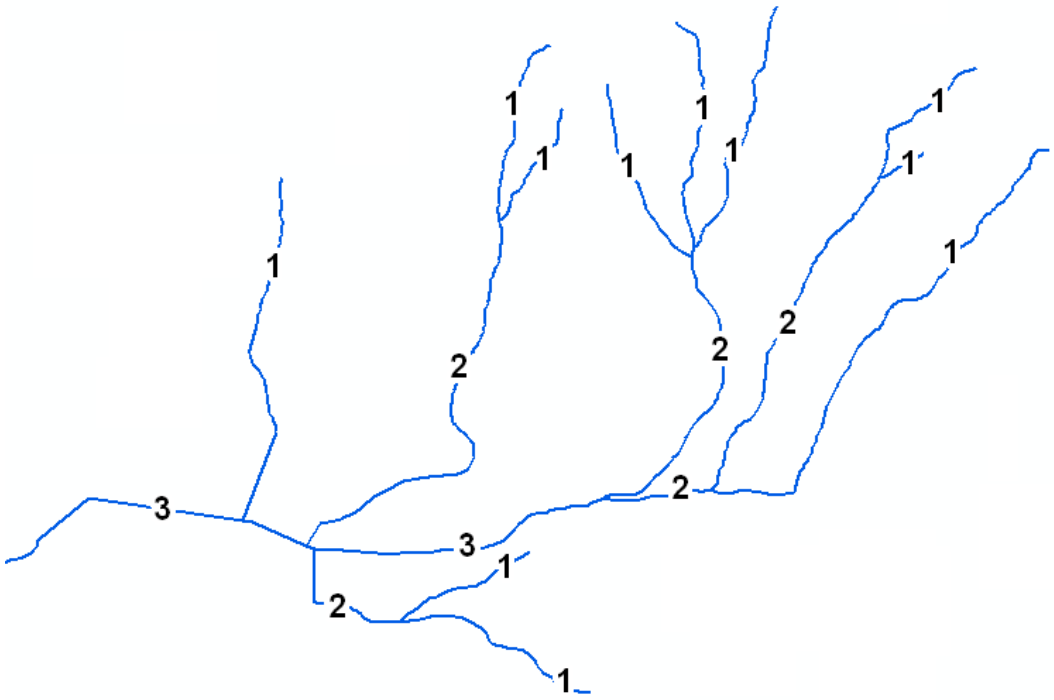
Stream order and stream magnitude describe the relative geometry of stream segments. The Freshwater Atlas stores both stream order and stream magnitude information for each stream segment.

2.4.2.1 Stream Order

Stream ordering is a process of identifying and grouping stream segments and their corresponding watersheds in terms of size and complexity. Theoretically, watersheds of similar order display similar hydraulic properties and ecological function. There are various approaches to stream ordering. In the Freshwater Atlas, the approach used was that originally described by Horton (1945) and revised by Strahler (1952). In this ordering scheme, the smallest stream segments near the drainage divide are assigned the lowest order (i.e., a first-order stream) and the stream segment at the watershed outlet is assigned the highest order (Figure 6). Each watershed identified is assigned the same order as the largest stream segment within it. The ordering system can be described by the following series of steps:

a) The smallest recognizable channels are designated order 1; these channels normally flow only during periods of wet weather.
b) Where two channels of order 1 join, a channel of order 2 results downstream; in general, where two channels of order n join, a channel of order n + 1 results.
c) Where a channel of lower order joins a channel of higher order, the channel downstream retains the higher of the two orders.
d) The order of the drainage basin is designated as the order of the stream draining its outlet, the highest stream order in the basin.

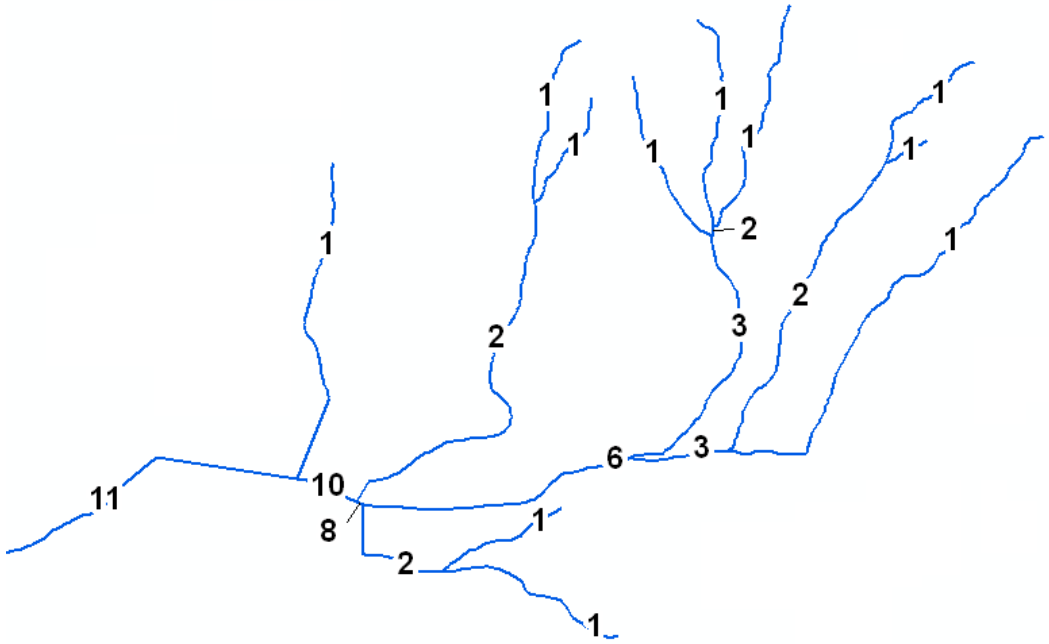
Figure 6. Stream Order



2.4.2.2 Stream Magnitude

Stream magnitude describes the relative geometry of stream segments by quantifying the number of tributaries flowing into a given stream segment. For example, if three tributaries flow into a stream then it is assigned a magnitude of 3 (Figure 7).

Figure 7. Stream Magnitude



2.5 Coding System

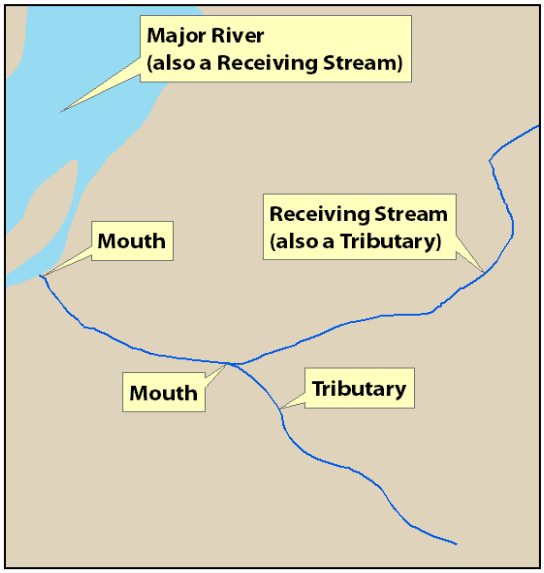
2.5.1 Overview

The Watershed Code is a hierarchical key that provides the ability to process both upstream and downstream queries, and uniquely identifies watersheds and waterbodies in British Columbia. The code is a 144 character string broken into 21 levels. The levels in the code represent the hierarchy of the stream network – a major river would have only Level 1 of the code populated, a stream flowing directly into a major river would have levels 1 and 2 populated, and a stream flowing into this stream would have levels 1, 2 and 3 populated. Table 4 outlines the format of the Watershed Code. The 'Xs' in the table represent numeric values.

Table 4: Format of the Watershed Code

Code	xxx	-	xxxxxx	-	xxxxxx	-	xxxxxx	-	xxxxxx	-	xxxxxx	…	xxxxxx
Code Level	Level 1	-	Level 2	-	Level 3	-	Level 4	-	Level 5	-	Level 6	…	Level 21
Code Example	100	-	531489	-	269874	-	898526	-	000000	-	000000	…	000000

Upon first glance, the code can appear intimidating and potentially difficult to understand; however, the information it is storing is fundamentally straightforward. As with any database key or code, the identifier for each feature must be unique to allow it, and its associated attributes, to be distinguished from other features. The coding system bases this unique identifier on proportional distances along the stream network. As a result, the code is not only unique but it allows spatial features to be related to one another and distances up and downstream to be determined. The Watershed Code for a tributary is the code of the receiving stream, concatenated with a number indicating the proportional distance upstream along the receiving stream from its mouth. Every tributary of a stream is associated with a unique watershed. The same Watershed Code is assigned to both the stream tributary and the watershed it falls within, allowing the streams to be related to the land base.



2.5.1.1 Principal Drainages

The first three digits of the code (i.e., Level 1) designate the Principal Drainage (Table 5). There are nine Principal Drainages in the province: Fraser River, Mackenzie River, Columbia River, Skeena River, Nass River, Stikine River, Taku River, Yukon River and the Coastal Rivers (Figure 8). The Coastal Rivers drainage is subdivided by geographic or administrative boundaries (e.g., South Coast Rivers, Moresby Island) rather than purely by hydrological characteristics as the other eight are. These subdivisions, or Major Watersheds, are explained in more detail in Section 2.5.1.2. The three-digit code prefix assigns each feature in the Freshwater Atlas to one of the nine Principal Drainages (Figure 8). In other words, if you wanted to select all the features in the Skeena River you would query the database for all records where the first three digits of the Watershed Code were equal to 400.

Table 5. Code Prefixes for the Principal Drainages

Code Prefix	Principal Drainage
100	Fraser River
200	Mackenzie River
300	Columbia River
400	Skeena River
500	Nass River
600	Stikine River
700	Taku River
800	Yukon River
900 series	Coastal Rivers

Figure 8. Principal Drainages

2.5.1.2 The Coastal Rivers Principal Drainage

Due to the complexity of the coastline (i.e., numerous small islands), the Coastal Rivers drainage is divided into a number of Major Watersheds. The regions are delineated through the three-digit Code Prefix as detailed in Table 6. Figure 9 illustrates the locations of each of the watersheds within the drainage.

Table 6: Coastal Rivers Hierarchical Code Prefixes

Major Watershed	Code Prefix	Location Description
South Coast Rivers	900	Rivers south of Cape Caution
South Coast Islands	905	Islands south of Cape Caution
North Coast Rivers	910	Rivers north of Cape Caution
North Coast Islands	915	Islands north of Cape Caution
Vancouver Island East Rivers	920	Rivers from Church Point to Cape Scott (East)
Vancouver Island East Gulf Islands	925	Gulf Islands
Vancouver Island West Rivers	930	Rivers from Church Point to Cape Scott (West)
Vancouver Island West Islands	935	Islands from Church Point to Cape Scott (West)
Graham Island Rivers	940	Rivers on Graham Island
Graham Island Islands	945	Islands off Graham Island
Moresby Island Rivers	950	Rivers on Moresby Island
Moresby Island Islands	955	Islands off Moresby Island
Alaska Rivers	960	Hyder Alaska to south of the 60th parallel
Washington Coast Rivers	970	Watersheds north 49°N that drain into the Columbia River in Washington State (e.g., the Skagit River)
Alsek River	990	The Alsek River drainage

In addition to specifying the regions with the code prefix, the Watershed Code uses the first, and sometimes the second, set of six-digit numbers (e.g., levels 2 and 3) to further refine the location of the features within the Coastal Rivers drainage. Table 7 details how the code levels are applied to features within the Coastal Rivers drainage and the other Principal Drainages.

Figure 9. Major Watersheds in the Coastal Rivers Drainage

Table 7: Hierarchical Key Descriptions

Code Level	Case	Description
Level 1	All rivers.	▪ Each hierarchical key has a three digit prefix representing the area of the province containing the stream – the Principal Drainage or, in the Coastal Rivers drainage, the Major Watershed.
Level 2	If the river is on a coastal island (excluding Vancouver, Moresby and Graham islands).	▪ Unique island hierarchical key identifier.
	If the river is on Vancouver, Moresby, or Graham Island.	▪ Percent along the island where the river flows into the ocean. o Vancouver Island East – percent from Church Point to Cape Scott eastwards (counter-clockwise). o Vancouver Island West – percent from Church Point to Cape Scott westwards (clockwise) o Moresby Island – percent around island from southern most point (clockwise) o Graham Island – percent around island from Rose Spit (clockwise)
	If the river flows into the ocean from the B.C. mainland coast.	▪ Percent along the coastline where the river meets ocean. o South Coast Rivers – percent from 49°N (near Blaine WA) to Cape Caution o North Coast Rivers – percent from Cape Caution to Hyder, B.C. o Alaska Rivers – percent from Hyder, Alaska to 60°N o Washington Rivers – percent down coastline from 49°N (near Blaine WA) to mouth of Columbia River
	If the river is a major river (e.g., the Fraser or Columbia rivers)	▪ 0 (Major rivers are identified by the hierarchical key prefix).
	All other rivers.	▪ Percent along the river it flows into.
Level 3	If the river is on an island (excluding Vancouver, Moresby, and Graham islands).	▪ Percent along island coastline (clockwise direction) from southern most point where the river hits the ocean.
	All other rivers.	▪ Percent along the river it flows into.
Levels 4 through 21	All rivers.	▪ Percent along the river it flows into.

