The Classification System in REGINE
Norway's catchment database

Introduction

Norway's national catchment database REGINE is established and maintained by Norwegian Water Resources and Energy Directorate (NVE). REGINE is based on the main map series N50 Kartdata compiled by Kartverket (the Norwegian Mapping Authorities).

REGINE divides Norway into major and subordinate reference units along the coastline, rivers and catchments. Watersheds and intersections in the water system determine the shape and size of the REGINE units, i.e. tributary river junctions, lakes, reservoirs etc. In this way the subdivision defines the structure in the hydrological system. The REGINE units are defined as polygons covering the whole country, every watercourse.

The subdivisions of the water system areas form a hierarchy, each level defined more detailed than the more superior. Subdivision of new, smaller units in REGINE does not influence the rest of the REGINE structure.

An alphanumeric number structure defines the water system number in REGINE. The letters Æ, Ø and Å are not used, as well as the letters I and O (avoiding digits 1 and 0 misinterpretation).

In REGINE the letter Z has a special function, used when defining a complete river basin. The Z-number occurs only in REGINE's A-level (see Table 1) and is "the owner"/ superior all other letters at the same main REGINE-level.

Digit 0 defines a hydrometric area (central catchment, coastal catchment, edge catchment) and is "the owner"/ superior all other letters at the same main REGINE-level.

The water system number in REGINE has a linked structure. The three first positions in any water system number, e.g. 250.C3, are reserved for the water system area ID. They contain only digits and are separated from the rest of the water system number by a period sign.

Table 1: Categories

Category		Water system number ends at:	Level
1	Water system area	.	0
2	River basin	Z	A
3	Sub unit in river basin	Character	B
4	Central catchment	0	A
5	Sub unit in central catchment	Digit	B
6	Edge area	0	A
7	Sub unit in edge area	Digit	B
8	Coastal area	0	A
9	Sub unit in coastal area	Digit	B

Criteria for REGINE's subdivision of catchments

When delineating catchments in the first REGINE version (1988) the following criteria were used for defining the units:

- all river branches longer than 10 km
- all lakes with area bigger than 1 km²
- catchments regulated/planned regulated for hydro power production purpose
- catchments that have be given a REGINE water system number in former registers at NVE

Further subdivision reflects current problems related to water resource regulations and rivers where anadromous fish are registered.

Within catchments that match one or more of the criteria above, the main river course is first determined. Generally this is an easy task; however in some cases it might not be straight forward. The main river course is defined as the river that either -

- has the same name from outlet to river source
- drains the biggest area
- drains from the highest elevation within the catchment

At the next step all tributary rivers were evaluated according to the criteria, and subdivided if adequate. In this manner the complete river course network was evaluated and subdivided. The criteria reflect a feasible and practical approach to the most relevant challenges at the time REGINE was established.

Categories/classes of catchments and hierarchy

The unit elements defined and subdivided in REGINE may be of different structure. Some drain to a coastal region, others to a lake or a river, while others drain to a defined outlet (river basin).

