Upper Owyhee Watershed Assessment

Appendix A. Notes on mapping

1. Description of how maps were created

The information included as maps in this assessment came from many different sources. The earth's surface is part of a sphere. Maps are flat. There are many different ways of orienting and shaping, "projecting", the spherical surface onto the flat plane. Our brains are capable of taking the landmarks which we recognize and correctly interpreting how the other features are related. However, for comparative purposes it is nice to have all data on paper in a similar projection.

The projection used for the base map is a Universal Transverse Mercator projection optimized for this region of the globe (UTM 11N), using the North American Datum of 1927 (NAD27) as a coordinate system for the placement of objects. The rivers, highways and outline of the upper Owyhee subbasin make up the base map. This is the map that serves as the background on which other information like vegetation can be charted.

There are computer programs to create maps using available "coverages", digitized information about where features are located. The programs used in this assessment were Adobe Photoshop 7.0 for Windows, QGIS 0.11.0 for Linux, and GRASS 6.3.0 for Linux. The original projections of a coverage (map of one characteristic) can be "reprojected" so they match the orientation of the base map.

All data were reprojected into the NAD27 (North American Datum of 1927), UTM11N (Universal Transverse Mercator Zone 11 North) projection. Although NAD83 (North American Datum of 1983) might be a more appropriate choice, the decision was made early in the project. The maximum difference between these data is approximately 82 meters in the area being assessed, but this difference is reduced to a few meters using GIS software with an appropriate mapping between the data. The ultimate mapping resolution is 1:960,000, representing exactly 100mx100m per pixel. The resolution was dictated by the limitations of the software approach used. Alignment error accounts for at most one pixel, meaning the data are aligned to within 182m (1/9 mile) of the correct NAD83 locations.

QGIS was used to view and export GRASS data to image files, which were imported into Adobe Photoshop. Adobe Photoshop 7.0 was used to combine maps from different sources. Some of the maps in this assessment contain information which was originally only available as an image. In that case the original map has been overlaid on the base map using the rivers to orient the information to the base map using Adobe Photoshop 7.0. All maps created in GRASS and QGIS were imported into Adobe Photoshop for final editing.

2. Sources of map data

Coolbaugh M. 2004. Major roads in the state of Nevada.

Major roads in the state of Nevada are represented by this digital line graph (vector map layer). The data were reprojected into the UTM11N NAD27 projection using QGIS.

Daly C, Taylor G. 2000. United States Average Annual Precipitation, 1961-1990. 2000.

> "This map layer shows polygons of average annual precipitation in the contiguous United States, for the climatological period 1961-1990. Parameter-elevation Regressions on Independent Slopes Model (PRISM) derived raster data is the underlying data set from which the polygons and vectors were created. PRISM is an analytical model that uses point data and a digital elevation model (DEM) to generate gridded estimates of annual, monthly and event-based climatic parameters."

Precipitation is represented at a scale of 1:2,000,000 by this polygonal graph (vector map layer with areal data) corresponding to the PRISM rainfall model. The data were reprojected into the UTM11N NAD27 projection using QGIS.

Department of Commerce/National Oceanic and Atmospheric Administration/Western Regional Climate Center. 2009. Western Regional Climate Center SNOTEL Station Data. NRCS National Water and Climate Center. Accessed 7/10/2009.

> "The Natural Resources Conservation Service (NRCS) installs, operates, and maintains an extensive, automated system to collect snowpack and related climatic data in the Western United States called SNOTEL (for SNOwpack TELemetry). The system evolved from NRCS's Congressional mandate in the mid-1930's 'to measure snowpack in the mountains of the West and forecast the water supply.' The programs began with manual measurements of snow courses; since 1980, SNOTEL has reliably and efficiently collected the data needed to produce water supply forecasts and to support the resource management activities of NRCS and others.
>
> Climate studies, air and water quality investigations, and resource management concerns are all served by the modern SNOTEL network. The high-elevation watershed locations and the broad coverage of the network provide important data collection opportunities to researchers, water managers, and emergency managers for natural disasters such as floods."

All SNOTEL sites within the subbasin were identified. Locations of sites were manually entered as a latitude-longitude map layer in the QGIS Geographic Information System.