2.5.1.3 Assignment of the Watershed Code

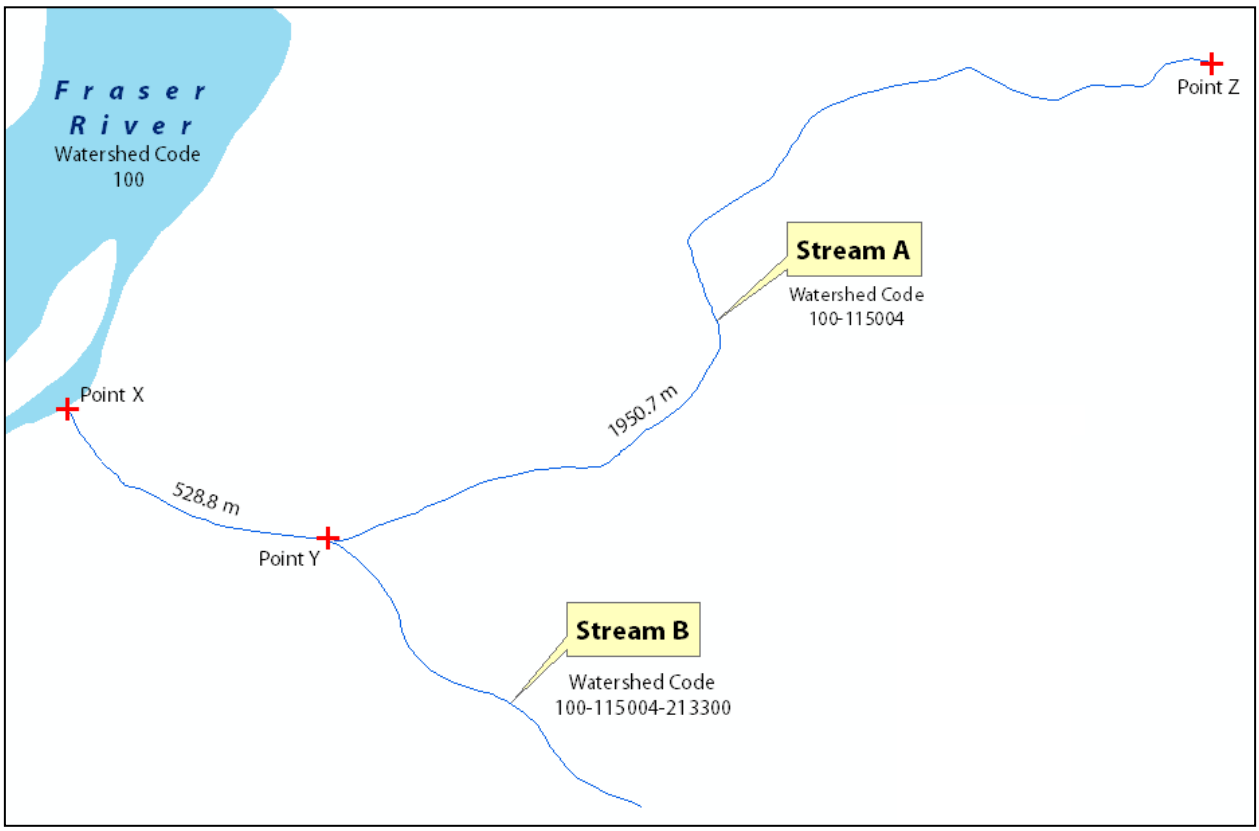
The code for the mainstem for each of the major rivers within the first eight Principal Drainages is the code prefix followed by twenty, six-digit, sets of zeros, as outlined in Table 4. In the Coastal Rivers drainage, code level 2 and potentially 3 are populated as outlined in Table 7. The values for subsequent code levels are determined the same way as those for the other drainages (i.e., the proportional difference upstream from the receiving stream's mouth). All of the tributaries associated with each of the eight major rivers have the same three-digit prefix (e.g., the Fraser River and all its tributaries begin with 100). As the stream network progresses

further away from the major river (i.e., higher order streams), additional levels of the code are populated based on the code of the receiving stream and the distance upstream. The example below, illustrated in Figure 10, explains how Watershed Codes are assigned to streams (the trailing 0s have been removed to simplify the example):

- The Fraser River has a Watershed Code of 100.
- The Watershed Code for Stream A is 100-115004. This tells us it flows directly into the Fraser River approximately 11.5% along the Fraser River from its mouth.
- Stream A is 2,479.5 metres long. This is the distance from Point X to Point Z (i.e. 528.8 m + 1,950.7 m).
- Stream B flows into Stream A at Point Y (528.8 m up from where Stream A flows into the Fraser at Point X).
- The Watershed Code for Stream B is 100-115004-213300. This tells us that Stream B is connected to Stream A at a point 21.33% along the length of Stream A. This is determined by taking the distance between Point X and Point Y (528.8 m) and then dividing it by the total length of Stream A (2,479.5 m) to calculate the percentage:

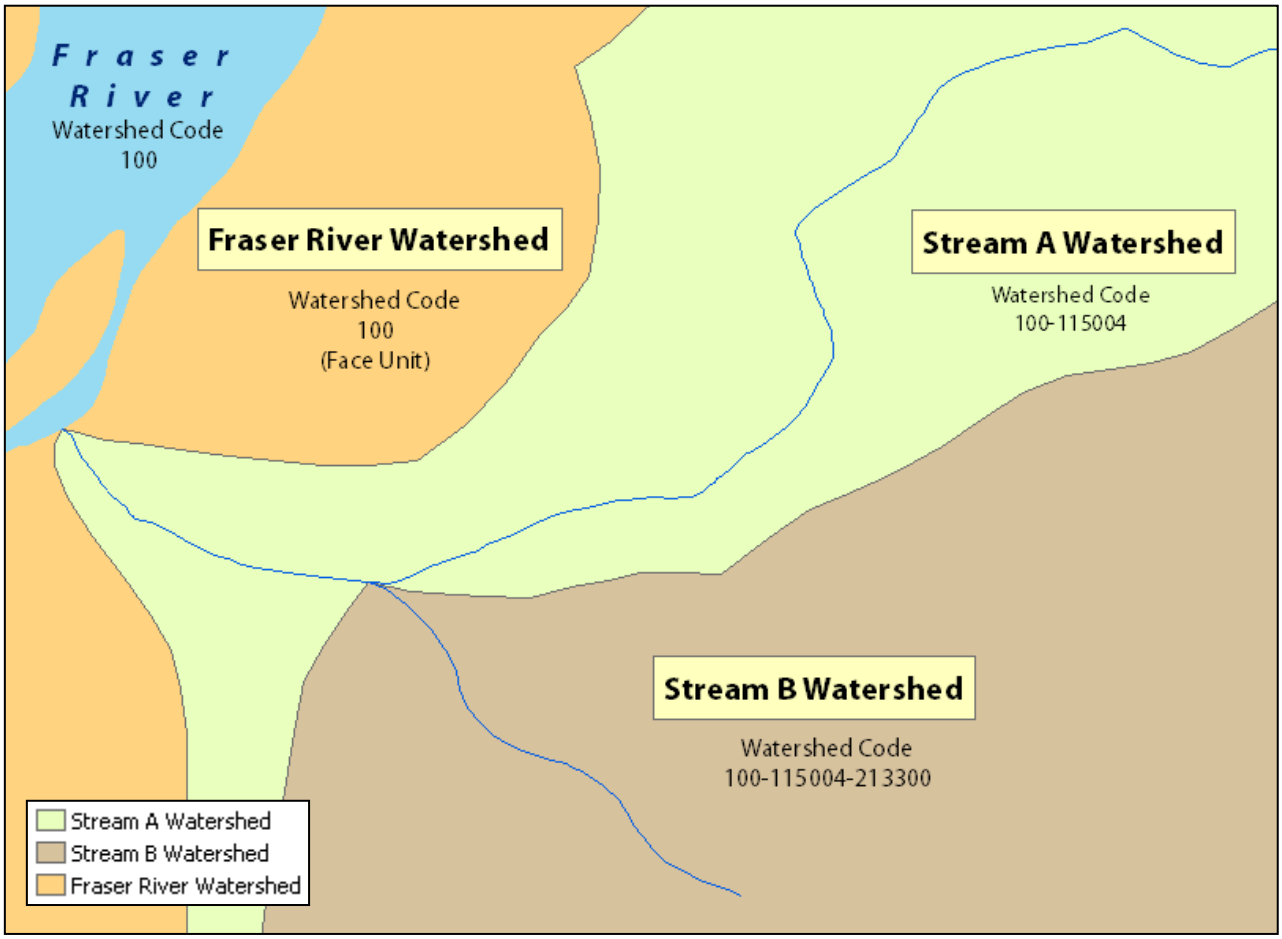
$$\frac{528.8}{2{,}479.5} = 0.2133 \times 100 = 21.33\%$$

Figure 10. Assignment of Watershed Codes to Streams



The watershed the stream drains receives the same Watershed Code as that assigned to the stream. This allows all streams to be related to the land base they flow through. Figure 11 illustrates the watersheds for both Stream A and Stream B. The watershed shaded in orange flows directly into the Fraser River and therefore receives the same watershed code as the Fraser River (the primary watershed to which it belongs).

Figure 11. Assignment of Watershed Codes to Watersheds



2.5.2 Fundamental Watersheds

As outlined above, Watershed Codes are assigned to watersheds based on the Watershed Code assigned to the stream or river flowing within it. This approach has two limitations:

- Watershed polygons along double-line rivers include the 'face unit' drainage areas along the banks of the rivers (Figure 11). This results in long, skinny watershed polygons, which do not adequately subdivide the land area along the rivers. Watershed polygons defined in this way also do not fully distinguish land from river area.
- Confluences between single-line rivers are not fully subdivided into watersheds for all stream edges meeting at the confluence. Specifically, the receiving (or mainstem) stream does not have a watershed

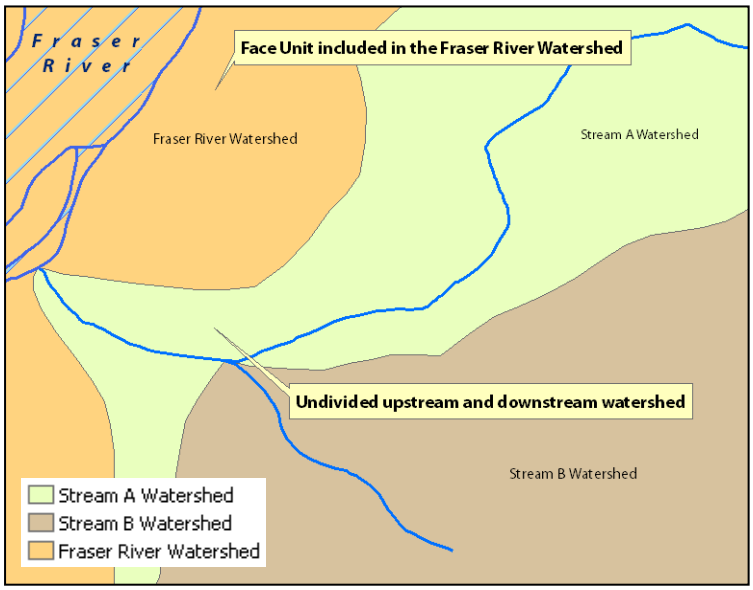
boundary dividing its upstream and downstream portions. This prevents attributes for the upstream watershed from being computed.

To resolve these issues, the Freshwater Atlas incorporates additional watershed boundary edges that provide a more useful subdivision of the land area and fully separate land from water. These are called Fundamental Watersheds.

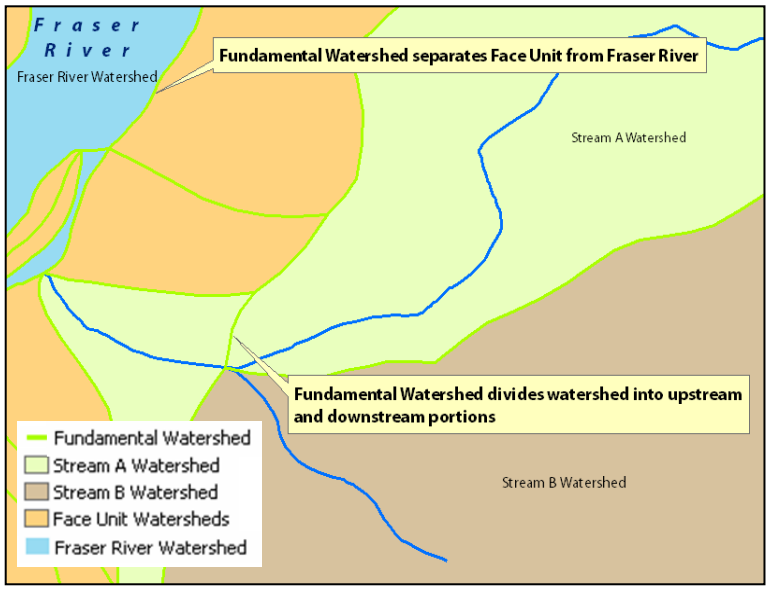
In addition to their basic Watershed Code attribute, Fundamental Watersheds are identified through a Local Watershed Code attribute. The Local Watershed Code gives each watershed polygon an ordering along the route from which it obtains its basic Watershed Code. This provides a more fine-grained hierarchy of watershed polygons. The Local Watershed Code is essentially defined as the Watershed Code of the most downstream tributary adjacent to the watershed polygon.

The goal of defining Fundamental Watersheds is to provide a subdivision of the provincial land area which is at an appropriate scale for use in applications. Also, by providing the Local Watershed Code it is possible to aggregate watersheds to any level in the watershed hierarchy by using only attribute queries (i.e. with no complex spatial or hierarchical querying).

Figure 12. Fundamental Watersheds



Watersheds Based on the Watershed Code



Fundamental Watershed Boundaries

3.0 USING THE FRESHWATER ATLAS

3.1 Downloading the Freshwater Atlas

The data layers associated with the Freshwater Atlas may be downloaded from the GeoBC website (http://www.geobc.gov.bc.ca/). From the website's home page, use the SEARCH TOOL (Figure 13) to generate a list of Subject specific links (The reference guide with instructions for downloading data is provided in Appendix C.

Figure 13. GeoBC Website Homeage

Once in the data distribution interface, search on the keyword 'watershed' and the search results will list the available data layers. Select the layers for download by adding them to you order (click on the plus symbol). Once you have selected the layers you are interested in, View Your Order. It is anticipated that the majority of users of the Freshwater Atlas data are going to be interested in the data for a specific area of interest (AoI) rather than for the entire province[3]. The Data Distribution Service interface allows you to configure your order to a specified area three different ways:

- By map sheet (based on either the 1:250,000 scale map grid or the 1:20,000 scale TRIM map grid)[4].
- By uploading an existing polygon (in the form of a shape file with a single polygonal record).
- Or by a custom AoI which the user can define in the interface.