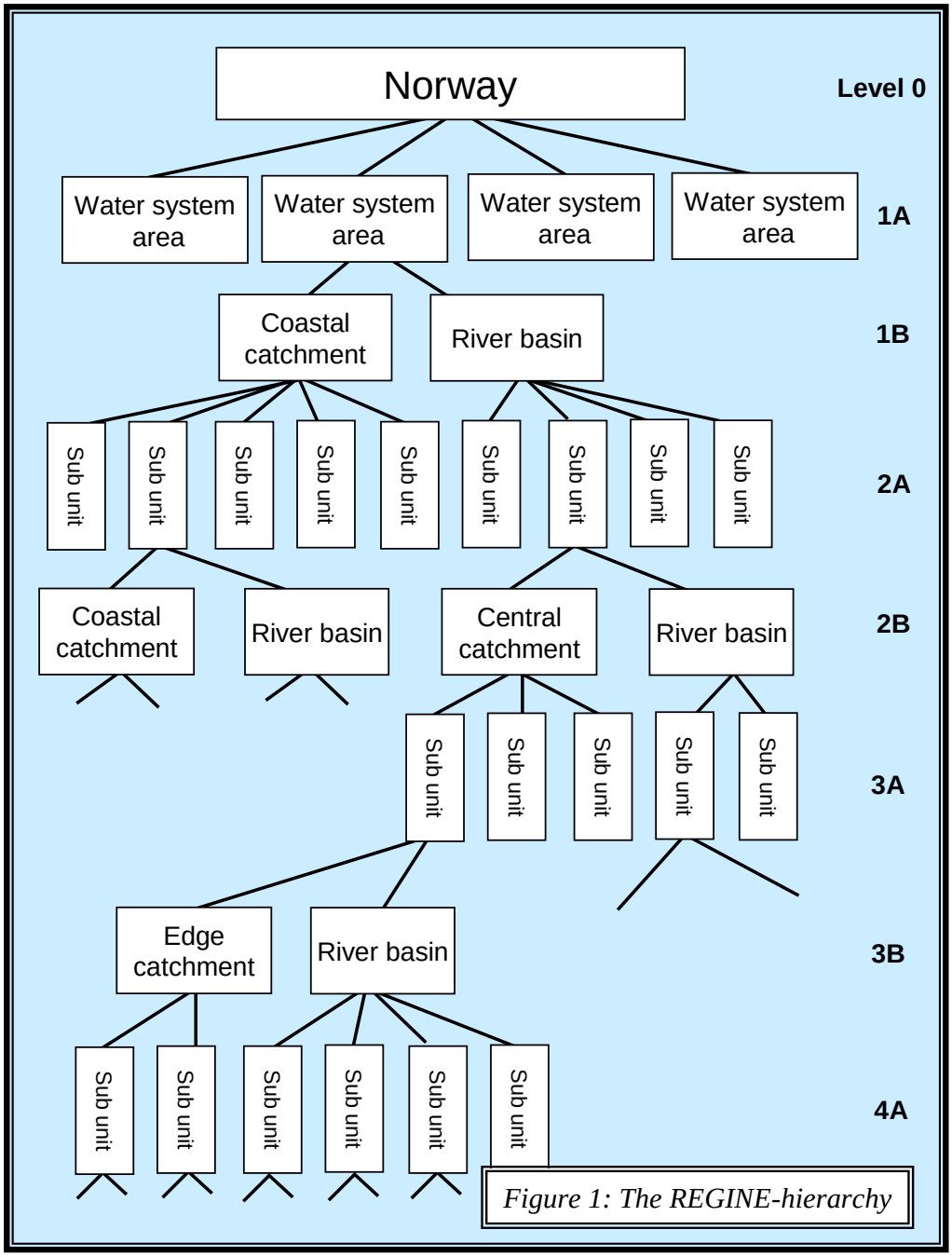

Figure 1: The REGINE-hierarchy

Due to the different unit categories the same type of information related to each unit may not be of relevance. To enable a REGINE-system that is logical/precise and open (i.e. new sub catchments may be established without changing existing units), a specific concept of categories is defined for the different REGINE units.

The different levels in REGINE are shown in figure 1. The digits state the main level, and then every main level is split in to sub levels if relevant. The characters after the period sign in the REGINE's water system number state the main level. The units at e.g. 2A and 2B are at the same main level (2) in the classification.

When understanding the logic in the upper part of the Figure 1, including level 2A, the most crucial part of REGINE is understood. However, this description will go deeper down in the REGINE hierarchy describing the subdivision system, the water system number and examples.

The levels indicate how far down in the REGINE structure a specific catchment is situated. The further down a sub unit is in the hierarchy the smaller and more "detailed" is the catchment/unit. Figure 1 shows how sub units at all A-levels may be divided in many sub catchments, while sub catchments at level B may be divided in 2 sub units.

REGINE-unit elements may be aggregated unit elements, i.e. may consist of a number of unit elements at a lower level in the subdivision. River basins, central catchments, edge catchments and costal catchments are all unit elements at the subdivision's A-level, while sub units are B-level unit elements.

Below, figures 2-5 show the relation between the different REGINE-unit categories for the imaginary water system area #250. The figures describes how bigger areas at a high level in the hierarchy are divided into sub units at lower levels.

Category 1: Water system area

A water system area is the land area that includes drainage area to all smaller and bigger water systems that drain to the sea within a coastal region. Often this comprises drainage area to a specific fjord. The watershed between two water system areas is drawn over headlands and other natural features along the coastline. Bigger islands – and archipelagos – are defined as unique water system areas.

