PART THREE

TABULAR DATA

CHAPTER 5

DRAINAGE SYSTEM

The New Brunswick Department of Natural Resources and Energy first developed a provincial drainage system in the late 1960's. It was a two level system, which divided the province into eleven drainage basins/composites. The second level represented the major watercourses within each drainage area. As such, there were 232 second level sub-drainage areas. The drainage unit boundaries were defined on a 1:500,000 scale provincial map.

The original drainage system has been revised to a six level hierarchal system. The size and complexity of a river system determines the number of levels required. Only a few of the more complex river systems require six levels - most have two or three. As there are no concise terms which can be used to name the levels, they are referred to as Level 1 through Level 6 drainage units, rather than drainage, subdrainage, sub-subdrainage, etc.

As in the original system, the first level represents the major drainage areas within the province. Six basins are defined by large river systems - Saint John, Miramichi, Restigouche, St. Croix, Nepisiguit and Petitcodiac. The remaining drainage areas are composites or collections of smaller streams.

The adjacent table lists the first level drainage basins and their associated drainage areas within New Brunswick. It does not include the drainage areas outside the province where river systems cross the provincial boundary, such as the Saint John, Restigouche and St. Croix basins.

Second level drainage units represent major watercourses (5^{th} order or higher and > 100 km^2 drainage area) within the first level basins. These sub-basins can be subdivided into third level units if they contain streams which meet or exceed the minimum size criteria: a combination of 4^{th} order and 100 km^2 drainage area. Similarly, third level drainage units are further subdivided into fourth level units if they contain streams meeting or exceeding the minimum size criteria. In a few cases where streams exhibit extreme dichotomy, sixth level drainage units are created. Stream order is based on the Strahler's (1952) modified Horton method. Please refer to Chapter 6 **Water Resource Inventory** for a discussion of the stream ordering methodology.

1^{st} LEVEL DRAINAGE BASINS

DRAINAGE BASIN / COMPOSITE	DRAINAGE AREA in N.B. (km^2)
01 Saint John River Basin	28,860.15
02 Miramichi River Basin	13,546.65
03 Restigouche River Basin	6,603.91
04 St. Croix River Basin	1,653.34
05 Nepisiguit River Basin	3,091.97
06 Petitcodiac River Basin	2,831.93
07 Northumberland Strait Comp.	4,707.44
08 West Fundy Composite	3,727.74
09 Acadian Peninsula Comp.	3,188.45
10 Chaleur Bay Composite	2,195.59
11 East Fundy Composite	1,515.16
12 Fundy Isles Composite	237.32
13 Inner Bay of Fundy Comp.	494.39
PROVINCIAL TOTAL	**72,656.04**

Cains River within the Miramichi basin illustrates five levels within the drainage system hierarchy. Please note not all the drainage units for Cains or the Miramichi basin are presented below. A complete drainage system listing is provided in Appendix A.

Level 1 02 MIRAMICHI
Level 2 01 Inner Miramichi Bay Composite
02 Bartibog River
03 Black Brook Composite
04 Southwest Miramichi River
....
Level 3 08 Cains River
Level 4 01 Salmon Bk Composite
02 Sabbies River
Level 5 01 "N of E Br Sabbies" Composite
02 E Br Sabbies
03 W Br Sabbies
03 Finn Brook Composite
.....

A GIS layer containing the boundaries of the 446 drainage units was created using Service New Brunswick's (SNB) digital elevation data.

DATA SOURCES

The New Brunswick Department of Natural Resources & Energy provided the original version of the provincial drainage system listing and a 1:500,000 scale map illustrating the boundaries. The new five level drainage system is based on SNB's hydrographic data.

METHODOLOGY

Regardless of the level within the drainage system, the first step is the delineation of the primary streams which meet the criteria for the given level. Second level drainage units are streams which are 5th order or higher with a drainage area greater than 100 km^2. Third to sixth level units represent streams meeting or exceeding the minimum size criteria: 4th order with a drainage area greater than 100 km^2.

