Assessment of the Mineral Potential of Public Lands Located within Proposed Solar Energy Zones in Utah

July 2012

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NOTATION

The following is a list of acronyms, abbreviations, and units of measure used in this document. Some acronyms used only in tables may be defined only in those tables.

GENERAL ACRONYMS AND ABBREVIATIONS

BLM	Bureau of Land Management
CBO	Congressional Budget Office
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
EERE	[Office of] Energy Efficiency and Renewable Energy [DOE]
FLPMA	Federal Land Policy Management Act of 1976
FR	*Federal Register*
GIS	geographic information system
IBLA	Interior Board of Land Appeals
LR2000	Land and Mineral Legacy Rehost 2000 System
MRDS	Mineral Resource Data System
PEIS	programmatic environmental impact statement
P.L.	Public Law
P.M.	Principal Meridian
ROW	right-of-way
SEZ	solar energy zone
UDOGM	Utah Division of Oil, Gas and Mining
UDWR	Utah Division of Water Rights
UGS	Utah Geological Survey
U.S.	United States
USC	*United States Code*
USGS	U.S. Geological Survey

UNITS OF MEASURE

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
ft	foot (feet)
km	kilometer(s)
km^2	square kilometer(s)
m	meter(s)
mi	mile(s)

ASSESSMENT OF THE MINERAL POTENTIAL OF PUBLIC LANDS LOCATED WITHIN PROPOSED SOLAR ENERGY ZONES IN UTAH

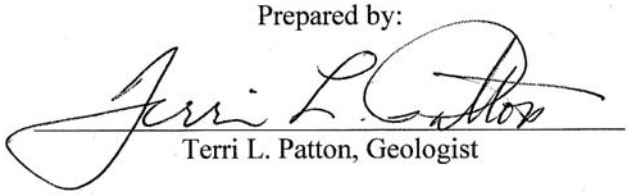
LANDS INVOLVED

Escalante Valley Solar Energy Zone
Covering 6,614 acres of public land in Iron County, Utah
T33S, R14W, sections 8 to 11, 14, 15, 17, 19, 30, and 31
T33S, R15W, sections 24 and 25
T34S, R14W, section 6
Salt Lake P.M.

Milford Flats South Solar Energy Zone
Covering 6,480 acres of public land in Beaver County, Utah
T30S, R10W, section 18
T30S, R11W, sections 7, 8, 10, 12 to 15, 17 to 22, 29, and 30
Salt Lake P.M.

Wah Wah Valley Solar Energy Zone
Covering 6,097 acres of public land in Beaver County, Utah
T27S, R14W, sections 8 to 11, 13 to 15, 17, 21 to 23, and 26 to 28
Salt Lake P.M.

Prepared by:



Terri L. Patton, Geologist

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ASSESSMENT OF THE MINERAL POTENTIAL OF PUBLIC LANDS LOCATED WITHIN PROPOSED SOLAR ENERGY ZONES IN UTAH

SUMMARY

The report that follows presents an assessment of the mineral resource potential of public lands located within three solar energy zones (SEZs) in southwestern Utah, on behalf of the U.S. Department of the Interior (DOI), Bureau of Land Management (BLM). The report was prepared in consultation with three BLM mineral specialists: Mr. Matt Shumaker, Chief Mineral Examiner (Division of Solid Minerals); Mr. Jason Powell, Geologist (Division of Solid Minerals); and Mr. Edward Ginouves, Geologist (Cedar City Field Office). Mr. Jeff Holdren, Senior Realty Specialist (Division of Lands, Realty, and Cadastral Survey), prepared the legal descriptions for each of the SEZs.

The subject lands are located within three SEZs in southwestern Utah: Escalante Valley (Iron County), Milford Flats South (Beaver County), and Wah Wah Valley (Beaver County). The mineral resource potential for each of these sites is summarized below.

S.1 ESCALANTE VALLEY SEZ

There are no documented occurrences of locatable mineral deposits within the Escalante Valley SEZ. Most of the locatable minerals in the region come from the Antelope Range, where the major deposits are copper and silver. Mineral deposits in this area occur in epithermal veins generally clustered along major structures and faults. Massive replacement and skarn deposits adjacent to a group of laccolith intrusions are the main sources of iron that is mined in the Iron and Granite Mountains region to the southeast. The SEZ is located in a deep sediment-filled basin where sediments are up to 2,400-ft (730-m) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on available geologic data, they are likely to be very deep (below basin sediments) if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).[1]

The Escalante Valley SEZ is an area with a high potential for clay, sand, and gravel (level of certainty B). There currently are no active free use permits or mineral materials contracts within the site. Demand for these resources in the region is generally low.

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1 Definitions of mineral potential are from the mineral potential classification system outlined in *BLM Manual 3031* (BLM 1985). Mineral potential ratings of low, moderate, or high are assigned where the geologic environment and inferred geologic processes indicate low, moderate, or high potential for accumulation of mineral resources. Levels of certainty are defined as follows: A = available data are *insufficient* to support or refute the occurrence of mineral resources; B = available data provide *indirect* evidence to support or refute the occurrence of mineral resources; C = available data provide *direct but quantitatively minimal* evidence to support or refute the occurrence of mineral resources; and D = available data provide *abundant direct and indirect* evidence to support or refute the occurrence of mineral resources.

There are two authorized oil and gas leases within and in close proximity to the Escalante Valley SEZ. One lease is located along the eastern border and overlaps small portions of the site. The other lease occurs to the south of the main portion of the SEZ. Two exploratory wells were drilled to depths of 11,500 and 16,000 ft (one in 1970 and one in 1983) near the southwestern corner of the site (one in section 36 of T33S, R15W; the other in section 1 of T34S, R15W), but there has been no oil or gas production in the area. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in the Uinta and Paradox Basins in the northeastern and southeastern parts of Utah, especially in Duchesne, Uintah, Carbon, Emery, Grand, and San Juan Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Future development under the current authorized oil and gas lease could take place until it expires in 2017.

The Escalante Valley SEZ is located in the Cedar City District, an area of high geothermal potential. Electric power has been generated at the Roosevelt Hot Springs (section 34 of T26S, R9W) and Cove Fort-Sulphurdale (section 7 of T26S, R6W) geothermal fields in north Beaver County, and is planned for the Thermo Hot Springs II geothermal area (section 28 of T30S, R12W) in south Beaver County. There are no active or historical geothermal leases and no nominated lands for geothermal sale within the SEZ. However, because of its location in the Cedar City District, the potential for development of geothermal energy within the site is considered moderate (level of certainty B) pending further study.

S.2 MILFORD FLATS SOUTH SEZ

There are no documented occurrences of locatable mineral deposits within the Milford Flats South SEZ. Most of the locatable minerals in the region come from the Star Range to the north, where the major deposits are silver, gold, lead, and copper. Mineral deposits in this area occur as a result of contact alteration, where quartz monzonite is in contact with limestone and along related fissures in the affected limestone. The SEZ is located in a deep sediment-filled basin where sediments are at least 500-ft (150-m) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on available geologic data, they are likely to be very deep (below basin sediments) if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

The Milford Flats South SEZ is an area with a high potential for sand and gravel (level of certainty C). Past mining of gravel pits near the northeast corner of the SEZ indicates that the future extraction of such resources within the site is viable; however, demand for these resources in the region is generally low. There currently are no active free use permits or mineral materials contracts within the site.

There are three authorized oil and gas leases within and around the Milford Flats South SEZ. One lease covers portions of the east end of the SEZ (sections 10 and 12 to 14 of T30S, R11W); another is located just outside the east end boundary (section 18 of T30S, R10W). A third lease covers portions of the northwest corner of the site (in sections 8 and 18 of T30S, R11W). No exploratory wells have been drilled within 20 mi (32 km) of the SEZ, and there has been no oil or gas production in the immediate region of the SEZ. Relative to more favorable

areas for oil and gas accumulation in the state (concentrated in the Uinta and Paradox Basins in the northeastern and southeastern parts of Utah, especially in Duchesne, Uintah, Carbon, Emery, Grand, and San Juan Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Future development under the current authorized oil and gas leases within the SEZ could take place until they expire in 2015.

The Milford Flats South SEZ is located in the Cedar City District, an area of high geothermal potential. Electric power has been generated at the Roosevelt Hot Springs (section 34 of T26S, R9W) and Cove Fort-Sulphurdale (section 7 of T26S, R6W) geothermal fields in north Beaver County, and is planned for the Thermo Hot Springs II geothermal area (section 28 of T30S, R12W) in south Beaver County. There are no active geothermal leases and no nominated lands for geothermal sale within the SEZ (four geothermal leases covered most of the site in the past but were closed in the mid-1980s). However, because of its location in the Cedar City District, the potential for development of geothermal energy within the site is considered moderate (level of certainty B) pending further study.

S.3 WAH WAH VALLEY SEZ

There are no documented occurrences of locatable mineral deposits within the Wah Wah Valley SEZ. Most of the locatable minerals in the region come from the Preuss (Newhouse)-San Francisco District in the San Francisco Mountains to the northeast, where the major deposits are gold, silver, copper, lead, and zinc. Mineral deposits in this area occur as a result of contact alteration, where quartz monzonite is in contact with limestone and along related fissures in the affected limestone. The site is located in a deep sediment-filled basin where sediments are up to 1,400-ft (430-m) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on available geologic data, they are likely to be very deep (below basin sediments) if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

The Wah Wah Valley SEZ is an area with a high potential for sand and gravel (level of certainty D), and a moderate potential for the occurrence of clay (level of certainty B). Past and present small-scale mining of sand and gravel within the SEZ indicates that the future extraction of such resources within the site is viable; however, demand for these resources in the region is generally low. There is currently one authorized free use permit for sand and gravel in the northwest corner of the SEZ. Mining under this permit would continue until the end of its term.

There are no active oil or gas leases within the Wah Wah Valley SEZ, and there has been no history of oil or gas production within or near the SEZ. Six oil and gas leases covered most of the site in the past, but these leases were closed in 1984 and 1985. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in the Uinta and Paradox Basins in the northeastern and southeastern parts of Utah, especially in Duchesne, Uintah, Carbon, Emery, Grand, and San Juan Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A).

The Wah Wah Valley SEZ is located in the Cedar City District, an area of high geothermal potential. Electric power has been generated at the Roosevelt Hot Springs (section 34 of T26S, R9W) and Cove Fort-Sulphurdale (section 7 of T26S, R6W) geothermal fields in north Beaver County, and is planned for the Thermo Hot Springs II geothermal area (section 28 of T30S, R12W) in south Beaver County. There are no active or historical geothermal leases and no nominated lands for geothermal sale within the SEZ. However, because of its location in the Cedar City District, the potential for development of geothermal energy within the site is considered moderate (level of certainty B) pending further study.

1 INTRODUCTION

1.1 PURPOSE OF REPORT

The purpose of this report is to assess the mineral resource potential of 18,658 acres (76 km^2) of public lands within three SEZs in southwestern Utah, which the Secretary of the Interior may decide to withdraw from potentially conflicting uses through the issuance of a Public Land Order. If the order is approved, the public lands within the SEZs would be withdrawn, subject to valid existing rights, from settlement, sale, location, or entry under the general land laws, including the mining laws, as follows:

- New mining claims could not be filed on the withdrawn lands; however, valid mining claims filed prior to the date the lands were segregated (i.e., withdrawal application notice was published in the *Federal Register*) would take precedence over future solar energy development right-of-way (ROW) application filings.

- Lands could not be sold, exchanged, or otherwise disposed of during the term of the withdrawal.

- Withdrawn lands would remain open to mineral leasing, geothermal leasing, and mineral material laws; the BLM could elect to lease the oil, gas, coal, or geothermal steam resources, or to sell common-variety mineral materials such as sand and gravel, if the authorized officer determined there would be no unacceptable impacts on future solar energy development.

- Withdrawn lands would remain open to ROW authorizations and land leases or permits authorized under Section 302 of the Federal Land Policy and Management Act of 1976 (FLPMA).

The public lands are currently segregated under an Interim Temporary Final Rule, which was published on April 26, 2011, and is in effect until June 30, 2013 (Vol. 76, pp. 23198–23205 of the *Federal Register* [76 FR 23198–23205]).

1.2 LEGAL DESCRIPTION OF THE SUBJECT LANDS

There are three SEZs in Utah: Escalante Valley, which is located in Iron County, and Milford Flats South and Wah Wah Valley, which are located in Beaver County. All the SEZs are located in the Cedar City Resource Area. The locations of the SEZs are shown in Figure 1. Their full legal descriptions are provided in Appendix A.

1.3 METHODOLOGY AND RESOURCES

The assessment presented in this report focuses on locatable (including those classified as strategic and critical), saleable, and leasable mineral resources within the three SEZs in Utah. The conclusions concerning mineral occurrence and development potential (and levels of certainty) follow the methodology outlined in *BLM Manual 3031* (BLM 1985) and are based on a review of topographic maps, geologic maps, mineral resource maps and reports, the scientific literature on the geology and mineral resources of Utah, and consultation with BLM mineral specialists. No mapping or field sampling was conducted as part of this assessment.

Digital data for the geologic maps in Figures 2, 5, and 8 were obtained from the U.S. Geological Survey (USGS) (Ludington et al. 2007). The dataset was digitized from previously published geologic maps ranging in scale from 1:100,000 to 1:1,000,000. Detailed map unit descriptions for this map are based on the published state geologic map by Hintze (1980). The large-scale, folded maps (Maps 1 through 3) provided in the back of this report show the public land survey system grid (township and range) and should be consulted to locate mines and other features discussed in the text. In addition, the Solar Programmatic Environmental Impact Statement (PEIS) Web site (http://solareis.anl.gov/sez/index.cfm) features mapped photographs of the SEZs.

The BLM's Legacy Rehost System (LR2000; BLM 2012) was queried on July 13, 2012, for information on active and historical (unpatented) mining claims and various leases and permits, including oil and gas leases, geothermal leases and land nominations, free use permits, and mineral materials contracts, issued on public lands within and around the proposed SEZs.

Mines and mineral prospects and occurrences and their descriptions are those reported in the USGS Mineral Resources Data System (MRDS; USGS 2011; Lipin 2000) and supplemented with information provided by Mr. Ed Ginouves, a mineral specialist from the Cedar City Field Office (Cedar City District). The MRDS is a large database containing historical records of the USGS and the U.S. Bureau of Mines (which is now part of the USGS). These records are of variable quality and currency, so it is possible that some information will be found to be out of date (the revision and refinement of the database is an ongoing effort at the USGS). The mining activity maps in Figures 4, 7, and 9 were prepared from the MRDS and are intended to provide a general picture of the location and nature of mining activity in the vicinity of each of the SEZs. Refinements with regard to the status of particular mines are included in the text, as warranted, based on conversations with Mr. Ginouves.

Geographic information system (GIS) data for Utah's known mineral deposit areas were obtained from the Utah GIS Portal (2011) for the mining activity maps. These areas generally overlap the mining districts delineated by Doelling and Tooker (1983). Information on mining permits in Iron and Beaver Counties is from the permits page of the Utah Department of Natural Resources, Division of Oil, Gas and Mining Web site (http://linux1.ogm.utah.gov/WebStuff/wwwroot/minerals/mineralsfilesbypermitinfo.php). Mineral occurrences by county are available from the Utah Geological Survey (UGS) (http://geology.utah.gov/databases/UMOS/send_county.cfm).

