Annex F
(informative)

Example of a data product specification

F.1 Overview

Information about the creation of the data product specification (DPS)

DPS title: National Road Network, Canada, Level 1 – an ISO 19131 example

DPS reference date: January 10, 2003

DPS responsible party: Natural Resources Canada
Centre for Topographic Information
2144, King Street West, Suite 010
Sherbrooke (Quebec) Canada J1J 2E8
Phone: +01-819-564-5600
1-800-661-2638 (Canada and USA)
Fax: +01-819-564-5698
E-mail: geobase@nrcan.gc.ca
URL: http://www.geobase.ca

DPS language: English, French

DPS topic category: 018 –Transportation/road network and vector data

DPS distribution format: PDF

Terms and definitions

Feature attribute
characteristic of a feature

NOTE For example, number of lanes or pavement status.

Class
description of a set of objects that share the same attributes, operations, methods, relationships, and semantics [UML Semantics]

NOTE A class does not always have an associated geometry (e.g. the metadata class).

Event
characteristic of a feature measured along a road object without modifying the associated geometry

Feature
abstraction of real world phenomena

Object
entity with a well-defined boundary and identity that encapsulates state and behaviour [UML Semantics]

NOTE An object is an instance of a class.

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Package
grouping of a set of classes, relationships, and even other packages with a view to organizing the model into more abstract structures

Linear referencing system
a means of identifying a location by reference to a segment of a linear geographic feature (such as a roadway) and a distance from some point along that segment

Abbreviations

CTIS: Centre for Topographic Information Sherbrooke

GDF: Geographic Data Files

ID: Identifier

NID: National Identifier

NRCan: Natural Resources Canada

NRNC1: National Road Network, Canada, Level 1

NTDB: National Topographic Data Base

UML: Unified Modelling Language

UUID: Universal Unique Identifiers

Name and acronyms of the data product

National Road Network, Canada, Level 1 – an ISO19131 example
NRNC1/ISO19131ex

Informal description of the data product

NRNC1/ISO19131ex focuses on providing a quality geometric description and a set of basic attributes of Canadian road phenomena. The first release of the *NRNC1/ISO19131ex* product will not include resource/recreation roads. *NRNC1/ISO19131ex* data will be revised on a regular basis. Geographic Data Files (GDF) V4 from ISO/TC 204 were used as a guideline for this model. The *NRNC1/ISO19131ex* product strives to comply, to the degree possible, with GDF vocabulary (class names, attribute names and definitions).

Unique Identifiers are associated with each geometric and event object. These IDs (called National Identifiers – NIDs) will lead to more efficient management of updates between data producers and data users.

The Centre for Topographic Information - Sherbrooke (CTIS), part of Natural Resources Canada (NRCan), produced the first version of the *NRNC1/ISO19131ex*. CTIS continues to pursue its goal of capturing and managing *NRNC1/ISO19131ex* data within a network of partners. These partner organizations are selected for their specific interests or for their ease in offering adequate, up-to-date representations of road phenomena. These data must be the product of a homogenous, standardized view of the entire Canadian landmass.

The data model can (and must) extend beyond the smallest common denominator obtained with the partners. The model must therefore contain two levels of information: mandatory data and optional data. Data homogeneity will thereby be ensured by a minimum set of data. Beyond the minimum level, the model serves as a target for all partners. Over the years, we will therefore work towards raising the minimum and redefining new targets. Minimum content has been defined for attributive and geometric data.

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The *NRNC1/ISO19131ex* data will serve as a foundation for several applications. This common geometric base will be maintained closest to the source and used by all who participate. This common infrastructure should facilitate data integration with supplementary data.

The available output file formats for the product are GML (Geography Markup Language) in ASCII and SHAPE (ESRI™).

F.2 Specification scope (DPS_ScopeInformation)

This clause defines only one general scope, which applies to each part of this data product specification.

