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OpenGIS® Catalogue Service Implementation Specification 2.0.1 - FGDC CSDGM Application Profile for CSW 2.0

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i. Preface

This document explains how Catalogue Services based on the FGDC Content Standard for Digital Geospatial Metadata (CSDGM) Application Profile for the OpenGIS® Catalogue Service Implementation Specification v2.0.1 are organised and implemented for the discovery, retrieval and management of data metadata

Suggested additions, changes, and comments on this draft report are welcome and encouraged. Such suggestions may be submitted by OGC portal message, email message, or by making suggested changes in an edited copy of this document.

Development of this draft specification was supported by the U.S. Federal Emergency Management Agency (FEMA) under its Map Modernization (MapMod) program (http://hazards.fema.gov).

ii. Submitting Organizations

The following organizations submitted this document to the Open Geospatial Consortium, Inc.

1. *Image Matters LLC*
2. *Michael Baker Corporation*
3. *Federal Emergency Management Agency (US)*
4. *GeoConnections Canada*
5. *Environmental Systems Research Institute, Inc.*
6. *Intergraph Corporation*

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iv. Revision history

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May2006	0.0.8	Neal, Westcott		Format and editorial changes overall
July2006	0.0.9	Westcott		Verification of OGC template structure; Incorporation of contributors' comments
August 2006	0.0.10	Westcott		Globally standardized "catalogue" spelling and name of OGC specification, as per OGC website. Incorporated various comments & suggestions of reviewers
September 2006	0.0.11	Westcott		Final edits, prior to initial OGC review

v. Changes to the OpenGIS® Catalogue Service Implementation Specification

According to the application profile the OpenGIS® Abstract Specification requires no further changes that go beyond the required changes stated in OpenGIS® Catalogue Service Implementation Specification v2.0.1.

vi. Future work

Future work may include the extension of the profile to interoperate with UDDI service registry instances. In addition, this profile specification will be adapted to conform to the ISO 19139 technical specification and XML schema (ISO/TS 19139:2006 Geographic information - Metadata - XML schema implementation

Foreword

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium Inc. shall not be held responsible for identifying any or all such patent rights.

This document, through its implementation profile, references several external standards and specifications as dependencies:

1) *Unified Modeling Language (UML) Version 1.3, The Object Management Group (OMG): http://www.omg.org/cgi-bin/doc?formal/00-03-01*

2) *The Extensible Markup Language (XML), World Wide Web Consortium, http://www.w3.org/TR/1998/REC-xml-19980210*

Appendix A, the Abstract Conformance Test Suite and Appendix D, Schemas and Sample XML Files, are normative to this specification and shall be implemented when a computing environment requires catalogue services.

Appendix B, Design rationale and Appendix C, FEMA MapMod Catalog Implementation Notes are informative and provide background information, such as terminology and alternative implementation approaches.

This document contains references to the Z39.50 Application Profile for Geospatial Metadata (a.k.a. the “GEO profile). Z39.50 is an internet transport protocol, and the “GEO profile” an implementation designed for use with that protocol, that were central to the deprecated versions 1.x of the OGC Catalogue Specification. These references are merely informative, intended to provide context with legacy Catalogue implementations.

Introduction

With the abundance of geospatial resources available today, technologies such as catalogue services, are necessary to facilitate data discovery, retrieval, and maintenance. Because of standardized interface specifications, clients of different origins and with potentially different focuses can access this technology and the geospatial metadata to which it provides potential access. Since these interfaces are standardized, a major role in the development of catalogue[1] services is left to developers, defining information models which can be utilized by these interfaces and yet remain independent of the underlying metadata.

Several different organizations have provided insight into these kinds of information models. They have produced such work as:

- the Geodata Infrastructure North-Rhine Westphalia (GDI NRW) -- which is the basis for the current Catalogue 2.0.1 Implementation Specification), and
- several profiles of CSW 2.0.1 for ISO19115/ISO19119 and ebRIM

This profile defines an application profile for valid FGDC Content Standard for Digital Geospatial Metadata (CSDGM) metadata documents as per the FGDC specification[2]. This profile, called FGDC CSDGM Catalogue or CSDGM Catalogue, is based on the requirements of the CSW 2.0.1 specification, and provides extensions to this base in several areas. As stated in CSW 2.0.1 (with Corrigendum), a base profile that provides a basic set of information objects must be supported by each catalogue instance; in addition, application profiles for different information communities should be specified.

[1] The spelling variants “catalog” and “catalogue” have each been used by OGC and other standards organizations. Because the current OGC specification document uses the “catalogue” variant, it has been adopted for use in this document. Exceptions are made when referencing specific documents, websites, etc. that use “catalog.”

[2] Federal Geographic Data Committee. FGDC-STD-001-1998. Content standard for digital geospatial metadata (revised June 1998) -- http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/base-metadata/index_html

OpenGIS® Catalogue Services – FGDC CSDGM Application Profile for CSW 2.0

1. Scope

This application profile document specifies the interfaces, bindings, and encodings required to publish and access digital catalogs of metadata for geospatial data that comply with the given profile. Metadata acts as generalized properties which can be queried and returned through catalogue services for resource evaluation, and in many cases invocation or retrieval of the referenced resource.

This document applies only to implementations of CSW supporting the FGDC Content Standard for Digital Geospatial Metadata (CSDGM) information model and schema. Implementations of CSW per this application profile are intended for purposes of publishing, inventory, discovery, and access of dataset and dataset collection resources. Implementations conforming to this profile are not intended for similar purposes relative to geospatial services and applications.

2. Conformance

Abstract conformance to the mandatory catalogue service interfaces is described in Appendix A. Test data and queries are not included in this profile.

3. Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this part of OGC 04-021r3. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

IETF RFC 2141 (May 1997), URN Syntax, R. Moats http://www.ietf.org/rfc/rfc2141.txt

IETF RFC 2396 (August 1998), Uniform Resource Identifiers (URI): Generic Syntax, Berners-Lee, T., Fielding, N., and Masinter, L., eds., http://www.ietf.org/rfc/rfc2396.txt

IETF RFC 2616 (June 1999), Hypertext Transfer Protocol – HTTP/1.1, Gettys, J., Mogul, J., Frystyk, H., Masinter, L., Leach, P., and Berners-Lee, T., eds., http://www.ietf.org/rfc/rfc2616.txt

IANA, Internet Assigned Numbers Authority, MIME Media Types, available at http://www.iana.org/assignments/media-types/

ISO/IEC TR 10000-1:1998. Information Technology – Framework and taxonomy of International Standardised Profiles – Part 1: General principles and documentation framework. Technical Report, JTC 1. Fourth edition. Available [online]: http://www.iso.ch/iso/en/ittf/ PubliclyAvailableStandards/c030726_ISO_IEC_TR_10000-1_1998(E).zip.

ISO/IEC 10746-2:1996. Information Technology – Open Distributed Processing – Reference Model: Foundations. Common text with ITU-T Recommendation X.902. Available [online]: *http://www.iso.ch/iso/en/ittf/PubliclyAvailableStandards/s018836_ISO_IEC_107462_1996(E).zip*.

ISO 19106:2003, Geographic Information – Profiles

ISO 19115:2003, Geographic Information – Metadata

ISO 19139, Geographic information - Metadata - Implementation specification

OGC 99-113, OGC Abstract Specification Topic 13: Catalog Services

OGC 02-006, OGC Abstract Specification Topic 12: OpenGIS Service Architecture

OGC 02-059, Filter Encoding Implementation Specification

OGC 04-016r2, OWS Common Implementation Specification, January 2004

OGC 04-038r4, ISO19115/ISO19119 Application Profile for CSW 2.0 (CAT2 AP ISO19115/19)

OGC 05-057r4, OpenGIS® Catalogue Services - Best Practices for Earth Observation Products (0.3) BP

OGC 05-025r3, OGC™ Catalogue Services — ebRIM (ISO/TS 15000-3) profile of CSW

OMG UML, Unified Modeling Language, Version 1.3, The Object Management Group (OMG): *http://www.omg.org/cgi-bin/doc?formal/00-03-01*

W3C Recommendation January 1999, Namespaces In XML, *http://www.w3.org/TR/2000/REC-xml-names*

W3C Recommendation 6 October 2000, Extensible Markup Language (XML) 1.0 (Second Edition), *http://www.w3.org/TR/REC-xml*

W3C Recommendation 2 May 2001: XML Schema Part 0: Primer, *http://www.w3.org/TR/2001/REC-xmlschema-0-20010502/*

W3C Recommendation 2 May 2001: XML Schema Part 1: Structures, *http://www.w3.org/TR/2001/REC-xmlschema-1-20010502/*

W3C Recommendation 2 May 2001: XML Schema Part 2: Datatypes, *http://www.w3.org/TR/2001/REC-xmlschema-2-20010502/*

WSDL, Web Services Description Language (WSDL) 1.1. Available [online]: *http://www.w3.org/TR/wsdl*

Z39.50 Maintenance Agency, *http://www.loc.gov/z3950/agency/*

Z39.50 Application Profile for Geospatial Metadata or "GEO", *http://www.blueangeltech.com/Standards/GeoProfile/geo22.htm*

In addition to this document, this specification includes several normative XML Schema files. These are posted online at the URL http://schemas.opengis.net/. These XML

Schema files are also bundled with this document. In the event of a discrepancy between the bundled and online versions of the XML Schema files, the online files shall be considered authoritative.

4. Terms and definitions

For the purposes of this document, the following terms and definitions apply:

4.1
application profile
Set of one or more base standards and - where applicable - the identification of chosen clauses, classes, subsets, options and parameters of those base standards that are necessary for accomplishing a particular function [ISO 19101, ISO 19106]

4.2
client
Software component that can invoke an **operation** from a **server**

4.3
data level
Stratum within a set of layered levels in which data is recorded that conforms to definitions of types found at the application model level [ISO 19101]

4.4
dataset series
Collection of datasets sharing the same product specification [ISO 19113, ISO 19114, ISO 19115]

4.5
geographic dataset
Dataset with a spatial aspect [ISO 19115]

4.6
geographic information
Information concerning phenomena implicitly or explicitly associated with a location relative to the Earth [ISO 19128:2005]

4.7
georesource
Geographic information of a specific type (e.g. geographic dataset, geographic application, geographic service)

4.8
identifier
Character string that may be composed of numbers and characters that is exchanged between the client and the server with respect to a specific identity of a resource

4.9
interface
Named set of operations that characterize the behavior of an entity [ISO 19119]

4.10
metadata dataset (metadata set)
Metadata describing a specific dataset [ISO 19101]

4.11
metadata entity
Group of metadata elements and other metadata entities describing the same aspect of data

4.12
metadata schema
Conceptual schema describing metadata

NOTE ISO 19115 describes a standard for a metadata schema. [ISO 19101]

4.13
metadata section
Subset of metadata that defines a collection of related metadata entities and elements [ISO 19115]

4.14
operation
Specification of a transformation or query that an object may be called to execute [ISO 19119]

4.15
parameter
Variable whose name and value are included in an operation **request** or **response**

4.16
qualified name
Name that is prefixed with its naming context

4.17
request
Invocation of an **operation** by a **client**

4.18
response
Result of an **operation,** returned from a **server** to a **client**

4.19
schema
Formal description of a model [ISO 19101, ISO 19103, ISO 19109, ISO 19118]

4.20
server
service instance
A particular instance of a **service** [ISO 19119 edited]

4.21
service
Distinct part of the functionality that is provided by an entity through interfaces [ISO 19119]

4.22
service interface
Shared boundary between an automated system or human being and another automated system or human being [ISO 19101]

4.23
service metadata
Metadata describing the **operations** and **geographic information** available at a **server** [ISO 19128:2005]

4.24
state
Condition that persists for a period

4.25
transfer protocol
Common set of rules for defining interactions between distributed systems [ISO 19118]

4.26
version
Version of an Implementation Specification (document) and XML Schemas to which the requested operation conforms

5. Symbols and abbreviations

Some frequently used abbreviated terms:

API Application Program Interface

COTS Commercial Off The Shelf

CQL Common Query Language

CRS Coordinate Reference System

CSW Catalogue Service for the Web

DCE Distributed Computing Environment

DC Dublin Core

DCMI Dublin Core Metadata Initiative

DCP Distributed Computing Platform

FGDC Federal Geographic Data Committee

GML Geospatial Markup Language

HTTP	HyperText Transport Protocol
ISO	International Organization for Standardization
OGC	OpenGIS Consortium
SQL	Structured Query Language
UID	Unique Identifier
UUID	Universal Unique Identifier
UML	Unified Modeling Language
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
URN	Uniform Resource Name
UTF-8	Unicode Transformation Format-8
WSDL	Web Service Definition Language
W3C	World Wide Web Consortium
XML	eXtensible Markup Language

6 System context

This section focuses on the purpose, scope and policies of catalogue services that comply with the given profile. It documents special requirements and describes the context of use.

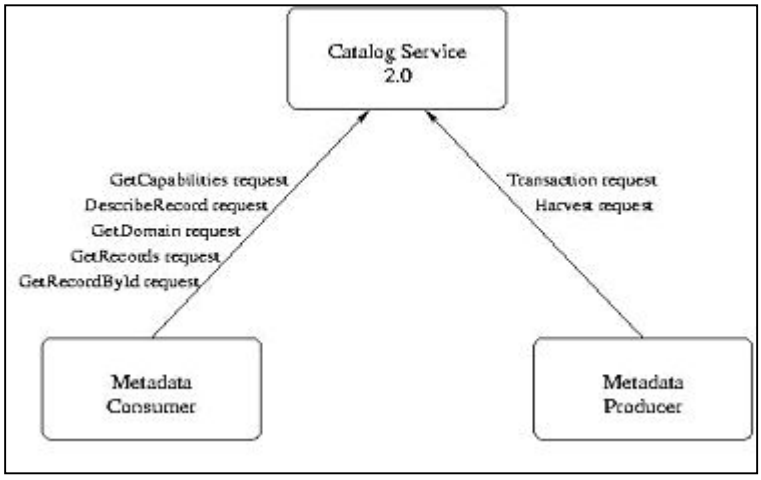

Figure 1: OGC Catalogue Service 2.0

6.1 Application domain[3]

This profile defines a catalogue implementation which allows for the discovery, retrieval, and modification of geospatial metadata. It is not intended to be all-encompassing or general purpose in scope. The catalogue information model used by this profile is based on FGDC CSDGM specification, and is specifically designed to operate with FGDC-based geospatial metadata.

This application profile has no specific disciplinary focus. All communities working with these sorts of geospatial information are addressed. Typical communities are surveying, environment, geology, landscaping, water management, power industry, telecommunications etc.

The intention is to implement a generally understood information model based on standard metadata with only a few relationships among the catalogue items. Usage should be as simple as possible, implementing a set of use cases typical in the geospatial community.

The requirements of the information model, search properties, details of the results sets and interfaces were defined in close cooperation with users in various communities as well as software vendors.

6.2 Essential use cases

This section describes essential use cases for the purpose of demonstrating typical interactions between users, as well as a catalogue service that supports the specified application profile. Figure 2 shows the overall system that contains major interactions between the actors.

