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SUPPLEMENTAL INFORMATION SOURCE DOCUMENT

ENVIRONMENTAL GEOGRAPHIC INFORMATION SYSTEM

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Abstract

This document describes how the Environmental Geographic Information System (EGIS) was used, along with externally received data, to create maps for the Site-Wide Environmental Impact Statement (SWEIS) Source Document project. Data quality among the various classes of geographic information system (GIS) data is addressed. A complete listing of map layers used is provided.

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ACRONYMS AND ABBREVIATIONS

CAD	Computer Aided Design
CD	compact disk
DOE	Department of Energy
EGIS	Environmental Geographic Information System (SNL/NM)
ER	Environmental Restoration
ES&H	Environment, Safety, and Heath
ESRI	Environmental Systems Research Institute
FGDC	Federal Geographic Data Committee
FGIS	Facilities Geographic Information System (SNL/NM)
FY	fiscal year
KAFB	Kirtland Air Force Base
GIS	Geographic Information System
GPS	Global Positioning System
MOU	Memorandum of Understanding
NAD	North American Datum
OAEE	Operational Area Environmental Evaluation
QAMP	Quality Assurance Management Plan
RCRA	Resource Conservation and Recovery Act
RGIS	Resource Geographic Information System (UNM)
SNL/NM	Sandia National Laboratories / New Mexico
SWEIS	Site-Wide Environmental Impact Statement
TA	Technical Area
UNM	University of New Mexico

1. INTRODUCTION

The Environmental Geographic Information System (EGIS) Supplemental Information Source Document contains a listing of all Geographic Information System (GIS) data used in the Site-Wide Environmental Impact Statement (SWEIS) Source Document project. This listing includes all layers used in Operational Area Environmental Evaluation (OAEE) maps, as well as layers used in other SWEIS source document maps.

This document also contains a rating of data quality for each layer, allowing the reader to comprehend its level of quality. The purpose is to allow the future SWEIS analyst to determine the quality of any layers that may be critical to particular SWEIS analyses.

This document is accompanied by a compact disk (CD) containing the map layers maintained in the database at Sandia National Laboratories/New Mexico (SNL/NM), including metadata for all the relevant layers. Also included are layers from external organizations.

1.1 Assumptions and Initial Conditions

This document was developed under the following assumptions and initial conditions:

- It is assumed that the data quality of the GIS layers is sufficient for SWEIS analyses. Upgraded data may be provided in fiscal year (FY) 2011/2012, if and when it is developed.
- GIS data provided to SNL/NM Environment, Safety, and Health (ES&H) personnel from external organizations, including SNL/NM Facilities, are not collected, entered, or maintained by SNL/NM ES&H personnel and, therefore the data quality cannot be assured.
- It is assumed that the Department of Energy (DOE) will be able to obtain copies of the externally-owned data sets directly from the external organizations; and therefore, data sets from external organizations are not necessarily included on the electronic deliverable from the EGIS.

2. GIS DATA FOR THE SWEIS

2.1 Sources of GIS Data

The GIS data used in SWEIS Source Document maps originates from four primary sources:

- SNL/NM Environmental Geographic Information System
- SNL/NM Facilities Geographic Information System (FGIS)
- Kirtland Air Force Base (KAFB) GeoBase system
- New Mexico Resource GIS (RGIS) from the University of New Mexico (UNM), which collects data about New Mexico from a variety of original public sources.

Only the data from the SNL/NM EGIS is collected, entered, and maintained by the SWEIS Source Document project in SNL/NM ES&H; and therefore, has quality that can be confidently ascertained and completely described in this document. While every effort has been made to ascertain the quality of data from other sources, the SWEIS Source Document project team ultimately has no control over what is received, and often has received little or no documentation as to its data quality (i.e., metadata).

The SNL/NM FGIS is a Computer Aided Design (CAD) system for infrastructure, so this system has not maintained Federal Geographic Data Committee (FGDC) compliant metadata. As a result, metadata has not been included in data transfers of geo-referenced CAD data to EGIS for use in EGIS-based maps. Likewise, KAFB has not typically provided any metadata with GIS data in the past. However, recent layers from both FGIS and KAFB are usually rated as high quality, due to the fact that both organizations are known to collect data using professional-grade, or even survey-grade, Global Positioning System (GPS) equipment.

