New Zealand Environmental Observation Data Profile

New Zealand Environmental Observation Data Working Group

ID	http://data.scinfo.org.nz/spec/eodp/core/1.0
Editor	Alistair Ritchie
Status	Final
Version	1.0

Contents

Acknowledgements

The authors thank the following for their guidance, support and technical feedback: Gareth Gray (Genesis Energy Ltd); Andrew Watkins and Uwe Duesing (NIWA); Mark Rodgers (Hilltop Software); Simon Cox and Bruce Simons (CSIRO). We gratefully acknowledge the endorsement of the National Environmental Monitoring Standards (NEMS) steering group.

Authors/Contacts

Contact	Company	E-mail
Sean Hodges	Horizons Regional Council	Sean.Hodges@horizons.govt.nz
Alex Kmoch	GNS Science/Auckland University of Technology	A.Kmoch@gns.cri.nz
Alistair Ritchie	Landcare Research	RitchieA@landcareresearch.co.nz
Jochen Schmidt	NIWA	Jochen.Schmidt@niwa.co.nz
Brent Watson	Horizons Regional Council	Brent.Watson@horizons.govt.nz
Paul White	GNS Science	P.White@gns.cri.nz

1.0 Introduction

This document is a profile of existing Open Geospatial Consortium (OGC) and World Wide Web Consortium (W3C) standards. It specifies the requirements for a standard XML implementation of environmental observation data services in New Zealand. Data servers and data clients developed according to this profile should be able to seamlessly and automatically exchange data without any ambiguity and should be interoperable and consistent with international best practice. As it is a profile, it introduces no new specifications for data or web services - each requirement is a restriction of clarification of existing components.

This document is a fundamental document defining the core behaviour of all environmental data services. Additional requirements specific to a particular domain - for example hydrology - will be defined in documents that add to the requirements specified here. Furthermore, these domain specific documents may specify rules for content - perhaps mandating acceptable vocabularies or naming conventions.

The profile refines existing information and web service specifications published by the OGC, and vocabulary data standards defined by the W3C. They a grouped according to three categories of requirements:

- *XML data requirements* refining the OGC Observation and Measurements (O&M) and W3C Simple Knowledge Organisation System (SKOS) standards.
- *Web service requirements* refining the behaviour of OGC Web Feature Services and Sensor Observation Services.
- *Linked data requirements* specifying how HTTP URIs can be used as simple links binding the contents of O&M and SKOS data elements.

The standard interoperability use cases are envisaged (for example data exchange and real-time monitoring). In particular, the profile is intended to encourage the aggregation of disparate data from different communities and/or disciplines for multi-domain modelling. As such, there should be minimal variation in the behaviour of all data services and the structure or content of the data they provide. Variation should only occur when information loss is unavoidable - for example when a O&M sampling feature description cannot fully describe all aspects of a water monitoring station.

The only scenario supported directly by this document is *data discovery* where the services and their responses act as indexes - providing the minimum required information to locate observation data for a phenomena in space and time. This will be supported by a WFS.

Other scenarios, mainly focussed on *data delivery*, will be addressed by the domain specific extensions to this profile. For example a WaterML 2.0 profile for hydro-climate time-series data delivery. These will be supported by a SOS and/or a WFS.

Future work will address episodic observation data exchange - data captured by one-off or long-period sampling campaigns (for example soil surveys, water quality sampling).

It is hoped that a single profile for discovery services will be sufficient for all uses, but it is likely that domain specific profiles will be required for sensor data.

2.0 Scope

This profile documents the data and capability requirements for OGC and W3C web services and servers that serve environmental observation data in New Zealand. It covers the deployment of services that: allow the discovery of sensor and observation data (WFS); report on the results generated (SOS); and provide definitions for entries in the controlled vocabularies used for some content.

2.1 Architecture

Figure 1. is an overview of the client and server components that are the standardisation targets of this profile (see Clause 3.0). The architecture assumes a client/server relationship bound using HTTP. The diagram also highlights the use of Linked Data principles to provide definitions of the vocabulary concepts provided as HTTP URIs in the XML output of the the WFS and SOS services.

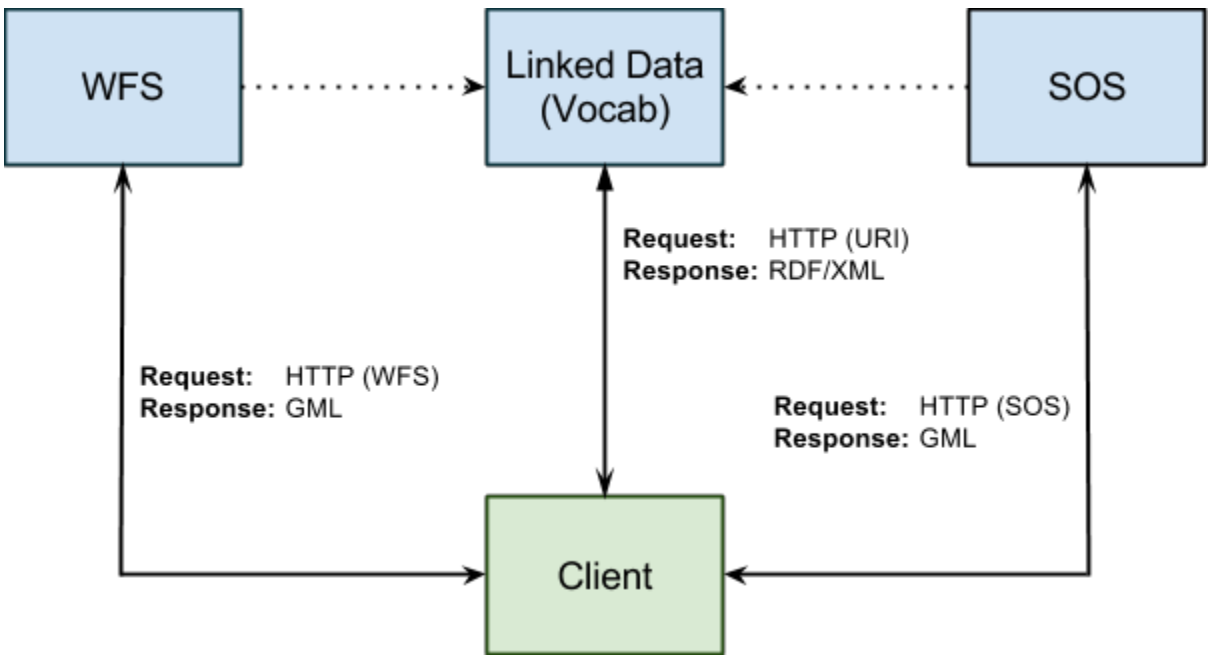

Figure 1. A simple overview of the components covered by this profile. Solid lines represent the HTTP request response path between data sources (blue) and a client agent (green). Dotted lines shows the OGC/W3C dependency.

