DIGITAL FILES DESCRIPTION FOR
MAPS SHOWING INUNDATION DEPTHS, ICE-RAFTED ERRATICS, AND SEDIMENTARY FACIES OF LATE PLEISTOCENE MISSOULA FLOODS
IN THE WILLAMETTE VALLEY, OREGON

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INTRODUCTION

This readme document serves to introduce and describe the digital files that are included in this publication. They are available for downloading at http://geopubs.wr.usgs.gov and include both Geographic Information System (GIS) software files (both raster and vector data) that are viewable with an Environmental Systems Research Institute (ESRI) compatible commercial GIS (or with ESRI's ArcReader utility; a free map viewer with no editing capabilities) as well as Portable Document Format (PDF) files that are viewable with a reader or web browser plug-in available for free on the internet.

Three download packages are available (see the section entitled "OF 03-408 Digital Contents" below for details) depending on the resources available to the user. For those interested only in a paper plot of the Open-File report, please see the section entitled "Obtaining Paper Plots" below.

This Open-File map sheet, representing a compilation of data sources, consists of 2 maps panels that together show some of the features associated with the inundation of the Willamette Valley and Portland basin in western Oregon by Missoula Flood waters in late Pleistocene time. These features include maximum flood inundation levels, inundation levels associated with stratigraphic evidence of repeated floodings, distribution of flood deposits, and sites of ice-rafted erratics. The map sheet also shows 6 explanatory figures of Missoula Flood features; a text explanation, 2 index maps, and references. The scales of the source maps limit the spatial resolution (scale) of the database to 1:250,000 or smaller.

OF 03-408 DIGITAL CONTENTS

The digital data for this Open-File report has been grouped into three separate packages:

1) A **Geodatabase** package that contains geologic vector and table data stored as data objects within an ESRI format personal geodatabase, raster data stored as ESRI format grids, an ESRI map document for use with ArcGIS 8.3 which allows full control of editing and rendering of the data sources, an ESRI published map document for use with ArcReader which allows viewing and querying of the source data, and a PDF file of this readme document.
2) A **Shapefile** package that contains shapefiles exported from the personal geodatabase, the same ESRI grids as in the Geodatabase package, two Excel (97-2000) files containing extra erratic information and unit descriptions not storable in the shapefile format, and a PDF file of this readme document.
3) A **PDF** package that contains a PDF file of the Open-File map sheet at true scale and a PDF file of this readme document.

Each package has been compressed into a single file (.zip extension) using WinZip, a freely downloadable compression software utility (download from http//: www.winzip.com. Each compressed file will uncompress into a folder containing the associated files.

If you:

- Have access to ArcGIS 8.3, download the Geodatabase package and open the map document (.mxd extension) from ArcGIS (preferably version 8.3, but 8.2 should work as well).
- Have access to ArcView 3.x (or a GIS that can read shapefiles), download the Shapefile package.
- Do not have access to a GIS but wish to view and query the data, download the Geodatabase package and open the published map document (.pmf extension) from ArcReader (free download from http//:www.esri.com).

- Do not have access to a GIS and only wish to print the map sheet or parts of it, download the PDF package and open them from Adobe Reader 5.0 (free download from *http//:www.adobe.com*). Note that the map sheet printed at the true scale of 1:250,000 is 36x58 inches and will require a large-format plotter.
- Only wish to have a paper copy of the Open-File report, see the section entitled "Obtaining Paper Plots" below.

1) GEODATABASE PACKAGE
(OF03_408_GDB.ZIP, 305 MB COMPRESSED, 535 MB UNCOMPRESSED)

Geodatabase data objects	Description
Will_Valley.mdb	An ESRI personal geodatabase with three simple feature classes and one stand-alone table:
Feature Classes	
erratics	A point feature class representing the locations of ice-rafted glacial erratics throughout the Willamette Valley. Symbolized in Will_Valley.mxd and Will_Valley.pmf by the attribute "Location_Qual" (location quality).
contours	A line feature class of specific contour lines representing 4 significant elevations to which the Willamette Valley was repeatedly inundated by Missoula Flood waters. These lines also help to highlight the uppermost elevations in each of the 4 four inundation grids. Symbolized in Will_Valley.mxd and Will_Valley.pmf by the attribute "Contour".
geology	A polygon feature class representing a compilation of Willamette Valley geology from three sources (O'Connor, et al., 2001; Gannett and Caldwell, 1998; and Trimble, 1963). Note that in the Will_Valley.mxd and Will_valley.pmf files the 5 units representing Missoula Flood deposits have been grouped into a either fine or coarse-grained facies. Those interested in the general geology of the area are referred to digital files associated with US Geological Survey Water-Investigation Report 99-4036 (*http://oregon.usgs.gov/pubs_dir/Online/Cd/WRIR99-4036/GEOL/README.HTM)*
Tables	
UnitDescription	A table containing geologic unit descriptions for the geology units. Can be joined or related to the 'geology' feature class by the common 'Unit' field.