Department of Commerce/National Oceanic and Atmospheric Administration/Western Regional Climate Center. 2009. Western U.S. Climate Historical Summaries. Accessed 7/10/2009.

"The Regional Climate Centers (RCC) deliver climate services at national, regional and state levels working with NOAA partners in the National Climatic Data Center, National Weather Service, the American Association of State Climatologists, and NOAA Research Institutes. This successful effort resulted in jointly developed products, services, and capabilities that enhance the delivery of climate information to the American public, and builds a solid foundation for a National Climate Service. As NOAA and Congress work to help society adapt to climate change, these collaborative efforts form a framework for the service, data stewardship, and applied research components of the National Climate Service."

All weather stations within the subbasin were identified. Locations of sites were manually entered as a latitude-longitude map layer in the GRASS Geographic Information System.

Department of the Interior/Bureau of Land Management/Idaho State Office/Geographic Sciences. 2009. Surface Management Agency for Idaho (Federal, State, and Private Lands). Version 1. Accessed 7/11/2009.

"This spatial data contains Surface Management Agency (SMA, also sometimes called Land Status) information for Idaho. It shows categories for Federal and State agencies as well as Private lands in Idaho.

For government land, this data displays the MANAGING AGENCY of the land, which may or may not be the same as the "owning agency" of the land. SMA is sometimes referred to as "ownership", although this term is inaccurate when describing public lands.

The Bureau of Land Management (BLM) in Idaho creates and maintains this spatial data. This dataset is derived by dissolving based on the "owner_type" field from the master SMA GIS dataset (which is edited often) kept by the BLM Idaho State Office.

Originally, the primary source of the GEOMETRY of the features was the BLM Geographic Coordinate Database (GCDB). In areas where GCDB records are unavailable, the spatial features are taken from a variety of sources including the BLM Idaho Resource Base Data collection, US Geological Survey Digital Line Graphs (DLGs), and US Forest Service Cartographic Feature Files (CFFs), among others (see Process Steps). It should be stressed that the geometry of the data may NOT be GCDB-based, and the GCDB-based features are not necessarily being edited to match improved GCDB, therefore this data should NOT be considered actual "GCDB data". For the latest GCDB spatial data, please download it from http://www.geocommunicator.gov

The source of the ATTRIBUTE information is an ongoing effort to coordinate between the BLM Master Title Plats (MTPs), the BLM case

files and Realty Staff, the BLM LR2000 database, cooperation with other government agencies that own or manage land parcels, and users of the data. The data for other agencies may not be accurately represented if the information was not provided to the BLM by the managing agency. BLM gives its best effort to attribute the parcels properly, but when errors are found, please contact the BLM Idaho State Office Geographic Sciences department at 208-373-3950.

Please get a fresh copy of this data a couple times a year as the SMA data is constantly changing. Official actions that affect the managing agency are finalized each day, and changes to correct found errors are always being updated.

Nevada SMA data was acquired from the BLM Nevada web site and clipped to the area that is managed by Idaho BLM Boise District.

Purpose: This layer is intended to be a source of surface management agency spatial information in Idaho. Uses of this data include spatial analysis and cartographic products. This data will be made available to all users as BLM corporate data.

The surface management agency data (land "ownership") should be used as a general guide only. Official land records, located at the Bureau of Land Management (BLM) and other offices, should be checked for up-to-date information concerning any specific tract of land. Roads crossing public lands may be used unless closed by signs or notice by the land management agency. Public domain lands surrounded by private land may not be accessible. Permission is required from private landowners to cross private land, unless access is provided by a Federal, State, or County road or a BLM road with legal access."

This digital polygon model digitized at 1:100,000 resolution indicates federal, state, and private management of lands within the state of Idaho. The model was reprojected to the standard UTM11N NAD27 projection using GRASS and subsequently accessed with QGIS.

Department of the Interior/USGS. 2009. National Elevation Dataset. Accessed 7/10/2009.