The Watershed Groups layer provides set of existing polygons that can be used to specify and area of interest – users can select one of the Watershed Groups from this dataset and copy it out to a new shape file. Alternatively, users can develop a study area polygon of their own and use this to define the area of interest. An important consideration when defining the area of interest is to select an area of a manageable size. Ideally users would want to select the smallest area possible to minimize file sizes and decrease the time required to process the data.

3.2 Typical Queries

The information contained within the Freshwater Atlas can be queried either spatially or based on the attribute tables.

3.2.1 Spatial Queries

Spatial queries are questions about 'where' certain features exist in space and how they relate to other features. They allow you to select features based on their absolute position and/or location relative to other features in other layers. For example, a spatial query will allow you to select all the sampling sites falling inside a watershed or within a specified distance along a river or lake shoreline.

3.2.2 Attribute Queries

Attribute queries are questions about the attributes (or non-spatial characteristics) of the data, for example, how many second order streams are in a given watershed? Because attributes are actual information associated with the features, the values stored in the Freshwater Atlas's attribute tables often hold the most relevant answers to the questions raised in GIS analysis. Structured Query Language (SQL) is the standard interface to extract records matching a query. Attribute queries develop selection sets that filter the dataset based on the user's requirements.

The Watershed Code can be used to perform approximate upstream/downstream queries without traversing the stream network and can be used independently of a GIS. For example, the Watershed Code of the Fraser River is 100-000000-000000- … -000000. Any tributary to the Fraser River will have a Watershed Code that starts with 100: 100-xxxxxx-xxxxxx - … - xxxxxx (where x = any number). Any tributary to the Fraser River that is more than half way up the Fraser River will have a Watershed Code with a second value > 500000, thus any key

[3] Note that some layers exceed the maximum allowable download size unless subdivided into smaller portions (e.g., by an Area of Interest).
4 When downloading by map sheet, it is most efficient to have a list of the sheets you want data for in advance.

formatted as "100-5xxxxx-xxxxxx - … - xxxxxx" flows into the Fraser River more than half way up Fraser River. Any side channel or distributary of the Fraser River will have the same Watershed Code as the Fraser River. By sorting the Watershed Codes it is possible to determine parent/child relationships as detailed in Table 8.

Table 8: Watershed Code Examples

Stream	Watershed Code
A	100-239874-000000-000000-000000- … - 000000
B	100-486403-000000-000000-000000- … - 000000
C	100-856124-000000-000000-000000- … - 000000
D	100-239874-112384-000000-000000- … - 000000
E	100-239874-384988-000000-000000- … - 000000
F	100-239874-384988-985012-000000- … - 000000

From the Watershed Codes in Table 8 it is possible to derive the following:

- Stream A is downstream of stream B, which is downstream of C.
- Stream D flows into stream A, downstream of the point where stream E flows into stream A.
- Stream F flows into stream E near the headwaters of the stream.

3.3 Applications

3.3.1 Cartographic

3.3.1.1 Using Feature Codes to Customize Map Display

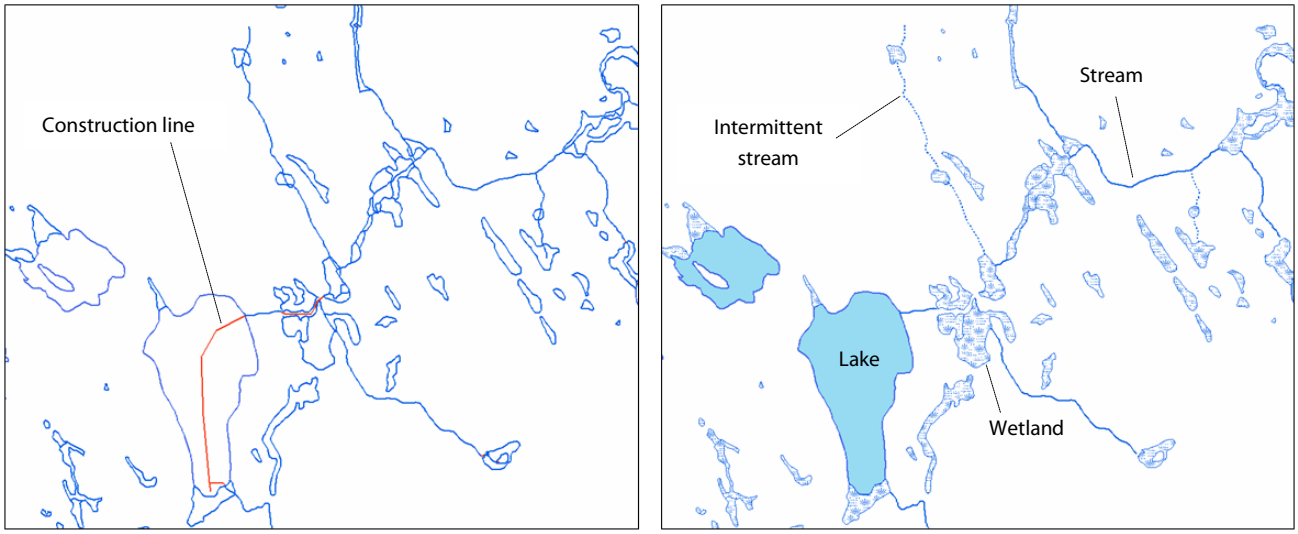
The feature code attribute (FEATURE_CODE) allows you to relate the spatial features in the Freshwater Atlas to the Province's standard feature code table available via the following link:
https://apps.gov.bc.ca/pub/geometadata/metadataDetail.do?recordUID=53358&recordSet=ISO19115.
The feature code is an alpha-numeric code that is associated with a detailed description of the feature.

Once you have related or joined the spatial data with the feature code attribute table, you can use the description attribute to remove features types you are not interested in or to differentiate the features. For example: wetlands can be further subdivided by type (e.g., flooded land, marsh and swamp); and streams can be classified to allow you to identify stream types (e.g., definite, indefinite and intermittent) and separate construction line features. You can customise the display of your map by generating a thematic map on the description attribute. This allows you to add and remove features, and select different colours, line weights, line styles and fill patterns for the different feature types. In addition, the feature type information allows you to query the data more effectively.

Figure 14 illustrates how you can customize the display of a map using the feature code description. Example A, on the left, displays all of the stream features and draws them in the same line style (construction lines appear

in red). Example B, on the right, illustrates the result when the feature description is used to remove the construction lines from the map display and apply line styles and fill to different feature types

Figure 14. Example of Using the Feature Code to Customize Map Display



Example A ***Example B***

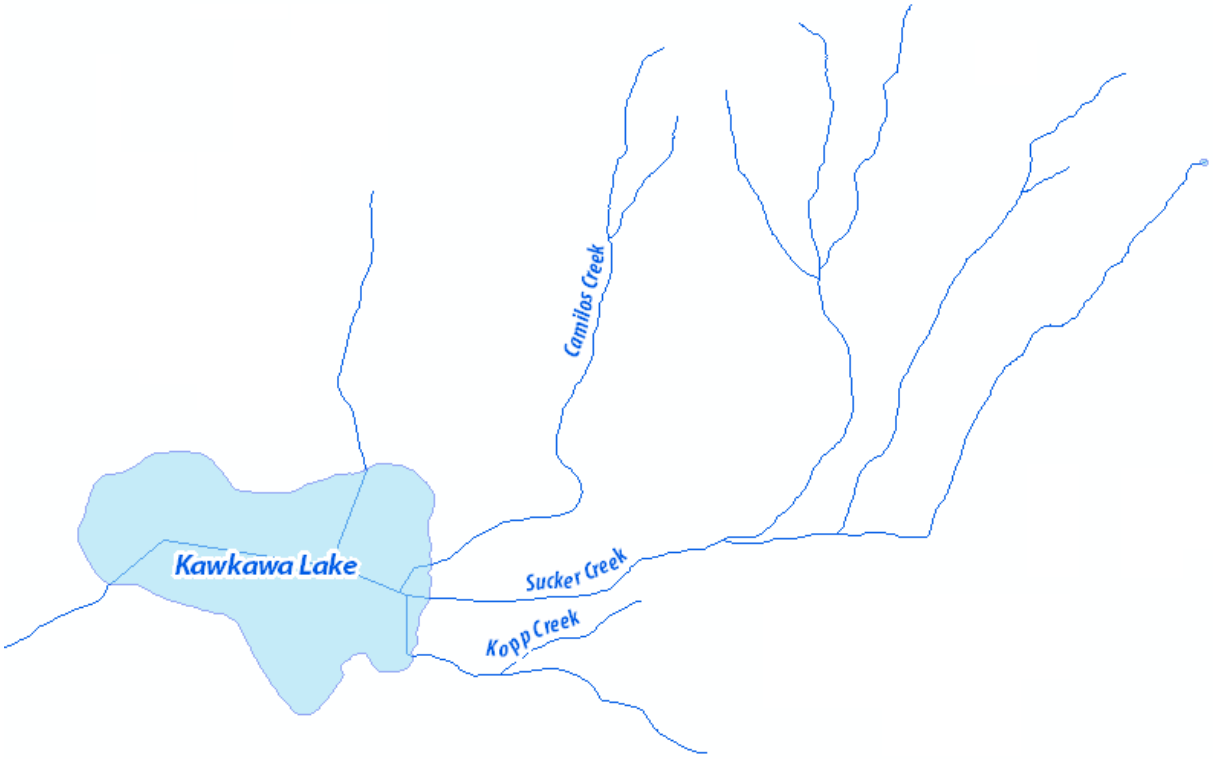
3.3.1.2 How to Find a Location by a Place Name

Locating a specific feature based on its name can be done through a SQL query of the feature's attribute table. The atlas stores the BC Geographical Names Information System (BCGNIS) feature identifier, where available, and an associated place name for the following feature types:

- Obstructions
- Named point features
- Streams
- Lakes
- Rivers
- Wetlands
- Man-made waterbodies
- Glaciers
- Watersheds
- Islands
- Bays and channels

Polygonal features contain up to three potential name attributes to allow multiple names for a single feature to be stored in the dataset (e.g., the place name in a different language). To locate Kawkawa Lake a query would be performed on the Lakes polygonal table (e.g., GNIS NAME 1 = Kawkawa Lake). Specific field names within the attribute tables are detailed in Appendix B. It should be noted that not all features have names. Figure 15 illustrates the level of detail present in the atlas.

Figure 15. Examples of Place Names in the Freshwater Atlas



In some cases, different features have been assigned the same name, for example, there are five Deep Lakes in the province. The BC Geographical Names website (http://ilmbwww.gov.bc.ca/bcnames/) can be used in conjunction with the Freshwater Atlas to locate specific features within your area of interest.

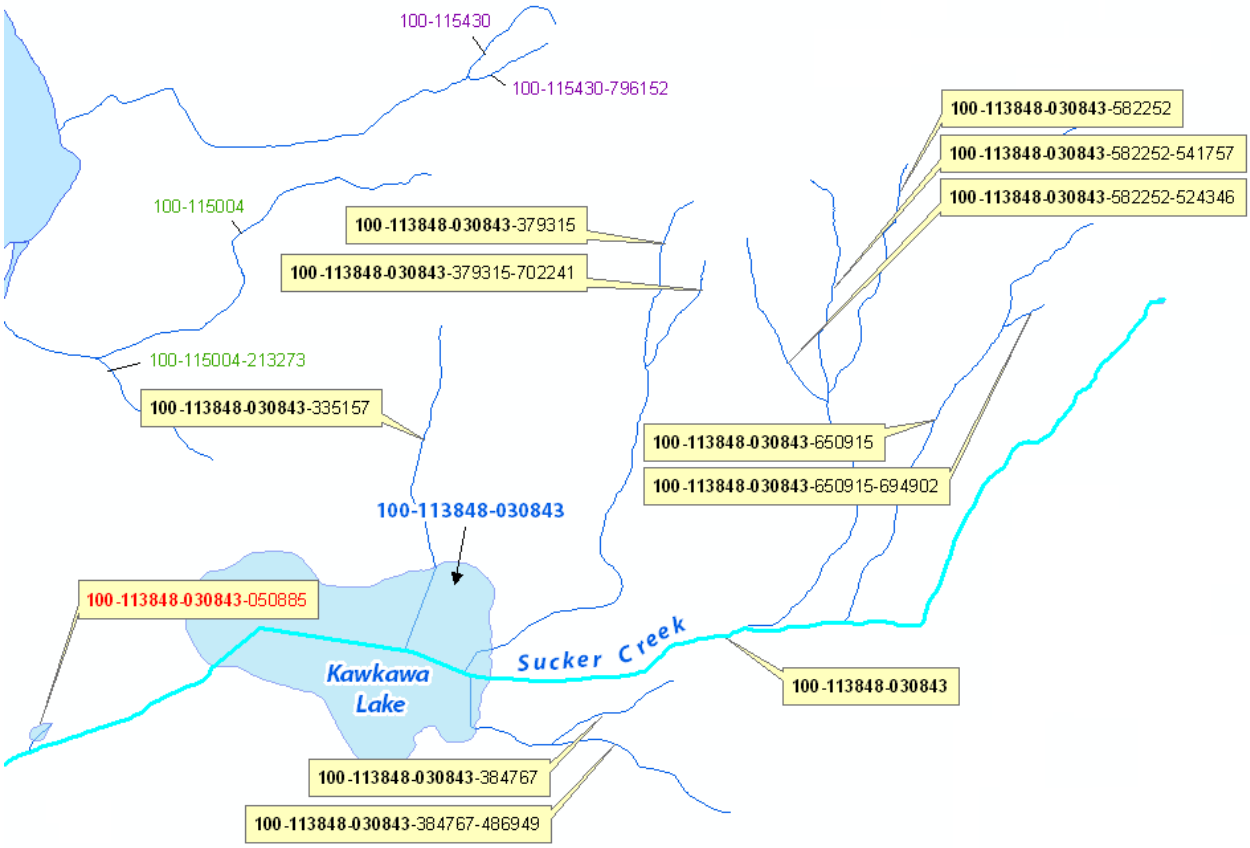
3.3.2 Using the Coding System

3.3.2.1 How to Use the Coding System to Identify a Stream Network

The coding system allows all of the streams within a given network to be selected through a relatively straightforward SQL query of the stream attribute table. Figure 16 illustrates the watershed codes associated with various streams in the vicinity of Kawkawa Lake. The Watershed Code for the lake is based on that of the main stream flowing through it (i.e., both Kawkawa Lake and Sucker Creek (drawn in cyan) have the code 100-113848-030843[5]). To identify the streams flowing into, or out of, the lake, an SQL query should be conducted to identify those streams flowing into Sucker Creek. Therefore the query should select those features where the string '100-113848-030843 is present in the first three levels of the code. This query selects all of the streams in the 'Sucker Creek network'. These streams are labelled with the pale yellow call-outs in Figure 16. Note that in the figure, one of the streams flowing into Sucker Creek has been labelled in red (stream 100-113848-030843-050885). If you are only interested in the streams flowing into and out of Kawkawa Lake a second query needs to be conducted to remove this stream from the selection set because it does not flow into the lake (see Section 3.3.2.2).

