

NOTATION

The following is a list of acronyms and abbreviations, chemical names, 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

10	AADT	annual average daily traffic
11	AASHTO	American Association of State Highway and Transportation Officials
12	AC	alternating current
13	ACC	air-cooled condenser
14	ACEC	Area of Critical Environmental Concern
15	ADEQ	Arizona Department of Environmental Quality
16	ACHP	Advisory Council on Historic Preservation
17	ADOT	Arizona Department of Transportation
18	ADWR	Arizona Department of Water Resources
19	AERMOD	AMS/EPA Regulatory Model
20	AFC	Application for Certification
21	AGL	above ground level
22	AIM	Assessment, Inventory and Monitoring
23	AIRFA	American Indian Religious Freedom Act
24	AMA	active management area
25	AML	animal management level
26	ANHP	Arizona National Heritage Program
27	APE	area of potential effect
28	APLIC	Avian Power Line Interaction Committee
29	APP	Avian Protection Plan
30	APS	Arizona Public Service
31	AQCR	Air Quality Control Region
32	AQRV	air quality-related value
33	ARB	Air Resources Board
34	ARRA	American Recovery and Reinvestment Act of 2009
35	ARRTIS	Arizona Renewable Resource and Transmission Identification Subcommittee
36	ARS	Agricultural Research Service
37	ARZC	Arizona and California
38	ATSDR	Agency for Toxic Substances and Disease Registry
39	AUM	animal unit month
40	AVSE	Arlington Valley Solar Energy
41	AVWS	Audio Visual Warning System
42	AWBA	Arizona Water Banking Authority
43	AWEA	American Wind Energy Association
44	AWRM	Active Water Resource Management
45	AZDA	Arizona Department of Agriculture
46	AZGFD	Arizona Game and Fish Department

1	AZGS	Arizona Geological Survey
2		
3	BA	biological assessment
4	BAP	base annual production
5	BEA	Bureau of Economic Analysis
6	BISON-M	Biota Information System of New Mexico
7	BLM	Bureau of Land Management
8	BLM-CA	Bureau of Land Management, California
9	BMP	best management practice
10	BNSF	Burlington Northern Santa Fe
11	BO	biological opinion
12	BOR	U.S. Bureau of Reclamation
13	BPA	Bonneville Power Administration
14	BRAC	Blue Ribbon Advisory Council on Climate Change
15	BSE	Beacon Solar Energy
16	BSEP	Beacon Solar Energy Project
17	BTS	Bureau of Transportation Statistics
18		
19	CAA	Clean Air Act
20	CAAQS	California Air Quality Standards
21	CAISO	California Independent System Operator
22	Caltrans	California Department of Transportation
23	C-AMA	California-Arizona Maneuver Area
24	CAP	Central Arizona Project
25	CARB	California Air Resources Board
26	CAReGAP	California Regional Gap Analysis Project
27	CASQA	California Stormwater Quality Association
28	CASTNET	Clean Air Status and Trends NETwork
29	CAWA	Colorado Agricultural Water Alliance
30	CCC	Civilian Conservation Corps
31	CDC	Centers for Disease Control and Prevention
32	CDCA	California Desert Conservation Area
33	CDFG	California Department of Fish and Game
34	CDNCA	California Desert National Conservation Area
35	CDOT	Colorado Department of Transportation
36	CDOW	Colorado Division of Wildlife (now Colorado Parks and Wildlife)
37	CDPHE	Colorado Department of Public Health and Environment
38	CDWR	California Department of Water Resources
39	CEC	California Energy Commission
40	CEQ	Council on Environmental Quality
41	CES	constant elasticity of substitution
42	CESA	California Endangered Species Act
43	CESF	Carrizo Energy Solar Farm
44	CFR	<i>Code of Federal Regulations</i>
45	CGE	computable general equilibrium
46	CHAT	crucial habitat assessment tool

1	CIRA	Cooperative Institute for Research in the Atmosphere
2	CLFR	compact linear Fresnel reflector
3	CNDDDB	California Natural Diversity Database
4	CNEL	community noise equivalent level
5	CNHP	Colorado National Heritage Program
6	Colorado DWR	Colorado Division of Water Resources
7	CO ₂ e	carbon dioxide equivalent
8	CPC	Center for Plant Conservation
9	CPUC	California Public Utilities Commission
10	CPV	concentrating photovoltaic
11	CRBSCF	Colorado River Basin Salinity Control Forum
12	CREZ	competitive renewable energy zone
13	CRPC	Cultural Resources Preservation Council
14	CRSCP	Colorado River Salinity Control Program
15	CSA	Candidate Study Area
16	CSC	Coastal Services Center
17	CSFG	carbon-sequestration fossil generation
18	CSP	concentrating solar power
19	CSQA	California Stormwater Quality Association
20	CSRI	Cultural Systems Research, Incorporated
21	CTG	combustion turbine generator
22	CTPG	California Transmission Planning Group
23	CTSR	Cumbres & Toltec Scenic Railroad
24	CUP	Conditional Use Permit
25	CVP	Central Valley Project
26	CWA	Clean Water Act
27	CWCB	Colorado Water Conservation Board
28	CWHR	California Wildlife Habitat Relationship System
29		
30	DC	direct current
31	DEM	digital elevation model
32	DHS	U.S. Department of Homeland Security
33	DIMA	Database for Inventory, Monitoring and Assessment
34	DLT	dedicated-line transmission
35	DNA	Determination of NEPA Adequacy
36	DNI	direct normal insulation
37	DNL	day-night average sound level
38	DoD	U.S. Department of Defense
39	DOE	U.S. Department of Energy
40	DOI	U.S. Department of the Interior
41	DOL	U.S. Department of Labor
42	DOT	U.S. Department of Transportation
43	DRECP	California Desert Renewable Energy Conservation Plan
44	DSM	demand-side management
45	DSRP	Decommissioning and Site Reclamation Plan
46	DTC/C-AMA	Desert Training Center/California–Arizona Maneuver Area

1	DWMA	Desert Wildlife Management Area
2	DWR	Division of Water Resources
3		
4	EA	environmental assessment
5	EBID	Elephant Butte Irrigation District
6	ECAR	East Central Area Reliability Coordination Agreement
7	ECOS	Environmental Conservation Online System (USFWS)
8	EERE	Energy Efficiency and Renewable Energy (DOE)
9	Eg	band gap energy
10	EIA	Energy Information Administration (DOE)
11	EIS	environmental impact statement
12	EISA	Energy Independence and Security Act of 2007
13	EMF	electromagnetic field
14	E.O.	Executive Order
15	EPA	U.S. Environmental Protection Agency
16	EPRI	Electric Power Research Institute
17	EQIP	Environmental Quality Incentives Program
18	ERCOT	Electric Reliability Council of Texas
19	ERO	Electric Reliability Organization
20	ERS	Economic Research Service
21	ESA	Endangered Species Act of 1973
22	ESRI	Environmental Systems Research Institute
23		
24	FAA	Federal Aviation Administration
25	FBI	Federal Bureau of Investigation
26	FEMA	Federal Emergency Management Agency
27	FERC	Federal Energy Regulatory Commission
28	FHWA	Federal Highway Administration
29	FIRM	Flood Insurance Rate Map
30	FLPMA	Federal Land Policy and Management Act of 1976
31	FONSI	Finding of No Significant Impact
32	FR	<i>Federal Register</i>
33	FRCC	Florida Reliability Coordinating Council
34	FSA	Final Staff Assessment
35	FTE	full-time equivalent
36	FY	fiscal year
37		
38	G&TM	generation and transmission modeling
39	GCRP	U.S. Global Climate Research Program
40	GDA	generation development area
41	GHG	greenhouse gas
42	GIS	geographic information system
43	GMU	game management unit
44	GPS	global positioning system
45	GTM	Generation and Transmission Model
46		

1	GUAC	Groundwater Users Advisory Council
2	GWP	global warming potential
3		
4	HA	herd area
5	HAP	hazardous air pollutant
6	HAZCOM	hazard communication
7	HCE	heat collection element
8	HCP	Habitat Conservation Plan
9	HMA	herd management area
10	HMMH	Harris Miller Miller & Hanson, Inc.
11	HRSG	heat recovery steam generator
12	HSPD	Homeland Security Presidential Directive
13	HTF	heat transfer fluid
14	HUC	hydrologic unit code
15	HVAC	heating, ventilation, and air-conditioning
16		
17	I	Interstate
18	IARC	International Agency for Research on Cancer
19	IBA	important bird area
20	ICE	internal combustion engine
21	ICPDS	Imperial County Planning & Development Services
22	ICWMA	Imperial County Weed Management Area
23	IDT	interdisciplinary team
24	IEC	International Electrochemical Commission
25	IFR	instrument flight rule
26	IID	Imperial Irrigation District
27	IM	Instruction Memorandum
28	IMPS	Iron Mountain Pumping Station
29	IMS	interim mitigation strategy
30	INA	Irrigation Non-Expansion Area
31	IOP	Interagency Operating Procedure
32	IOU	investor-owned utility
33	IPCC	Intergovernmental Panel on Climate Change
34	ISA	Independent Science Advisor; Instant Study Area
35	ISB	Intermontane Seismic Belt
36	ISCC	integrated solar combined cycle
37	ISDRA	Imperial Sand Dunes Recreation Area
38	ISEGS	Ivanpah Solar Energy Generating System
39	ISO	independent system operator; iterative self-organizing
40	ITFR	Interim Temporary Final Rulemaking
41	ITP	incidental take permit
42	IUCNNR	International Union for Conservation of Nature and Natural Resources
43	IUCNP	International Union for Conservation of Nature Pakistan
44		
45	KGA	known geothermal resources area
46	KML	keyhole markup language

1	KOP	key observation point
2	KSLA	known sodium leasing area
3		
4	LCC	Landscape Conservation Cooperative
5	LCCRDA	Lincoln County Conservation, Recreation, and Development Act of 2004
6	LCOE	levelized cost of energy
7	L _{dn}	day-night average sound level
8	LDWMA	Low Desert Weed Management Area
9	L _{eq}	equivalent sound pressure level
10	LiDAR	light detection and ranging
11	LLA	limited land available
12	LLRW	low-level radioactive waste (waste classification)
13	LPN	listing priority number
14	LRG	Lower Rio Grande
15	LSA	lake and streambed alteration
16	LSE	load-serving entity
17	LTMP	long-term monitoring and adaptive management plan
18	LTVA	long-term visitor area
19		
20	MAAC	Mid-Atlantic Area Council
21	MAIN	Mid-Atlantic Interconnected Network
22	MAPP	methyl acetylene propadiene stabilizer; Mid-Continent Area Power Pool
23	MCAS	Marine Corps Air Station
24	MCL	maximum contaminant level
25	MEB	Marine Expeditionary Brigade
26	MFP	Management Framework Plan
27	MIG	Minnesota IMPLAN Group
28	MLA	maximum land available
29	MOA	military operating area
30	MOU	Memorandum of Understanding
31	MPDS	maximum potential development scenario
32	MRA	Multiple Resource Area
33	MRI	Midwest Research Institute
34	MRO	Midwest Reliability Organization
35	MSDS	Material Safety Data Sheet
36	MSL	mean sea level
37	MTR	military training route
38	MVEDA	Mesilla Valley Economic Development Alliance
39	MWA	Mojave Water Agency
40	MWD	Metropolitan Water District
41	MWMA	Mojave Weed Management Area
42	NAAQS	National Ambient Air Quality Standard(s)
43	NADP	National Atmospheric Deposition Program
44	NAGPRA	Native American Graves Protection and Repatriation Act
45	NAHC	Native American Heritage Commission (California)
46	NAIC	North American Industrial Classification System