"The National Elevation Dataset (NED) is the primary elevation data product of the USGS. The NED is a seamless dataset with the best available raster elevation data of the conterminous United States, Alaska, Hawaii, and territorial islands. The NED is updated on a nominal two month cycle to integrate newly available, improved elevation source data. All NED data are public domain. The NED is derived from diverse source data that are processed to a common coordinate system and unit of vertical measure. NED data are distributed in geographic coordinates in units of decimal degrees, and in conformance with the North American Datum of 1983 (NAD 83). All elevation values are in meters and, over the conterminous United States, are referenced to the North American Vertical

Datum of 1988 (NAVD 88). The vertical reference will vary in other areas. NED data are available nationally (except for Alaska) at resolutions of 1 arc-second (about 30 meters) and 1/3 arc-second (about 10 meters), and in limited areas at 1/9 arc-second (about 3 meters). In most of Alaska, only lower resolution source data are available. As a result, most NED data for Alaska are at 2-arc-second (about 60 meters) grid spacing, Part of Alaska is available at the 1- and 1/3-arc-second resolution, and plans are in development for a significant improvement in elevation data coverage of the state.

The NED serves as the elevation layer of The National Map, and provides basic elevation information for earth science studies and mapping applications in the United States. Scientists and resource managers use NED data for global change research, hydrologic modeling, resource monitoring, mapping and visualization, and many other applications.

The Seamless Data Distribution System (SDDS) offers seamless data for a user-defined area, in a variety of formats, for online download or media delivery.

Historic Digital Elevation Models (DEMs) are now available."

The National Elevation Dataset was used at a resolution of 1 arc-second. The files for four separate sectors were patched into a seamless dataset. Contours as digital line graphs at 500-ft, 1,000-ft, 2,500-ft, and 5,000 ft intervals were created using the GRASS contour function. The data were reprojected into the UTM11N NAD27 projection using GRASS.

Department of the Interior/USGS. 2009. National Hydrography Dataset.

"The National Hydrography Dataset (NHD) is the surface water component of The National Map. The NHD is a comprehensive set of digital spatial data representing the surface water of the United States using common features such as lakes, ponds, streams, rivers, canals, and oceans. These data are designed to be used in general mapping and in the analysis of surface-water systems using geographic information systems (GIS). In mapping, the NHD is used with other data themes such as elevation, boundaries, and transportation to produce general reference maps. Customized maps can be made to meet specific needs of the user by emphasizing certain aspects of the data. A map emphasizing hydrography can be produced by displaying more of the content embedded in hydrography.

The NHD often is used by scientists, specifically in surface-water analysis using GIS technology. This takes advantage of a rich set of embedded attributes that can be processed by a computer system to generate specialized information. This information can then be portrayed in specialized maps to better understand the results. These analyses of hydrography are possible largely because the NHD contains a flow direction network that traces the water downstream or upstream. It also

> uses an addressing system to link specific information about the water such as water discharge, water quality, and fish population. Using the basic water features, flow network, linked information, and other characteristics, it is possible to study cause and affect relations, such as how a source of poor water quality upstream might affect a fish population downstream."

The National Hydrography Dataset was used to create data for water bodies, flowlines, and perennial streams. This dataset contains in vector format artificial flowlines, connectors, canals/ditches, flows through lakes and ponds, flows through playas, flows through swamps and marshes, and perennial streams. The artificial flowlines and perennial streams were used to generate digital line graphs of the flows in the Upper Owyhee subbasin.

Also included in the National Hydrography Dataset are polygon maps of the lakes, reservoirs, ponds, playas, swamps, and marshes in the Upper Owyhee subbasin. These maps were used for mapping of major water bodies in the subbasin.

All data were imported into GRASS and reprojected into the UTM11N NAD27 projection using GRASS.

Department of the Interior/USGS. 2009. USGS Water-Data Site Information for the Nation. Accessed 7/10/2009.

> "The Site Inventory System contains and provides access to inventory information about sites at stream reaches, wells, test holes, springs, tunnels, drains, lakes, reservoirs, ponds, excavations, and water-use facilities.
>
> About 300 components make up the descriptive elements of the site inventory. The retrieval program can be used for retrieving information about sites in summary lists, in detailed tables, or a file suitable for input to other programs."

USGS Water-Data Site Information for the Nation comprises all streamflow gages. The latitude-longitude data for these sites (in NAD27) were used to place the gages on the corresponding map. This was done via direct latitude-longitude entry of points in QGIS.