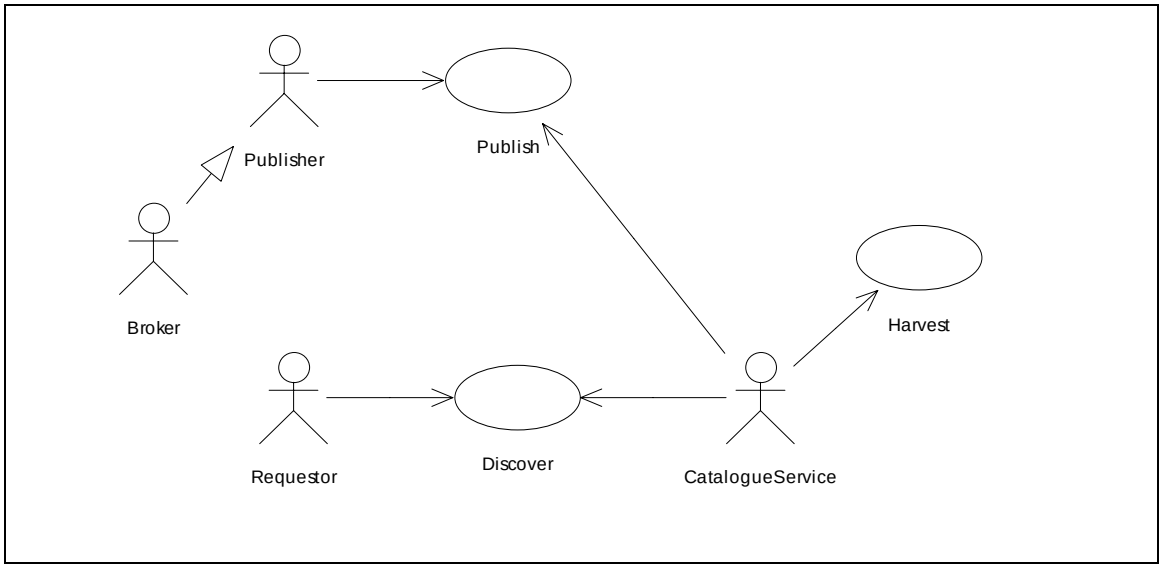

Figure 2: Overall system use cases

[3] The discussion in this section is largely drawn from OGC 04-038r4, ISO19115/ISO19119 Application Profile for CSW 2.0; contributors to the FGDC CSDGM profile offer their thanks to the developers of that document.

An actor is a person, organisation, or external system that plays a role in one or more interactions with the system. Four actors are identified:

Publisher: A publisher publishes metadata descriptions to a catalogue. By doing so, he enables the discovery of that description record by a requestor entity. This actor is also the owner of the geo-resource that he describes.

Broker: This actor is a specialised publisher that publishes and maintains metadata records on behalf of the owner of georesources.

Requestor: This actor searches for metadata records in a catalogue service, either by browsing or through more complicated queries.

Catalogue Service: This is a system that handles the discovery and publishing of metadata entries. Furthermore, this actor has the ability to harvest metadata records from other catalogue services.

The following sections describe the use cases in more detail.

6.2.1 Publish metadata

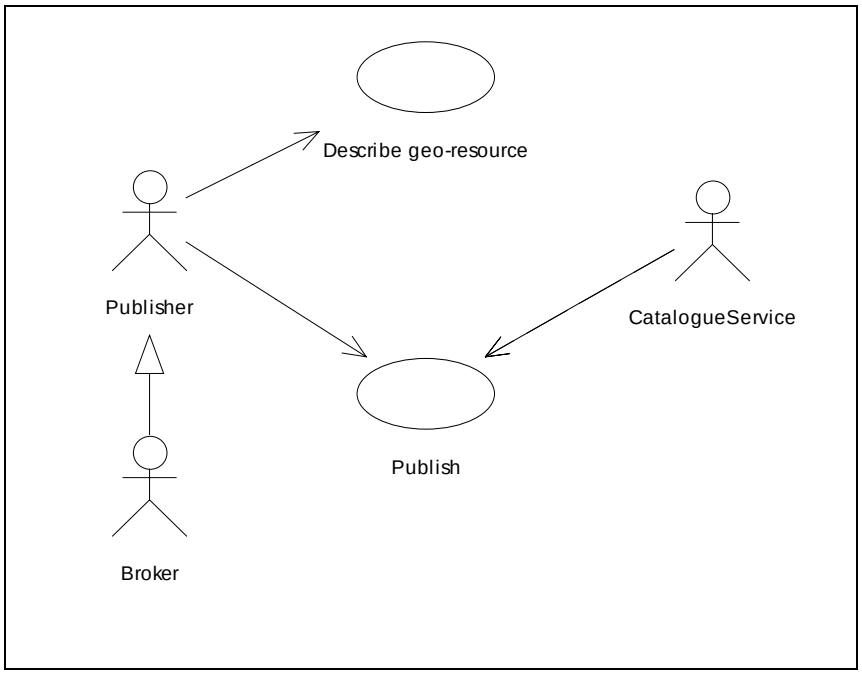

Figure 3: Publish metadata

Description: A publisher describes geo-resources by applying ISO19139 [ISO19139] as specified by this document. A geo-resource might be a service, a geodataset (single or collection) or an application. The publisher owns the georesource. As an alternative, the publisher might be a broker that does not own the geo-resource, but describes and publishes metadata descriptions to a catalogue service on behalf of a publisher.

Pre-conditions: The publisher knows the URL of the catalogue service has knowledge about the transaction interface and has the right to access the catalogue service.

Post-conditions: The metadata record is either successfully published to the catalogue service or publishing fails due to a non-valid metadata description.

6.2.2 Discover metadata

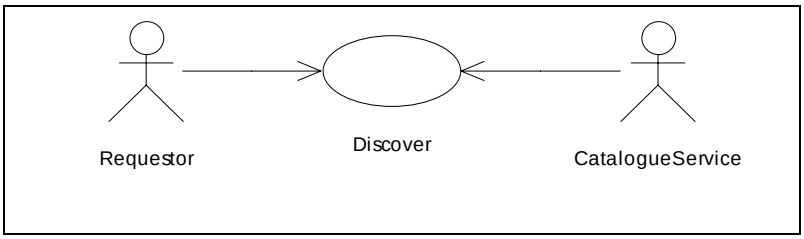

Figure 4: Discover metadata

Description: A requestor discovers metadata entries in a catalogue service either by browsing the content of the catalogue or by placing certain query terms. If a service is discovered that fits his search terms, he can bind to this service in accordance with the information in the result sets of the catalogue service.

Pre-conditions: The requestor knows the location of the catalogue service.

Post-Condition: The requestor receives a valid catalogue response (due to a valid request) with a result set that contains all the information that fits the requestor's query.

6.2.3 Harvest metadata

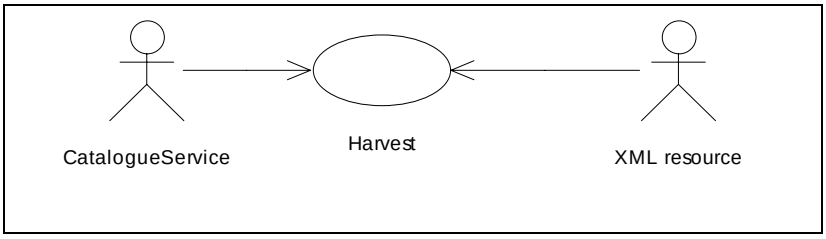

Figure 5: Harvest metadata

Description: A catalogue service may harvest metadata records from a given XML resource, i.e. a metadata description that complies with XML schemas provided by this specification. This could be a metadata description of services or geodata or, additionally in case of services, a capabilities document of an OGC service that complies with OGC Common Implementation Specification.

Pre-conditions: The resource is a valid XML document that complies with the schemas given by this profile[4]. The XML resource must be accessible over a network.

[4] or is a capabilities document which must a priori be translated into the schema given by this profile.

Post-Condition: The XML resource is inserted into the catalogue storage and is available immediately in case of an adequate query.

7 Information models

This profile is based on the FGDC CSDGM metadata specification and extends this by adding several additional properties which relate the FGDC CSDGM metadata to the CSW Core requirements information model.

7.1 Capability classes

This section defines the capability classes of the catalogue service. The application profile distinguishes several capability classes based on the general catalogue information model.

Since both the OGC_Service and the Discovery functions must be provided by all conforming implementations, they are a mandatory part of the capability class (CSW-Catalog). A 'read-only' catalogue service has to provide operations labeled 'CSW'. In addition, a transactional catalogue service has to provide operations labeled 'CSWT'.

The additional Manager functions, which provide a standardized interface for the active management (push-model) or the passive harvesting (pull-model) of metadata, are an optional part of the profile (CSWT Catalog).

Table 1 - Operations provided by CSW capability classes

Capability class label	Operations provided
CSW	OGC_Service.GetCapabilities CSW_Discovery.DescribeRecord CSW_Discovery.GetRecords CSW_Discovery.GetDomain CSW_Discovery.GetRecordById
CSWT	As above, plus: CSW_Manager.Transaction CSW_Manager.Harvest

7.1.1 CSW extensions

This profile requires extensions to the referenced OGC and FGDC specifications. These extensions and recommendations are described in the following paragraphs.

7.1.1.1 Unique Identifier

UIDs are required to reference metadata records in the repository. Because the FGDC CSDGM metadata schema defines no unique identifier for a given instance, a separate

field is needed to represent the UID of each instance record. For this implementation, the information model uses `fgdc:recordID` as the unique identifier for a given metadata entity. This property must be associated with the database primary key field external to the XML metadata. UUIDs are recommended to ensure the uniqueness of each identifier. This profile, however, is satisfied with the use of UIDs to identify metadata records, as the probability of a non-unique identifier is extremely remote.

7.1.1.1.1 GOS2

In conformance with the GOS2 specifications (http://www.geodata.gov/gos/metadata/CreatePublishMetadata.pdf), this profile supports the optional *catid* attribute assigned to full metadata records returned from CSW. This attribute is assigned to the *Title* element of the xml-encoded metadata using the unique identifier referenced above.

7.1.2 Mappings to the common XML Record format

7.1.2.1 OGC Core Queryable Properties

CSDGM Catalogue uses queryable properties to formulate constraint expressions which can be used to refine searches for metadata information. The core queryables as defined in the OGC catalogue specification and their mappings to this profile are defined in the following table.

The queryable properties listed in Tables 2 and 3 should be encoded as simple unqualified string literals. When found in a valid CSW request no procedure -- other than simple string comparison -- is necessary for processing these queryable property names.

Table 2 - OGC Core Queryable Properties

Property	Definition	Data type	Mapping to FGDC Information Model
Subject[2]	The topic of the content of the resource.	Character String	Keywords, see **Table 6**
Title	A name given to the resource	Character String	Title: metadata.idinfo.citation.citinfo.title
Abstract	A summary of the content of the resource	Character String	Abstract: metadata.idinfo.descript.abstract
Format	The physical or digital manifestation of the resource	Code List One of MIME types	Format: metadata.distinfo.stdorder.digform.digtform.formname
Identifier	An unambiguous reference to the resource within a given context	Identifier	No Direct Mapping
Modified	Date on which the resource was last changed	Date as Character String in format: YYYYMMDD[4]	Metadata_Date: metadata.metainfo.metd
Type	The nature or genre of the content of the resource. Type can include general categories, genres or aggregation levels of	Code List	Citation: Geospatial Data Presentation Form: /metadata/idinfo/citation/citinfo/geoform

Property	Definition	Data type	Mapping to FGDC Information Model
	content.		
Envelope	A bounding box for identifying a geographic area of interest	Numeric	Envelope, see **Table 6**
CRS[2]	Coordinate Reference System (Authority and ID) for the Envelope	Character String	Spatial_Reference_Information, see **Table 6**
Association	Complete statement of a one-to-one relationship		Not supported by the profile.
AnyText	This represents the catalogue entry as a whole.	Character String	Any available XML element and attribute content conforming to the FGDC content standard

1
2 Because of the nature of the mapping between the Core queryables and the FDGC metadata, properties which have sub-properties cannot be used in the constraint portion of queries. Use the most appropriate sub-property instead. Note that this does not apply to spatial queries since these are special cases and can only be performed on the Envelope property.
3 See discussion of FGDC recurrence, which follows Table 3.
4 See discussion of FGDC Dates, which follows Table 3.

1 FGDC CSDGM provides no mapping for a unique identifier of a resource or a metadata
2 record. As such, this profile assumes nothing about the unique identifier of a resource,
3 and assumes the use of a unique key, labeled `fgdc:recordID`, which is associated
4 with the metadata record.

5 The OGC Core Queryable property "Modified" is mapped to the FGDC content element
6 "metainfo.metd," reflecting a recommended best practice. That is, since the FGDC
7 CSDGM does not include in its information model a "Date on which the resource was
8 last changed," this profile assumes that the same date will be recorded in metadata
9 records in the value for "metainfo.metd". FGDC defines this content element as "the date
10 that the metadata were created or last updated."

11

12 **Table 3 – FGDC Queryable Properties**

Property	Definition	Data type	Mapping to FGDC Information Model
Title	See Table 2 (above)		
Originator	Creator of the resource	Character String	Originator: metadata.idinfo.citation.citeinfo.origin
Publisher	Publisher of the resource	Character String	Publisher: metadata.idinfo.citation.citeinfo.publinfo.publish.
Abstract	See Table 2 (above)		
Purpose	A description of the purpose of the resource	Character String	Purpose: metadata.idinfo.descript.purpose

Property	Definition	Data type	Mapping to FGDC Information Model
GeospatialPresentationForm	The type of geospatial data in the resource	Code List	Geospatial_Presentation_Form: metadata.idinfo.citation.citeinfo.geoform
PublicationDate	Date on which the resource was published	Date as Character String in format: YYYYMMDD[1]	Publication_Date: metadata.idinfo.citation.citeinfo.pubdate
ThemeKeywords	The topic of the content of the resource.	Character String	Theme_Keywords: Metadata.idinfo.keywords.theme.themekey
Progress	A description of the status of the resource	Code List	Progress: metadata.idinfo.status.progress
BeginDate	Beginning date for the resource	Date as Character String in format: YYYYMMDD[1]	Beginning_Date: metadata.idinfo.timeperd.timeinfo.rngdates.begdate
EndDate	Ending date for the resource	Date as Character String in format: YYYYMMDD[1]	Ending_Date: metadata.idinfo.timeperd.timeinfo.rngdates.enddate OR metadata.idinfo.timeperd.timeinfo.sngdate.caldate OR metadata.idinfo.timeperd.timeinfo.mdattim.sngdate.caldate
Envelope	See Table 2 (above)		
AnyText	See Table 2 (above)		
1 See discussion of FGDC Dates, which follows Table 3.			

The OGC Core Queryable property “format” maps to the FGDC content element “formname” (see Table 2), which may occur multiple times in a single metadata record. Implementations of this profile will be assumed to apply the query against all occurrences of this content element in a record.

The specified domain for numerous “date” elements in the FGDC CSDGM include “YYYMMDD,” “YYYYMM,” “YYYY,” “Unknown,” "Not complete," and other values which are not numeric[5]. This profile assumes that the presence of content that does not conform to a specified numeric date convention may cause a query against a property that specifies such an element to fail. However such non-numeric values may be treated differently, depending upon the implementation.

7.1.2.2 OGC Core Returnable Properties

The following table lists the mapping between core returnable properties and the associated properties defined by this profile.

[5] http://www.fgdc.gov/metadata/csdgm/organization.html describes the liberties taken with the domains of some elements as follows: “The domain also may note that the domain is free from restrictions, and any values that can be represented by the "type" of the data element can be assigned. These unrestricted domains are represented by the use of the word "free" followed by the type of the data element (that is, free text, free date, free real, free time, free integer).”