[5] The extra zeros in the code have been removed in the example.

Figure 16. Stream Watershed Codes



3.3.2.2 How to Identify the Streams Flowing into a Lake

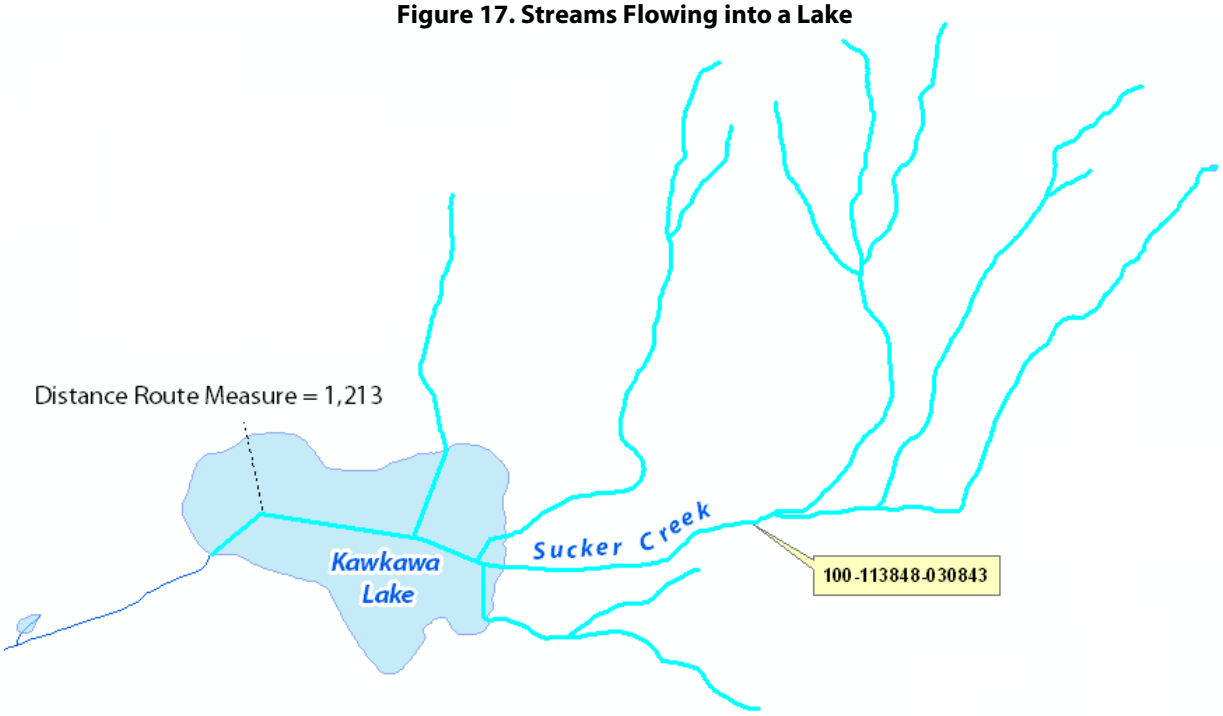
To identify the streams flowing into a lake the query would be very similar to that required to identify the streams flowing into and out of the lake. However, in this circumstance we need to remove the streams flowing out of the lake from the selection set. Using our Kawkawa Lake example (see Section 3.3.2.1), we would develop an SQL query based on the following three steps:

1. Select all stream features where the string 100-113848-030843 is present in the first three levels of the code. This query identifies all the streams flowing into Sucker Creek , the mainstem of Kawkawa Lake.
2. The second part of the query involves removing the segments of Sucker Creek that flow out of the lake from our selection set. To accomplish this we need to query the Downstream Route Measurement attribute (see Section 2.4.1). The Downstream Route Measure for the most downstream segment of Sucker Creek still within Kawkawa Lake = 1,213 metres (Figure 17). To remove everything downstream of this segment we need to remove those streams where the Watershed Code = 100-113848-030843 (Sucker Creek) and the Downstream Route Measure is less than 1,213 metres.
3. Remove streams that flow into Sucker Creek downstream of Kawkawa Lake. This would be done through a second query to remove the stream 100-113848-030843-050885 (Figure 16) from the selection set. Using the DRM we identified the streams flowing into Kawkawa Lake. We now need to determine the Watershed Code for the most downstream stream that flows into the lake. The codes for

both Sucker Creek and Kawkawa Lake are populated to Level 3. Therefore, we need to identify the stream with the lowest Level 4 value. Figure 16 illustrates that the code for this stream is 100-113848-030843-335157. Therefore, streams not flowing into the lake are those where the Level 4 value is less than 335157.

The results of this three-step query are highlighted in cyan in Figure 17.

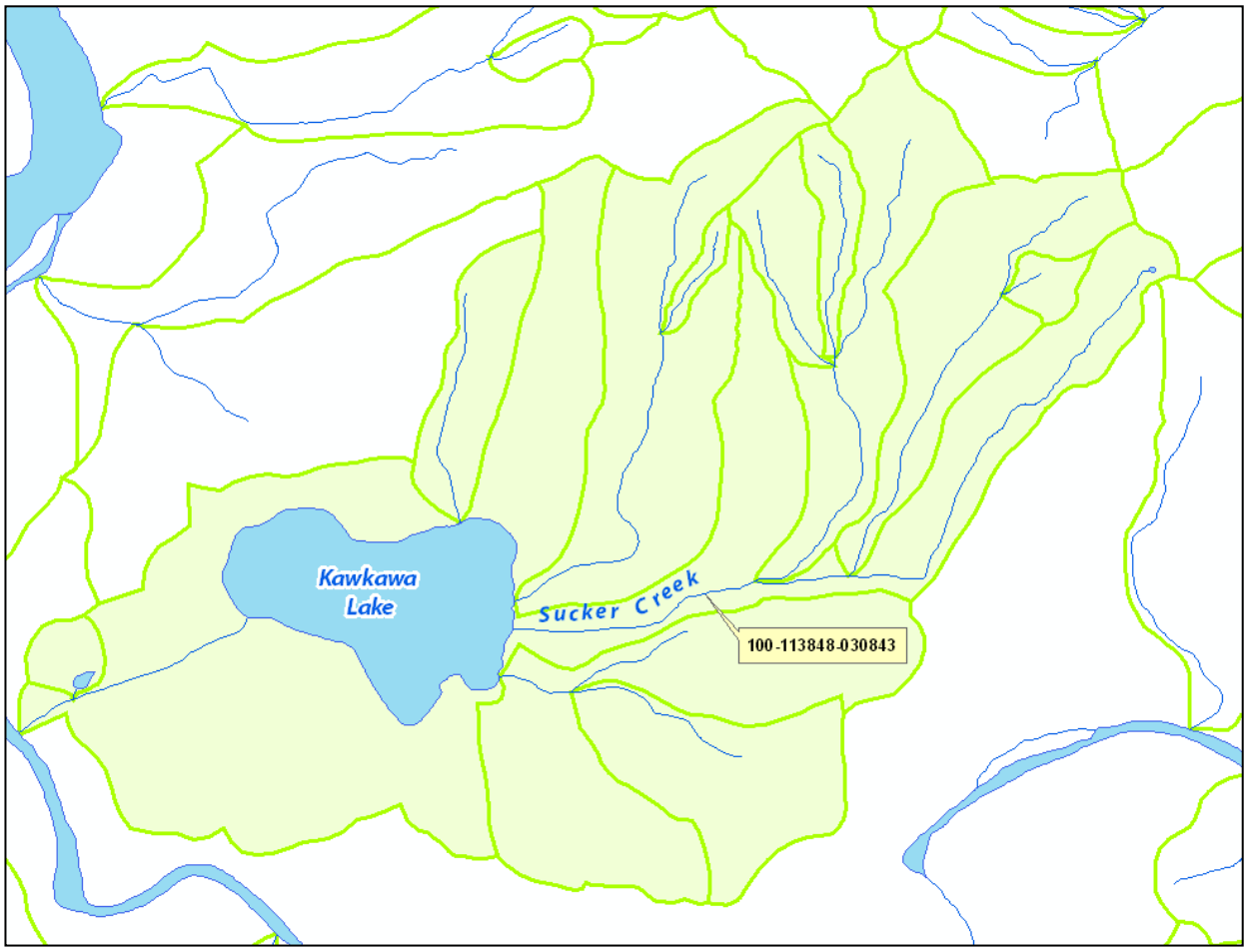
Figure 17. Streams Flowing into a Lake



3.3.2.3 How to Determine which Watershed a Stream Falls In

Each stream has its own watershed and the Watershed Code of the stream and its watershed are identical. This allows you to easily identify the watershed associated with an individual stream as the query is the same for both feature types. We can also select all the individual watersheds associated with a stream through an SQL query similar to that used to select all the stream features flowing into a stream - select all watershed features where the string 100-113848-030843 is present in the first three levels of the Watershed Code. Figure 18 illustrates the results of this query.

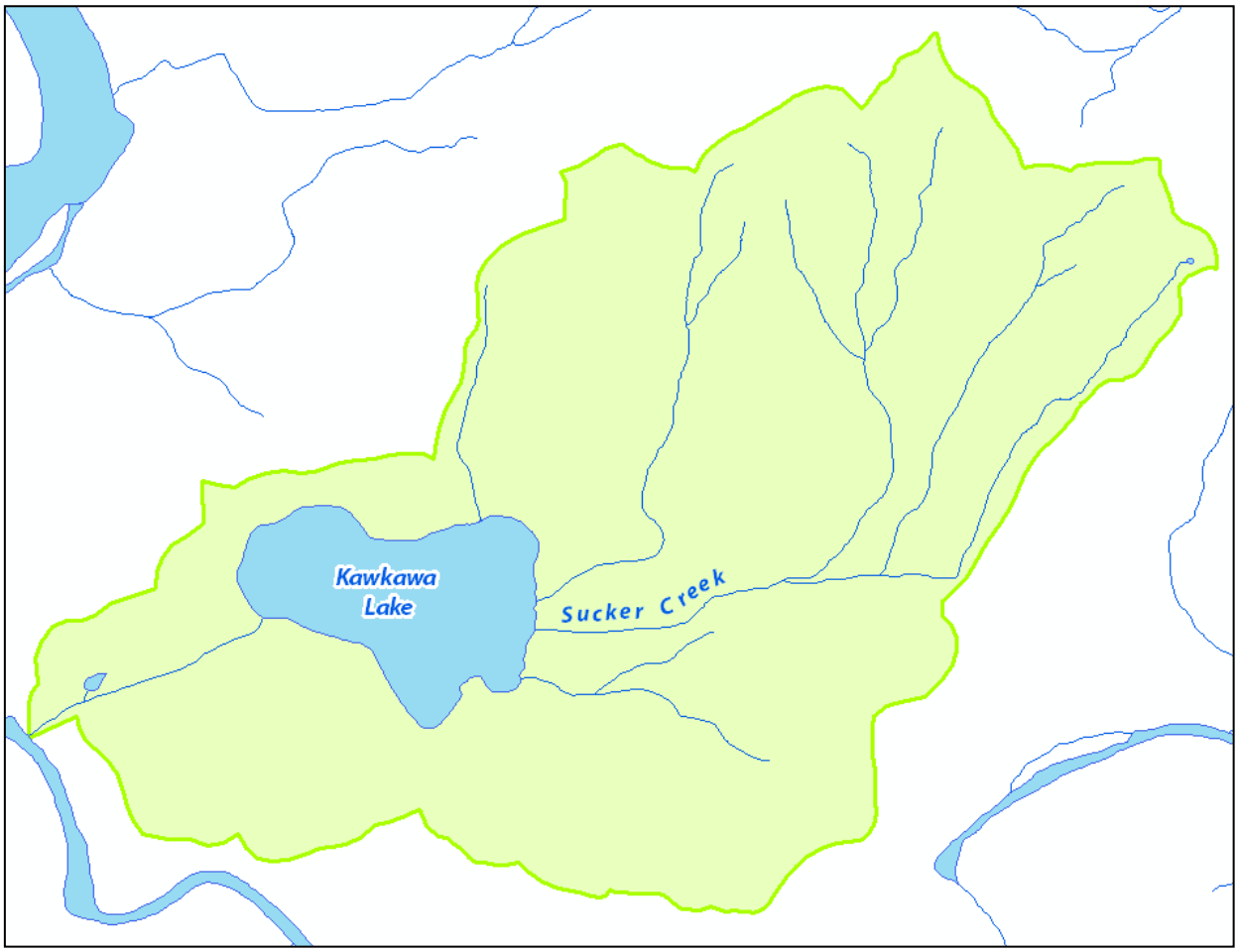
Figure 18. Sucker Creek Watersheds



Watersheds are outlined in green and selected watersheds are shaded green

To amalgamate the individual watersheds associated with Sucker Creek to develop a single watershed polygon for the Sucker Creek basin a dissolve function can be run within a GIS to yield a single polygon (Figure 19). Watersheds can be selected and/or amalgamated using this approach for a small creek, as in the example, or to group all the watersheds associated with one of the Principal Drainages (e.g., the Fraser River).

