# Oregon Elevation Data Standard

**Version 1.1**

## Oregon Vector Elevation Standard

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**Please address comments to:**

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## 1.0 Introduction

The Oregon Framework Elevation Theme (OFET) is a spatially referenced vertical representation of the surface of Oregon above and below a datum reference surface. The OFET is composed of five parts: 1) raster elevation model (also known as a DEM), 2) vector (line and point representations of surface elevation), 3) subsurface water depth measurements (bathymetry), 4) Digital Terrain Model (DTM) composed of surface "break lines" and mass elevation points, and 5) elevation bands (polygons). These layers may be used to calculate derived layers such as slope, aspect, and flow direction. This is a principal aspect of the Oregon Elevation Data Standard (OEDS) focusing on vector elevation. For raster elevation data, see *Oregon Terrestrial Raster Elevation Data Standard, Version 1.04,* November 2003, at www.gis.state.or.us/coord/standards/elevstandarddraft.pdf.

## 1.1 Mission and Goals of Standard

The Oregon Vector Elevation Standard (OVES) will provide a consistent structure for data producers and data users to ensure the compatibility of datasets within the same framework layer and between other framework layers and themes.

## 1.2 Relationship to Existing Standards

The Federal Geographic Data Committee (FGDC) has prepared a document, entitled Content Standards for *Framework Elevation Data,* which serves as a reference for the Oregon standard.

## 1.3 Description of Standard

The OVES describes the critical metadata elements necessary to adequately describe, distribute, and use elevation contours and spot elevation points in Oregon. These vector data have multiple database fields attached to individual graphic elements. The OVES focuses on the database structure.

## 1.4 Applicability and Intended Use of Standard

For Oregon geospatial data, this standard is applicable to the data sets that represent the height of the earth's surface relative to a given hypothetical surface or datum such as mean high tide or North American Vertical Datum 1988 (NAVD 88). The intended use of this standard is to guide accurate elevation contour and spot elevation documentation that will enable data users to understand how the representations of constant elevation and point elevations were generated and their appropriate uses.

## 1.5 Standard Development Procedures

The Oregon Framework Implementation Team for Elevation (FIT-Elevation) is comprised of representatives from federal, state, and local governmental agencies in Oregon. This team created the first draft of the OVES database elements and published that draft standard via email lists and open meetings. The public review and comment period commenced December 9, 2003, at the standards forum in Roseburg, Oregon. In 1997 a group of agency representatives met on an informal basis to collaboratively develop an elevation model with a finer spatial resolution than the existing 90-meter DEM data. This group recognized the value of developing additional elevation data sets beyond the DEMs and named the group Oregon Terrain Information System (OTIS). The first effort of the OTIS group was the collection, cleaning, merging, and distribution of the 30-meter DEM data produced by the United States Geological Survey (USGS).

Additional design contributions have been made by:
- US Forest Service (USFS)
- US Environmental Protection Agency
- US Bureau of Land Management
- US Fish & Wildlife Service
- Bonneville Power Administration
- Oregon Department of Forestry
- Oregon State University
- Oregon Water Resources Department
- Oregon Department of Administrative Services
- Oregon Department of Environmental Quality
- Association of Oregon Counties

Future elevation data standards will continue to be developed through a combination of periodic framework meetings and documents shared on the Oregon Framework web site, http://egov.oregon.gov/DAS/IRMD/GEO/fit/FIT.shtml. This is the second standard in the series.

### 1.6 Maintenance of Standard

The OVES will be revised as needed when initiated by participants of the standards process.

## 2.0 Body of the Standard

### 2.1 Scope and Content of the Standard

The scope of the OVES is to provide a standard for publicly available surface elevation contour and spot elevation data in Oregon. The content is focused on the critical metadata elements and database attributes required for individual data sets.

### 2.2 Need for the Standard

The OVES is needed in Oregon to ensure that when users acquire data from disparate sources, they can use, display, and analyze the data within the context of the stated spatial accuracy and appropriate use of the data. When followed, the standard minimizes the possible errors associated with inconsistent data.

## 2.3 Participation in Standards Development

The elevation data standard has been in development for five years. Agencies interested in using elevation data are welcome to participate in standards development. The vector elevation standard is also open to public review and comment.

## 2.4 Integration with Other Standards

The Vector Elevation section of the OEDS follows the same format as other Oregon Framework standards. The specifics of this part of the standard are related to the Raster and Bathymetric standards. The Bathymetric standard, Part 3, has yet to be written. The relationship with other non-elevation data standards is primarily georeferencing.

## 2.5 Technical and Operation Context

### *2.5.1 Data Environment*

The data environment for OVES is vector linear and point features that represent constant elevation values and spot elevation values, respectively. The exchange format for vector elevation data files is the ESRI shapefile, which is an open data structure relating points, lines, and feature attribution (including shape geometry). This exchange medium is supported by all known GIS software suites used in Oregon. Information about the technical specification for the shapefile format can be found at http://www.esri.com/library/whitepapers/pdfs/shapefile.pdf.