Table 4 – OGC Core Returnable Properties

Dublin Core metadata element name	Term used in application profile	Data type	Property Mapping to FGDC Information Model
dc:creator	Originator, fgdc:origin	Character String	Originator metadata.idinfo.citation.citeinfo.origin
dc:publisher	Publisher, fgdc:publish	Character String	Publisher: metadata.idinfo.citation.citeinfo.pubinfo.publish
dc:contributor	Contributor, fgdc:datacred	Character String	Data_Set_Credit: metadata.idinfo.datacred
dc:language	Language	Character String	No Mapping, unused by this profile[1]
dc:rights	Rights fgdc:constraints	Character String	Constraints, See **Table 6**
dc:title	Title, fgdc:title	Character String	Title: metadata.idinfo.citation.citinfo.title
dc:subject	Subject fgdc:keywords	Code List At least one of Topic Category [ISO19115]	Keywords, See **Table 6**
dct:abstract	Abstract, fgdc:abstract	Character String	Abstract: metadata.idinfo.descript.abstract
dc:modified	Modified, fgdc:metd	Date as Character String in Format: YYYYMMDD	Metadata_Date metadata.metainfo.metd
dc:type	Type, fgdc:direct	Code List	Direct_Spatial_Reference: metadata.idinfo.spdoinfo.direct
dc:format	Format, fgdc:formname	Code List One of MIME types	Format: metadata.distinfo.stdorder.digform.digtinfo.formname
dc:identifier	Identifier fgdc:recordID	Identifier	No Mapping, See **Table 2**
dc:source	Source, fgdc:source	Character String	Source_Citation: metadata.lineage.srcinfo.srccite.citeinfo.title
dc:relation	Relation, fgdc:onlink	URI	Online_Linkage: metadata.idinfo.citation.citeinfo.onlink
dct:spatial	Envelope fgdc:bounding	Numeric	Bounding Coordinates, See **Table 6**

1 FGDC provides no content element(s) characterizing the language of the data resource or the metadata record. The CSDGM was defined with an unstated default language of "English," but is implemented in other languages in many countries. Nothing in this profile is intended to prevent successful execution of all operations in Catalogue instances that contain metadata records in languages other than English.

1

Table 5 - FGDC Returnable Properties

FGDC-defined element name	Term used in application profile	Data type	Property Mapping to FGDC Information Model
fgdc:title	Title	Character String	Title: metadata.idinfo.citation.citeinfo.title
fgdc:pubdate	Publication Date	Date as Character String in Format: YYYYMMDD	Publication_Date: metadata.idinfo.citation.citeinfo.pubdate
fgdc:begdate	Beginning Date	Date as Character String in Format: YYYYMMDD	Beginning_Date: metadata.idinfo.timeperd.timeinfo.rngdates.begdate
fgdc:enddate	Ending Date	Date as Character String in Format: YYYYMMDD	Ending_Date: metadata.idinfo.timeperd.timeinfo.rngdates.enddate
fgdc:bounding	Envelope	Compound	Bounding_Coordinates, See **Table 6**
fgdc:onlink	Relation	URL	Onlink_Linkage: metadata.idinfo.citation.citeinfo.onlink
fgdc:extent	Extent	Number	Extent: Not in FGDC Model[1]
fgdc:enttypl	Entity Type Label	Character String	Entity_Type_Label: metadata.eainfo.detailed.enttyp.enttypl
fgdc:attrlabl	Attribute Label	Character String	Attribute_Label: metadata.eainfo.detailed.attr.attrlabl
fgdc:browse	Browse Graphic	Compound	Browse_Graphic, See **Table 4**
fgdc:dsgpoly	Data Set G-Polygon	Compound	Data_Set_G_Polygon, See **Table 4**
1 . Defined by GEO Profile as: (NorthBC-SouthBC)*(EastBC-WestBC)			

1

2

1

2 7.1.2.3 Compound Properties

3 Certain properties of the Dublin Core element set cannot be mapped to the FGDC
4 information model of this profile in a one-to-one relationship. Table 6 lists these
5 compound properties and their mappings.

Table 6 – Mapping of Compound Properties

Compound element name	Dublin Core sub-element name	Terms used in application profile	Mapping properties to FGDC Information Model
Envelope[2]		Bounding, fgdc:bounding, dct:spatial	Bounding_Coordinates metadata.idinfo.spdom.bounding
	WestLimit	WestBoundingCoordinate, fgdc:westbc, dcmi:westlimit	West_Bounding_Coordinate: metadata.idinfo.spdom.bounding.westbc
	SouthLimit	SouthBoundingCoordinate, fgdc:southbc, dcmi:southlimit	South_Bounding_Coordinate: metadata.idinfo.spdom.bounding.southbc
	EastLimit	EastBoundingCoordinate, fgdc:eastbc, dcmi:eastlimit	East_Bounding-Coordinate: metadata.idinfo.spdom.bounding.eastbc
	NorthLimit	NorthBoundingCoordinate, fgdc:northbc, dcmi:northlimit	North_Bounding_Coordinate: metadata.idinfo.spdom.bounding.northbc
Subject		Keywords, fgdc:keywords, dc:subject	Keywords: metadata.idinfo.*.keywords metadata.idinfo.keywords.theme.themekey metadata.idinfo.keywords.place.placekey Metadata.idinfo.keywords.stratum.stratkey metadata.idinfo.keywords.temporal.tempkey
CRS		CRS, fgdc:spref, csw:crs	Spatial_Reference_Information[4]: metadata.spref
Rights		Rights, fgdc:constraints, dc:rights	No direct mapping[3]
	Access	AccessConstraints, fgdc:accconst, dct:accessRights	Access_Constraints: metadata/idinfo/accconst
	Use	UseConstraints, fgdc:useconst, dct:license	Use_Constraints: metadata/idinfo/useconst
Browse Graphic		Graphic, fgdc:browse, fgdc:graphic	Browse_Graphic[4]: metadata.idinfo.browse

Data Set G-Polygon		Polygon, fgdc:dsgpoly fgdc:polygon	Data_Set_G_Polygon[4]: metadata.idinfo.spdom.dsgpoly

1 No suitable mapping to DC elements. Non-FGDC queries should use the provided element name.
2 dc:Envelope contains the element dcmi:Box which contains the four coordinate elements. The Envelope element is mapped to fgdc:Bounding and the Box element is automatically handled by the Server.
3 Although there is no direct mapping to a specific FGDC element, using this element in as a returnable will result in the use of the sub-elements which may or may not map directly to the Dublin Core element set.
4 This element or its children/grandchildren are repeating elements and are only necessary for returnable support. Because of this, this element is stored and returned as an xml fragment containing all occurrences of itself and its descendant nodes. Request for the values of these elements must be qualified in the "csw" namespace, i.e. "fgdc:browse" would be "csw:browse".

7.1.3 Additional Properties

In addition to the core properties, this profile defines additional supported properties in Table 7. These are queryable and returnable and follow the same rules of use as the core elements.

Table 7 - Additional Queryable/Returnable Properties

Name	Definition	Term used in application profile	Data type	Property Mapping to Information Model
Content Begin Date	Begin date relevant to data referenced	BeginningDate fgdc:begdate csw:begindate	Date Format: YYYYMMDD	metadata.idinfo.timeperd.timeinfo.rngdates.begdate
Content End Date	End date relevant to data referenced	EndingDate fgdc:enddate csw:enddate	Date Format: YYYYMMDD	metadata.idinfo.timeperd.timeinfo.rngdates.enddate
Progress	Status of the data referenced	Progress fgdc:progress csw:progress	Character String	metadata.idinfo.status.progress
Calendar Date	Date relevant to the data referenced	CalendarDate fgdc:caldate csw:calendardate	Date Format: YYYYMMDD	metadata.idinfo.timeperd.timeinfo.sngdate.caldate

7.2 Result sets

This section defines XML Schema presentations for valid result sets of the application profile. A representation of catalogue entries in a result set may substitute for the element `csw:AbstractRecord` defined in the Catalogue Service Implementation Specifications 2.0.1 record schema, 'record.xsd' or the element `csw:AbstractElement` defined by the record schema of this profile, 'record-fgdc.xsd'. For this profile and all implementations,

the OGC Core schema result set ("OGCCORE") is assumed to be synonymous with the "csw:Record" schema result set.

Table 8 – Result Sets Supported by Schemas

Schema	BRIEF	SUMMARY	FULL
OGC Core/CSW	+	+	+
FGDC	+	+	+
GEO	+	+	+

Table 9 describes which properties of the information model of this profile are contained within the supported result sets. An important note to point out is that the "full" result set includes all elements of the metadata record, even those beyond the elements listed in the queryable and returnable tables, since the valid response to such a request is to return the entire metadata record. It is important to note that a "full" result set response will always contain the full FGDC CSDGM metadata record, regardless of the schema requested.

Table 9 - Result Set Properties

Property Name	FGDC BRIEF	CSW BRIEF	GEO BRIEF	FGDC SUMM.	CSW SUMM.	GEO SUMM.
Abstract				+	+	
Attribute Label						+
Browse Graphic						+
Contributor				+		
Data Set G-Polygon						+
Entity Type Label						+
Envelope				+	+	+
Extent						+
Format				+	+	
Identifier	+	+		+	+	
Modified				+	+	
Originator				+		
Progress						+
Publication Date						+
Publisher				+		
Purpose						+
Relation				+	+	+

Property Name	FGDC BRIEF	CSW BRIEF	GEO BRIEF	FGDC SUMM.	CSW SUMM.	GEO SUMM.
Rights				+		
Source				+		
Subject				+	+	+
Title	+		+	+	+	+
Type		+		+	+	

1

2 7.2.1 BRIEF Result Set

3 A response to a valid catalogue service request with `ElementSetName=BRIEF`. This set
4 corresponds to the smallest amount of information which represents the metadata record
5 in the database. See Appendix D sections 2 and 3 for brief result set definitions and
6 examples.

7 7.2.2 SUMMARY Result Set

8 A response to a valid catalogue service request with `ElementSetName=SUMMARY`. This set
9 corresponds to the average amount of information which represents the metadata record
10 in the database. See Appendix D sections 2 and 3 for summary result set definitions and
11 examples.

12 7.2.3 FULL Result Set

13 A response to a valid catalogue service request with `ElementSetName=FULL`. Such a
14 response includes the metadata record in its stored format in its entirety. See Appendix D
15 sections 2 and 3 for full result set definitions and examples.

16 **8 External interfaces**

17 This view describes the externally visible behavior of the system, including the interfaces
18 provided by its components and the supported protocol bindings. It defines the request
19 and response message structures as part of the operation signatures, primarily the
20 differences to that of the OGC CS 2.0 base specification. It also documents supported
21 query facilities and some implementations guidance as well as a few security
22 considerations.

23 ***8.1 Imported protocol binding (Relationship to the common model)***

24 This profile imports the HTTP protocol binding from the CSW 2.0 specification. Table
25 10 shows the mapping of the operations specified by the CSW 2.0 specification to the
26 operations of this profile, CSW(T)-FGDC.

Table 10 - Mapping CSW operations to CSW(T) FGDC operations

CSW operation	CSW(T)-FGDC operation

CSW operation	CSW(T)-FGDC operation
OGC_Service.GetCapabilities	OGC_Service.GetCapabilities
CSW-Discovery.GetRecords	CSW Discovery.GetRecords
CSW-Discovery.DescribeRecord	CSW Discovery.DescribeRecord
CSW-Discovery.GetDomain	CSW Discovery.GetDomain
CSW-Discovery.GetRecordById	CSW Discovery.GetRecordById
CSW-Publication.Transaction	CSWT Manager.Transaction
CSW-Publication.Harvest	CSWT Manager.Harvest

All non-transactional CSW operations support keyword-value pairs (KVP) encoding of requests within a request URI. All operations support XML encoding of requests. Also, all responses generated by the server are XML-encoded. KVP-encoding of requests is supported through HTTP-GET binding while XML-encoded requests are supported through HTTP-POST. Table 11 summarizes the CSW(T)-FGDC operations and their encoding methods that are applied in this profile.

Table 11 - Operation request encoding

CSW(T)-FGDC Operation	Request encoding
GetCapabilities	XML (POST) and KVP (GET)
DescribeRecord	XML (POST) and KVP (GET)
GetDomain	XML (POST) and KVP (GET)
GetRecords	XML (POST) and KVP (GET)
GetRecordById	XML (POST) and KVP (GET)
Transaction	XML (POST)
Harvest	XML (POST) and KVP (GET)

8.2 Interface specifications

This section describes the syntax and semantics of the interface operations of this profile in comparison to those defined by the CSW 2.0 specification.

8.2.1 OGC_Service Interface

8.2.1.1 GetCapabilities Operation

The *GetCapabilities* operation allows clients to retrieve service metadata from the server. The response to a *GetCapabilities* request should be an XML-encoded document containing service metadata about the server. HTTP-GET using KVP and HTTP-POST using XML encoding are available as protocol bindings.

Examples of a *GetCapabilities* request and response are shown in Listing 1 and Listing 3, respectively. Namespace declarations and some response information were omitted for space and readability.

Table 12 - Parameters in GetCapabilities operation request

Name	Definition	Data Type and value	Multiplicity and use	FGDC App.-Profile
SERVICE	Service type identifier	Character String type, not empty Fixed value of "CSW"	Mandatory	Mandatory
REQUEST	Operation name	Character String type, not empty Fixed value of "GetCapabilities"	Mandatory	Mandatory
ACCEPT VERSIONS	Prioritized sequence of one or more specification versions accepted by client, with preferred versions listed first	Sequence of Character String type, not empty Value is "2.0.1" When omitted, return latest supported version	Zero or one (Optional)	Zero or one (Optional)
SECTIONS	Unordered list of zero or more names of requested sections in complete service metadata document	Sequence of Character String type, not empty Value is list of section names Allowed section names are specified by each Implementation Specification	Zero or one (Optional)	Zero or one (Optional) When omitted or not supported by server, return complete service metadata document
UPDATE SEQUENCE	Service metadata document version, value is "increased" whenever any change is made in complete service metadata document	Character String type, not empty Values are selected by each server, and are always opaque to clients	Zero or one (Optional)	Zero or one (Optional)
ACCEPT FORMATS	Prioritized sequence of zero or more response formats desired by client, with preferred formats listed first	Sequence of Character String type, not empty Value is list of format identifiers Identifiers are MIME types of formats useful for service metadata documents. Supports "text/xml" and "text/html"	Zero or one (Optional) Default value is "text/xml"	Zero or one (Optional) Default value is "text/xml"

Listing 1 – GetCapabilities Request in XML

```
<csw:GetCapabilities service="CSW" version="2.0.1">
```

```
  <csw:AcceptVersion>
    <csw:Version>2.0.1</csw:Version>
  </csw:AcceptVersion>
  <csw:Sections>
    <csw:Section>ServiceIdentification</csw:Section>
    <csw:Section>OperationsMetadata</csw:Section>
     <csw:Section>Contents</csw:Section>
  </csw:Sections>
  <csw:AcceptFormat>
    <csw:OutputFormat>text/xml</csw:OutputFormat>
  </csw:AcceptFormat>
</csw:GetCapabilities>
```

Listing 2 - GetCapabilities Response

```
<csw:Capabilities version="2.0.1" updateSequence="0">
  <ows:ServiceIdentification>
    ...omitted for space...
  </ows:ServiceIdentification>
  <ows:OperationsMetadata>
    ...omitted for space...
  </ows:OperationsMetadata>
  <csw:Contents>
    ...omitted for space...
  </csw:Contents>
</csw:Capabilities>
```

8.2.2 CSW Discovery Interface

8.2.2.1 GetRecords Operation

The *GetRecords* operation is equivalent to the combination of the two general model operations *Search* and *Present*. HTTP-GET using KVP and HTTP-POST using XML encoding are available as protocol bindings for this operation.