2.2 Data Model

This profile defines rules for a limited set of types from the XML implementation of O&M and SKOS. It does not preclude the use of other types. Figure 2. summarises the information model using classes from the O&M abstract specification (OGC 10-004r3). While the O&M XML implementation's data model differs from the abstract specification (it uses a virtual typing strategy), they are close enough to be informative.

The diagram shows where SKOS Concepts are used as proxies for the O&M classes that do not have concrete or consistent instances in implemented GML application schema: OM_Process (describing sensors and other procedure uses to make observations) and GF_PropertyType (an entry in a register of observable phenomena). At present the SKOS

Concepts are the only available representations of these classes, but with time will be used to provide an alternative representation to a formally defined entry in an ontology (GF_PropertyType) or application schema (OM_Process).

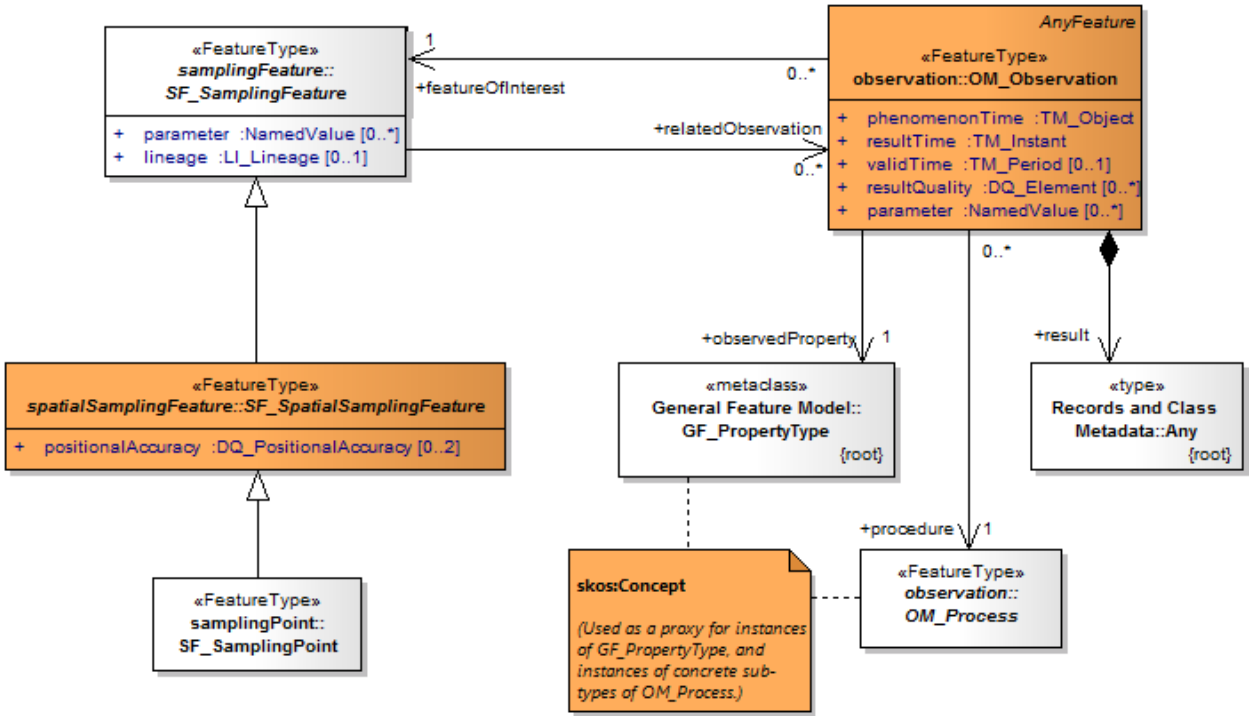

Figure 2. An overview of the O&M abstract specification classes covered by this profile. The classes shown in orange are the subject of one or more requirements classes in this document. (Note that a UML note is used to show a skos:Concept as it is formally modelled using another notation.)

2.3 Exclusions

This profile documents the basic behaviour of a harmonized set of service interfaces as exposed to external parties. Deployment environments, and local or community requirements for access and security, vary to the extent that no requirements and recommendations can be made concerning:

- how these services are implemented (including servers and software);
- how data are transforms from local data stores to the external information model;
- how data are collected (see standards developed by bodies such as NEMS); and
- the implementation of web security and access protocols.

3.0 Conformance

This specification is not an OGC standard or discussion document. However, to ensure consistency with the OGC standards it refines, the document is structured along the lines of an OGC standard and largely conforms OGC documentation conventions.

This specification is written to comply with the OGC Specification Model – A Standard for Modular Specification (OGC 08-131r3). All domain specific specifications that extend this specification shall also comply with OGC 08-131r3. The domain specific documents will refer to this document as a normative reference. Domain specific requirements shall cite requirements in this document as dependencies.

This document conforms to the OGC and ISO use of the normative language: SHALL, SHOULD, CAN and MAY (OGC 06-121r3 - Clause 5.3).

The standardisation targets of this specification are:

- Data instances: Observations and Measurements 2.0 and SKOS.
- Web services: Web Feature Service 2.0 and Sensor Observation Service 2.0.
- Web servers: a simple linked data specification for HTTP URIs.

Requirements are documented as classes within Clause 7.0. Conformance with these classes will be established by the tests documented in Annex A.
This specification defines requirements for non-OGC standards:

- SKOS - governed by the World Wide Web Consortium (W3C)
- HTTP - governed by the Internet Engineering Task Force (IETF)

The requirements for these standards are not documented according to the modular specification. Where they are dependencies for a requirements class they shall be identified by the URI of the relevant Technical Recommendation (W3C) or Request For Comment (IETF) documenting the standard.