Water systems which drain abroad over the national border are also merged into water system areas. The watersheds for such water system areas are defined by the water system structure in Sweden and Finland.

In REGINE total 262 water system areas are defined for Norway. 247 of these drain to the coast while 15 drain to the national border.

In 2007 NVE began to establish water system areas and sub catchments for the Arctic Archipelago Svalbard. Hydrometric reference numbers starting at 401 are used for this area.

Category 2: River basins

The river basin is the sum of the river system (the river course itself) and the adjacent drainage area. In REGINE two types of river basins are defined:

- River basins draining to the ocean or the national border
- Sub river basins (for tributary rivers)

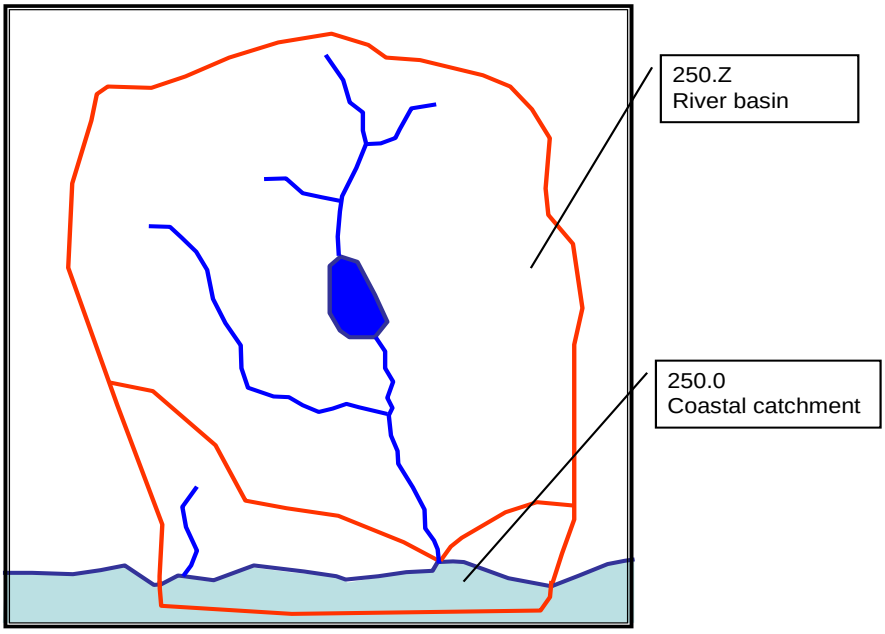

Figure 2: Water system area #250 divided into coastal catchment and river basin.

Category 3: Sub Units in River Basins

River basin may be subdivided into a number of sub units, see figure 3. Normally a sub unit in a river basin contains a central catchment along the main river plus a sub river basin. Some sub units contain central catchments only.