Scope identification
(DPS_ScopeInformation.scopeIdentification) rootScope

Level
(DPS_ScopeInformation.level > MD_ScopeCode) 006 – series

Level name
(DPS_ScopeInformation.levelName) NRN general scope

Extent
(DPS_ScopeInformation.extent > EX_Extent.description) Canada's landmass

Level description
(DPS_ScopeInformation.levelDescription) root level in the scope level hierarchy

F.3 Data product identification (DPS_IdentificationInformation)

Title
(DPS_IdentificationInformation.title) National Road Network, Canada, Level 1 – an ISO19131 example

Alternate title
(DPS_IdentificationInformation.alternateTitle) NRNC1/ISO19131ex

Abstract
(DPS_IdentificationInformation.abstract) The National Road Network, Canada, Level 1 – an ISO 19131 example focuses on providing a quality geometric description and a set of basic attributes of Canadian road phenomena. The first release of the *NRNC1/ISO19131ex* product will not include resource/recreation roads. *NRNC1/ISO19131ex* data will be revised on a regular basis. Geographic Data Files (GDF) V4 from ISO/TC 204 were used as a guideline for this model. The *NRNC1/ISO19131ex* product strives to comply, to the degree possible, with GDF vocabulary (class names, attribute names and definitions).

Purpose
(DPS_IdentificationInformation.purpose) The *NRNC1/ISO19131ex* data will serve as a foundation for several applications. This common geometric base will be maintained closest to the source and used by all who participate. This common infrastructure should facilitate data integration with supplementary data.

Topic category
(DPS_IdentificationInformation.topicCategory > MD_TopicCategoryCode) 018 – transportation/road network and vector data

Spatial resolution
(DPS_IdentificationInformation.spatialResolution > MD_Resolution.equivalentScale > MD_RepresentativeFraction.denominator) 10 000

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Geographic description
(DPS_IdentificationInformation.geographicDescription > EX_GeographicDescription.geographicIdentifier > MD_Identifier.authority > CI_Citation.title) ISO 3166-1:1997 Codes for the representation of names of countries and their subdivisions – Part 1: Country codes
(DPS_IdentificationInformation.geographicDescription > EX_GeographicDescription.geographicIdentifier > MD_Identifier.authority > CI_Citation.date > CI_Date.date > Date.year) 1997
(DPS_IdentificationInformation.geographicDescription > EX_GeographicDescription.geographicIdentifier > MD_Identifier.authority > CI_Citation.date > CI_Date.date > Date.month) 00
(DPS_IdentificationInformation.geographicDescription > EX_GeographicDescription.geographicIdentifier > MD_Identifier.authority > CI_Citation.date > CI_Date.date > Date.day) 00
(DPS_IdentificationInformation.geographicDescription > EX_GeographicDescription.geographicIdentifier > MD_Identifier.authority > CI_Citation.date > CI_Date.dateType > CI_DateTypeCode) publication
(DPS_IdentificationInformation.geographicDescription > EX_GeographicDescription.geographicIdentifier > MD_Identifier.code) CA – Canada
(DPS_IdentificationInformation.geographicDescription > EX_GeographicDescription.extentTypeCode) 1 – inclusion

Identification scope
(DPS_IdentificationInformation.identificationScope > DPS_ScopeInformation.scopeIdentification) rootScope

F.4 Data content and structure

NRNC1/ISO19131ex is a feature-based product. An application schema expressed in UML (Section D.1) details the *NRNC1/ISO19131ex*'s content and an associated feature catalogue (Section D.2) provides the semantics of the *NRNC1/ISO19131ex* model elements.

Feature-based data

(DPS_FeatureBasedDataInformation.narrativeDescription) Basically, the *NRNC1/ISO19131ex* is presented as a UML package. The root feature type is *road network featur*e, which is characterized by a network identifier, a dataset name and a standards version identifier. *Road network feature* is subtyped by *network linear element, junction* and *point event*, which have different spatial and descriptive characteristics. *Network linear elemen*t is a general description of linear road feature types that is subtyped by *road element* and *ferry connection*. *Event* is a feature type that describes special characteristics that occur on a *network linear element* without any geometric modifications of the *network segment* (such as segmentation). The two possible event types are *blocked passage* and *toll point*. *Junction* is a feature type that includes intersection between *network linear elements*.