4.0 Normative References

The following references are normative in that they provide the requirements that are refined by this specification. Users of this specification are expected to conform to all requirements and specifications documented in these references and their normative references.

IETF RFC 2616	Hypertext Transfer Protocol - HTTP/1.1
OGC 08-131r3	The Specification Model – A Standard for Modular Specification
OGC 09-025r1	WFS 2.0 OpenGIS Web Feature Service 2.0 Interface Standard
OGC 10-004r3	Geographic information - Observations and measurements
OGC 10-025r1	Observations and Measurements - XML Implementation
OGC 12-006	OGC Sensor Observation Service Interface Standard
W3C SKOS	SKOS Simple Knowledge Organization System Reference

5.0 Terms and Definitions

5.1 General terms

application schema	Conceptual schema for data required by one or more domains (applications - eg hydrology data - WaterML 2.0). May be implemented as a GML schema. [adapted from OGC 10-004r3]
concept	The fundamental element of the SKOS vocabulary. Concepts are the units of thought - ideas, meanings, or (categories of) objects and events. [SKOS Primer]
conformance test	A set of conformance classes that define tests for all requirements of a standard. [OGC 08-131r3]
domain	A domain of interest, for example hydrology or pedology.
feature	Abstraction of real-world phenomena. [OGC 10-004r3]
linked data	A method of publishing structured data so that it can be interlinked and become more useful. It builds upon standard Web technologies such as HTTP, RDF and URIs, allowing information to be provided in a way that can be read automatically by computers. [Wikipedia]
observation	Act of measuring or otherwise determining the value of a property. [OGC 10-004r3]
procedure	Method, algorithm or instrument, or system of these, which may be used in making an observation. [OGC 10-004r3]
profile	A restriction of an existing GML specification.
property	Facet or attribute of an object referenced by a name. [OGC 10-004r3]
requirements class	An aggregate of all requirements that must all be satisfied to satisfy a conformance test. [OGC 08-131r3]
sampling feature	Feature which is involved in making observations concerning a domain feature (eg a station or specimen). [OGC 08-131r3]
sensor	Type of observation procedure that provides the estimated value of an observed property at its output. (Note: A sensor uses a combination of physical, chemical or biological means in order to estimate the underlying observed property. At the end of the measuring chain electronic devices often produce signals to be processed.) [OGC 10-126r3]

5.2 Normative language

From OGC 06-121r3 - Clause 5.3

can	A statement of possibility.
informative	A part of a document that is provided for explanation, but is not required.
may	An action permissible within the limits of this specification.
normative	A part of a standards document that is required
shall	A requirement to be strictly followed to conform to this specification, from which no deviation is permitted
should	A desirable ability or use, without mentioning or excluding other possibilities

6.0 Notation and conventions

6.1 Use of Identifiers

The provisional identifier for this profile is: http://data.scinfo.org.nz/spec/eodp/core/1.0

This URI is the namespace of the identifiers for the requirements classes and conformance tests within this document.

6.2 XML Notation

This document uses XPath notation to refer to the XML elements constrained by the requirements classes. Each XML element is represented using the `Consolas` font. The XML namespaces used in this document are presented in Table 1.

Table 1. XML and Semantic Web namespaces used in this document. Note that each namespace URI resolves to a canonical schema location (for GML application schema) or on-line documentation.

Prefix	Namespace
gml	http://www.opengis.net/gml/3.2
om	http://www.opengis.net/om/2.0
sams	http://www.opengis.net/samplingSpatial/2.0
rdfs	http://www.w3.org/2000/01/rdf-schema#
skos	http://www.w3.org/2004/02/skos/core#
xlink	http://www.w3.org/1999/xlink

6.3 UML Notation

Unified Modelling Language (UML) notation has been used to define:

- a summary data model
- a requirements dependency model (where each requirements class is represented as a UML Package)

6.4 Abbreviated terms

The following abbreviations and acronyms have been used:

EODP	New Zealand Environmental Observation Data Profile
GML	Geography Markup Language
HTTP	Hypertext Transfer Protocol
IANA	Internet Assigned Numbers Authority
O&M	Observations and Measurements
OGC	Open Geospatial Consortium
RDF	Resource Description Framework
SKOS	Simple Knowledge Organisation System
SOS	Sensor Observation Service
UML	Unified Modeling Language
URI	Uniform Resource Identifier
UTC	Coordinated Universal Time
WFS	Web Feature Service
XML	Extensible Markup Language
XPath	XML Path Language

7.0 Requirements

These requirements classes define the structure of XML data instances, and the behaviour of the web services and linked data servers that deliver them. Figure 3. shows the dependencies between the existing (externally defined) specifications and the requirements classes that this profile uses to refine them.

Each UML package is a requirements class (or document). Package names are the trailing fragment of the requirements class's URI. For classes in this specification, prefix this profile's namespace; for external requirements use the URI shown in italics below the package.