It is important to note that some data layers are the result of a mixture of data from two sources (e.g., FGIS/KAFB) which means that data was transferred from KAFB to FGIS, then combined with FGIS data (or vice-versa) prior to being supplied to the EGIS for SWEIS map making. This results from the fact that FGIS is responsible for maintaining infrastructure data on SNL/NM-owned areas of KAFB, while KAFB is responsible for maintaining infrastructure data on the balance of the base. However, both SNL/NM and KAFB need the combined data for their mission-related activities.

A Memorandum of Understanding (MOU) is currently being pursued between DOE and KAFB to allow free exchange of GIS and other data. While this MOU is not anticipated to be executed for many months, it may be a key document for expediting any data calls involving updated KAFB data during the course of the SWEIS analysis in FY2011/2012.

The RGIS, being a publicly accessible data store maintained by a government entity (UNM), tends to have exceptionally thorough metadata. Therefore, even if the quality of such data is not perfect, it is very well documented. Updates of this data may be freely obtained online, but it is included on the deliverable CD for convenience.

2.2 Consistency of Map Layers Used in Source Documents

GIS data is used throughout the SWEIS Source Documents in the form of inserted maps. One difficulty is that the dozen or more source documents were developed and went through the review and approval process at different times, and yet must be consistent in terms of generic maps displayed. SNL/NM and KAFB are always changing, resulting in GIS data constantly changing as well (although with a significant time lag). Making maps for the source documents using the very latest GIS data at the time of a particular source document's internal delivery could result in maps showing alterations in some features between several source documents. It is also considered unacceptable to revise maps with upgraded data during or after the review and approval process.

The solution to this issue was to freeze the data used in the source document maps at a given point in time, just when signature and classification review of the final OAEE document was completed. While recognizing that GIS data may change between that time and the time of final project delivery, consistency among source documents was considered to be the higher priority. It is assumed that if updated layers are needed for particular SWEIS-related analyses during FY2011/2012, they can be provided at that time after the appropriate review and approval process.

2.3 EGIS Data Layer Creation Methodology

GIS layers in the EGIS were created according to a standard methodology (Bleakly 2006). EGIS data is typically created by trained GIS professionals using professional-grade Trimble GPS units, resulting in data that is typically accurate to less than 1 meter. The primary exception to this involves GPS of wildlife locations, in which most data is collected with consumer grade equipment and confirmatory data is collected with professional grade equipment, resulting in potentially less accurate data, though data that is still considered adequate for the purposes of wildlife tracking. All data is processed using an Environmental Systems Research Institute (ESRI) ArcInfo Unix workstation and initially stored in the ArcInfo coverage format. All data is created, stored, and projected in New Mexico State Plane North American Datum (NAD) 1927, though a changeover to NAD 1983 is anticipated during 2010.

All official maps involving Environmental Management and Environmental Restoration data are created using the Unix ArcInfo environment. Map production is executed with ArcPlot within the ArcInfo workstation environment utilizing Arc Macro Language (.aml) programs to catalog all the GIS layers with their symbols and create the maps in postscript format. Maps then undergo a review and approval process to verify that the proper data is displayed.

All EGIS data for the SWEIS received a final processing step, in which the ArcInfo coverages were imported as feature classes into feature data sets in an ESRI file geodatabase. This final data can be easily viewed and analyzed using the Windows-based ESRI ArcMap/ArcCatalog 9.3 suite (ArcInfo, ArcEditor, or ArcView license level).

Metadata is stored in the EGIS ArcInfo Unix system in the form of metadata files (.met) files generated by the National Oceanic and Atmospheric Administration FGDC Metadata Tool for ArcView 3.2. For the SWEIS Source Document Project deliverable, these metadata files were

imported into the final ESRI file geodatabase. Each ArcInfo coverage becomes a feature class in the database and the metadata file becomes an integrated part of that feature class. FGDC metadata compliance for SNL/NM personnel as data stewards for DOE is suggested as a best business practices measure (Bleakly 1995a, 1995b, 1994) that is not strictly required, because SNL/NM personnel have not publically placed data on any federal government data server. When geographic data was sent to a 3rd party, the metadata was included and will continue to be included with the data. Metadata has been and will continue to be provided at the highest level of quality possible. At the very least, the minimum information regarding date of creation and most recent edits, creator of the data, and an abstract of what the data represents is always maintained.