Once the primary streams for a given level are delineated, the remaining undelineated areas represent composites or collections of smaller streams. As such, composites vary in size, meeting no predetermined standard. They are always denoted by the word "composite" in the drainage unit name, e.g. Northumberland Strait Composite. When a composite is a unit within a primary river drainage unit, the composite encompasses both sides of the stream which is being divided into drainage units (Figure 5). There are three exceptions to this rule:

< First level drainage basin composites that flow into the ocean;

< Collections of streams between the major tributaries flowing into Grand Lake and other large lakes have been combined into single composites;

< Similarly, composites at the mouth of large streams like the Miramichi River have been combined in single composites.

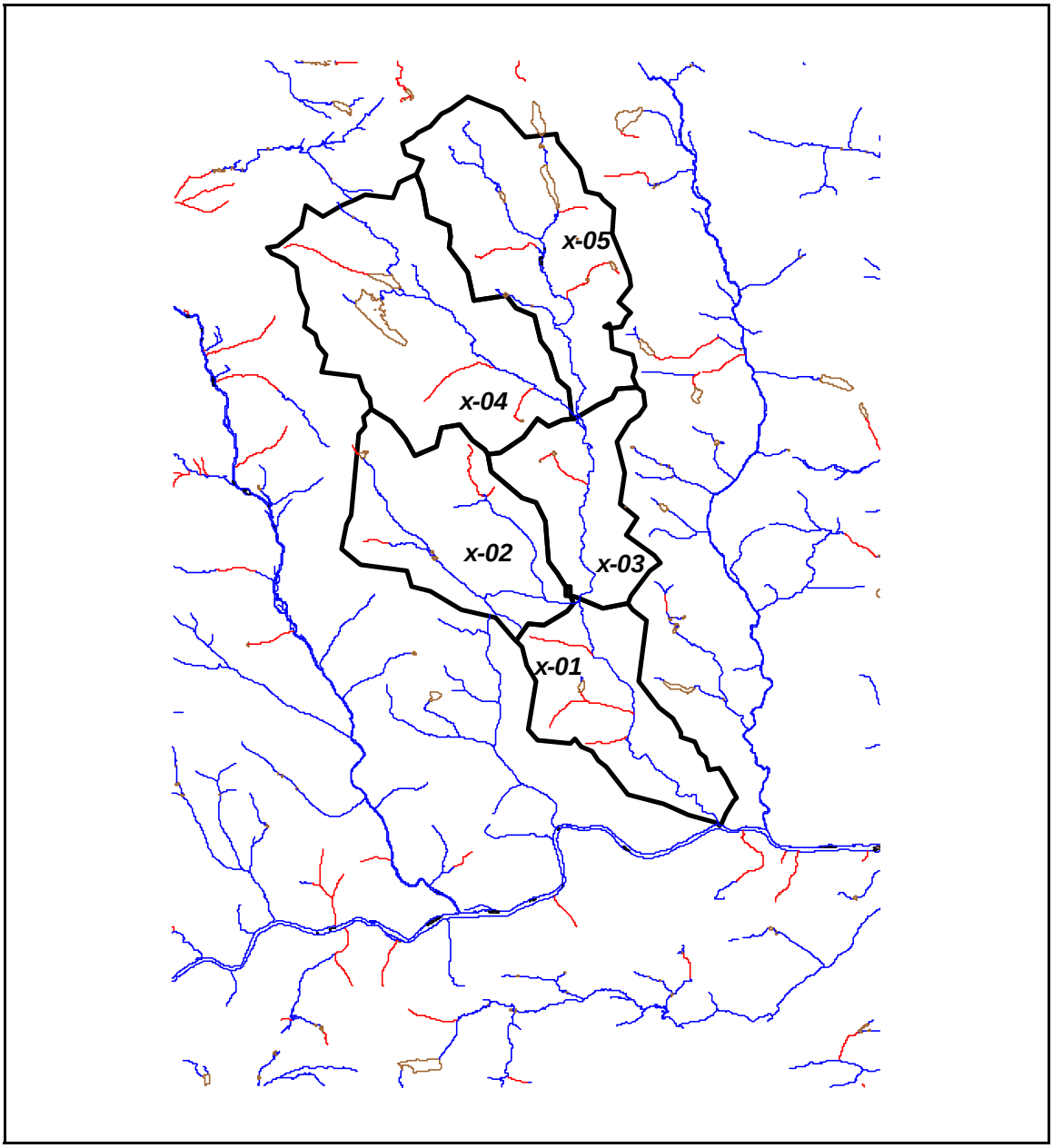
It should be noted that some drainage basins are incomplete as they contain streams which originate in Maine, Quebec or Nova Scotia. Partial basins include the Restigouche, Saint John, and St. Croix. Reversely, New Brunswick contains small drainage areas along its borders which drain into adjacent states or provinces, representing approximately 14.5 km^2.

