

## Appendix 4

# Federal Oil And Gas Lease Stipulation Data Preparation

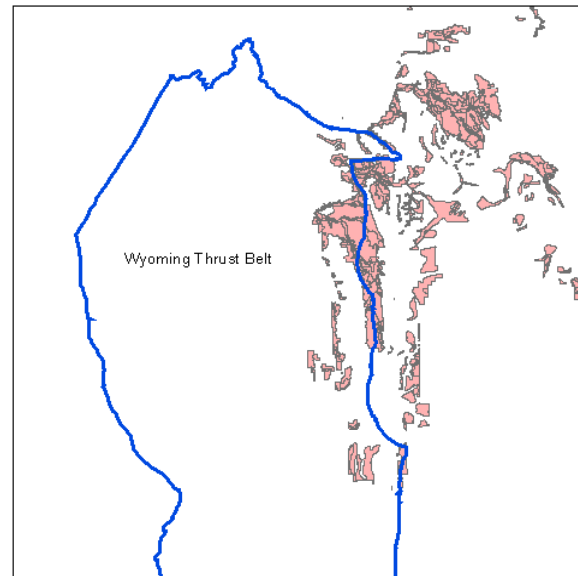
The bulk of the data preparation for lease stipulations consisted of data gathering, digitization, and compilation in a multi-layered GIS format (ESRI shapefiles). FGDC-compliant metadata for the resulting GIS layers were also created. GIS coverages from SMA land status, stipulations, and the analyses, as well as the associated metadata, are presented on the DVD-ROM accompanying this report.

Where necessary, the shapefiles obtained from the Federal land management agencies were processed using ArcGIS software by matching specific leasing stipulations found in the guidance documents.

This inventory is limited to those Federal lands within the aggregate resource play boundaries of the eleven study areas, which are based on geology as defined in the USGS National Assessment of Oil and Gas Resources. The land status and stipulation shapefiles, which correspond to Federal land management agency jurisdiction boundaries, were “clipped” using the GIS to the appropriate study boundary. Some of the shapefiles fell into multiple study areas, in which case the clipping process was repeated for each area. The attribute tables of the compiled shapefiles were then queried for unique leasing stipulation values. The query results were then saved as separate polygon shapefiles. Each shapefile represents a unique stipulation value.

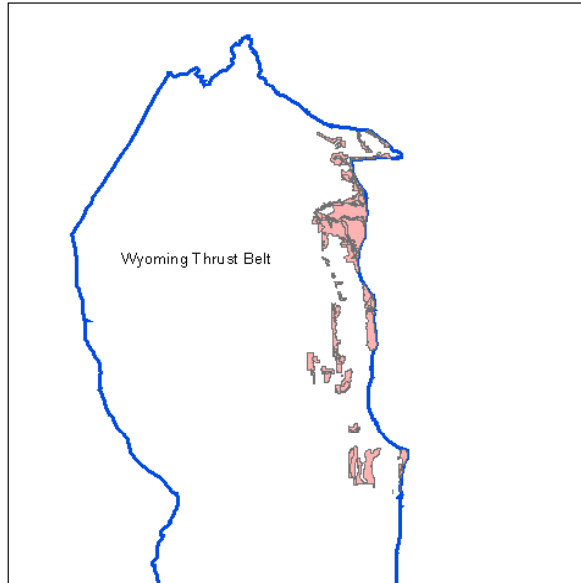
The following discussion of the specific data preparation steps uses the Wyoming Thrust Belt study area as an example:

1. The first step entails loading the study area (union of resource plays) boundary shapefile and the compiled stipulation shapefile into ArcGIS (Figure A4-1)



**Figure A4-1. Stipulation Polygons and Study Area Boundary**

The next step in this process is to “clip” or cut the compiled stipulation shapefile to the study boundary. Figure A4-2 shows the GIS coverage after it has been clipped.