Feature-based application schema

(DPS_FeatureBasedDataInformation.applicationSchema)

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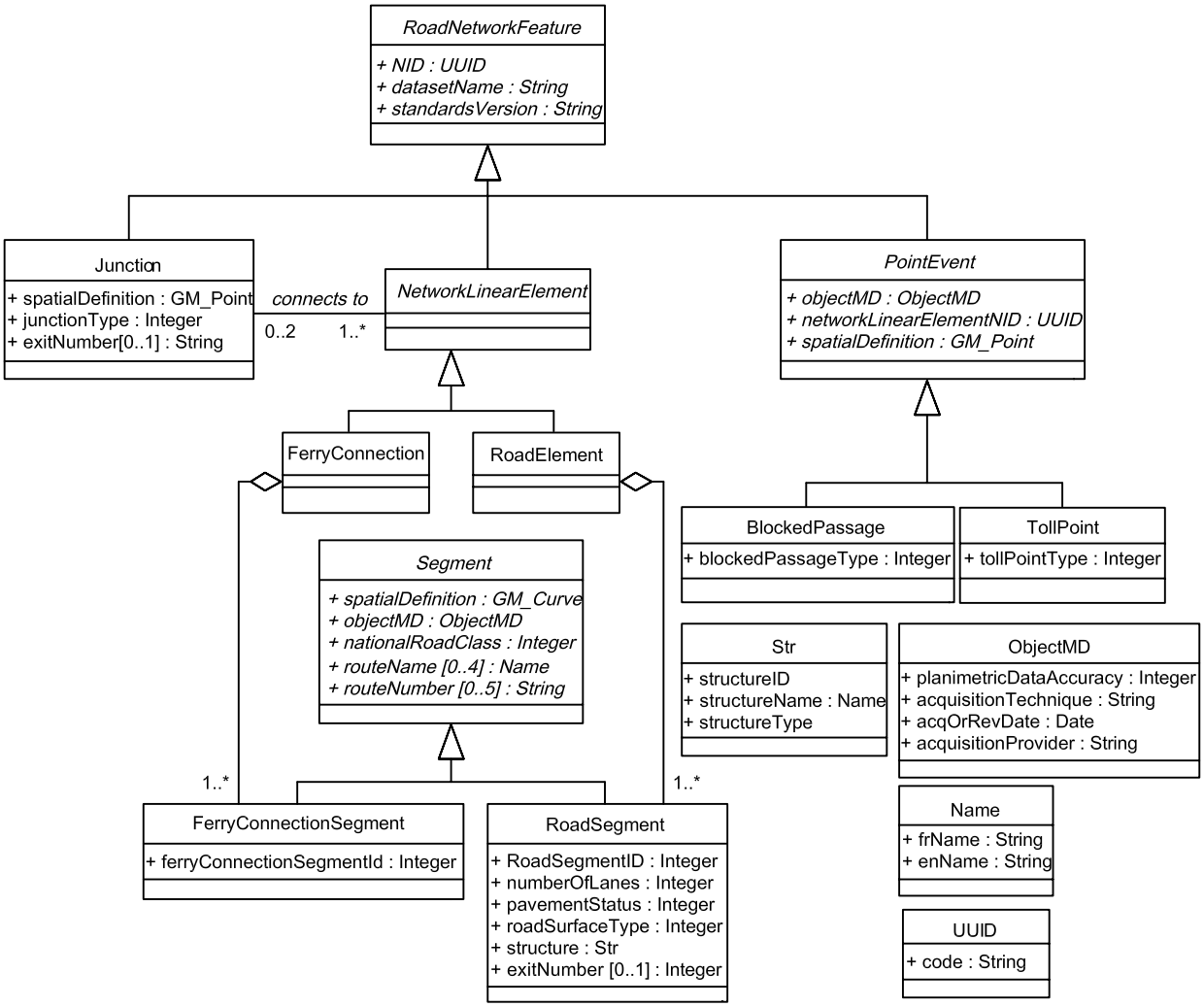

Figure F.1 — NRNC1/ISO19131ex UML Class Diagram

Feature-based feature Catalogue (sample)

This section provides the feature catalogue in support to the application schema. Spatial attributes are added to the feature catalogue in the same manner as other attributes for completeness and conformance to the application schema.

NOTE As an example, this section provides only a sample of the complete feature catalogue of the *NRNC1/ISO19131ex*.