Department of the Interior/USGS/U.S. Board on Geographic Names. 2009. Geographic Names Information System (GNIS). Accessed 7/10/2009.

> "The Geographic Names Information System (GNIS) is the Federal and national standard for geographic nomenclature. The U.S. Geological Survey developed the GNIS in support of the U.S. Board on Geographic Names as the official repository of domestic geographic names data, the official vehicle for geographic names use by all departments of the Federal Government, and the source for applying geographic names to Federal electronic and printed products.
>
> The GNIS contains information about physical and cultural geographic features of all types in the United States, associated areas, and

> Antarctica, current and historical, but not including roads and highways. The database holds the Federally recognized name of each feature and defines the feature location by state, county, USGS topographic map, and geographic coordinates. Other attributes include names or spellings other than the official name, feature designations, feature classification, historical and descriptive information, and for some categories the geometric boundaries.
>
> The database assigns a unique, permanent feature identifier, the Feature ID, as the only standard Federal key for accessing, integrating, or reconciling feature data from multiple data sets. The GNIS collects data from a broad program of partnerships with Federal, State, and local government agencies and other authorized contributors, and provides data to all levels of government, to the public, and to numerous applications through a web query site, web map and feature services, file download services, and customized files upon request."

GNIS was used for determination and placement of both populated places and mine sites. Direct latitude-longitude entry was used to bring the data into QGIS.

Department of the Interior & Department of Agriculture/GeoMAC (Geospatial Multi-Agency Coordination). 2009. Historic Fire Data. Accessed 7/10/2009.

> "The Geospatial Multi-Agency Coordination Group or GeoMAC, is an internet-based mapping application originally designed for fire managers to access online maps of current fire locations and perimeters in the conterminous 48 States and Alaska. Using a standard web browser, fire personnel can view this information to pinpoint the affected areas. With the growing concern of western wildland fires in the summer of 2000, this application has also become available to the public. We hope that you find this important information both timely and helpful."

Historic fire data are available on an annual basis and on a multi-annual basis. The data were reprojected into the UTM11N NAD27 projection using QGIS.

Environmental Protection Agency/Office of Water/OST. 1998. Counties and County Equivalents Boundaries in the United States for BASINS. Accessed 7/10/2009.

> "This coverage is of the county boundaries of the conterminous United States. It was derived from the U.S. Geological Survey State Boundaries, which were derived from Digital Line Graph (DLG) files representing the 1:2,000,000-scale map in the National Atlas of the United States."

BASINS was used to generate boundaries both within QGIS and within GRASS for reference purposes and to generate baseline reference data. BASINS was used to generate basemaps for both systems in the native UTM11N NAD27 projection.

Environmental Protection Agency/Office of Water/OST. 1998. Hydrologic Unit Boundaries of the Conterminous United States in BASINS. Accessed 7/10/2009.

"This metadata describes various delineations of watershed boundaries being stored in the EPA Spatial Data Library System (ESDLS). These delineations are based on the Hydrologic Unit Maps published by the U.S. Geological Survey Office of Water Data Coordination, together with the list descriptions and name of region, subregion, accounting units, and cataloging units. This metadata set describes the spatial data sets as they exist after downloading the data from ESDLS.

The changes made to the data sets from ESDLS are as follows:

1) Reprojected the ARC/INFO coverages to a geographic projection.

2) Derived accounting unit and cataloging unit layers only from original data.

3) Convertted ARC/INFO coverages to Arcview Shapefiles with ARCSHAPE

command in Environmental Systems Research Institute (ESRI) GIS software."

BASINS was used to generate boundaries both within QGIS and within GRASS for reference purposes and to generate baseline reference data. BASINS was used to generate basemaps for both systems in the native UTM11N NAD27 projection.

Geographic Information Services Unit, Oregon Department of Transportation (ODOT). 2006. Highways. 2006. Accessed 7/11/2009.

"This statewide file represents an annual snapshot and includes all state owned or maintained highways, spurs, connections, frontage roads, temporary traveled routes (TTR) and located lines."

Oregon publishes all GIS data in the Oregon Lambert Projection, a conical projection base on the NAD83 datum. These data were reprojected into the UTM11N NAD27 projection in GRASS, and then imported into QGIS. One road from north of McDermitt, OR to the Nevada border was manually projected with a linear transformation from the ODOT county map system in Oregon Lambert to the UTM11N NAD27 coordinate sytem.