8.2.2.1.1 Request

The parameters of the *GetRecords* operation request are specified in Table 13. The **FGDC App.-Profile** column lists any restrictions or variations in comparison to those of the base specification. The encoding in the table is directly suitable for the HTTP-GET binding.

An example of a *GetRecords* request in XML is shown in Listing 3. In this example, the brief element set containing FGDC elements is requested for all records using an empty constraint. The associated *GetRecords* response for this request is shown in Listing 4. Namespace declarations were omitted for space and readability.

Table 13 - Parameters in GetRecords operation request

Keyword	Data Type & Value	Optionality	FGDC App.-Profile
REQUEST	Character String. Fixed value of “GetRecords”. The value is case insensitive.	Mandatory	Mandatory
SERVICE	Character String. Fixed value of “CSW”	Mandatory	Mandatory
VERSION	Character String. Fixed value of “2.0.1”	Mandatory	Mandatory
NAMESPACE	List of Character String, comma separated. Used to specify namespace. Format must be <prefix>:<url>.	Zero or one (Optional) Include value for each namespace If not included, all qualified names are in default namespace	Mandatory
RESULTTYPE	CodeList. One of “HITS”, “RESULTS” or “VALIDATE”. If this value is ”HITS” or “VALIDATE”, `ElementSetName` and `ElementName` are ignored.	Optional Default value is “RESULTS”.	Optional Default value is “RESULTS”.
OUTPUTFORMAT	Character String Value is Mime type Supports “text/ xml” and “text/html”	Optional; Default value is “text/xml”	Optional; Default value is “text/xml”
OUTPUTSCHEMA	Defined in a profile. Must support “OGCCORE”. Also supports “fgdc:metadata”, “csw:Record”, and “OGCCORE“.	Optional	Zero or one (Optional) Default value is “fgdc:metadata”.
STARTPOSITION	Positive Integer	Optional Default value is 1.	Optional Default value is 1.
MAXRECORDS	Positive Integer	Optional Default value is 10.	Optional Default value is 10.
TYPENAMES	List of Character String, comma separated Unordered List of object types implicated in the query	Mandatory	Mandatory
ELEMENTNAME	List of Character String Valid values include the names and XPath expressions of FGDC metadata model elements or their equivalent DC names.	Optional	Optional
ELEMENTSETNAME	Character String One of: “brief”, “summary”, or “full”.	Optional Default value is “summary”.	Optional Default value is “summary”.
CONSTRAINTLANGUAGE	Code List “FILTER”	Mandatory	This profile does not support “CQL_TEXT”
CONSTRAINT	Character String The predicate expression specified in the language indicated by the CONSTRAINTLANGUAGE parameter.	Optional Default action is to execute an unconstrained query.	Optional Default action is to execute an unconstrained query.

Keyword	Data Type & Value	Optionality	FGDC App.-Profile
SORTBY	List of Character String, comma separated Ordered list of names of metadata elements to use for sorting the response KVP Format: *element_name[:A|D]* 'A' for ascending sort, 'D' for descending sort	Optional Default action is to present the records in the order in which they are retrieved.	Optional Default action is to present the records in the order in which they are retrieved.
DISTRIBUTEDSEARCH	Boolean	Optional Default value is FALSE.	Optional
HOPCOUNT	Integer May be specified only if DISTRIBUTEDSEARCH is specified. If not specified, the default value is 2.	Optional Default value is 2	Optional
RESPONSEHANDLER	URL	Zero or one Optional If not included, process request synchronously	Not supported by this profile.

Listing 3 – GetRecords Request in XML

```
<csw:GetRecords service="CSW" version="2.0.1" outputFormat="text/xml"
                outputSchema="fgdc:metadata" startPosition="1" maxRecords="10">
  <csw:Query typeNames="Any">
    <csw:ElementSetName>brief</csw:ElementSetName>
    <csw:Constraint>
      <ogc:Filter>
        <ogc:OR>
          <ogc:AND>
            <ogc:BBOX>
              <ogc:PropertyName>Envelope</ogc:PropertyName>
              <gml:Box>
                <gml:coordinates>
                    -179.899,-155.637 175.231,82.428
                </gml:coordinates>
              </gml:Box>
            </ogc:BBOX>
            <ogc:PropertyIsBetween>
              <ogc:PropertyName>Modified</ogc:PropertyName>
              <ogc:LowerBoundary>
                 <ogc:Literal>19000000</ogc:Literal>
              </ogc:LowerBoundary>
              <ogc:UpperBoundary>
                <ogc:Literal>20000000</ogc:Literal>
              </ogc:UpperBoundary>
            </ogc:PropertyIsBetween>
          </ogc:AND>
          <ogc:PropertyIsLike wildCard="*" singleChar="?" escapeChar="!">
            <ogc:PropertyName>fgdc:themekey</ogc:PropertyName>
            <ogc:Literal>F*MA</ogc:Literal>
          </ogc:PropertyIsLike>
        </ogc:OR>
      </ogc:Filter>
    </csw:Constraint>
  </csw:Query>
</csw:GetRecords>
```

8.2.2.1.2 Response

Listing 4 – GetRecords Response in XML

```xml
<csw:GetRecordsResponse version="2.0.1">
  <csw:RequestId>db3331:10061cc6373:-7fff</csw:RequestId>
  <csw:SearchStatus status="complete" />
  <csw:SearchResults resultSetId="1" elementSet="brief"
        recordSchema="fgdc:metadata" numberOfRecordsMatched="419"
        numberOfRecordsReturned="10" nextRecord="11">
    <fgdc:BriefRecord>
       <fgdc:publish>Publisher 1</fgdc:publish>
       <fgdc:metd>20021122</fgdc:metd>
       <fgdc:title>Title 1</fgdc:title>
       <fgdc:recordID>14da8f4:fee9daddfa:-7ffe</fgdc:recordID>
    </fgdc:BriefRecord>
    <fgdc:BriefRecord>
    ...record contents omitted for space...
    </fgdc:BriefRecord>
    <fgdc:BriefRecord>
    ...record contents omitted for space...
    </fgdc:BriefRecord>
    <fgdc:BriefRecord>
    ...record contents omitted for space...
    </fgdc:BriefRecord>
    <fgdc:BriefRecord>
    ...record contents omitted for space...
    </fgdc:BriefRecord>
    <fgdc:BriefRecord>
    ...record contents omitted for space...
    </fgdc:BriefRecord>
    <fgdc:BriefRecord>
    ...record contents omitted for space...
    </fgdc:BriefRecord>
    <fgdc:BriefRecord>
    ...record contents omitted for space...
    </fgdc:BriefRecord>
    <fgdc:BriefRecord>
    ...record contents omitted for space...
    </fgdc:BriefRecord>
    <fgdc:BriefRecord>
    ...record contents omitted for space...
    </fgdc:BriefRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

8.2.2.2 GetRecordById Operation

The *GetRecordById* request retrieves the default information model representation of catalogue records using their identifier as the constraint. This operation presumes that a previous query has been performed in order to obtain the identifiers that may be used with this operation.

8.2.2.2.1 Request

The parameters of the *GetRecordById* operation request are specified in Table 14. The **FGDC App.-Profile** column lists any restrictions or variations in comparison to those of

the base specifications. The encoding in the table is directly suitable for the HTTP-GET binding.

An example of a *GetRecordById* request in XML is shown in Listing 5. In this example, a summary element set of FGDC elements is requested for a specific record matching the specified ID. The associated *GetRecordById* response to the request is shown in Listing 6. Namespace declarations were omitted for space and readability.

Table 14 - Parameters in GetRecordById operation request

Keyword	Data Type & Value	Optionality	ISO App.-Profile
REQUEST	Character String. Fixed values of "GetRecordById". The value is case insensitive.	Mandatory	Mandatory
SERVICE	Character String. Fixed value of "CSW"	Mandatory	Mandatory
VERSION	Character String. Fixed value of "2.0.1"	Mandatory	Mandatory
OUTPUTFORMAT	Character String Value is Mime type Supports "text/ xml" and "text/html"	Optional Default value is "text/xml"	Optional Default value is "text/xml"
OUTPUTSCHEMA	Defined in a profile. Must support "OGCCORE". Supports "fgdc:metadata", "csw:record", "OGCCORE", and "fgdc:metadata".	Optional.	Zero or one (Optional) Default value is "fgdc:metadata".
ELEMENTSETNAME	CodeList One of: "brief", "summary" or "full"	Zero or one (Optional) Default value is "summary".	Zero or one (Optional) Default value is "summary"
ID	KVP – Comma separated list of anyURI XML – Separately-tagged <Id> elements or comma-separated list inside single <Id> element.	One Mandatory	One Mandatory

Listing 5 – GetRecordById Request in XML

```
<csw:GetRecordById service="CSW" version="2.0.1" outputFormat="text/xml"
                   outputSchema="fgdc:metadata">
  <csw:Id>1f26605:fe7d93fd50:-7fea</csw:Id>
  <csw:ElementSetName>summary</csw:ElementSetName>
</csw:GetRecordById>
```

8.2.2.2.2 Response

Listing 6 – GetRecordById Response

```
<?xml version="1.0" encoding="UTF-8"?>
<fgdc:GetRecordByIdResponse version="2.0.1">
   <fgdc:SummaryRecord>
        <fgdc:direct>DataSet</fgdc:direct>
        <fgdc:keywords>
           <fgdc:themekey>Inventory</fgdc:themekey>
           <fgdc:themekey>Faults</fgdc:themekey>
           <fgdc:themekey>FEMA</fgdc:themekey>
           <fgdc:placekey>Mississippi</fgdc:placekey>
           <fgdc:placekey>Maryland</fgdc:placekey>
           <fgdc:placekey>Kentucky</fgdc:placekey>
           <fgdc:stratkey>Sedimentary Rocks</fgdc:stratkey>
           <fgdc:tempkey/>
        </fgdc:keywords>
        <fgdc:bounding>
           <fgdc:westbc>-167.391</fgdc:westbc>
           <fgdc:eastbc>71.435</fgdc:eastbc>
           <fgdc:northbc>128.512</fgdc:northbc>
           <fgdc:southbc>81.315</fgdc:southbc>
        </fgdc:bounding>
        <fgdc:abstract>Some abstract information.</fgdc:abstract>
        <fgdc:source>FEMA</fgdc:source>
        <fgdc:pubdate>19940014</fgdc:pubdate>
        <fgdc:title>Essential Conterminous United States Faults</fgdc:title>
        <fgdc:recordID>1f26605:fe8c0aac98:-7ed4</fgdc:recordID>
        <fgdc:origin>Geospatial Impact Structures</fgdc:origin>
        <fgdc:accconst>None</fgdc:accconst>
        <fgdc:useconst>None</fgdc:useconst>
        <fgdc:publish>FEMA</fgdc:publish>
        <fgdc:onlink>
          http://www.fema.gov/sample-documents/001.html
        </fgdc:onlink>
        <fgdc:datacred>Third Party Associates, Inc.</fgdc:datacred>
        <fgdc:formname>text/xml</fgdc:formname>
   </fgdc:SummaryRecord>
</fgdc:GetRecordByIdResponse>
```

8.2.2.3 DescribeRecord Operation

The *DescribeRecord* operation allows a client to discover elements of the information model supported by the target catalogue service.

8.2.2.3.1 Request

Table 15 specifies the parameters for the *DescribeRecord* operation request. The FGDC App.-Profile column lists any restrictions or variations in comparison to that of the base specification. The encoding in the table is directly suitable for the HTTP-GET binding. An example of a *DescribeRecord* request is shown in

Listing 7. In this example, the schema which defines the information model of this profile, defined by `fgdc:metadata`, is requested. The associated *DescribeRecord* response is shown in Listing 8. The actual schema definition is omitted from the listing for space. Namespace declarations were omitted for space and readability.

Table 15 - Parameters in DescribeRecord operation request

Keyword	Data Type & Value	Optionality	FGDC App.-Profile
REQUEST	Character String. Fixed value of "DescribeRecord". The value is case insensitive.	Mandatory	Mandatory
SERVICE	Character String. Fixed values of "CSW"	Mandatory	Mandatory
VERSION	Character String. Fixed value of "2.0.1"	Mandatory	Mandatory
NAMESPACE	List of Character String, comma separated. Used to specify a namespace and its prefix. Format must be [<prefix>:]<url>. If the prefix is not specified then this is the default namespace.	Zero or one Optional Include value for each namespace If not included, all qualified names are in default namespace	Optional
TYPENAME	List of Character String, comma separated One or more qualified type names to be described	Zero or one (Optional) Default action is to describe all types known to server	Optional.
OUTPUTFORMAT	Character String Value is Mime type Supports "text/ xml" and "text/html"	Optional Default value is "text/xml"	Optional Default value is "text/xml"
SCHEMALANGUAGE	Character String	Zero or one (Optional) Default value is XMLSCHEMA	Only "XMLSCHEMA" is supported

Listing 7 – DescribeRecord Request in XML

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<csw:DescribeRecord version="2.0.1" service="CSW" outputFormat="text/xml"
        schemaLanguage="XMLSCHEMA">
   <csw:typeName>fgdc:metadata</csw:typeName>
   <csw:typeName>csw:record</csw:typeName>
</csw:DescribeRecord>
```

8.2.2.3.2 Response

Listing 8 – DescribeRecord Response

```
<csw:DescribeRecordResponse>
  <csw:SchemaComponent targetNamespace=
          " http://www.opengis.net/cat/csw/csdgm"
parentSchema="metadataEntity.xsd" schemaLanguage="XMLSCHEMA">
    <xs:schema elementFormDefault="qualified">
    ...omitted for space...
    </xs:schema>
```

```
  </csw:SchemaComponent>
  <csw:SchemaComponent targetNamespace="fgdc:http://www.fgdc.gov/csdgm/fgdc"
          parentSchema="metadataEntity.xsd" schemaLanguage="XMLSCHEMA">
    ...omitted for space...
  </csw:SchemaComponent>
  <csw:SchemaComponent targetNamespace="http://www.opengis.net/cat/csw"
parentSchema="metadataEntity.xsd" schemaLanguage="XMLSCHEMA">
    ...omitted for space...
  </csw:SchemaComponent>
</csw:DescribeRecordResponse>
```

8.2.2.4 GetDomain Operation

The *GetDomain* operation is used to obtain runtime information about the metadata record elements and request parameters. This type of runtime information is useful for generating user interfaces with meaningful pick lists or for generating query predicates that have a higher chance of identifying a result set.

8.2.2.4.1 Request

Table 16 specifies the parameters for the *GetDomain* operation request. The **FGDC App.-Profile** column lists any restrictions or variations in comparison to those of the base specification. The encoding in the table is directly suitable for the HTTP-GET binding.

An example of a *GetDomain* request in XML is shown in Listing 9. In this example, the list of possible values for the parameter name `GetRecords.ElementSetName` and the schema which defines the property name `fgdc:title` are requested. The associated response is shown in Listing 10. Namespace declarations were omitted for space and readability.