ESRI grids (appear as folders in Windows Explorer)

wv_elevation	10m cellsize digital elevation model (DEM) of the Willamette Valley and Portland basin
wv_hillshade	10m cellsize hillshade of the Willamette Valley derived from the DEM
wv_hydro	20m cellsize, 2 class grid showing major rivers in the area
(inundation grids)	
0to115ft	10m cellsize elevation grid derived from the DEM showing just elevations between 0 and 115 feet.
115to177ft	10m cellsize elevation grid derived from the DEM showing just elevations between 115 and 177 feet.
177to260ft	10m cellsize elevation grid derived from the DEM showing just elevations between 177 and 260 feet.
260to400ft	10m cellsize elevation grid derived from the DEM showing just elevations between 260 and 400 feet.

Map document files

Will_Valley.mxd	Map document created in ArcGIS 8.3 containing the data rendering and symbolization information that was used in the production of the Open-File map sheet. All symbols and color information should be accessible to those users with default ArcMap styles installed on their system. For this release, the layers were grouped logically and given aliases in order to be more usable.

Will_Valley.pmf	Published map document created from Will_Valley.mxd for use with ArcReader. It contains all of the same rendering and symbolization information that is in the original .mxd. Features may be queried with the identify tool in the same way they could in the .mxd, but there are no editing capabilities with this utility.

PDF file

OF03408README.pdf	PDF file of this readme document

2) SHAPEFILE PACKAGE (OF03_408_SHP.ZIP, 312 MB COMPRESSED, 532 MB UNCOMPRESSED)

Shapefiles	Description
erratics	Point shapefile of the erratic feature class from the Will_Valley geodatabase (see Geodatabase Package above)
contours	Line shapefile of the contours feature class from the Will_Valley geodatabase (see Geodatabase Package above)
geology	Polygon shapefile of the geology feature class from the Will_Valley geodatabase (see Geodatabase Package above)

Tables

ErraticNotes.xls	Excel (97-2000) file of the erratics table from the Will_Valley geodatabase (see Geodatabase Package above). Join with the erratics shapefile on the common "Erratic_No" field.
UnitDesc.xls	Excel (97-2000) file of the UnitDescripton table from the Will_Valley geodatabase. Relate to the geology shapefile by the common 'Unit' field.

ESRI grids

The same grids as in the Geodatabase package

PDF files

OF03408README.pdf	PDF file of this readme document

3) PORTABLE DOCUMENT FORMAT (ADOBE ACROBAT 5.0) PACKAGE (OF 03-408_PDF.ZIP, 17 MB COMPRESSED, 17.5 MB UNCOMPRESSED)

Files	Description
OF03_408.pdf	A PDF file containing an image of the entire open-file map sheet, exported from Adobe Illustrator
readme.pdf	A PDF file of this readme file document

OBTAINING THE DIGITAL DATA

The digital data for this map can be obtained by any of three ways:

1) Download from the Western Region Geologic Information Web Page
2) Anonymous ftp over the Internet
3) Request a compact disc (CD) of the files.

1) TO OBTAIN THE FILES FROM THE U.S. GEOLOGICAL SURVEY WEB PAGES

The U.S. Geological Survey supports a set of graphical pages on the World Wide Web. Digital publications (including this one) can be accessed via these pages. The location of the main Web page for the entire U.S. Geological Survey is *http://www.usgs.gov*. The Web server for digital publications from the Western Region is http://geopubs.wr.usgs.gov. To access files for this Open-File report, go to *http://geopubs.wr.usgs.gov/of-03408/*.

2) TO OBTAIN THE FILES BY FTP

The files in this report are stored on the U.S. Geological Survey Western Region FTP server. The Internet ftp address of this server is *ftp://geopubs.wr.usgs.gov/*. The user should log in with the user name

'anonymous' and then input their e-mail address as the password. This will give the user access to all the publications available via ftp from this server. The files in this report are stored in the subdirectory */pub/open-file/of03-408/*.