3. LAYER LISTING

This section provides a listing of GIS Layers, contact information of GIS Layer owners, and a description of the quality ratings for the GIS Layers.

3.1 Fields in Layer Listing

Table 3-1 provides a listing of all GIS layers used in the maps provided in the SWEIS Source Documents. The table provides the following information:

- GIS Category (e.g., Buildings, Transportation, Environmental).
- Legend Item under which the layer appears on map legends.
- Name(s) that the layer is called in map legends in source documents.
- Geodatabase Location (feature data set name and feature class name).
- Description. A short description of the layer.
- Layer quality (high, medium, low). Layer quality that is rated as low or medium may become a candidate for an effort to improve the layer and/or the documentation on it, depending on the needs of the SWEIS analyses in FY2011/2012, and on budgetary constraints.
- Metadata quality (high, medium, low). Metadata quality that is rated as low or medium may become a candidate for an effort to improve the metadata, depending on the needs of the SWEIS analyses in FY2011/2012, and on budgetary constraints.
- Data Origin. This shows whether the data is from the SNL/NM EGIS, the SNL/NM FGIS, KAFB, or the UNM RGIS. Some data layers are actually a mixture (e.g., FGIS/KAFB) which means that data was transferred from KAFB to FGIS, then combined with FGIS data (or vice-versa) prior to being supplied to the EGIS for map making.
- Map IDs. A list of the Source Document Maps that the layer appears in.

3.2 Layer Quality Ratings

EGIS data and metadata are being rated with a simple high, medium, or low quality rating in the SWEIS GIS data deliverable as a general guideline to the overall spatial accuracy and informational quality of the map layers.

In 22 of the 56 map layers, layer quality and metadata quality do not match. In four of those instances, the layer quality was rated lower than the metadata. Each of the four layers are New Mexico RGIS layers that are well documented, but over 10 years old. These layers are of small scale (1:100,000 or greater) and are easily updated via the RGIS public website. The other 18 layers have little in their sources for metadata, but are known to be accurate as to the geographic representation of the ground conditions at the time of their creation. Twelve of these are Facilities GIS layers that do not have metadata generated by the proprietary entity, but are known

Table 3-1. GIS Layers Used in SWEIS Source Documents

GIS Category	Legend Item	Geodatabase Location	Description	Layer Quality	Metadata Quality	Data Origin	Map IDs
Transportation	Road	/KAFB_GIS/roadeop8	Edge of pavement / dirt KAFB	High	Med.	FGIS/KAFB	Numerous
	Albuquerque Roads	/NM_RGIS/ctynet00	Centerline City of Albuquerque	Med.	High	RGIS	dh090198, dh090199
	NM Roads	/NM_GIS/roadsp	Major NM Roads	Med.	High	RGIS	dh090060
	Parking	/KAFB_GIS/roadpark	Paved / unpaved parking KAFB	High	Low	FGIS/KAFB	Numerous
	Road Maintenance	/SNL_FGIS/rdmaintn	Selected subset from roadeop8	High	Med.	FGIS/EGIS	dh090089, dh090136, dh090184, dh090215, dh090246
Building/ Structure	Walkway	/KAFB_GIS/bldgwalk	Sidewalks	High	Low	FGIS/KAFB	Numerous
	Building	/KAFB_GIS/bldgbase	Buildings and structures (includes eligible and Contributing historic)	High	Low	FGIS/KAFB	Numerous including dh090195, dh090234, dh100221, dh100140, dh100207, dh100190, dh100225, dh100289
	Concrete Slab / Structure	/KAFB_GIS/bldgslab	Concrete Pads and small structures on slabs	High	Low	FGIS/KAFB	Numerous
	Fence	/KAFB_GIS/fncebase	Fences -basewide - walls, chainlink, etc.	High	Low	FGIS/KAFB	Numerous
	Gate	/KAFB_GIS/fncegate	Gates – basewide	High	Low	FGIS/KAFB	Numerous
	Stormwater Structures	/SNL_FGIS/stormnew	Built stormwater structures	Med.	Low	FGIS	dh090085, dh090131, dh090189, dh090220, dh090249, dh100005
Boundaries	KAFB Boundary	/KAFB_GIS/kafb (line & polygon)	Installation Boundary (line and polygon layer)	High	High	KAFB	Numerous
	SNL/NM Technical Area	/SNL_FGIS/techonly (line & polygon)	Functionally permitted Technical Area Boundaries	High	Med.	FGIS	Numerous
	Eubank Corridor	/EGIS/eubcorri	Eubank Corridor Permit Boundary	High	High	FGIS/EGIS	dh090198, dh090199, dh090200
	Thunder Range Extension Bnd	/EGIS/trexpbnd (line & polygon)	Thunder Range Area boundaries	Med.	Med.	EGIS	dh090183, dh090195, dh090233, dh090234