GRASS Development Team. 2009. Geographic Resources Analysis Support System (GRASS) Software. Open Source Geospatial Foundation.

GRASS software was used for sophisticated reprojection and data analysis problems, including creating contours from the NED (National Elevation Dataset) and counting census data. GRASS represents the state-of-the-art in open-source geographic information systems.

Idaho Transportation Department, GIS Section. 2004. Idaho State Highways. 2004. Accessed 7/11/2009.

"Idaho State Highway System (US Highways, State Highways, Interstate Highways and Rest Areas/POEs)."

Idaho's state highway map is published in a GIS-friendly format. The data were reprojected with minimal error from UTM11N NAD83 into the UTM11N NAD27 projection using QGIS.

Multi-Resolution Land Characteristics Consortium (MRLC). 2008. National Land Cover Database (NLCD) 1992/2001 Retrofit Land Cover Change.

"New developments in mapping methodology, new sources of input data, and changes in the mapping legend for the 2001 National Land Cover Database (NLCD 2001) will confound any direct comparison between NLCD 2001 and the 1992 National Land Cover Dataset (NLCD 1992). Users are cautioned that direct comparison of these two independently created land cover products is not recommended. This NLCD 1992/2001 Retrofit Land Cover Change Product was developed to offer users more accurate direct change analysis between the two products.

The NLCD 1992/2001 Retrofit Land Cover Change Product uses a specially developed methodology to provide land cover change information at the Anderson Level I classification scale (Anderson et al., 1976), relying on decision tree classification of Landsat imagery from 1992 and 2001. Unchanged pixels between the two dates are coded with the NLCD 2001 Anderson Level I class code, while changed pixels are labeled with a "from-to" land cover change value (Change Code Table). Additional detail is available in the metadata included in the multizone downloadable zip file. This product is designed for regional application only and is not recommended for local scales.

The 65 CONUS mapping zones (excluding Alaska) have been grouped into 14 larger zonal areas to facilitate distribution and download. A mouse click on an area of interest will follow the link to the multizone download site. A shapefile with the standard NLCD zone attributes and multizone attributes is also available."

This 30-meter-resolution product classifies land cover and land cover change over a nine-year period between 1992 and 2001. Data were reprojected from the Albers conical equal-area projection to UTM11N NAD27 using GRASS GIS software.

Multi-Resolution Land Characteristics Consortium (MRLC). 2008. National Land Cover Database 2001 (NLCD 2001).

"New developments in mapping methodology, new sources of input data, and changes in the mapping legend for the 2001 National Land Cover Database (NLCD 2001) will confound any direct comparison between NLCD 2001 and the 1992 National Land Cover Dataset (NLCD 1992). Users are cautioned that direct comparison of these two independently

created land cover products is not recommended. This NLCD 1992/2001 Retrofit Land Cover Change Product was developed to offer users more accurate direct change analysis between the two products.

The NLCD 1992/2001 Retrofit Land Cover Change Product uses a specially developed methodology to provide land cover change information at the Anderson Level I classification scale (Anderson et al., 1976), relying on decision tree classification of Landsat imagery from 1992 and 2001. Unchanged pixels between the two dates are coded with the NLCD 2001 Anderson Level I class code, while changed pixels are labeled with a "from-to" land cover change value (Change Code Table). Additional detail is available in the metadata included in the multizone downloadable zip file. This product is designed for regional application only and is not recommended for local scales.

The 65 CONUS mapping zones (excluding Alaska) have been grouped into 14 larger zonal areas to facilitate distribution and download. A mouse click on an area of interest will follow the link to the multizone download site. A shapefile with the standard NLCD zone attributes and multizone attributes is also available."

This 30-meter-resolution product classifies land cover in the calendar year 2001. Data were reprojected from the Albers conical equal-area projection to UTM11N NAD27 using GRASS GIS software.

National Atlas of the United States. 2006. Federal Lands of the United States.

"This map layer consists of federally owned or administered lands of the United States, Puerto Rico, and the U.S. Virgin Islands. Only areas of 640 acres or more are included. There may be private inholdings within the boundaries of Federal lands in this map layer. This is a revised version of the December 2005 map layer."