3) TO OBTAIN A CD OF THE FILES

A CD of any or all of the digital files described here can be obtained by sending a request and return address to:

Karen Wheeler (or Ray Wells)
U.S. Geological Survey
345 Middlefield Road, M/S 973
Menlo Park, CA 94025

or by email: *kwheeler@usgs.gov* or *rwells@usgs.gov*

OBTAINING PAPER PLOTS

TO OBTAIN PLOTS FROM A COMMERCIAL VENDOR

First obtain the PDF package via a download or by requesting a CD (see section above). Take that package to a commercial vendor with a large-format plotter. Make sure the vendor is capable of reading CD's and PDFs and provide the vendor with a copy of this readme document.

TO OBTAIN PAPER PLOTS FROM THE U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey provides a print on demand service for digital maps such as this report. To obtain plots, contact the U.S. Geological Survey:

USGS Information Services
Box 25286
Denver Federal Center
Denver, CO 80225-0046

(303) 202-4200
1-800-USA-MAPS
FAX: (303) 202-4695
e-mail: *infoservices@usgs.gov*

Be sure to include with your request the Open-File number, OF 03-408.

DIGITAL COMPILATION

The layout of the map used to create the two panels on the map sheet consists of three layers of vector data (erratics, geology, and floodwater inundation contours) overlying a set of raster grids representing the physiography of the map area and floodwater inundation levels. The layers were compiled, rendered, and editing within ArcGIS 8.3. The two maps comprising the two panels on the Open-File map sheet were then exported from the layout view in ArcGIS to Adobe Illustrator files. These were added to a single Adobe Illustrator file that also contained the text, explanatory figures, index maps, and references. Differences between the maps as they appear in the final map sheet and as they appear in the either the .mxd or .pmf files represent changes made in the Adobe Illustrator file to the symbology only (in particular, the addition of annotation) and do not reflect any changes in the actual source data. The map is in UTM projection, zone 10, with units in meters, and at 1:250,000 scale. The accompanying text files were both composed in and exported to PDF files using Microsoft Word.

BASE MAP

The base map layer for this Open-File report consists of a group of three grids arranged in an ArcGIS map document with particular drawing priorities and transparencies. The lowest grid is a version of a 10m cellsize digital elevation model (DEM) of the Willamette Valley and Portland basin (wv_elevation) where elevations are stored in decimeters. This DEM was colored by elevation and overlain with a hillshade image (wv_hillshade) derived from wv_elevation and made 50% transparent. The final grid comes from a

20m cellsize grid representing major rivers of the same area (wv_hydro). All of these grids were previously released in Open-File Report 01-294.

INUNDATION GRIDS

The four inundation grids were derived from wv_elevation by extracting particular ranges of values. They have the same cellsize, spatial reference, and spatial resolution as the original grid.

VECTOR DATA

Geology

Most of the polygons (from the southern extent of the map to latitude 45° 22') in this feature class come from a digital version of USGS Professional Paper 1620 by O'Connor and others (2001). North of latitude 45° 22', the geology comes from digital versions of both Gannett and Caldwell (1998) and Trimble (1963). The spatial resolutions of the data sources are:

O'Connor and others (2001)	1:250,000
Gannett and Caldwell (1998)	1:250,000
Trimble (1963)	1:62,500

Erratics

From the map sheet explanation:

'The glacial erratic database

Known erratic locations in the Willamette Valley come from a variety of published and unpublished sources. Arthur M. Piper cataloged field observations (mostly during 1928 and 1929) and literature citations of glacial erratics in the Willamette Valley and Portland basin in a series of 82 index cards and accompanying field maps archived at the U.S. Geological Survey Water Resources office in Portland, Oregon. From these records, 54 erratic locations were documented. Allison (1935) published a comprehensive study of Willamette Valley glacial erratics. Allison's original records are not available, but 42 locations of glacial erratics were located to the quarter- or half-section in his 1935 publication ["Source" field of "erratics" feature class = "Allison(table)" – E.T. 8/8/03]. These 42 locations were digitized using the elevation and Public Land Survey information published by Allison (1935). In addition to these glacial erratics, 249 additional locations were digitized from a map figure in the same report, in which he indicates the Public Land Office Survey sections (2.6 km2; 1 mi2) that contain erratics ["Source" field of "erratics" feature class = "Allison(fig)" – E.T.]. Consequently, the locations and elevations of these 249 glacial erratics are less well known than others in the database, may include duplicates of erratics described in other sources, and are symbolized by gray triangles on our maps. Field sheets and notes from mapping completed by Jim Bela (Bela, 1981) in the late 70's and early 80's in the west-central Willamette Valley provided the locations of 16 erratics. Several dozen additional locations were collected from various other scientists. John Eliot Allen (1986) describes the location of 5 erratics. Our own observations and communications with scientists, landowners, and other sources account for another 33 erratic locations. As of June 2003, the database contains records of 400 glacial erratics and their locations; however, as many as 28 of these might be duplicates.'