Numeric codes are assigned to each drainage unit at every level. First level drainage units have the original codes (01 through 13) as assigned by the New Brunswick Department of Natural Resources and Energy. Each subsequent drainage level begins numbering at 01 again.

Drainage units always alternate between a primary stream and a composite. Second to sixth level composites encompass small streams on both sides of the stream. In some cases, composites can be very small; in fact some may not have any streams, but still represent actual drainage area.

The method of ordering or sequencing the drainage units (i.e. the order they appear on a list) within a particular level varies between composites and non-composite drainage units. Drainage units within a

Figure 5. Drainage unit delineation and numbering scheme. *X* represents preceding drainage codes.



composite are numbered in a clockwise direction while drainage units within a large stream are ordered beginning at the mouth of the stream and moving upwards (Figure 5).

The general rule for drawing drainage boundaries for single stream drainage units (not composites) is as follows: the boundary line begins at the mouth of the stream, circles its tributaries and headwaters and returns to the mouth of the stream on the other side of the channel. A "head of land" rule was adopted for determining the mouth of a stream channel. This is fairly obvious for inland waters, but in coastal streams, the head of land is not always clear. Therefore, the following rules were used:

- In estuarial locations where a primary river extends in a straight and relatively narrow channel, the head of land is at the furthermost points of land. Examples include the Miramichi and St.Croix Rivers (Figure 6).

- In estuarial locations where a wide bay or pocket has been formed and several streams of equal order and size enter into the area, each stream has a head of land within the bay area. In this case the streams flow into the bay rather than into a primary stream. An example is Lepreau and Little Lepreau Rivers within Maces Bay (Figure 6).

Since this process is somewhat subjective, several coastal watersheds are represented by multiple polygons within the GIS layer. Seaward drainage areas are coded as "Harbour" so users can choose whether to include these areas in their study.

Please refer to the **DTM Watershed Final Report** for details on the methods used to generate the watershed boundaries using Service New Brunswick's digital elevation data.

POSITIONAL ACCURACY

The positional accuracy of Service New Brunswick's digital elevation data is ±2.5 m vertical accuracy in areas of good ground visibility. Please refer to SNB's **User's Guide to the Digital Topographic Data Base (DTDB98) of New Brunswick** for further details.

DATA FILES

Tabular Data
There is a single table listing the drainage units within the drainage system.

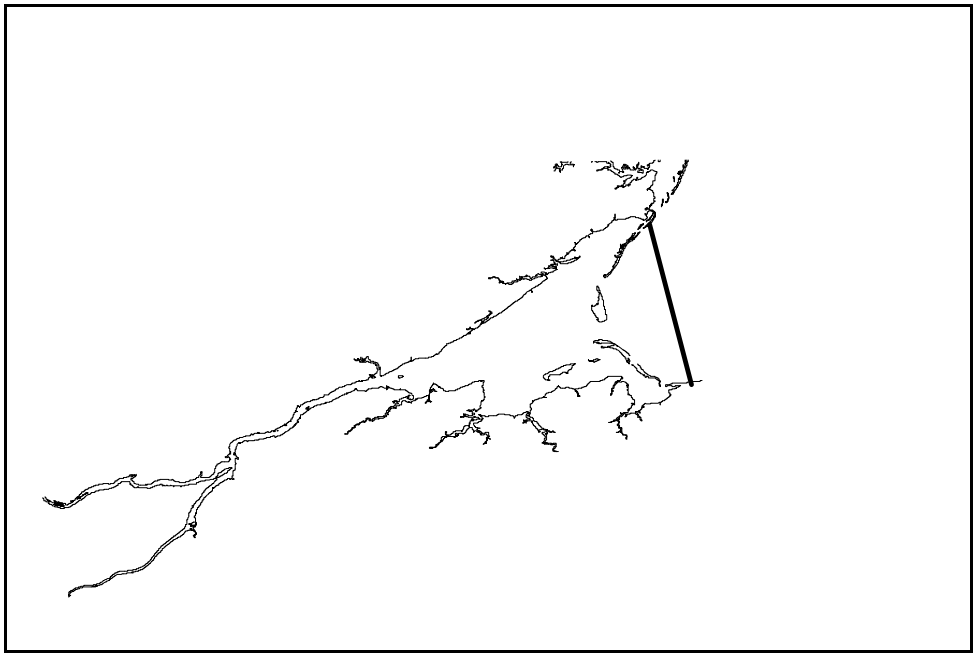
- **Drainage Units** - List of drainage units within each drainage basin.