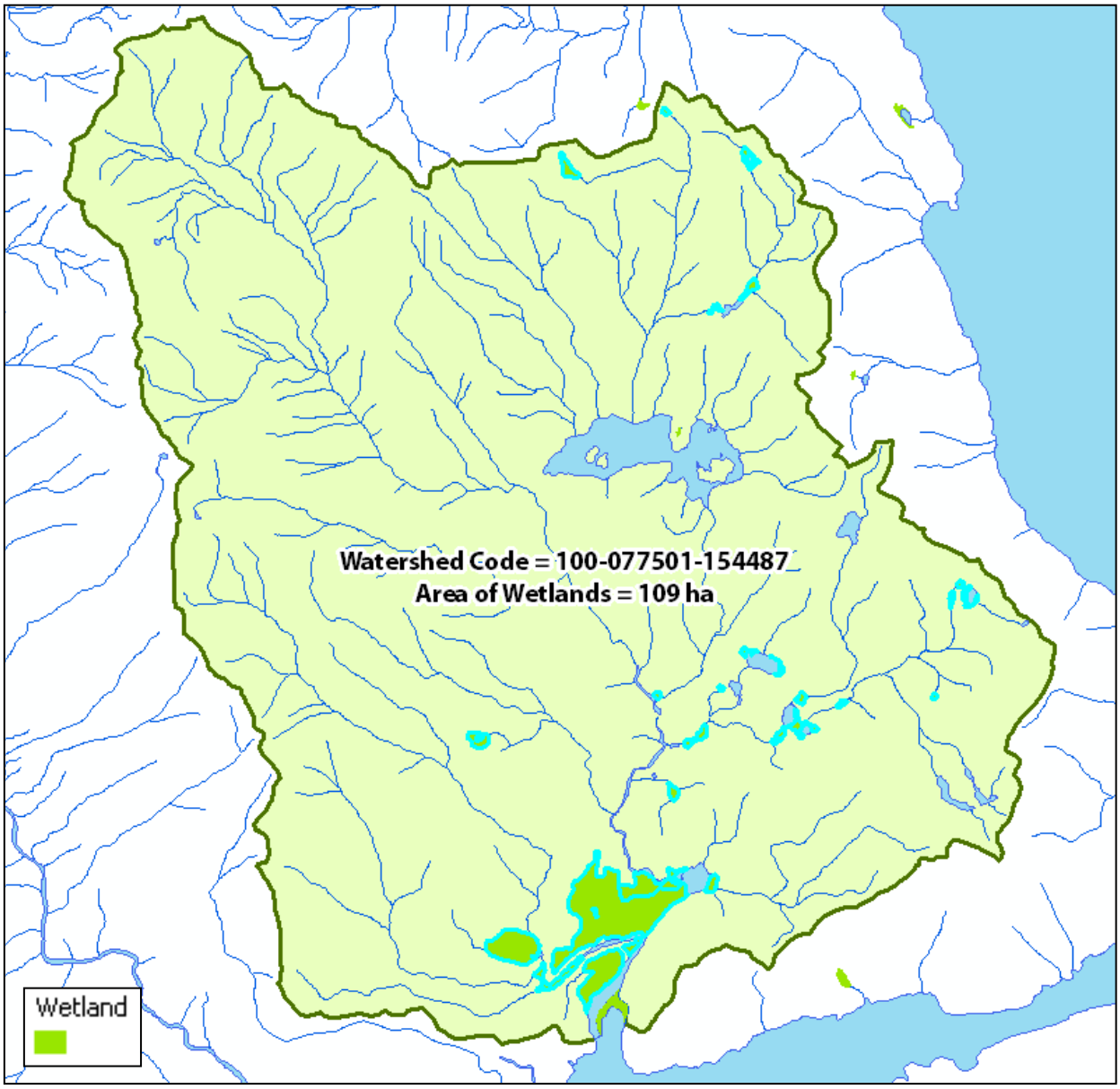
Figure 19. Sucker Creek Basin



3.3.2.4 How to Use the Coding System to Identify the Features within a Watershed

The Watershed Code can be used to identify any of the features falling within a specified watershed or group of watersheds. The first step is to determine the Watershed Code of the watershed(s) you are interested in. This code can then be used to query any of the other feature types. For example, if you want to determine the total area of wetlands in a given watershed just determine the stream network you are interested in. The Watershed Codes of the streams can be used to query the watershed features to confirm the watershed polygons (not a requirement but useful to verify the extent of your area of interest). Then just query the wetlands dataset based on the same Watershed Code to develop your selection set. The last step is to sum the AREA attribute for the selected wetlands. Figure 20 illustrates the results of this type of query.

Figure 20. Identifying Wetlands in a Watershed



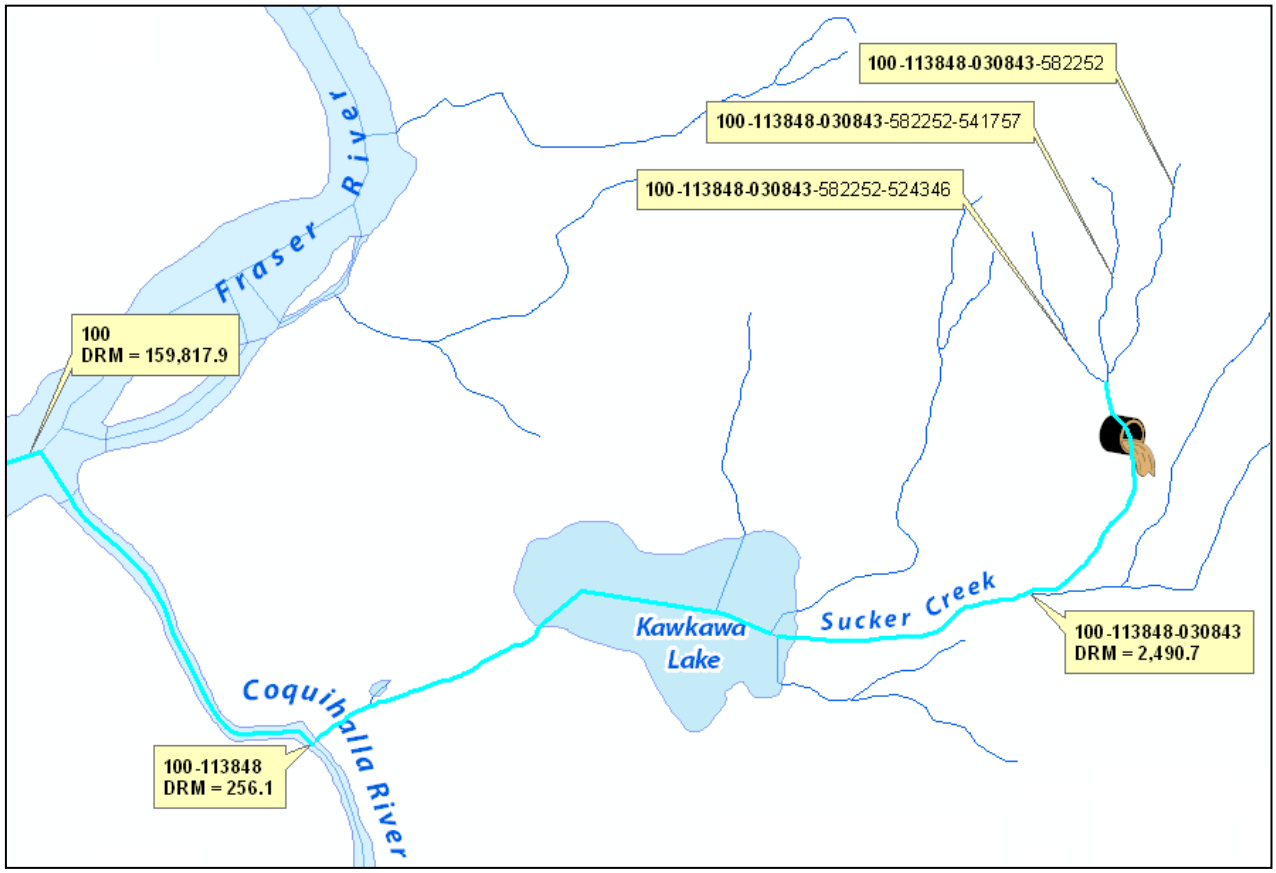
3.3.2.5 How to Identify the Features Upstream and Downstream of a Point

Selecting features either upstream or downstream of a point is conceptually very similar to identifying the streams flowing into a lake: rather than using the lake polygon as our upstream/downstream location we are using a specific point. However, in this case we also need to consider the Downstream Route Measure (DRM) to identify the portions of partial streams upstream and downstream. This functionality allows us to identify the zone of influence associated with a point (e.g., a point pollution source or a chemical spill) by identifying downstream features. If an outfall was located part way along stream 100-113848-030843-582252 (Figure 21) we can identify the stream reaches both above and below the site through the following steps:

1. Use the outfall location coordinates to map the location of the feature.
2. Identify the watershed code associated with the outfall location. In our example, this point falls on the first reach of stream 100-113848-030843-582252 so it has a DRM = 0.
3. Streams upstream of the outfall are those with:
    a) a watershed code of 100-113848-030843-582252 with the fifth level of the code populated (i.e., streams 100-113848-030843-582252-541757 and 100-113848-030843-582252-524346); and
    b) portions of stream 100-113848-030843-582252 with a DRM greater than 0.
4. Streams downstream of the point will meet the following conditions:
    a) a watershed code of 100-113848-030843-582252 and a DRM of 0
    b) the portions of Sucker Creek (100-113848-030843) downstream from the mouth of 100-113848-030843-582252 (i.e., with a DRM less than or equal to 2,490.7)
    c) the portions of the Coquihalla River (100-113848) downstream of the confluence with Sucker Creek (i.e., with a DRM less than or equal to 256.1
    d) the portions of the Fraser River (100) downstream of the confluence with the Coquihalla River (i.e., with a DRM less than or equal to 159,817.9)

The stream segments highlighted in cyan in Figure 21 illustrate the results of the query. Note that the portion of stream 100-113848-030843-582252 above the outfall is highlighted because the DRM applies to the entire reach.

Figure 21. Identifying Upstream and Downstream Features



3.3.2.6 How to Select all the Obstructions Downstream of a Point

To select obstructions downstream of a point we need to identify the watershed code of the stream the point falls on and then query the obstructions table to identify the downstream obstruction features using an approach identical to that outlined above to identify the streams downstream of a point.

3.3.3 Integrating Your Own Data

To integrate your own point dataset (i.e., sample locations) a point dataset should be developed either by digitizing the point locations or by mapping their locations based on their coordinates (i.e., coordinates gathered using a Geographic Positioning System [GPS]). A watershed code field should be added to the point dataset's attribute table, allowing the dataset to be related to the tables in the Freshwater Atlas. In all likelihood, the points will not fall directly on the stream network and therefore should be snapped to the line locations either manually of based on a specified tolerance (e.g., 10 metres). A spatial join can then be performed to populate the watershed code attribute in the point file with that of the stream it falls on. Alternatively, the local watershed code of the watershed the sample site falls within can be used to link the sample site to a specific stream segment.

Appendix A – Watershed Group Codes

Watershed Group Code	Watershed Group
ADMS	Adams River
ALBN	Alberni Inlet
ATLL	Atlin Lake
ATNA	Atnarko River
BABL	Babine Lake
BABR	Babine River
BARR	Barrington River
BBAR	Big Bar Creek
BEAV	Beaver River
BELA	Bella Coola River
BIGC	Big Creek
BLAR	Blackwater River
BLUR	Blue River
BONP	Bonaparte River
BOWR	Bowron
BRID	Bridge Creek
BRKS	Brooks Peninsula
BULK	Bulkley River
BULL	Bull River
CAMB	Campbell River
CANO	Canoe Reach
CARP	Carp Lake
CARR	Cariboo River
CHES	Cheslatta River
CHIL	Chilako River
CHIR	Chilko River
CHUK	Chukachida River
CHWK	Chilliwack River
CLAY	Clayoquot
CLRH	Columbia Reach
CLWR	Clearwater River
COAL	Coal River
COLR	Columbia River
COMX	Comox
COTR	Cottonwood River
COWN	Cowichan
CRKD	Crooked River
CRYL	Cry Lake
DEAD	Deadman River
DEAL	Dease Lake
DEAR	Dease River
DOGC	Dog Creek
DRIR	Driftwood River
DUNC	Duncan Lake
DUNE	Dunedin River
ELKR	Elk River
EUCH	Euchiniko River

Watershed Group Code	Watershed Group
EUCL	Euchiniko Lake
FINA	Finlay Arm
FINL	Finlay River
FIRE	Firesteel River
FONT	Fontas River
FOXR	Fox River
FRAN	Francois Lake
FRCN	Fraser Canyon
FROG	Frog River
GATA	Gataga River
GLAR	Gladys River
GOLD	Gold River
GRAI	Graham Island
GRNL	Green Lake
GUIC	Guichon Creek
HARR	Harrison River
HAYR	Hay River
HERR	Herrick Creek
HOLB	Holberg
HOMA	Homathko River
HORS	Horsefly River
INGR	Ingenika River
INKR	Inklin River
ISKR	Iskut River
JENR	Jennings River
JERV	Jervis Inlet
KAHN	Kahntah River
KAKC	Kakiddi Creek
KCHL	Kotcho Lake
KEEC	Keecha Creek
KETL	Kettle River
KHOR	Kicking Horse River
KHTZ	Khutze River
KINR	Kinskuch River
KISK	Kiskatinaw River
KISP	Kispiox River
KITL	Kitlope River
KITR	Kitimat River
KLAR	Klappan River
KLIN	Klinaklini River
KLUM	Kalum River
KNIG	Knight Inlet
KOTL	Kootenay Lake
KOTR	Kootenay River
KSHR	Kshwan River
KTSU	Kitasu Bay
KUMR	Kumowdah River
KUSR	Kusawa River

