INTERNET-BASED INTERACTIVE MAPS AND SATELLITE IMAGES OF THE YUCCA MOUNTAIN AREA

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FIGURES

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QUALITY OF DATA, ANALYSES, AND CODE DEVELOPMENT

DATA: Data and information contained in this report meet quality assurance requirements described in the CNWRA Quality Assurance Manual. The data and information used in support of this report are from documents published by the U.S. Department of Energy (DOE), its contractors, and supporting organizations for the Yucca Mountain Project. The respective sources of these documents should be consulted for determining the level of quality assurance.

ANALYSES AND CODES: Maps and related Geographic Information System data were generated and plotted by the software ArcGIS® (Environmental Systems Research Institute, Inc., 2004), that includes ArcMap® Version 9.0, and ArcInfo® Version 9.0, which are commercially available software codes that are maintained in accordance with CNWRA Technical Operating Procedure TOP–018.

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1 INTRODUCTION

The U.S. Department of Energy (DOE) has been investigating Yucca Mountain, Nevada, as a potential deep geologic repository for high-level waste. DOE, Nye County, Nevada, Inyo County, California, and the U.S. Geological Survey, among other interested organizations, have been conducting geological, geophysical, and hydrological investigations to obtain data about Yucca Mountain and the surrounding region. Such data are available in numerous reports. The Center for Nuclear Waste Regulatory Analyses (CNWRA®) staff selected certain data sets and developed a practical method to display them on maps and images.

As described in this report, staff developed a set of internet-based interactive maps and satellite images of the Yucca Mountain area to be used as a tool to facilitate the staff review of the DOE Yucca Mountain Repository License Application (YMRLA)[1].

2 PURPOSE

U.S. Nuclear Regulatory Commission (NRC) and Center for Nuclear Waste Regulatory Analyses (CNWRA®) staffs may need to consult and refer to a series of geographical, geological, and geophysical maps and satellite images of the Yucca Mountain area in conducting their review of the YMRLA. Staff therefore need to have a tool enabling them to instantly access, view, and compare large sets of graphical-based and text-based geographical and geological information of the Yucca Mountain area, including information and data on hundreds of borings and wells drilled during the site characterization phases. This internet-based tool of interactive maps and satellite images was therefore specifically designed and constructed to be practical and efficient and to help staff review the YMRLA. Instead of giving each staff member a set of these large printed maps and satellite images, staff can use this tool to view an electronic version of these maps and images interactively through an internet-based application on their computer screen. Staff will also be able to view basic information and data on boreholes and wells in the area of Yucca Mountain.

3 DESCRIPTION AND USE OF THE INTERNET SITE

3.1 Description of the Internet Site

This internet-based tool of interactive maps and satellite images of the Yucca Mountain area has been developed on a dedicated internet site accessible to the public from any location at http://gedinfomaps.swri.org/YMmaps/.

This internet site is based on a free Application Interface Programming (API)[2] Google Maps™ provides. Google Maps API allows individuals, organizations, or businesses to embed Google Maps in their own public internet sites or to use the maps and satellite images Google Maps provides as a base and add their own customized maps application. The API provides a number of utilities for overlaying maps, adding a variety of text and graphic-based contents, features, and links to the maps.

[1] Yucca Mountain Repository License Application (YMRLA) is used frequently throughout this document, therefore the acronym “YMRLA” will be used.
[2] Application Interface Programming (API) is used frequently throughout this document, therefore the acronym “API” will be used.

Staff selected four base maps and satellite images Google Maps provides:

1. A basic geographical map of places, roads, rivers, water bodies, recreational places, and parks labeled “Map”

2. A shaded-relief and topographic contours map labeled “Terrain”

3. High resolution satellite images labeled “Satellite”

4. A hybrid combination of the basic geographical map and satellite images labeled “Hybrid”

In building this internet-based tool, staff added five separate maps and features that can be overlain one at a time on the base satellite images Google Maps provides. These five maps are

1. Topographic Map (U.S. Geological Survey, 1998; 1997a–e; 1996a,b; 1985). This is a mosaic of nine 1:100,000-scale maps.

2. Digital Bedrock Geological Map, Beatty Quadrangle (Carr, et al., 1996). The printed version of this map is at a scale of 1:100,000.

3. Geologic Map of the Yucca Mountain Region (Potter, et al., 2002). The printed version of this map is at a scale of 1:50,000.

4. Faults from the Tectonic Map of the Death Valley Ground-Water Model Area (Workman, et al., 2002). The printed version of this map is at a scale of 1:250,000.

5. Magnetic Anomaly Map based on 2004 DOE Aeromagnetic Survey (Stamatakos, et al., 2007).

The features (i.e., not maps or images) added consist of

1. Names and labels of geographic features not present in Google Maps base geographic map

2. Well locations of the Early Warning Drilling Program of the Nye County Nuclear Waste Repository Project Office (Nye County Nuclear Waste Repository Project Office, 2008)

3. Well locations of the Inyo County Research Wells of the Inyo County Yucca Mountain Repository Assessment Office (Inyo County Yucca Mountain Repository Assessment Office, 2007, 2005)

4. DOE boreholes drilled prior to 2000 (DOE, 1999)

5. Amargosa Valley miscellaneous wells and natural springs located in the vicinity of Yucca Mountain prior to 2000, the Exploratory Studies Facility, and Enhanced Characterization of the Repository Block Cross Drift (DOE, 1999)

Features data and information are being added to a database, and these five features are currently available on the internet site.

3.2 Use of the Internet Site

This internet-based tool provides interactivity to the maps and images that printed maps and images can not. Using Google Maps API features, a selected map can be overlain on top of the Google base satellite images. A user can navigate over selected maps and images using a panning feature and can magnify or decrease the size of the maps and images using a zooming feature.