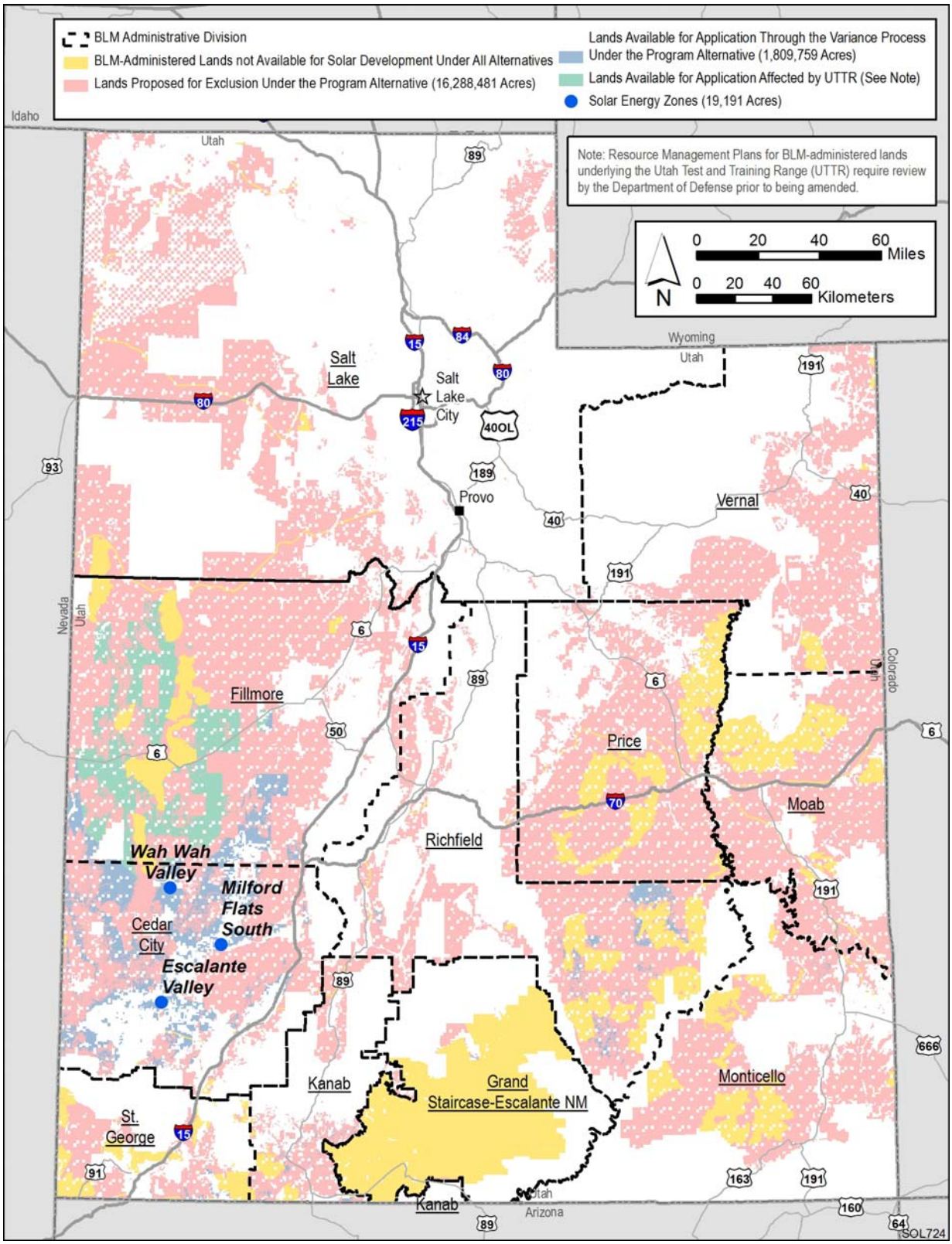

FIGURE 1 BLM-Administered Lands in Utah Available for Application for Solar Energy Right-of-Way Authorization (SEZs are represented by the blue dots)

1.4 LOCATABLE MINERALS

Under United States (U.S.) mining laws, minerals fall into three categories: locatable, leasable, and saleable. Because these categories were created by acts of Congress, they do not fall into simple economic or mineralogical divisions. Creating an exact and thorough list of locatable minerals (e.g., those subject to appropriation by locating mining claims) is therefore difficult. Metallic minerals (e.g., gold, silver, copper, mercury, aluminum, antimony, lithium, molybdenum, tungsten, uranium, vanadium, and rare earths) are considered to be locatable. Numerous uncommon varieties of nonmetallic minerals may also be locatable, depending on their chemical content, quality, uses, and characteristics, as well as on certain associated economic and legal matters. These nonmetallic minerals could include barite, calcite, specialty clays, bentonite, diatomite, feldspar, some gemstones (e.g., opals and diamonds), gypsum, chemical-grade limestone, perlite, chemical-grade silica sand, specific types of stone, talc, zeolites, and specific and uncommon types of dolomite. The determination of the actual locatability of uncommon varieties of nonmetallic minerals and the validity of mining claims for them is complex and relies on Public Law (P.L.) 84-167 (*United States Code*, Title 30, Section 601 et seq. [30 USC 601 et seq.]) and applicable case law (e.g., *U.S. vs. Kenneth McClarty*, 17 Interior Board of Land Appeals [IBLA] 20, 1974 [81 Interior Department (I.D.) 472]) (Shumaker 2011).

Utah's nonfuel raw mineral production in 2007 was down by about 3% over that in 2006 (although 2006 was up 43% over that of 2005). The top nonfuel minerals were copper, molybdenum, and gold, which accounted for about 94% of the state's nonfuel mineral production value in 2007. Significant increases in the production values of phosphate rock, magnesium metal, lime, and potash occurred in 2007. Most of the exploration activity in 2007 focused on copper, gold, molybdenum, silver, uranium, and zinc. Utah was the only state to produce beryllium concentrates and magnesium metal; it was second in the production of copper, molybdenum concentrates, and potash, and third in bentonite, gold, and magnesium compounds (USGS 2010). In 2009, the Utah Division of Oil, Gas, and Mining (UDOGM) listed a total of 309 active mines (including coal mines) in Utah: 114 were large mines, and 195 were small ones (Bon and Krahulec 2010).

1.5 STRATEGIC AND CRITICAL MINERALS

Table 1 lists the nonfuel strategic and critical nonfuel minerals that are imported by the United States for its National Defense Stockpile, as authorized by the Strategic and Critical Materials Stock Piling Act (50 USC 98 et seq.). Several of the minerals produced in Utah are classified as strategic and critical minerals; these include beryllium, copper, vanadium, and zinc.

TABLE 1 Strategic and Critical Nonfuel Minerals

Antimony	Copper	Platinum group
Asbestos	Diamonds (industrial)	Quartz crystals
Bauxite and alumina	Fluorspar	Rutile (titanium)
Beryllium	Graphite	Silicon
Bismuth	Iodine	Tantalum
Cadmium	Manganese	Thorium
Chromium	Mercury	Tin
Cobalt	Mica sheet	Tungsten
Columbian	Nickel	Vanadium
		Zinc

Source: CBO (1983).

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2 ESCALANTE VALLEY SEZ

2.1 SUMMARY AND CONCLUSIONS

This chapter assesses the mineral resource potential of 6,614 acres (27 km^2) of public lands within an area known as the Escalante Valley SEZ, located in Iron County in southwestern Utah, about 4 mi (6 km) to the south of Lund and 5 mi (8 km) to the east of Zane.

There are no documented occurrences of locatable mineral deposits within the Escalante Valley SEZ. Most of the locatable minerals in the region come from the Antelope Range, where the major deposits are copper and silver. Mineral deposits in this area occur in epithermal veins generally clustered along major structures and faults. Massive replacement and skarn deposits adjacent to a group of laccolith intrusions are the main sources of iron that is mined in the Iron and Granite Mountains region to the southeast. The SEZ is located in a deep sediment-filled basin where sediments are up to 2,400-ft (730-m) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on available geologic data, they are likely to be very deep (below basin sediments) if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

The Escalante Valley SEZ is an area with a high potential for clay, sand, and gravel (level of certainty B). There currently are no active free use permits or mineral materials contracts within the site. Demand for these resources in the region is generally low.

There are two authorized oil and gas leases within and in close proximity to the Escalante Valley SEZ. One lease is located along the eastern border and overlaps small portions of the site. The other lease occurs to the south of the main portion of the SEZ. Two exploratory wells were drilled to depths of 11,500 and 16,000 ft (one in 1970 and one in 1983) near the southwestern corner of the site (one in section 36 of T33S, R15W; the other in section 1 of T34S, R15W), but there has been no oil or gas production in the area. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in the Uinta and Paradox Basins in the northeastern and southeastern parts of Utah, especially in Duchesne, Uintah, Carbon, Emery, Grand, and San Juan Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Future development under the current authorized oil and gas lease could take place until it expires in 2017.

The Escalante Valley SEZ is located in the Cedar City District, an area of high geothermal potential. Electric power has been generated at the Roosevelt Hot Springs (section 34 of T26S, R9W) and Cove Fort-Sulphurdale (section 7 of T26S, R6W) geothermal fields in north Beaver County, and is planned for the Thermo Hot Springs II geothermal area (section 28 of T30S, R12W) in south Beaver County. There are no active or historical geothermal leases and no nominated lands for geothermal sale within the SEZ. However, because of its location in the Cedar City District, the potential for development of geothermal energy within the site is considered moderate (level of certainty B) pending further study.

2.2 LANDS INVOLVED

The Escalante Valley SEZ is located on BLM lands in the Cedar City Resource Area, in Iron County. The site lies within Township 33 south, Range 14 west (T33S, R14W), sections 8 to 11, 14, 15, 17, 19, 30, and 31; T33S, R15W, sections 24 and 25; and T34S, R14W, section 6 (Salt Lake Principal Meridian). Within this area, 12 acres (0.05 km^2) of dry lake area and 69 acres (0.28 km^2) of dune area have been designated as non-development areas (BLM and DOE 2011). The SEZ and the non-development areas within it are shown on the location map in the back of this report (Map 1). The full legal description of the SEZ is provided in Appendix A.

2.3 LAND STATUS

According to the LR2000, accessed on July 13, 2012, there are no active locatable mining claims within the Escalante Valley SEZ; however, there are five lode claims located in the southwest quadrant of section 6 in T34S, R14W, immediately south of the site, which were abandoned/forfeited in 1988 (BLM 2012). The lands within the SEZ were first segregated from locatable mineral entry in June 2009, pending the outcome of the Draft Solar PEIS (BLM and DOE 2010). They are currently segregated under an Interim Temporary Final Rule, which is in effect until June 30, 2013 (76 FR 23198–23205).

There are no active or closed free use permits or mineral materials contracts within the SEZ (BLM 2012). The site remains open for the disposal of saleable mineral materials.

There are 2 authorized (and 12 closed) oil and gas leases within and in close proximity to the SEZ (BLM 2012). One lease (UTU 085550) is located along the eastern border of the SEZ (in sections 1, 11 to 14, and 24 of T33S, R14W) and overlaps the site in sections 11 and 14. The other lease (UTU 085556) occurs to the south of the main portion of the SEZ (in sections 6, 7, 11, 14, 18, 24, and 25 of T34S, R14W). Although this lease covers part of section 6, it is outside the boundary of the small part of the SEZ that also occurs in section 6 (see Map 1). There are no active or historical geothermal leases and no nominated lands for geothermal sale within the SEZ. The site remains open for discretionary leasing for oil and gas, geothermal, and other leasable minerals.

2.4 GEOLOGIC SETTING

The Escalante Valley SEZ is located in the Escalante Desert region of the Basin and Range physiographic province in southwestern Utah. The SEZ sits in Escalante Valley, which occupies the southernmost portion of the Escalante Desert. Escalante Valley is surrounded by the Indian Peak Range and Wah Wah Mountains on the northwest, the Bull Valley and Pine Valley Mountains on the south, and the Antelope Range on the southeast. The valley opens to the northeast into the Escalante Desert.

Escalante Valley has a long depositional history, with thick sequences of marine miogeosynclinal sediments (carbonates, sandstone, siltstone, and shale) deposited throughout the

Late Precambrian and Paleozoic, followed by several orogenic episodes (from the Early Triassic to Oligocene). Volcanic activity in southwestern Utah during the Oligocene and Miocene produced extensive deposits of ignimbrites, lava flows, and volcanic breccias in the region. Block faulting associated with crustal extension in the Basin and Range province began in the Miocene, about 20 million years ago. The Escalante Valley SEZ overlies a large northeast-trending gravity low (near Lund) that indicates the presence of a graben (Klauk and Gourley 1983; Mason 1998).

Basin-fill sediments in the valley are estimated to be up to 4,900-ft (1,490-m) thick, with the uppermost layer consisting of lacustrine deposits of fine-grained clay, silt, and marl in the valley center, intertongued with deltaic and alluvial deposits of clay, silt, sand, and gravel along the valley margins (Mason 1998; Lund et al. 2005). The thickness of the upper layer is estimated by Gerston and Smith (1979) to range from 300 ft (90 m) near the valley margins to as much as 3,900 ft (1,190 m) along the valley axis. The lacustrine and deltaic sediments are associated with Lake Bonneville, an ancient (Pleistocene) lake that covered most of western Utah and parts of eastern Nevada and southern Idaho from 32,000 to 14,000 years ago (UGS 2010). Shoreline deposits of Lake Bonneville occur at elevations up to about 5,200 ft (1,585 m) (White 1932; Mason 1998). The composition of deeper sediments (more than 3,900 ft [1,190 m]) is unknown, but seismic refraction profiles indicate they are more consolidated (i.e., cemented and compacted) than sediments of the upper layer. These sediments overlie basement rocks composed of Precambrian gneiss (Mason 1998).

Exposed sediments in Escalante Valley are predominantly modern alluvium and Lake Bonneville lacustrine deposits. Dune sands are common and occur along the edges or close to the exposed lake deposits. The surrounding mountains are composed of volcanic rocks of Tertiary and Quaternary age (Hintze 1980; Mason 1998). The geology of the region near the Escalante Valley SEZ is shown in Figure 2.

2.5 PHYSICAL FEATURES AND ACCESS

The Escalante Valley SEZ lies just north of the Antelope Range in the Escalante Desert. Its terrain is relatively flat, with elevations ranging from 5,094 ft (1,553 m) along the northern border of the site to 5,242 ft (1,600 m) in the southeast corner of its lower portion. The highest point in the area is Table Butte, just to the southwest of the SEZ, which has a maximum elevation of 5,845 ft (1,782 m). The Dick Palmer Wash (flowing to the northwest across the northeast corner) and several unnamed ephemeral streams cross the site.

Access to the SEZ is via county roads and numerous dirt roads. A railroad spur runs through the eastern edge of the site. Iron County has asserted Revised Statute 2477 Class B and D road ROWs within the site.