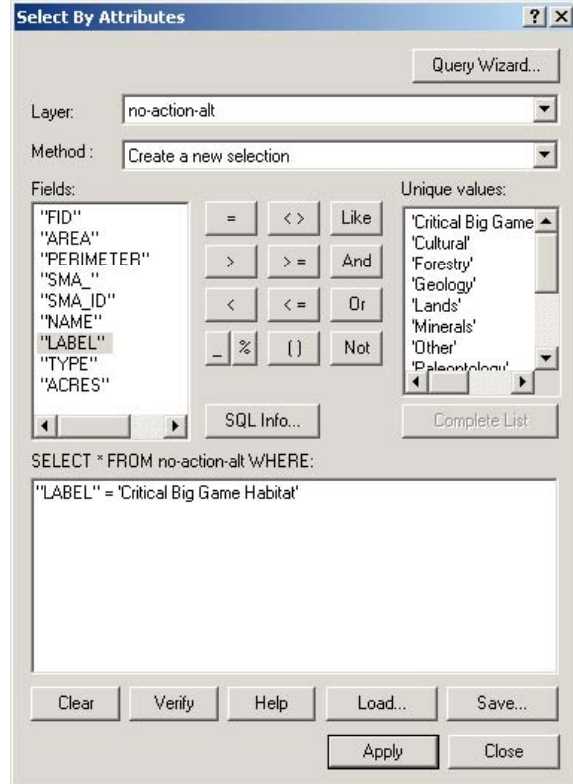


**Figure A4-2. Example of Polygons after Clipping to Study Area Boundary**

2. The compiled stipulation shapefile is then queried for unique stipulation attributes values as shown in the ArcGIS Query Builder (Figure A4-3). For this example, all polygons covered by the leasing stipulation “Critical Big Game Habitat” were selected. The highlighted rows in the attribute table (Figure A4-5) show which records are selected.

3. Using the ArcGIS function “Create layer from Selected Features,” a new shapefile is created that contains only polygons labeled with the attribute “Critical Big Game Habitat”. Figure A4-5 shows the new shapefile that is created.

For certain stipulations, such as steep slopes, for which GIS data were not available from the BLM or Forest Service offices, shapefiles were created from available data in conformance with stipulation requirements. For example, a typical steep slope stipulation impacts leasing in areas where slopes exceed 25 percent.