Table 16 - Parameters in GetDomain operation request

Keyword	Data Type & Value	Optionality	ISO App.-Profile
REQUEST	Character String. Fixed value of “GetDomain”. The value is case insensitive.	Mandatory	Mandatory
SERVICE	Character String. Fixed values of “CSW”	Mandatory	Mandatory
VERSION	Character String. Fixed value of “2.0.1”	Mandatory	Mandatory
OUTPUTFORMAT	Character String Value is Mime type Supports “text/ xml” and “text/html”	Optional Default value is “text/xml”	Optional Default value is “text/xml”
PARAMETERNAME	List of Character String, comma separated Unordered list of names of an interface parameter, of the form *OperationName.ParameterName*	Optional	Optional

Keyword	Data Type & Value	Optionality	ISO App.-Profile
PROPERTYNAME	List of Character String, comma separated Unordered list of names of requested properties, from the information model that the catalogue is using.	Optional	Optional

Listing 9 - GetDomain Request in XML

```
<csw:GetDomain service="CSW" version="2.0.1">
   <csw:ParameterName>GetRecords.ResultType</csw:ParameterName>
   <csw:ParameterName>GetRecords.OutputFormat</csw:ParameterName>
   <csw:ParameterName>GetRecords.ElementSetName</csw:ParameterName>
   <csw:ParameterName>GetRecordById.OutputSchema</csw:ParameterName>
   <csw:ParameterName>DescribeRecord.SchemaLanguage</csw:ParameterName>
   <csw:ParameterName>Harvest.ResourceFormat</csw:ParameterName>
   <csw:PropertyName>fgdc:title</csw:PropertyName>
</csw:GetDomain>
```

8.2.2.4.2 Response

The domain response is composed of one or more *DomainValues* elements, which contain a list of enumerated values (*ListOfValues*) or a reference to some authoritative vocabulary (*ConceptualSchema*). An example of an authoritative vocabulary might be a standard list of animal and plant species names.

If the only child element of the *DomainValue* element is the *PropertyName* or *ParameterName* element, this means that the server was unable to determine any information about the specified property or parameter.

The XML encoding of a valid response is specified in the HTTP binding of CSW 2.0 specification. Please refer to this section to determine the appropriate XML schema.

Listing 10 – GetDomain Response

```
<csw:GetDomainResponse version="2.0.1">
  <csw:DomainValues type="PropertyName" uom="">
    <csw:PropertyName>fgdc:title</csw:PropertyName>
    <csw:ConceptualScheme>
      <csw:Name>...omitted for space...</csw:Name>
      <csw:Document>...omitted for space...</csw:Document>
      <csw:Authority>...omitted for space...</csw:Authority>
    </csw:ConceptualScheme>
  </csw:DomainValues>
  <csw:DomainValues type="ParameterName" uom="">
   <csw:ParameterName>GetRecords.ResultType</csw:ParameterName>
   <csw:ListOfValues>
      <csw:Value>hits</csw:Value>
      <csw:Value>results</csw:Value>
      <csw:Value>validate</csw:Value>
   </csw:ListOfValues>
  </csw:DomainValues>
```

```
  <csw:DomainValues type="ParameterName" uom="">
   <csw:ParameterName>GetRecords.OutputFormat</csw:ParameterName>
   <csw:ListOfValues>
     <csw:Value>text/xml</csw:Value>
     <csw:Value>text/html</csw:Value>
   </csw:ListOfValues>
  </csw:DomainValues>
  <csw:DomainValues type="ParameterName" uom="">
   <csw:ParameterName>GetRecords.ElementSetName</csw:ParameterName>
   <csw:ListOfValues>
      <csw:Value>brief</csw:Value>
      <csw:Value>summary</csw:Value>
      <csw:Value>full</csw:Value>
   </csw:ListOfValues>
  </csw:DomainValues>
  <csw:DomainValues type="ParameterName" uom="">
    <csw:ParameterName>GetRecordById.OutputSchema</csw:ParameterName>
    <csw:ListOfValues>
      <csw:Value>fgdc:metadata</csw:Value>
      <csw:Value>csw:record</csw:Value>
      <csw:Value>fgdc:metadata</csw:Value>
    </csw:ListOfValues>
  </csw:DomainValues>
  <csw:DomainValues type="ParameterName" uom="">
    <csw:ParameterName>DescribeRecord.SchemaLanguage</csw:ParameterName>
    <csw:ListOfValues>
      <csw:Value>xmlschema</csw:Value>
    </csw:ListOfValues>
  </csw:DomainValues>
  <csw:DomainValues type="ParameterName" uom="">
    <csw:ParameterName>Harvest.ResourceFormat</csw:ParameterName>
    <csw:ListOfValues>
      <csw:Value>text/xml</csw:Value>
    </csw:ListOfValues>
  </csw:DomainValues>
</csw:GetDomainResponse>
```

8.2.3 CSWT Manager Interface

The CSW-Transaction Manager Interface defines operations for creating, modifying and deleting catalogue records. These operations can all performed using a *Transaction* operation. The Manager Interface also defines the *Harvest* operation, which allows for bulk transmission of one catalogue to another for purposes of populating a data repository.

8.2.3.1 Harvest Operation

The “harvestResource” operation, on the other hand, directs the catalogue to retrieve an accessible metadata record and processes it for inclusion in the catalog, perhaps periodically re-fetching the metadata records to refresh the information in the catalog. The client does not need to be aware of the information model of the catalogue when using the “harvestResource” operation, since the catalogue itself is doing the work required to process the information. The client is simply pointing to where the metadata resource to be harvested is.

8.2.3.1.1 Request

In the following tables, the parameters for harvest operation requests are specified.

The **FGDC App.-Profile** column lists any restrictions or variations in comparison to those of the base specification. The base parameters are specified in Table 18.

An example of a harvest request is shown in Listing 15. The associated response is shown in Listing 16. Namespace declarations were omitted for space and readability.

Table 17 - Parameters in Harvest operation request

Keyword	Data Type & Value	Optionality	FGDC App.-Profile
REQUEST	Character String. Fixed value of "harvestResource". The value is case insensitive.	Mandatory	Mandatory
SERVICE	Character String. Fixed value of "CSW"	Mandatory	Mandatory
VERSION	Character String. Fixed value of "2.0.1"	Mandatory	Mandatory
OUTPUTFORMAT	Character String A MIME type indicating the format that the output document should have Supports "text/ xml" and "text/html"	Optional Default value is "text/xml"	Optional Default value is "text/xml"
SOURCE	URI Reference to the type of resource being harvested.	Mandatory	Mandatory
RESOURCE FORMAT	Character String MIME type indicating format of the resource being harvested	Zero or One (Optional) Default value is "text/xml"	Zero or One (Optional) "text/xml" is only format supported by this profile.
RESOURCETYPE	The ResourceType parameter is a reference to a schema document that defines the structure of the resource being harvested.	Zero or One (Optional)	Zero or One (Optional) "fgdc:metadata" is only type supported by this profile.
HARVEST INTERVAL	Period Must conform to ISO8601 Period syntax.	Zero or One (Optional)	Not supported by this profile.

Listing 11 - Harvest Request

```
<csw:Harvest service="CSW" version="2.0.1" requestId="hOp1"
             xmlns:csw="http://www.opengis.net/cat/csw"
                xmlns:ows="http://www.opengis.net/ows"
                xmlns:ogc="http://www.opengis.net/ogc"
                xmlns:fgdc="http://www.opengis.net/cat/csw/csdgm">
  <csw:Source>http://localhost:8080/cswwar/csw.jsp</csw:Source>
  <csw:ResourceType>fgdc:metadata</csw:ResourceType>
```

```
  <csw:ResourceFormat>text/xml</csw:ResourceFormat>
</csw:Harvest>
```

8.2.3.1.2 Response

The *Harvest* response reports a summary of the harvesting operation by indicating the number of records harvested from the old data repository(s) and inserted into the new repository by the request.

Unlike the OpenGIS™ Catalogue Service Implementation Specification (2.0.1), this profile does not recommend using the *InsertResults* element to detail each record harvested. The purpose of the *Harvest* operation is to perform a mass transit of data from one catalogue to another, and a detail of each record in the list of potentially thousands of harvested records would greatly affect performance of the CSW server as well as the requesting CSW client and the data repository interfaced by the server.

Listing 12 – Harvest Response

```
<csw:HarvestResponse version="2.0.1">
  <csw:HarvestResults requested="14da8f4:feaff59c37:-7fba">
    <csw:TransactionSummary>
      <csw:totalInserted>10000</csw:totalInserted>
    </csw:TransactionSummary>
  </csw:HarvestResults>
</csw:HarvestResponse>
```

8.2.3.2 Transaction Operation

The “transaction” operation allows a client to formulate a transaction, and send it to the catalogue to be processed. The transaction may contain metadata records and elements of the information model that the catalogue understands. To use the transaction operation, the client must know something about the information model that the catalogue implements.

8.2.3.2.1 Request

In the following tables, the parameters for transaction operation requests are specified. There is no KVP encoding for transaction operation request, because there is no convenient way of encoding the transaction payloads using keyword-value pairs. Although only XML is supported, the parameters are presented in tabular form to give a better overview.

The **FGDC App.-Profile** column lists any restrictions or variations in comparison to those of the base specification. The base parameters are specified in Table 18. The *Transaction* element defines an atomic unit of work and is a container for one or more insert, update and/or delete actions which are defined in the following tables.

An example of a transaction request using an Insert, Update, and Delete is shown in Listing 13. The associated Transaction Response is shown in Listing 14. Namespace declarations were omitted for space and readability.

Table 18 - Parameters in Transaction operation request

Keyword	Data Type & Value	Optionality	FGDC App.-Profile
REQUEST	Character String. Fixed value of “Transaction”. The value is case insensitive.	Mandatory	Mandatory
SERVICE	Character String. Fixed value of “CSW”	Mandatory	Mandatory
VERSION	Character String. Fixed value of “2.0.1”	Mandatory	Mandatory
OUTPUTFORMAT	Character String A MIME type indicating the format that the output document should have	Optional. Default value is “text/xml”.	Supports “text/ xml” and “text/html”
TRANSACTION	Defines an atomic unit of work and is a container for one or more insert, update and/or delete actions.	One or more	One or more

Valid parameters for an insert operation are listed in Table 19. The *Insert* element is a container for one or more records that are to be inserted into the catalog. These record(s) must conform to the schema of the information model described by the *DescribeRecord* operation. Additionally, the schema by which the data repository is bound must be defined as the namespace schema for each record to be inserted, using the `xsi:noNamespaceSchemaLocation` attribute of the `fgdc:metadata` element as specified by the XML 1.0 specifications. An example of this can be found in the Appendix section of this document.

The verbal response attribute can be used to obtain a more detailed result set of information from the newly inserted record. If the value of the attribute is “true”, the server will return a “summary” result set from the record along with the standard transactional summary information. If the value if “false”, then a “brief” result set is returned.

Table 19 - Parameters of Insert Operation

Keyword	Data Type & Value	Optionality	ISO App.-Profile
TransactionType	Code List Value of “Insert”	Mandatory	Mandatory
REQUESTID	May be used by a client application to associate a user-defined identifier with the operation.	Zero or one	Zero or one

Keyword	Data Type & Value	Optionality	ISO App.-Profile
VERBOSERESPONSE	May be used by a client to indicate to a server the amount of detail to generate in the response. A value of FALSE means that a CSW should generate a terse or brief transaction response. A value of TRUE, or the absence of the attribute, means that the normal detailed transaction response should be generated.	Boolean, default "FALSE"	Boolean, default "FALSE" See description of request.
RECORD	Record(s) that conform to the schema of the information model described using the DescribeRecord operation. Should be bound to the CSW namespace.	Mandatory, one or more	Mandatory, one or more
HANDLE	Used to associate a mnemonic name for the purpose of error handling.	Zero or one	Zero or one

Valid parameters for an update operation are specified in Table 20. An *Update* operation may contain either a *Record* or a *RecordProperty* element to specify how to update the record(s) delineated by the constraint. If a complete record instance is provided in the request, the entire record in the catalogue will be replaced by the metadata record contained within the *Record* element. If individual record property values are specified using the *RecordProperty* element, then only those individual property values of the catalogue record will be updated.

The *RecordProperty* element contains a *Name* element, specifying the name of the record property to be updated, and a *Value* element, specifying the value to replace the existing value of the record property to be updated. The value of the *Name* element may be the FGDC or equivalent element name or the XPath expression which identifies the FGDC element, or the generic profile name for the element (See Table 2).

Table 20 - Parameters of Update Operation

Keyword	Data Type & Value	Optionality	FGDC App.-Profile
TransactionType	CodeList Value of "Update"	Mandatory	Mandatory
REQUESTID	May be used by a client application to associate a user-defined identifier with the operation.	Zero or one	Zero or one
RECORD	Complete record instance as Character String	Conditional	Conditional Should be included when "RecordProperty" is not used.

Keyword	Data Type & Value	Optionality	FGDC App.-Profile
VERBOSERESPONSE	May be used by a client to indicate to a server the amount of detail to generate in the response. A value of FALSE means that a CSW should generate a terse or brief transaction response. A value of TRUE, or the absence of the attribute, means that the normal detailed transaction response should be generated.	Boolean, default "FALSE"	Boolean, default "FALSE" Not used for Transactional operations other than Insert.
RECORDPROPERTY	A list of one or more property names with their replacement values	Conditional	Conditional Should be included when "Record" is not used.
TYPENAMES	Character String	Zero or one	Zero or one of: Service, Dataset; Dataset Collection, Application
CONSTRAINTLANGUAGE	CodeList "FILTER"	Must be specified according XML encoding rules for CSW 2.0	Must be specified according XML encoding rules for CSW 2.0
CONSTRAINTLANGUAGEVERSION	String May be used to specify a version number indicating which version of a specification the constraint conforms to.	Mandatory	Not supported by this profile.
CONSTRAINT	Character String The predicate expression specified in the language indicated by the CONSTRAINTLANGUAGE parameter.	Mandatory	Mandatory Must be specified according OGC Filter 1.0.0 encoding rules.
HANDLE	Used to associate a mnemonic name for the purpose of error handling.	Zero or one	Zero or one

1

2 Table 21 specifies the parameters which are valid for a delete operation. All record
3 instances specified by the constraint will be affected by this operation.