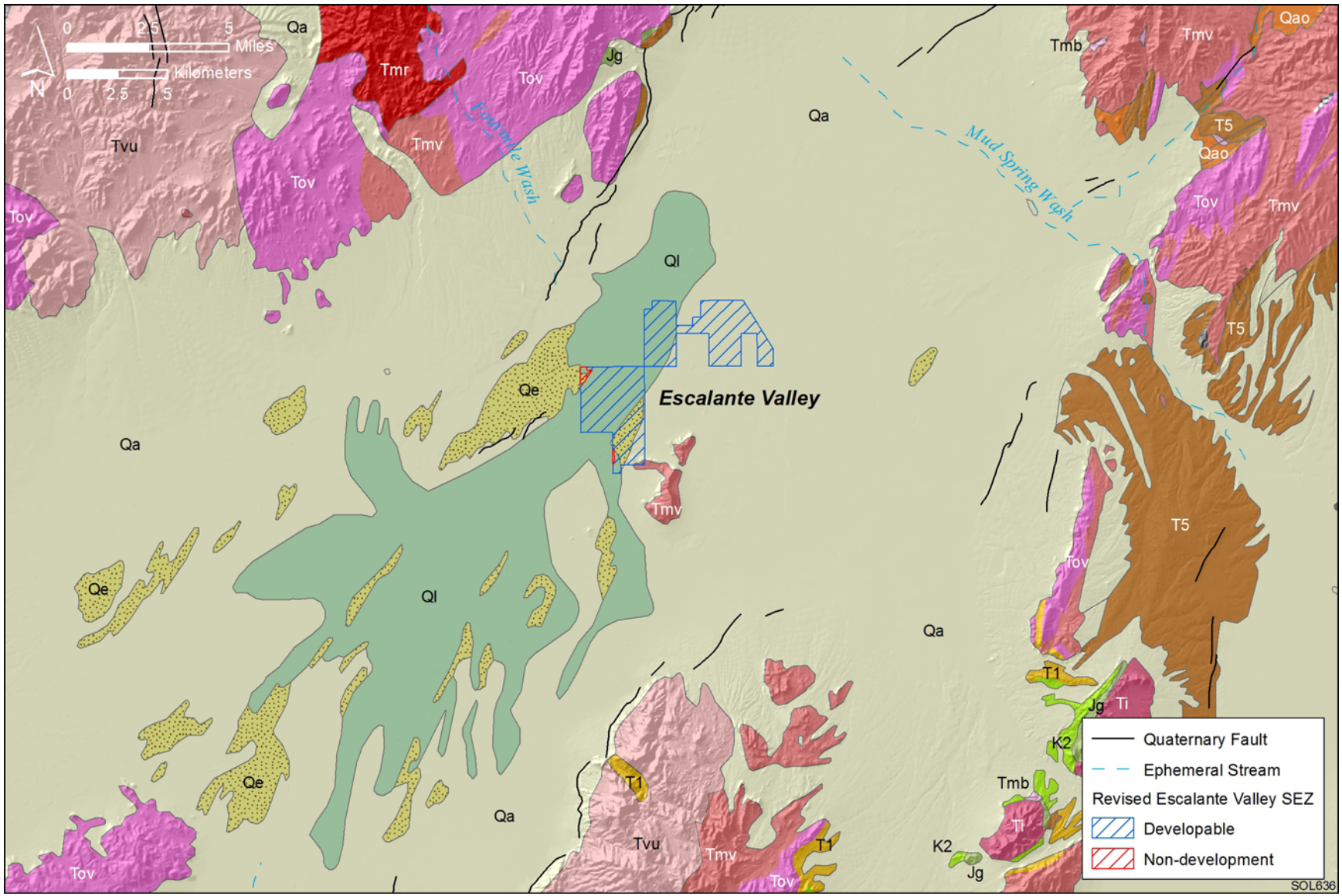


FIGURE 2 Geologic Map of the Escalante Desert Region (Sources: Ludington et al. 2007; Hintze 1980)

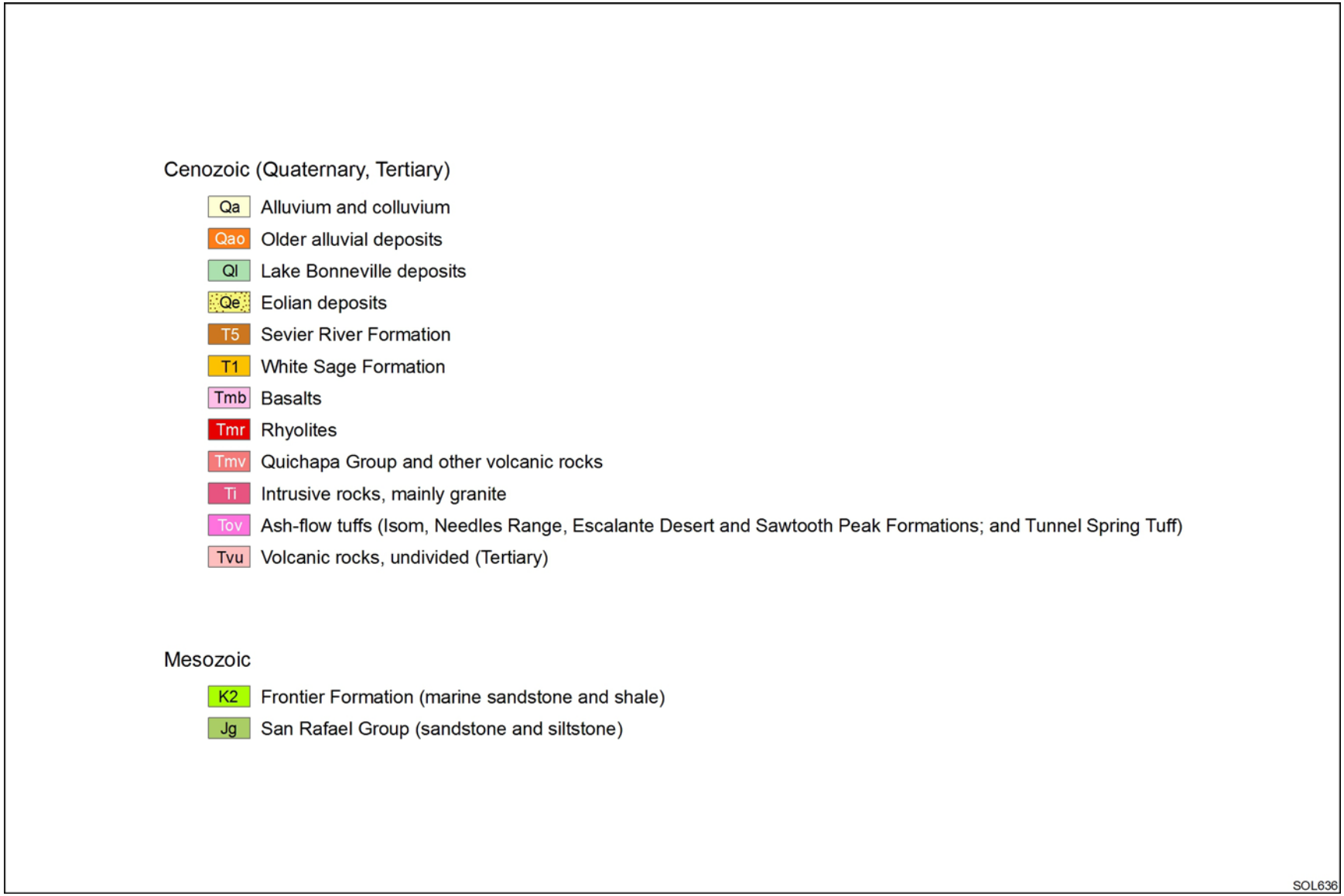


FIGURE 2 (Cont.)

2.6 SITE GEOLOGY

The geology of the Escalante Valley SEZ is described based on a 1:100,000 scale geologic map by Rowley et al. (2006). The thicknesses of geologic units were inferred from a cross-section transect on this map across the southern portion of the SEZ. Surface sediments at the site consist predominantly of Quaternary alluvium, playa, and eolian deposits (sand dunes and sheets) (map units Qal, Qp, Qed, and Qes; Figure 3). Lacustrine sediments associated with Pleistocene Lake Bonneville occur to the southeast of the SEZ and cover a small portion of its east end (map unit Qls).

The SEZ is underlain by basin-fill sediments of Quaternary and Tertiary age, which are about 250-ft (76-m) thick. These sediments consist of poorly to moderately consolidated tuffaceous sandstone and subordinate mudstone, siltstone, and conglomerate. They are underlain by Tertiary volcanic units (undivided), which are estimated to be about 450-ft (140-m) thick below the southern portion of the site. At depths greater than 700 ft (210 m), soft to resistant lacustrine and fluvial limestone, calcrete, sandstone, siltstone, mudstone, and conglomerate of the Claron Formation (Eocene and Oligocene) are encountered. These rocks are up to 1,700-ft (500-m) thick in the vicinity of the Escalante Valley SEZ.

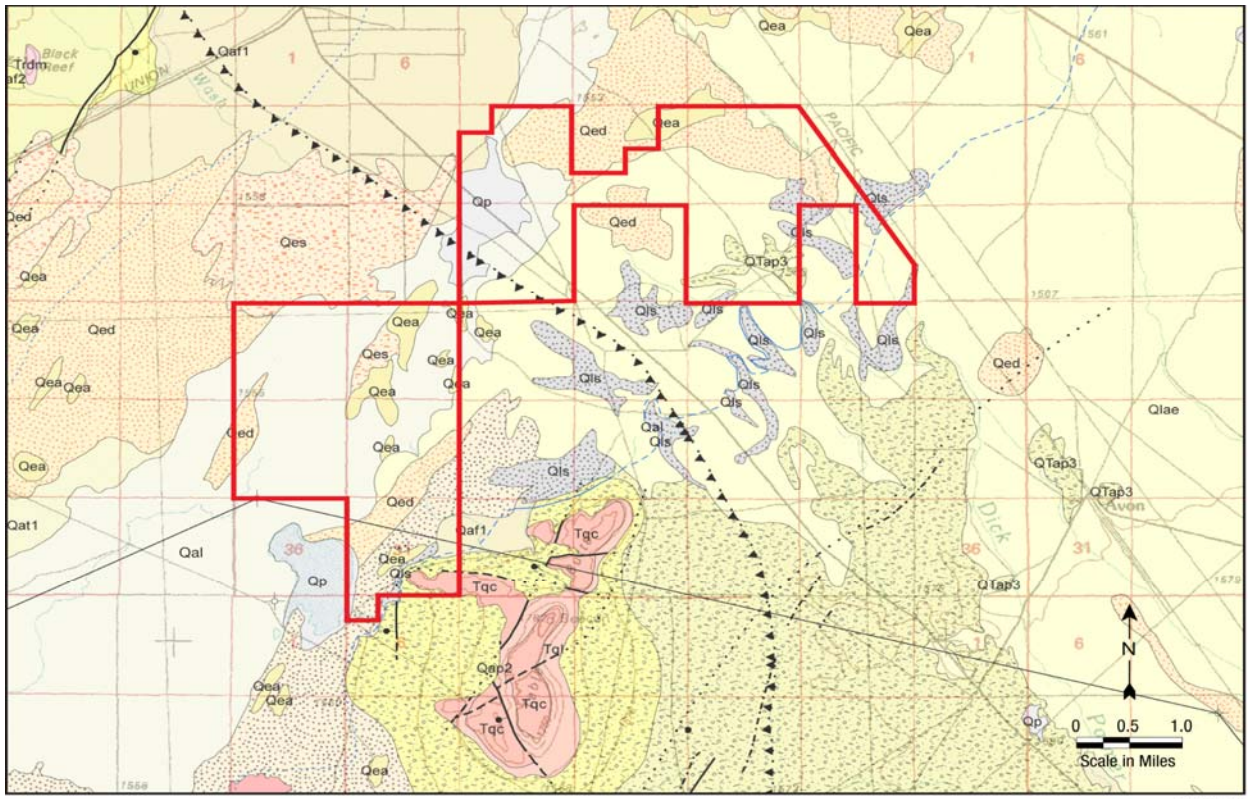
2.7 MINERAL HISTORY

There has been no documented mining within the Escalante Valley SEZ. Most of the mining activity in the region has been limited to the mining of precious and base metals (gold, silver, copper, lead, and zinc) and iron in the mountains to the south and to the mining of sand and gravel in the valley (Figure 4; see also Map 1).

No mineral exploration or development work is currently being conducted within the SEZ. The only development work reported for the region is taking place in the Iron Springs District several miles to the southeast (Map 1), where the Palladon Iron Corp. acquired the former Comstock-Mountain Lion open pit and began mining in 2008. According to Bon and Krahulec (2010), mining ceased in 2009 because of instability in the iron ore market and difficulties locating a suitable export facility. The company is currently reevaluating its production plans. In western Iron County, the Newmont Mining Corp. staked about 145 gold-silver claims in the Stateline District (about 30 mi [48 km] west of the SEZ). Along the Utah–Nevada border (Gold Springs District), the High Desert Gold Corp. drilled holes to explore a swarm of volcanic-hosted gold-silver veins (Gwynn et al. 2011).

2.7.1 Locatable Minerals

There are no documented locatable mineral deposits or prospects within the Escalante Valley SEZ (although five closed lode claims were located immediately south of the site in section 6 of T34S, R14W) (BLM 2012). Most of the locatable minerals in the region come from the Antelope Range, where the major deposits are copper and silver. Mineral deposits in this area occur in epithermal veins generally clustered along major structures and faults. Massive



Escalante Valley SEZ

Qal	ALLUVIUM – Youngest alluvium and colluvium in channels, floodplains, and adjacent low terrances of rivers and major streams; sand, silt, and clay with lenses of gravel (maximum thickness about 20 ft [6 m])
Qaf_1	YOUNGER ALLUVIAL-FAN DEPOSITS – Poorly to moderately sorted silt, sand, and gravel deposited by streams, sheetwash, debris flows, and flash floods on alluvial fans (maximum thickness at least 30 ft [10 m])
Qaf_2	MIDDLE ALLUVIAL-FAN DEPOSITS – Poorly to moderately sorted silt, sand, and gravel deposited by streams, sheetwash, debris flows, and flash floods on alluvial fans (maximum thickness at least 50 ft [15 m])
$QTaf_3$	OLD ALLUVIAL-FAN DEPOSITS – Poorly to moderately sorted silt, sand, and gravel deposited by streams, sheetwash, debris flows, and flash floods on coalesced proximal alluvial fans and pediments; surface is modern and generally undissected (maximum thickness at least 30 ft [10 m])
$QTap_3$	OLD PIEDMONT_SLOPE ALLUVIUM – Poorly to moderately sorted silt, sand, and gravel deposited by streams, sheetwash, debris flows, and flash floods on coalesced proximal alluvial fans and pediments; surface is well dissected by modern and older streams (maximum thickness at least 100 ft [30m])
Qp	PLAYA DEPOSITS – Laminated clay, silt, and fine-grained sand deposited in intermittent lakes (playas); locally contains salt efflorescences (maximum thickness about 30 ft [10 m])
Qed	WINDBLOWN SAND IN DUNES – Well sorted sand in mostly northeast-oriented parabolic dunes and in transverse dunes (up to 15 ft [5 m] high); partly vegetated (maximum thickness about 30 ft [10m])
Qes	WINDBLOWN SAND – Occurs in windblown sheets that lack dune form (maximum thickness about 10 ft [3 m])
Qea	MIXED EOLIAN AND ALLUVIAL DEPOSITS – Sand, silt, and clay in deflation basins and lag material from underlying reworked alluvium; includes playa deposits in small seasonal ponds in the basins (maximum thickness about 10 ft [3 m])
Qls	LACUSTRINE AND DELTAIC SAND AND GRAVEL – Shoreline, deltaic, and lagoonal deposits of Escalante Bay of Lake Bonneville, consisting of sand, silt, clay, and subordinate pebble gravel
Tiq	INTRUSIONS OF QUARTZ MONZONITE PORPHYRY – Mostly resistant, gray and pink, crystal-rich, shallow (most emplaced within 1.2 mi [2 km] of surface), quartz monzonite laccoliths and concordant stocks
Tqc	CONDOR CANYON FORMATION – Resistant, brown, gray, and purple, crystal-poor, densely welded, dacitic to trachydacitic ash-slow tuff