1	NASA	National Aeronautics and Space Administration
2	NCA	National Conservation Area
3	NCCAC	Nevada Climate Change Advisory Committee
4	NCDC	National Climatic Data Center
5	NCES	National Center for Education Statistics
6	NDAA	National Defense Authorization Act
7	NDCNR	Nevada Department of Conservation and Natural Resources
8	NDEP	Nevada Division of Environmental Protection
9	NDOT	Nevada Department of Transportation
10	NDOW	Nevada Department of Wildlife
11	NDWP	Nevada Division of Water Planning
12	NDWR	Nevada Division of Water Resources
13	NEAP	Natural Events Action Plan
14	NEC	National Electric Code
15	NED	National Elevation Database
16	NEP	Natural Events Policy
17	NEPA	National Environmental Policy Act of 1969
18	NERC	North American Electricity Reliability Corporation
19	NGO	non-governmental organization
20	NHA	National Heritage Area
21	NHD	National Hydrography Dataset
22	NHNM	National Heritage New Mexico
23	NHPA	National Historic Preservation Act of 1966
24	NID	National Inventory of Dams
25	NLCS	National Landscape Conservation System
26	NMAC	<i>New Mexico Administrative Code</i>
27	NMBGMR	New Mexico Bureau of Geology and Mineral Resources
28	NMDGF	New Mexico Department of Game and Fish
29	NM DOT	New Mexico Department of Transportation
30	NMED	New Mexico Environment Department
31	NMED-AQB	New Mexico Environment Department-Air Quality Board
32	NMFS	National Marine Fisheries Service
33	NMOSE	New Mexico Office of the State Engineer
34	NMSU	New Mexico State University
35	NNHP	Nevada Natural Heritage Program
36	NNL	National Natural Landmark
37	NNSA	National Nuclear Security Administration
38	NOA	Notice of Availability
39	NOAA	National Oceanic and Atmospheric Administration
40	NOI	Notice of Intent
41	NP	National Park
42	NPDES	National Pollutant Discharge Elimination System
43	NPL	National Priorities List
44	NPS	National Park Service
45	NPV	net present value
46	NRA	National Recreation Area

1	NRCS	Natural Resources Conservation Service
2	NREL	National Renewable Energy Laboratory
3	NRHP	<i>National Register of Historic Places</i>
4	NRS	<i>Nevada Revised Statutes</i>
5	NSC	National Safety Council
6	NSO	no surface occupancy
7	NSTC	National Science and Technology Council
8	NTHP	National Trust for Historic Preservation
9	NTS	Nevada Test Site
10	NTTR	Nevada Test and Training Range
11	NVCRS	Nevada Cultural Resources Inventory System
12	NV DOT	Nevada Department of Transportation
13	NWCC	National Wind Coordinating Committee
14	NWI	National Wetlands Inventory
15	NWIS	National Water Information System (USGS)
16	NWPP	Northwest Power Pool
17	NWR	National Wildlife Refuge
18	NWSRS	National Wild and Scenic River System
19		
20	O&M	operation and maintenance
21	ODFW	Oregon Department of Fish and Wildlife
22	OHV	off-highway vehicle
23	ONA	Outstanding Natural Area
24	ORC	organic Rankine cycle
25	OSE/ISC	Office of the State Engineer/Interstate Stream Commission
26	OSHA	Occupational Safety and Health Administration
27	OTA	Office of Technology Assessment
28		
29	PA	Programmatic Agreement
30	PAD	Preliminary Application Document
31	PAH	polycyclic aromatic hydrocarbon
32	PAT	peer analysis tool
33	PCB	polychlorinated biphenyl
34	PCM	purchase change material
35	PCS	power conditioning system
36	PCU	power converting unit
37	PEIS	programmatic environmental impact statement
38	PFYC	potential fossil yield classification
39	PGH	Preliminary General Habitat
40	PIER	Public Interest Energy Research
41	P.L.	Public Law
42	PLSS	Public Land Survey System
43	PM	particulate matter
44	PM _{2.5}	particulate matter with a diameter of 2.5 µm or less
45	PM ₁₀	particulate matter with a diameter of 10 µm or less
46	PPA	Power Purchase Agreement

1	P-P-D	population-to-power density
2	PPH	Preliminary Priority Habitat
3	POD	plan of development
4	POU	publicly owned utility
5	PPA	Power Purchase Agreement
6	PPE	personal protective equipment
7	PSD	Prevention of Significant Deterioration
8	PURPA	Public Utility Regulatory Policy Act
9	PV	photovoltaic
10	PVID	Palo Verde Irrigation District
11	PWR	public water reserve
12		
13	QRA	qualified resource area
14		
15	R&I	relevance and importance
16	RAC	Resource Advisory Council
17	RCE	Reclamation Cost Estimate
18	RCI	residential, commercial, and industrial (sector)
19	RCRA	Resource Conservation and Recovery Act of 1976
20	RD&D	research, development, and demonstration; research, development, and
21		deployment
22	RDBMS	Relational Database Management System
23	RDEP	Restoration Design Energy Project
24	REA	Rapid Ecoregional Assessment
25	REAT	Renewable Energy Action Team
26	REDA	Renewable Energy Development Area
27	REDI	Renewable Energy Development Infrastructure
28	REEA	Renewable Energy Evaluation Area
29	ReEDS	Regional Energy Deployment System
30	REPG	Renewable Energy Policy Group
31	RETA	Renewable Energy Transmission Authority
32	RETAAC	Renewable Energy Transmission Access Advisory Committee
33	RETI	Renewable Energy Transmission Initiative
34	REZ	renewable energy zone
35	RF	radio frequency
36	RFC	Reliability First Corporation
37	RFDS	reasonably foreseeable development scenario
38	RGP	Rio Grande Project
39	RGWCD	Rio Grande Water Conservation District
40	RMP	Resource Management Plan
41	RMPA	Rocky Mountain Power Area
42	RMZ	Resource Management Zone
43	ROD	Record of Decision
44	ROI	region of influence
45	ROS	recreation opportunity spectrum
46	ROW	right-of-way

1	RPG	renewable portfolio goal
2	RPS	Renewable Portfolio Standard
3	RRC	Regional Reliability Council
4	RSEP	Rice Solar Energy Project
5	RSI	Renewable Systems Interconnection
6	RTO	regional transmission organization
7	RTTF	Renewable Transmission Task Force
8	RV	recreational vehicle
9		
10	SAAQS	State Ambient Air Quality Standard(s)
11	SAMHSA	Substance Abuse and Mental Health Services Administration
12	SCADA	supervisory control and data acquisition
13	SCE	Southern California Edison
14	SCRMA	Special Cultural Resource Management Area
15	SDRREG	San Diego Regional Renewable Energy Group
16	SDWA	Safe Drinking Water Act of 1974
17	SEGIS	Solar Energy Grid Integration System
18	SEGS	Solar Energy Generating System
19	SEI	Sustainable Energy Ireland
20	SEIA	Solar Energy Industrial Association
21	SES	Stirling Energy Systems
22	SETP	Solar Energy Technologies Program (DOE)
23	SEZ	solar energy zone
24	SHPO	State Historic Preservation Office(r)
25	SIP	State Implementation Plan
26	SLRG	San Luis & Rio Grande
27	SMA	Special Management Area
28	SMART	specific, measurable, achievable, relevant, and time sensitive
29	SMP	suggested management practice
30	SNWA	Southern Nevada Water Authority
31	SPP	Southwest Power Pool
32	SRMA	Special Recreation Management Area
33	SSA	Socorro Seismic Anomaly
34	SSI	self-supplied industry
35	ST	solar thermal
36	STG	steam turbine generator
37	SUA	special use airspace
38	SWAT	Southwest Area Transmission
39	SWIP	Southwest Intertie Project
40	SWPPP	Stormwater Pollution Prevention Plan
41	SWReGAP	Southwest Regional Gap Analysis Project
42		
43	TAP	toxic air pollutant
44	TCC	Transmission Corridor Committee
45	TDS	total dissolved solids
46	TEPPC	Transmission Expansion Planning Policy Committee

1	TES	thermal energy storage
2	TRACE	Transmission Routing and Configuration Estimator
3	TSA	Transportation Security Administration
4	TSCA	Toxic Substances Control Act of 1976
5	TSDF	treatment, storage, and disposal facility
6	TSP	total suspended particulates
7		
8	UACD	Utah Association of Conservation Districts
9	UBWR	Utah Board of Water Resources
10	UDA	Utah Department of Agriculture
11	UDEQ	Utah Department of Environmental Quality
12	UDNR	Utah Department of Natural Resources
13	UDOT	Utah Department of Transportation
14	UDWQ	Utah Division of Water Quality
15	UDWR	Utah Division of Wildlife Resources
16	UGS	Utah Geological Survey
17	UNEP	United Nations Environmental Programme
18	UNPS	Utah Native Plant Society
19	UP	Union Pacific
20	UREZ	Utah Renewable Energy Zone
21	USACE	U.S. Army Corps of Engineers
22	USAF	U.S. Air Force
23	USC	<i>United States Code</i>
24	USDA	U.S. Department of Agriculture
25	USFS	U.S. Forest Service
26	USFWS	U.S. Fish and Wildlife Service
27	USGS	U.S. Geological Survey
28	Utah DWR	Utah Division of Water Rights
29	UTTR	Utah Test and Training Range
30	UWS	Underground Water Storage, Savings and Replenishment Act
31		
32	VACAR	Virginia–Carolinas Subregion
33	VCRS	Visual Contrast Rating System
34	VFR	visual flight rule
35	VOC	volatile organic compound
36	VRHCRP	Virgin River Habitat Conservation & Recovery Program
37	VRI	Visual Resource Inventory
38	VRM	Visual Resource Management
39		
40	WA	Wilderness Area
41	WECC	Western Electricity Coordinating Council
42	WECC CAN	Western Electricity Coordinating Council–Canada
43	WEG	wind erodibility group
44	Western	Western Area Power Administration
45	WGA	Western Governors’ Association
46	WGFD	Wyoming Game and Fish Department

1	WHA	wildlife habitat area
2	WHO	World Health Organization
3	WIA	Wyoming Infrastructure Authority
4	WRAP	Water Resources Allocation Program; Western Regional Air Partnership
5	WRCC	Western Regional Climate Center
6	WREZ	Western Renewable Energy Zones
7	WRI	Water Resources Research Institute
8	WSA	Wilderness Study Area
9	WSC	wildlife species of special concern
10	WSMR	White Sands Missile Range
11	WSR	Wild and Scenic River
12	WSRA	Wild and Scenic Rivers Act of 1968
13	WWII	World War II
14	WWP	Western Watersheds Project
15		
16	YPG	Yuma Proving Ground
17		
18	ZITA	zone identification and technical analysis
19	ZLD	zero liquid discharge