Table 21 - Parameters of Delete Operation

Keyword	Data Type & Value	Optionality	FGDC App.-Profile
TransactionType	CodeList Value of "Update"	Mandatory	Mandatory
REQUESTID	May be used by a client application to associate a user-defined identifier with the operation.	Zero or one	Zero or one

Keyword	Data Type & Value	Optionality	FGDC App.-Profile
TYPENAMES	Character String	Zero or one	Zero or one of: Service, Dataset; Dataset Collection, Application
VERBOSERESPONSE	May be used by a client to indicate to a server the amount of detail to generate in the response. A value of FALSE means that a CSW should generate a terse or brief transaction response. A value of TRUE, or the absence of the attribute, means that the normal detailed transaction response should be generated.	Boolean, default "FALSE"	Boolean, default "FALSE" Not used for Transactional operations other than Insert.
CONSTRAINTLANGUAGE	CodeList "FILTER"	Must be specified according XML encoding rules for CSW 2.0	Must be specified according XML encoding rules for CSW 2.0
CONSTRAINTLANGUAGEVERSION	String May be used to specify a version number indicating which version of a specification the constraint conforms to. For example, if "FILTER" is being used, this parameter could be set to "1.0.0" indicating that the filter conforms to version 1.0.0 of the Filter Encoding Implementation Specification [OGC 02-059].	Mandatory	Not supported in the profile.
CONSTRAINT	String The predicate expression specified in the language indicated by the CONSTRAINTLANGUAGE parameter.	Mandatory.	Mandatory Must be specified according OGC Filter 1.0.0 encoding rules.
HANDLE	Used to associate a mnemonic name for the purpose of error handling.	Zero or one	Zero or one

Listing 13 - Transaction Request

```
<csw:Transaction service="CSW" version="2.0.1"
                 requestId="tOpi1" verboseResponse="false">
  <csw:Insert handle="insertop1">
      <csw:Record>
          <metadata>...</metadata>
      </csw:Record>
  </csw:Insert>
  <csw:Update handle="update1" typeNames="Any">
     <csw:RecordProperty>
        <csw:Name>fgdc:pubdate</csw:Name>
        <csw:Value>20040100</csw:Value>
     </csw:RecordProperty>
     <csw:Constraint>
        <ogc:Filter>
```

```
            <ogc:PropertyIsEqualTo>
                <ogc:PropertyName>fgdc:recordID</ogc:PropertyName>
                <ogc:Literal>10655dd:fe59c5225c:-7ffe</ogc:Literal>
            </ogc:PropertyIsEqualTo>
         </ogc:Filter>
      </csw:Constraint>
   </csw:Update>
   <csw:Delete handle="delete1" typeNames="Any">
      <csw:Constraint>
         <ogc:Filter>
            <ogc:PropertyIsEqualTo>
               <ogc:PropertyName>fgdc:recordID</ogc:PropertyName>
               <ogc:Literal>10655dd:fe59c5225c:-7ffe</ogc:Literal>
            </ogc:PropertyIsEqualTo>
         </ogc:Filter>
      </csw:Constraint>
   </csw:Delete>
</csw:Transaction>
```

8.2.3.2.2 Response

The *Transaction* response reports a summary of the transaction by indicating the number of records created, updated or deleted by the request and details the results of each *Insert* operation in the *InsertResult* element of the response.

The *InsertResult* element only occurs if *Insert* operations were present in the request. If a new record is inserted into the repository, this element will contain the newly created identifier for the record.

The element **<csw:AbstractRecord>** of <**TransactionResultType>** must be substituted by the brief result set specified in section 7.2.1**.**

Listing 14 – Transaction Response

```
<csw:TransactionResponse version="2.0.1">
   <csw:TransactionSummary requestId="14da8f4:feaff59c37:-7fff">
      <csw:totalInserted>1</csw:totalInserted>
      <csw:totalUpdated>1</csw:totalUpdated>
      <csw:totalDeleted>1</csw:totalDeleted>
   </csw:TransactionSummary>
   <csw:InsertResults handleRef="insertop1">
      <fgdc:BriefRecord>
         <fgdc:publish>USGS</fgdc:publish>
         <fgdc:pubdate>19630119</fgdc:pubdate>
         <fgdc:title>USGS Inventory </fgdc:title>
         <fgdc:recordID>14da8f4:feaff59c37:-7ffe</fgdc:recordID>
      </fgdc:BriefRecord>
   </csw:InsertResults>
</csw:TransactionResponse>
```

The handle attribute of an *Insert* request may be used to correlate the specific *Insert* request instance with the related *InsertResult* element in the *Transaction* response.

8.2.4 Record locking

This profile does not define a locking interface for the underlying data repository. Instead, the repository is assumed to mediate concurrent access to catalogue records.

8.2.5 Error handling

During a request which fails, due to improper formatting or run-time exceptions, exception reports are generated and returned to the client. These reports comply with the OGC Common specification definition of exception reports. In addition to the specification, this profile defines an additional attribute for each exception generated. A unique identifier is generated, according to UID standards, which is associated with the current exception. This UID allows for easy referencing between requests and exceptions as well as between the logged information for each exception in the different log files maintained by this profile's application. Table 22 lists valid exception codes supported by this profile and their descriptions.

Table 22 – OWS Common Exceptions

Exception Code	Description of code	"locator" value
OperationNotSupported	Request is for an operation that is not supported by this server	Name of operation not supported
MissingParameterValue	Operation request does not include a parameter value, and this server did not declare a default value for that parameter	Name of missing parameter
InvalidParameterValue	Operation request contains an invalid parameter value a	Name of parameter with invalid value
VersionNegotiationFailed	List of versions in "AcceptVersions" parameter value in GetCapabilities operation request did not include any version supported by this server	None, omit "locator" parameter
InvalidUpdateSequence	Value of (optional) updateSequence parameter in GetCapabilities operation request is greater than current value of service metadata updateSequence number	None, omit "locator" parameter
NoApplicableCode	No other exceptionCode specified by this service and server applies to this exception	None, omit "locator" parameter
a When an invalid parameter value is received, it seems desirable to place the invalid value(s) in ExceptionText string(s) associated with the InvalidParameterValue value.		

8.3 Query facilities

According to the CSW 2.0.1 specification, every catalogue service should support the common query language (CQL). The XML-encoded version of CQL, based on the OGC Filter 1.0.0 specification, is supported by this profile. The plain-text encoding of this language, referred to as CQL Text, is not supported because the OGC Filter specification provides the same level of interoperability support in a formal, organized manner.

The following are supported by this profile:

- All comparison operators
- All logical operators
- Expressions:
    - Property name
    - Literal
- Spatial operators:
    - Intersect
    - Disjoint
    - BBOX

8.4 Security considerations

This profile does not discuss security issues with respect to data-sensitive operations, such as those in the CSWT interface. However, it is recommended that some level of authentication, such as HTTP Basic Authentication, be used to prevent unwanted access to the CSWT interface.

Appendix A[BW1]
(normative)

Abstract test suite

A.1 Read-only CSW

A.1.1 Basic CSW Client

A.1.1.1 Basic service elements

a) Test purpose: Verify that a CSW client satisfies the requirements for request parameter rules.
b) Test method: Generate an adequate sample of requests from the client and verify that each is a valid request.
c) Reference: 8.1
d) Test type: Basic

A.1.1.2 GetCapabilities Request

a) Test purpose: Verify that a CSW client satisfies all requirements for a GetCapabilities request.
b) Test method: Generate an adequate sample of GetCapabilities requests from the client and verify that each is a valid request.
c) Reference: 8.2.1.1
d) Test type: Basic

A.1.1.3 GetRecords Request

a) Test purpose: Verify that a CSW client satisfies all requirements for a GetRecords request.
b) Test method: Generate an adequate sample of GetRecords requests from the client and verify that each is a valid request.
c) Reference: 8.2.2.1.1
d) Test type: Basic

A.1.1.4 GetRecordById Request

a) Test purpose: Verify that a CSW client satisfies all requirements for a GetRecordById request.
b) Test method: Generate an adequate sample of GetRecordById requests from the client and verify that each is a valid request.
c) Reference: 8.2.2.2.1
d) Test type: Basic

A.1.1.5 DescribeRecord Request

a) Test purpose: Verify that a CSW client satisfies all requirements for a DescribeRecord request.
b) Test method: Generate an adequate sample of DescribeRecord requests from the client and verify that each is a valid request.

c) Reference: 8.2.2.3.1
d) Test type: Basic

A.1.1.6 GetDomain Request

a) Test purpose: Verify that a basic CSW client satisfies all requirements for a GetDomain request.
b) Test method: Generate an adequate sample of GetDomain requests from the client and verify that each is a valid request.
c) Reference: 8.2.2.4.1
d) Test type: Basic

A.1.2 CSW Server

A.1.2.1 Version negotiation

a) Test Purpose: Verify that a CSW server interface satisfies the requirements for version negotiation.
b) Test Method: Submit requests containing version number both lower than and higher than the version supported by the server. Verify that the server responses are in accord with the rules for version negotiation.
c) Reference: 8.2.1.1
d) Test Type: Basic

A.1.2.2 Request parameter rules

a) Test Purpose: Verify that a CSW server interface satisfies the requirements for request parameter rules.
b) Test Method: Generate a sample of requests from a client. Include both invalid requests and valid request that vary within the limits allowed by the rules. Verify that the server provides an appropriate response in each case.
c) Reference: 8.2.1
d) Test Type: Basic

A.1.2.3 GetCapabilities response

a) Test Purpose: Verify that a basic CSW server interface satisfies all requirements of the GetCapabilities operation.
b) Test Method: Make several GetCapabilities requests using a variety of input parameters. Verify that an appropriate response is returned in each case.
c) Reference: 8.2.1.1
d) Test Type: Basic

A.1.2.4 GetRecords response

a) Test Purpose: Verify that a basic CSW server interface satisfies all requirements of the GetRecords operation.
b) Test Method: Make several GetRecords requests using a variety of input parameters. Verify that an appropriate response is returned in each case.

c) Reference: 8.2.2.1.2
d) Test Type: Basic

A.1.2.5 GetRecordById response

a) Test Purpose: Verify that a basic CSW server satisfies all requirements of the GetRecordsById operation.
b) Test Method: Make several GetRecordsById requests using a variety of input parameters. Verify that an appropriate response is returned in each case.
c) Reference: 8.2.2.2.2
d) Test Type: Basic

A.1.2.6 DescribeRecord response

a) Test Purpose: Verify that a basic CSW server interface satisfies all requirements of the DescribeRecord operation.
b) Test Method: Make several DescribeRecord requests using a variety of input parameters. Verify that an appropriate response is returned in each case.
c) Reference: 0
d) Test Type: Basic

A.1.2.7 GetDomain response

a) Test Purpose: Verify that a basic CSW server interface satisfies all requirements of the GetDomain operation.
b) Test Method: Make several GetDomain requests using a variety of input parameters. Verify that an appropriate response is returned in each case.
c) Reference: 8.2.2.4.2
d) Test Type: Basic

A.2 Transactional CSW

A.2.1 Client

A.2.1.1 Transaction request

a) Test Purpose: Verify that a CSW client satisfies all requirements for a Transaction request.
b) Test Method: Generate an adequate sample of Transaction requests from the client and verify that each is a valid request.
c) Reference: 8.2.3.1.1
d) Test Type: Basic

A.2.1.2 Harvest request

a) Test Purpose: Verify that a CSW client satisfies all requirements for a Harvest request.
b) Test Method: Generate an adequate sample of Harvest requests from the client and verify that each is a valid request.
c) Reference:

d) Test Type: Basic

A.2.2 CSW Server

A.2.2.1 Transaction response

a) Test Purpose: Verify that a CSW server interface satisfies all requirements for a Transaction operation.
b) Test Method: Make several Transaction requests using a variety of input parameters. Verify that an appropriate response is returned in each case.
c) Reference: 0
d) Test Type: Basic

A.2.2.2 Harvest response

a) Test Purpose: Verify that a CSW server interface satisfies all requirements for a Harvest operation.
b) Test Method: Make several Harvest requests using a variety of input parameters. Verify that an appropriate response is returned in each case.
c) Reference:
d) Test Type: Basic

Appendix B
(informative)

Design rationale

This section of the profile discusses decisions made during the design of a CSW 2.0.1-compliant catalogue server, referred to as "CSW4FGDC".

1. Information Model

This section details the decisions made regarding support for an information model based on FGDC metadata content.

1.1 The OpenGIS® Catalogue Implementation Service Specification (2.0.1) states that all web services must support a common set of operations and operation parameters. It does not, however, detail a mandatory set of metadata elements that must be supported. Several implementations of the specifications have been based around the Dublin Core (DC) set of elements, but this profile is designed to cover a catalogue service based on FGDC elements.

Despite the design for FGDC, this profile recommends any implementation of this design support the inherent FGDC metadata elements as well as the equivalent DC elements as they pertain to the supported FGDC elements. To overcome problems in mapping the elements of the two models to each other in a manner suitable for a catalogue service, this profile assumes that certain profile-specific elements may be created which serve as an intermediate mapping between FGDC and DC elements that do not directly map to each other. For instance, DC defines a single-value element named "source" while FGDC defines a set of compound elements named "source". The proper mapping might be dc:source to the "title" element defined within the fgdc:source element. However, this is confusing with the fgdc:title element defined in the identification section of the record. Therefore a new element designated "fgdc:source" is created to map dc:source to the title element within fgdc:source. All requests for this element should be made using the "fgdc" qualification to ensure the proper values are extracted. Similar tactics should be used with further information model discrepancies to ensure data integrity and metadata content support.

2. Harvest Records

This section describes the decisions reached during the design of the harvest records feature of CSW4FGDC.

2.1 The OpenGIS® Catalogue Implementation Service Specification (2.0.1) details the optional usage of the *verboseResponse* attribute of the *HarvestRecords* operation to allow for a "brief" or "summary" result set description of each record harvested as a result of the harvest request. Because a harvest request can potentially affect several thousand records, this profile omits the usage of a result set description for harvested records. The normal description detailing the total number of harvested records is still required, but the use of individual record descriptions is not recommended.

Appendix C
(informative)

FEMA MapMod Catalog Implementation Notes

This appendix describes implementation decisions that were made in the design of the US FEMA NFIP metadata catalog (accessible at http://hazards.fema.gov/metadata/catalog/csw) and the US NDEP and NDOP Tracking System metadata catalog (accessible at http://hazards.fema.gov/metadata/ier/csw). This Appendix is intended to be informative to others who are implementing this profile.

C.1 Information Model

The following section describes issues that are a result of the inherent information model and its mapping to the OGC Core sets of queryable and returnable elements.

C.1.1 Record Schemas

MapMod Catalog Server supports the OGC Core sets of queryable and returnable elements as required by the OpenGIS® Catalogue Service Implementation Specification (2.0.1) (http://www.opengeospatial.org/standards/cat) and defined by the Specifications record format schema, 'record.xsd'. For FGDC metadata support, MapMod Catalog also supports another version of this schema, 'fgdc-record.xsd', which defines alternative sets of returnable elements.

C.1.1.1 CSW:Record

OGC defines three result sets which must be supported by all Catalogue implementations. The metadata elements contained in these result sets belong to the Dublin Core set of metadata terms (http://dublincore.org/documents/dcmi-terms/).

C.1.1.2 FGDC:Record

MapMod Catalog Server defines alternative result sets to the three mandatory core sets. The metadata elements contained therein belong to the FGDC metadata standard (http://www.fgdc.gov/metadata/csdgm/) and a set defined by the FGDC Application Profile for CSW 2.0.

C.1.2 Unique Identifiers

The Dublin Core metadata term `dc:identifier` can potentially be used as the unique identifier for records stored in the repository. However, there is no suitable mapping of this DC term to an appropriate FGDC metadata term, so the unique identifier used by the CSW Server is the primary key column in the repository's data table. This key is generated by the server during insert operations and is guaranteed to be unique with a suitable margin of error. See the section below for more details. Because of the need for a primary key, this implementation of the CSW Server assumes that all repository tables will contain one primary key column and one XML metadata column.

The ids generated by the system upon the insertion of records into the repository are created using the Java™ UID class. This class generates unique keys by combining a virtual machine (VM) identifier, a `long` representation of the time during generation, and a random number (to distinguish same-VM, same-time UIDs) to ensure that the key is unique. See the Java™ 1.4.2 API Specification for more information on the UID class.

C.1.3 Bounding Coordinates

The FGDC element `fgdc:bounding` contains four sub-elements which represent bounding coordinates. Unlike with the sub-elements of `fgdc:keywords`, these four sub-elements appear only once each in the XML metadata record. They must still be handled differently than the rest of the metadata elements of the information model, though.

- If the four coordinates are requested individually, each utilizes their associated XPath expressions to extract the requested information in the same fashion as the rest of the elements in the information model.
- If the coordinates are requested through a single `fgdc:bounding` element request, the XPath expression associated with this single element is used which contains the XPath predicate symbol '*' which identifies all sub-elements of the current element at the next lowest level of the XML Document Object Model (DOM) tree.
- The resulting data returned from the query execution must be transformed to match the record schemas supported by this profile.