FIGURE 3 Geologic Map of the Escalante Valley SEZ (Source: Rowley et al. 2006)

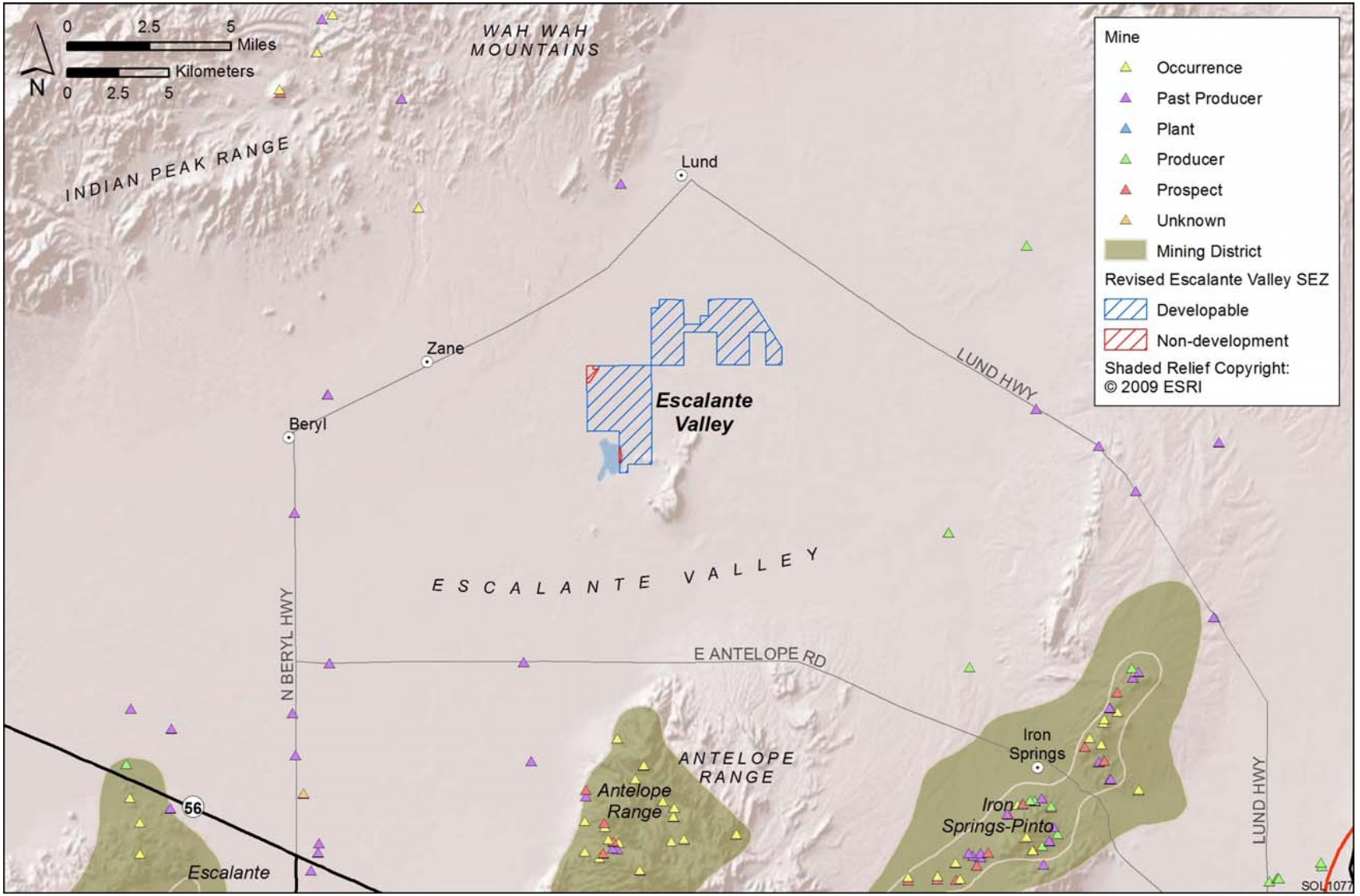


FIGURE 4 Map Showing Mining Districts, Mines, and Mineral Prospects near the Escalante Valley SEZ (Sources: USGS 2011; Utah GIS Portal 2011)

replacement and skarn deposits adjacent to a group of laccolith intrusions are the main sources of iron that is mined in the Iron and Granite Mountains region to the southeast (Shubat and McIntosh 1988; Bon and Krahulec 2010; USGS 2011).

Mines and mineral prospects in the vicinity of the SEZ are shown in Figure 4. A detailed map (Map 1) of the SEZ and surrounding region is provided in the back of this report. The nearest occurrences of locatable minerals are from a small producer of uranium and vanadium, John Hill Flat, located in the valley about 8.2 mi (13 km) to the northeast (in section 31 of T32S, R12W), according to the USGS MRDS (USGS 2011). However, this entry seems to be referring to uranium mineralization in the Trachyte area of Garfield County and may be misidentified (when compared to descriptions provided by Doelling [1967]). A very small, inactive gold and silver mine (King Solomon) occurs 8.5 mi (14 km) to the southeast (in section 14 of T34S, R13W) (USGS 2011; Ginouves 2012).

There are three known mineralized areas in the vicinity of the Escalante Valley SEZ land withdrawal area (based on data obtained from the Utah GIS Portal [2011]). The mineralized areas, which generally coincide with the mining districts mapped by Doelling and Tooker (1983), are shown in Figure 4 and are as follows:

- Escalante District: gold, silver, copper, lead, and zinc; about 23 mi (37 km) to the southwest;

- Antelope Range District: gold, silver, copper, lead, and zinc; about 9 mi (14 km) to the south; and

- Iron Springs-Pinto District: iron; about 16 mi (26 km) to the southeast.

The Escalante District (also known as the Escalante Silver District) is located to the southwest of the Escalante Valley SEZ, mostly south of Highway 56. Silver deposits in the district (and throughout Utah) are associated with porphyritic plutonic complexes and caldera-related veins (James and Atkinson 2000). The most productive mine in the district, Escalante Silver Mine, produced silver, lead, and zinc (and minor copper and gold) (USGS 2011), but according to the Raw Materials Group (2011), it is currently closed.

The Antelope Range District is located within the west–central portion of the Antelope Range and is historically known as a silver district. Known mineral occurrences include mineralized, epithermal veins that may be up to 4,500-ft (1,370-m) long. The veins occur predominantly along major structures and follow the strike of dominant faults. There is also a tendency for veins to be clustered (referred to as vein systems). Veins contain sparse amounts of original sulfides (galena, pyrite, and chalcopyrite), supergene cerussite, malachite, chrysocolla, and brochantite, and a gangue assemblage of quartz, calcite, and barite. Silver is found in vuggy quartz veins with abundant barite and rose-colored to amethyst quartz. Gold occurs in chalcedony-rich veins that may also contain fine-grained, disseminated pyrite. Past mines (Bullion Mine and other unnamed mines) produced copper, silver, lead, manganese, and bentonite. Currently, there are no active mines in the district (Shubat and McIntosh 1988; Ege 2005; USGS 2011).

The largest iron deposits in the western United States are found within the Iron Springs-Pinto mining districts, encompassing three areas to the southeast of the Escalante Valley SEZ: Three Peaks, Granite Mountain, and Iron Mountain. Iron deposits are associated with the emplacement of three Miocene age laccolith intrusions of porphyritic quartz monzonite. Massive replacement deposits (hematite and magnetite) in the Homestake Limestone Member of the Carmel Formation contain most of the iron ore in the district; iron is also found in breccia fillings and fissure veins. Other minerals include calcite, fluorapatite, quartz (amethyst or crystal), chalcedony, pyrite, marcasite, siderite, barite, and epidote (Barker 1995; Bon and Krahulec 2010; Ege 2005). Ege (2005) identifies several open pits in the districts (Great Western, Smith, Lindsay Hill, Desert Mound, Comstock-Mountain Lion, Excelsior, and Blowout) but states that the district is currently inactive.

Active mines in several districts in the Wah Wah Mountains and Indian Peak Range to the north and northwest of the Escalante Valley SEZ (beyond the map extent in Figure 3) currently produce fluorine-fluorite, uranium, copper, gold, silver, lead, zinc, and gemstones (and minor quartz and calcium) (USGS 2011).

The Escalante Valley SEZ crosses none of the mineralized areas or historical mining districts listed above, and there has been no hard rock or locatable mining activity within the site. Most of the locatable minerals in the region come from the Antelope Range, where the major deposits are copper and silver. Mineral deposits in this area occur in epithermal veins generally clustered along major structures and faults. Massive replacement and skarn deposits adjacent to a group of laccolith intrusions are the main sources of iron that is mined in the Iron and Granite Mountains region to the southeast. The SEZ is located in a deep sediment-filled basin where sediments are up to 2,400-ft (730-m) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on available geologic data, they are likely to be very deep (below basin sediments) if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

2.7.2 Saleable Mineral Materials

Saleable mineral materials in the region are mainly limited to sand and gravel. According to the LR2000, there currently are no active free use permits or mineral materials contracts within the Escalante Valley SEZ (BLM 2012). Demand for these resources in the region is generally low; however, gravel, which occurs along buried shorelines in the Escalante Valley, is currently being used by local farmers and by the county for road maintenance material (Ginouves 2012).

The Escalante Valley SEZ is underlain by alluvial, lacustrine, and basin-fill sediments and is, therefore, a high-potential area for clay, sand, and gravel deposits (level of certainty B). However, based on the absence of free use permits or mineral materials contracts within the site, the demand for these materials in the immediate area is assumed to be low.

2.7.3 Leasable Minerals

There has been no recent history of oil and gas production in Iron County (UDOGM 2012), and coal has not been produced in Iron County since 1969 (UGS 2012a). Estimated recoverable coal reserves in Iron County are about 259.4 million short tons, making up only about 1.7% of the total estimated recoverable coal reserves in Utah (UGS 2012b). Currently, most of the coal in Utah is produced from the Wasatch Plateau coal field in Emery County to the northeast (Gwynn et al. 2011).

There are two authorized oil and gas leases within and around the Escalante Valley SEZ (BLM 2012). One lease (UTU 085550) is located along the eastern border and overlaps small portions of the site. The other lease (UTU 085556) occurs to the south of the main portion of the SEZ. Two exploratory wells were drilled to depths of 11,500 and 16,000 ft [3,505 and 4,876 m] (one in 1970 and one in 1983) near the southwestern corner of the SEZ (one in section 36 of T33S, R15W; the other in section 1 of T34S, R15W), but there has been no history of oil or gas production within or near the SEZ (Utah GIS Portal 2012). Oil and gas production in Utah is mainly concentrated in the Uinta and Paradox Basins in the northeastern and southeastern parts of the state, especially in Duchesne, Uintah, Carbon, Emery, Grand, and San Juan Counties (UDOGM 2012; Bon and Chidsey 2006). Relative to these areas, the SEZ is an area with low potential for oil and gas development (level of certainty A). Future development under the current authorized oil and gas lease (UTU 085550) could take place until it expires in 2017.

The Cedar City District is an area of high geothermal potential (BLM and EERE 2003). Electric power has been generated at the Roosevelt Hot Springs (section 34 of T26S, R9W) and Cove Fort-Sulphurdale (section 7 of T26S, R6W) geothermal fields in north Beaver County, and is planned for the Thermo Hot Springs II geothermal area (section 28 of T30S, R12W) in south Beaver County (BLM and EERE 2003; Blackett et al. 2004; UGS 2012c). The hot springs lie within high-heat-flow areas of southwestern Utah; other areas of geothermal areas occur along the Wasatch fault zone in northern Utah and the transitional zone (between the Basin and Range and Colorado Plateau provinces) in central Utah. According to the LR2000, there are no active or historical geothermal leases with the Escalante Valley SEZ, and there are no nominated lands for geothermal sale within or near the site. However, because of its location in the Cedar City District, the potential for development of geothermal energy within the SEZ is considered moderate (level of certainty B) pending further study.

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3 MILFORD FLATS SOUTH SEZ

3.1 SUMMARY AND CONCLUSIONS

This chapter assesses the mineral resource potential of 6,480 acres (26 km^2) of public lands within an area known as the Milford Flats South SEZ, located in Beaver County in southwestern Utah, about 5 mi (8 km) to the west of Minersville and 13 mi (21 km) to the south–southwest of Milford.

There are no documented occurrences of locatable mineral deposits within the Milford Flats South SEZ. Most of the locatable minerals in the region come from the Star Range to the north, where the major deposits are silver, gold, lead, and copper. Mineral deposits in this area occur as a result of contact alteration, where quartz monzonite is in contact with limestone and along related fissures in the affected limestone. The SEZ is located in a deep sediment-filled basin where sediments are at least 500-ft (150-m) thick. The occurrence of mineralized zones below the site is unconfirmed; but based on available geologic data, they are likely to be very deep (below basin sediments) if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

The Milford Flats South SEZ is an area with a high potential for sand and gravel (level of certainty C). Past mining of gravel pits near the northeast corner of the SEZ indicates that the future extraction of such resources within the site is viable; however, demand for these resources in the region is generally low. There currently are no active free use permits or mineral materials contracts within the site.

There are three authorized oil and gas leases within and around the Milford Flats South SEZ. One lease covers portions of the east end of the SEZ (sections 10 and 12 to 14 of T30S, R11W); another is located just outside the east end boundary (section 18 of T30S, R10W). A third lease covers portions of the northwest corner of the site (in sections 8 and 18 of T30S, R11W). No exploratory wells have been drilled within 20 mi (32 km) of the SEZ, and there has been no oil or gas production in the immediate region of the SEZ. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in the Uinta and Paradox Basins in the northeastern and southeastern parts of Utah, especially in Duchesne, Uintah, Carbon, Emery, Grand, and San Juan Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A). Future development under the current authorized oil and gas leases within the SEZ could take place until they expire in 2015.

The Milford Flats South SEZ is located in the Cedar City District, an area of high geothermal potential. Electric power has been generated at the Roosevelt Hot Springs (section 34 of T26S, R9W) and Cove Fort-Sulphurdale (section 7 of T26S, R6W) geothermal fields in north Beaver County, and is planned for the Thermo Hot Springs II geothermal area (section 28 of T30S, R12W) in south Beaver County. There are no active geothermal leases and no nominated lands for geothermal sale within the SEZ (four geothermal leases covered most of the site in the past but were closed in the mid-1980s). However, because of its location in the Cedar City

District, the potential for development of geothermal energy within the site is considered moderate (level of certainty B) pending further study.

3.2 LANDS INVOLVED

The Milford Flats South SEZ is located on BLM lands in the Cedar City Resource Area, in Beaver County. The site lies within T30S, R10W, section 18; T30S, R11W, sections 7, 8, 10, 12 to 15, 17 to 22, 29, and 30 (Salt Lake Principal Meridian). Within this area, 228 acres (0.9 km^2) composing the Minersville Canal were identified as non-development areas (BLM and DOE 2011). The SEZ and the non-development area within it are shown on the location map in the back of this report (Map 2). The full legal description of the SEZ is provided in Appendix A.

