

Table 1. Layer Information, described by their order in the GIS map files (MXD and PMF), table of contents

<div>Thematic Layers</div> <div>USGS National Oil and Gas Assessment Province boundaries</div> <div><p>The USGS Geological Survey (USGS) Central Energy Resources Science Center assesses oil and gas resources of the United States. The onshore and State water areas of the United States comprise 71 provinces. Within these provinces, hydrocarbon assessment units (AU) are defined and assessed. Each of these provinces is defined geologically, and most province boundaries are defined by major geologic changes.</p></div> <div>Source</div> <div>http://energy.usgs.gov/Oil/GasAssessment/Map%20National%20Assessment%20USGS</div>	<div>Thematic Layers</div> <div>Oil Shale Resources of the Eocene Green River Formation</div> <div><p>The USGS recently (2011) completed an assessment of in-place oil shale resources, regardless of grade, in the Eocene Green River Formation of the Greater Green River Basin in southwestern Wyoming, northwestern Colorado, and northeastern Utah. Green River Formation oil shale also is present in the Piceance Basin of western Colorado and in the Uinta Basin of eastern Utah and western Colorado, and the results of these assessments are published separately. No attempt was made to estimate the amount of oil that is economically recoverable because there has not yet been an economic method developed to recover the oil from Green River Formation oil shale. See http://pubs.usgs.gov/circ/2011/2063/.</p></div> <div>Source</div> <div>http://pubs.usgs.gov/circ/2011/2063/</div>	<div>Thematic Layers</div> <div>Authorized Oil and Gas Leases</div> <div><p>This data theme represents authorized oil and gas leases in the WLCL. Stipulations are applied when new oil and gas leases are issued. Stipulations and conditions of approval are requirements that are attached to Federal oil and gas leases and drilling permits for environmental protection and other reasons and are subject to change over time (U.S. Department of the Interior, Agriculture, and Energy, 2006).</p></div> <div>Source</div> <div>http://www.eoconcomm.senate.gov/ArcGIS/rest/services/USGS_Oil_Gas/MapServer</div>	<div>Thematic Layers</div> <div>BLM Oil and Gas Stipulations</div> <div><p>Oil and gas stipulations as defined by the BLM and served from the Geocommunicator. Data current to July, 2008.</p></div> <div>Source</div> <div>http://www.asscommin.senate.gov/GeoComm</div>																														
<div>Wyoming Landscape Conservation Initiative area</div> <div><p>This theme represents the boundary of the Wyoming Landscape Conservation Initiative (WLCL). The WLCL is part of the Healthy Lands Initiative. http://www.blm.gov/pld/arc/mediash/bhm/wco/comm/Initiative_Directive/public_affairs/healthy_lands_initiative/P154243/d4/d4/HLWV_FY09.pdf</p><p>South: Wyoming-COLORADO and Wyoming-Utah State Line West: Wyoming-Utah and Wyoming-KANSAS State Line North: Lincoln-Teton-Saltwater-Teton-Saltwater-Fremont County Line Following the Fremont County Line to the crossing of the Continental Divide and Fremont County-Carbon Natrual County Line. East: Carbon-Albany County Line</p></div> <div>Source</div> <div>http://www.wlcl.gov/</div>	<div>Oil-Shale Drill Cores and Rotary Cuttings</div> <div><p>For several decades, the USGS has collected cores and cuttings and other subsurface data from boreholes drilled in the Eocene Green River Formation oil-shale deposits in the Great Divide, Green River, and Washakie Basins of southwestern and south-central Wyoming. In Wyoming, the Green River Formation was deposited in Lake Gosiute during the early to middle Eocene epoch. The richest oil-shale deposits are in the Wilkins Peak, Tipton Shale, and Laramie Members (Roehrer, 1992); as many as 77 persistent beds of oil shale were identified in the Wilkins Peak Member by Roehrer (1992). A database was compiled that includes about 47,000 Fischer assays from 186 core holes and 240 rotary drill holes. Most of the oil-yield data are from analyses performed by the former U.S. Bureau of Mines oil shale laboratory in Laramie, Wyoming, with some analyses made by private laboratories. Because of an increased interest in oil shale, a CD-ROM containing location data for 971 Wyoming oil-shale drill holes, Fischer assay data and oil-yield histograms for the Green River oil shale deposits in southwestern Wyoming was released to the public (USGS Oil Shale Assessment Team, 2008).