National Atlas of the United States. 2006. Indian Lands of the United States.

"This map layer shows Indian lands of the United States. Only areas of 640 acres or more are included. Federally-administered lands within a reservation are included for continuity; these may or may not be considered part of the reservation and are simply described with their feature type and the administrating Federal agency. This is an updated version of the December 2005 map layer."

This map layer was used to map the boundaries of the Duck Valley Indian Reservation.

National Atlas of the United States. 2004. Cities and Towns of the United States. Accessed 7/10/2009.

"This map layer includes cities in the United States, Puerto Rico and the U.S. Virgin Islands. These cities were collected from the 1970 National Atlas of the United States. Where applicable, U.S. Census Bureau codes for named populated places were associated with each name to allow

additional information to be attached. The Geographic Names Information System (GNIS) was also used as a source for additional information. This is a revised version of the December 2003 map layer."

This map is a point map (vector map without lines). The map was dynamically reprojected in QGIS to the standard UTM11N NAD27 projection used for this project.

National Atlas of the United States. 2005. Streams and Waterbodies of the United States. Accessed 7/10/2009.

"This map layer shows areal and linear water features of the United States, Puerto Rico, and the U.S. Virgin Islands. The original file was produced by joining the individual State hydrography layers from the 1:2,000,000- scale Digital Line Graph (DLG) data produced by the USGS. This map layer was formerly distributed as Hydrography Features of the United States. This is a revised version of the January 2003 map layer."

The map layer was edited in QGIS to remove all but principal water courses outside of the Upper Owyhee subbasin. The map was dynamically reprojected in QGIS to the standard UTM11N NAD27 projection used for this project. The map forms the basis for hydrological mapping within this project.

National Atlas of the United States. 2006. Major Dams of the United States Accessed 7/10/2009.

"This map layer shows areal and linear water features of the United States, Puerto Rico, and the U.S. Virgin Islands. The original file was produced by joining the individual State hydrography layers from the 1:2,000,000- scale Digital Line Graph (DLG) data produced by the USGS. This map layer was formerly distributed as Hydrography Features of the United States. This is a revised version of the January 2003 map layer."

This map is a point map (vector map without lines). The map was dynamically reprojected in QGIS to the standard UTM11N NAD27 projection used for this project.

Quantum GIS Development Team. 2009. Quantum GIS Geographic Information System. Open Source Geospatial Foundation.

QGIS is the most user-friendly open-source GIS application.

USDA Service Center Agencies. 2004. National Coordinated Common Resource Area.

"A CRA map delineation is defined as a geographical area where resource concerns, problems, or treatment needs are similar. It is considered a subdivision of an existing Major Land Resource Area (MLRA) map delineation or polygon. Landscape conditions, soil, climate, human considerations, and other natural resource information are used to determin the geographic boundaries of a CRA (Title 450, Technology, General Manual, Part 401, Technical Guides, Section 401.21, Definitions).

The National Coordinated CRA Geographic Database, Version 1.1, provides:

1) A consistent CRA geographic database;

2) CRA geographic data compatible with other Geographic Information System (GIS) data digitized from 1:250,000 scale maps, such as land use/land cover, political boundaries, Digital General Soil Map of the U.S. (updated STATSGO), and ecoregion boundaries;

3) A consistent (correlated) geographic index for Conservation Management Guide Sheet information and the electronic Field Office Technical Guide (eFOTG); and

4) A geographic linkage with the national MLRA framework."

Polygon maps at a resolution of 1:250,000 were imported into GRASS and reprojected into the standard UTM11N NAD27 projection used for this project. They were subsequently accessed with QGIS.

3. USGS topographic maps

Inside Idaho. Idaho USGS 1:24,000-scale digital raster graphic (DRG) collection search and download. Accessed 2/10/2009. http://maps.insideidaho.org/WebMapping/Search/DownloadDRG/index.asp

This interactive map was used to identify the USGS 7.5' quadrangles in the Idaho and Oregon sections of the upper Owyhee subbasin.