3.3 LAND STATUS

According to the LR2000, accessed on July 13, 2012, there are no active locatable mining claims within the Milford Flats South SEZ; however, there are four lode claims located in sections 14, 18, and 19 of T30S, R11W that were abandoned/forfeited in the mid- to late-1980s (BLM 2012). The lands within the SEZ were first segregated from locatable mineral entry in June 2009, pending the outcome of the Draft Solar PEIS (BLM and DOE 2010). They are currently segregated under an Interim Temporary Final Rule, which is in effect until June 30, 2013 (76 FR 23198–23205).

There are no active or closed free use permits or mineral materials contracts within the SEZ (BLM 2012). The site remains open for the disposal of saleable mineral materials.

There are three authorized (and eight closed) oil and gas leases within and in close proximity to the SEZ. One lease (UTU 082526) covers portions of the east end of the SEZ (sections 10 and 12 to 14 of T30S, R11W); another (UTU 084869) is located just outside the east end boundary (section 18 of T30S, R10W). A third lease (UTU 082527) covers portions of the northwest corner of the site (in sections 8 and 18 of T30S, R11W). There are no active geothermal leases within the SEZ; however, four geothermal leases covered most of the site in the past (but were closed in the mid-1980s). There are no nominated lands for geothermal sale within or near the SEZ. The site remains open for discretionary leasing for oil and gas, geothermal, and other leasable minerals.

3.4 GEOLOGIC SETTING

The Milford Flats South SEZ is located in the Escalante Desert region of the Basin and Range physiographic province in southwestern Utah. The SEZ sits at the southern end of a north-trending valley, just to the north of the Black Mountains. The northern part of the valley lies between the San Francisco Mountains to the west and the Mineral Mountains to the east.

The Milford area has a long depositional history, with thick sequences of marine miogeosynclinal sediments (carbonates, sandstone, siltstone, and shale) deposited throughout the Late Precambrian and Paleozoic, followed by several orogenic episodes (from the Early Triassic to Oligocene). Volcanic activity in southwestern Utah during the Oligocene and Miocene produced extensive deposits of ignimbrites, lava flows, and volcanic breccias in the region. Block faulting associated with crustal extension in the Basin and Range province began in the Miocene, about 20 million years ago (Mason 1998).

Basin fill is composed predominantly of Sevier River Formation and Salt Lake Formation sediments interlayered with volcanic rocks (basalts and rhyolites) of Quaternary and Tertiary age (Hintze 1980). Sediments are estimated to be up to 4,900-ft (1,490-m) thick, with the uppermost layer consisting of lacustrine deposits of fine-grained clay, silt, and marl in the valley center, intertongued with deltaic and alluvial deposits of clay, silt, sand, and gravel along the valley margins (Mason 1998; Lund et al. 2005). A report by Gerston and Smith (1979) estimates that the thickness of the upper layer ranges from 300 ft (90 m) near the valley margins to as much as 3,900 ft (1,190 m) along the valley axis. The lacustrine and deltaic sediments are associated with Lake Bonneville, an ancient (Pleistocene) lake that covered most of western Utah and parts of eastern Nevada and southern Idaho from 32,000 to 14,000 years ago (UGS 2010). Shoreline deposits of Lake Bonneville occur at elevations up to about 5,200 ft (1,585 m) (White 1932; Mason 1998). The composition of deeper sediments (more than 3,900 ft [1,190 m]) is unknown, but seismic refraction profiles indicate that they are more consolidated (i.e., cemented and compacted) than sediments of the upper layer. These sediments overlie Tertiary (Oligocene) volcanics and basement rocks composed of Cambrian quartzite and Precambrian gneiss (Hintze 1980; Mason 1998).

Exposed sediments in the Milford area are predominantly modern alluvial fan deposits. The surrounding mountains are capped with volcanic rocks of Tertiary and Quaternary age (Hintze 1980; Mason 1998). The geology of the region near the Milford Flats South SEZ is shown in Figure 5.

3.5 PHYSICAL FEATURES AND ACCESS

The Milford Flats South SEZ lies just north of the Black Mountains in the Escalante Desert, about 4.5 mi (7.2 km) to the west of Minersville. Its terrain is relatively flat, with a gentle slope to the west–northwest. Elevations range from 5,120 ft (1,560 m) along the site's eastern border to 5,020 ft (1,530 m) at its northwest corner. The highest point in the area is Ninemile Knoll, just to the south of the SEZ, with a maximum elevation of 5,176 ft (1,578 m). Several irrigation ditches run along the site's southern boundary.

The SEZ is accessible via a county road passing along the northern edge of the SEZ that connects to State Highway 21 at Minersville. Beaver County has asserted Revised Statute 2477 Class B and D road ROWs within the site.

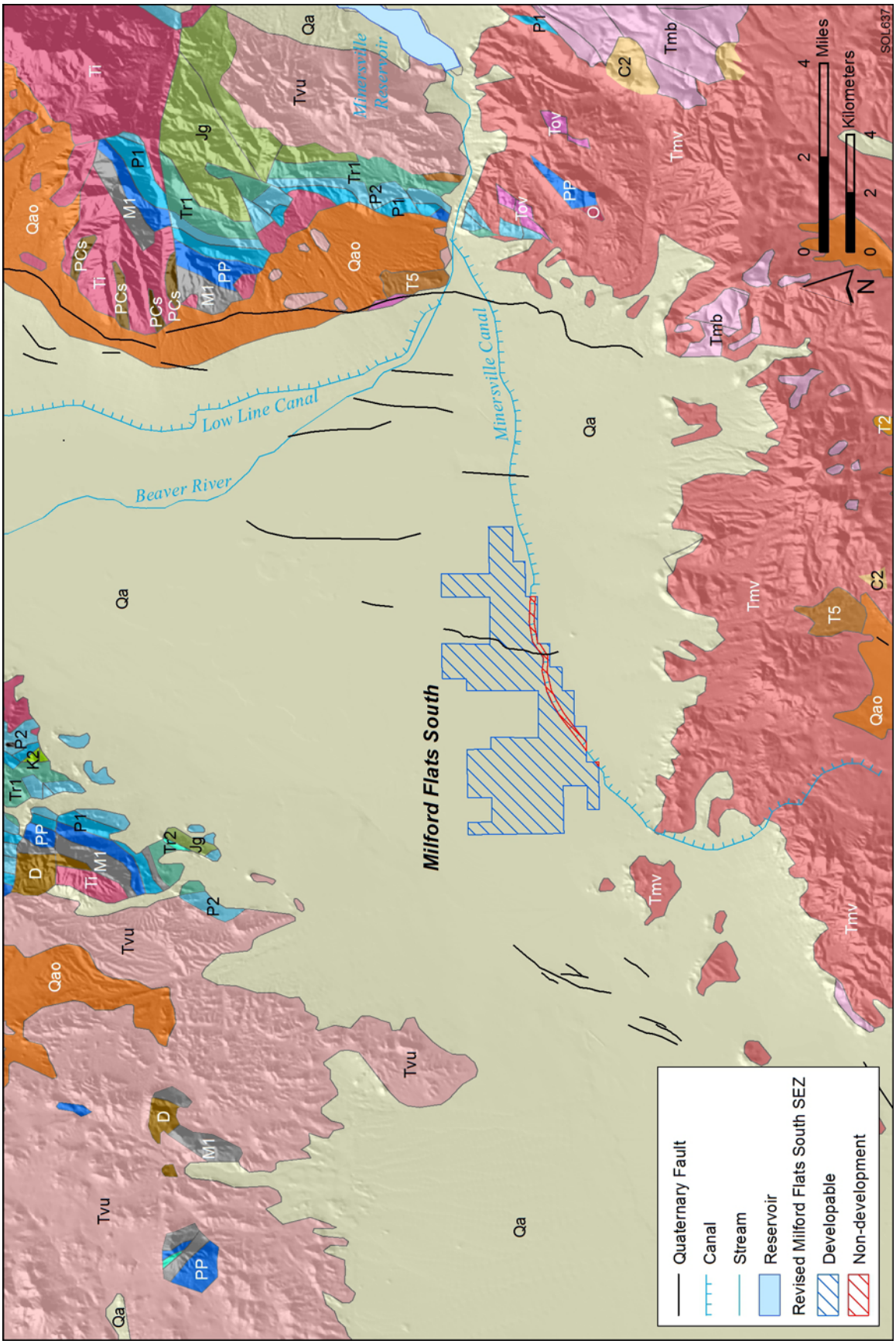


FIGURE 5 Geologic Map of the Milford Flats South Region (Sources: Ludington et al. 2007; Hintze 1980)

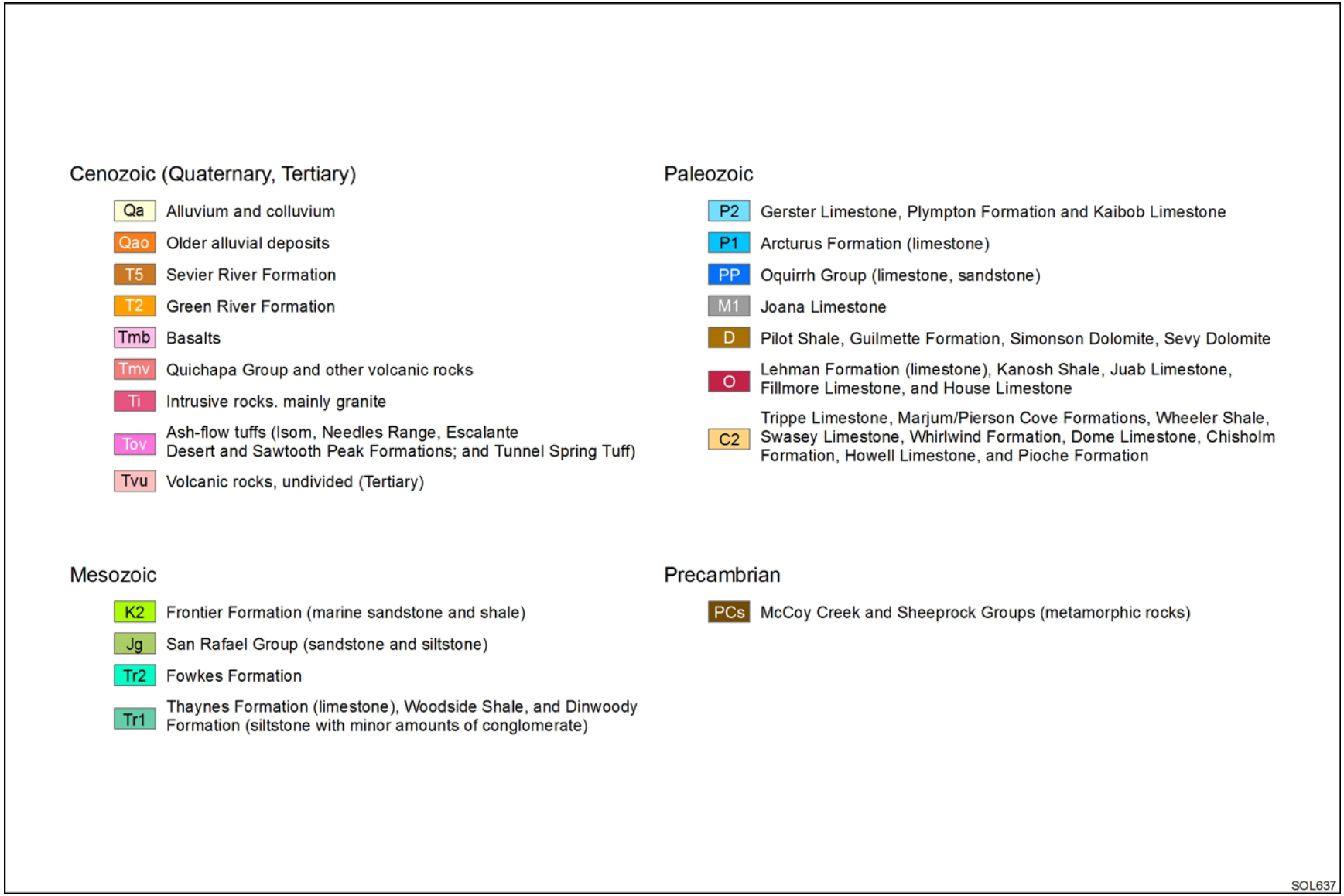


FIGURE 5 (Cont.)

3.6 SITE GEOLOGY

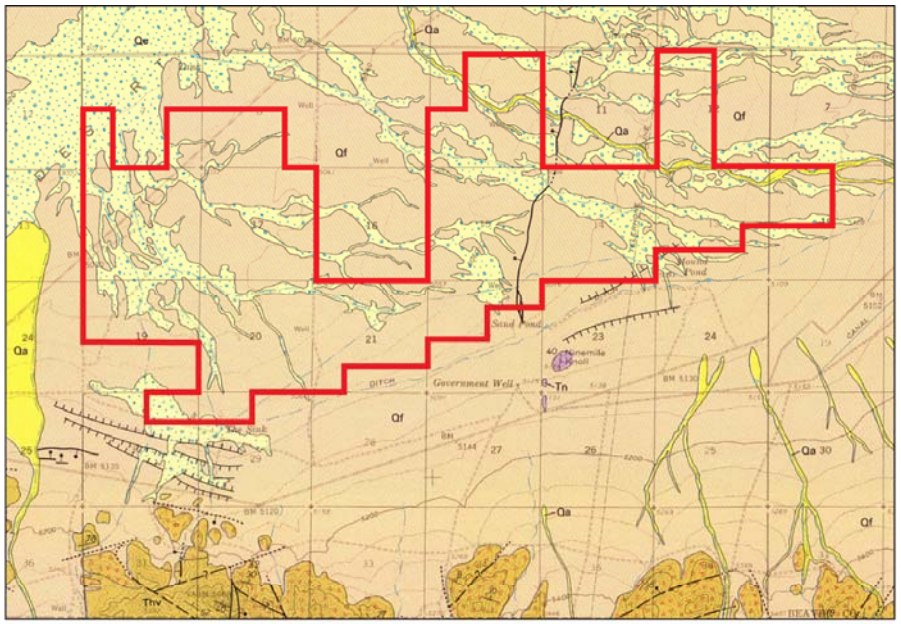
The geology of the Milford Flats South SEZ is described on the basis of a 1:62,500 scale geologic map by Rowley (1978) and corroborated by a Utah Division of Water Rights (UDWR 2012) log for a water well (1071001M00) drilled less than a mile north of the site (in the northwest corner of section 10, T30S, R11W) (see Figure 6). Surface sediments at the SEZ are predominantly Holocene and Pleistocene fan and pediment deposits, consisting of silt, sand, and minor pebble gravel (map unit Qf). These deposits extend to depths of at least 500 ft (150 m), according to the well log. Shoreline deposits of the Escalante Arm of Lake Bonneville cross all portions of the site (map unit Qe); they consist mainly of clay, silt, sand, and pebble gravel and have a northwest-trending pattern in the immediate region. The exposed Qe unit marks the remnants of higher elevation Lake Bonneville shoreline deposits; those at lower elevations have been eroded or covered by younger alluvium or fan and pediment deposits. Coarse-grained sediments in the Qe unit are attributed to fluvial deposits from streams emptying into Lake Bonneville; fluvial deposits also formed as the lake was drying up and draining its water to lower parts of the Lake Bonneville topographic basin to the north.