(DPS_FeatureBasedDataInformation.featureCatalogue)

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Name:	**National Road Network, Canada, Level 1 – an ISO 19131 example (Conceptual segmented view)**
Scope:	Transportation
Field of application:	
Version Number:	1.0
Version Date:	May 2002
Definition Source:	
Definition Type:	
Producer:	Canadian Council on Geomatics – GeoBase Steering Committee
Functional Language:	

Feature Type

Name:	**Road Network Feature** (RoadNetworkFeature)
Definition:	The root feature type of the Road Network package.
Code:	
Aliases:	
Feature Operation Names:	
Feature Attribute Names:	National Road Network ID, Dataset Name, Standards version
Feature Association Names:	
Subtype Of:	

Feature Attribute

Name:	**National Road Network ID** (NID)
Definition:	The Universal Unique Identifier of the feature. NOTE In the case of Network Segment, all segments of the set of adjoining Network Segments between Network Junctions have the same NID.
Code:	
Value Data Type:	UUID
Value Measurement Unit:	
Value Domain Type:	0 (“not enumerated”)
Value Domain:	

Feature Attribute

Name:	**Dataset Name** (datasetName)
Definition:	Province or territory occupied by the dataset.
Code:	
Value Data Type:	Integer
Value Measurement Unit:	
Value Domain Type:	1 (“enumerated”)
Value Domain:	

Feature Attribute Value:

Label:	Code:	Definition:
Newfoundland and Labrador	1	
Nova Scotia	2	
Prince-Edward Island	3	
New-Brunswick	4	
Québec	5	
Ontario	6	
Manitoba	7	
Saskatchewan	8	
Alberta	9	
British Columbia	10	
Yukon Territories	11	
North West Territories	12	
Nunavut Territories	13	
Manitoba	7	

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Feature Attribute

Name: **Standards Version** (standardsVersion)

Definition: Version number of the NRNC1/ISO19131ex Product Specifications to which the dataset conforms.

Code:

Value Data Type: String

Value Measurement Unit:

Value Domain Type: 0 (“not enumerated”)

Value Domain:

Feature Type

Name: **Junction** (Junction)

Definition: A point feature that is always connected to one or more Road Segments or Ferry Connection Segments. A Junction is defined at the intersection of two or more road, at the intersection of a road and a ferry, at the end of a dead-end road and at the intersection of a road or ferry with a National, Provincial or Territorial Boundary.

NOTE Grade-separated road crossings do not share a Junction. If a Junction is present at the location of the grade separation, it is either connected to the lower set of Road Segments or to the higher, but never to both.

Code:

Aliases:

Feature Operation Names:

Feature Attribute Names: Spatial Definition, Junction Type, Exit Number

Feature Association Names: Network Junction is connected to

Names:

Subtype Of: Road Network Feature

Feature Attribute

Name: **Spatial Definition** (spatialDefinition)

NOTE Spatial Definition is included for completeness and conformance to the application schema.

Definition: Spatial representation of a Junction.

Code:

Value Data Type: GM_Point

Value Measurement Unit:

Value Domain Type: 0 (“not enumerated”)

Value Domain:

Feature Attribute

Name: **Junction Type** (junctionType)

Definition: A type assignation based on the number of Road or Ferry Connection Segment Elements joining at a Junction.

Code:

Value Data Type: Integer

Value Measurement Unit:

Value Domain Type: 1 (“enumerated”)

Value Domain:

Feature Attribute Value:

Label:	Code:	Definition:
Intersection	1	An intersection between three or more Road Segments meeting at same grade level.
Dead End	2	A specific Junction that indicates that a Road Segment ends and is not connected to any other Road Segment or Ferry Connection Segment.
Ferry	3	A specific Junction that indicates that a Road Segment further continues as a Ferry Connection Segment.
NatProvTer	4	A specific Junction at the limit of a dataset indicating that a Road Segment or Ferry Connection Segment further continues in the following dataset.

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Feature Attribute

Name:	**Exit Number** (exitNumber)
Definition:	The ID number of an exit on and off a controlled access thoroughfare, which has been assigned by an administrating body.
Code:	
Value Data Type:	String
Value Measurement Unit:	
Value Domain Type:	0 (“not enumerated”)
Value Domain:	

Feature Association

Name:	Junction connects to
Inverse Relationship:	Network Linear Element connects to
Definition:	
Code:	
Feature Types Included:	Network Linear Element
Order Indicator:	0 (“not ordered”)
Cardinality:	1 : ?
Constraints:	
Role Name:	