20
21

22 **CHEMICALS**

23				
24	CH ₄	methane	NO ₂	nitrogen dioxide
25	CO	carbon monoxide	NO _x	nitrogen oxides
26	CO ₂	carbon dioxide		
27			O ₃	ozone
28	H ₂ S	hydrogen sulfide		
29	Hg	mercury	Pb	lead
30				
31	N ₂ O	nitrous oxide	SF ₆	sulfur hexafluoride
32	NH ₃	ammonia	SO ₂	sulfur dioxide
			SO _x	sulfur oxides

33
34

35 **UNITS OF MEASURE**

36				
37	ac-ft	acre-foot (feet)	dB(A)	A-weighted decibel(s)
38	bhp	brake horsepower		
39			°F	degree(s) Fahrenheit
40	°C	degree(s) Celsius	ft	foot (feet)
41	cf	cubic foot (feet)	ft ²	square foot (feet)
42	cfs	cubic foot (feet) per second	ft ³	cubic foot (feet)
43	cm	centimeter(s)		
44			g	gram(s)
45	dB	decibel(s)	gal	gallon(s)

1	GJ	gigajoule(s)	MWe	megawatt(s) electric
2	gpcd	gallon per capita per day	MWh	megawatt-hour(s)
3	gpd	gallon(s) per day		
4	gpm	gallon(s) per minute	ppm	part(s) per million
5	GW	gigawatt(s)	psi	pound(s) per square inch
6	GWh	gigawatt hour(s)	psia	pound(s) per square inch absolute
7	GWh/yr	gigawatt hour(s) per year		
8			rpm	rotation(s) per minute
9	h	hour(s)		
10	ha	hectare(s)	s	second(s)
11	Hz	hertz	scf	standard cubic foot (feet)
12				
13	in.	inch(es)	TWh	terawatt hour(s)
14				
15	J	joule(s)	VdB	vibration velocity decibel(s)
16				
17	K	degree(s) Kelvin	W	watt(s)
18	kcal	kilocalorie(s)		
19	kg	kilogram(s)	yd ²	square yard(s)
20	kHz	kilohertz	yd ³	cubic yard(s)
21	km	kilometer(s)	yr	year(s)
22	km ²	square kilometer(s)		
23	kPa	kilopascal(s)	µg	microgram(s)
24	kV	kilovolt(s)	µm	micrometer(s)
25	kVA	kilovolt-ampere(s)		
26	kW	kilowatt(s)		
27	kWh	kilowatt-hour(s)		
28	kWp	kilowatt peak		
29				
30	L	liter(s)		
31	lb	pound(s)		
32				
33	m	meter(s)		
34	m ²	square meter(s)		
35	m ³	cubic meter(s)		
36	mg	milligram(s)		
37	Mgal	million gallons		
38	mi	mile(s)		
39	mi ²	square mile(s)		
40	min	minute(s)		
41	mm	millimeter(s)		
42	MMt	million metric ton(s)		
43	MPa	megapascal(s)		
44	mph	mile(s) per hour		
45	MVA	megavolt-ampere(s)		
46	MW	megawatt(s)		

1 **10 UPDATE TO AFFECTED ENVIRONMENT AND IMPACT ASSESSMENT**
2 **FOR PROPOSED SOLAR ENERGY ZONES IN COLORADO**
3
4

5 The U.S. Department of the Interior Bureau of Land Management (BLM) has carried
6 17 solar energy zones (SEZs) forward for analysis in this Final Solar Programmatic
7 Environmental Impact Statement (PEIS). These SEZs total approximately 285,000 acres
8 (1,153 km²) of land potentially available for development. This chapter includes analyses of
9 potential environmental impacts for the proposed SEZs in Colorado—Antonito Southeast,
10 De Tilla Gulch, Fourmile East, and Los Mogotes East. The SEZ-specific analyses provide
11 documentation from which the BLM will tier future project authorizations, thereby limiting the
12 required scope and effort of project-specific National Environmental Policy Act of 1969 (NEPA)
13 analyses.
14

15 The BLM is committed to collecting additional SEZ-specific resource data and
16 conducting additional analysis in order to more efficiently facilitate future development in
17 SEZs. The BLM developed action plans for each of the 17 SEZs carried forward as part of
18 the Supplement to the Draft Solar PEIS (BLM and DOE 2011). These action plans described
19 additional data that could be collected for individual SEZs and proposed data sources and
20 methods for the collection of those data. Work is under way to collect additional data as
21 specified under these action plans (e.g., additional data collection to support evaluation of
22 cultural, visual, and water resources has begun). As the data become available, they will be
23 posted on the project Web site (<http://solareis.anl.gov>) for use by applicants and the BLM and
24 other agency staff.
25

26 To accommodate the flexibility described in the BLM’s program objectives and in light
27 of anticipated changes in technologies and environmental conditions over time, the BLM has
28 removed some of the prescriptive SEZ-specific design features presented in the Draft Solar PEIS
29 (BLM and DOE 2010) and the Supplement to the Draft (e.g., height restrictions on technologies
30 used to address visual resource impacts). Alternatively, the BLM will give full consideration to
31 any outstanding conflicts in SEZs as part of the competitive process being developed through
32 rulemaking (see Section 2.2.2.2.1).
33

34 In preparing selected parcels for competitive offer, the BLM will review all existing
35 analysis for an SEZ and consider any new or changed circumstances that may affect the
36 development of the SEZ. The BLM will also work with appropriate federal, state, and local
37 agencies, and affected tribes, as necessary, to discuss SEZ-related issues. This work would
38 ultimately inform how a parcel would be offered competitively (e.g., parcel size and
39 configuration, technology limitations, mitigation requirements, and parcel-specific competitive
40 process). Prior to issuing a notice of competitive offer, the BLM would complete appropriate
41 NEPA analysis to support the offer. This analysis would tier to the analysis for SEZs in the Solar
42 PEIS to the extent practicable.
43

44 It is the BLM’s goal to compile all data, information, and analyses for SEZs from the
45 Draft Solar PEIS, the Supplement to the Draft, and this Final PEIS into a single location

1 accessible via the project Web site (<http://solareis.anl.gov>) for ease of use by applicants and the
2 BLM and other agency staff.

3

4 This chapter is an update to the information on Colorado SEZs presented in the Draft
5 Solar PEIS. The information presented in this chapter supplements and updates, but does not
6 replace, the information provided in the corresponding Chapter 10 on proposed SEZs in
7 Colorado in the Draft Solar PEIS. Corrections to incorrect information in Sections 10.1, 10.2,
8 10.3, and 10.4 of the Draft Solar PEIS and in Sections C.3.1, C.3.2, C.3.3, and C.3.4 of the
9 Supplement to the Draft are provided in Sections 10.1.26, 10.2.26, 10.3.26, and 10.4.26 of this
10 Final Solar PEIS.

1 **10.3 FOURMILE EAST**

2
3
4 **10.3.1 Background and Summary of Impacts**

5
6
7 **10.3.1.1 General Information**

8
9 The proposed Fourmile East SEZ is located in Alamosa County in south-central
10 Colorado. The town of Alamosa is located about 13 mi (21 km) west of the SEZ and had an
11 estimated 2008 population of 8,745. In 2008, the county population was 15,783. U.S. 160 runs
12 from west to east about 0.6 mi (1 km) south of the SEZ, while CO 150 runs north–south near the
13 eastern border of the SEZ; Great Sands Dunes National Park is located about 9 mi (14 km) north
14 of the SEZ on CO 150. The SLRG Railroad serves the area. As of October 28, 2011, there were
15 no pending solar project applications within or adjacent to the SEZ.

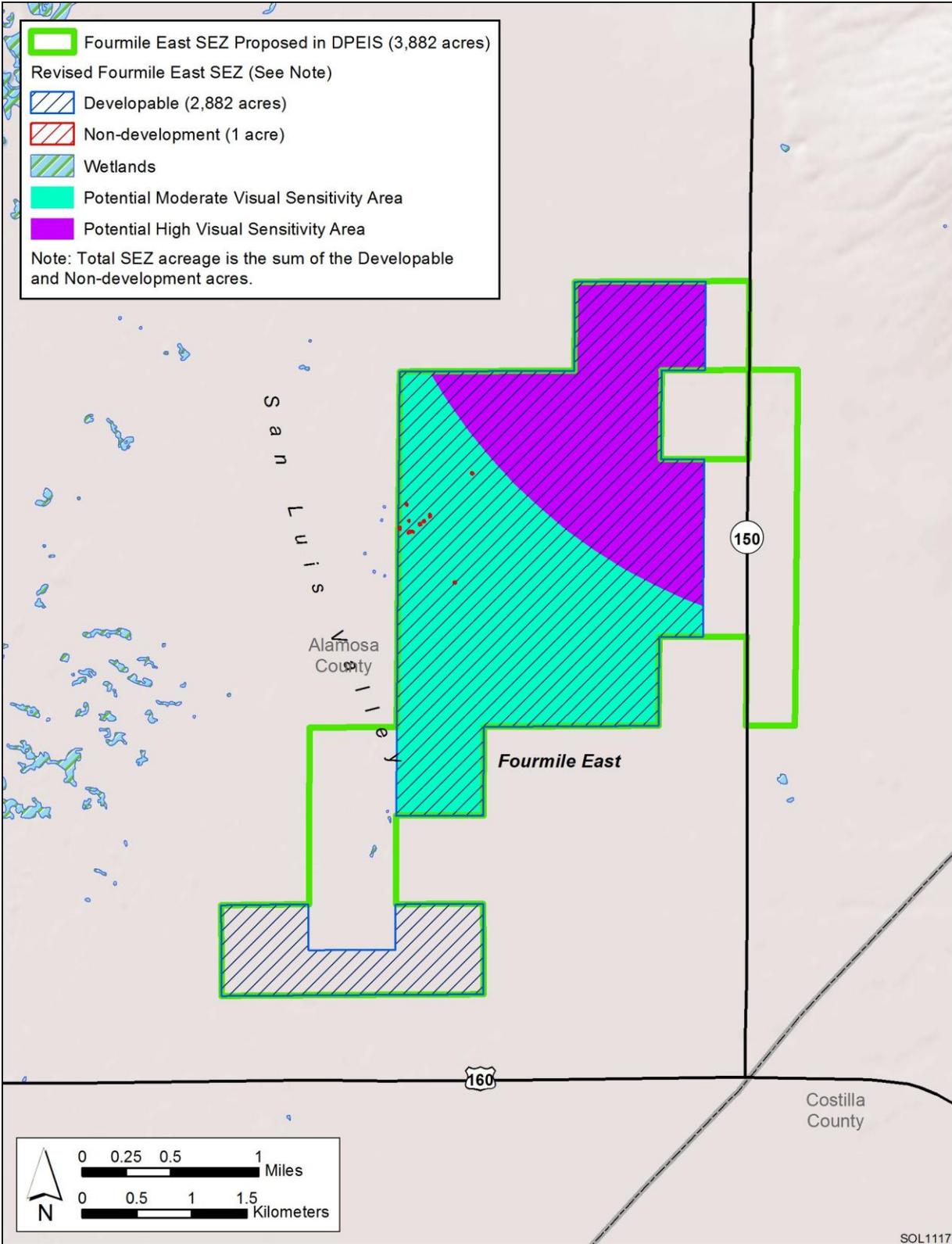
16
17 As published in the Draft Solar PEIS (BLM and DOE 2010), the proposed Fourmile East
18 SEZ had a total area of 3,882 acres (15.7 km²) (see Figure 10.3.1.1-1). In the Supplement to the
19 Draft Solar PEIS (BLM and DOE 2011), the size of the SEZ was reduced, eliminating 999 acres
20 (4 km²) and identifying a total of about 1 acre (0.004 km²) of dispersed wetlands as a non-
21 development area. The eliminated areas are mainly along the eastern boundary of the SEZ and
22 include a small area on the west side of the proposed SEZ (see Figure 10.3.1.1-2). Eliminating
23 these areas is primarily intended to avoid or minimize impacts on known cultural resources, a
24 historic playa basin, Caminos Antiguos Scenic Byway, the Old Spanish National Historic Trail,
25 the Pike National Historic Trail, big game winter range, and important riparian habitat. The
26 remaining developable area within the SEZ area is 2,882 acres (11.7 km²).