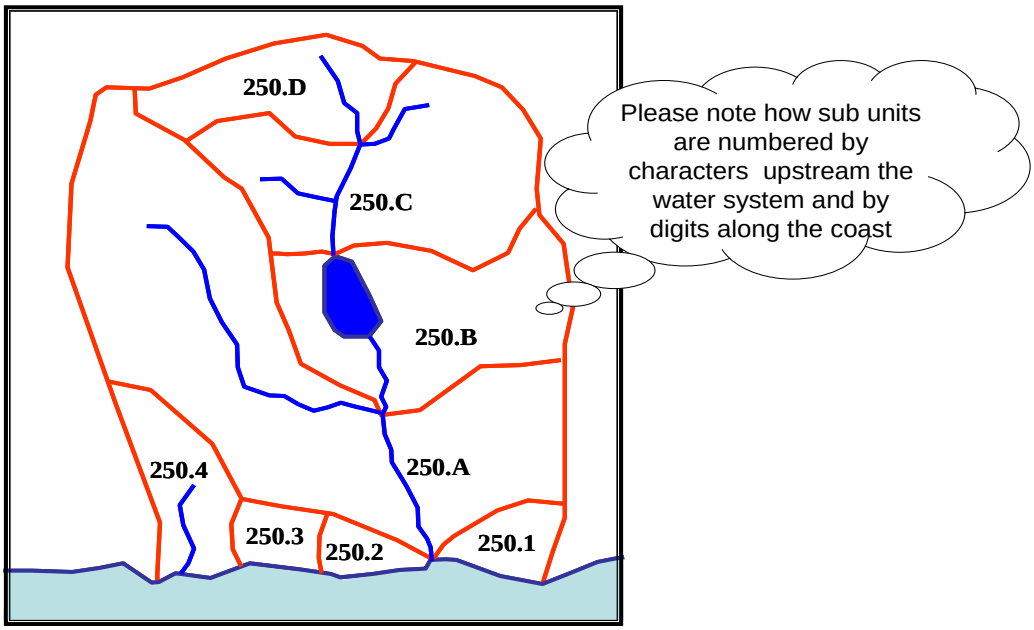

Figure 3: Sub units within water system area #250

The water system's river structure and natural drainage flow define the subdivision of river basins and thereby define how many sub units are needed for each river basin. The subdivision is based on the following principles:

- The divide between sub units is defined right above an important tributary river junction, and therefore includes this. If adequate longer river sections may be split in spite of no tributary river at the divide. At bigger lakes the divides are defined at the river outlet and/or inlet.
- Sub river basins may, as mentioned above, be subdivided exactly the same way as the main river basin.

Category 4: Central Catchments

The central catchment along a water course is defined as the part of the catchments' sub unit that drains directly to the main river below the sub river basin. The central catchment may also contain smaller sub river basins, see figure 4. These sub basins will then be at a lower lever in the hierarchy. Central catchments may be spilt in sub units.

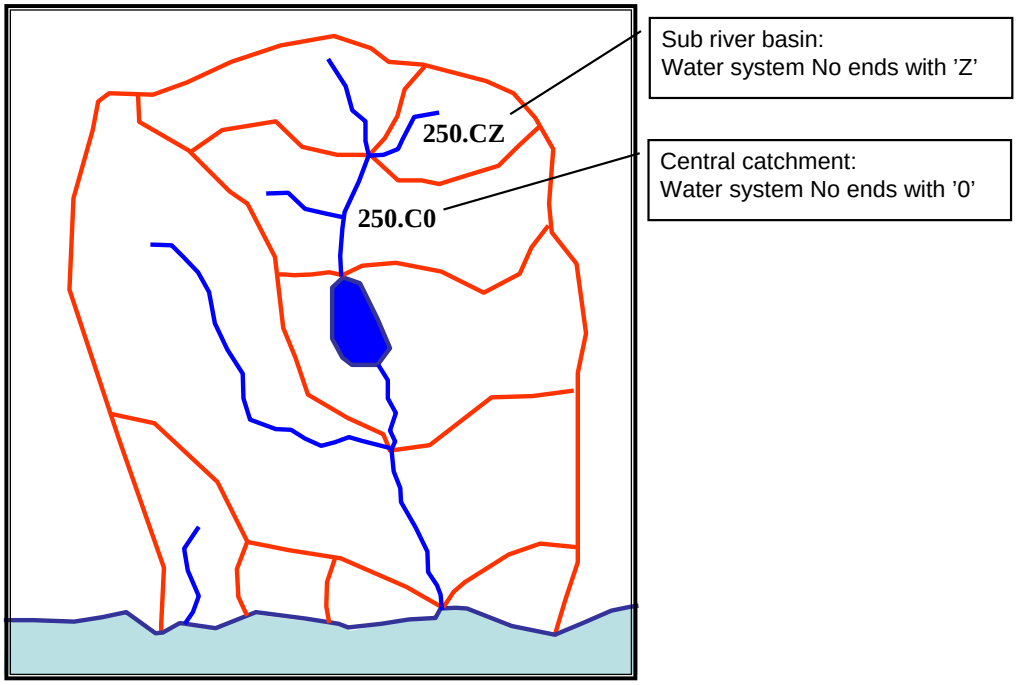

Figure 4: Central catchments and sub river basin

Category 5: Sub units in Central Catchments

The central catchment may be split in 9 sub units. As a rule the same number of sub units will be defined on each riverside, see figure 5. Sub units on the right and left riverside have the same start and stop point (nearly always, exception in lakes).