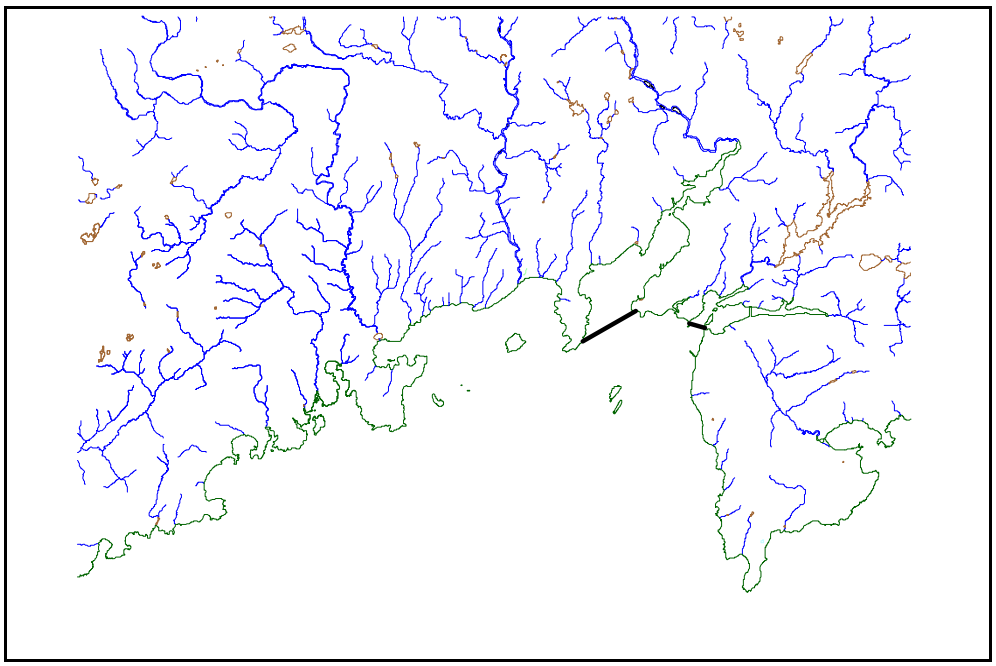
Spatial Data
The drainage unit layer exists in both ArcInfo and ArcView format. A second layer was generated from the drainage units to represent the first level basins.

References:

Strahler, , A. N. 1952. Hypsometric (area-altitude) analysis of erosional topography. Bull. Geol. Soc. Am. 63: 1117-1142.

Figure 6. Illustrations of the two types of coastal stream confluences and how head of land is determined.





TABULAR DATA FILES

DRAINAGE UNITS

The ***Drainage Units*** table (dr-units.dbf) maintains the list of six level drainage units within each drainage basin.