27
28 Because of the extensive potential impacts from solar development in the portion of the
29 Fourmile East SEZ that has been eliminated, those lands are proposed as solar ROW exclusion
30 areas; that is, applications for solar development on those lands will not be accepted by the BLM.

31
32 The analyses in the following sections update the affected environment and potential
33 environmental, cultural, and socioeconomic impacts associated with utility-scale solar energy
34 development in the Fourmile East SEZ as described in the Draft Solar PEIS.

35
36
37 **10.3.1.2 Development Assumptions for the Impact Analysis**

38
39 Maximum development of the proposed Fourmile East SEZ was assumed to be
40 80% of the total SEZ area over a period of 20 years, a maximum of 2,306 acres (9.3 km²)
41 (Table 10.3.1.2-1). Full development of the Fourmile East SEZ would allow development
42 of facilities with an estimated total of between 256 MW (power tower, dish engine, or PV
43 technologies, 9 acres/MW [0.04 km²/MW]) and 461 MW (solar trough technologies,
44 5 acres/MW [0.02 km²/MW]) of electrical power capacity.



1

2 **FIGURE 10.3.1.1-2 Developable and Non-development Areas for the Proposed Fourmile East**
 3 **SEZ as Revised**

1 **TABLE 10.3.1.2-1 Assumed Development Acreages, Solar MW Output, and Nearest Major Access**
 2 **Road and Transmission Line for the Proposed Fourmile East SEZ as Revised**

Total Developable Acreage and Assumed Developed Acreage (80% of Total)	Assumed Maximum SEZ Output for PV Technologies	Distance to Nearest State, U.S., or Interstate Highway	Distance and Capacity of Nearest Existing Transmission Line	Assumed Area of Road ROW	Distance to Nearest BLM-Designated Transmission Corridor ^e
2,882 acres ^a and 2,306 acres	256 MW ^b 461 MW ^c	Adjacent (CO 150)	2 mi ^d and 69 kV	0 acres	Adjacent/ through ^f

- a To convert acres to km², multiply by 0.004047.
- b Maximum power output if the SEZ were fully developed using PV technologies, assuming 9 acres/MW (0.04 km²/MW) of land required.
- c Maximum power output if the SEZ were fully developed using solar trough technologies, assuming 5 acres/MW (0.02 km²/MW) of land required.
- d To convert mi to km, multiply by 1.609.
- e BLM-designated corridors are developed for federal land use planning purposes only and are not applicable to state-owned or privately owned land.
- f A BLM locally designated corridor covers the entire proposed Fourmile East SEZ.

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Availability of transmission from SEZs to load centers will be an important consideration for future development in SEZs. For the proposed Fourmile East SEZ, the nearest existing transmission line as identified in the Draft Solar PEIS is a 69-kV line 2 mi (3.2 km) south of the SEZ. It is possible that a new transmission line could be constructed from the SEZ to the nearest existing line, but the 69-kV capacity of that line would be inadequate for 256 to 461 MW of new capacity. Therefore, at full build-out capacity, new transmission lines and possibly upgrades of existing transmission lines would be required to bring electricity from the proposed Fourmile East SEZ to load centers. An assessment of the most likely load center destinations for power generated at the Fourmile East SEZ and a general assessment of the impacts of constructing and operating new transmission facilities to those load centers are provided in Section 10.3.23. In addition, the generic impacts of transmission and associated infrastructure construction and of line upgrades for various resources are discussed in Chapter 5 of this Final Solar PEIS. Project-specific analyses would also be required to identify the specific impacts of new transmission construction and line upgrades for any projects proposed within the SEZ.

The transmission assessment for the Fourmile East SEZ has been updated, and the hypothetical transmission corridor assessed in the Draft Solar PEIS is no longer applicable. For this updated assessment, the 61 acres (0.25 km²) of land disturbance for a hypothetical transmission corridor to the existing transmission line is no longer assumed (although the impacts of required new transmission overall are addressed in Section 10.3.23).

1 Most of the Fourmile East SEZ overlaps a locally designated transmission corridor that
2 does not currently contain any transmission facilities. For this impact assessment, it is assumed
3 that up to 80% of the proposed SEZ could be developed. This does not take into account the
4 potential limitations to solar development that may result from siting constraints associated with the
5 corridor. The development of solar facilities and the existing corridor will be dealt with by the BLM
6 on a case-by-case basis. See Section 10.3.2.2 on impacts on lands and realty for further discussion.
7

8 For the proposed Fourmile East SEZ, both CO 150 and U.S. 160 run within 1 mi (2 km)
9 of the SEZ. Existing road access to the proposed Fourmile East SEZ should be adequate to
10 support construction and operation of solar facilities. No additional road construction outside of
11 the SEZ is assumed to be required to support solar development, as summarized in
12 Table 10.3.1.2-1.
13

14 **10.3.1.3 Programmatic and SEZ-Specific Design Features**

15
16
17 The proposed programmatic design features for each resource area to be required under
18 BLM's Solar Energy Program are presented in Section A.2.2 of Appendix A of this Final Solar
19 PEIS. These programmatic design features are intended to avoid, minimize, and/or mitigate
20 adverse impacts from solar energy development and will be required for development on all
21 BLM-administered lands, including SEZ and non-SEZ lands.
22

23 The discussions below addressing potential impacts from solar energy development on
24 specific resource areas (Sections 10.3.2 through 10.3.22) also provide an assessment of the
25 effectiveness of the programmatic design features in mitigating adverse impacts from solar
26 development within the SEZ. SEZ-specific design features to address impacts specific to the
27 proposed Fourmile East SEZ may be required in addition to the programmatic design features.
28 The proposed SEZ-specific design features for the Fourmile East SEZ have been updated on the
29 basis of revisions to the SEZ since the Draft Solar PEIS (such as boundary changes and the
30 identification of non-development areas), and on the basis of comments received on the Draft
31 and Supplement to the Draft Solar PEIS. All applicable SEZ-specific design features identified
32 to date (including those from the Draft Solar PEIS that are still applicable) are presented in
33 Sections 10.3.2 through 10.3.22.
34

35 **10.3.2 Lands and Realty**

36 **10.3.2.1 Affected Environment**

37
38
39
40
41 The total developable acreage of the proposed Fourmile East SEZ has been reduced to
42 2,882 acres (11.7 km²), with an assumed developable area (80%) of 2,306 acres (9.3 km²). The
43 description of the condition of the SEZ contained in the Draft Solar PEIS remains accurate, with
44 the exception that because of the boundary change, CO 50 no longer passes through the SEZ. It
45 now is located 0.25 mi (0.4 km) east of the eastern border of the SEZ, and a short road ROW
46 would be required to access the SEZ from the highway. The boundary adjustment of the SEZ has

1 also resulted in a 400-acre (1.6-km²) portion of the southwestern corner of the proposed SEZ not
2 being contiguous with the rest of the SEZ (Figure 10.3.1.1-1). Access to this detached parcel of
3 the SEZ would require a separate ROW of about 0.5 mi (0.8 km). A BLM-designated
4 transmission corridor covers all of the proposed SEZ.
5
6

7 **10.3.2.2 Impacts**

8
9 Full development of the SEZ would disturb up to 2,306 acres (9.3 km²) and would
10 exclude many existing and potential uses of the public land. Because the SEZ is undeveloped and
11 rural, utility-scale solar energy development would introduce a new and discordant land use into
12 the area. The boundary adjustment of the SEZ has further fragmented the public land ownership
13 in the area and may make the isolated public lands more difficult to manage. If the public lands
14 are developed for solar energy production, similar development could be induced on neighboring
15 state and private lands with landowner agreement.
16

17 Most of the proposed Fourmile East SEZ overlaps a locally designated transmission
18 corridor. This existing corridor will be used primarily for the siting of transmission lines and
19 other infrastructure such as pipelines. The existing corridor will be the preferred location for any
20 transmission development that is required to support solar development and future transmission
21 grid improvements related to the build-out of the Fourmile East SEZ. Any use of the corridor
22 lands within the Fourmile East SEZ for solar energy facilities, such as solar panels or heliostats,
23 must be compatible with the future use of the existing corridor. The BLM will assess solar
24 projects in the vicinity of the existing corridor on a case-by-case basis. The BLM will review and
25 approve individual project plans of development to ensure compatible development that
26 maintains the use of the corridor.
27

28 The additional description of impacts in the Draft Solar PEIS remains valid.
29
30

31 **10.3.2.3 SEZ-Specific Design Features and Design Feature Effectiveness**

32
33 Required programmatic design features that would reduce impacts on lands and realty
34 activities are described in Section A.2.2 of Appendix A of this Final Solar PEIS. Implementing
35 the programmatic design features will provide some mitigation for identified impacts but will not
36 mitigate all adverse impacts. For example, impacts related to the exclusion of many existing and
37 potential uses of the public land, the visual impact of an industrial-type solar facility within an
38 otherwise rural area, and induced land use changes on state and private lands, if any, may not be
39 fully mitigated.
40

41 No SEZ-specific design features for lands and realty have been identified through this
42 Final Solar PEIS, Some SEZ-specific design features may be established for parcels within the
43 Fourmile East SEZ through the process of preparing parcels for competitive offer and subsequent
44 project-specific analysis.
45
46

1 **10.3.3 Specially Designated Areas and Lands with Wilderness Characteristics**
2
3

4 **10.3.3.1 Affected Environment**
5

6 The affected environment section in the Draft Solar PEIS is generally accurate,
7 with some corrections and modifications. A recently maintained inventory of wilderness
8 characteristics was used to determine whether public lands within the SEZ have wilderness
9 characteristics. The finding of this inventory was that these lands do not contain wilderness
10 characteristics.
11