Watershed Group Code	Watershed Group
LARL	Lower Arrow Lake
LBIR	Lower Bell -Irving River
LBTN	Lower Beatton River
LCHL	Lower Chilako River
LCHR	Lower Chilcotin River
LDEN	Lower Dean River
LEUT	Lower Eutsuk Lake
LFRA	Lower Fraser
LFRT	Lower Fort Nelson River
LHAF	Lower Halfway River
LIAR	Liard River
LILL	Lillooet
LISR	Lower Iskut River
LKEC	Lower Kechika River
LKEL	Lakelse
LMUS	Lower Muskwa River
LNAR	Lower Nass River
LNIC	Lower Nicola River
LNRS	Lower Nechako Reservoir
LNTH	Lower North Thompson River
LOMI	Lower Omineca River
LPCE	Lower Peace River
LPET	Lower Petitot River
LPRO	Lower Prophet River
LRAN	Little Rancheria River
LRDO	Laredo Inlet
LSAL	Lower Salmon River
LSIK	Lower Sikanni Chief River
LSKE	Lower Skeena River
LSTR	Lower Stikine River
LTRE	Lower Trembleur Lake
MAHD	Mahood Lake
MBNK	Middle Banks Island
MCGR	McGregor River
MDEA	Middle Dease River
MESC	Mess Creek
MESI	Mesilinka River
MFRA	Middle Fraser
MFRT	Middle Fort Nelson River
MIDR	Middle River
MILL	Milligan Creek
MMUS	Middle Muskwa River
MORI	Morsby Island
MORK	Morkill River
MORR	Morice River
MPRO	Middle Prophet River
MSKE	Middle Skeena River
MSTR	Middle Stikine River

Watershed Group Code	Watershed Group
MURR	Murray River
MURT	Murtle Lake
MUSK	Muskeg River
NAHR	Nahlin River
NAKR	Nakina River
NARC	Narcosli Creek
NASC	Nascall River
NASR	Nass River
NATR	Nation River
NAZR	Nazko River
NBNK	North Banks Island
NECL	Necleetsconnay River
NECR	Nechako River
NEVI	Northeast Vancouver Island
NICL	Nicola River
NIEL	Niel Creek
NIMP	Nimpkish River
OKAN	Okanagan River
OSPK	Ospika River
OWIK	Owikeno Lake
PARA	Parsnip Arm
PARK	Parksville
PARS	Parsnip River
PCEA	Peace Arm
PINE	Pine River
PITR	Pitman River
PORI	Porcher Island
QUES	Quesnel River
REVL	Revelstoke Lake
SAHD	Sahdoanah Creek
SAHT	Sahtaneh River
SAJR	San Jose River
SALM	Salmon River
SALR	Salmon River
SANJ	San Juan River
SETN	Seton Lake
SEYM	Seymour Inlet
SHEK	Shekilie River
SHER	Sheslay River
SHUL	Shuswap Lake
SIML	Similkameen River
SKGT	Skagit River
SLOC	Slocan River
SMAR	St. Mary River
SMOK	Smoky River
SPAT	Spatsizi River
SQAM	Squamish
STHM	South Thompson River

Watershed Group Code	Watershed Group
STIR	Stikine River
STUL	Stuart Lake
STUR	Stuart River
SUST	Sustut River
SWIR	Swift River
TABR	Tabor River
TAHR	Tahltan River
TAHS	Tahsis
TAKL	Takla Lake
TASR	Taseko River
TATR	Tatshenshini River
TAYR	Taylor River
TESR	Teslin River
THOM	Thompson River
TOAD	Toad River
TOBA	Toba Inlet
TOOD	Toodoggone River
TSAY	Tsaytis River
TSEA	Tsea River
TSIT	Tsitika River
TURN	Turnagain River
TUTR	Tutshi River
TUYR	Tuya River
TWAC	Twan Creek
UARL	Upper Arrow Lake
UBIR	Upper Bell -Irving River
UBTN	Upper Beatton River
UCHR	Upper Chilcotin River
UDEN	Upper Dean River
UEUT	Upper Eutsuk Lake
UFRA	Upper Fraser River
UFRT	Upper Fort Nelson River
UHAF	Upper Halfway River
UISR	Upper Iskut River
UJER	Upper Jennings River
UKEC	Upper Kechika River
ULRD	Upper Liard River
UMUS	Upper Muskwa River
UNAR	Upper Nass River
UNRS	Upper Nechako Reservoir
UNTH	Upper North Thompson River
UNUR	Unuk River
UOMI	Upper Omineca River
UPCE	Upper Peace River
UPET	Upper Petitot River
UPRO	Upper Prophet River
USHU	Upper Shuswap
USIK	Upper Sikanni Chief River

Watershed Group Code	Watershed Group
USKE	Upper Skeena River
USTK	Upper Stikine River
UTRE	Upper Trembleur Lake
VICT	Victoria
WILL	Willow River
WORC	Work Channel
ZYMO	Zymoetz River

The locations of the Watershed Groups are illustrated in Figure A1.

Figure A1. Watershed Groups

Appendix B – Attribute Tables

Point Layer Descriptions

Table 9. Attributes for Obstruction Features

ATTRIBUTE NAME	version	DESCRIPTION
OBSTRUCTION_ID	2.0	Unique key representing the point.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
LINEAR_FEATURE_ID	2.0	The unique identifier of the stream edge the obstruction lies on.
GNIS_ID	2.0	The BCGNIS (BC Geographical Names Information System) feature id associated with the feature.
GNIS_NAME	2.0	The BCGNIS (BC Geographical Names Information System) name associated with the GNIS feature id (an English name was used where available, otherwise another language was selected).
OBSTRUCTION_TYPE	2.0	String representing the type of obstacle (Rapid, Fall, Dam etc.).
BLUE_LINE_KEY	2.0	The blue line key of the flow arc that the obstruction lies on.
WATERSHED_KEY	2.0	The watershed key of the flow arc that the obstruction lies on.
FWA_WATERSHED_CODE	2.0	The watershed code of the flow arc the obstruction lies on.
LOCAL_WATERSHED_CODE	N	The local watershed code of the flow arc the obstruction lies on.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
ROUTE_MEASURE	2.0	The distance along the route in meters, measured from the mouth of the route containing the obstruction to the obstruction.
FEATURE_SOURCE	2.0	The source of the arc; where the feature was obtained or modified.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 10. Attributes for Named Point Features

ATTRIBUTE NAME	version	DESCRIPTION
NAMED_POINT_FEATURE_ID	2.0	Unique identifier for each named feature.
GNIS_ID	2.0	The BCGNIS (BC Geographical Names Information System) feature id associated with the feature.
GNIS_NAME	2.0	The BCGNIS (BC Geographical Names Information System) name associated with the GNIS feature id (an English name was used where available, otherwise another language was selected).
NAMED_FEATURE_TYPE	2.0	Type of the named point. Contains one of the following: Fresh or Marine.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Line Layer Descriptions

Table 11. Attributes for Coastline Features

ATTRIBUTE NAME	version	DESCRIPTION
LINEAR_FEATURE_ID	2.0	A unique numeric identifier used to link the arc to the database.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
EDGE_TYPE	2.0	The numeric code used by the Freshwater Atlas to identify the various types of water network linear features.
BLUE_LINE_KEY	2.0	Uniquely identifies a single flow line such that a main channel and a secondary channel with the same watershed code would have different blue line keys (the Fraser River and all side channels have different blue line keys).
WATERSHED_KEY	2.0	A key that identifies a stream system (for example the Fraser River mainstem and all its side channels the same watershed key). There is a 1:1 match between a watershed key and watershed code. The watershed key will match the blue line key for the mainstem.
FWA_WATERSHED_CODE	2.0	A 143 character code derived using a hierarchy coding scheme. Approximately identifies where a particular stream is located within the province.
LOCAL_WATERSHED_CODE	N	A 143 character code similar to the FWA WATERSHED CODE that further subdivides remnant polygons to provide an approximate location along the mainstem.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
DOWNSTREAM_ROUTE_MEASURE	2.0	The distance along the route from the mouth of the route to the feature. This distance is measured from the mouth of the containing route to the downstream end of the feature.
LENGTH_METRE	2.0	The length in meters of the linear object
FEATURE_SOURCE	2.0	The source of the arc; where the feature was obtained or modified.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 12. Attributes for Stream Network Features

ATTRIBUTE NAME	version	DESCRIPTION
LINEAR_FEATURE_ID	2.0	A unique numeric identifier used to link the arc to the database.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
EDGE_TYPE	2.0	The numeric code used by the Freshwater Atlas to identify the various types of water network linear features.

ATTRIBUTE NAME	version	DESCRIPTION
BLUE_LINE_KEY	2.0	Uniquely identifies a single flow line such that a main channel and a secondary channel with the same watershed code would have different blue line keys (the Fraser River and all side channels have different blue line keys).
WATERSHED_KEY	2.0	A key that identifies a stream system (for example the Fraser River mainstem and all its side channels the same watershed key). There is a 1:1 match between a watershed key and watershed code. The watershed key will match the blue line key for the mainstem.
FWA_WATERSHED_CODE	2.0	A 143 character code derived using a hierarchy coding scheme. Approximately identifies where a particular stream is located within the province.
LOCAL_WATERSHED_CODE	2.0	A 143 character code similar to the fwa watershed code that further subdivides remnant polygons to provide an approximate location along the mainstem.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
DOWNSTREAM_ROUTE_MEASURE	2.0	The distance along the route from the mouth of the route to the feature. This distance is measured from the mouth of the containing route to the downstream end of the feature.
LENGTH_METRE	2.0	The length in meters of the linear object
FEATURE_SOURCE	2.0	The source of the arc; where the feature was obtained or modified.
GNIS_ID	2.0	The BCGNIS (BC Geographical Names Information System) feature id.
GNIS_NAME	2.0	The BCGNIS (BC Geographical Names Information System) name associated with the GNIS feature id (an English name was used where available, otherwise another language was selected).
LEFT_RIGHT_TRIBUTARY	2.0	Describes which side of the local mainstem this tributary enters on. "LEFT" or "RIGHT" is assigned to all main-flow streams based on the angle of entry of the stream to its parent stream. If an observer was standing in the stream facing downstream, the bank on the left of the observer would be the left bank. Any stream entering the stream on the left is assigned a "LEFT" attribute. Left and right is determined by using the angles of hte upstream and downstream edges of the parent stream at the confluence. Streams that flow into the coastline are attributed as "NONE". Primary streams that sink or that flow out of the province and do not connect to any extrajurisdictional streams are attributed as "UNKNOWN".
STREAM_ORDER	2.0	The calculated modified Strahler order.
STREAM_MAGNITUDE	2.0	The calculated magnitude.

ATTRIBUTE NAME	version	DESCRIPTION
WATERBODY_KEY	2.0	The waterbody key of the waterbody the edge is contained within.
BLUE_LINE_KEY_50K	2.0	The best matched blue line key from the 1:50K Watershed Atlas.
WATERSHED_CODE_50K	2.0	The hierarchical identifier from the 1:50K Watershed Atlas associated with the blue line key 50k.
WATERSHED_KEY_50K	2.0	The 50K watershed key associated with the blue line key 50K from the 1:50K Watershed Atlas.
WATERSHED_GROUP_CODE_50K	2.0	The 50K group code associated with the 50K blue line key from the 1:50K Watershed Atlas.
GRADIENT	N	The gradient of the stream. How the gradient is defined has yet to be determined.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature. Note: version 1.3 and now 2.0 have x,y,z values where z represents the refined elevation.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 13. Attributes for Linear Boundary Features

ATTRIBUTE NAME	version	DESCRIPTION
LINEAR_FEATURE_ID	2.0	A unique numeric identifier used to link the arc to the database.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
EDGE_TYPE	2.0	The numeric code used by the Freshwater Atlas to identify the various types of water network linear features.
DOWNSTREAM_ROUTE_MEASURE	N	The distance, in meters, along the route from the mouth of the route to the feature. This distance is measured from the mouth of the containing route to the downstream end of the feature.
FEATURE_SOURCE	2.0	The source of the arc; where the feature was obtained or modified.
WATERBODY_KEY	2.0	The WATERBODY KEY of the WATERBODY POLY this LINEAR BOUNDARY SP edge bounds.
BLUE_LINE_KEY	2.0	Uniquely identifies a single flow line such that a main channel and a secondary channel with the same watershed code would have different blue line keys (the Fraser River and all side channels have different blue line keys).
WATERSHED_KEY	2.0	A key that identifies a stream system (for example the Fraser River mainstem and all its side channels the same watershed key). There is a 1:1 match between a watershed key and watershed code. The watershed key will match the blue line key for the mainstem.
FWA_WATERSHED_CODE	2.0	A 143 character code derived using a hierarchy coding scheme. Approximately identifies where a particular stream is located

ATTRIBUTE NAME	version	DESCRIPTION
		within the province.
LOCAL_WATERSHED_CODE	N	A 143 character code similar to the FWA_WATERSHED_CODE that further subdivides remnant polygons to provide an approximate location along the mainstem.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
LENGTH_METRE	2.0	The length in meters of the linear object
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 14. Attributes for Watershed Boundary Features

ATTRIBUTE NAME	version	DESCRIPTION
WATERSHED_BOUNDARY_ID	2.0	A unique numeric identifier used to link the arc to the database.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
EDGE_TYPE	2.0	The numeric code used by the Freshwater Atlas to identify the various types of water network linear features.
BLUE_LINE_KEY_LEFT	N	The blue line key of the watershed to the left of this edge.
BLUE_LINE_KEY_RIGHT	N	The blue line key of watershed to the right of this edge.
WATERSHED_KEY_LEFT	N	The watershed key of the stream to the left of this edge.
WATERSHED_KEY_RIGHT	N	The watershed key of the stream to the right of this edge.
FWA_WATERSHED_CODE_LEFT	N	The watershed code of the watershed to the left of this edge.
FWA_WATERSHED_CODE_RIGHT	N	The watershed code of the watershed to the right of this edge.
LOCAL_WATERSHED_CODE_LEFT	N	The local watershed code of the watershed to the left of this edge.
LOCAL_WATERSHED_CODE_RIGHT	N	The local watershed code of the watershed to the right of this edge.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
LENGTH_METRE	2.0	The length in meters of the linear object.
FEATURE_SOURCE	2.0	The source of the arc; where the feature was obtained or modified.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Polygon Layer Descriptions

Table 15. Attributes for Lake Features

ATTRIBUTE NAME	version	DESCRIPTION
WATERBODY_POLY_ID	2.0	The unique key for the waterbody polygon spatial layer.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
WATERBODY_TYPE	2.0	The type of waterbody. Possible values include: 'L' (lake), 'R' (double lined river), 'W' (wetland), 'X' (manmade river or lake), or 'G' (glacier or icefield)
WATERBODY_KEY	2.0	A unique identifier associated with waterbodies in order to group polygons that make up a single waterbody.
AREA_HA	2.0	Area of polygon (hectares).
GNIS_ID_1	2.0	A BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable. In a grouped system the feature id of the BCGNIS group is provided here and any subsequent names provided in gnis_id2 and gnis_id3.
GNIS_NAME_1	2.0	The name of the first BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_2	2.0	A second BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable.
GNIS_NAME_2	2.0	The name of the second BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_3	2.0	A third BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable.
GNIS_NAME_3	2.0	The name of the third BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
BLUE_LINE_KEY	2.0	The blue line key of the controlling route through the waterbody.
WATERSHED_KEY	2.0	The watershed key of the controlling route through the waterbody.
FWA_WATERSHED_CODE	2.0	The watershed code of the controlling route through the waterbody.
LOCAL_WATERSHED_CODE	N	The local watershed code associated with the waterbody.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
LEFT_RIGHT_TRIBUTARY	2.0	A value attributed via the watershed code to all waterbodies indicating on what side of the watershed they drain into.