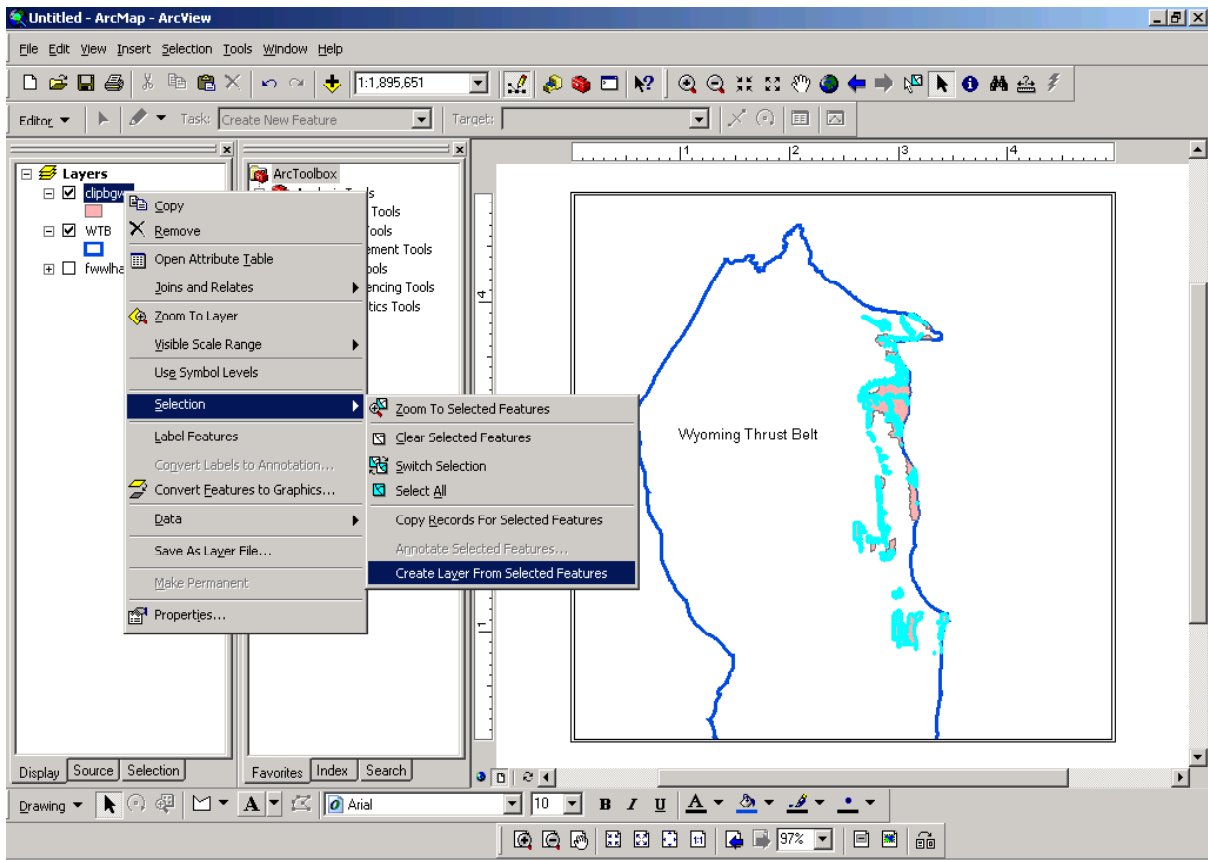


**Figure A4-3. Query in ArcGIS for all “Critical Big Game Habitat” Stipulations**

FID	Shape	AREA	PERIMETER	SMA_	SMA_ID	NAME	LABEL
15 Polygon	0	0.0041	0	0	0	Etanaco Homestead	Culture
17 Polygon	0	0.0031	0	0	0	Etanaco Homestead	Culture
18 Polygon	0	0.0043	0	0	0	Etanaco Homestead	Culture
19 Polygon	0	0.0045	0	0	0	Etanaco Homestead	Culture
20 Polygon	0	0.0045	0	0	0	Etanaco Homestead	Culture
21 Polygon	0	0.0045	0	0	0	Etanaco Homestead	Culture
22 Polygon	0.0007	0.0066	0	0	0	Critical Big Game	Critical Big Game Habitat
23 Polygon	0.0075	1.0097	0	0	0	Critical Big Game	Critical Big Game Habitat
24 Polygon	0.0171	1.0097	0	0	0	Critical Big Game	Critical Big Game Habitat
25 Polygon	0.0081	0.0790	0	0	0	Critical Big Game	Critical Big Game Habitat
26 Polygon	0.0000	0.0193	0	0	0	Critical Big Game	Critical Big Game Habitat
27 Polygon	0.0003	0.0004	0	0	0	Critical Big Game	Critical Big Game Habitat
28 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
29 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
30 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
31 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
32 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
33 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
34 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
35 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
36 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
37 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
38 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
39 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
40 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
41 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
42 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
43 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
44 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
45 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
46 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
47 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
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59 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
60 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
61 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
62 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
63 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
64 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
65 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
66 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
67 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
68 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
69 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
70 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
71 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
72 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
73 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
74 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
75 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
76 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
77 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
78 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
79 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
80 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
81 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
82 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
83 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
84 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
85 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
86 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
87 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
88 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
89 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
90 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
91 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
92 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
93 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
94 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
95 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
96 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
97 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
98 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat
99 Polygon	0.0000	0.0000	0	0	0	Critical Big Game	Critical Big Game Habitat

**Figure A4-4. Attribute Table Showing all “Critical Big Game Habitat” Polygons**

Polygon themes were created from slope data derived from USGS 1:24,000 Digital Elevation Models (DEMs). These raster data sets contain elevation information on a 100-meter grid spacing. The original for the Phase I inventory was a 30-meter grid spacing, which was resampled to 100 meters.