### *2.5.2 Reference Systems*

The coordinate reference systems typically used in Oregon are the Universal Transverse Mercator (UTM), the Oregon State Plane and the custom Oregon Lambert. The applicable UTM zones are zone 10, which comprises all land in Oregon to the west of 120 degrees west longitude, and zone 11, which comprises all land to the east of 120 degrees west longitude. The State Plane North and State Plane South zones are divided along Oregon county boundaries near 44 degrees north latitude. The custom Oregon Lambert coordinate system is described at http://www.gis.state.or.us/data/format.html.

### *2.5.3 Global Positioning Systems (GPS)*

GPS data-capturing devices enable data collection systems on the ground and above the earth to determine precise X and Y coordinate values, as well as a less precise Z value. As of version 1.0 of the OVES, no standard has been adopted for the use of GPS technology. However, this does not preclude the use of GPS technology for the capture of surface elevation values. This standard recommends the inclusion of the local GPS collection method as a component of vector elevation metadata where appropriate.

### 2.5.4 Integration of Themes

Elevation contours are often derived from DEMs. In early methodologies, DEMs were developed from USGS elevation contours drawn on topographic quadrangle maps. Elevation contours and spot elevations can also be derived from USGS composites, digital terrain models, LIDAR, IFSAR, SRTM, Geodetic Control, and benchmark data. Elevation contours are often traced for digital capture. Elevation contours are critical for mapping hazards from events, such as floods, tsunamis, and landslides.

### 2.5.5 Encoding

The vector data model is appropriate for this type of elevation data. Vector-based spatial objects must conform to topological rules. The applicable topological rules for contours are: 1) they must not intersect with each other or self-intersect; 2) they must be continuous (no gaps); and 3) the beginning and end must join together to form a ring, except where a contour occurs at the edge of a mapped extent.

### 2.5.6 Resolution

At 1:24,000, the contour interval for Oregon shall be 200 feet for index contours, 40 feet for intermediate contours, and 5, 10 or 20 feet for supplemental contours.

### 2.5.7 Accuracy

The accuracy of any contour line is half the contour interval. In cases where contour lines are scanned or digitized from existing maps, the resulting contours shall maintain the same accuracy as the source material.

Mapping standards used to express the accuracy of an elevation point include the following (ASPRS, 2001): National Map Accuracy Standard (NMAS; Bureau of the Budget, 1947), ASPRS Accuracy Standards for Large-Scale Maps (ASPRS, 1990), and the FGDC Geospatial Positioning Accuracy Standards (FGDC, 1999).

### 2.5.8 Edge Matching

Hypsography is designed to be seamless across Oregon. Similar data sets from adjacent states using the same vertical datum should merge with OVES data without gaps.

### 2.5.9 Feature Identification Code

The attribute containing the number of feet or meters above a hypothetical surface or datum sufficiently distinguishes the line feature representing a particular constant elevation, although there may be many features with the same elevation. However, a local unique identifier will be assigned by the capturing entity, and a framework unique identifier will be assigned for purposes of a statewide elevation contour data set. Point features representing spot elevations should include a unique identifier assigned by the capturing entity; a framework identifier will be assigned when compiling a statewide spot elevation data set.

### *2.5.10 Attributes*

Attributes are categorized in three principal ways: points, lines, and associated characteristics.

#### 2.5.10.1 Points

In this context, points are geospatial objects that represent spot elevations.

#### 2.5.10.2 Lines

Lines are geospatial objects that represent constant elevation being digitally captured in compliance with this standard.

#### 2.5.10.3 Associated Characteristics

Associated characteristics are any of the additional information that is collected and shared in relation to vector elevation data. See Section 3 for the specification of minimal characteristics.

### *2.5.11 Transactional Updating*

Occasional changes to the surface of the earth will occur due to human activities or periodic natural events such as volcanoes, earthquakes, or landslides. Additionally, more precise forms of measurement may be able to correct data inadequacies where vegetation has obscured the ground profile. When new DEMs or supplemental terrain information becomes available that more accurately portrays the earth's surface, the OVES and associated data products should be updated. These updates will be infrequent and can be done by an individual agency or contractor. A review of updated areas will be conducted every two years.

### *2.5.12 Records Management*

Past versions of vector elevation should be maintained for areas where the earth's surface has changed. For geographic areas of increased precision, previous versions of the data should be archived due to legal or administrative decisions that may have been made based on it.

### *2.5.13 Metadata*

The OVES follows the Oregon Core Metadata Standard for geospatial data. Metadata detailing the characteristics and quality of submitted vector elevation data must be provided, including the version of this standard which the dataset uses. Metadata should make every effort to meet the more rigorous standards set forth in the Federal Metadata Content Standard, where feasible. Metadata must provide sufficient information to allow the user to determine if that data will meet the intended purpose, as well as telling the user how to access the data.