A segment of the Mineral Mountains fault system (USGS Fault No. 2489) runs through the center of the Milford Flats South SEZ (Figure 6). The Mineral Mountains fault is a normal, north–northeast striking fault that runs along the western side of the Mineral Mountains (downdropped block is to the west of the fault). The highly dissected scarps along this fault system and the displacement of sediments associated with post-Lake Bonneville drainage development in the valley suggest that movement occurred less than 15,000 years ago (Black and Hecker 1999).

3.7 MINERAL HISTORY

There has been no documented mining within the Milford Flats South SEZ, although several active and inactive sand and gravel pits are located along an east–west road that runs along the northernmost border of the site. Most of the mining activity in the region has been limited to the mining of precious and base metals (gold, silver, copper, lead, and zinc) in the mountains to the north and northeast and to the mining of sand and gravel in the valley (USGS 2011). The Lone Star Mining's high-alumina clay pit is located in Beaver County (USGS 2010); the author was not able to confirm its production status or location.

No mineral exploration or development work is currently being conducted within the SEZ. The only exploration activities reported for Beaver County are taking place in the Rocky District and the Beaver Lake Mountains District to the northeast of the Star-North Star Districts, where the Western Utah Copper Company is exploring the mineral potential of copper skarn and breccia pipe deposits on about 91,920 acres (370 km^2) of land (Bon and Krahulec 2010).



Milford Flats South SEZ

Qa — ALLUVIUM (HOLOCENE AND PLEISTOCENE) – Sand and less abundant pebble gravel deposited in intermittent stream channels, on bordering floodplains, and in fans of major drainages.

Qf — FAN AND PEDIMENT DEPOSITS (HOLOCENE and PLEISTOCENE) – Silt, sand, and minor pebble gravel from local sources deposited in alluvial fans and on pediments. Includes minor colluvium.

Qe — DEPOSITS OF ESCALANTE ARM OF LAKE BONNEVILLE (PLEISTOCENE) – Includes clay, silt, sand, and pebble gravel deposited in, and on shorelines of, Lake Bonneville.

Thv — HORSE VALLEY FORMATION (MIOCENE) – Undivided; gray or pink, or less commonly white, red, tan, black, purple, or brown, soft to resistant, rhyodacite to dacitic lava flows, volcanic mudflow breccia, plugs, and minor ash flow tuff.

Thm — MAFIC MEMBER OF HORSE VALLEY FORMATION (MIOCENE) – Soft to resistant, mostly black, dacitic to andesitic (?) volcanic mudflow breccia and subordinate lava flows (previously mapped as basalt and latite).

Tn — NEEDLES RANGE FORMATION (OLIGOCENE) – Moderately resistant, pink, light-reddish-purple, or light gray, moderately welded, crystal-rich ash-flow tuff containing plagioclase, hornblende, quartz, biotite, and minor magnetite and sanidine.

FIGURE 6 Geologic Map of the Milford Flats South SEZ (Source: Rowley 1978)

3.7.1 Locatable Minerals

There are no documented locatable mineral deposits or prospects within the Milford Flats South SEZ (BLM 2012). Most of the locatable minerals in the region come from the Star Range to the north, where the major deposits are silver, gold, lead, and copper. Mineral deposits in this area occur as a result of contact alteration, where quartz monzonite is in contact with limestone and along related fissures in the affected limestone (USGS 2011; Butler 1913).

Mines and mineral prospects in the vicinity of the SEZ are shown in Figure 7. A detailed map (Map 2) of the SEZ and surrounding region is provided in the back of this report. The nearest occurrence of locatable minerals (silver, lead, and zinc) is in Permian carbonate rocks (geologic map unit P2) at the Mammoth Lode Mine, located about 5.6 mi (9.0 km) to the northwest along the base of the Star Range (USGS 2011).

There are three known mineralized areas in the vicinity of the Milford Flats South SEZ (based on data obtained from Utah GIS Portal [2011]). The mineralized areas, which generally coincide with the mining districts mapped by Doelling and Tooker (1983), are shown in Figure 7 and are as follows:

- Star-North Star District: gold, silver, copper, lead, and zinc; about 9.4 mi (15 km) to the north–northwest;
- Bradshaw-Lincoln District: gold, silver, copper, lead, and zinc; about 7.6 mi (12 km) to the northeast; and
- Jarloose District: gold, silver, copper, lead, and zinc; about 16 mi (26 km) to the east.

Mining in the Star-North Star Districts began in the 1870s; the two districts (Star and North Star) are separated by Elephant Canyon. Mineral deposits in the districts include quartz, garnet, pyroxene, tremolite, mica, magnetite, and sulfides (e.g., galena, sphalerite, and pyrite). These deposits are hosted by Permian limestone and related fissures along contacts with intrusive bodies of quartz monzonite (stocks and dikes). Past mines produced silver, gold, lead, copper, zinc, fluorine-fluorite, and tungsten. Several mines in the region (Harrington-Hickory, Florence, Last Chance, Monitor, and Marble Pit) reportedly produced lead, silver, copper, zinc, limestone, and dimension stone in the past, but they are no longer active (Butler 1913; USGS 2011; Utah Archives 2011; Ginouves 2012).

The Bradshaw-Lincoln District was organized at Bradshaw Springs in 1875. The district covers most of the Mineral Mountains to the northeast of the SEZ. (The western slopes of the mountains are included in Utah's southernmost major mineral belt.) Past mines produced silver, gold, lead, copper, zinc, fluorine-fluorite, and tungsten. Several mines (Summit, Skyline, Honey Boy, Geyser Basin, Monitor, and Creole) reportedly produced lead, silver, copper, zinc, fluorine-fluorite, and uranium in the past, but they are no longer active (Utah Archives 2011; USGS 2011; Ginouves 2012).

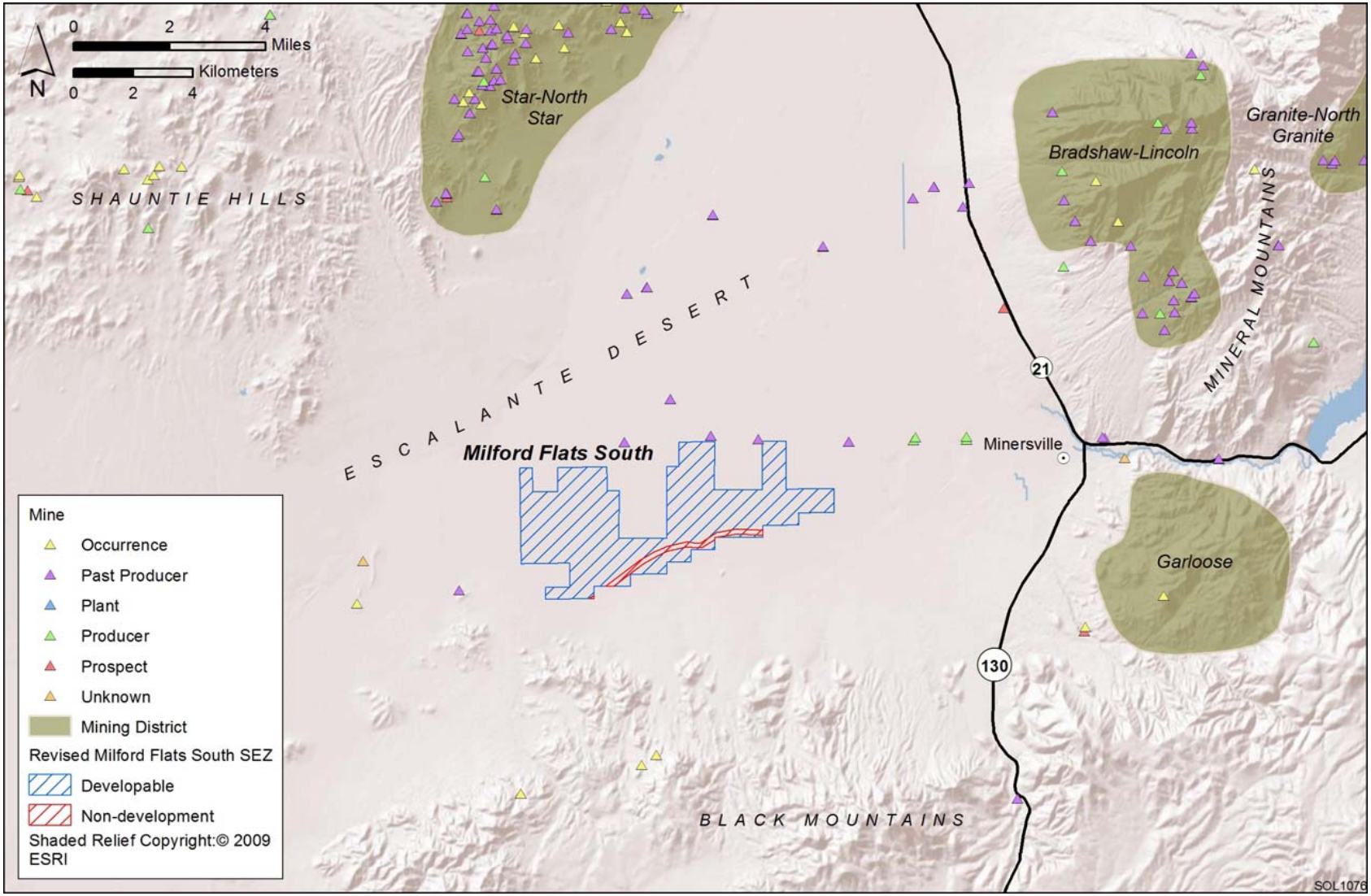


FIGURE 7 Map Showing Mining Districts, Mines, and Mineral Prospects near the Milford Flats South SEZ (Sources: USGS 2011; Utah GIS Portal 2011)

The Jarloose District is centered on Black Mountain just south of Minersville. Past mines mainly produced sand and gravel; an occurrence of copper (chrysocolla) (South Black Mountain Adit) is located about 7.1 mi (11 km) to the east–southeast of the SEZ. There are no active mines in the district (USGS 2011).

The Milford Flats South SEZ crosses none of the mineralized areas or historical mining districts listed above, and there has been no hard rock or locatable mining activity within the site. Most of the locatable minerals in the region come from the Star Range to the north, where the major deposits are silver, gold, lead, and copper. Mineral deposits in this area occur as a result of contact alteration, where quartz monzonite is in contact with limestone and along related fissures in the affected limestone. The SEZ is located in a deep sediment-filled basin where sediments are at least 500-ft (150-m) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on available geologic data, they are likely to be very deep (below basin sediments) if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

3.7.2 Saleable Mineral Materials

Saleable mineral materials in the region are mainly limited to sand and gravel. According to the LR2000, there currently are no active free use permits or mineral materials contracts within the Milford Flats South SEZ (BLM 2012). Past producing gravel pits occur near the northeast corner of the SEZ (in section 2 of T30S, R11W) and about a mile west of its southwest corner (in section 26 of T30S, R12W) (see Map 2). Demand for these resources in the region is generally low; however, gravel, which occurs along buried shorelines in the Escalante Valley, is currently being used by local farmers and by the county for road maintenance material (Ginouves 2012).

The Milford Flats South SEZ is underlain by alluvial and basin-fill sediments and is, therefore, a high-potential area for sand and gravel deposits (level of certainty C). Past mining of gravel pits near the northeast corner of the SEZ indicates that the future extraction of such resources within the site is viable.

3.7.3 Leasable Minerals

There is no recent history of oil and gas production in Beaver County (UDOGM 2012). Coal has never been produced in Beaver County, and there are no estimated coal reserves in the county (UGS 2012a, b). Currently, most of the coal in Utah is produced from the Wasatch Plateau coal field in Emery County to the northeast (Gwynn et al. 2011).

There are three authorized oil and gas leases within and around the Milford Flats South SEZ (BLM 2012). One lease (UTU 082526) covers portions of the east end of the SEZ (sections 10 and 12 to 14 of T30S, R11W); another (UTU 084869) is located just outside the east end boundary (section 18 of T30S, R10W). A third lease (UTU 082527) covers portions of the northwest corner of the site (in sections 8 and 18 of T30S, R11W). No exploratory wells have

been drilled within 20 mi (32 km) of the SEZ, and there has been no history of oil or gas production within or near the SEZ (Utah GIS Portal 2012). Oil and gas accumulation and production in Utah is concentrated in the Uinta and Paradox Basins in the northeastern and southeastern parts of the state, especially in Duchesne, Uintah, Carbon, Emery, Grand, and San Juan Counties (UDOGM 2012; Bon and Chidsey 2006). Relative to these areas, the SEZ is an area with low potential for oil and gas development (level of certainty A). Future development under the current authorized oil and gas leases (UTU 082526 and UTU 082527) could take place until they expire in 2015.

The Cedar City District is an area of high geothermal potential (BLM and EERE 2003). Electric power has been generated at the Roosevelt Hot Springs (section 34 of T26S, R9W) and Cove Fort-Sulphurdale (section 7 of T26S, R6W) geothermal fields in north Beaver County, and is planned for the Thermo Hot Springs II geothermal area (section 28 of T30S, R12W) in south Beaver County (BLM and EERE 2003; Blackett et al. 2004; UGS 2012c). The hot springs lie within high-heat-flow areas of southwestern Utah; other areas of geothermal areas occur along the Wasatch fault zone in northern Utah and the transitional zone (between the Basin and Range and Colorado Plateau provinces) in central Utah. According to the LR2000, there are no active geothermal leases with the Milford Flats South SEZ, and there are no nominated lands for geothermal sale within or near the site (four geothermal leases covered most of the site in the past but were closed in the mid-1980s). However, because of its location in the Cedar City District, the potential for development of geothermal energy within the SEZ is considered moderate (level of certainty B) pending further study.

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4 WAH WAH VALLEY SEZ

4.1 SUMMARY AND CONCLUSIONS

This chapter assesses the mineral resource potential of 6,097 acres (25 km^2) of public lands within an area known as the Wah Wah Valley SEZ, located in Beaver County in southwestern Utah, about 23 mi (37 km) to the west of Milford.

There are no documented occurrences of locatable mineral deposits within the Wah Wah Valley SEZ. Most of the locatable minerals in the region come from the Preuss (Newhouse)-San Francisco District in the San Francisco Mountains to the northeast, where the major deposits are gold, silver, copper, lead, and zinc. Mineral deposits in this area occur as a result of contact alteration, where quartz monzonite is in contact with limestone and along related fissures in the affected limestone. The site is located in a deep sediment-filled basin where sediments are up to 1,400-ft (430-m) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on available geologic data, they are likely to be very deep (below basin sediments) if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

The Wah Wah Valley SEZ is an area with a high potential for sand and gravel (level of certainty D) and a moderate potential for the occurrence of clay (level of certainty B). Past and present small-scale mining of sand and gravel within the SEZ indicates that the future extraction of such resources within the site is viable; however, demand for these resources in the region is generally low. There is currently one authorized free use permit for sand and gravel in the northwest corner of the SEZ. Mining under this permit would continue until the end of its term.

There are no active oil or gas leases within the Wah Wah Valley SEZ and there has been no history of oil or gas production within or near the SEZ. Six oil and gas leases covered most of the site in the past, but these leases were closed in 1984 and 1985. Relative to more favorable areas for oil and gas accumulation in the state (concentrated in the Uinta and Paradox Basins in the northeastern and southeastern parts of Utah, especially in Duchesne, Uintah, Carbon, Emery, Grand, and San Juan Counties), the SEZ is an area with low potential for oil and gas development (level of certainty A).