**Figure A4-5. New Polygons Representing Land with Leasing Stipulation for “Critical Big Game Habitat”**

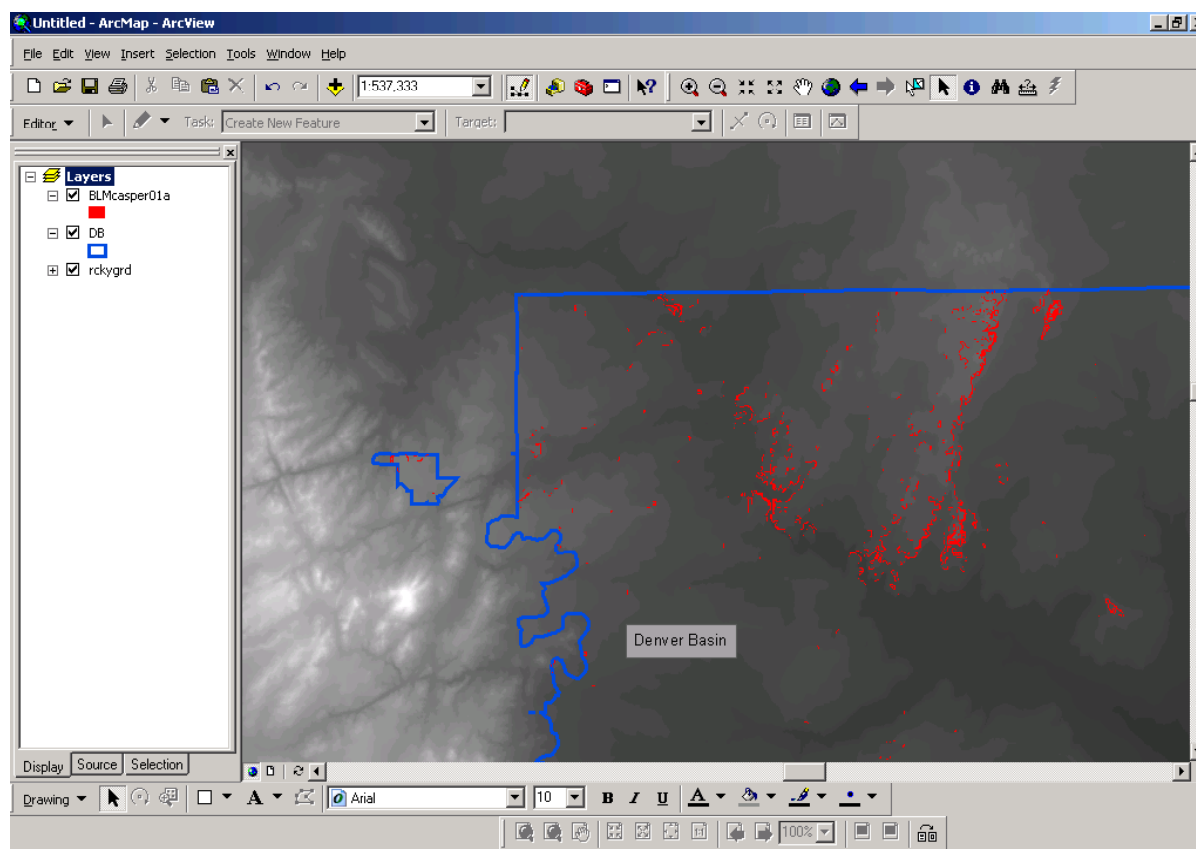
The USGS DEMs were first clipped to the BLM or Forest Service jurisdictional area. In situations where more than one agency had the same stipulations, the DEM was clipped to the agencies’ combined jurisdictional area. A raster coverage was then created containing slope percentage data as calculated by ArcGIS. This coverage was then queried to isolate the areas covered by the stipulation (e.g., all areas steeper than 25 percent). The selected raster data was then converted to a vector polygon coverage, and the coverage was coded and attributed as described above. Figure A4-6 shows the creation of steep slope polygons. The 100-meter USGS DEM for this portion of the Denver Basin is shown in shades of grey. The red theme represents the polygon