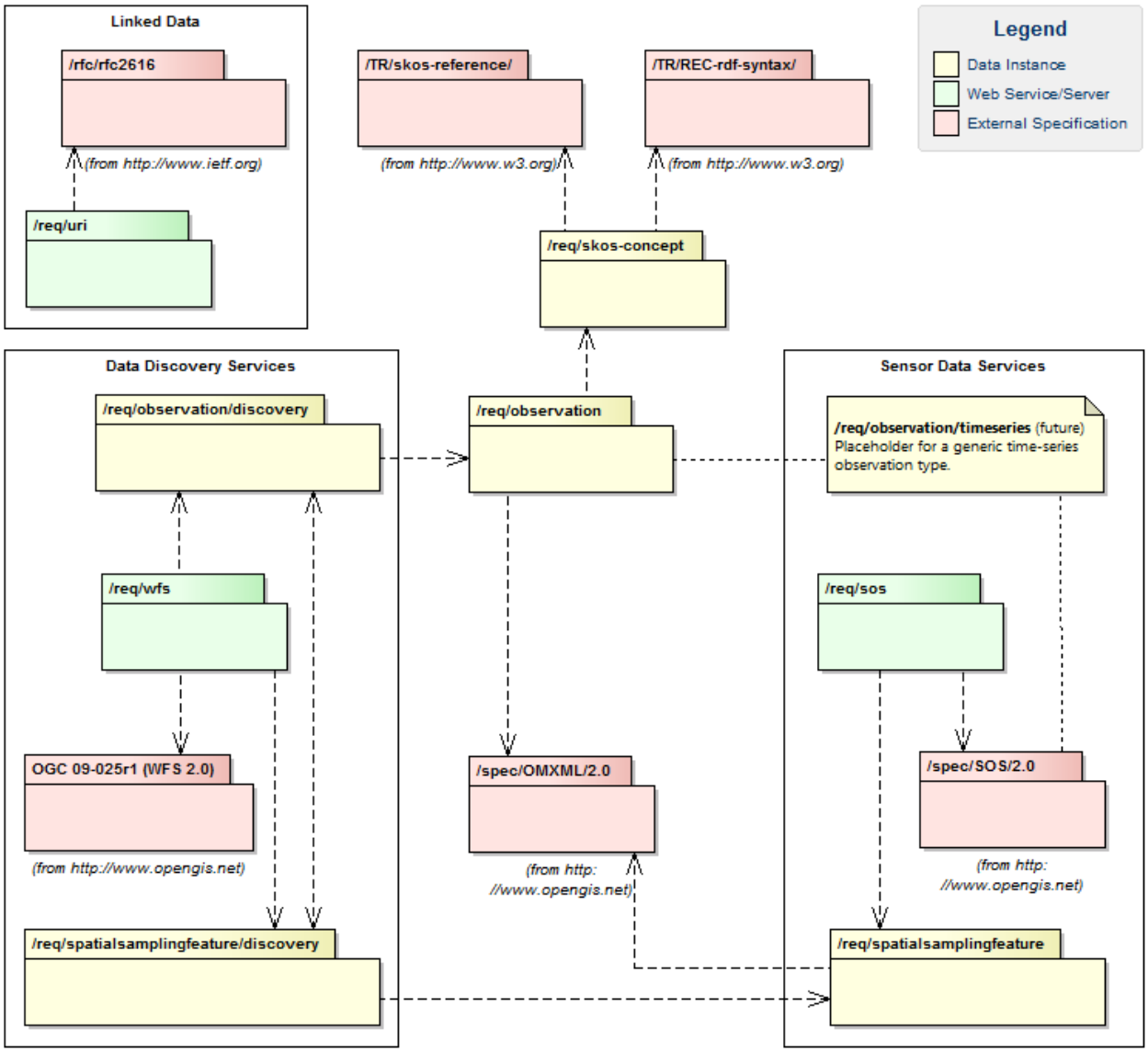

Figure 3. UML requirements class dependency diagram. System boundaries are shown for informative purposes only.

7.1 XML Data Instances

Requirements for the structure and content of XML data instances provided by web services or servers.

7.1.1 Requirements classes: om:OM_Observation

ID	**http://data.scinfo.org.nz/spec/eodp/core/1.0/req/observation**
Target type	Data instance
Description	Fundamental constraints on the encoding of an Observations and Measurements version 2.0 `om:OM_Observation` feature type.
Dependency	http://www.opengis.net/spec/OMXML/2.0
Dependency	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/skos-concept
Requirement	**../gml/identifier** A `om:OM_Observation` SHALL include a `gml:identifier` element and its value SHALL be a unique and persistent HTTP URI as specified by the appropriate naming authority. Each `gml:identifier` SHALL have a `@codespace` attribute and its value SHALL be a unique and persistent HTTP URI identifying the party responsible for the observation data.
Requirement	**../time** The values of temporal elements - `om:phenomenonTime`, `om:validTime` and `om:resultTime` - SHALL be encoded using the ISO8601 extended time format and SHALL include the time offset from UTC.
Requirement	**../observedproperty** The value of the `om:observedProperty/@xlink:href` attribute SHALL be an HTTP URI that dereferences to a RDF/XML description of the property type that conforms to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/skos-concept. The value of the `om:observedProperty/@xlink:title` attribute SHALL match the value of the associated `skos:Concept/skos:prefLabel`.

ID	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/observation/discovery
Target type	Data instance
Description	Additional constraints on the encoding of an Observations and Measurements version 2.0 `om:OM_Observation` feature type used for discovery purposes (WFS or HTTP URI response). Each `om:OM_Observation` instance is a placeholder for all observations related to a sampling feature - groups by phenomena and process. The `om:phenomenonTime` will show the time period over which all observations have been collected. The result is withheld as an unconstrained request for data can be detrimental to the host service - requests for actual observations are deferred to the appropriate SOS instance. Each `om:OM_Observation` instance represents a continuous period of sampling. Any sustained breaks in sampling (longer than the typical sampling frequency) shall require a new `om:OM_Observation` when sampling resumes.
Dependency	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/observation
Dependency	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/spatialsamplingfeature/discovery
Requirement	**../onlineresource** If the `om:OM_Observation` is the root element (in a document or service response then) one or more `gml:metaDataProperty/gml:GenericMetaData/gmd:CI_OnlineResource` elements identifying services (WFS and/or SOS) that deliver the actual measurements SHALL be provided.
Requirement	**../type** The value of the `om:type/@xlink:href` attribute SHALL be appropriate to the `om:result`.
Requirement	**../procedure** The value of the `om:procedure/@xlink:href` attribute SHALL be an HTTP URI that dereferences to a RDF/XML description of the `om:OM_Process` that conforms to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/skos-concept.
Requirement	**../featureofinterest** If the `om:OM_Observation` is the root element (in a document or service response then): The value of the `om:featureOfInterest` element SHALL be an `sams:SF_SpatialSamplingFeature` that conforms to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/spatialsamplingfeature/discovery If the `om:OM_Observation` is the value of a `sams:SF_SpatialSamplingFeature/sam:relatedObservation` element then: The value of the `om:featureOfInterest` element SHALL be a `@xlink:href` attribute containing an HTTP URI that dereferences to a GML description of a `sams:SF_SpatialSamplingFeature`. The GML SHALL conform to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/spatialsamplingfeature/discovery. The value of the associated `om:featureOfInterest/@xlink:title` attribute SHOULD match the value of an associated `sams:SF_SpatialSamplingFeature/gml:name`.
Requirement	**../result** The value of the `om:result` element SHALL be a `xlink:href` attribute having the value 'http://www.opengis.net/def/nil/OGC/0/withheld'.