12 Because the eastern boundary of the proposed SEZ has been shifted to the west, the route
13 of the Old Spanish Trail is now about 1.25 mi (2 km) from the SEZ at the nearest point.
14

15
16 **10.3.3.2 Impacts**
17

18 The description of impacts presented in the Draft Solar PEIS remains valid, with the
19 following updates. While the size of the proposed SEZ has been reduced by 999 acres (4 km²),
20 solar energy development of the remaining portion of the SEZ will still result in the development
21 of a very large industrial site in an area that otherwise is currently rural. Elevated and relatively
22 nearby viewpoints such as Blanca Peak and the slightly elevated portions of the Old Spanish
23 National Historic Trail will still have significant views of development within the SEZ. A high-
24 potential segment of the Trail has been identified directly to the northeast of the SEZ. Solar
25 development in the SEZ may have a major impact on the historic and visual integrity of the
26 Blanca Peak and the Trail.
27

28 Tall facilities such as power towers would have a larger visual impact than shorter
29 facilities. Site-specific analysis, including consideration of the potential for visible glint and glare
30 from solar facility mirrors and panels, will need to be completed before impacts can be fully
31 assessed. Because of the proximity of the SEZ to the Blanca Wetlands ACEC/SRMA, it is likely
32 there will be an adverse impact on visitor use of the portion of the ACEC/SRMA nearest to the
33 SEZ. Where the scenic highway passes within 0.25 mi (0.4 km) to 0.50 mi (0.8 km) from the
34 boundary of the SEZ, development within the SEZ still would be very visible and has the
35 potential to detract from the visitor experience on the highway. The westward relocation of the
36 eastern boundary of the SEZ will remove the “tunnel effect” that would have been created by
37 development on both sides of the highway and will reduce the impact on highway users. There
38 also is potential for adverse impact on the Sangre de Cristo NHA.
39

40
41 **10.3.3.3 SEZ-Specific Design Features and Design Feature Effectiveness**
42

43 Required programmatic design features that would reduce impacts on specially
44 designated areas are described in Section A.2.2 of Appendix A of this Final Solar PEIS (design
45 features for specially designated areas, cultural resources, and visual resources would address
46 impacts). Implementing the programmatic design features will provide some mitigation for the

1 identified impacts. Exceptions to this may include impacts on recreational users of the Blanca
2 Wetlands ACEC, impacts on wilderness characteristics in the Sangre de Cristo WA, and, impacts
3 on users of the Los Antiguos Scenic Byway. Programmatic design features will be applied to
4 address SEZ-specific resources and conditions, for example:

- 5
6 • For projects in the Fourmile East SEZ that are located within the viewshed of
7 the Old Spanish National Historic Trail, a National Trail inventory will be
8 required to determine the area of possible adverse impact on resources,
9 qualities, values, and associated settings of the Trail; to prevent substantial
10 interference; and to determine any areas unsuitable for development. Residual
11 impacts will be avoided, minimized, and/or mitigated to the extent practicable
12 according to program policy standards. Programmatic design features have
13 been included in BLM's Solar Energy Program to address impacts on
14 National Historic Trails (see Section A.2.2.23 of Appendix A).

15
16 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
17 analyses due to changes to the SEZ boundaries, and consideration of comments received as
18 applicable, the following SEZ-specific design feature has been identified:

- 19
20 • As part of project-specific analysis, early consultation should be initiated with
21 the entity responsible for developing the management plan for the Sangre de
22 Cristo NHA to understand how development could be consistent with the
23 goals of the NHA.

24
25 The need for additional SEZ-specific design features will be identified through the
26 process of preparing parcels for competitive offer and subsequent project-specific analysis.

27 28 29 **10.3.4 Rangeland Resources**

30 31 32 **10.3.4.1 Livestock Grazing**

33 34 35 ***10.3.4.1.1 Affected Environment***

36
37 The analysis in the Draft Solar PEIS indicated that there are two BLM seasonal grazing
38 allotments that would be affected by the proposed SEZ. Since the eastern boundary of the SEZ
39 has been moved about 0.25 mi (0.4 km) west of CO 150, only the Tobin Allotment now would
40 be affected by the SEZ. About 44% of the Tobin Allotment is now located within the SEZ, and
41 the allotment permittee is authorized to graze 139 AUMs.

42 43 44 ***10.3.4.1.2 Impacts***

45
46 For the SEZ as presented in the Draft Solar PEIS, about 60% of the Tobin allotment was
47 within the SEZ, and it was assumed to be likely that the grazing permit on the public lands would

1 be cancelled and that all 139 AUMs would be lost. This is still a likely outcome, although a
2 smaller percentage (44%) of the allotment is within the proposed SEZ. For the purposes of this
3 Final Solar PEIS, it is assumed that the allotment would be cancelled and the permittee would be
4 displaced. In this scenario, all 139 AUMs would be lost. While the specific situation of the
5 grazing permittee is not known, it is clear that loss of all or part of the grazing permit would be a
6 significant adverse impact. Economic losses would not be limited to the value of the lost grazing
7 opportunity but would extend to the value of the overall ranch operation, including any private
8 lands tied to the grazing operation. While the permittee would be reimbursed for the portion of
9 the value of range improvements on the permits, this would cover their economic loss.

10 11 12 ***10.3.4.1.3 SEZ-Specific Design Features and Design Feature Effectiveness***

13
14 Required programmatic design features that would reduce impacts on livestock grazing
15 are described in Section A.2.2 of Appendix A of this Final Solar PEIS. Implementing the
16 programmatic design features will provide some mitigation for identified impacts should only
17 portions of the grazing permit be affected, but they would not mitigate a complete loss of the
18 grazing permit, any loss of livestock AUMs, or the loss of value in the ranching operations
19 including private land values.

20
21 No SEZ-specific design features to protect livestock grazing have been identified in this
22 Final Solar PEIS. Some SEZ-specific design features may be identified through the process of
23 preparing parcels for competitive offer and subsequent project-specific analysis.

24 25 26 **10.3.4.2 Wild Horses and Burros**

27 28 29 ***10.3.4.2.1 Affected Environment***

30
31 As presented in the Draft Solar PEIS, no wild horse or burro HMAs occur within the
32 proposed Fourmile East SEZ or in proximity to it. The reduced size of the SEZ does not alter
33 these data.

34 35 36 ***10.3.4.2.2 Impacts***

37
38 As presented in the Draft Solar PEIS, solar energy development within the proposed
39 Fourmile East SEZ would not affect wild horses and burros. The reduction in size of the SEZ
40 does not affect this conclusion.

41 42 43 ***10.3.4.2.3 SEZ-Specific Design Features and Design Feature Effectiveness***

44
45 Because solar energy development within the proposed Fourmile East SEZ would not
46 affect wild horses and burros, no SEZ-specific design features to address wild horses and burros
47 have been identified in this Final Solar PEIS.

1 **10.3.5 Recreation**

2
3
4 **10.3.5.1 Affected Environment**

5
6 The area of the proposed Fourmile East SEZ has been reduced by about 26%, to
7 2,882 acres (11.7 km²), by removing areas mainly along the eastern boundary of the SEZ.
8

9 Commenters have pointed out that most of the recreational discussion in the Draft Solar
10 PEIS was focused internally within the SEZ and did not address the larger part that public and
11 other federal lands play in the landscape and tourism economy of the San Luis Valley. A
12 summary of the better-known attractions within the valley includes Great Sand Dunes
13 National Park and Preserve, the Old Spanish National Historic Trail, two scenic railroads, the
14 Los Caminos Antiguos Scenic Byway, the Sangre de Cristo Mountains, three national wildlife
15 refuges, and numerous designated wilderness areas; these are among the highlights of the
16 recreational and tourism opportunities on federal lands in the area. Tourism is an important part
17 of the valley economy and an important focus for future economic growth.
18

19 The land within the Fourmile East SEZ is flat, plain, and not an important recreational
20 use area, but it is adjacent to both U.S. 160 and CO 150, which make up part of the heavily
21 traveled and important visitor route, the Los Caminos Antiguos Scenic Byway, also the main
22 access route into Great Sand Dunes National Park. In addition, the SEZ sits near the base of the
23 magnificent Sangre de Cristo Mountains and 14,345-ft (4,372-m) Blanca Peak, which is the
24 fourth-highest mountain in Colorado. The Rio Grande Scenic Railroad runs east–west about
25 2.5 mi (4 km) south of the SEZ.
26

27
28 **10.3.5.2 Impacts**

29
30 Solar development of the SEZ still will be readily visible to travelers on the Los Caminos
31 Antiguos Scenic Byway and to travelers headed to the national park and preserve, but the
32 modification to the SEZ that removes the potential development on the east side of CO 150 will
33 reduce the level of impact on travelers and on the view of the Sangre de Cristos and Blanca Peak.
34 The boundary change will also provide additional distance between the SEZ and the Old Spanish
35 National Historic Trail, but it is anticipated that the viewshed of the Trail would still be
36 adversely affected. Whether there will be any adverse impacts on recreational visitors traveling
37 to the national park or visiting the Trail is not known. Visual impacts on surrounding recreational
38 areas would be greater with taller solar facilities such as power towers and facilities with wet
39 cooling. Visitors to areas located at elevations higher than that of the SEZ (e.g., Great Sand
40 Dunes National Park, Zapata Falls recreation area, Sangre de Cristo wilderness areas) will see
41 the solar development within the SEZ, but the impact on recreational use of these areas is
42 unknown at this time. Whether there is significant glint or glare from reflective surfaces of solar
43 facilities and what types of technologies might be employed will have a big impact on visibility.
44 The focus and intent of the relatively new Sangre de Cristo NHA is not yet well defined, so it has
45 not been possible to assess how solar development may interact with the objectives of the NHA.