The Wah Wah Valley SEZ is located in the Cedar City District, an area of high geothermal potential. Electric power has been generated at the Roosevelt Hot Springs (section 34 of T26S, R9W) and Cove Fort-Sulphurdale (section 7 of T26S, R6W) geothermal fields in north Beaver County, and is planned for the Thermo Hot Springs II geothermal area (section 28 of T30S, R12W) in south Beaver County. There are no active or historical geothermal leases and no nominated lands for geothermal sale within the SEZ. However, because of its location in the Cedar City District, the potential for development of geothermal energy within the site is considered moderate (level of certainty B) pending further study.

4.2 LANDS INVOLVED

The Wah Wah Valley SEZ is located on BLM lands in the Cedar City Resource Area, in Beaver County. The site lies within T27S, R14W, sections 8 to 11, 13 to 15, 17, 21 to 23, and 26 to 28 (Salt Lake Principal Meridian). Within this area, 224 acres (0.91 km^2) of the Wah Wah Wash were identified as a non-development area (BLM and DOE 2011). The SEZ and the non-development area within it are shown on the location map in the back of this report (Map 3). The full legal description of the SEZ is provided in Appendix A.

4.3 LAND STATUS

According to the LR2000, accessed on July 13, 2012, there are no active locatable mining claims within the Wah Wah Valley SEZ; however, there are 26 lode claims (Lead File No. UMC 207250) located in section 9 of T27S, R14W within the site that were abandoned/forfeited in the late-1980s (BLM 2012). The lands within the SEZ were first segregated from locatable mineral entry in June 2009, pending the outcome of the Draft Solar PEIS (BLM and DOE 2010). They are currently segregated under an Interim Temporary Final Rule, which is in effect until June 30, 2013 (76 FR 23198–23205).

There is one authorized free use permit (UTU 080870) to Beaver County for sand and gravel in the north part of the SEZ, in section 9 of T27S, R14W; another free use permit to Beaver County for sand and gravel (UTU 091128), also in section 9 of T27S, R14W, was closed in 2004 (BLM 2012). The site remains open for the disposal of saleable mineral materials.

There are no active oil and gas leases within the SEZ; however, a good portion of the site was leased for oil and gas in the past (six oil and gas leases covered most of the site but were closed in 1984 and 1985). There are no active or historical geothermal leases and no nominated lands for geothermal sale within the SEZ. The site remains open for discretionary leasing for oil and gas, geothermal, and other leasable minerals.

4.4 GEOLOGIC SETTING

The Wah Wah Valley SEZ is located in the Wah Wah Valley, an alluvial basin within the Basin and Range physiographic province in southwestern Utah. The valley lies between the Sevier Lake Valley to the north and the Escalante Desert to the south and is bounded on the west by the Wah Wah Mountains and on the east by the San Francisco Mountains. The Wah Wah Valley is an intermontane structural depression typical of the Basin and Range physiographic province. Normal faults occur along the base of the mountains on each side of the valley. Valley sediments fill the deepest part of a west-tilting half-graben that has moved downward relative to the Wah Wah Mountains to the west (Ertec Western, Inc. 1981).

Exposed sediments in the Wah Wah Valley are predominantly lacustrine, associated with Lake Bonneville, an ancient (Pleistocene) lake that covered most of western Utah and parts of eastern Nevada and southern Idaho from 32,000 to 14,000 years ago (UGS 2010). These fine-

grained sediments—sandy silts, silts, sandy clays, and clays—are found in the valley center and are abundant within the Wah Wah Valley Hardpan, a playa or dry lake with a hardpan surface. The playa is an active remnant of Lake Bonneville. Alluvial fan deposits (Pleistocene to recent) are prevalent along the edges of the valley, except to the north. These deposits grade from cobbles and boulders at the mountain fronts surrounding the valley to silty or clayey sands toward the valley center. The highest shoreline of Lake Bonneville is well preserved and marks the contact between the alluvial fans along the valley margins and the lacustrine deposits within the valley center (Ertec Western, Inc. 1981).

Recent fluvial and floodplain deposits occur along the small channels that empty onto alluvial fans in the valley. The surrounding mountains are composed primarily of thick sequences of Paleozoic limestone and dolomite, with lesser amounts of Precambrian and Cambrian metasediments (quartzites and phyllites). Tertiary volcanic rocks are also present (Ertec Western, Inc. 1981). The geology of the region near the Wah Wah Valley SEZ is shown in Figure 8.

4.5 PHYSICAL FEATURES AND ACCESS

The Wah Wah Valley SEZ is located in the central part of the Wah Wah Valley. Its terrain is relatively flat, with a gentle dip to the north. Elevations range from 5,040 ft (1,536 m) near the site's southern border to 4,860 ft (1,481 m) at its northern border. The SEZ is dissected by several ephemeral streams, including the Wah Wah Wash (east side) and Quartz Creek (west side). Irrigation ditches run along the northern boundary of the site. The site is accessible via State Highway 21.

4.6 SITE GEOLOGY

The geology of the Wah Wah Valley SEZ was inferred from published geologic maps for areas surrounding the SEZ (Hintze et al. 1984; Best et al. 1989) and from the lithologic log of a boring drilled adjacent to the southwest corner of the site (in section 28 of T27S, R14W) (Wright Drilling 1980). Surface sediments are predominantly fine-grained lacustrine deposits associated with Lake Bonneville (see Section 4.4). Unconsolidated Quaternary deposits beneath the SEZ are at least 1,400-ft (430-m) deep.

4.7 MINERAL HISTORY

The only documented mining within the Wah Wah Valley SEZ has been for sand and gravel. Most of the mining activity in the region has been limited to the mining of precious and base metals (gold, silver, copper, lead, and zinc) in the mountains to the east and to the mining of sand and gravel in the valley (USGS 2011).

Currently, no mineral exploration or development work is being conducted within the SEZ. The only exploration activities reported for Beaver County are taking place in the Rocky

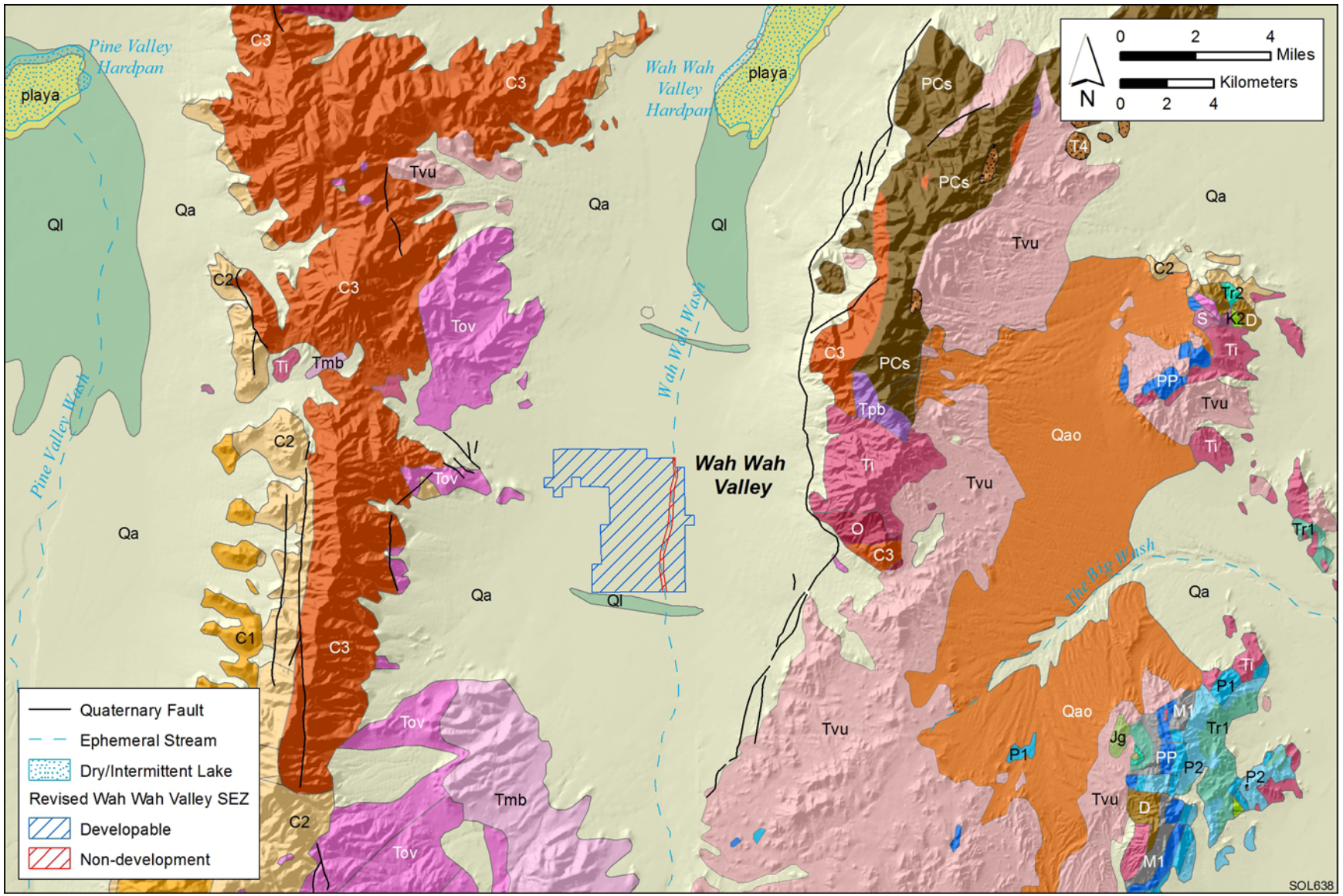

FIGURE 8 Geologic Map of the Wah Wah Valley Region (Sources: Ludington et al. 2007; Hintze 1980)

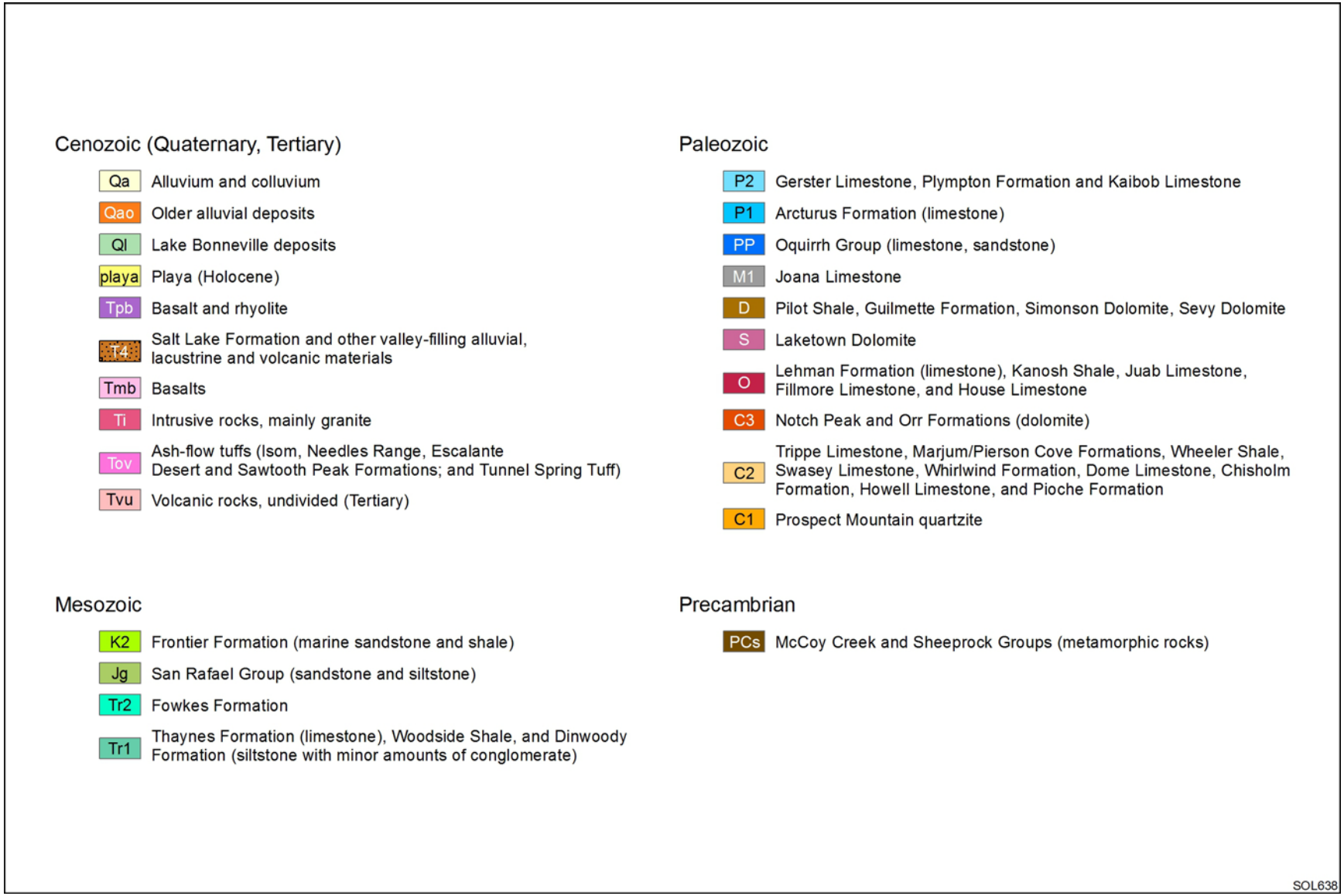

FIGURE 8 (Cont.)

District and the Beaver Lake Mountains District (which are to the northeast of the Star-North Star Districts), where the Western Utah Copper Company is exploring the mineral potential of copper skarn and breccia pipe deposits on about 91,920 acres (370 km^2) of land (Bon and Krahulec 2010).

4.7.1 Locatable Minerals

There are no documented occurrences of locatable mineral deposits or prospects within the Wah Wah Valley SEZ (BLM 2012). Most of the locatable minerals in the region come from the Preuss (Newhouse)-San Francisco District in the San Francisco Mountains to the northeast, where the major deposits are gold, silver, copper, lead, and zinc. Mineral deposits in this area occur as a result of contact alteration, where quartz monzonite is in contact with limestone and along related fissures in the affected limestone [Butler 1913]).

Mines and mineral prospects in the vicinity of the SEZ are shown in Figure 9. A detailed map (Map 3) of the SEZ and surrounding region is provided in the back of this report. The nearest occurrence of locatable minerals is a silver and gold prospect located along the base of the San Francisco Mountains a few miles to the east (USGS 2011).

There are three known mineralized areas in the vicinity of the Wah Wah Valley SEZ (based on data obtained from Utah GIS Portal [2011]). The mineralized areas, which generally coincide with the mining districts mapped by Doelling and Tooker (1983), are shown in Figure 9 and are as follows:

- Pruess-San Francisco District: gold, silver, copper, lead, and zinc; about 3.6 mi (5.8 km) to the east;

- Star-North Star District: gold, silver, copper, lead, and zinc; about 13 mi (21 km) to the southeast; and

- Pine Grove District: gold, silver, copper, lead, and zinc; about 10 mi (16 km) to the southwest.