Element Name	Description	Dbase Field Name	Field Type (Length . Decimals)	Comments
Level 1 Drainage Unit No.	Numeric code representing the 1st level drainage basin	Levl1_No	Character (2)	
Level 1 Drainage Unit Name	Name of the 1st level drainage basin	Levl1_Name	Character (40)	
Level 2 Drainage Unit No.	Numeric code representing the 2nd level drainage unit	Levl2_No	Character (2)	
Level 2 Drainage Unit Name	Name of the 2nd level drainage basin	Levl2_Name	Character (50)	
Level 3 Drainage Unit No.	Numeric code representing the 3rd level drainage unit	Levl3_No	Character (2)	
Level 3 Drainage Unit Name	Name of the 3rd level drainage basin	Levl3_Name	Character (50)	
Level 4 Drainage Unit No.	Numeric code representing the 4th level drainage unit	Levl4_No	Character (2)	
Level 4 Drainage Unit Name	Name of the 4th level drainage basin	Levl4_Name	Character (50)	
Level 5 Drainage Unit No.	Numeric code representing the 5th level drainage unit	Levl5_No	Character (2)	
Level 5 Drainage Unit Name	Name of the 5th level drainage basin	Levl5_Name	Character (50)	
Level 6 Drainage Unit No.	Numeric code representing the 6th level drainage unit	Levl6_No	Character (2)	
Level 6 Drainage Unit Name	Name of the 6th level drainage basin	Levl6_Name	Character (50)	
Drainage Codes	Concatenation of the drainage system codes	Drainge_Cd	Character (17)	
Drainage Unit Type	Type of drainage unit - stream, headwaters or composite	Unit_Type	Character (4)	
Border Indicator	Indicates whether the drainage unit is incomplete as drainage area extends into Maine, Québec or Nova Scotia	Border_Ind	Character (1)	Y = Yes Blank = No
Stream Order	The order of the stream if a drainage unit represents a stream	Strm_Order	Numeric (4)	
Drainage Unit Name	Name of the drainage unit	Unit_Name	Character (55)	
Drainage Area (ha)	Drainage area measured in hectares as defined by the drainage area polygon	Area_ha	Numeric (16.1)	

Element Name	Description	Dbase Field Name	Field Type (Length . Decimals)	Comments
Drainage Area Percent	Percent of province drainage unit's drainage area represents	Area_PC	Numeric (6.1)	

SPATIAL DATA FILES

1st LEVEL DRAINAGE BOUNDARIES

The ***1st Level Drainage Boundaries*** (basins) spatial file represents the boundaries of the 1st level drainage basins. It exists in both ArcInfo and ArcView (shape) formats. The ArcView format contains 1 record per basin, although basins may be made up of multiple polygons, in particular in the coastal areas.

Element Name	Description	Dbase Field Name	Field Type (Length . Decimals)	Comments
Polygon Area (m^2)	Area of the drainage unit polygon measured in m^2	Area	Numeric (18.4)	
Polygon Perimeter	Perimeter of the drainage unit polygon measured in meters	Perimeter	Numeric (18.4)	
1st Level Drainage Code	Code representing the 1st level drainage unit	Levl1_No	Character (2)	
1st Level Drainage Name	Name of the 1st level drainage unit	Levl1_Name	Character (40)	
1st Level Drainage Area	Area measured in km^2 of the drainage basin	Levl1_Area	Numeric (12.4)	
1st Level Drainage Area Percent	Percent of province drainage unit's drainage area represents	Levl1_PC	Numeric (6.2)	

DRAINAGE UNIT BOUNDARIES

The ***Drainage Unit Boundaries*** (watersheds) spatial file was created by processing SNB's digital elevation data. A single drainage unit may be include multiple polygons especially in coastal areas.

Element Name	Description	Dbase Field Name	Field Type (Length . Decimals)	Comments
Polygon Area	Area of the drainage unit polygon measured in m^2	Area	Numeric (18.5)	
Polygon Perimeter	Perimeter of the drainage unit polygon measured in meters	Perimeter	Numeric (18.5)	
Polygon Number	Internal identifier generated by ArcInfo	WShed_No	Numeric (11)	
Polygon ID	Internal identifier generated by ArcInfo	WShed_ID	Numeric (11)	
Drainage Code	Drainage code for the drainage unit	Drainge_Cd	Character (17)	
Harbour Indicator	Indicator for users who do not wish to include the estuarial component of the stream - this only occurs where the "head of land" was ambiguous	Harbour	Character (1)	Y = Yes Blank = No
Border Indicator	Indicates whether the drainage unit may be incomplete as drainage area extends into Maine, Québec or Nova Scotia	Border	Character (1)	Y = Yes Blank = No
Unit Name	Name of the drainage unit	Unit_Name	Character (70)	
Level 1 Code	Code representing the 1st level drainage unit	Levl1_No	Character (2)	
Agency	Organization who sponsored the development of the boundary. These agencies must be credited when the watershed layer is published	Agency	Character (4)	
Agency 2	Second organization who sponsored the development of the boundary. These agencies must be credited when the watershed layer is published	Agency2	Character (4)	