1 There may be some potential to provide interpretive activities focused on solar energy and
2 development that would be of interest to travelers.
3

4 In addition, lands that are outside of the proposed SEZ may be acquired or managed for
5 mitigation of impacts on other resources (e.g., sensitive species). Managing these lands for
6 mitigation could further exclude or restrict recreational use, potentially leading to additional
7 losses in recreational opportunities in the region. The impact of acquisition and management of
8 mitigation lands would be considered as a part of the environmental analysis of specific solar
9 energy projects.
10

11 **10.3.5.3 SEZ-Specific Design Features and Design Feature Effectiveness**

12
13
14 Required programmatic design features that would reduce impacts on resources are
15 described in Section A.2.2 of Appendix A of this Final Solar PEIS. Implementing the
16 programmatic design features will help reduce impacts of individual solar projects but will not
17 address the larger question of what level of solar energy development would cause adverse
18 impacts on tourism and recreational segments of the local economy. In addition, implementing
19 the programmatic design features for recreation will not mitigate the loss of recreation access to
20 public lands developed for solar energy production.
21

22 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
23 analyses due to changes in the SEZ boundaries, and consideration of comments received as
24 applicable, the following SEZ-specific design feature has been identified:
25

- 26 • Tourism is an important economic growth area for the San Luis Valley, and
27 the four proposed SEZs are located in visible locations adjacent to the
28 principal highway routes into the valley. Because of the location of the SEZs,
29 there is potential to influence visitors' perception of the tourism climate in the
30 valley. As projects are proposed for the SEZs, the potential impacts on
31 tourism should be considered and reviewed with local community leaders.
32

33 The need for additional SEZ-specific design features will be identified through the
34 process of preparing parcels for competitive offer and subsequent project-specific analysis.
35
36

37 **10.3.6 Military and Civilian Aviation**

38 **10.3.6.1 Affected Environment**

39
40
41
42 Although the size of the SEZ has been reduced, the remaining proposed SEZ is still
43 located under an MTR and is identified by the BLM as an area of required consultation with
44 the DoD.
45
46

1 **10.3.6.2 Impacts**

2
3 Through comments on the Draft Solar PEIS, the military has indicated that it has no
4 concerns about potential impacts on its activities associated with solar development. There also
5 are no anticipated impacts on civilian aviation.
6

7
8 **10.3.6.3 SEZ-Specific Design Features and Design Feature Effectiveness**

9
10 Required programmatic design features that would reduce impacts on military and
11 civilian aviation are described in Section A.2.2 of Appendix A of this Final Solar PEIS. The
12 programmatic design features require early coordination with the DoD to identify and avoid,
13 minimize, and/or mitigate, if possible, any potential impacts on the use of military airspace.
14

15 No SEZ-specific design features for military and civilian aviation have been identified in
16 this Final Solar PEIS. Some SEZ-specific design features may be identified through the process
17 of preparing parcels for competitive offer and subsequent project-specific analysis.
18

19
20 **10.3.7 Geologic Setting and Soil Resources**

21
22
23 **10.3.7.1 Affected Environment**

24
25
26 ***10.3.7.1.1 Geologic Setting***

27
28 Data provided in the Draft Solar PEIS remain valid, with the following update:
29

- 30 • The terrain of the proposed Fourmile East SEZ is relatively flat with a very
31 gentle dip to the west and northwest (Figure 10.3.7.1-1). The boundaries
32 of the Fourmile East SEZ have been changed to eliminate 999 acres (4.0 km²),
33 mainly along the eastern boundary of the SEZ, as well as a small area on the
34 west side. Within this area, additional small wetland areas with a total area of
35 about 1 acre (0.0040 km²) have been identified as a non-development area.
36 Based on these changes, the elevations range from about 7,660 ft (2,335 m)
37 near the new northeastern corner of the site to less than 7,600 ft (2,316 m)
38 along its western boundary.
39

40
41 ***10.3.7.1.2 Soil Resources***

42
43 Data provided in the Draft Solar PEIS remain valid, with the following updates:
44

- 45 • Soils within the proposed Fourmile East SEZ as revised are predominantly the
46 loamy fine sands and loamy sands of the Space City, Hooper, and Mosca

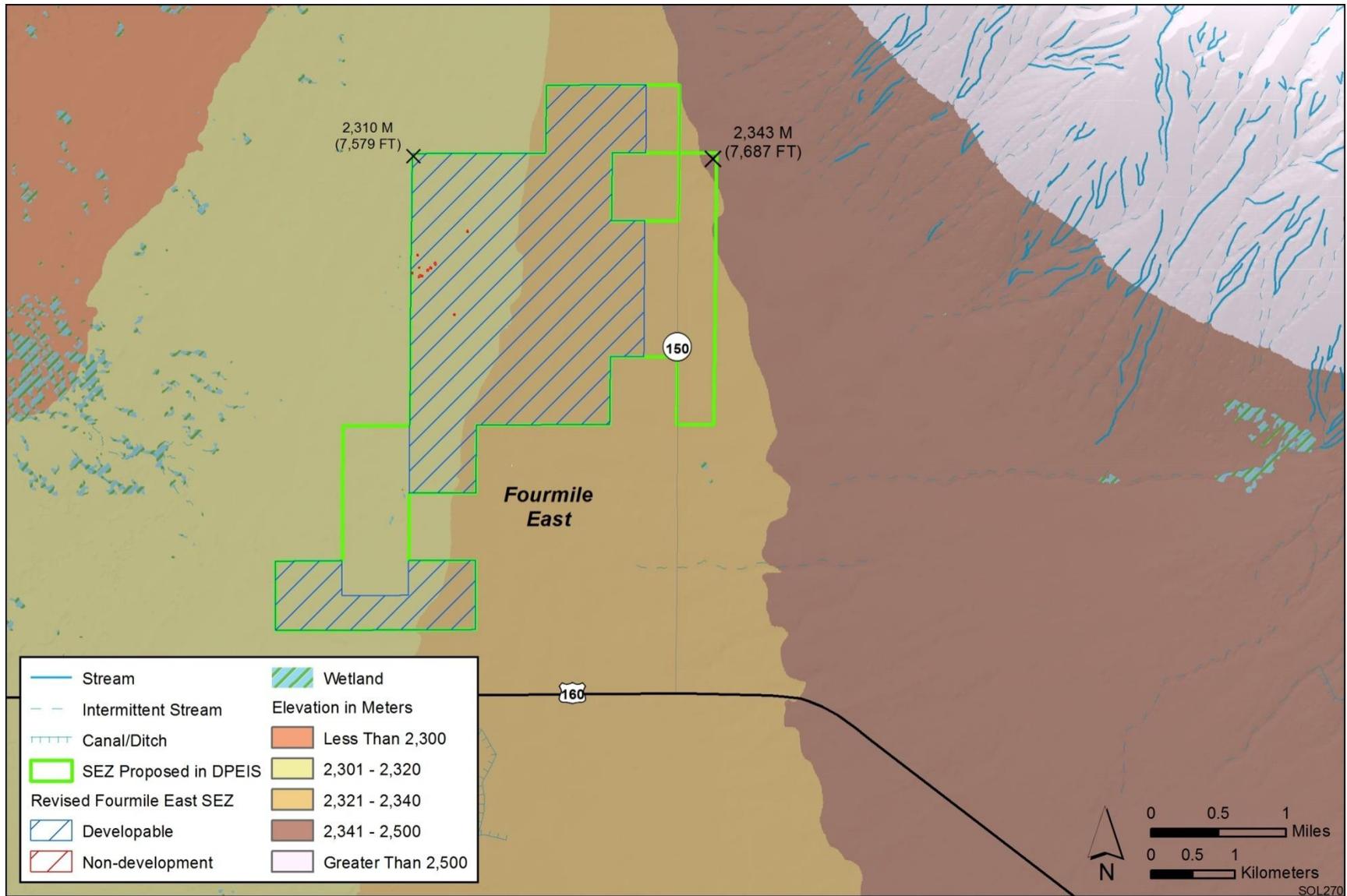


FIGURE 10.3.7.1-1 General Terrain of the Proposed Fourmile East SEZ as Revised

1 Series, which now make up about 86% of the soil coverage at the site. Dune
2 land soils still cover less than 1% of the SEZ.

- 3
- 4 • Soil unit coverage at the proposed Fourmile East SEZ as revised is shown in
5 Figure 10.3.7.1-2. The new SEZ boundaries eliminate 622 acres (2.5 km²) of
6 the Space City loamy fine sand (0 to 3% slopes), 167 acres (0.66 km²) of the
7 Laney loam, 151 acres (0.61 km²) of the Hooper clay loam, 59 acres
8 (0.24 km²) of the Corlett–Hooper complex, and 1 acre (0.0040 km²) of the
9 Hooper loamy sand (non-development wetland areas) (Table 10.3.7.1-1).

10
11

12 **10.3.7.2 Impacts**

13
14 Impacts on soil resources would occur mainly as a result of ground-disturbing activities
15 (e.g., grading, excavating, and drilling), especially during the construction phase of a solar
16 project. The assessment provided in the Draft Solar PEIS remains valid, with the following
17 update:

- 18
- 19 • Impacts related to wind erodibility are reduced because the new SEZ
20 boundaries eliminate 833 acres (3.4 km²) of highly erodible soils and
21 167 acres (0.66 km²) of moderately erodible soils from development. The
22 coverage by dune land sands (13 acres, or 0.053 km²), which have a high
23 wind erosion potential, remains the same.

24
25

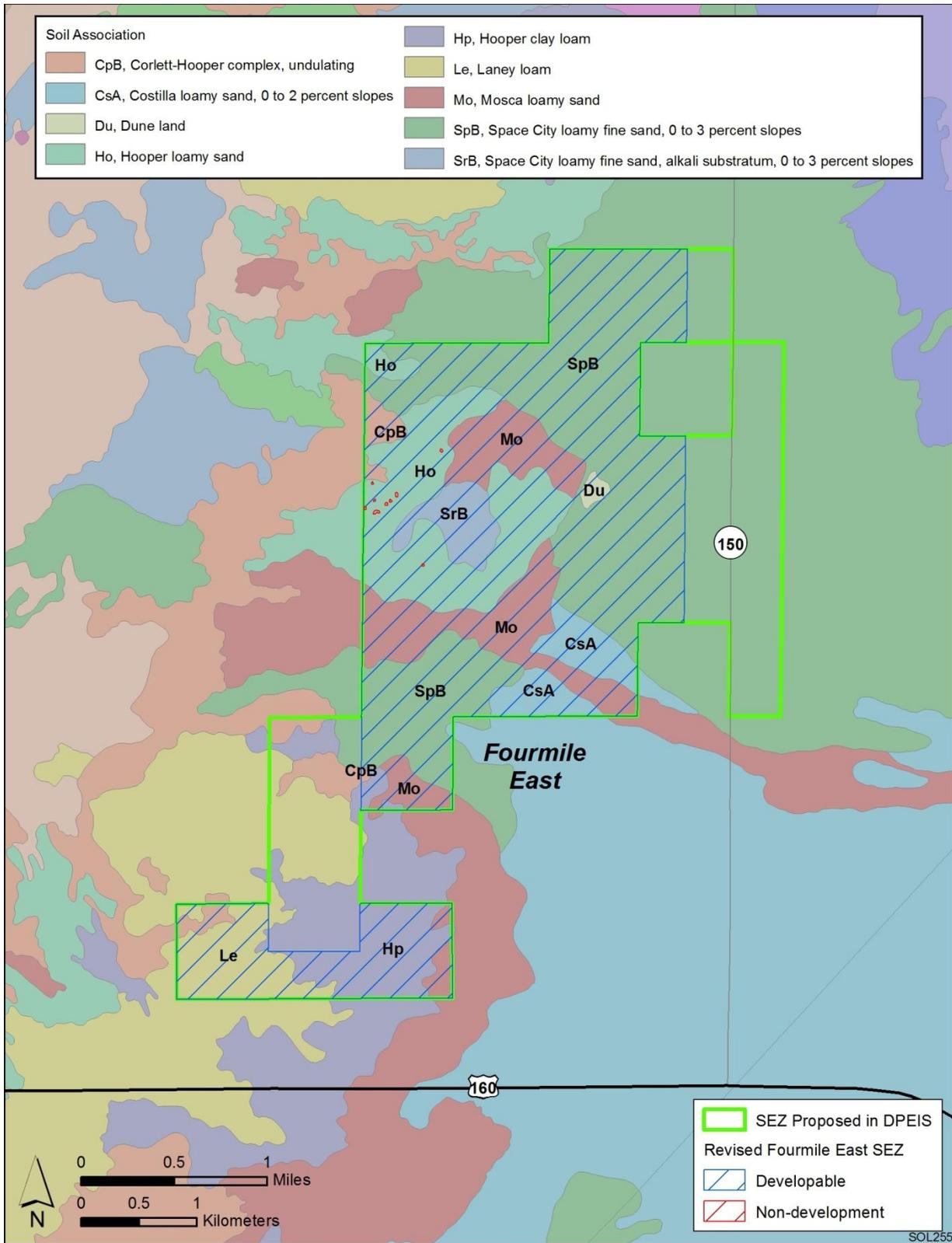
26 **10.3.7.3 SEZ-Specific Design Features and Design Feature Effectiveness**

27
28 Required programmatic design features that would reduce impacts on soils are described
29 in Section A.2.2 of Appendix A of this Final Solar PEIS. Implementing the programmatic design
30 features will reduce the potential for soil impacts during all project phases.