</p></div> <div>Source</div> <div>http://pubs.usgs.gov/of/2008/152/</div>	<div>USGS Oil and Gas Assessment Units</div> <div><p>The USGS conducts assessments of undiscovered, technically recoverable oil and natural gas and gas resource estimation. The USGS assessment process estimates the volume of undiscovered oil, natural gas, and natural-gas liquids that have the potential to be added to reserves during a thirty-year forecast period. Assessment results are based on known or estimated geologic input parameters including: trapping mechanism, source rock, reservoir quality, and size of known accumulations. Because of the uncertainty about the input parameters, the assessment result is expressed as a probability distribution of potential resources in the assessment unit (U.S. DOI, 2006). Using the geologic-based assessment methodology, the USGS estimated means of: Southwestern Wyoming Province (USGS Southwestern Wyoming Province Assessment Team, 2002)</p><ul style="list-style-type: none">• 84.6 million cubic feet of undiscovered natural gas• 131 million barrels of undiscovered oil• 2.6 billion barrels of undiscovered natural gas liquids<p>Wyoming Thrust Belt Province (USGS Wyoming Thrust Belt Assessment Team, 2004)</p><ul style="list-style-type: none">• 419 billion cubic feet of undiscovered natural gas• 59 million barrels of undiscovered oil• 57.3 million barrels of undiscovered natural gas liquids<p>Hanna, Laramie, Shirley Basins Province, Wyoming (Dymann and others, 2005)</p><ul style="list-style-type: none">• 298 billion cubic feet of undiscovered natural gas• 94 million barrels of undiscovered oil• 14 million barrels of undiscovered natural gas liquids</div> <div>Source</div> <div>http://pubs.usgs.gov/of/2006/049-049/</div>	<div>Geologic Structures</div> <div><p>Symbols from the Oil and Gas Map of Wyoming (DeBarn, 2007) and the Geologic Map of Wyoming (Love and Christiansen, 1985) show approximate location of major basin axes, the antithetical axis of the Mesa arch, thrust faults defining the eastern boundary of the Overthrust Belt, major thrust faults on the northeastern edge of the Green River Basin and other faults.</p></div> <div>Source</div> <div>http://sales.wsp.wyo.edu/catalog/index.php and http://pubs.usgs.gov/of/1994/of-94-0425</div>																														
<div>Uranium</div> <div><p>Renewed demand for uranium in the last few years has resulted in increased exploration and development in several areas in and immediately adjacent to the WLCL. Uranium mineralized areas at Ketchikan Buttes, Shirley Basin, Shirley Basin, and Great Divide Basin are nearly all within the WLCL, and the southern end of the Crooks Gap-Green Mountain overlaps the northern margin of WLCL (Wilson, 2014).</p></div> <div>Source</div> <div>http://pubs.usgs.gov/of/2014/</div>	<div>Oil and Gas</div> <div>Historical Oil and Gas Drilling Activity</div> <div><p>The ArcGIS oil and gas wells feature class was developed to provide a historical perspective of drilling activity for the WLCL area. These data, originated from the Wyoming Oil and Gas Conservation Commission (WOGCC), have been processed by the USGS and are now available as online resources. This product complements the 2009 USGS publication on oil and gas development in southwestern Wyoming (Brewick, 2009), by approximating, based on database attributes, both beginning and ending dates of drilling activity. Each well is assigned a start year and a stop year. This product also complements the 2011 USGS published geodatabase on oil and gas development in Wyoming (Brewick, 2011), by adding more current well information. These data represent decades of oil and gas drilling (1900 to 2012), and will facilitate a landscape-level approach to integrated science assessments, science-based resource management and science-based decision making.</p></div> <div>Source</div> <div>http://energy.usgs.gov/RegionalStudies/Southwest%20Wyoming%20Assessment%20USGS</div>	<div>Federal Land Access Categories</div> <div><p>This data theme represents surface and mineral ownership for Wyoming, and is intended to represent the ownership information on master title plans (MTPs). When the surface is Federal, surface ownership is identified by the agency of jurisdiction. All other parcels are identified as either private or State. Mineral ownership identifies only the Federal interest. Definition query shows Federal oil, gas and other minerals (BLM, 2011).</p></div> <div>Source</div> <div>http://pubs.usgs.gov/of/2014/02/15-145-02.pdf</div>	<div>Surface Geology</div> <div><p>This geologic map was prepared as part of a study of digital methods and techniques as applied to complex geologic maps. The geologic map was digitized from the original scribble sheets used to prepare the published Geologic Map of Wyoming (Love and Christiansen, 1985) and is 1:500,000 scale. Each vector and polygon was given attributes derived from the original 1985 geologic map. The data are intended to be used as a base geologic map, and are accessible online (Green and Drenthall, 1994).</p></div> <div>Source</div> <div>http://pubs.usgs.gov/of/1994/of-94-0425</div>																														