Feature Type

Name:	**Road Element** (RoadElement)
Definition:	A road is a linear section of the Earth designed for, or the result of, vehicular movement. A Road Element is the representation of a road between Junctions. A Road Element is always bounded by two Junctions and composed of one or more Road Segment. NOTE Where there are grade-separated road crossings, the bisecting Road Segments do not share a Junction. Grade-separated crossings between Road Segments involve road Structure objects, either Bridges or Tunnels. If a Junction is present at the location of the grade separation, it is either connected to the lower set of Road Segments or to the higher but never to both. Proposed roads are not represented within the NRNC1/ISO19131ex.
Code:	
Aliases:	
Feature Operation Names:	
Feature Attribute Names:	
Feature Association Names:	Composed of Road Segments
Subtype Of:	Network Linear Element

Feature-based content scope

(DPS_FeatureBasedDataInformation.contentScope > DPS_ScopeInformation.scopeIdentification) rootScope

F.5 Reference systems (DPS_ReferenceSystemInformation)

Spatial reference system
(DPS_ReferenceSystemInformation.spatialReferenceSystem > MD_ReferenceSystem.referenceSystemIdentifier > RS_Identifier.code) Canadian Spatial Reference System – CSRS

Temporal reference system
(DPS_ReferenceSystemInformation.temporalReferenceSystem > TM_ReferenceSystem.name) Gregorian calendar

Reference system scope
(DPS_ReferenceSystemInformation.rsScope > DPS_ScopeInformation.scopeIdentification) rootScope

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F.6 Data quality (DPS_DataQualityInformation)

Data quality
(DPS_DataQualityInformation.dataQuality > DQ_DataQuality.scope > DQ_Scope.level > MD_ScopeCode) 006 – series
(DPS_DataQualityInformation.dataQuality > DQ_DataQuality.scope > DQ_Scope.extent > EX_Extent.description) Canada's landmass
(DPS_DataQualityInformation.dataQuality > DQ_DataQuality.report > DQ_Completeness)

NOTE DQ_Completeness is not applicable

(DPS_DataQualityInformation.dataQuality > DQ_DataQuality.report > DQ_TopologicalConsistency.nameOfMeasure) percentage of topological consistency
(DPS_DataQualityInformation.dataQuality > DQ_DataQuality.report > DQ_TopologicalConsistency.result > DQ_QuantitativeResult.valueUnit > UnitOfMeasure.uomName) percentage
(DPS_DataQualityInformation.dataQuality > DQ_DataQuality.report > DQ_AbsoluteExternalPositionalAccuracy.nameOfMeasure) standard circular error

NOTE The accuracy of geometric representation is given by the difference between the position of the geometric representation of an object and its absolute position, as measured with respect to the geodetic network. NRN linear features shall be within a circular map accuracy standard (CMAS)[1)] of 10 meters.

(DPS_DataQualityInformation.dataQuality > DQ_DataQuality.report > DQ_AbsoluteExternalPositionalAccuracy.result > DQ_QuantitativeResult.valueUnit > UnitOfMeasure.uomName) decametre
(DPS_DataQualityInformation.dataQuality > DQ_DataQuality.report > DQ_TemporalAccuracy)

NOTE DQ_TemporalAccuracy is not applicable.

(DPS_DataQualityInformation.dataQuality > DQ_DataQuality.report > DQ_ThematicAccuracy)

NOTE DQ_ThematicAccuracy is not applicable.

Quality scope
(DPS_DataQualityInformation.qualityScope > DPS_ScopeInformation.scopeIdentification) rootScope

F.7 Data capture (DPS_DataCaptureInformation)

(DPS_DataCaptureInformation.dataCaptureStatement)

Rules for linear feature geometry
In order to make the determination of the characteristics to the left and to the right of the road feature possible, directionality of geometric representation of linear feature is standardized. Open curve and closed curve conventions are used to depict the geometry of road features.

Open curve
Open curves are depicted according to the "Lower Left Rule" (see Figure F.2). According to this rule, the direction of an open curve is determined from the coordinate sequence, that is to compare the first and the last coordinate to determine the lowest coordinates and, if equal, the leftmost coordinate. Open curve vertices are organized to comply with this convention.

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1) Standard circular error: $\sigma_c = 0{,}7071\ (\sigma_x^2 + \sigma_y^2)^{1/2}$
σ_x: standard deviation in the X-axis
σ_y: standard deviation in the Y-axis

Circular map accuracy standard: CMAS = 2,1460 σ_c

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NOTE Computations are carried out in latitude and longitude coordinates.