7.1.2 Requirements classes: sams:SF_SpatialSamplingFeature

ID	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/spatialsamplingfeature
Target type	Data instance
Description	Fundamental constraints on the encoding of an Observations and Measurements version 2.0 `sams:SF_SpatialSamplingFeature` feature type.
Dependency	http://www.opengis.net/spec/OMXML/2.0
Requirement	**../gml/identifier** A `sams:SF_SpatialSamplingFeature` SHALL include a `gml:identifier` element and its value SHALL be a unique and persistent HTTP URI as specified by the appropriate naming authority. Each `gml:identifier` SHALL have a `@codespace` attribute and its value SHALL be a unique and persistent HTTP URI identifying the party responsible for the observation data.
Requirement	**../gml/name** Where available the value of the `gml:name` element SHALL be a station or location name and unique in the context of the authority that uses the name (as specified in the `gml:name/@codespace` attribute). The value of the `gml:name/@codeSpace` attribute SHALL be an HTTP URI identifying the party that assigned the name.
Requirement	**../sams/shape/srs** The spatial reference system of the sams:shape values SHALL be WGS84 (EPSG:4326).

ID	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/spatialsamplingfeature/discovery
Target type	Data instance
Description	Additional constraints on the encoding of a `sams:SF_SpatialSamplingFeature` feature type used for discovery purposes (WFS or HTTP URI response). The same feature type will be presented for any `sams:SF_SpatialSamplingFeature` or any member of its substitution group (for example, in this context a WaterML 2.0 `MonitoringPoint` would be cast to a `sams:SF_SpatialSamplingFeature`).
Dependency	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/observation
Dependency	http://www.opengis.net/spec/OMXML/2.0/req/samplingPoint
Requirement	**../onlineresource** If the `sams:SF_SpatialSamplingFeature` is the root element (in a document or service response then) one or more `gml:metaDataProperty/gml:GenericMetaData/gmd:CI_OnlineResource` elements identifying services (WFS and/or SOS) that deliver the actual measurements SHALL be provided.
Requirement	**../type** The value of the `sam:type/@xlink:href` attribute SHALL be appropriate to the sampling feature.
Requirement	**../relatedObservation** If the `sams:SF_SpatialSamplingFeature` is the root element (in a document or service response then): The value of the `sam:relatedObservation` element SHALL be an `om:OM_Observation` that conforms to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/observation/discovery If the `sams:SF_SpatialSamplingFeature` is the value of a `om:OM_Observation/om:featureOfInterest` element then: `The sam:relatedObservation` element SHALL not be returned.
Requirement	**../shape** The value of the `sams:shape` element SHALL be a 2D `gml:point`.

7.1.3 Requirements class: skos:Concept

ID	**http://data.scinfo.org.nz/spec/eodp/core/1.0/req/skos-concept**
Target type	Data instance
Description	Fundamental constraints on the encoding of a Simple Knowledge Organisation System (SKOS) `skos:Concept` encoded as RDF/XML.
Dependency	http://www.w3.org/TR/REC-rdf-syntax/
Dependency	http://www.w3.org/TR/skos-reference/
Requirement	**../preflabel** A skos:Concept SHALL include a `skos:prefLabel` element.
Requirement	**../definition** A skos:Concept SHALL include a `skos:definition` element.
Requirement	**../seealso** A skos:Concept SHALL inlcude a `rdfs:seeAlso` element identifying a resource or party than describes the concept in detail.

7.2 Web Services

Requirements for the behaviour - supported operations, methods and response encodings - of web services.

7.2.1 Requirements class: Sensor Observation Service

ID	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/sos
Target type	Web service
Description	Fundamental capabilities of a Sensor Observation Service instance.
Dependency	http://www.opengis.net/spec/SOS/2.0/req/core
Dependency	http://www.opengis.net/spec/SOS/2.0/req/foiRetrieval
Dependency	http://www.opengis.net/spec/SOS/2.0/req/xml
Dependency	http://www.opengis.net/spec/SOS/2.0/req/kvp-core
Dependency	http://www.opengis.net/spec/SOS/2.0/req/kvp-foiRetrieval
Requirement	**../version** The server SHALL implement version 2.0 of the Sensor Observation Service Interface Standard (OGC 12-006).
Requirement	**../operation/core** The server SHALL implement the core operations GetCapabilities, DescribeSensor, and GetObservation as defined by http://www.opengis.net/spec/SOS/2.0/req/core.
Requirement	**../operation/foiRetrieval** The server SHALL implement the GetFeatureOfInterest operation as defined by http://www.opengis.net/spec/SOS/2.0/req/foiRetrieval.
Requirement	**../binding/xml** The server SHALL encode the data types from the SOS conceptual model in XML as defined by http://www.opengis.net/spec/SOS/2.0/req/xml.
Requirement	**../binding/kvp-core** The server SHALL implement the key-value pair encoding for the operations GetCapabilities, DescribeSensor, and GetObservation as defined in http://www.opengis.net/spec/SOS/2.0/req/kvp-core.
Requirement	**../binding/kvp-foiRetrieval** The server SHALL implement the key-value pair encoding for the operation GetFeatureOfInterest as defined in http://www.opengis.net/spec/SOS/2.0/req/kvp-foiRetrieval.