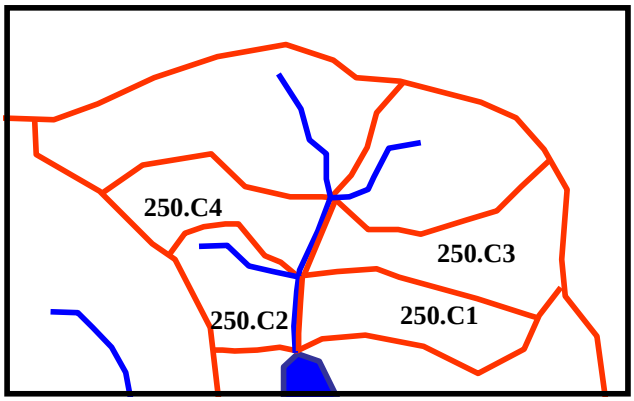

Figure 5: Sub units in central catchments

Category 6: Edge catchments

A sub unit in a central catchment will always be situated at one side of the river system. Within a sub unit one or many new sub river basins may be defined. The remaining part of the sub unit (area draining directly to the main river in the sub unit) is in REGINE defined as an edge catchment.

The edge catchment will always be found on one side of the main river in the central catchment, while the central catchment is always on both sides of the river. On the other hand an edge catchment is

often defines on both sides of the subdivided downstream sub river basin. The REGINE water system number to edge catchments always ends with digit 0, as for central catchments (e.g. 250.C20).

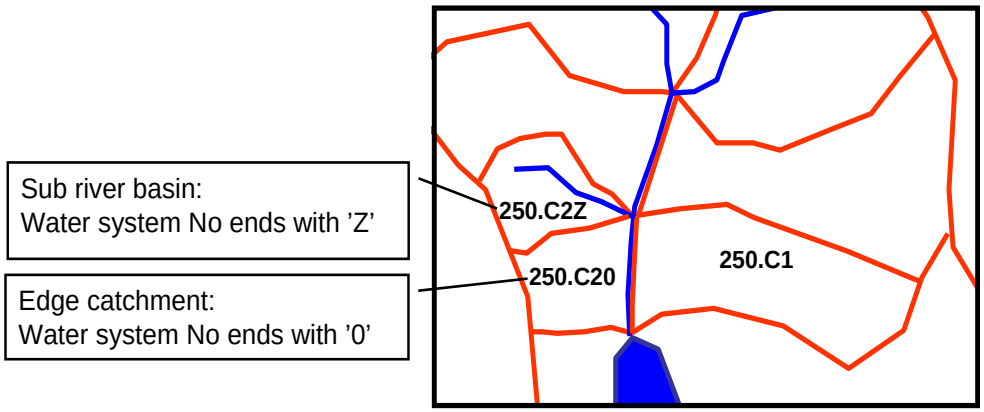

Figure 6: Edge catchment and sub river basin

Category 7: Sub units in edge catchments

The description of edge catchments shows how these may consist of several discontinuous units. Edge catchments may be split in 9 sub units. Sub units in edge catchments may also be further subdivided (occasionally they are) in new edge catchments and sub river basins. These catchments have the same structure as described above and may be subdivided in the same way.

Category 8: Coastal Catchments

The coastal catchment is identical to the water system area minus the main river basin and thereby comprises the areas that drain to a coastal region. See figure 2. A coastal catchment may consist of maximum 9 sub units (to the right and left of the main river basin). Coastal catchments draining