ATTRIBUTE NAME	version	DESCRIPTION
WATERBODY_KEY_50K	2.0	The 'best' matched waterbody from the 1:50K Watershed Atlas. In cases where there are multiple matches to features in the 1:50K watershed atlas the match with the greatest overlapping area was used.
WATERSHED_GROUP_CODE_50K	2.0	The group code from the 1:50K Watershed Atlas associated with the waterbody key 50k.
WATERBODY_KEY_GROUP_CODE_50K	2.0	The waterbody key 50K with the group code 50K concatenated.
WATERSHED_CODE_50K	2.0	The 1:50K Watershed Atlas watershed code associated with the waterbody key 50K.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 16. Attributes for River Features

ATTRIBUTE NAME	version	DESCRIPTION
WATERBODY_POLY_ID	2.0	The unique key for the waterbody polygon spatial layer.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
WATERBODY_TYPE	2.0	The type of waterbody. Possible values include: 'L' (lake), 'R' (double lined river), 'W' (wetland), 'X' (manmade river or lake), or 'G' (glacier or icefield)
WATERBODY_KEY	2.0	A unique identifier associated with waterbodies in order to group polygons that make up a single waterbody.
AREA_HA	2.0	Area of polygon (hectares).
GNIS_ID_1	N	A BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable. In a grouped system the feature id of the BCGNIS group is provided here and any subsequent names provided in gnis_id2 and gnis_id3. For Version 1.2 River names are attached to the linear features and have not been transferred to the polygons.
GNIS_NAME_1	N	The name of the first BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected). For Version 1.2 River names are attached to the linear features and have not been transferred to the polygons.
GNIS_ID_2	N	A second BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable. For Version 1.2 River names are attached to the linear features and have not been transferred to the polygons.
GNIS_NAME_2	N	The name of the second BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).

ATTRIBUTE NAME	version	DESCRIPTION
		For Version 1.2 River names are attached to the linear features and have not been transferred to the polygons.
GNIS_ID_3	N	A third BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable. For Version 1.2 River names are attached to the linear features and have not been transferred to the polygons.
GNIS_NAME_3	N	The name of the third BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected). For Version 1.2 River names are attached to the linear features and have not been transferred to the polygons.
BLUE_LINE_KEY	2.0	The blue line key of the controlling route through the waterbody.
WATERSHED_KEY	2.0	The watershed key of the controlling route through the waterbody.
FWA_WATERSHED_CODE	2.0	The watershed code of the controlling route through the waterbody.
LOCAL_WATERSHED_CODE	N	The local watershed code associated with the waterbody.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
LEFT_RIGHT_TRIBUTARY	2.0	A value attributed via the watershed code to all waterbodies indicating on what side of the watershed they drain into.
WATERBODY_KEY_50K	2.0	The 'best' matched waterbody from the 1:50K Watershed Atlas. In cases where there are multiple matches to features in the 1:50K watershed atlas the match with the greatest overlapping area was used.
WATERSHED_GROUP_CODE_50K	2.0	The group code from the 1:50K Watershed Atlas associated with the waterbody key 50k.
WATERBODY_KEY_GROUP_CODE_50K	2.0	The waterbody key 50K with the group code 50K concatenated.
WATERSHED_CODE_50K	2.0	The 1:50K Watershed Atlas watershed code associated with the waterbody key 50K.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 17. Attributes for Wetland Features

ATTRIBUTE NAME	version	DESCRIPTION
WATERBODY_POLY_ID	2.0	The unique key for the waterbody polygon spatial layer.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
WATERBODY_TYPE	2.0	The type of waterbody. Possible values include: 'L' (lake), 'R' (double lined river), 'W' (wetland), 'X' (manmade river or lake), or 'G' (glacier or icefield)
WATERBODY_KEY	2.0	A unique identifier associated with waterbodies in order to group polygons that make up a single waterbody.
AREA_HA	2.0	Area of polygon (hectares).

ATTRIBUTE NAME	version	DESCRIPTION
GNIS_ID_1	2.0	A BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable. In a grouped system the feature id of the BCGNIS group is provided here and any subsequent names provided in gnis_id2 and gnis_id3.
GNIS_NAME_1	2.0	The name of the first BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_2	2.0	A second BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable.
GNIS_NAME_2	2.0	The name of the second BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_3	2.0	A third BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable.
GNIS_NAME_3	2.0	The name of the third BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
BLUE_LINE_KEY	2.0	The blue line key of the controlling route through the waterbody.
WATERSHED_KEY	2.0	The watershed key of the controlling route through the waterbody.
FWA_WATERSHED_CODE	2.0	The watershed code of the controlling route through the waterbody.
LOCAL_WATERSHED_CODE	N	The local watershed code associated with the waterbody.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
LEFT_RIGHT_TRIBUTARY	2.0	A value attributed via the watershed code to all waterbodies indicating on what side of the watershed they drain into.
WATERBODY_KEY_50K	2.0	The 'best' matched waterbody from the 1:50K Watershed Atlas. In cases where there are multiple matches to features in the 1:50K watershed atlas the match with the greatest overlapping area was used.
WATERSHED_GROUP_CODE_50K	2.0	The group code from the 1:50K Watershed Atlas associated with the waterbody key 50k.
WATERBODY_KEY_GROUP_CODE_50K	2.0	The waterbody key 50K with the group code 50K concatenated.
WATERSHED_CODE_50K	2.0	The 1:50K Watershed Atlas watershed code associated with the waterbody key 50K.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 18. Attributes for Manmade Waterbody Features

ATTRIBUTE NAME	version	DESCRIPTION
WATERBODY_POLY_ID	2.0	The unique key for the waterbody polygon spatial layer.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
WATERBODY_TYPE	2.0	The type of waterbody. Possible values include: 'L' (lake), 'R' (double lined river), 'W' (wetland), 'X' (manmade river or lake), or 'G' (glacier or

ATTRIBUTE NAME	version	DESCRIPTION
		icefield)
WATERBODY_KEY	2.0	A unique identifier associated with waterbodies in order to group polygons that make up a single waterbody.
AREA_HA	2.0	Area of polygon (hectares).
GNIS_ID_1	2.0	A BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable. In a grouped system the feature id of the BCGNIS group is provided here and any subsequent names provided in gnis_id2 and gnis_id3.
GNIS_NAME_1	2.0	The name of the first BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_2	2.0	A second BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable.
GNIS_NAME_2	2.0	The name of the second BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_3	2.0	A third BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable.
GNIS_NAME_3	2.0	The name of the third BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
BLUE_LINE_KEY	2.0	The blue line key of the controlling route through the waterbody.
WATERSHED_KEY	2.0	The watershed key of the controlling route through the waterbody.
FWA_WATERSHED_CODE	2.0	The watershed code of the controlling route through the waterbody.
LOCAL_WATERSHED_CODE	N	The local watershed code associated with the waterbody.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
LEFT_RIGHT_TRIBUTARY	2.0	A value attributed via the watershed code to all waterbodies indicating on what side of the watershed they drain into.
WATERBODY_KEY_50K	2.0	The 'best' matched waterbody from the 1:50K Watershed Atlas. In cases where there are multiple matches to features in the 1:50K watershed atlas the match with the greatest overlapping area was used.
WATERSHED_GROUP_CODE_50K	2.0	The group code from the 1:50K Watershed Atlas associated with the waterbody key 50k.
WATERBODY_KEY_GROUP_CODE_50K	2.0	The waterbody key 50K with the group code 50K concatenated.
WATERSHED_CODE_50K	2.0	The 1:50K Watershed Atlas watershed code associated with the waterbody key 50K.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 19. Attributes for Glacier Features

ATTRIBUTE NAME	version	DESCRIPTION
WATERBODY_POLY_ID	2.0	The unique key for the waterbody polygon spatial layer.
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
WATERBODY_TYPE	2.0	The type of waterbody. Possible values include: 'L' (lake), 'R' (double lined river), 'W' (wetland), 'X' (manmade river or lake), or 'G' (glacier or icefield)
WATERBODY_KEY	N	A unique identifier associated with waterbodies in order to group polygons that make up a single waterbody.
AREA_HA	2.0	Area of polygon (hectares).
GNIS_ID_1	N	A BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable. In a grouped system the feature id of the BCGNIS group is provided here and any subsequent names provided in gnis_id2 and gnis_id3.
GNIS_NAME_1	N	The name of the first BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_2	N	A second BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable.
GNIS_NAME_2	N	The name of the second BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_3	N	A third BCGNIS (BC Geographical Names Information System) feature id attached to a waterbody or island, if applicable.
GNIS_NAME_3	N	The name of the third BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
BLUE_LINE_KEY	N	The blue line key of the controlling route through the waterbody.
WATERSHED_KEY	N	The watershed key of the controlling route through the waterbody.
FWA_WATERSHED_CODE	N	The watershed code of the controlling route through the waterbody.
LOCAL_WATERSHED_CODE	N	The local watershed code associated with the waterbody.
WATERSHED_GROUP_CODE	2.0	The watershed group code the feature is contained within.
LEFT_RIGHT_TRIBUTARY	N	A value attributed via the watershed code to all waterbodies indicating on what side of the watershed they drain into.
WATERBODY_KEY_50K	N	The 'best' matched waterbody from the 1:50K Watershed Atlas. In cases where there are multiple matches to features in the 1:50K watershed atlas the match with the greatest overlapping area was used.
WATERSHED_GROUP_CODE_50K	N	The group code from the 1:50K Watershed Atlas associated with the waterbody key 50k.
WATERBODY_KEY_GROUP_CODE_50K	N	The waterbody key 50K with the group code 50K concatenated.
WATERSHED_CODE_50K	N	The 1:50K Watershed Atlas watershed code associated with the waterbody key 50K.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 20. Attributes for Watershed Group Features

ATTRIBUTE NAME	version	DESCRIPTION
WATERSHED_GROUP_ID	2.0	A unique numeric key representing the watershed group code.
WATERSHED_GROUP_CODE	2.0	The four character watershed group code, e.g. ADMS (Adams River), ALBN (Alberni Inlet).
WATERSHED_GROUP_NAME	2.0	The name of the watershed group.
AREA_HA	2.0	The area of the polygon in hectares.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 21. Attributes for Watershed Features

ATTRIBUTE NAME	version	DESCRIPTION
WATERSHED_FEATURE_ID	N	A unique identifier for each watershed in the layer.
WATERSHED_GROUP_ID	N	A unique numeric key representing the watershed group code.
WATERSHED_TYPE	N	The type of watershed. This has yet to be determined for FWA version 2.0.0, but possible values may include: 'R' - real watershed, 'F' - face unit watershed, 'W' - waterbody watershed, etc.
GNIS_ID_1	N	The first BCGNIS (BC Geographical Names Information System) feature id associated with the watershed key of the watershed.
GNIS_NAME_1	N	The first BCGNIS (BC Geographical Names Information System) name associated with the watershed key of the watershed.
GNIS_ID_2	N	The second BCGNIS (BC Geographical Names Information System) feature id associated with the watershed key of the watershed.
GNIS_NAME_2	N	The second BCGNIS (BC Geographical Names Information System) name associated with the watershed key of the watershed.
GNIS_ID_3	N	The third BCGNIS (BC Geographical Names Information System) feature id associated with the watershed key of the watershed.
GNIS_NAME_3	N	The third BCGNIS (BC Geographical Names Information System) name associated with the watershed key of the watershed.
WATERBODY_ID	N	If the watershed is made up of a lake or river, this field will contain the waterbody id associated with that waterbody, otherwise it will be null.
WATERBODY_KEY	N	If the watershed is made up of a lake or river, this field will contain the waterbody key associated with that waterbody, otherwise it will be null.
WATERSHED_KEY	N	The watershed key associated with the watershed polygon (and watershed code).
FWA_WATERSHED_CODE	N	The 143 character watershed code associated with the watershed polygon.
LOCAL_WATERSHED_CODE	N	A 143 character code similar to the FWA watershed code that further subdivides remnant polygons to provide an approximate location along the mainstem.
WATERSHED_GROUP_CODE	N	The watershed group code associated with the polygon.
LEFT_RIGHT_TRIBUTARY	N	A value attributed via the watershed code to all waterbodies indicating on what side of the watershed they drain into.