Contours

Contours were generated in the Spatial Analyst extension to ArcGIS 8.3 from the wv_elevation DEM and converted to line feature classes in the Will_Valley geodatabase. While the original DEM grid has z values in decimeters, the values of the contour lines are in feet.

SPATIAL RESOLUTION

Uses of this digital geologic map should not violate the spatial resolution of the data. Although the digital form of the data removes the constraint imposed by the scale of a paper map, the detail and accuracy inherent in map scale are also present in the digital data. The fact that this database was edited at a scale of 1:250,000 means that higher resolution information is not present in the dataset. Plotting at scales larger than 1:250,000 will not yield greater real detail, although it may reveal fine-scale irregularities below the intended resolution of the database. Similarly, where this database is used in combination with other data of higher resolution, the resolution of the combined output will be limited by the lower resolution of these data.

ANNOTATION
Annotation exists only as graphic elements within the final Adobe Illustrator file.

DATABASE SPECIFICS

MAP PROJECTION
The map is projected into UTM Zone 10, NAD 1927, in meters. The ESRI projection file (NAD 27 UTM Zone 10N.prj) is shown below.

```
PROJCS["NAD_1927_UTM_Zone_10N]
GEOGCS["GCS_North_American_1927]
DATUM["D_North_American_1927]
SPHEROID["Clarke_1866",6378206.4,294.9786982]
PRIMEM["Greenwich",0]
UNIT["Degree",0.017453292519943295]
PROJECTION["Transverse_Mercator"]
PARAMETER["False_Easting",500000]
PARAMETER["False_Northing",0]
PARAMETER["Central_Meridian",123]
PARAMETER["Scale_Factor",0.9996]
PARAMETER["Latitude_Of_Origin",0]
UNIT["Meter",1]]
```

DATA OBJECT ATTRIBUTE TABLES
In general, data are stored within a geodatabase as 'data objects'. Specifially, those objects may include 'feature classes', which are collections of vector features with the same type of geometry and the same attributes; 'object classes', which store non-spatial table; and 'feature datasets', which are collections of feature classes that share the same spatial reference and, usually, participate in a topological relationship. Feature classes that exist outside of a feature dataset are known as 'stand-alone feature classes'.

Attributes are stored within the geodatabase as database fields. For those without access to ESRI's ArcCatalog, the structure and data of personal geodatabases can be browsed by opening the geodatabase in Microsoft Access, although editing of the geodatabase from within Access is strongly discouraged.

Below, a table of definitions of the field formatting terms is followed by a table for each of the three feature classes within the Will_Valley geodatabase. No topology or relationship classes exists. One coded attribute domain exists for the 'Unit' field of the *geology* feature class

A note on shapefile attribute tables:
If you are using the shapefile versions of the feature classes, you will find 4 principal differences between the following information and the shapefile attribute tables:

1) A field called 'FID' has been added that contains the unique internal ID number that shapefiles use. It will not be the same as the OBJECT ID field.
2) Field names longer than 10 characters have been truncated, but you should still be able to use the following tables to identify the format and purpose of specific fields
3) Text fields longer than 255 characters have been truncated. This only affects the 'Notes' field of the *erratics* feature class. For this reason, the shapefile download package also includes an Excel (97-2000 format) file containing the unabridged text called ErraticsNotes.xls
4) Double data-type fields will have a precision of 18 and a scale of 11 and long integer data-type fields will have a precision of 9. These appear to be arbitrary values that are set during the process of exporting from geodatabase feature classes to shapefiles.