shapefile showing areas with a greater than 25 percent slope.

Following the above procedures, the GIS shapefiles of the stipulations were coded with their respective descriptions from the various land use plans. These stipulations can be found in Appendix 11.

#### **A4.1 Differences Between The Phase II And Phase I Inventories**

The Phase II inventory is a cumulative effort and incorporates data from the Phase I inventory. There are a number of differences between the two studies, some minor and some significant. These



*Figure A4-6. Creation of Steep Slope Restriction Polygons*

differences are divided into changes, omissions and errors as detailed below.

Some offices inventoried in Phase I had revised their LUPs since that time. The Medicine Bow-Routt NF is an example. The Phase II inventory does not incorporate these updates. A subsequent release of this inventory will include the updated LUPs.

#### **A4.1.1 Methodological Changes**

**Categorization Hierarchy.** In order to better capture the scope of the limitations on access to Federal lands, changes were made to the categorization hierarchy for the land status and the stipulations in the Phase II inventory:

- Because the purpose of the study is to identify limitations to exploration and development, proved reserves are not included in the resource categorization in the results tables (Section 3). In Phase I, proved reserves had been categorized as accessible under standard lease terms. This change was made for the Phase II inventory due to amendments to Section 604 of EPCA found in Section 364 of EPCA 2005, which strikes the term “reserves”. All categories (where leasing can occur) are defined as requiring drilling for discovery and conversion into reserves. The proved reserves are listed in Section 2, Table 2-6 but are not included elsewhere in this inventory.

- The NLA/LUP and NLA categories are switched (NLA acceding to the second level in the categorization) to present a more logical progression to the hierarchy. The rationale for this decision is that the NLA category is based on a decision within the land use plan or made by the office not to lease an area. In contrast the NLA/LUP category is an area where a decision has not yet occurred and consequently the categorization may be less restrictive when the final land use plan is completed.
- Because their impacts on operators' capacities to drill are similar, stipulations for TLs  $\leq$  3 months and CSU were combined at level 8 as a simplification. Note that due to this change, some areas on the Phase I land access categorization maps which were pink in color will be gold on the Phase II maps. Lands stipulated with TLs  $\leq$  3 months cover a very small area.
- A clarification change was made to labeling for the NSO category, where the term "net" was added in reference to the oil and gas resources. Because the analytical model adjusts for directional drilling capabilities (see Appendix 7), Net NSO resource areas are effectively inaccessible.

**Citizens' Proposal Areas (CPAs).** CPAs, CWPAs, and Wilderness Reinventory Areas (WRAs) were considered NLA in Phase I. As a result of *Utah vs Norton*<sup>1</sup>, CPAs and WRAs are now considered leasable and subject to stipulations.

**Blackleaf Study Area.** The Blackleaf area in the Montana Thrust Belt study area

<sup>1</sup> See <http://www.blm.gov/nhp/efoia/wo/fy03/im2003-274.htm>

was explicitly added due to an indefinite postponement of its EIS in 2004<sup>2</sup>.