7.2.2 Requirements class: Web Feature Service

ID	**http://data.scinfo.org.nz/spec/eodp/core/1.0/req/wfs**
Target type	Web service
Description	Fundamental capabilities of a Web Feature Service instance.
Dependency	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/observation/discovery
Dependency	http://data.scinfo.org.nz/spec/eodp/core/1.0/req/spatialsamplingfeature/discovery
Requirement	**../version** The server SHALL implement version 2.0 of the Web Feature Service interface standard (OGC 09-025r1).
Requirement	**../test/basic** The server SHALL conform to the Basic WFS Conformance Test (A. 1.2).
Requirement	**../test/http-get** The server SHALL conform to the HTTP GET Conformance Test (A. 1.5).
Requirement	**../test/http-post** The server SHALL conform to the HTTP POST Conformance Test (A. 1.6).
Requirement	**../data/om_observation** The server SHALL serve an `om:OM_Observation` that conforms to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/observation/discovery
Requirement	**../data/sf_spatialsamplingfeature** The server SHALL serve a `sams:SF_SpatialSamplingFeature` that conforms to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/spatialsamplingfeature/discovery
Requirement	**../storedquery/finddata** The server SHALL offer a stored query called 'EODP - Find Data'. It will fetch a `sams:SF_SpatialSamplingFeature` based on its location within a bounding box AND the phenomena measured by related observations AND the temporal location of the measured phenomena. See Table 2 and Annex D for its definition and examples. The stored query id SHALL be http://data.scinfo.org.nz/id/storedquery/eodp/finddata

Table 2 Summary of the definition of the EODP Find Data query. This fetches a `sams:SF_SpatialSamplingFeature` based on its location within a bounding box (xMin, yMin, xMax, yMax) AND the phenomena measured by related observations (observedPropertyURI) AND the temporal location of the measured phenomena (phenomenonTimeBegin, phenomenonTimeEnd). See Annex D for examples.

ID	http://data.scinfo.org.nz/id/storedquery/eodp/finddata
Title	EODP - Find Data
Description	Get metadata about `om:OM_Observations` available from published `sams:SF_SpatialSamplingFeatures`

Parameter	**Type**	**Target Element**
xMin	double	sams:shape
yMin	double	sams:shape
xMax	double	sams:shape
yMax	double	sams:shape
observedPropertyURI	string	sam:relatedObservation/om:OM_Observation/om:observedProperty /@xlink:href
phenomenonTimeBegin	date	sam:relatedObservation/om:OM_Observation/om:phenomenonTime
phenomenonTimeBegin	date	sam:relatedObservation/om:OM_Observation/om:phenomenonTime

7.3 Linked Data

Requirements for the behaviour - supported operations, methods and response encodings - of web servers.

7.3.1 Requirements class: Linked Data and HTTP URIs

ID	**http://data.scinfo.org.nz/spec/eodp/core/1.0/req/uri**
Target type	Web server
Description	Fundamental requirements for web servers used to dereference an HTTP URIs.
Dependency	http://www.ietf.org/rfc/rfc2616
Requirement	**../method** The web server SHALL support the use of HTTP GET requests to dereference HTTP URIs.
Requirement	**../response** The web server SHALL respond with an HTTP '303 See Other' status response (that includes the URI of a representation of the resource) according to clause 10.3.4 of http://www.ietf.org/rfc/rfc2616.
Requirement	**../media-type** The web server SHALL return content according to the IANA media-types listed in Table 2 (this table includes a mapping of the media types onto the XML implementations used by this specification).
Requirement	**../conneg** A web server MAY respond with media types other than those listed in Table 2 (for example HTML). If so, then the server SHALL implement HTTP Content Negotiation to allow the end user's agent to request the desired media type. *NOTE: the* onus *is on the developers of client applications to compose HTTP GET requests that anticipate the implementation of content negotiation.*

Table 3. Mapping of IANA Media Types onto the core XML implementation specifications used by this specification. The Specification IDs are found as dependencies for the XML implementation requirements classes

IANA Media Type	**XML Specification**	**Specification ID**
application/xml (or text/xml)	O&M XML	http://www.opengis.net/spec/OMXML/2.0
	RDF/XML	http://www.w3.org/TR/REC-rdf-syntax/
application/rdf+xml	RDF/XML	http://www.w3.org/TR/REC-rdf-syntax/

Annex A. Abstract test suite

(normative)

Conformance classes to enable testing of service implementations will be provided in the next release of this document. They will be implemented using published schematron documents.

Annex B. Example Service Implementations

(informative)

B.1 Introduction

The following services demonstrate the implementation of the EODP.

Table B1. EODP exemplar WFS and SOS instances.

Agency	Type	URL
Landcare Research	WFS	http://test.data.scinfo.org.nz/eodp/wfs

Annex C. Example EODP XML Documents

(informative)

C.1 Introduction

The following documents illustrate the use of the EODP.

C.2 Observation data

Example of an om:OM_Observation that is the root element in a document or service. Conforms to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/observation/discovery.

```
<om:OM_Observation gml:id="eodp.om.om_observation.1">
  <gml:metaDataProperty>
    <gml:GenericMetaData>
      <gmd:CI_OnlineResource>
        <gmd:linkage>
          <gmd:URL>http://test.data.scinfo.org.nz/x/service/eodp-data/sos</gmd:URL>
        </gmd:linkage>
        <gmd:protocol>
          <gco:CharacterString>OGC:SOS-2.0.0</gco:CharacterString>
        </gmd:protocol>
      </gmd:CI_OnlineResource>
    </gml:GenericMetaData>
  </gml:metaDataProperty>
  <gml:metaDataProperty>
    <gml:GenericMetaData>
      <gmd:CI_OnlineResource>
        <gmd:linkage>
          <gmd:URL>http://test.data.scinfo.org.nz/x/service/eodp-data/wfs</gmd:URL>
        </gmd:linkage>
        <gmd:protocol>
          <gco:CharacterString>OGC:WFS-2.0.0</gco:CharacterString>
        </gmd:protocol>
      </gmd:CI_OnlineResource>
    </gml:GenericMetaData>
  </gml:metaDataProperty>
  <gml:identifier codeSpace="http://www.landcareresearch.co.nz">
    http://test.data.scinfo.org.nz/x/id/eodp/om/om_observation/1</gml:identifier>
  <om:type xlink:href="http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement"/>
  <om:phenomenonTime>
    <gml:TimePeriod gml:id="om.phenomenontime.1">
      <gml:beginPosition>2012-06-12T00:00:00.000+12:00</gml:beginPosition>
      <gml:endPosition>2012-06-17T00:00:00.000+12:00</gml:endPosition>
    </gml:TimePeriod>
  </om:phenomenonTime>
  <om:resultTime>
    <gml:TimeInstant gml:id="om.resulttime.1">
      <gml:timePosition>2014-11-20T16:00:30.065+13:00</gml:timePosition>
    </gml:TimeInstant>
  </om:resultTime>
  <om:validTime xlink:href="http://www.opengis.net/def/nil/OGC/0/inapplicable"/>
  <om:procedure xlink:href=
    "http://test.data.scinfo.org.nz/x/id/eodp/om/om_process/3000000000001"/>
```

```
  <om:observedProperty xlink:href=
    "http://test.data.scinfo.org.nz/x/def/propertytype/eodp/soilmoisture-1"/>
  <om:featureOfInterest>
    <sams:SF_SpatialSamplingFeature
      gml:id="eodp.sams.sf_spatialsamplingfeature.2000000000001">
      <gml:description> Sensor Platform located on the Hororata study area wet
        paddock.</gml:description>
      <gml:identifier codeSpace="http://www.landcareresearch.co.nz">
        http://test.data.scinfo.org.nz/x/id/eodp/sams/sf_spatialsamplingfeature/2000000000001
      </gml:identifier>
      <gml:name codeSpace="http://www.landcareresearch.co.nz">
        Hororata Sensor Platform (wet paddock)</gml:name>
      <gml:name codeSpace="http://someotherparty.example.org.nz">
        MS.SI.2000000000001</gml:name>
      <sam:type xlink:href=
        "http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingPoint"/>
      <sam:sampledFeature nilReason="missing" xsi:nil="true"/>
      <sams:shape>
        <gml:Point srsName="urn:ogc:def:crs:EPSG::4326" gml:id="sams.shape.2000000000001">
          <gml:pos>-43.593582 171.929995</gml:pos>
        </gml:Point>
      </sams:shape>
    </sams:SF_SpatialSamplingFeature>
  </om:featureOfInterest>
  <om:resultQuality xlink:href="http://www.opengis.net/def/nil/OGC/0/inapplicable"/>
  <om:result xlink:href="http://www.opengis.net/def/nil/OGC/0/withheld"/>
</om:OM_Observation>
```