<div>Energy corridor</div> <div><p>This theme contains oil refineries and natural gas processing plants, current to Sept. 25, 2002. The location of pipelines, refineries, and gas processing plants often parallel exploration and development trends. They are often a limiting economic consideration for exploration and development of petroleum resources (DeBarn, 2007).</p></div> <div>Source</div> <div>http://sales.wsp.wyo.edu/catalog/index.php</div>	<div>Oil and Gas Wells</div> <div><p>This graphic shows an example of working in ArcMap with the oil and gas wells layer and Satellite Imagery. With ArcGIS Online Services, users have access to high-resolution (1 m or better) imagery for the United States and other areas around the world from ESRI ArcGIS 9.3 or more recent recommended, update frequency is twice per year.</p></div> <div>Source</div> <div>http://wopce.state.wy.us/</div>	<div>Federal Land Access Categories</div> <div>Modified from U.S. Departments of the Interior, Agriculture, and Energy, 2006</div> <div><table><thead><tr><th>Level</th><th>Access Category</th><th>Comments</th></tr></thead><tbody><tr><td>1</td><td>No Leasing (Discretionary or Executive Order), N/A</td><td>Accessability determined by Law or Executive Order; drilling prohibited</td></tr><tr><td>2</td><td>No Leasing (Administrative), general</td><td>Accessability determined by Federal surface land management agency; drilling prohibited</td></tr><tr><td>3</td><td>No Leasing (Administrative), Pending Land Use Planning or NEPA Compliance</td><td>Drilling may be allowed subject to management agency, drilling prohibited pending planning or NEPA compliance</td></tr><tr><td>4</td><td>No Leasing (Administrative), NEPA Compliance</td><td>Drilling may be allowed subject to management agency, drilling prohibited pending planning or NEPA compliance</td></tr><tr><td>5</td><td>Leasing, No Surface Occupancy (NSO) (net 100% for public resources)</td><td>Not accessible for drilling except for resources within an extended drilling zone</td></tr><tr><td>6</td><td>Leasing, Cumulative Timing Limitations (TL) on Drilling > 3 Months</td><td>Categorized by the cumulative effect of seasonal leasing stipulations during which drilling is prohibited, generally for protection of wildlife</td></tr><tr><td>7</td><td>Leasing, Cumulative Timing Limitations (TL) on Drilling > 6 Months</td><td>Drilling permitted, specialized mitigation plan required (this category includes Cumulative Timing Limitations (TL) on Drilling > 3 Months, which are minimal)</td></tr><tr><td>8</td><td>Leasing, Controlled Surface Use (CSU)</td><td>Drilling permitted, mitigation plan required</td></tr><tr><td>9</td><td>Leasing, Standard Lease Terms (SLT)</td><td>Drilling permitted, mitigation plan required</td></tr></tbody></table></div> <div>Source</div> <div>http://www.blm.gov/sp/csl/</div>	Level	Access Category	Comments	1	No Leasing (Discretionary or Executive Order), N/A	Accessability determined by Law or Executive Order; drilling prohibited	2	No Leasing (Administrative), general	Accessability determined by Federal surface land management agency; drilling prohibited	3	No Leasing (Administrative), Pending Land Use Planning or NEPA Compliance	Drilling may be allowed subject to management agency, drilling prohibited pending planning or NEPA compliance	4	No Leasing (Administrative), NEPA Compliance	Drilling may be allowed subject to management agency, drilling prohibited pending planning or NEPA compliance	5	Leasing, No Surface Occupancy (NSO) (net 100% for public resources)	Not accessible for drilling except for resources within an extended drilling zone	6	Leasing, Cumulative Timing Limitations (TL) on Drilling > 3 Months	Categorized by the cumulative effect of seasonal leasing stipulations during which drilling is prohibited, generally for protection of wildlife	7	Leasing, Cumulative Timing Limitations (TL) on Drilling > 6 Months	Drilling permitted, specialized mitigation plan required (this category includes Cumulative Timing Limitations (TL) on Drilling > 3 Months, which are minimal)	8	Leasing, Controlled Surface Use (CSU)	Drilling permitted, mitigation plan required	9	Leasing, Standard Lease Terms (SLT)	Drilling permitted, mitigation plan required	<div>Solar Resources</div> <div><p>This data provides monthly and annual average daily total solar resource over surface cells of 0.1 degrees in both latitude and longitude, or about 10 km in size. This data was developed using the State University of New York-Albany satellite