GWML2: GW_Well and Borehole

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GroundWaterML2 (GW_Well and Borehole)

• Rationale
  – Need to have a model for well and well construction features
  – The main method of sampling hydrogeologic units, fluid, flow properties
  – Hydrogeologic Unit specialises GeoSciML4 GeologicUnit
  – No attempt to harmonise GWML ‘GW_Well’ with GeoSciML ‘Borehole’:
    • the existence of multiple “Borehole” standards
    • binding of GeoSciML:Borehole to MappedFeature and GeologicFeature
    • inadequate construction details for producing wells
  – Aim to have an international harmonisation activity
  – GWML2 SWG and GeoSciML4SWG membership overlaps
    • meetings never coincided
Two related application schemas
- Well: feature = ‘GW_Well’
- WellConstruction: feature = ‘Borehole’ re-use from GWML1
GeoSciML3.2
Borehole

Borehole

constraints
{mappedInterval.samplingFrame=self}

OriginPosition
elevation: DirectPosition
location: GM_Point

DrillingDetails
boreholeDiameter: Quantity
drillingMethod: BoreholeDrillingMethodCode
intervalBegin: Quantity [0..1]
intervalEnd: Quantity [0..1]
downholeDrillingDetails

MappedInterval
mappedIntervalBegin: Quantity [0..1]
mappedIntervalEnd: Quantity [0..1]

MappedFeature
occurrence 0..*
specification 1

IndexData

BoreholeDetails
boreholeLength: Quantity
boreholeMaterialCustodian: CI_ResponsibleParty [1..*]
dataCustodian: CI_ResponsibleParty [1..*]
dateOfDrilling: TM_Period
driller: CI_ResponsibleParty
inclinationType: BoreholeInclinationCode
operator: CI_ResponsibleParty
purpose: BoreholePurposeCode [1..*]
startPoint: BoreholeStartPointCode

GeologicFeature

positionalAccuracy: DQ_PositionalAccuracy [0..2]

SF_SamplingFeature

SF_SpatialSamplingFeature

SF_SamplingCurve
GWML2:GW_Well

GW_Well

gwWellBody: GW_FluidBody[0..*]
gwWellConstructedDepth: OM_Measurement[0..1]
gwWellConstruction: Borehole[0..1]
gwWellContributionZone: GM_Object[0..1]
gwWellLicence: GW_Licence[0..*]
gwWellLocation: GM_Point[0..1]
gwWellPurpose: WellPurposeTerm[0..*]
gwWellReferenceElevation: Elevation[0..*]
gwWellStaticWaterDepth: OM_Measurement[0..*]
gwWellStatus: WellStatusTypeTerm[0..1]
gwWellTotalLength: Quantity[0..1]
gwWellUnit: GW_HydrogeoUnit[0..*]
gwWellWaterUse: WaterWellUseTypeTerm[0..*]
gwWellYield: OM_Measurement[0..1]

GW_MonitoringSite

gwMonitoringHost: GFI_Feature[0..1]
gwSiteReferenceElevation: Elevation[0..*]
gwSiteType: SiteTypeTerm[0..1]

SF_SamplingCurve

GM_Curve

GW_GeologyLog

effDepth: Quantity[0..1]
startDepth: Quantity[0..1]
::OM_Observation
parameter: NamedValue[0..*]
phenomenonTime: TM_Object
resultQuality: DQ_Element[0..*]
resultTime: TM_Instant
validTime: TM_Period[0..1]

For lithology, stratigraphy, age, geophysics
GeoSciML3.2: Borehole GML encoding

```xml
<logElement>
  <MappedInterval gml:id="MyBoreholeInterval1">
    <gsml:observationMethod xsi:nil="true" nilReason="missing"/>
    <gsml:positionalAccuracy xsi:nil="true" nilReason="missing"/>
    <gsml:resolutionScale xsi:nil="true" gco:nilReason="missing"/>
    <gsml:samplingFrame nilReason="missing"/>
    <gsml:shape>
      <gml:LineString gml:id="MyBoreholeInterval1String" uomLabels="m" srsDimension="1" srsName="#MyBoreholeShape">
        <gml:posList>24 25</gml:posList>
      </gml:LineString>
      <gml:LineString>
        <gsml:metadata xsi:nil="true" gco:nilReason="missing"/>
      </gml:LineString>
    </gsml:shape>
    <swe:Quantity>
      <swe:uom code="m" xlink:href="http://www.opengis.net/def/uom/OGC/1.0/metre" xlink:title="metre"/>
      <swe:value>24</swe:value>
    </swe:Quantity>
    <swe:Quantity>
      <swe:uom code="m" xlink:href="http://www.opengis.net/def/uom/OGC/1.0/metre" xlink:title="metre"/>
      <swe:value>25</swe:value>
    </swe:Quantity>
  </MappedIntervalBegin>
  <gsmlbh:mappedIntervalEnd>
    <swe:Quantity>
      <swe:uom code="m" xlink:href="http://www.opengis.net/def/uom/OGC/1.0/metre" xlink:title="metre"/>
      <swe:value>25</swe:value>
    </swe:Quantity>
  </gsmlbh:mappedIntervalEnd>
</MappedInterval>
<logElement>
gsmlbh:Borehole
```

Must be a GeologicFeature
GWML2:GeologyLogCoverage GML

Any DiscreteElement Coverage
GWML2:Well

Link to well construction features via ‘Borehole’
Borehole - WellConstruction

Figure 11.2  Examples of Casing Slotting

End of slot should be located at least 150 mm from joint (particularly for screened casing) to prevent distortion.

Slots should be cut progressively around and along the casing to prevent distortion or buckling.

Note - Minimum slot length 900 mm - Diagrammatic only, not to scale. Not full length.

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GroundWaterML2 GW_Well harmonisation

- Lots of similarities with GeoSciML v3.2
- How does it compare to GeoSciML 4.0?
- How does it compare to other proposed standards
- Can we mine the best from all the options to create a Borehole/Well standard that meets most domain requirements?