C.2 Sampling feature data

Example of a sams:SF_SpatialSamplingFeature that is the root element in a document. Conforms to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/spatialsamplingfeature/discovery.

```
<sams:SF_SpatialSamplingFeature gml:id="eodp.sams.sf_spatialsamplingfeature.2000000000001">
  <gml:metaDataProperty>
    <gml:GenericMetaData>
      <gmd:CI_OnlineResource>
        <gmd:linkage>
          <gmd:URL>http://test.data.scinfo.org.nz/x/eodp-data/sos</gmd:URL>
        </gmd:linkage>
        <gmd:protocol>
          <gco:CharacterString>OGC:SOS-2.0.0</gco:CharacterString>
        </gmd:protocol>
      </gmd:CI_OnlineResource>
    </gml:GenericMetaData>
  </gml:metaDataProperty>
  <gml:metaDataProperty>
    <gml:GenericMetaData>
      <gmd:CI_OnlineResource>
        <gmd:linkage>
          <gmd:URL>http://test.data.scinfo.org.nz/x/eodp-data/wfs</gmd:URL>
        </gmd:linkage>
        <gmd:protocol>
          <gco:CharacterString>OGC:WFS-2.0.0</gco:CharacterString>
```

```
      </gmd:protocol>
    </gmd:CI_OnlineResource>
  </gml:GenericMetaData>
</gml:metaDataProperty>
<gml:description>
  Sensor Platform located on the Hororata study area wet paddock.</gml:description>
<gml:identifier codeSpace="http://www.landcareresearch.co.nz">
  http://test.data.scinfo.org.nz/x/id/eodp/sams/sf_spatialsamplingfeature/2000000000001
</gml:identifier>
<gml:name codeSpace="http://www.landcareresearch.co.nz">
  Hororata Sensor Platform (wet paddock)</gml:name>
<gml:name codeSpace="http://someotherparty.example.org.nz">
  MS.SI.2000000000001</gml:name>
<sam:type xlink:href=
  "http://www.opengis.net/def/samplingFeatureType/OGC-OM/2.0/SF_SamplingPoint"/>
<sam:sampledFeature nilReason="missing" xsi:nil="true"/>
<sam:relatedObservation>
  <om:OM_Observation gml:id="eodp.om.om_observation.1">
    <gml:identifier codeSpace="http://www.landcareresearch.co.nz">
      http://test.data.scinfo.org.nz/x/id/eodp/om/om_observation/1
    </gml:identifier>
    <om:type xlink:href=
      "http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement"/>
    <om:phenomenonTime>
      <gml:TimePeriod gml:id="om.phenomenontime.1">
        <gml:beginPosition>2012-06-12T00:00:00.000+12:00</gml:beginPosition>
        <gml:endPosition>2012-06-17T00:00:00.000+12:00</gml:endPosition>
      </gml:TimePeriod>
    </om:phenomenonTime>
    <om:resultTime>
      <gml:TimeInstant gml:id="om.resulttime.1">
        <gml:timePosition>2014-11-20T16:29:26.735+13:00</gml:timePosition>
      </gml:TimeInstant>
    </om:resultTime>
    <om:validTime xlink:href="http://www.opengis.net/def/nil/OGC/0/inapplicable"/>
    <om:procedure xlink:href=
      "http://test.data.scinfo.org.nz/x/id/eodp/om/om_process/3000000000001"/>
    <om:observedProperty xlink:href=
      "http://test.data.scinfo.org.nz/x/def/propertytype/eodp/soilmoisture-1"/>
    <om:featureOfInterest xlink:href=
      "http://test.data.scinfo.org.nz/x/id/eodp/sams/sf_spatialsamplingfeature/
       2000000000001"/>
    <om:resultQuality xlink:href="http://www.opengis.net/def/nil/OGC/0/inapplicable"/>
    <om:result xlink:href="http://www.opengis.net/def/nil/OGC/0/withheld"/>
  </om:OM_Observation>
</sam:relatedObservation>
<sam:relatedObservation>
  <om:OM_Observation gml:id="eodp.om.om_observation.2">
    <gml:identifier codeSpace="http://www.landcareresearch.co.nz">
      http://test.data.scinfo.org.nz/x/id/eodp/om/om_observation/2</gml:identifier>
    <om:type xlink:href=
      "http://www.opengis.net/def/observationType/OGC-OM/2.0/OM_Measurement"/>
    <om:phenomenonTime>
      <gml:TimePeriod gml:id="om.phenomenontime.2">
        <gml:beginPosition>2012-06-13T00:00:00.000+12:00</gml:beginPosition>
        <gml:endPosition>2012-06-14T00:00:00.000+12:00</gml:endPosition>
      </gml:TimePeriod>
```

```
      </om:phenomenonTime>
      <om:resultTime>
        <gml:TimeInstant gml:id="om.resulttime.2">
          <gml:timePosition>2014-11-20T16:29:26.735+13:00</gml:timePosition>
        </gml:TimeInstant>
      </om:resultTime>
      <om:validTime xlink:href="http://www.opengis.net/def/nil/OGC/0/inapplicable"/>
      <om:procedure xlink:href=
        "http://test.data.scinfo.org.nz/x/id/eodp/om/om_process/3000000000001"/>
      <om:observedProperty xlink:href=
        "http://test.data.scinfo.org.nz/x/def/propertytype/eodp/soilmoisture-2"/>
      <om:featureOfInterest xlink:href=
        "http://test.data.scinfo.org.nz/x/id/eodp/sams/sf_spatialsamplingfeature/
         2000000000001"/>
      <om:resultQuality xlink:href="http://www.opengis.net/def/nil/OGC/0/inapplicable"/>
      <om:result xlink:href="http://www.opengis.net/def/nil/OGC/0/withheld"/>
    </om:OM_Observation>
  </sam:relatedObservation>
  <sams:shape>
    <gml:Point srsName="urn:ogc:def:crs:EPSG::4326" gml:id="sams.shape.2000000000001">
      <gml:pos>-43.593582 171.929995</gml:pos>
    </gml:Point>
  </sams:shape>
</sams:SF_SpatialSamplingFeature>
```