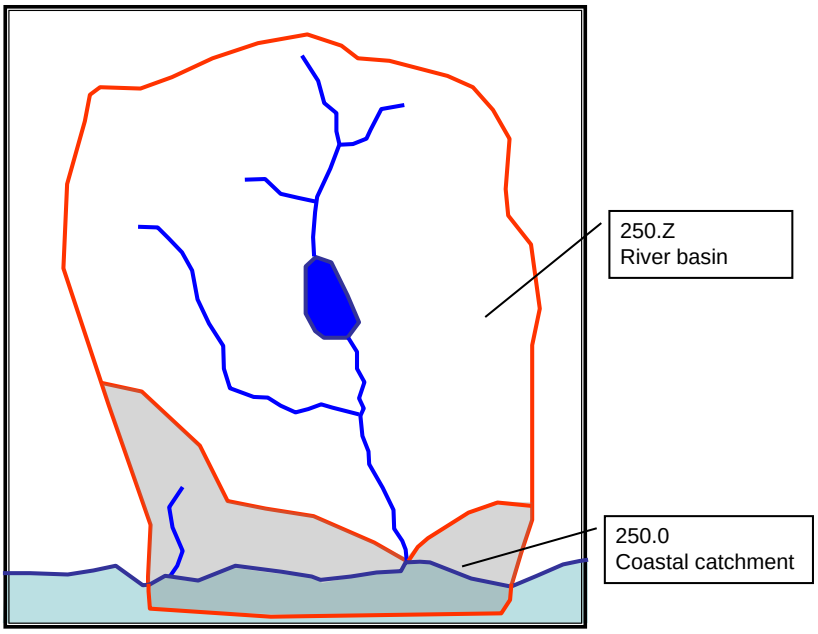

Figure 7: Coastal catchment

over the national border are named border catchments in REGINE. The coastal catchment may be regarded as an edge catchment along the coast and is situated either on one or both sides for the main river basin in a water system area. Structurally coastal catchments and edge catchments are equal.

Category 9: Sub units in Coast Catchments

Coastal catchments may – as for river basins, central catchments & edge catchments – be further divided into sub units.

The watershed between to water system areas is drawn over headlands and other natural dividing features. As a principal each sub unit has the same structure as a water system area and may therefore be subdivided the same way; into sub river basins and coastal catchments at a lower level.

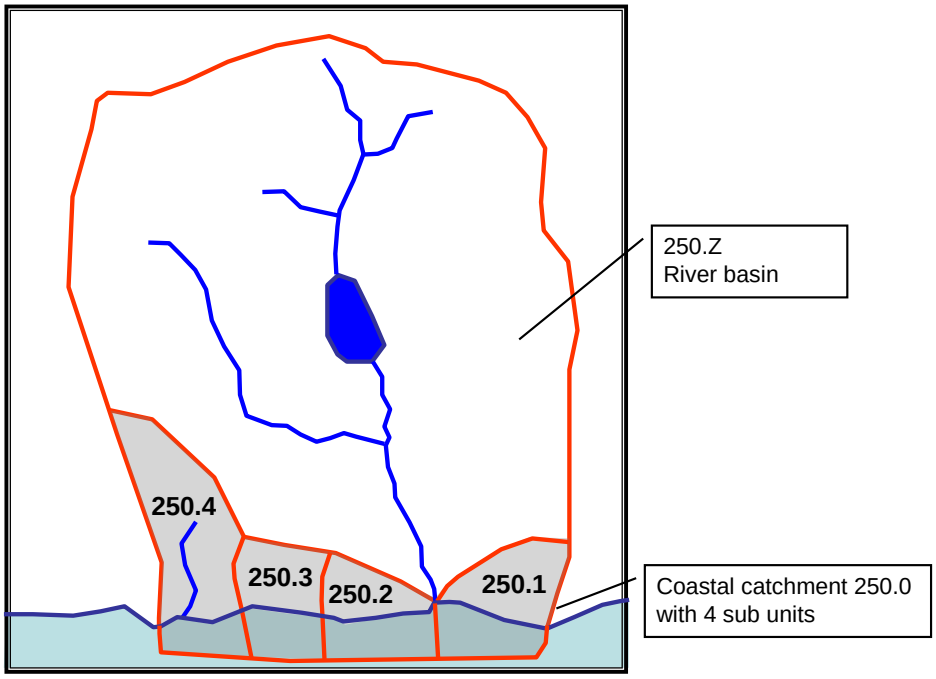

Figure 8: Sub units in coastal catchment #250.0

Comments to REGINE's subdivision

5) Islands in the sea

REGINE includes the whole area of Norway. Therefore, all archipelagos and islands – small and big – along Norway's broken coastline are defined within a water system area. This is done by prolonging the divide for water system areas – and sub units in coastal catchments – out into the sea. Bigger islands and archipelagos are defined as separate water system areas.

Islands are subdivided according to these criteria:

- The northernmost headland is chosen as starting point for a subdivision
- Islands are split in two by following the watershed from the chosen starting point headland to the furthermost headland on the opposite side.
- Further adequate subdivision of islands is based on the water system and fjord structure. When defining sub units of an island these are given rising numbers clockwise.