C.2 Compliance Issues

The following section describes any deviation by this profile from the OpenGIS® Catalog Service Implementaiton Specification (2.0.1) (http://www.opengeospatial.org/standards/cat).

C.2.1 Filter Support

The following sections describe the compliance of the MapMod Catalog Server constraint language support.

C.2.1.1 CQL Text

OGC Filter, the XML-encoded version of CQL Text, provides a formal, organized representation of query constraints and should be used when constructing requests. CQL Text is considered optional by this profile.

C.2.1.2 Function Operation

OGC Filter-based function operations are not supported by this profile as the FGDC metadata elements assumed by this profile do not allow for function-based queries.

C.2.2 XPath Support

MapMod Catalog Server supports XPath expressions as references of queryable elements in request files as per the OGC Filter Specifications 1.0.0 with a few exceptions:

- Partial expressions (e.g., abbreviated relative location paths as per the OGC Filter 1.0.0 Specifications Document) are not supported by this profile. Relative

location paths (RLPs) support requires the loading and maintenance of elements of the FGDC information model which are not used by the discovery process (e.g., non-members of the core queryable/returnable sets). This leads to inefficient information model processing and therefore longer request processing times. Because of this issue and the limited number of elements supported by the queryable and returnable result sets of MapMod Catalog, this profile does not support the abbreviated relative location path requirement of the OGC Filter 1.0.0 Specification.

- This profile assumes the use of namespaces for distinguishing elements of the information model (as in `fgdc:title` or the equivalent `dc:title`) but does not assume the use of namespaces when processing XPath expressions (as in `/metadata/idinfo/citeinfo/pubdate`). The reason for this is because the names of the elements can be similar across the FGDC and DC metadata models (as in the case of the *title* element), but the XPath expression can only map to the FGDC metadata element, and no two separate elements in the FGDC metadata model share the same full XPath expression. Also, the records stored in the repository are assumed to conform to the FGDC metadata schema, 'fgdc-std-001-1998-csw.xsd', and that only FGDC metadata elements will be encountered in the XML documents stored in the repository. If a mixed schema or identification through DC XPath expressions were to be supported by the MapMod Catalog Server, namespaces would be needed.

Appendix D
(normative)

Schemas and Sample XML Files

D.1 FGDC CSDGM Metadata

D.1.1 Schema for FGDC CSDGM

Refer to the full annotated XML schema defining FGDC metadata elements available at http://www.csc.noaa.gov/metadata/xml/fgdc-std-001-1998-ann.zip.

D.1.2 Sample FGDC CSDGM metadata document

The following is an example of a valid FGDC CSDGM metadata record that validates to the schema referenced above.

```
        <metadata xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
          <idinfo>
            <citation>
              <citeinfo>
                <origin>Floodplain Mapping Program</origin>
                <pubdate>20040901</pubdate>
                <title>River Basin; 50 ft Hydrologically Corrected Digital
Elevation Model, September 2004</title>
                <geoform>Framework-Elevation-Regular Grid</geoform>
                <onlink>String</onlink>
                <lworkcit>
                  <citeinfo>
                    <origin>String</origin>
                    <pubdate>2004</pubdate>
                    <title>2004-0001</title>
                  </citeinfo>
                </lworkcit>
              </citeinfo>
            </citation>
            <descript>
              <abstract>50 ft Hydrologically Corrected Digital Elevation Model
(DEM) in ASCII raster format. DEMs were developed from Light Detection and
Ranging (LIDAR) data acquired February through April 2003, with partial re-
flights for gap data in December 2003.  Cell values in the Digital Elevation
Model were derived from a Triangulated Irregular Network (TIN) produced from
the bare earth mass points and breaklines. Individual cell values are based on
an average of 25 points inside each 50 ft DEM cell.  The data are organized in
10,000 ft x 10,000 ft tiles. Specific information about individual data tiles
is included in the data delivery index.
              </abstract>
              <purpose>THIS IS A SAMPLE METADATA RECORD THAT IN NO WAY
DESCRIBES ACTUAL GEOSPATIAL DATA</purpose>
            </descript>
            <timeperd>
              <timeinfo>
                <sngdate>
                  <caldate>2006</caldate>
                </sngdate>
              </timeinfo>
              <current>String</current>
```

```
            </timeperd>
            <status>
              <progress>Complete</progress>
              <update>String</update>
            </status>
            <spdom>
              <bounding>
                <westbc>-88.23211</westbc>
                <eastbc>-87.89283</eastbc>
                <northbc>41.13321</northbc>
                <southbc>40.00134</southbc>
              </bounding>
            </spdom>
            <keywords>
              <theme>
                <themekt>String</themekt>
                <themekey>DEM</themekey>
                <themekey>Elevation</themekey>
              </theme>
              <place>
                <placekt>String</placekt>
                <placekey>Lincoln County</placekey>
                <placekey>String</placekey>
              </place>
            </keywords>
            <accconst>Restricted</accconst>
            <useconst>String</useconst>
            <ptcontac>
              <cntinfo>
                <cntperp>
                  <cntper>String</cntper>
                  <cntorg>String</cntorg>
                </cntperp>
                <cntaddr>
                  <addrtype>String</addrtype>
                  <city>String</city>
                  <state>String</state>
                  <postal>String</postal>
                  <country>String</country>
                </cntaddr>
                <cntvoice>String</cntvoice>
                <cntemail>String</cntemail>
              </cntinfo>
            </ptcontac>
            <native>String</native>
          </idinfo>
          <dataqual>
            <logic>String</logic>
            <complete>String</complete>
            <lineage>
              <srcinfo>
                <srccite>
                  <citeinfo>
                    <origin>String</origin>
                    <pubdate>2006</pubdate>
                    <title>String</title>
                  </citeinfo>
                </srccite>
                <typesrc>String</typesrc>
                <srctime>
                  <timeinfo>
                    <sngdate>
                      <caldate>2006</caldate>
```

```
                    </sngdate>
                  </timeinfo>
                  <srccurr>String</srccurr>
                </srctime>
                <srccitea>token1</srccitea>
                <srccontr>String</srccontr>
              </srcinfo>
              <procstep>
                <procdesc>String</procdesc>
                <procdate>2006</procdate>
              </procstep>
            </lineage>
          </dataqual>
          <spdoinfo>
            <direct>Point</direct>
            <ptvctinf>
              <sdtsterm>
                <sdtstype>Point</sdtstype>
              </sdtsterm>
              <sdtsterm>
                <sdtstype>Point</sdtstype>
              </sdtsterm>
            </ptvctinf>
          </spdoinfo>
          <spref>
            <horizsys>
              <planar>
                <mapproj>
                  <mapprojn>Lambert Conformal Conic</mapprojn>
                  <lambertc>
                    <stdparll>0.0</stdparll>
                    <longcm>0.0</longcm>
                    <latprjo>0.0</latprjo>
                    <feast>0.0</feast>
                    <fnorth>0.0</fnorth>
                  </lambertc>
                </mapproj>
                <planci>
                  <plance>coordinate pair</plance>
                  <coordrep>
                    <absres>1.0</absres>
                    <ordres>1.0</ordres>
                  </coordrep>
                  <plandu>feet</plandu>
                </planci>
              </planar>
              <planar>
                <gridsys>
                  <gridsysn>State Plane Coordinate System 1983</gridsysn>
                  <spcs>
                    <spcszone>1000</spcszone>
                    <lambertc>
                      <stdparll>1</stdparll>
                      <longcm>1</longcm>
                      <latprjo>1</latprjo>
                      <feast>1</feast>
                      <fnorth>1</fnorth>
                    </lambertc>
                  </spcs>
                </gridsys>
                <planci>
                  <plance>coordinate pair</plance>
                  <coordrep>
```

```
                    <absres>1.0</absres>
                    <ordres>1.0</ordres>
                  </coordrep>
                  <plandu>feet</plandu>
                </planci>
              </planar>
              <geodetic>
                <horizdn>String</horizdn>
                <ellips>String</ellips>
                <semiaxis>3.14159265358979</semiaxis>
                <denflat>3.14159265358979</denflat>
              </geodetic>
            </horizsys>
            <vertdef>
              <altsys>
                <altdatum>String</altdatum>
                <altres>3.14159265358979</altres>
                <altunits>String</altunits>
                <altenc>Explicit elevation coordinate included with horizontal
coordinates</altenc>
              </altsys>
            </vertdef>
          </spref>
          <eainfo>
            <detailed>
              <enttyp>
                <enttypl>Bare Earth Surface</enttypl>
                <enttypd>String</enttypd>
                <enttypds>String</enttypds>
              </enttyp>
            </detailed>
            <overview>
              <eaover>String</eaover>
              <eadetcit>String</eadetcit>
            </overview>
          </eainfo>
          <distinfo>
            <distrib>
              <cntinfo>
                <cntperp>
                  <cntper>String</cntper>
                  <cntorg>String</cntorg>
                </cntperp>
                <cntaddr>
                  <addrtype>String</addrtype>
                  <address>String</address>
                  <city>String</city>
                  <state>String</state>
                  <postal>String</postal>
                  <country>String</country>
                </cntaddr>
                <cntvoice>String</cntvoice>
                <cntemail>String</cntemail>
              </cntinfo>
            </distrib>
            <distliab>String</distliab>
            <stdorder>
              <nondig>String</nondig>
              <fees>String</fees>
            </stdorder>
            <stdorder>
              <nondig>String</nondig>
              <fees>String</fees>
```

```
            </stdorder>
          </distinfo>
          <distinfo>
            <distrib>
              <cntinfo>
                <cntperp>
                  <cntper>String</cntper>
                  <cntorg>String</cntorg>
                </cntperp>
                <cntaddr>
                  <addrtype>String</addrtype>
                  <address>String</address>
                  <city>String</city>
                  <state>String</state>
                  <postal>String</postal>
                  <country>String</country>
                </cntaddr>
                <cntvoice>String</cntvoice>
                <cntemail>String</cntemail>
              </cntinfo>
            </distrib>
            <distliab>String</distliab>
            <stdorder>
              <nondig>String</nondig>
              <fees>String</fees>
            </stdorder>
          </distinfo>
          <metainfo>
            <metd>20060101</metd>
            <metc>
              <cntinfo>
                <cntperp>
                  <cntper>String</cntper>
                  <cntorg>String</cntorg>
                </cntperp>
                <cntaddr>
                  <addrtype>String</addrtype>
                  <address>String</address>
                  <city>String</city>
                  <state>String</state>
                  <postal>String</postal>
                  <country>String</country>
                </cntaddr>
                <cntvoice>String</cntvoice>
                <cntemail>String</cntemail>
              </cntinfo>
            </metc>
            <metstdn>String</metstdn>
            <metstdv>String</metstdv>
            <metextns>
              <onlink>String</onlink>
              <metprof>String</metprof>
            </metextns>
            <metextns>
              <onlink>String</onlink>
              <metprof>String</metprof>
            </metextns>
          </metainfo>
        </metadata>
```

D.2 FGDC Application Profile Result Set Schemas

This section describes the result sets defined by this profile.

D.2.1 Schemas

In the following sections, the schema fragments which define the various result sets for this profile are listed.

D.2.1.1 Brief

```
<xsd:complexType name="BriefRecordType" final="#all">
  <xsd:complexContent>
    <xsd:extension base="csw:AbstractRecordType">
      <xsd:sequence>
       <xsd:element ref="fgdc:recordID"/>
       <xsd:element ref="fgdc:title"/>
       <xsd:element ref="fgdc:metd"/>
       <xsd:element ref="fgdc:publish"/>
     </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
```

D.2.1.2 Summary

```
<xsd:complexType name="SummaryRecordType" final="#all">
  <xsd:complexContent>
    <xsd:extension base="csw:BriefRecordType">
     <xsd:sequence>
       <xsd:element ref="fgdc:origin"/>
       <xsd:element ref="fgdc:keywords"/>
       <xsd:element ref="fgdc:abstract"/>
       <xsd:element ref="fgdc:datacred"/>
       <xsd:element ref="fgdc:direct"/>
       <xsd:element ref="fgdc:formname"/>
       <xsd:element ref="fgdc:source"/>
       <xsd:element ref="fgdc:onlink"/>
       <xsd:element ref="fgdc:bounding"/>
       <xsd:element ref="csw:rights"/>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
```

D.2.1.3 Full

```
<xsd:complexType name="FullRecordType" final="#all">
  <xsd:complexContent>
    <xsd:extension base="fgdc:FGDCRecordType">
     <xsd:sequence>
       <xsd:element ref="fgdc:recordID"/>
     </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>
```

D.2.2 Sample FGDC Result Sets

This section provides sample records in the result set record format specified by this profile.

D.2.2.1 Brief

```
<?xml version="1.0" encoding="UTF-8"?>
<csw:GetRecordsResponse xmlns:csw="http://www.opengis.net/cat/csw"
xmlns:fgdc="http://www.opengis.net/cat/csw/csdgm" version="2.0.0">
  <csw:RequestId>3df7c6fe:10e5c4d9348:-7fed</csw:RequestId>
  <csw:SearchStatus>complete</csw:SearchStatus>
  <csw:SearchResults resultSetId="3df7c6fe:10e5c4d9348:-7fee"
outputFormat="text/xml" outputSchema="fgdc:metadata" numberOfRecordsMatched="6"
numberOfRecordsReturned="1" nextRecord="2" ElementSetName="brief">
    <fgdc:BriefRecord>
      <fgdc:title>River Basin; 50 ft Hydrologically Corrected Digital Elevation
Model, September 2004</fgdc:title>
      <fgdc:publish />
      <fgdc:metd>20060101</fgdc:metd>
      <fgdc:recordID>6cb4678f10807965a2bn8000</fgdc:recordID>
    </fgdc:BriefRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

D.2.2.2 Summary

```
<?xml version="1.0" encoding="UTF-8"?>
<csw:GetRecordsResponse xmlns:csw="http://www.opengis.net/cat/csw"
xmlns:fgdc="http://www.opengis.net/cat/csw/csdgm" version="2.0.0">
  <csw:RequestId>3df7c6fe:10e5c4d9348:-7ff1</csw:RequestId>
  <csw:SearchStatus>complete</csw:SearchStatus>
  <csw:SearchResults resultSetId="3df7c6fe:10e5c4d9348:-7ff2"
outputFormat="text/xml" outputSchema="fgdc:metadata" numberOfRecordsMatched="6"
numberOfRecordsReturned="1" nextRecord="2" ElementSetName="summary">
    <fgdc:SummaryRecord>
      <fgdc:direct>Point</fgdc:direct>
      <fgdc:abstract>50 ft Hydrologically Corrected Digital Elevation Model
(DEM) in ASCII raster format. DEMs were developed from Light Detection and
Ranging (LIDAR) data acquired February through April 2003, with partial re-
flights for gap data in December 2003.  Cell values in the Digital Elevation
Model were derived from a Triangulated Irregular Network (TIN) produced from
the bare earth mass points and breaklines. Individual cell values are based on
an average of 25 points inside each 50 ft DEM cell.  The data are organized in
10,000 ft x 10,000 ft tiles. Specific information about individual data tiles
is included in the data delivery index.</fgdc:abstract>
      <fgdc:title>River Basin; 50 ft Hydrologically Corrected Digital Elevation
Model, September 2004</fgdc:title>
      <fgdc:useconst>String</fgdc:useconst>
      <fgdc:datacred />
      <csw:source>String</csw:source>
      <csw:source>String</csw:source>
      <fgdc:accconst>Restricted</fgdc:accconst>
      <fgdc:keywords>
        <fgdc:themekey>DEM</fgdc:themekey>
        <fgdc:themekey>Elevation</fgdc:themekey>
        <fgdc:placekey>Lincoln County</fgdc:placekey>
        <fgdc:stratkey />
        <fgdc:tempkey />
      </fgdc:keywords>
      <fgdc:publish />
      <fgdc:metd>20060101</fgdc:metd>
      <fgdc:cntvoice1>String</fgdc:cntvoice1>
```