Idaho Geospatial Office. 2009. DRG: 24K UTM with collar. In: Gail Eckwright, Director. *Inside Idaho:Interactive Numeric & Spatial Information Data Engine.* Accessed 2/20/2009. http://inside.uidaho.edu/asp/drgnameUTM.asp?Letter=A

A Digital Raster Graphic (DRG) is a georeferenced raster image of a scanned USGS topographic map. A DRG is useful as a source or background layer in a GIS, as a means to perform quality assurance on other digital products, and as a source for the collection and revision of other data.

This site was the source of the topographic maps of Idaho retrieved for reference while writing this assessment.

W. M. Keck Earth Sciences and Mining Research Information Center. 2001. 1:24,000 scale topos clickable map. Accessed 2/11/2009. http://keck.library.unr.edu/data/drg/nv24k_clickable.html

This interactive map was used to identify the USGS 7.5' quadrangles in the Nevada section of the upper Owyhee subbasin.

W. M. Keck Earth Sciences and Mining Research Information Center. 2003. USGS topographical maps (DRGs). Retrived 2/20/2009. http://keck.library.unr.edu/data/drg/drgs.html

Digital raster graphic (DRGs) are scanned images (minimum resolution of 250 dots per inch) of USGS standard series topographic maps, including all collar information. The image is georeferenced and fit to the Universal

Transverse Mercator projection. Most DRGs on this site are North American Datum (NAD) 1927_UTM_Zone11. Exceptions are the 1:24000 clipped/no collar files which are NAD 83 and the California DRG's which are NAD_1927_California_Teale_Albers.

This site was the source of the topographic maps of Nevada retrieved for reference while writing this assessment.

Oregon USGS Digital Raster Graphics (DRG) Index. Accessed 7/21/2009. http://libremap.org/data/state/oregon/drg/

The sources of topographic maps have changed over time. Oregon no longer has a state web site with the maps. However, as of July 21, 2009 the topographic maps for all the states of the United States were available from the Libre Map Project at http://libremap.org/

The USGS 1:24,000 scale topographic quadrangles in the upper Owyhee subbasin:

In Idaho:

Battle Creek Lakes
Bedstead Ridge
Big Springs Ranch
Brace Flat
Bull Basin Camp
Bull Camp Butte
Castro Table
Clover Mountain
Coyote Hole
Crab Spint Butte
Defeat Butte
Dickshooter Ridge
Flying H Ranch
Four Corners
Frying Pan Basin
Grassy Ridge
Hat Peak
Hurry Up Creek
Indian Meadows
Jarvis Pasture
Juniper Basin
Juniper Basin SE
Little Blue Table
Lost Valley
Mountain View Lake
Nadine Butte
Nichol Flat
Piute Basin East
Piute Basin West
Pleasant Valley
Red Basin
Riddle
Ross Lake
Rubber Hill
Shoofly Springs
Slack Mountain
Smith Creek
Snow Creek
Spring Creek Basin
Star Valley
Star Valley Knoll
Star Valley Ridge East
Star Valley Ridge West
State Line Camp
Turner Table
Wagon Box Basin
Wickiup Creek

In Nevada:

Badger Creek
Big Cottonwood Canyon
Bull Run Reservoir
Burner Hills
Button Lake
Button Lake Well
Calico Butte
Capitol Peak
Chicken Creek Summit
Cornucopia Ridge
Cornwall Mountain
Corral Lake
Cottonwood Peak
Deep Creek
Desert Ranch
Dry Creek Reservoir
Fourmile Butte
Greeley Flat
Greeley Flat SE
Groundhog Reservoir
Haystack Peak
Hicks Mountain
Humboldt Hill
I-L Ranch
Jacks Peak
Lake Mountain
Maggie Summit

Maiden Butte
Maiden Butte SE
McAfee Peak
McCleary Wells
Merritt Mountain
Middle Draw Reservoir
Mountain City
Mount Blitzen
Owyhee
Peterson Table East
Red Cow Creek
Rodear Flat
Sheep Creek Reservoir
Silver Lake
Soldier Cap
Star Valley Ridge SE
Star Valley Ridge SW
Sugarloaf Butte
Tennesee Mountain
The Point
Tuscarora
Twelvemile Flat
Twelvemile Flat SE
Ungina Wongo
Water Pipe Canyon
Wild Horse
Wilson Reservoir
Winter Ridge
Winters Ranch Reservoir