Within a water system area existing of an archipelago some islands may be separated as sub units in coastal catchment.

2) Catchments in Neighbouring Countries draining to Norway

Several catchments in Norway have their source in Sweden, Finland and Russia. These river basins are in their entirety included in REGINE and subdivided neglecting the border.

For three trans-border water systems – Tana, Pasvikelva and Grense Jakobselv – the rivers follow the national border for longer sections before running into the sea. Subdivisions of these river basins are also defined as if national borders were non-existing. River basins where the river cross the border several times (e.g. Neidenelva) are handled the same way.

3) Catchments in Norway draining to Neighbouring Countries

Some water systems in Norway drain to Sweden and Finland. For these REGINE contains only information about the Norwegian part of the river basins. This is done by treating the national border as a coastline. The divergence with this "coastline" is however that it is broken by river basins with outlet in Norway and inlet in Sweden or Finland. The result of this as a multitude of small and big catchments spread out along the national border. These small catchments are also gathered to water system areas. Such a water system area exists of all small catchments in Norway that drain to the same river basin outlet in Sweden or Finland.

Water system areas #301-315 all drain to separate Finnish or Swedish water systems.

Areas #311-314 drain to Swedish Göteelven/Göta älv. In comparison to the rest of the water system areas draining abroad the sum of catchment areas #311-314 is very big. Therefore a subdivision is done reflecting the run-off pattern towards the Swedish lake Vänern.

As a coastal catchment is defined along the coastline, a water system area along the national border consists of a border catchment. If the main river of such a drainage system has its source in Norway the accompanying catchment is characterized as a river basin.

The border catchment is divided into sub units by gathering catchments belonging to the same sub river basin into the same sub unit. Within the sub units in a border catchment bigger and smaller river basins may be defined and subdivided. The criteria for subdivisions are the same as for other river basins, but start from the national border as if this should be the sea.

Sub units in the border catchments may in some cases exist of only one subordinate river basin (and not subordinate border catchment). This occurs when the river basin downstream to the outlet of the Norwegian part of a river covers the whole sub unit.

4) Transfer of Water (Hydro Power Production)

REGINE – as described above – was originally based on the natural drainage pattern in a water system. When water is transferred through tunnels and pipes this pattern is broken. Transfer of water may occur within a water system – or between two/several water systems. At the inlet and outlet of water transfer tunnels/pipes divides are established in REGINE. By use of databases and GIS (geographical information system) NVE handle the connections between the water transfer inlets and adjacent catchments.

5) Lakes

A few Norwegian lakes drain to two river branches or water systems. In such lakes watershed delineation and subdivision are done using judgment as there is no precise rule in REGINE for how subdivision should be done. At this stage discharge data for the different river branches is integrated in the REGINE-definition.

Most of the smaller lakes with to outlets are in their entirety included to the river basin defined for the assumed biggest outlet. For some major lakes such delineation would be evidently unreasonable. Such lakes are divided in the middle – or at a natural narrow passage in the lake (Lesjaskogsvatnet is such a lake. Traditionally, and in REGINE, it is regarded as the source for both the rivers Gudbrandsdalslågen and Rauma).

For lakes regulated/modified to hydro power reservoir the catchment dividing line is defined to the new outlet. This solution is chosen since most reservoirs lack reliable topographic maps describing the state of the lake in its natural state.

Technical terms – English / Norwegian

English expression	**Norwegian**	**Comments**
Water system area	Vassdragsområde	Figure 2
River basin	Nedbørfelt	Figure 2

Central catchment	Sentralfelt	Figure 4
Edge catchment	Randfelt	Figure 6
Coastal catchment	Kystfelt	Figure 2
Border catchment	Riksfelt	
Sub river basin	Sidefelt	Figure 4
Sub unit	Delområde	Figure 5
Sub unit in catchment	Delområde i nedbørfelt	
Sub unit in central catchment	Delområde i sentralfelt	Figure 3
Sub unit in edge catchment	Delområde i randfelt	
Sub unit in costal catchment	Delområde i kystfelt	Figure 3
Water system number	Vassdragsnummer	

Responsible for the information: Geoinformation Section, NVE