```
      <fgdc:bounding>
        <fgdc:westbc>-88.2321</fgdc:westbc>
        <fgdc:eastbc>-87.8928</fgdc:eastbc>
        <fgdc:northbc>41.1332</fgdc:northbc>
        <fgdc:southbc>40.0013</fgdc:southbc>
      </fgdc:bounding>
      <fgdc:origin>Floodplain Mapping Program</fgdc:origin>
      <fgdc:onlink>String</fgdc:onlink>
      <fgdc:recordID>6cb4678f10807965a2bn8000</fgdc:recordID>
      <fgdc:formname />
    </fgdc:SummaryRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

D.2.2.3 Full

```
<?xml version="1.0" encoding="UTF-8"?>
<csw:GetRecordsResponse xmlns:csw="http://www.opengis.net/cat/csw"
xmlns:fgdc="http://www.opengis.net/cat/csw/csdgm" version="2.0.0">
  <csw:RequestId>3df7c6fe:10e5c4d9348:-7fef</csw:RequestId>
  <csw:SearchStatus>complete</csw:SearchStatus>
  <csw:SearchResults resultSetId="3df7c6fe:10e5c4d9348:-7ff0"
outputFormat="text/xml" outputSchema="fgdc:metadata" numberOfRecordsMatched="6"
numberOfRecordsReturned="1" nextRecord="2" ElementSetName="full">
    <fgdc:FullRecord>
      <fgdc:recordID>6cb4678f10807965a2bn8000</fgdc:recordID>
      <fgdc:FGDCRecord>
For space considerations full response not shown. Insert valid FGDC CSDGM
metadata content here (see clause D.1.2 above).
      </fgdc:FGDCRecord>
    </fgdc:FullRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

D.3 CSW Record Result Sets

This section describes the CSW “OGC Core” record format.

D.3.1 Schemas

In the following sections, the schema fragments which define the various result sets for the OGC Core profile are listed.

D.3.1.1 Brief

```
<xsd:complexType name="BriefRecordType">
   <xsd:complexContent>
      <xsd:extension base="csw:AbstractRecordType">
         <xsd:sequence>
            <xsd:element ref="dc:identifier" />
            <xsd:element ref="dc:type" />
         </xsd:sequence>
      </xsd:extension>
   </xsd:complexContent>
</xsd:complexType>
```

D.3.1.2 Summary

```
<xsd:element name="SummaryRecord" type="csw:SummaryRecordType"
    substitutionGroup="csw:AbstractRecord" />
  <xsd:complexType name="SummaryRecordType">
    <xsd:complexContent>
      <xsd:extension base="csw:AbstractRecordType">
        <xsd:sequence>
          <xsd:choice minOccurs="1" maxOccurs="unbounded">
            <xsd:element ref="dc:identifier" />
            <xsd:element ref="dc:type" />
            <xsd:element ref="dc:title" />
            <xsd:element ref="dc:subject" />
            <xsd:element ref="dc:format" />
            <xsd:element ref="dc:relation" />
            <xsd:element ref="dct:modified" />
            <xsd:element ref="dct:abstract" />
            <xsd:element ref="dct:spatial" />
          </xsd:choice>
        </xsd:sequence>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
```

D.3.1.1 Full

Full result sets are always returned in FGDC format. Refer to section D.2.1.3 for this schema.

D.3.2 Sample CSW Record Result Sets

This section provides sample records in CSW result set record format.

D.3.2.1 Brief

```
<?xml version="1.0" encoding="UTF-8"?>
<csw:GetRecordsResponse xmlns:csw="http://www.opengis.net/cat/csw"
xmlns:dc="http://purl.org/dc/elements/1.1/" version="2.0.0">
  <csw:RequestId>3df7c6fe:10e5c4d9348:-7feb</csw:RequestId>
  <csw:SearchStatus>complete</csw:SearchStatus>
  <csw:SearchResults resultSetId="3df7c6fe:10e5c4d9348:-7fec"
outputFormat="text/xml" outputSchema="csw:record" numberOfRecordsMatched="6"
numberOfRecordsReturned="1" nextRecord="2" ElementSetName="brief">
    <csw:BriefRecord>
      <dc:type>Point</dc:type>
      <dc:identifier>6cb4678f10807965a2bn8000</dc:identifier>
    </csw:BriefRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

D.3.2.2 Summary

```
<?xml version="1.0" encoding="UTF-8"?>
```

```
<csw:GetRecordsResponse xmlns:csw="http://www.opengis.net/cat/csw"
xmlns:fgdc="http://www.opengis.net/cat/csw/csdgm"
xmlns:dc="http://purl.org/dc/elements/1.1/"
xmlns:dct="http://purl.org/dc/terms/" version="2.0.0">
  <csw:RequestId>3df7c6fe:10e5c4d9348:-7fe9</csw:RequestId>
  <csw:SearchStatus>complete</csw:SearchStatus>
  <csw:SearchResults resultSetId="3df7c6fe:10e5c4d9348:-7fea"
outputFormat="text/xml" outputSchema="csw:record" numberOfRecordsMatched="6"
numberOfRecordsReturned="1" nextRecord="2" ElementSetName="summary">
    <csw:SummaryRecord>
      <dc:type>Point</dc:type>
      <dct:abstract>50 ft Hydrologically Corrected Digital Elevation Model
(DEM) in ASCII raster format. DEMs were developed from Light Detection and
Ranging (LIDAR) data acquired February through April 2003, with partial re-
flights for gap data in December 2003.  Cell values in the Digital Elevation
Model were derived from a Triangulated Irregular Network (TIN) produced from
the bare earth mass points and breaklines. Individual cell values are based on
an average of 25 points inside each 50 ft DEM cell.  The data are organized in
10,000 ft x 10,000 ft tiles. Specific information about individual data tiles
is included in the data delivery index.</dct:abstract>
      <dc:date>20040901</dc:date>
      <dc:title>River Basin; 50 ft Hydrologically Corrected Digital Elevation
Model, September 2004</dc:title>
      <dc:contributor />
      <dc:source>String</dc:source>
      <dc:subject>
        <fgdc:themekey>DEM</fgdc:themekey>
        <fgdc:themekey>Elevation</fgdc:themekey>
        <fgdc:placekey>Lincoln County</fgdc:placekey>
        <fgdc:stratkey />
        <fgdc:tempkey />
      </dc:subject>
      <dc:publisher />
      <dc:rights>
        <fgdc:accconst>Restricted</fgdc:accconst>
        <fgdc:useconst>String</fgdc:useconst>
      </dc:rights>
      <dc:modified>20060101</dc:modified>
      <dct:spatial>
        <fgdc:westbc>-88.2321</fgdc:westbc>
        <fgdc:eastbc>-87.8928</fgdc:eastbc>
        <fgdc:northbc>41.1332</fgdc:northbc>
        <fgdc:southbc>40.0013</fgdc:southbc>
      </dct:spatial>
      <dc:creator>Floodplain Mapping Program</dc:creator>
      <dc:relation>String</dc:relation>
      <dc:identifier>6cb4678f10807965a2bn8000</dc:identifier>
      <dc:format />
    </csw:SummaryRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

D.3.2.3 Full

```
<?xml version="1.0" encoding="UTF-8"?>
<csw:GetRecordsResponse xmlns:csw="http://www.opengis.net/cat/csw"
xmlns:fgdc="http://www.opengis.net/cat/csw/csdgm" version="2.0.0">
  <csw:RequestId>3df7c6fe:10e5c4d9348:-7fe1</csw:RequestId>
  <csw:SearchStatus>complete</csw:SearchStatus>
```

```
  <csw:SearchResults resultSetId="3df7c6fe:10e5c4d9348:-7fe2"
outputFormat="text/xml" outputSchema="csw:record" numberOfRecordsMatched="6"
numberOfRecordsReturned="1" nextRecord="2" ElementSetName="full">
    <csw:FullRecord>
      <csw:recordid>6cb4678f10807965a2bn8000</csw:recordid>
      <fgdc:FGDCRecord>
For space considerations full response not shown. Insert valid FGDC CSDGM
metadata content here (see clause D.1.2 above).
      </fgdc:FGDCRecord>
    </csw:FullRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

D.4 GEO Result Sets

This section describes the record format specified by the GEO profile -- http://www.blueangeltech.com/Standards/GeoProfile/geo22.htm .

D.4.1 Schemas

In the following sections, the schema fragments which define the various result sets for the GEO profile are listed.

D.4.1.1 Brief

```
<xsd:complexType name="BriefRecordType">
   <xsd:complexContent>
      <xsd:extension base="csw:AbstractRecordType">
         <xsd:sequence>
            <xsd:element ref="fgdc:title" />
         </xsd:sequence>
      </xsd:extension>
   </xsd:complexContent>
</xsd:complexType>
```

D.4.1.2 Summary

```
<xsd:complexType name="BriefRecordType">
   <xsd:complexContent>
      <xsd:extension base="csw:AbstractRecordType">
         <xsd:sequence>
            <xsd:element ref="csw:browse" />
            <xsd:element ref="fgdc:attrlabl" />
            <xsd:element ref="fgdc:geoform" />
            <xsd:element ref="csw:dsgpoly" maxOccurs="unbounded" />
            <xsd:element ref="fgdc:begdate" />
            <xsd:element ref="fgdc:enttypl" />
            <xsd:element ref="fgdc:keywords" />
            <xsd:element ref="fgdc:bounding" />
            <xsd:element ref="fgdc:pubdate" />
            <xsd:element ref="fgdc:purpose" />
            <xsd:element ref="fgdc:enddate" />
            <xsd:element ref="fgdc:extent" />
            <xsd:element ref="fgdc:onlink" />
         </xsd:sequence>
      </xsd:extension>
```

```
   </xsd:complexContent>
</xsd:complexType>
```

D.4.1.3 Full

Full result sets are always returned in FGDC format. Refer to section D.2.1.3 for this schema.

D.4.2 Sample GEO Result Sets

This section provides sample records in GEO result set record format.

D.4.2.1 Brief

```
<?xml version="1.0" encoding="UTF-8"?>
<csw:GetRecordsResponse xmlns:csw="http://www.opengis.net/cat/csw"
xmlns:fgdc="http://www.opengis.net/cat/csw/csdgm"
xmlns:geo="http://www.opengis.net/cat/csw/csdgm/geo" version="2.0.0">
  <csw:RequestId>3df7c6fe:10e5c4d9348:-7fe5</csw:RequestId
  <csw:SearchStatus>complete</csw:SearchStatus>
  <csw:SearchResults resultSetId="3df7c6fe:10e5c4d9348:-7fe6"
outputFormat="text/xml" outputSchema="geo:metadata" numberOfRecordsMatched="6"
numberOfRecordsReturned="1" nextRecord="2" ElementSetName="brief">
    <geo:BriefRecord>
      <fgdc:title>River Basin; 50 ft Hydrologically Corrected Digital Elevation
Model, September 2004</fgdc:title>
    </geo:BriefRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

D.4.2.2 Summary

```
<?xml version="1.0" encoding="UTF-8"?>
<csw:GetRecordsResponse xmlns:csw="http://www.opengis.net/cat/csw"
xmlns:fgdc="http://www.opengis.net/cat/csw/csdgm"
xmlns:geo="http://www.opengis.net/cat/csw/csdgm/geo" version="2.0.0">
  <csw:RequestId>3df7c6fe:10e5c4d9348:-7fe7</csw:RequestId>
  <csw:SearchStatus>complete</csw:SearchStatus>
  <csw:SearchResults resultSetId="3df7c6fe:10e5c4d9348:-7fe8"
outputFormat="text/xml" outputSchema="geo:metadata" numberOfRecordsMatched="6"
numberOfRecordsReturned="1" nextRecord="2" ElementSetName="summary">
    <geo:SummaryRecord>
      <fgdc:pubdate>20040901</fgdc:pubdate>
      <fgdc:enttypl>Bare Earth Surface</fgdc:enttypl>
      <fgdc:enttypl>String</fgdc:enttypl>
      <fgdc:enddate />
      <geo:extent>000000.3841</geo:extent>
      <fgdc:dsgpoly>
        <fgdc:dsgpolyo>
          <fgdc:grngpoino>
            <fgdc:gringlato />
            <fgdc:gringlongo />
          </fgdc:grngpoino>
        </fgdc:dsgpolyo>
        <fgdc:dsgpolyx>
          <fgdc:grngpoinx>
            <fgdc:gringlatx />
            <fgdc:gringlongx />
          </fgdc:grngpoinx>
```

```
        </fgdc:dsgpolyx>
      </fgdc:dsgpoly>
      <fgdc:browse>
        <fgdc:browsen />
        <fgdc:browsed />
        <fgdc:browset />
      </fgdc:browse>
      <fgdc:geoform>Framework-Elevation-Regular Grid</fgdc:geoform>
      <fgdc:purpose>THIS IS A SAMPLE METADATA RECORD THAT IN NO WAY DESCRIBES
ACTUAL GEOSPATIAL DATA</fgdc:purpose>
      <fgdc:keywords>
        <fgdc:themekey>DEM</fgdc:themekey>
        <fgdc:themekey>Elevation</fgdc:themekey>
        <fgdc:placekey>Lincoln County</fgdc:placekey>
        <fgdc:stratkey />
        <fgdc:tempkey />
      </fgdc:keywords>
      <fgdc:attrlabl />
      <fgdc:begdate />
      <fgdc:bounding>
        <fgdc:westbc>-88.2321</fgdc:westbc>
        <fgdc:eastbc>-87.8928</fgdc:eastbc>
        <fgdc:northbc>41.1332</fgdc:northbc>
        <fgdc:southbc>40.0013</fgdc:southbc>
      </fgdc:bounding>
      <fgdc:onlink>String</fgdc:onlink>
    </geo:SummaryRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```

D.4.2.3 Full

```
<?xml version="1.0" encoding="UTF-8"?>
<csw:GetRecordsResponse xmlns:csw="http://www.opengis.net/cat/csw"
xmlns:fgdc="http://www.opengis.net/cat/csw/csdgm"
xmlns:geo="http://www.opengis.net/cat/csw/csdgm/geo" version="2.0.0">
  <csw:RequestId>3df7c6fe:10e5c4d9348:-7fe3</csw:RequestId>
  <csw:SearchStatus>complete</csw:SearchStatus>
  <csw:SearchResults resultSetId="3df7c6fe:10e5c4d9348:-7fe4"
outputFormat="text/xml" outputSchema="geo:metadata" numberOfRecordsMatched="6"
numberOfRecordsReturned="1" nextRecord="2" ElementSetName="full">
    <geo:FullRecord>
      <csw:recordid>6cb4678f10807965a2bn8000</csw:recordid>
      <fgdc:FGDCRecord>
For space considerations full response not shown. Insert valid FGDC CSDGM
metadata content here (see clause D.1.2 above).
      </fgdc:FGDCRecord>
    </geo:FullRecord>
  </csw:SearchResults>
</csw:GetRecordsResponse>
```