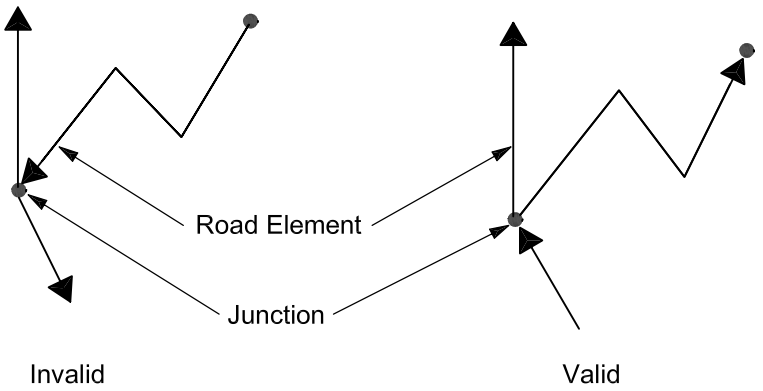

Figure F.2 — Lower left rule

Closed curve
Closed curves are depicted in a counterclockwise direction as shown in Figure F.3.

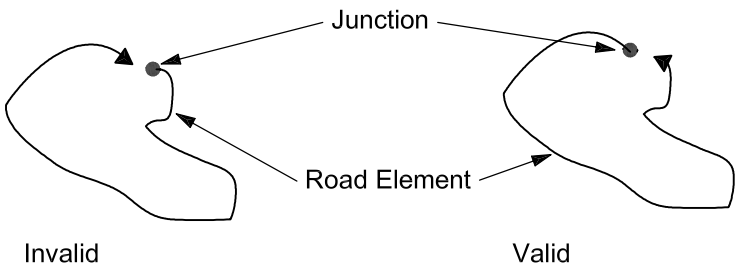

Figure F.3 — Counterclockwise rule

Segmentation rules
Linear network elements constitute the geometric structure of the *NRNC1/ISO19131ex*. These elements are segmented according to the following rules:

— where there is intersection at the same level with another linear element;
— where there is intersection with a provincial or territory boundary;
— where attribute values change.

Geometric representation
Geometric representation is the digital description of the spatial component of an object. With respect to ISO 19107, the *NRNC1/ISO19131ex* uses three types of geometric primitive: GM_Point, GM_Curve, and GM_Surface.

Data capture scope
(DPS_DataCaptureInformation.captureScope > DPS_ScopeInformation.scopeIdentification) rootScope

F.8 Data maintenance (DPSMaintenanceInformation)

Maintenance and update frequency
(DPS_MaintenanceInformation.maintenanceAndUpdateFrequency) The *NRNC1/ISO19131ex* data is updated as deemed necessary. Updates are inserted in the *NRNC1/ISO19131ex* data product when supplied by partners.

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Maintenance scope
(DPS_MaintenanceInformation.maintenanceScope > DPS_ScopeInformation.scopeIdentification) rootScope

F.9 Data product delivery (DPS_DeliveryInformation)

Delivery medium information

Units of delivery
(DPS_DeliveryInformation.deliveryMedium > DPS_DeliveryMedium.unitsOfDelivery) Province

Medium name
(DPS_DeliveryInformation.deliveryMedium > DPS_DeliveryMedium.mediumName) Online via FTP

Delivery format information

GML

Format name
(DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.formatName) Geography Markup Language – GML
Version
(DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.version) v2.0
Specification
(DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.specification) Geography Markup Language – GML – 2.0, OpenGIS® Implementation Specification, 20 February 2001, OGC Document Number 01-029
Language
(DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.language) French, English
Character set
(DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.characterSet > MD_CharacterSetCode) 004 – utf8

Shape

Format name
(DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.formatName) Shape – ESRI™
Version
(DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.version) Not applicable
Specification
(DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.specification) ESRI Shapefile Technical Description, an ESRI White Paper, July 1998
Language
(DPS_DeliveryInformation.deliveryFormat > DPS_DeliveryFormat.language) French, English

Delivery scope
(DPS_DeliveryInformation.deliveryScope > DPS_ScopeInformation.scopeIdentification) rootScope

F.10 Metadata

Not applicable.

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