**Additional Resources in the Phase I Study Areas.** Study areas for this inventory are defined by the USGS play boundaries. Further, plays from distinct USGS oil and gas provinces can overlap, as is the case in the WTB relative to the GGRB. However, because the inventory is focused on the land surface, study areas must, by definition, be geographically unique. In the case of the WTB and the GGRB, the overlapping resources have been allocated to the GGRB, resulting in a change in the resource numbers in comparison to the originally published Phase I results. While this does not affect the land access categorization, it does affect resource access categorization to the extent that resource densities in the GGRB for the Phase II inventory are different where associated with specific stipulations. This situation also occurs at the intersection of the Powder River and Denver basins and in the Paradox and Uinta basins in Phase I inventory.

**Inventoried Roadless Areas.** The Phase I inventory included the IRAs as a Federal Land Use Designation and categorized them as subject to stipulations. In the Phase II inventory, the guidance from the USDA-FS was modified slightly—specifically, the accessibility of roadless areas is determined by the local Forest Plan. Roadless area stipulations exist for Ashley, Grand Mesa/Uncompahgre/Gunnison, Uinta, White River and Lewis and Clark NFs. The GIS data were not available for many of these stipulations. Instead, the national IRA GIS layer was used.

**NSO Areas.** In the EPCA II inventory, the geoprocessing of NSO areas was

<sup>2</sup> See <http://www.doi.gov/news/041005a>

made stricter to provide greater accuracy. Specifically, if an NSO area abutted an area that cannot be leased, an “extended drilling zone” (EDZ, see Appendix 7 for a full description) was not calculated from that area based upon the fact that a drilling rig could not legally be set up. Further, within a Federal jurisdiction that contained NSO lands, buffering from non-Federal lands onto Federal lands was not performed, as it could not be assumed that the non-Federal lands are leasable.

Further, in the GGRB study area, a generalized EDZ for the basin was used in the Phase I inventory (based on a prior DOE analysis).<sup>3</sup> During the course of Phase II data collection, individual offices (that are also in the Phase I Study Area) were interviewed to determine specific EDZs, and those EDZ values were used in the Phase II analysis. These offices were: Kemmerer, WY, BLM FO; Rawlins, WY, BLM FO; Casper, WY, BLM FO; Wasatch-Cache NF; Bridger-Teton NF.

**Stipulations for Which No GIS Data Are Available.** As noted in Section 2.1.2.3., specific efforts were made to assess stipulations where no GIS data were available. By count, approximately 39 percent of the 2132 stipulations in the Phase II inventory do not have GIS associated with them. To the extent that this exists, the Inventory overestimates access to lands and resources. This quantification had not been made in the Phase I inventory.

#### **A4.1.2 Omissions in Phase I**

**Additional Data Received from Offices.** For some Phase I offices, especially

<sup>3</sup> The Greater Green River Basin Study. See website [http://www.fossil.energy.gov/news/techlines/2001/tl\\_ggrb\\_gas.html](http://www.fossil.energy.gov/news/techlines/2001/tl_ggrb_gas.html)

those that are also in the Phase II study areas, some additional data was received. Offices where significant new GIS data were obtained are the Black Hills NF; Bridger-Teton NF; Casper, WY, BLM FO; Kemmerer, WY, BLM FO; Nebraska NF; Newcastle, WY, BLM FO; Rawlins, WY, BLM FO; Rock Springs, WY, BLM FO; and the Wasatch Cache NF.

In addition, an updated national GIS layer for Wilderness Areas, Inventoried Roadless Areas, Special Designated Areas, National Conservation Areas, Wilderness Reinventory Areas, Incorporated Towns and Cities, Wilderness Study Areas, Research Natural Areas, National Monuments Areas, National Wildlife Refuges, Wild and Scenic Rivers, and National Scenic and Historic Trails was provided by the BLM’s National Landscape Conservation System.

**Incorporated Towns and Cities (ITCs).** After the Phase I inventory was published, it was determined that ITCs were not considered. These were added in Phase II because, by regulation, incorporated areas are not available for Federal mineral leasing as established in 43 CFR 3100-3(a)(2)(iii) and 3100-3(b)(2)(ii).