ATTRIBUTE NAME	version	DESCRIPTION
WATERSHED_ORDER	N	The maximum order of the watershed key associated with the watershed polygon.
WATERSHED_MAGNITUDE	N	The maximum magnitude of the watershed key associated with the watershed polygon.
LOCAL_WATERSHED_ORDER	N	The order associated with the local watershed code.
LOCAL_WATERSHED_MAGNITUDE	N	The magnitude associated with the local watershed code.
AREA_HA	N	Area of the watershed, in hectares.
FEATURE_CODE	N	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	N	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	N	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 22. Attributes for Named Watershed Features

ATTRIBUTE NAME	version	DESCRIPTION
NAMED_WATERSHED_ID	N	A unique identifier for each watershed in the layer.
GNIS_ID	N	The BCGNIS (BC Geographical Names Information System) feature id associated with the watershed.
GNIS_NAME	N	The BCGNIS (BC Geographical Names Information System) name associated with the GNIS feature id (an English name was used where available, otherwise another language was selected).
BLUE_LINE_KEY	N	The blue line key associated with the named stream.
WATERSHED_KEY	N	The watershed key associated with the named stream.
FWA_WATERSHED_CODE	N	The watershed code associated with the named stream.
STREAM_ORDER	N	The maximum order associated with the watershed key of the named stream.
STREAM_MAGNITUDE	N	The maximum magnitude associated with the watershed key of the named stream.
AREA_HA	N	Area of the watershed, in hectares.
FEATURE_CODE	N	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	N	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	N	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 23. Attributes for Island Features

ATTRIBUTE NAME	version	DESCRIPTION
ISLAND_ID	2.0	ISLAND ID is a unique identifier for each feature.
ISLAND_TYPE	2.0	ISLAND TYPE contains one of "Fresh, Marine or Marine/Fresh"
GNIS_ID_1	2.0	The BCGNIS (BC Geographical Names Information System) feature id.
GNIS_NAME_1	2.0	The name of the first BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_2	2.0	A second BCGNIS (BC Geographical Names Information System) feature id
GNIS_NAME_2	2.0	The name of the second BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
GNIS_ID_3	2.0	A third BCGNIS (BC Geographical Names Information System) feature id attached
GNIS_NAME_3	2.0	The name of the third BCGNIS (BC Geographical Names Information System) feature id (an English name was used where available, otherwise another language was selected).
FWA_WATERSHED_CODE	2.0	To be populated with the watershed code of the island for coastal islands; and the most downstream watershed code of bounding features for interior islands. Vancouver Island is the exception with the resolution to be determined.
LOCAL_WATERSHED_CODE	N	Populated with the local watershed code of the island for coastal islands; and the most downstream local watershed code of bounding features for interior islands. Vancouver Island is handled specially.
AREA_HA	2.0	Area of the island, in hectares.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Table 24. Attributes for Bay and Channel Features

ATTRIBUTE NAME	version	DESCRIPTION
BAY_AND_CHANNEL_ID	2.0	Unique identifier for each feature.
BAY_CHANNEL_TYPE	2.0	BAY CHANNEL TYPE contains one of the following: Fresh Bay, Fresh Channel, Marine Bay, or Marine Channel.
GNIS_ID	2.0	The BCGNIS (BC Geographical Names Information System) feature id associated with the named bay or channel.
GNIS_NAME	2.0	The BCGNIS (BC Geographical Names Information System) name associated with the GNIS feature id (an English name was used where available, otherwise another language was selected).
AREA_HA	2.0	Area of the bay or channel, in hectares.
FEATURE_CODE	2.0	FEATURE CODE contains a value based on the Canadian Council of Surveys and Mapping's (CCSM) system for classification of geographic features.

ATTRIBUTE NAME	version	DESCRIPTION
GEOMETRY	2.0	GEOMETRY is the column used to reference the spatial coordinates defining the feature.
OBJECTID	2.0	OBJECTID is a column required by spatial layers that interact with ESRI ArcSDE. It is populated with unique values automatically by SDE.

Non-spatial Data Layer Descriptions

Table 25. Attributes for Edge Type Codes

ATTRIBUTE NAME	version	DESCRIPTION
EDG_ TYPE	2.0	A 4 digit numeric code used by the Freshwater Atlas to identify the various types of water network linear features. eg. 1050
EDGE_DESCRIPTION	2.0	A plain English description of the type code, for example “Single line blueline, main flow”.

Table 26. Attributes for Waterbody Type Codes

ATTRIBUTE NAME	version	DESCRIPTION
WATERBODY_TYPE	2.0	The type of waterbody. Possible values include: L, R, W, X, G.
WATERBODY_DESCRIPTION	2.0	Contains a plain English description of the waterbody type.

Table 27. Attributes for Waterbody 20K 50K Codes

ATTRIBUTE NAME	version	DESCRIPTION
WATERBODIES_20K_50K_ID	2.0	A unique identifier populated by the database.
WATERBODY_TYPE_20K	2.0	The type of 20k waterbody feature.
WATERSHED_GROUP_ID_20K	2.0	A unique numeric key representing the 20k watershed group code.
WATERBODY_ID_20K	2.0	The 20k waterbody id matched to the 50k feature.
WATERBODY_KEY_20K	2.0	The 20k waterbody key matched to a 50k key feature.
FWA_WATERSHED_CODE_20K	2.0	The controlling route of the matched 20k waterbody.
LOCAL_WATERSHED_CODE_20K	N	The local watershed code associated with the 20k waterbody.
WATERSHED_GROUP_CODE_20K	2.0	The watershed group of the 20k waterbody feature.
WATERBODY_TYPE_50K	2.0	The type of the matched 50k waterbody.
WATERBODY_KEY_50K	2.0	The 50k waterbody key of the matched waterbody.
WATERSHED_GROUP_CODE_50K	2.0	The 50k watershed group code of the matched waterbody.
WATERSHED_CODE_50K	2.0	The controlling route of the matched 50k waterbody.
MATCH_TYPE	2.0	A string identifying the type of match. One of 'Primary', indicating the best match, or 'X-Ref', indicating cross reference or secondary match.

Table 28. Attributes for Streams 20K 50K Codes

ATTRIBUTE NAME	version	DESCRIPTION
STREAMS_20K_50K_ID	2.0	A unique identifier populated by the database.
LINEAR_FEATURE_ID_20K	2.0	The edge id used to link to a unique line in the 1:20K stream network.
WATERSHED_GROUP_ID_20K	2.0	A unique numeric key representing the 20k watershed group code.
BLUE_LINE_KEY_20K	2.0	The blue line key associated with the 20k edge.
WATERSHED_KEY_20K	2.0	The watershed key associated with the 20k edge.
FWA_WATERSHED_CODE_20K	2.0	The watershed code associated with the 20k edge.

ATTRIBUTE NAME	version	DESCRIPTION
WATERSHED_GROUP_CODE_20K	2.0	The watershed group code associated with the 20k edge.
BLUE_LINE_KEY_50K	2.0	The best matched 50k blue line key.
WATERSHED_KEY_50K	2.0	The watershed key for the best matched 50k blue line key.
WATERSHED_CODE_50K	2.0	The 50k watershed code of the best matched 50k blue line key.
WATERSHED_GROUP_CODE_50K	2.0	The watershed group code of the best matched 50k blue line key.
MATCH_TYPE	2.0	A string identifying the type of match. One of 'Primary', indicating the best match, or 'X-Ref', indicating cross reference or secondary match.

Table 29. Attributes for Watershed Type Codes

ATTRIBUTE NAME	version	DESCRIPTION
WATERSHED_TYPE	N	The type of watershed. This has yet to be determined for FWA version 2.0.0, but possible values may include: ''R'' - real watershed, ''F'' - face unit watershed, ''W'' - waterbody watershed, etc.
WATERBODY_DESCRIPTION	N	Contains a plain english description of the watershed type. This has yet to be determined for FWA version 2.0.0, but possible values include: real watershed, face unit watershed, waterbody watershed, etc.

Appendix C – Data Distribution Quick Reference Guide

Appendix D – Glossary

Attribute query
Attribute queries are questions about the attributes (or non-spatial characteristics) of the data. Structured Query Language (SQL) is the standard interface to extract records matching a query.

Breakline
A breakline is a natural or man made occurrence in the topography where there is a definite and obvious change in contour direction. There is a definite change in deflection along a breakline, and elevations are captured along its entirety. An example would be a stream or a vertical bluff. I. Sharp Breakline: A sharp breakline causes a definite pointed character to the interpolated contour. ii. Rounded Breakline: A rounded breakline causes a smoother but still well defined deflection to the contour. Terrain data points, whether in a regular or irregular pattern, always fail to represent terrain fully in areas where there are sharp breaks or discontinuities in slope. Such discontinuities occur along ridge lines, at the upper and lower edges of a steep embankment, along drainage lines (streambeds), and in the vicinity of constructed cuts and fills. In these areas, the DEM points must be supplemented by breaklines that indicate sharp changes in slope. TRIM contains three types of breakline: - Hypsographic breaklines (prominent land features such as ridges and cliffs); - Hydrographic breaklines (the streams, rivers and lake edges); - Anthropological breaklines (e.g. manmade features such as roads and railways).

Catchment Area
The entire area from which drainage is received by a river system. It is also referred to as a basin. Any point on a stream will define an upstream catchment area, whereas watersheds are typically defined only at confluences (places where streams meet).

DEM
Digital Elevation Model. A series of points and breaklines (such as ridges) defining the Earth's surface. In TRIM, the DEM data consist of individual (x,y,z)-tuples, as well as some ridge lines, streams and certain other linear features.

Gazetted Name
The official name of the waterbody being surveyed as listed in the Gazetteer of Canada for British Columbia.

Headwaters
The source of a stream, river or lake.

Height of Land
A portion of a watershed boundary. Often used in defining the legal definition of a land parcel. Definition from FAMAP Global Glossary: The high point of land which separates watersheds and which forms part of the legal description of various Forest Tenures.

Hydrography
1. The scientific description and analysis of the physical conditions, boundaries, flow, and related characteristics of the earth's surface waters. 2. The mapping of bodies of water.

Hypsography
The scientific study of the earth's topologic configuration above sea level, especially the measurement and mapping of land elevation. Hypsometry: The measurement of elevation relative to sea level.

Mouth
A mouth is the downstream terminus of a waterbody as it intercepts another waterbody (i.e., confluence, estuary, delta, etc.)

Oxbow
1: the land inside an oxbow bend in a river 2: a U-shaped curve in a stream

Planimetric Features
Geographic features whose two-dimensional representations have significance (unlike points and surfaces). These include all man-made features such as roads, buildings, fences, etc., as well as natural features such as streams, lakes, swamps, etc.

Primary Flow
The main channel (majority of flow) of a natural river, stream or creek.

Riparian
Of, on, or relating to the banks of a natural course of water.

Secondary Flow
Any channel that is not the main channel of a natural river, stream or creek.

Sequence Number
A sequential numeric code that uniquely identifies a lake within a watershed.

Spatial Query
Queries to a database or GIS in which the returned data are constrained by some spatial description (e.g., return all points within 100 meters from the well site at location (49:32:12.231N, 123:42:45.693W)).

Stream
The water course formed when water flows between continuous definable channel boundaries, with definable beds and banks, and with perennial or intermittent flow; such flow must be in a definite direction; includes rivers, creeks, streams, brooks, and springs.

Stream Magnitude
Stream magnitude describes the relative geometry of stream segments by quantifying the number of tributaries flowing into a given stream segment. If three tributaries flow into a stream then it is assigned a magnitude of 3.

Stream Order

Stream ordering is a process of identifying and grouping stream segments and their corresponding watersheds in terms of size and complexity. Theoretically, watersheds of similar order display similar hydraulic properties and ecological function. There are four commonly described approaches to stream ordering. In the Freshwater Atlas, the approach used was that originally described by Horton (1945) and revised by Strahler (1952). In this ordering scheme, the smallest stream segments near the drainage divide are assigned the lowest order (i.e., first-order stream) and the stream segment at the watershed outlet is assigned the highest order. Each sub-basin identified is assigned the same order as the largest stream segment within it. The ordering system can be described by the following series of steps: a) The smallest recognizable channels are designated order 1; these channels normally flow only during periods of wet weather. b) Where two channels of order 1 join, a channel of order 2 results downstream; in general, where two channels of order x join, a channel of order x + 1 results. c) Where a channel of lower order joins a channel of higher order, the channel downstream retains the higher of the two orders. d)The order of the drainage basin is designated as the order of the stream draining its outlet, the highest stream order in the basin.

Topology

The "connectedness & adjacency" between features. In CWB context: - Connectedness could represent how tributaries drain into the main channel of a river. - Adjacency could show how a series of wetlands surround a neigbouring lake.

TRIM

Terrain Resource Information Management. The digital base map of British Columbia. Nominal scale, 1:20,000. Dataset includes a non-gridded DEM.

TWA

TRIM Watershed Atlas. A database comprising the HoL Database and the Stream Network Database.

Waterbody

A natural or man-made container or portion thereof which permanently or semi-permanently holds standing or running water. A waterbody is determined by the evidence of permanent/semi-permanent presence of water. For the purpose of the Watershed/Waterbody Identifier System (including this document) the word “waterbody” includes lakes, ponds, swamps, marshes, bogs, reservoirs, canals, and stream segments which appear as double lines on 1:50 000 maps.

Waterbody Identifier

An alpha-numeric identifier that uniquely identifies a waterbody within the Province of British Columbia.

Watershed

Watersheds, which provide linked gradients of terrestrial, riparian, and aquatic systems, were established as the critical, ecosystem delineation/mapping unit. A watershed (also known as a hydrologic unit, catchment, or drainage basin) is defined as that area of land draining into a particular stream or other surface water body. For any location in a stream, there is an associated area that contributes water to its flow. The watershed divide is that line which divides the area contributing water to the stream and that which contributes water to neighboring streams or water bodies. Therefore, each watershed is defined by its outlet or pour point (the point

in the stream which receives all water in the watershed) and the associated watershed divide derived from that point and the local topography.

Watershed Atlas
The topologically structured digital map used by various organizations to geo-reference aquatic-related data. The Atlas consists of all aquatic-related linework (lakes, streams, wetlands) and text. In addition, watershed boundaries have been delineated for third order and greater stream systems.

Watershed Code
A 45-digit numeric code that uniquely identifies (province-wide) the lowest order watershed associated with the stream at its mouth.

Watershed Group
A watershed group provides a means of subdividing the Provincial coverage of the Watershed Atlas into manageable "chunks." The Watershed Groups are based upon natural watershed boundaries that cover drainage areas comparable to most aquatic management and planning activities. In order to make the Watershed Atlas dataset manageable, it is divided into smaller groupings called Watershed Groups.