Table 1 - *Definitions of field formatting terms*

Required fields	Description
OBJECT ID	Unique internal ID number
Shape	Geometry type of the feature. Possibilities include: Point Line – Has associated required field *Shape_Length* Polygon – Has associated required fields *Shape_Length* and *Shape_Area*
Field name	Name of the field in the database
Data type	Type of data stored in the field. Possibilities include: Short Integer: 16 bit integer between –32,000 and +32,000 Long Integer: 32 bit integer between –2 billion and +2 billion Float: Binary fractional number with 7 possible significant digits Double: Binary fractional number with 15 possible significant digits Text: Alphanumeric text limited to 64,000 characters.
Allow nulls	Boolean controlling whether or not the field can have a null value
Domain	Name of the range or coded attribute domain. Used to constrain and validate the data for that field.
Precision	The number of digits that can be stored in the field. 0 if unspecified by designer
Scale	The number of decimal places for double or float fields. 0 if unspecified by designer
Length	The number of characters allowed in a text field

Feature Classes

Table 2 - *Contours*

Field name	*Data type*	*Allow nulls*	*Precision*	*Scale*	*Length*	*Description*
OBJECT ID	Object ID	na	na	na	na	Unique internal ID number
Shape	Line	na	na	na	na	
Contour	Double	yes	0	0	0	Elevation of contour line in feet
Shape_Length	Double	yes	0	0	0	Length of line in map units

Table 3 - *Erratics*

Field name	*Data type*	*Allow nulls*	*Precision*	*Scale*	*Length*	*Description*
OBJECT ID	Object ID	na	na	na	na	Unique internal ID number
Shape	Point	yes	na	na	na	
Erratic_No	Text	yes	na	na	50	Unique ID number within the erratic database.
Source	Text	yes	na	na	50	Original recorder
Elevation	Text	yes	na	na	25	Elevation in feet of the erratic
Township	Text	yes	na	na	5	
Range	Text	yes	na	na	5	
Section	Text	yes	na	na	25	
Lithology	Text	yes	na	na	50	
Comments	Text	yes	na	na	50	Usually on the quality of the location
Location_Qual	Text	yes	na	na	4	Quality of the location accuracy
Date	Text	yes	na	na	12	Date information was recorded
Notes	Text	yes	na	na	2.1E9	Notes of original recorder

Table 4 - *Geology*

Field name	*Data type*	*Allow nulls*	*Domain*	*Precision*	*Scale*	*Length*	*Description*
OBJECT ID	Object ID	na		na	na	na	Unique internal ID number
Shape	Polygon	yes		na	na	na	
Unit	Text	yes	Unit	na	na	4	Geologic unit abbreviation.
Facies	Text	yes		0	0	6	Fine or coarse-grained facies of flood deposits
Shape_Length	Double	yes		0	0	na	Length of perimeter in map units
Shape_Area	Double	yes		0	0	na	Area of polygon in map units

Attribute Domains

Attribute domains are used in geodatabases to constrain and validate the values that are entered into certain fields. A domain may consist of a range of values for a numeric field or as coded values for text fields and, once defined, may be applied to any suitable field within the geodatabase. The Will_Valley geodatabase makes use of one coded domain consisting of geologic unit abbreviations:

Table 6 – *Unit Attribute Domain*

Code	*Description*
Qfc	Qfc
Qff1	Qff1
Qff2	Qff2
Qlg	Qlg
Qs	Qs

Stand-alone tables

Table 5 - *UnitDescription*

Field name	*Data type*	*Allow nulls*	*Precision*	*Scale*	*Length*	*Description*
Unit	Text	yes	na	na	5	Geologic unit abbreviaton
Facies	Text	yes	na	na	6	Whether the unit is a considered a fine or coarse-grained deposit
Description	Text	yes	na	na	2.1E9	Geologic unit description
Source	Text	yes	na	na	255	Publication the description comes from

ACKNOWLEDGMENTS

We thank David Bedford for the digital review of this Open-File Report.

REFERENCES CITED

Gannett, M.W., and Caldwell, R.C., 1998, Geologic framework of the Willamette lowland aquifer system, Oregon and Washington: U.S. Geological Survey Professional Paper 1424-A, 32 p.

O'Connor, J.E., Sarna-Wojcicki, A., Wozniak, K.C., Polette, D.J., and Fleck, R.J., 2001, Origin, extent, and thickness of Quaternary geologic units in the Willamette Valley, Oregon: U.S. Geological Survey Professional Paper 1620, 52 p.

Trimble, D.E., 1963, Geology of Portland, Oregon, and adjacent areas: U.S. Geological Survey Bulletin 1119, 119 p.