radiation model. The model was developed by Dr. Richard Perez and collaborators at the National Renewable Energy Laboratory and other universities for the U.S. Department of Energy. Specific information about this model can be found in Perez and others (2002). This data is derived from satellite imagery from geostationary weather satellites, daily snow cover data, and monthly averages of atmospheric water vapor, trace gases, and the amount of aerosols in the atmosphere to calculate the hourly total insolation (sun and sky) falling on a horizontal surface. Atmospheric water vapor, trace gases, and aerosols are derived from a variety of sources. A modified Bird model is used to calculate clear sky direct normal (DNM). This is then adjusted as a function of the ratio of clear sky global horizontal (GHI), and the model predicted GHI. See http://www.nrel.gov/gis/.</p></div> <div>Source</div> <div>http://www.nrel.gov/gis/</div>
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<div>West-wide energy corridor</div> <div><p>The Energy Policy Act of 2005, Public Law 109-58 (H.R. 6), enacted August 8, 2005, directs the Secretaries of Agriculture, Commerce, Defense, Energy, and the Interior to designate under their respective authorities corridors on Federal land in 11 western States for oil, gas and hydrogen pipelines and electricity transmission and distribution facilities, for example, energy corridors. The Agencies have prepared a programmatic environmental impact statement (PEIS) entitled "Programmatic Environmental Impact Statement, Designation of Energy Corridors on Federal Land in the 11 Western States" (DOE/EIS-1386) to address the environmental impacts from the proposed "action" and "no-action" alternatives. Because the proposed action may affect floodplains and wetlands, the PEIS includes a floodplain and wetlands assessment and the Record of Decision will include a floodplain statement of findings (U.S. Department of Energy, Interior (Bureau of Land Management), Agriculture (Forest Service), and Defense, 2010).</p></div> <div>Source</div> <div>http://comdevand.blm.gov/index.cfm</div>	<div>Oil and Gas Sale Parcels</div> <div><p>This data theme identifies oil and gas sale parcels, which can eventually become leases. The stipulations/restrictions for each parcel are printed in the lease notice.</p></div> <div>Source</div> <div>http://www.blm.gov/wy/s/6/en/resources/publications/wy/6/en/wy6/blm-wy6/blm-wy6-sys.html</div>	<div>Total Oil and Total Natural Gas</div> <div>Modified from U.S. Departments of the Interior, Agriculture, and Energy, 2006</div> <div><p>In November 2000, Congress passed and President Clinton signed the Energy Act of 2000 (also referred to as the Energy Policy and Conservation Act (EPACA)). The Act directed the Secretary of the Interior, in consultation with the Secretaries of Agriculture and Energy, to conduct an inventory of oil and natural gas resources beneath onshore Federal lands. In 2006, the Scientific Inventory of Onshore Federal Land: Oil and Gas Resources and the Extent and Nature of Restrictions or Impediments to Their Development—Phase I Cumulative Inventory, was published and included the Wyoming Thrust Belt and the Greater Green River Basin Provinces. The report provides an inventory of the extent and nature of limitations to development of these resources and does not make any policy recommendations in response to its findings (U.S. Departments of the Interior, Agriculture, and Energy, 2006).</p><p>The USGS has identified discrete oil and natural gas resource assessment units in the Phase II study areas. Resource assessment unit boundaries and oil and gas resource estimates within the assessment units were obtained in GIS format from the USGS. These assessment units were then aggregated in a GIS to create a resource-density map layer for each study area. The probabilistic mean estimate of hydrocarbon resource volumes for each USGS-defined assessment unit was utilized for this inventory. The assessed resources include oil, natural gas liquids (NGL), associated dissolved (AD) natural gas, non-associated natural gas (NAG) and liquids in gas reservoirs. Oil is a natural liquid of mostly hydrocarbon molecules. NGLs are liquid when produced to the surface, but exist in the gas phase in the subsurface. Natural gas is a mixture of hydrocarbon gases consisting primarily of methane. Associated dissolved natural gas is that produced from oil fields, whereas nonassociated natural gas is that produced from gas fields. The USGS assesses technically recoverable resources for each of these resource types, and these volumes were provided for the inventory. While modeled discrete in this analysis, for purposes of presentation in this inventory, undiscovered NGLs, and liquids associated with natural gas reservoirs were subsequently aggregated into a single "Total Oil" resource category. Similarly, AD and non-associated natural gases were combined as "Total Natural Gas" (U.S. Departments of the Interior, Agriculture, and Energy, 2006).