Table 3-1. GIS Layers Used in SWEIS Source Documents (Continued)

GIS Category	Legend Item	Geodatabase Location	Description	Layer Quality	Metadata Quality	Data Origin	Map IDs
Boundaries (Continued)	Thunder Range Test Areas	/EGISr/trtrarea	Thunder Range Test Areas	Med.	Med.	EGIS	dh090183, dh090195, dh090233, dh090234
	Thunder Range Blast Areas	/EGIS/trblasar	Thunder Range Blast Area locations	Med.	Med.	EGIS	dh090183, dh090195, dh090233, dh090234
	Albuquerque City boundary	/NM_RGIS/albpoly	Detailed Albuquerque city limits as of 2006	Med.	High	RGIS	dh090060
	NM Town locations	/NM_RGIS/townbnsp	NM town boundary locations	High	High	RGIS	dh090060
	NM County boundaries	/NM_RGIS/countysp	NM county boundaries	High	High	RGIS	dh090060
	KAFB Future Land Use	/KAFB_GIS/kafbfutu	KAFB future land use coverage - DRAFT form	Low	Low	KAFB	dh090142o
	SNL/NM Future Land Use	/SNL_FGIS/futuse	SNL/NM Future land use polygons - generalized draft	Med.	Low	FGIS	dh090142o
	SNL/NM Technical Area (TA) I Future Plan	/SNL_FGIS/ta1_plan	SNL/NM Planning Dept. future use of TA-I - draft form	Med.	Low	FGIS	dh090142o
Permits	Resource Conservation and Recovery Act (RCRA) Buffer	/EGIS/rcrabuff	RCRA Buffers	Med.	High	EGIS	dh090088, dh090113, dh090129, dh090134, dh090135
	Permit Locations	/EGIS/tapermpt	Technical Areas - Various Permit locations	Med.	Med.	EGIS	dh090129, dh090131, dh090135
	Permit Locations	/EGIS/cwpermpt	Coyote West and East - Various Permit locations	Med.	Med.	EGIS	dh090195, dh090230, dh090234
	Permits - Land Use	/SNL_FGIS/permit08	Permit boundaries for KAFB/SNL/NM	Med.	Low	FGIS/KAFB	dh090061, dh090187, dh090217, dh100036

Table 3-1. GIS Layers Used in SWEIS Source Documents (Continued)