31
32 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
33 analyses due to changes to the SEZ boundaries, and consideration of comments received as
34 applicable, the following SEZ-specific design feature for soil resources has been identified:

- 35
- 36 • The need for a study of the eolian processes that maintain the sand dune fields
37 in Great Sand Dunes National Park should be determined. The study would
38 support the assessment of whether building a solar facility close to the park
39 could have impacts on the sand dunes there (by disrupting these processes).

40
41 The need for additional SEZ-specific design features will be identified through the
42 process of preparing parcels for competitive offer and subsequent project-specific analysis.



1

2 **FIGURE 10.3.7.1-2 Soil Map for the Proposed Fourmile East SEZ as Revised (Source:**
 3 **NRCS 2008)**

1 **TABLE 10.3.7.1-1 Summary of Soil Map Units within the Proposed Fourmile East SEZ as Revised**

Map Unit Symbol	Map Unit Name	Erosion Potential		Description	Area, in Acres ^c (Percentage of SEZ)
		Water ^a	Wind ^b		
SpB	Space City loamy fine sand (0 to 3% slope)	Slight	High (WEG 2) ^d	Level to nearly level soils along isolated low ridges on the valley floor. Parent material consists of eolian sands derived from igneous rock. Somewhat excessively drained with high surface-runoff potential (low infiltration rate) and rapid permeability. Shrink-swell potential is low. Available water capacity is low. Moderate rutting hazard. Used mainly as rangeland.	1,264 (44.9)
Mo	Mosca loamy sand	Slight	High (WEG 2)	Nearly level soils on floodplains. Parent material consists of alluvium derived from igneous rock. Deep and well drained with moderate surface-runoff potential and moderate permeability; moderately to strongly alkaline. Shrink-swell potential is low. Available water capacity is low. Moderate rutting hazard. Used locally for irrigated crops and pastureland. Farmland of unique importance. ^e	466 (16.2)
Ho	Hooper loamy sand	Slight	High (WEG 2)	Level to nearly level soils on floodplains. Parent material consists of alluvium derived from igneous rock. Deep and well drained with high surface-runoff potential (low infiltration rate) and slow permeability; strongly alkaline. Shrink-swell potential is low to moderate. Available water capacity is low. Moderate rutting hazard. Used mainly as rangeland.	463 (16.1) ^f
Hp	Hooper clay loam	Slight	High (WEG 1)	Level to nearly level soils on floodplains. Parent material consists of alluvium derived from igneous rock. Deep and well drained with high surface runoff potential (low infiltration rate) and slow permeability; strongly alkaline. Most areas are without vegetation; provides some cover for wildlife. Shrink-swell potential is moderate to high. Available water capacity is very low. Severe rutting hazard. Used mainly as rangeland.	203 (7.1)

TABLE 10.3.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Erosion Potential		Description	Area, in Acres ^c (Percentage of SEZ)
		Water ^a	Wind ^b		
Le	Laney loam	Slight	Moderate (WEG 4)	Nearly level soils on floodplains. Parent material consists of alluvium derived from igneous rock. Deep and well drained, with moderate surface-runoff potential and moderate permeability. Shrink-swell potential is low to moderate. Available water capacity is moderate. Severe rutting hazard. Used mainly as rangeland.	174 (6.1)
CsA	Costilla loamy sand (0 to 2%)	Slight	High (WEG 1)	Level to nearly level soils on floodplains. Parent material consists of wind-worked alluvium. Deep and somewhat excessively drained with low runoff potential (high infiltration rate) and rapid permeability. Shrink-swell potential is low. Available water capacity is low. Moderate rutting hazard. Used locally for irrigated cropland.	150 (5.2)
SrB	Space City loamy fine sand, alkali substratum (0 to 3% slope)	Slight	High (WEG 2)	Level to nearly level soils along isolated low ridges on the valley floor. Parent material consists of eolian sands derived from igneous rock. Somewhat excessively drained, with low surface runoff potential (high infiltration rate) and rapid permeability. Strongly alkaline below 24 in. ^g Shrink-swell potential is low. Available water capacity is low. Moderate rutting hazard. Used mainly as rangeland.	94 (3.3)
CpB	Corlett–Hooper complex, undulating	Slight	High (WEG 1)	Composed of 45% Corlett sand and loamy sand, 40% Hooper loamy sand and sandy loam, and 15% minor components. Parent material consists of eolian deposits; soils occur on and between sand dunes. Undulating, deep and moderately well drained with low surface runoff potential (high infiltration rate) and rapid permeability. Shrink-swell potential is low. Available water capacity is very low. Severe rutting hazard.	56 (1.9)

TABLE 10.3.7.1-1 (Cont.)

Map Unit Symbol	Map Unit Name	Erosion Potential		Description	Area, in Acres ^c (Percentage of SEZ)
		Water ^a	Wind ^b		
u	Dune land	Very severe	High (WEG 1)	Constantly shifting medium-grained sand deposited by wind blowing across the valley. Parent material consists of eolian sands. Little or no vegetation; low surface runoff potential (high infiltration rate) and very rapid permeability. Shrink-swell potential is low. Available water capacity is very low. Severe rutting hazard.	13 (<1)

^a Water erosion potential rates the hazard of soil loss from off-road and off-trail areas after disturbance activities that expose the soil surface. The ratings are based on slope and soil erosion factor K and represent soil loss caused by sheet or rill erosion where 50 to 75% of the surface has been exposed by ground disturbance. A rating of “slight” indicates that erosion is unlikely under ordinary climatic conditions. A rating of “very severe” indicates that significant erosion is expected; loss of soil productivity and damage are likely and erosion control measures are costly and generally impractical.

^b Wind erosion potential here is based on the wind erodibility group (WEG) designation: groups 1 and 2, high; groups 3 through 6, moderate; and groups 7 and 8, low (see footnote d for further explanation).

^c To convert acres to km², multiply by 0.004047.

^d WEGs are based on soil texture, content of organic matter, effervescence of carbonates, content of rock fragments, and mineralogy, and also take into account soil moisture, surface cover, soil surface roughness, wind velocity and direction, and the length of unsheltered distance (USDA 2004). Groups range in value from 1 (most susceptible to wind erosion) to 8 (least susceptible to wind erosion). The NRCS provides a wind erodibility index, expressed as an erosion rate in tons per acre (4,000 m²) per year, for each of the wind erodibility groups: WEG 1, 220 tons (200 metric tons) per acre (4,000 m²) per year (average); WEG 2, 134 tons (122 metric tons) per acre (4,000 m²) per year; WEGs 3 and 4 (and 4L), 86 tons (78 metric tons) per acre (4,000 m²) per year; WEG 5, 56 tons (51 metric tons) per acre (4,000 m²) per year; WEG 6, 48 tons (44 metric tons) per acre (4,000 m²) per year; WEG 7, 38 tons (34 metric tons) per acre (4,000 m²) per year; and WEG 8, 0 tons (0 metric tons) per acre (4,000 m²) per year.

^e Farmland is of unique importance for the production of food, feed, fiber, forage, or oilseed crops.

^f One acre (0.0040 km²) within the Hooper loamy sand is currently categorized as a non-development area (denoted by red areas in Figure 10.3.7.1-2).

^g To convert in. to cm, multiply by 2.54.

Sources: NRCS (2009); USDA (1968).

1 **10.3.8 Minerals (Fluids, Solids, and Geothermal Resources)**
2

3 A mineral potential assessment for the proposed Fourmile East SEZ has been prepared
4 and reviewed by BLM mineral specialists knowledgeable about the region where the SEZ is
5 located (BLM 2012). The BLM is proposing to withdraw the SEZ from settlement, sale, location,
6 or entry under the general land laws, including the mining laws, for a period of 20 years (see
7 Section 2.2.2.2.4 of the Final Solar PEIS). The potential impacts of this withdrawal are discussed
8 in Section 10.3.24.
9

10
11 **10.3.8.1 Affected Environment**
12

13 There are no oil and gas leases, mining claims, or geothermal leases located in the
14 proposed SEZ. The description in the Draft Solar PEIS remains valid.
15

16
17 **10.3.8.2 Impacts**
18

19 There are no anticipated impacts on mineral resources from the development of solar
20 energy facilities in the proposed SEZ. The analysis of impacts on mineral resources in the Draft
21 Solar PEIS remains valid.
22

23
24 **10.3.8.3 SEZ-Specific Design Features and Design Feature Effectiveness**
25

26 Required programmatic design features that will reduce impacts on mineral resources
27 are described in Section A.2.2 of Appendix A of this Final Solar PEIS. Implementing the
28 programmatic design features will provide adequate protection of mineral resources.
29

30 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
31 analyses due to changes to the SEZ boundaries, and consideration of comments received as
32 applicable, no SEZ-specific design features for minerals have been identified in this Final Solar
33 PEIS. Some SEZ-specific design features may be identified through the process of preparing
34 parcels for competitive offer and subsequent project-specific analysis.
35

36
37 **10.3.9 Water Resources**
38

39
40 **10.3.9.1 Affected Environment**
41

42 The overall size of the Fourmile East SEZ has been reduced by 26% from the area
43 described in the Draft Solar PEIS, resulting in a total area of 2,883 acres (11.7 km²). The
44 description of the affected environment given in the Draft Solar PEIS relevant to water resources
45 at the Fourmile East SEZ remains valid and is summarized in the following paragraphs.
46