Annex D. Example EODP Service Requests

(informative)

D.1 Introduction

The following documents provide examples of EODP-defined service requests.

D.2 Find Data WFS Stored Query

EODP Find Data request examples. Conforms to http://data.scinfo.org.nz/spec/eodp/core/1.0/req/storedquery/finddata.

D.2.1 GetFeature HTTP POST (XML) Example

```
<wfs:GetFeature service="WFS" version="2.0.0" xmlns:wfs="http://www.opengis.net/wfs/2.0"
                xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                xsi:schemaLocation="http://www.opengis.net/wfs/2.0
                                    http://schemas.opengis.net/wfs/2.0/wfs.xsd">
  <wfs:StoredQuery id="http://data.scinfo.org.nz/id/storedquery/eodp/finddata">
      <wfs:Parameter name="xMin">171.927</wfs:Parameter>
      <wfs:Parameter name="yMin">-43.593</wfs:Parameter>
      <wfs:Parameter name="xMax">171.929</wfs:Parameter>
      <wfs:Parameter name="yMax">-43.591</wfs:Parameter>
      <wfs:Parameter name="observedPropertyURI">
        http://test.data.scinfo.org.nz/x/def/propertytype/eodp/soilmoisture-1
      </wfs:Parameter>
      <wfs:Parameter name="phenomenonTimeBegin">2012-06-11T00:00:00.000+12</wfs:Parameter>
      <wfs:Parameter name="phenomenonTimeEnd">2012-06-12T00:00:00.000+12</wfs:Parameter>
  </wfs:StoredQuery>
</wfs:GetFeature>
```

D.2.2 GetFeature HTTP GET (KVP) Example

http://test.data.scinfo.org.nz/eodp/wfs
?service=wfs&version=2.0.0&request=GetFeature
&typename=sams:SF_SpatialSamplingFeature
&storedquery_id=http://data.scinfo.org.nz/id/storedquery/eodp/finddata
&xMin=171.927&yMin=-43.593&xMax=171.929&yMax=-43.591
&observedPropertyURI=http://test.data.scinfo.org.nz/x/def/propertytype/eodp/soilmoisture-1
&phenomenonTimeBegin=2012-06-11T00:00:00.000+12
&phenomenonTimeEnd=2012-06-12T00:00:00.000+12

D.2.3 StoredQueryDefinition HTTP POST (XML) Template

Template for the EODP - Find Data stored query definition request. The `fes:Filter` element has been left empty as its definition will vary according to the application used to implement the WFS. For example: the `om:phenomenonTime` temporal filter must be defined differently in Geoserver (app-schema) and Snowflake Go Publisher WFS.

```
<wfs:CreateStoredQuery service="WFS" version="2.0.0" xmlns="http://www.opengis.net/wfs/2.0"
  xmlns:wfs="http://www.opengis.net/wfs/2.0" xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:fes="http://www.opengis.net/fes/2.0" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:sams="http://www.opengis.net/samplingSpatial/2.0"
  xsi:schemaLocation="http://www.opengis.net/wfs/2.0
                      http://schemas.opengis.net/wfs/2.0/wfs.xsd
                    http://www.opengis.net/gml/3.2
                      http://schemas.opengis.net/gml/3.2.1/gml.xsd">
  <wfs:StoredQueryDefinition id="http://data.scinfo.org.nz/id/storedquery/eodp/finddata">
      <Title>EODP - Find Data</Title>
      <wfs:Parameter name="xMin" type="xsd:double" />
      <wfs:Parameter name="yMin" type="xsd:double" />
      <wfs:Parameter name="xMax" type="xsd:double" />
      <wfs:Parameter name="yMax" type="xsd:double" />
      <wfs:Parameter name="observedPropertyURI" type="xsd:string" />
      <wfs:Parameter name="phenomenonTimeBegin" type="xsd:date" />
      <wfs:Parameter name="phenomenonTimeEnd" type="xsd:date" />
      <wfs:QueryExpressionText returnFeatureTypes="sams:SF_SpatialSamplingFeature"
        language="urn:ogc:def:queryLanguage:OGC-WFS::WFS_QueryExpression">
          <wfs:Query typeNames="sams:SF_SpatialSamplingFeature">
              <fes:Filter/>
          </wfs:Query>
      </wfs:QueryExpressionText>
  </wfs:StoredQueryDefinition>
</wfs:CreateStoredQuery>
```