#### **A4.1.3 Errors in Phase I**

**Analytical Errors.** There were about 980 stipulations having GIS data in the Phase I inventory. Miscellaneous analytical errors were made that impacted the results presented in published version of that inventory. Without running the analytical model specifically for the stipulations in question, the absolute magnitude of these errors cannot be assessed; however their impacts are believed to be modest to minor

for any individual study area. The errors are:

- In the Vernal, UT, BLM FO, Phase I results indicate larger areas of NSO than is the case. Comparison of the Phase I and Phase II model runs shows this error to make a 4 percent difference in NNSO areas in the UP study area.
- In the Rock Springs, WY, BLM FO, some sage grouse leks<sup>4</sup> were absent from the model runs. Based upon a comparison of the model runs for this FO, the impact of this is believed to be significant. Differences in TLs between the two runs are 13 percent, although a noteworthy portion of these differences also come from additional sage grouse stipulation data received from the Kemmerer, WY, BLM FO during Phase II. Another error in the Rock Springs FO is one stipulation that was miscategorized as NLA. It has been corrected to CSU.
- In the Lander, WY, BLM FO, a stipulation had an incorrect listing of its timing limitation resulting in a one-level higher categorization than is the case. In addition, another CSU stipulation was improperly depicted to partially cover the FO when it should have covered the portion of the FO within in the GGRB study area. The stipulation geography was corrected.
- In the Craig, CO, FO, one stipulation had been categorized as NLS and was corrected to NSO.
- In the St. George, UT, BLM FO, missing NLA and CSU stipulations were added.
- In the Richfield, UT, BLM FO some stipulations were missing from the Phase I model runs. During EPCA
  - If a complete copy of the stipulation data was obtained and the error was corrected.
  - For the Navajo Reservoir, NM, BOR, the reservoir should have been classified as NSO.
  - In the Thunder Basin NG, a NSO stipulation has been deleted as it is not a USDA-FS stipulation (but does occur in the BLM RMP covering this portion of the study area).
  - In the Buffalo, WY, BLM FO, a wildlife stipulation had an incorrect listing of its timing limitation resulting in a one-level higher categorization than is the case.
  - In the PDX/SJ and UP study areas, an error was made in the allocation of overlapping resources resulting in changes to the results. The oil resource assessment was shown as incorrect by 30 percent (however the total amount of oil resource is modest). The gas assessment was shown as incorrect by 15 percent.
  - In the PRB, an error in the land status layer resulted in a 10 percent understatement of Federal lands. At the resource level the error is  $\leq 1.5$  percent.

**Rendering Errors.** In the presentation of some Federal land status and land access categorization (LAC) in the Phase I inventory publication, errors were made in rendering in figures within the report. These items have been checked specifically and they do not impact the analytical results presented, but are an erroneous display of the land status and categorization on maps. Table A4-1 presents listing of offices where such rendering errors occurred relative to the Phase I report figures.

<sup>4</sup> Sage grouse have a lek mating system in which males defend display territories but provide no resources such as nesting or forage to females.

**Table A4-1. Rendering Errors in Phase I Offices**

<b>Office</b>	<b>Remarks</b>
Manti La Sal NF	Partial CSU displayed
Price, UT BLM FO	Partial NSO, TLS, CSU displayed
Moab, UT BLM FO	Partial CSU displayed
Craig, CO BLM FO	Partial TLS displayed
White River, CO BLM FO	Partial split estate, CSU displayed
GMUG NF	Partial NLA, NSO, TLS, CSU displayed
Rock Springs, WY BLM FO	Partial TLS displayed
Pinedale, WY BLM FO	Partial CSU displayed
Richfield, UT BLM FO	Partial NSO, TLS, CSU displayed
Monticello, UT BLM FO	Partial TLS displayed
PDX/SJ SA	Erroneous split estate depiction

To alleviate this problem, the Phase II geospatial model has been modified to explicitly produce Federal land status and LAC map presentations.