</p></div> <div>Source</div> <div>http://www.blm.gov/sp/csl/</div>	<div>Base Cartographic Maps, Reference Boundaries, and Transportation (ESRI ArcGIS Online Services)</div> <div><p>These Esri map services are designed to be used to overlay base maps and thematic maps such as demographics or land cover for reference purposes. These services include: administrative boundaries, cities, water features, physiographic features, parks, landmarks, highways, roads, railways, and airports on a transparent background. The services were compiled from a variety of best-available sources from several data providers, including the USGS, National Park Service, Tele Atlas, AND, and Esri. The services currently provide coverage for the world to a scale of approximately 1:1 M and coverage for the continental United States and Hawaii to a scale of approximately 1:70 K (Esri, 2010).</p><p>NOTE: These services function correctly with ArcGIS version 9.3.1 or more recent, due to caching using the PNG32 graphic format, which isn't supported in ArcMap prior to 9.3.1. It can be used in ArcDesktop 9.2 or more recent products (Esri, 2010).</p></div> <div>Source</div> <div>http://www.arcgis.com/arcmap/</div>																														
<div>Protected land or sensitive resource group</div> <div><p>This theme was compiled to analyze potential effects to visual resources in preparation of the Final Programmatic Environmental Impact Statement (PEIS) for Energy Corridors in the 11 western States in accordance with Section 368 of the Energy Policy Act of 2005. Data sources are the administering agencies of the Federal Government, including, but not limited to, the National Park Service, Bureau of Land Management, U.S. Forest Service and U.S. Geological Survey (U.S. Department of Energy, Interior (Bureau of Land Management), Agriculture (Forest Service), and Defense, 2010).</p></div> <div>Source</div> <div>http://comdevand.blm.gov/index.cfm</div>	<div>Oil and Gas Unit Agreement Areas</div> <div><p>A unit agreement is submitted on behalf of owners of oil and gas interests who wish to unite to facilitate the orderly, efficient, and timely development of the oil and gas resources within a unit area. The agreement designates one party to the operator and commits that party to diligently pursue an exploration program to develop the oil and gas potential of the area on behalf of all committed interests. Where Federal or Tribal lands are to be committed to the unit agreement, approval by the Federal Government is required.</p></div> <div>Source</div> <div>http://www.eoconcomm.senate.gov/ArcGIS/rest/services/USGS_Oil_Gas/MapServer</div>	<div>Base Cartographic Maps, Reference Boundaries, and Transportation (ESRI ArcGIS Online Services)</div> <div><p>The ArcGIS.com website provides access to content in ArcGIS Online using a Web browser (Esri, 2010). ArcGIS Online is Esri's shared repository of maps, data, applications, and tools, the content of which are from Esri, its partners, and the GIS community at large. Users can share maps and data via ArcGIS Online. Several ArcGIS Online web maps are embedded in the interactive map, including the National Park physical map (Source: NPS), high-resolution imagery (Esri, 2009), e-roads, GeoEye, street-level data (Esri, 2009), AND, TANA, Esri Japan, UNEP-WCMC, topographic information (Source: USGS, FAO, NPS, ARI, Esri, DeLorme, TANA, other suppliers), and shaded relief (Esri, 2009).</p></div> <div>Source</div> <div>http://www.arcgis.com/arcmap/</div>	<div>Base Cartographic Maps, Reference Boundaries, and Transportation (ESRI ArcGIS Online Services)</div> <div><p>The ArcGIS.com website provides access to content in ArcGIS Online using a Web browser (Esri, 2010). ArcGIS Online is Esri's shared repository of maps, data, applications, and tools, the content of which are from Esri, its partners, and the GIS community at large. Users can share maps and data via ArcGIS Online. Several ArcGIS Online web maps are embedded in the interactive map, including the National Park physical map (Source: NPS), high-resolution imagery (Esri, 2009), e-roads, GeoEye, street-level data (Esri, 2009), AND, TANA, Esri Japan, UNEP-WCMC, topographic information (Source: USGS, FAO, NPS, ARI, Esri, DeLorme, TANA, other suppliers), and shaded relief (Esri, 2009).</p></div> <div>Source</div> <div>http://www.arcgis.com/arcmap/</div>																														