The Pruess (Newhouse)-San Francisco District covers both flanks of the San Francisco Mountains. Mining in the district began in the 1870s. Early mines produced high-grade silver, lead, gold, and zinc. One of the most productive early mines was the Horn Silver Mine; activity at this mine resulted in the settlement of the town of Frisco. Mineral deposits in the district include garnet, diopside, tremolite, vesuvianite, muscovite, epidote, chlorite, fluorite, quartz, calcite, dolomite, magnesite, magnetite, pyrite, chalcopyrite, molybdenite, and pyrolusite. These deposits are hosted by Permian limestone and related fissures along contacts with intrusive bodies of quartz monzonite (stocks and dikes). Galena and sphalerite occur at some distance from the contact zones and in association with fissures in limestone. Several mines in the district (Silver Star, Horn Silver, Washington, and Frisco Silver and Lead) reportedly produced lead, zinc, gold, silver, and copper in the past, but they are no longer active (Butler 1913; USGS 2011; Utah Archives 2011; Ginouves 2012).

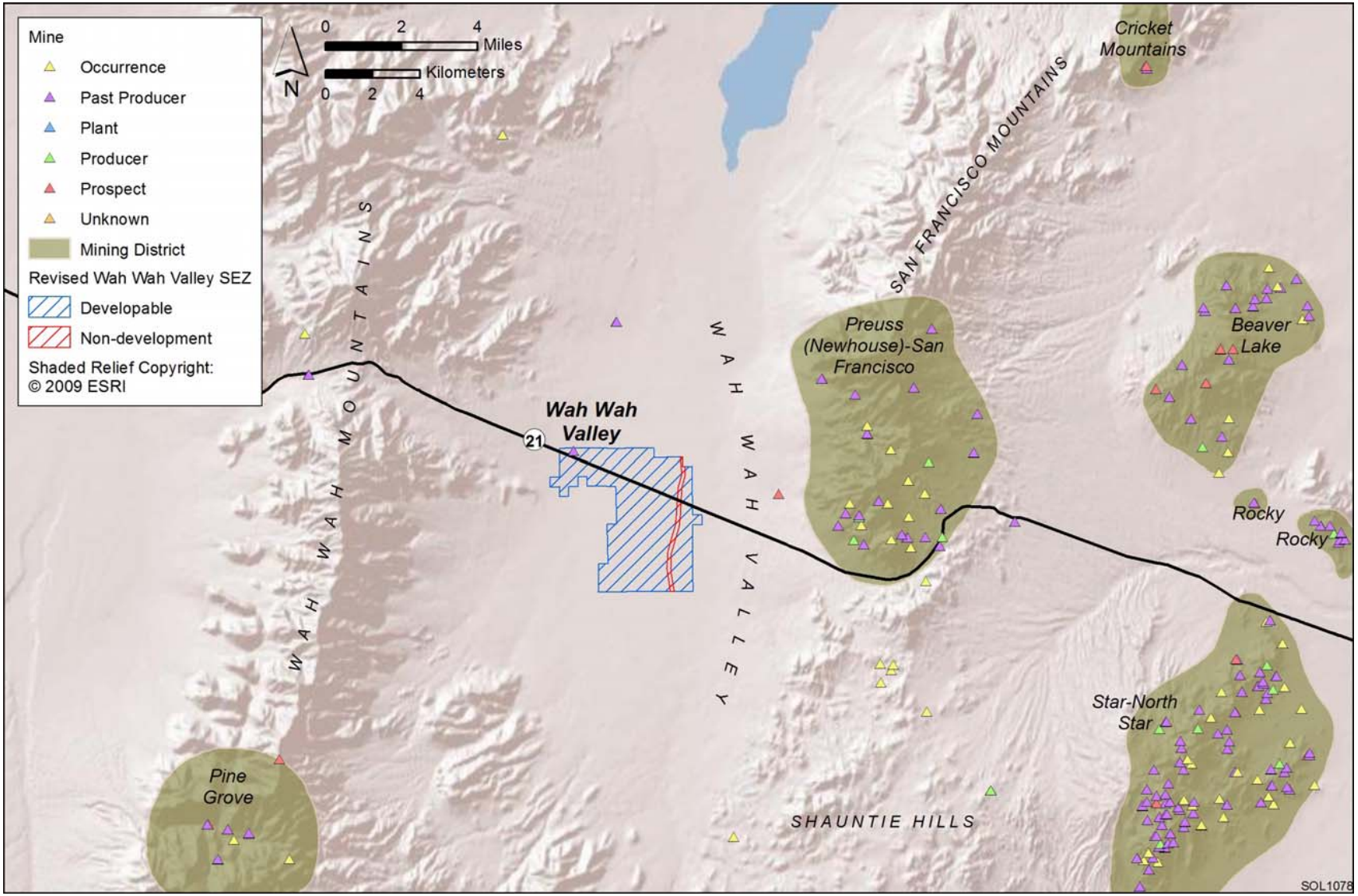

FIGURE 9 Map Showing Mining Districts, Mines, and Mineral Prospects near the Wah Wah Valley SEZ (Sources: USGS 2011; Utah GIS Portal 2011)

Mining in the Star-North Star Districts of the Star Range began in the 1870s; the two districts (Star and North Star) are separated by Elephant Canyon. Mineral deposits in the districts include quartz, garnet, pyroxene, tremolite, mica, magnetite, and sulfides (e.g., galena, sphalerite, and pyrite). These deposits are hosted by Permian limestone and related fissures along contacts with intrusive bodies of quartz monzonite (stocks and dikes). Past mines produced silver, gold, lead, copper, zinc, fluorine-fluorite, and tungsten. Several mines in the district (Harrington-Hickory, Florence, Last Chance, Monitor, and Marble Pit) reportedly produced lead, silver, copper, zinc, limestone, and dimension stone in the past, but they are no longer active (Butler 1913; USGS 2011; Utah Archives 2011; Ginouves 2012).

The Pine Grove District is located in the southern part of the Wah Wah Mountains and is centered on a porphyry molybdenum deposit that sits in the eroded vent of a lower Miocene ash flow (Keith et al. 1986). Past mines in the district (Revenue, Wah Wah, Lou, and Southside) produced silver, gold, and zinc. There is a gold prospect (Blue Mountain), and there is one documented occurrence of molybdenum and tungsten. There are currently no active mines in the district (USGS 2011).

The Wah Wah Valley SEZ crosses none of the mineralized areas or historical mining districts listed above, and there has been no hard rock or locatable mining activity within the site. Most of the locatable minerals in the region come from the Preuss (Newhouse)-San Francisco District in the San Francisco Mountains to the northeast where the major deposits are gold, silver, copper, lead, and zinc. Mineral deposits in this area occur as a result of contact alteration, where quartz monzonite is in contact with limestone and along related fissures in the affected limestone. The SEZ is located in a deep sediment-filled basin where sediments are up to 1,400-ft (430-m) thick. The occurrence of mineralized zones below the site is unconfirmed, but based on geologic studies to date, they are likely to be very deep (below basin sediments) if present. Therefore, the potential for locatable minerals to occur within the SEZ is low (level of certainty B).

4.7.2 Saleable Mineral Materials

Saleable mineral materials in the region are mainly limited to sand and gravel. According to the LR2000, there is currently one authorized free use permit for sand and gravel (UTU 080870; for use by Beaver County) in the northwest corner of the Wah Wah Valley SEZ (in section 9 of T27S, R14W) (BLM 2012). Past producing gravel pits occur a few miles north of the SEZ (in sections 21 and 22 of T26S, R14W) and along the northern border of the site (in section 8 of T27S, R14W) (see Map 3). Demand for these resources in the region is generally low (Ginouves 2012).

The Wah Wah Valley SEZ is underlain by alluvial, lacustrine, and basin-fill sediments and is, therefore, an area with a high potential for sand and gravel (level of certainty D) and a moderate potential for clay (level of certainty B). Past and present small-scale mining of sand and gravel within the SEZ indicates that the future extraction of such resources within the site is viable. Mining under the current authorized free use permit would continue until the end of its term.

4.7.3 Leasable Minerals

There has been no recent history of oil and gas production in Beaver County (UDOGM 2012). Coal has never been produced in Beaver County, and there are no estimated coal reserves in the county (UGS 2012a, b). Currently, most of the coal produced in Utah is from the Wasatch Plateau coalfield in Emery County to the northeast (Gwynn et al. 2011).

There currently are no active oil and gas leases within and around the Wah Wah Valley SEZ (BLM 2012). There was an exploratory well drilled within 10 mi (16 km) of the SEZ in 1994, but it is located in Pine Valley on the west side of the Wah Wah Mountains (in section 25 of T27S, R16W). There has been no history of oil or gas production within or near the SEZ (Utah GIS Portal 2012). Oil and gas accumulation and production in Utah is concentrated in the Uinta and Paradox Basins in the northeastern and southeastern parts of the state, especially in Duchesne, Uintah, Carbon, Emery, Grand, and San Juan Counties (UDOGM 2012; Bon and Chidsey 2006). Relative to these areas, the SEZ is an area with low potential for oil and gas development (level of certainty A).

The Cedar City District is an area of high geothermal potential (BLM and EERE 2003). Electric power has been generated at the Roosevelt Hot Springs (section 34 of T26S, R9W) and Cove Fort-Sulphurdale (section7 of T26S, R6W) geothermal fields in north Beaver County, and is planned for the Thermo Hot Springs II geothermal area (section 28 of T30Ss, R12W) in south Beaver County (BLM and EERE 2003; Blackett et al. 2004; UGS 2012c). The hot springs lie within high-heat-flow areas of southwestern Utah; other areas of geothermal areas occur along the Wasatch fault zone in northern Utah and the transitional zone (between the Basin and Range and Colorado Plateau provinces) in central Utah. According to the LR2000, there are no active or historical geothermal leases with the Wah Wah Valley SEZ, and there are no nominated lands for geothermal sale within or near the site. However, because of its location in the Cedar City District, the potential for development of geothermal energy within the SEZ is considered moderate (level of certainty B) pending further study.

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6 LIST OF PREPARERS

Table 2 lists the BLM management team members and technical reviewers for this assessment. Table 3 lists the names, education, and expertise of the report preparers.

TABLE 2 BLM Management Team and Mineral Specialists Consulted

Name	Office/Title
Linda Resseguie	Minerals and Realty Management Directorate, Realty Specialist
Shannon Stewart	Renewable Resources and Planning Directorate, Senior Planning and Environmental Analyst
Jeff Holdren	Division of Lands, Realty and Cadastral Survey, Senior Realty Specialist
Matt Shumaker	Division of Solid Minerals, Chief Mineral Examiner
Jason Powell	Division of Solid Minerals, Geologist
Ed Ginouves	Cedar City Field Office, Geologist

TABLE 3 Report Preparers

Name	Education/Expertise	Contribution
Linda Graf	Desktop publishing specialist; 41 years of experience in creating, revising, formatting, and printing documents.	Document assembly and production
Heidi Hartmann	M.S., Environmental Toxicology and Epidemiology; 25 years of experience in environmental assessment, exposure and risk analysis, and environmental impact assessment.	Solar PEIS Project Manager
Irene Hogstrom	M.A. Geography and Environmental Studies; B.L.A., Landscape Architecture; 23 years of experience in landscape architecture, including design, regional planning, and ecological restoration.	LR2000 queries
Patricia Hollopeter	B.A., Religion; M.A., Philosophy; 27 years of experience in technical editing and environmental assessment document production.	Editor
James E. May	M.S., Water Resources Management, B.A., Zoology; 34 years of experience in natural resources management; 8 years of consulting experience in resource management, land use planning, and NEPA compliance.	Lands and realty; and mineral review
Greg McGovern	M.S., B.S., Geology (Hydrogeology); 23 years of experience in environmental site assessment and contaminant fate and transport studies.	Site specific geology
Mary R. Moniger	B.A., English; 35 years of experience in editing and writing.	Lead editor
Michele Nelson	Graphic designer; 35 years of experience in graphical design and technical illustration.	Report cover design and foldout map layout
Terri L. Patton	M.S., B.S., Geology (Igneous Petrology and Mineral Chemistry); 24 years of experience in environmental research and assessment.	Lead author; geology and mineral assessment
Kurt Picel	Ph.D., Environmental Health Sciences; 33 years of experience in environmental health analysis and 18 years in environmental assessment.	Environmental analysis and review
Lorenza Salinas	Desktop publishing specialist; 30 years of experience in creating, revising, formatting, and printing documents.	Document assembly and production

TABLE 3 (Cont.)

Name	Education/Expertise	Contribution
Barbara Simmons	B.A., Technical Writing; E.L.S. certification by the Board of Editors in the Life Sciences; Fellow, Society for Technical Communication; 45 years of experience in technical editing and publications management.	Editor
Karen P. Smith	M.S., B.A., Geology; B.S., Anthropology; more than 23 years of experience in energy and environmental regulatory and policy analysis.	Solar PEIS Program Manager
Emily A. Zvolanek	B.A., Environmental Science; 4 years of experience in GIS mapping.	GIS mapping

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APPENDIX A:

LEGAL DESCRIPTIONS OF UTAH SOLAR ENERGY ZONES

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APPENDIX A:

LEGAL DESCRIPTIONS OF UTAH SOLAR ENERGY ZONES

This appendix presents the legal descriptions for the three SEZs in Utah.

Salt Lake Meridian

Escalante Valley SEZ

T. 33 S., R. 14 W.,
sec. 8, NE¼, E½NW¼, SW¼NW¼, and S½;
sec. 9, E½NE¼, S½SW¼, and SE¼;
sec. 10;
sec. 11, W½ and W½SE¼, those portions lying west of Railroad Right-of-Way Grant UTSL 0032533;
sec. 14, E½, that portion lying west of Railroad Right-of-Way Grant UTSL 0032533;
secs. 15, 17, 19, 30, and 31.

T. 33 S., R. 15 W.,
secs. 24 and 25.

T. 34 S., R. 14 W.,
sec. 6, lot 4.

The areas described above aggregate approximately 6,614 acres (27 km^2).

Milford Flats South SEZ

T. 30 S., R. 10 W.,
sec. 18, lots 1 and 2, and E½NW¼.

T. 30 S., R. 11 W.,
sec. 7, lots 3 and 4, and E½SE¼;
sec. 8, SW¼ and W½SE¼;
sec. 10, NE¼, E½NW¼, and S½;
sec. 12, W½;
sec. 13, N½, N½SW¼, and NW¼SE¼;
sec. 14, N½, SW¼, N½SE¼, SW¼SE¼;
secs. 15, 17, and 18;
sec. 19, lots 1 and 2, NE¼, and E½ NW¼;
sec. 20;
sec. 21, N½, N½S½, and SW¼SW¼;
sec. 22, N½NE¼ and NW¼;
sec. 29, N½NW¼;

sec. 30, N½NE¼.

The areas described above aggregate approximately 6,480 acres 26 km^2).

Wah Wah Valley SEZ

T. 27 S., R. 14 W.,
sec. 8, E½ and SE¼SW¼;
sec. 9, N½, N½SW¼, SE¼SW¼, and SE¼;
sec. 10;
sec. 11, lots 1 and 2, SW¼NE¼, S½NW¼, SW¼, and W½SE¼;
sec. 13, lot 1;
secs. 14 and 15;
sec. 17, NW¼NE¼;
sec. 21, lots 1 and 6, and E½NE¼;
secs. 22 and 23;
sec. 26, N½ and N½S½;
sec. 27, N½ and N½S½;
sec. 28, NE¼ and N½SE¼.

The areas described above aggregate approximately 6,097 acres (25 km^2).