GIS Category	Legend Item	Geodatabase Location	Description	Layer Quality	Metadata Quality	Data Origin	Map IDs
Environmental Restoration (ER) Sites	ER Sites	/EGIS/erpoly09	ER Sites with coding for Institutional Controls and confirmatory data dates and data types	High	High	EGIS	dh090080, dh090088dh090128, dh090137, dh090138, dh090176, dh090180, dh090185, dh090192, dh090218, dh090223, dh090234, dh090244, dh090247, dh090252, dh090254, dh100003, dh100008, dh100011
	DSS Sites	/EGIS/dssersit	Non-ER Drain and Septic site locations	High	High	EGIS	dh090080, dh090088, dh090128, dh090192, dh100008
Ecology	Conservation Area West	/EGIS/consarea	SNL/NM Conservation Plan Areas	High	High	EGIS	dh090077, dh090126, dh090129, dh090135, dh090190, dh090198, dh090199, dh090221, dh090230, dh090244, dh090250, dh100006, dh100011
	Conservation Area East	/EGIS/conseast	SNL/NM Conservation Plan Areas in the Withdrawn Area	High	High	EGIS	dh090190, dh090221, dh090230
	Wildlife Guzzlers	/EGIS/guzzlesp	Wildlife guzzlers	High	High	EGIS	dh090062, dh090221, dh090230
	Raptors/Bats	/EGIS/raptobat	Raptor and bat roost and nest sites	High	High	EGIS	dh090077, dh090129, dh090190, dh090221, dh090230
	Prairie Dog Colony	/EGIS/pdcolony	Prairie Dog Communities	High	High	EGIS	dh090077, dh090126, dh090129, dh090135, dh090190, dh090198, dh090199, dh090244, dh090250

Table 3-1. GIS Layers Used in SWEIS Source Documents (Continued)

GIS Category	Legend Item	Geodatabase Location	Description	Layer Quality	Metadata Quality	Data Origin	Map IDs
Ecology (Continued)	Vegetation	/EGIS/veget04	Basewide vegetation classification	High	High	EGIS	dh090076
	Ecological zones - Wildlife	/EGIS/ecozon08	Ecological zones - Wildlife	High	High	EGIS	dh090111
Routine Sampling	Ambient Air / Meteorological Towers	/EGIS/mtower	Meteorological and Air Sampling towers	Med.	High	EGIS	dh090078, dh090174, dh090191, dh090203, dh090235, dh090251, dh100007
	Terrestrial Surveillance Locations.	/EGIS/ts_tld_08	Terrestrial Surveillance sampling locations	High	High	EGIS	dh090086, dh090177, dh090193, dh090224, dh090253, dh100009
	Stormwater Monitoring Points	/EGIS/stodispt	Storm Water Monitoring and Discharge locations	High	High	EGIS	dh100005, dh090249, dh090220, dh090189, dh090139, dh090131, dh090125, dh090085
Geology/Soils	Soils	/EGIS/soilbase (anno & polygon)	Basewide Soil classification	High	Med.	EGIS	dh040630
	Major Faults	/EGIS/majfaults (anno & line)	Major Faults	High	High	EGIS	dh040626
	Geology	/EGIS/bedrock (anno & polygon)	Exposed bedrock types	High	High	EGIS	dh060629
	Surface Geology	/EGIS/saniace7	Surface geology	High	High	EGIS	dh060629
	Hypsography	/EGIS/kafb_c40	40 foot contour intervals	Med.	Med.	EGIS	dh060629, dh090701a
Hydrology	Groundwater Area of Concern	/EGIS/chlormay	TA-V Groundwater Area of Concern	High	High	EGIS	dh100011, dh100012
	Groundwater Elevation Contour	/EGIS/ta5pot09	TA-V Groundwater Elevations contour intervals	High	High	EGIS	dh100012, dh090114, dh090067

Table 3-1. GIS Layers Used in SWEIS Source Documents (Continued)