## 3.0 Data Characteristics

## 3.1 Minimum Graphic Data Elements

### *3.1.1 Points*

| *Item Name* | *Type* | *Width* | *Description* |
|---|---|---|---|
| shape | Point | | spot elevation point (generated internally by GIS software) |
| local_id | Number | 9 | local identifier (generated by capturing entity) |
| unique_id | Number | 9 | framework unique identifier (generated by data steward) |

### *3.1.2 Lines*

| *Item Name* | *Type* | *Width* | *Description* |
|---|---|---|---|
| shape | Shapeline | | ordered string of coordinate pairs representing constant elevation shape/geometry (generated internally by GIS software) |
| local_id | Number | 9 | local feature identifier (generated by data developer) |
| unique_id | Number | 9 | framework unique identifier (generated by data steward) |

## 3.2 Minimum Attribute or Non-graphic Data Elements

### *3.2.1 Points*

| *Item Name* | *Definition* | *Description* | *Domain* |
|---|---|---|---|
| elevation | Decimal, 8, 1 | Elevation | -xxx.x to xxxxx.x |
| units | String, 6 | Units | feet or meters |
| surf_type | String, 15 | Surface type being portrayed | depression, peak, break |
| v_datum | String, 12 | Vertical datum | NGVD29, NAVD88, [local datum] |
| h_datum | String, 12 | Horizontal datum | NAD27, NAD83, WGS84, [local datum] |
| e_datum | String, 8 | Ellipsoid datum | xxxx.xxx (decimal years, e.g., 2005.3) |
| precision | String, 6 | Precision | single, double |
| g_control | String, 15 | Geodetic control | unique id of geodetic control point |
| elev_src | String, 30 | Source of measurements | STDS – USGS SDTS format (DLG3)<br>TVC – Tagged Vector Contours, from USGS via BLM (optional DLG format)<br>HYS – Received with TVCs, different attributes (optional DLG format)<br>DEM10 – Generated from 10-meter DEMs<br>Edit – Hand edit for edgematching issues<br>Photogrammetric – Created by photogrammetric techniques<br>Resource GPS – Created from resource-quality GPS data |

| | | | |
|---|---|---|---|
| | | | Survey GPS – Created from survey-quality GPS data<br>Differential level – Created from differential levels<br>Plane table – Created using a plane table<br>LIDAR – Generated from LIDAR data<br>IFSAR – Generated from Interferometric Synthetic Aperture Radar<br>SRTM – Generated from 30-meter Shuttle Radar Topography Mission<br>Radar – Created from radar data<br>Ground Survey – Created from ground survey data |

### *3.2.2 Lines*

| *Item Name* | *Definition* | *Description* | *Domain* |
|---|---|---|---|
| elevation | Decimal, 8, 1 | Elevation | -xxx.x to xxxxx.x |
| units | String, 6 | Units | feet or meters |
| cont_type | String, 15 | Contour type | index, index depression (200 feet for 1:24,000 scale)<br>intermediate, intermediate depression (40 feet for 1:24,000 scale)<br>supplemental, supplemental depression (20, 10, or 5 feet for 1:24,000 scale) |
| elev_src | String, 30 | Source of measurements | STDS – USGS SDTS format (DLG3)<br>TVC – Tagged Vector Contours, from USGS via BLM (optional DLG format)<br>HYS – Received with TVCs, different attributes (optional DLG format)<br>DEM10 – Generated from 10-meter DEMs<br>Edit – Hand edit for edgematching issues<br>Photogrammetric – Created by photogrammetric techniques<br>Resource GPS – Created from resource-quality GPS data<br>Survey GPS – Created from survey-quality GPS data<br>Differential level – Created from differential levels<br>Plane table – Created using a plane table<br>LIDAR – Generated from LIDAR data<br>IFSAR – Generated from Interferometric Synthetic Aperture Radar<br>SRTM – Generated from 30-meter Shuttle Radar Topography Mission<br>Radar – Created from radar data |

| | | | |
|---|---|---|---|
| | | | Ground Survey – Created from ground survey data |
| v_datum | String, 12 | Vertical datum | NGVD29, NAVD88, [local datum] |
| OEDSver | String, 5 | Version of standard | 1.0, 1.1, etc. |

### 3.3 Optional Graphic Data Elements
N/A

### 3.4 Optional Attribute or Non-graphic Data Elements
N/A

## References

American Society for Photogrammetry and Remote Sensing, 1990. *ASPRS Accuracy Standards for Large-scale maps,* ASPRS, *Photogrammetric Engineering and Remote Sensing*, Vol. 56, No. 7, pp 1068-1070.

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