Using this internet site is fairly evident and self-explanatory. Basic features of the internet site include (i) toggling maps and images layers and features on and off; (ii) panning over maps and images on the screen in any direction; (iii) zooming in or out on the selected maps and images on the screen; (iv) having basic well/borehole information appear in a pop-up window when a well marker is selected; and (v) viewing well lithologic log and completion diagrams, if available, in a separate window or through internet links.

For example in Figure 1, a typical screen shows a Google Maps base satellite image of the Yucca Mountain area centered on Crater Flat. Basic panning and zooming navigation tools are located on the top left corner of the screen. Toggling maps, satellite images, and features on and off the screen is enabled by a pull-down menu and button located on the top and bottom left corners of the screen.

Additionally, staff added a transparency feature. Upon selecting and overlaying a map on top of the base satellite images, a user can increase or decrease the transparency of the selected overlain map, while conversely, the visibility of the underlying base satellite images increase or decrease.

Many features (i.e., wells, borings, springs, etc.) are turned on or off on the maps and satellite images. When turned on, their locations on the screen are shown with distinctive markers. Upon clicking on a selected marker, a small pop-up window opens, provides some basic data and information on the selected feature, and may also redirect the user to files or separate internet links providing comprehensive data and information on the selected feature.

In summary, this internet-based tool of interactive maps and satellite images of the Yucca Mountain area was designed to be intuitive, user friendly, and efficient in providing a wealth of geographical, geological, and geophysical information and data to help staff review the DOE YMRLA.

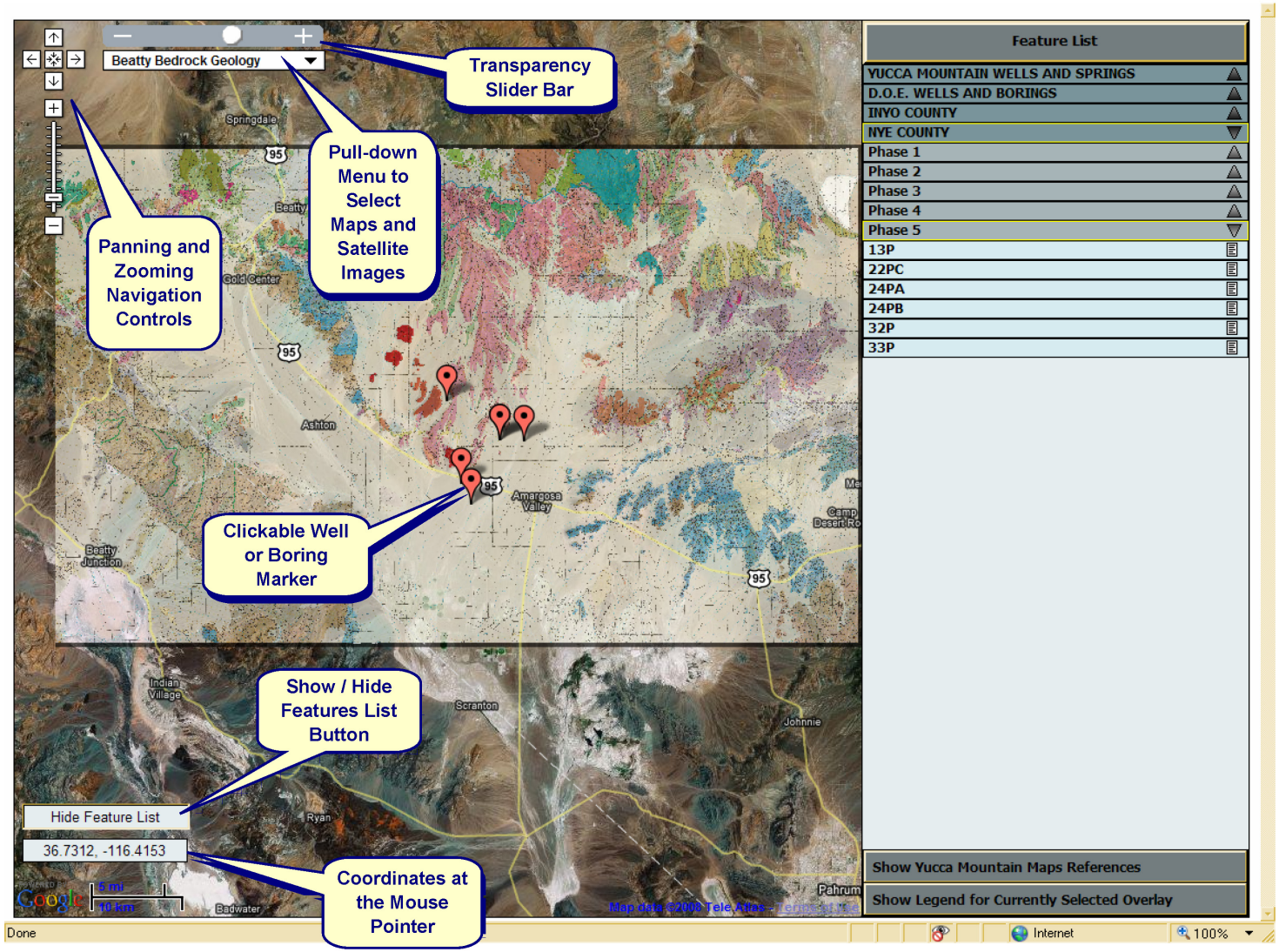

Figure 1. Example of a Screen of the Internet Site of Interactive Maps and Satellite Images of the Yucca Mountain Area

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