GIS Category	Legend Item	Geodatabase Location	Description	Layer Quality	Metadata Quality	Data Origin	Map IDs
Hydrology (Continued)	Wells	/EGIS/sweiswells	Wells of all types and ownerships, excluding KAFB.	Med.	Med.	EGIS	dh090084, dh090090, dh090095, dh090124, dh090130, dh090133, dh090170a, dh090178, dh090179, dh090186, dh090188, dh090219, dh090225, dh090248, dh100004, dh100010, dh100012
	Springs	/EGIS/springs	Springs	High	High	EGIS	dh090062, dh090076, dh090111
	Perched Aquifer	/EGIS/perchaq	Tijeras Arroyo Groundwater Perched aquifer extent	Med.	High	EGIS	dh090062
	Liquid Waste Disposal Site Lagoons	/EGIS/lwdsgoon	Liquid Waste Disposal Site Lagoon pit / depressions	High	High	EGIS	dh100012, dh090242, dh090114, dh090094
	Groundwater Area of Concern	/EGIS/tceplume	Chemical Waste Landfill Trichloroethylene contamination plume	High	High	EGIS	dh090113, dh090129, dh090201
	Burn Site Potentiometric	/EGIS/bspotsu8	Burn Site Potentiometric Surface Contours	High	High	EGIS	dh090170a(mxd)
	100-Yr. Flood Plain	/EGIS/flood100	100-Year flood plain	High	Low	EGIS	dh090062
	500-yr. Flood Plain	/EGIS/flood500	500-Year flood plain	High	Low	EGIS	dh090062
	Surface Drainage	/EGIS/sw_kafb2	Detailed surface water with 6 orders of streams	Med.	Low	EGIS	dh090062

Table 3-1. GIS Layers Used in SWEIS Source Documents (Concluded)

GIS Category	Legend Item	Geodatabase Location	Description	Layer Quality	Metadata Quality	Data Origin	Map IDs
Hydrology (Continued)	Surface water	/EGIS/surwat	General Surface water on and off base in vicinity	High	Low	EGIS	dh040626, dh040630, dh090061, dh090076 dh090111, dh090121, dh100036
	Rio Grande and Rio Puerco	/NM_RGIS/riversp	NM River coverage	Med.	Med.	RGIS	dh040625
	Albuquerque Basin	/EGIS/itbasin	Albuquerque - Rio Grande Basin	Med.	Low	EGIS	dh040625
	Watershed basins	EGIS/wtrsheds	Watershed basins for KAFB	High	Med.	EGIS	dh080062
Hazards/ Training	TA-III blast/overpressure zone	/EGIS/rstrzone (line & polygon)	Restriction zones in TA-III	Med.	Med.	EGIS	dh090129
	Safety Zone	/EGIS/saftzon9	Inhabited Building Distance / Explosive Weight Limit Safety Zones	High	Med	EGIS	dh100212

to be accurate through ground-truthing and aerial photo verification. The other six are older EGIS layers that were derived from entities such as the RGIS. The older EGIS layers underwent edits, but never had metadata generated until within the last five to seven years.

The following criteria were considered when determining how data or metadata falls into the high, medium, and low quality ratings. Note that the scale for most data is 1:24000 or better regardless of the quality rating placed on it for the purposes of the SWEIS. In general, the age of the layer is the most important criteria. The reason for most ratings of medium and low have to do with the age of the layer, with older layers being assumed to be of lesser quality than newer layers, due to improvements in equipment and processing software over time. Other rating criteria include frequency of updates, field verification activities, personal operational knowledge of EGIS staff about data set collection, and quality of metadata.

GIS layers rated as high quality have been updated or maintained over the years since their creation, or are of recent (last three years) creation. This data has been verified or updated through sub-meter GPS collection/verification or has been provided via traditional surveys by non-SNL/NM contractors. Further verification utilizing the 2006 or 2008 6-inch orthorectified aerial photography has been conducted when needed. Where particular programs require updated maps for reporting information, the data edits are provided on a regular basis.

Data rated medium quality may be from 5 to 15 years old, but is known to be of a static nature such that edits are not usually warranted, or occur on an infrequent or inconsistent basis, or not required under reporting mechanisms. The Thunder Range boundary data is marked as medium, because it has gone through frequent edits but has never been verified as "official." The boundaries for Thunder Range extension are not officially approved and are still of a proposed nature.

Data rated low quality is generally 10 years old or older, and either has very little information available for metadata creation or its existing metadata is sparse, or has no description as to source or method of creation.

Quality rating of the metadata is a separate issue from quality of the data layer itself, though the metadata rating does play into the layer quality rating as explained above. Metadata quality ratings are based entirely on how much useful information is contained in the metadata file. Useful information is a subjective term that includes such qualities as thoroughness and readability of abstract, process and accuracy data, dates of creation and updates, contact information, and spatial projection information.

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