In Oregon:

Defeat Butte
Oregon Butte
Lookout Lake
Star Valley Knoll

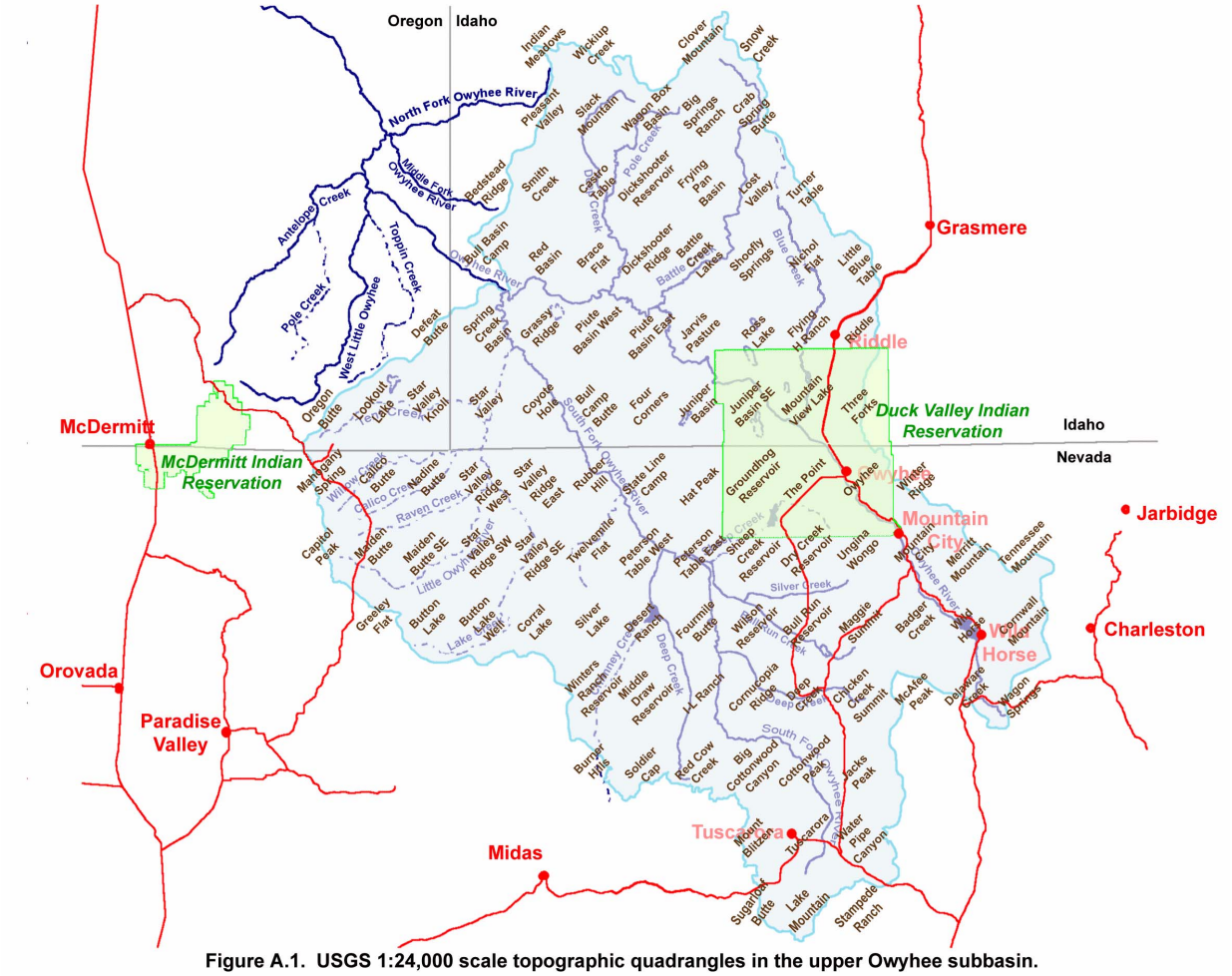

Figure A.1. USGS 1:24,000 scale topographic quadrangles in the upper Owyhee subbasin.