1 The Fourmile East SEZ is within the Rio Grande Headwaters subbasin of the Rio Grande
2 hydrologic region. The SEZ is located in the eastern part of the San Luis Valley bounded by the
3 San Juan Mountains to the west and the Sangre de Cristo Mountains to the east. Precipitation and
4 snowfall in the eastern part of the valley are about 8.5 in./yr (22 cm/yr) and 24 in./yr (61 cm/yr),
5 respectively, with much greater amounts in the surrounding mountains. Annual pan evaporation
6 rates are estimated to be on the order of 54 in./yr (137 cm/yr). No permanent surface water
7 features, intermittent/ephemeral washes, or flood hazards have been identified within the SEZ.
8 Several small palustrine wetlands have been identified along the western boundary of the SEZ,
9 which are temporally flooded throughout the year and have been identified as non-development
10 areas (total area of 1 acre [0.004 km²]). Groundwater in the San Luis Valley is primarily in
11 basin-fill deposits with an upper unconfined aquifer and a lower confined aquifer, which are
12 separated by a series of confining clay layers and unfractured volcanic rocks. The Fourmile East
13 SEZ sits atop the distal area of an alluvial fan, above an unconfined aquifer about 125 ft (38 m)
14 thick. Groundwater monitoring wells within the SEZ have reported depths to groundwater
15 ranging from 32 to 52 ft (10 to 16 m) below the surface and indicate a groundwater flow from
16 east to west. Water quality in the aquifers of the San Luis Valley varies, and in 2007, the level of
17 TDS in the groundwater surrounding the SEZ was well below the maximum contaminant level.
18

19 The Fourmile East SEZ is located in the Colorado Division 3 management zone
20 (Rio Grande Basin) of the CDWR, where both surface water and groundwater rights are over-
21 appropriated. The Rio Grande Compact of 1938 obligates Colorado to meet water delivery
22 schedules to New Mexico, and governs much of the water management decision making in the
23 San Luis Valley. In order to balance water uses within the San Luis Valley and to meet treaty
24 obligations, several water management mechanisms have been developed that affect existing
25 water rights and water rights transfers. The two primary water management considerations
26 affecting solar energy development are the need for an augmentation water plan, and the rules set
27 by the recently formed Special Improvement District Number 1 (Subdistrict #1). Augmentation
28 water plans were described in the Draft Solar PEIS (Section 10.3.9.1.3), but essentially require
29 junior water rights holders to have additional water reserves to ensure that more senior water
30 rights are not hindered. The water management plan for Subdistrict #1 was ruled on in June 2010
31 and places restrictions on groundwater withdrawals in an effort to restore groundwater levels in
32 the unconfined aquifer. None of the Colorado SEZs are located within the boundaries of
33 Subdistrict #1, which primarily includes central portions of the San Luis Valley currently used
34 for agriculture. However, given that water rights are overappropriated in the San Luis Valley and
35 largely clustered within Subdistrict #1, it is likely that any new water diversions and water right
36 transfers would involve these new groundwater management considerations.
37

38 In addition to the water resources information provided in the Draft Solar PEIS, this
39 section provides a planning-level inventory of available climate, surface water, and groundwater
40 monitoring stations within the immediate vicinity of the Fourmile East SEZ and surrounding
41 basin. Additional data regarding climate, surface water, and groundwater conditions are
42 presented in Tables 10.3.9.1-1 through 10.3.9.1-7 and in Figures 10.3.9.1-1 and 10.3.9.1-2.
43 Fieldwork and hydrologic analyses needed to determine 100-year floodplains and jurisdictional
44 water bodies would need to be coordinated with appropriate federal, state, and local agencies.
45 Areas within the Fourmile East SEZ that are found to be within a 100-year floodplain will be
46

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TABLE 10.3.9.1-1 Watershed and Water Management Basin Information Relevant to the Proposed Fourmile East SEZ as Revised

Basin	Name	Area (acres) ^a
Subregion (HUC4) ^b	Rio Grande Headwaters (1301)	4,871,764
Cataloging unit (HUC8)	San Luis (13010003)	1,021,562
Groundwater basin	San Luis Valley	2,000,000
SEZ	Fourmile East	2,883

^a To convert acres to km², multiply by 0.004047.

^b HUC = Hydrologic Unit Code; a USGS system for characterizing nested watersheds that includes large-scale subregions (HUC4) and small-scale cataloging units (HUC8).

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TABLE 10.3.9.1-2 Climate Station Information Relevant to the Proposed Fourmile East SEZ as Revised

Climate Station (COOP ID ^a)	Elevation ^b (ft) ^c	Distance to SEZ (mi) ^d	Period of Record	Mean Annual Precipitation (in./yr) ^e	Mean Annual Snowfall (in./yr)
Alamosa 2S, Colorado (050128)	7,533	14	2005–2011	7.07	28.80
Blanca, Colorado (050776)	7,750	8	1909–2010	8.56	24.30
Great Sand Dunes NM, Colorado (053541)	8,120	15	1950–2011	11.16	41.00
La Veta Pass, Colorado (054870)	9,245	25	1909–1954	21.60	150.10

^a National Weather Service’s Cooperative Station Network station identification code.

^b Surface elevations for the proposed Fourmile East SEZ range from 7,585 to 7,675 ft.

^c To convert ft to m, multiply by 0.3048.

^d To convert mi to km, multiply by 1.6093.

^e To convert in. to cm, multiply by 2.54.

Source: NOAA (2012).

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TABLE 10.3.9.1-3 Total Lengths of Selected Streams at the Subregion, Cataloging Unit, and SEZ Scale Relevant to the Proposed Fourmile East SEZ as Revised

Water Feature	Subregion, HUC4 (ft) ^a	Cataloging Unit, HUC8 (ft)	SEZ (ft)
Unclassified streams	19,502	12,089	0
Perennial streams	14,694,407	2,241,783	0
Intermittent/ephemeral streams	94,288,163	14,696,358	0
Canals	12,151,458	3,537,124	0

^a To convert ft to m, multiply by 0.3048.

Source: USGS (2012a).

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TABLE 10.3.9.1-4 Stream Discharge Information Relevant to the Proposed Fourmile East SEZ as Revised

Parameter	Station (USGS ID)		
	San Luis Creek near Poncha Pass, Colorado (08224110)	San Luis Creek above Villa Grove, Colorado (08224113)	Closed Basin Project Canal above Hwy 150 near Mosca, Colorado (373947105421101)
Period of record	1984–1986	1984–1986	2004–2011
No. of observations	16	17	73
Discharge, median (ft ³ /s) ^a	1.22	1.32	16.8
Discharge, range (ft ³ /s)	0.74–3.48	0.72–3.57	0.37–23.3
Discharge, most recent observation (ft ³ /s)	1.25	0.96	15
Distance to SEZ (mi) ^b	55	66	11

^a To convert ft³ to m³, multiply by 0.0283.

^b To convert mi to km, multiply by 1.6093.

Source: USGS (2012b).

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1 **TABLE 10.3.9.1-5 Surface Water Quality Data Relevant to the Proposed Fourmile East SEZ as Revised**

Parameter	Station (USGS ID) ^a					
	08224110	08224200	08224500	08226700	08227500	08234200
Period of record	1979–1984	1967–1970	1967–1981	1967–1970	1967–1981	1966–2000
No. of records	60	56	86	66	73	93
Temperature (°C) ^b	9.75 (0–28)	4.75 (0–10)	5.5 (0–21)	5.25 (0–12)	2 (0–13.5)	6.95 (0–15.3)
Total dissolved solids (mg/L)	NA ^c	38.5 (37–40)	202 (70–436)	175.5 (128–191)	59 (39–68)	122 (101–150)
Dissolved oxygen (mg/L)	NA	NA	6.6	NA	NA	8.25 (7.2–11.1)
pH	NA	7.2 (6.9–7.4)	6.7 (3.6–7.6)	7.65 (7.5–7.8)	7.15 (7.1–7.4)	8 (7.3–8.2)
Total nitrogen (mg/L)	NA	NA	NA	NA	NA	NA
Phosphorus (mg/L as P)	NA	NA	NA	NA	NA	NA
Organic carbon (mg/L)	NA	NA	NA	NA	NA	NA
Calcium (mg/L)	NA	8.2 (8–9.2)	39 (10–49)	39.5 (29–44)	17 (10–20)	24 (16.9–33)
Magnesium (mg/L)	NA	1.2 (1–2.2)	7.1 (2.7–15)	11.5 (9.2–13)	1.5 (1–2.4)	5.815 (4.41–7.3)
Sodium (mg/L)	NA	1.45 (1.4–1.7)	4.9 (2.4–7.2)	2.15 (1.2–2.8)	1.4 (0.7–1.9)	7.2 (5.8–9.6)
Chloride (mg/L)	NA	1.45 (0.8–1.8)	1.6 (0.9–2.6)	1.1 (0.9–2.3)	0.9 (0.8–1.1)	2.95 (1.5–3.7)
Sulfate (mg/L)	NA	5.5 (4.5–5.8)	125.5 (28–311)	56 (38–67)	4.6 (3.8–5.5)	10.85 (7.18–14)
Arsenic (mg/L)	NA	NA	NA	NA	NA	NA

^a Median values are listed; the range in values is shown in parentheses.

^b To convert °C to °F, multiply by 1.8, then add 32.

^c NA = no data collected for this parameter.

Source: USGS (2012b).

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TABLE 10.3.9.1-6 Water Quality Data from Groundwater Samples Relevant to the Proposed Fourmile East SEZ as Revised

Parameter	Station (USGS ID) ^a		
	372920105405601	373104105403801	373247105382301
Period of record	1979	1978	1979
No. of records	2	1	2
Temperature (°C) ^b	13.75 (11.5–16)	20.5	13.5
Total dissolved solids (mg/L)	44 (42–46)	94	74
Dissolved oxygen (mg/L)	NA ^c	NA	NA
pH	8.4 (8.3–8.5)	8.5	8.6
Nitrate + nitrite (mg/L as N)	0.23 (0.22–0.24)	0.02	0.13
Phosphate (mg/L)	NA	0.03	NA
Organic carbon (mg/L)	NA	2.8	NA
Calcium (mg/L)	16 (15–17)	18	14
Magnesium (mg/L)	1.35 (1.1–1.6)	1	0.5
Sodium (mg/L)	15.5 (15–16)	7.4	6.1
Chloride (mg/L)	2.2 (2.1–2.3)	1.3	2.2
Sulfate (mg/L)	12 (10–14)	7.3	1.1
Arsenic (mg/L)	3	2	NA

^a Median values listed.

^b To convert °C to °F, multiply by 1.8, then add 32.

^c NA = no data collected for this parameter.

Source: USGS (2012b).

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TABLE 10.3.9.1-7 Groundwater Surface Elevations Relevant to the Proposed Fourmile East SEZ as Revised

Parameter	Station (USGS ID)		
	372923105383501	372948105385202	373106105363401
Period of record	1976–2011	1982–2005	1980–2005
No. of observations	378	25	60
Surface elevation (ft) ^a	7,598	7,587	7,529
Well depth (ft)	50	113	80
Depth to water, median (ft)	28.03	22.68	47.8
Depth to water, range (ft)	20.5–32.6	14.36–25	41.64–50.75
Depth to water, most recent observation (ft)	32.57	25	50.75
Distance to SEZ (mi) ^b	2	2	1

^a To convert ft to m, multiply by 0.3048.

^b To convert mi to km, multiply by 1.6093.

Source: USGS (2012b).

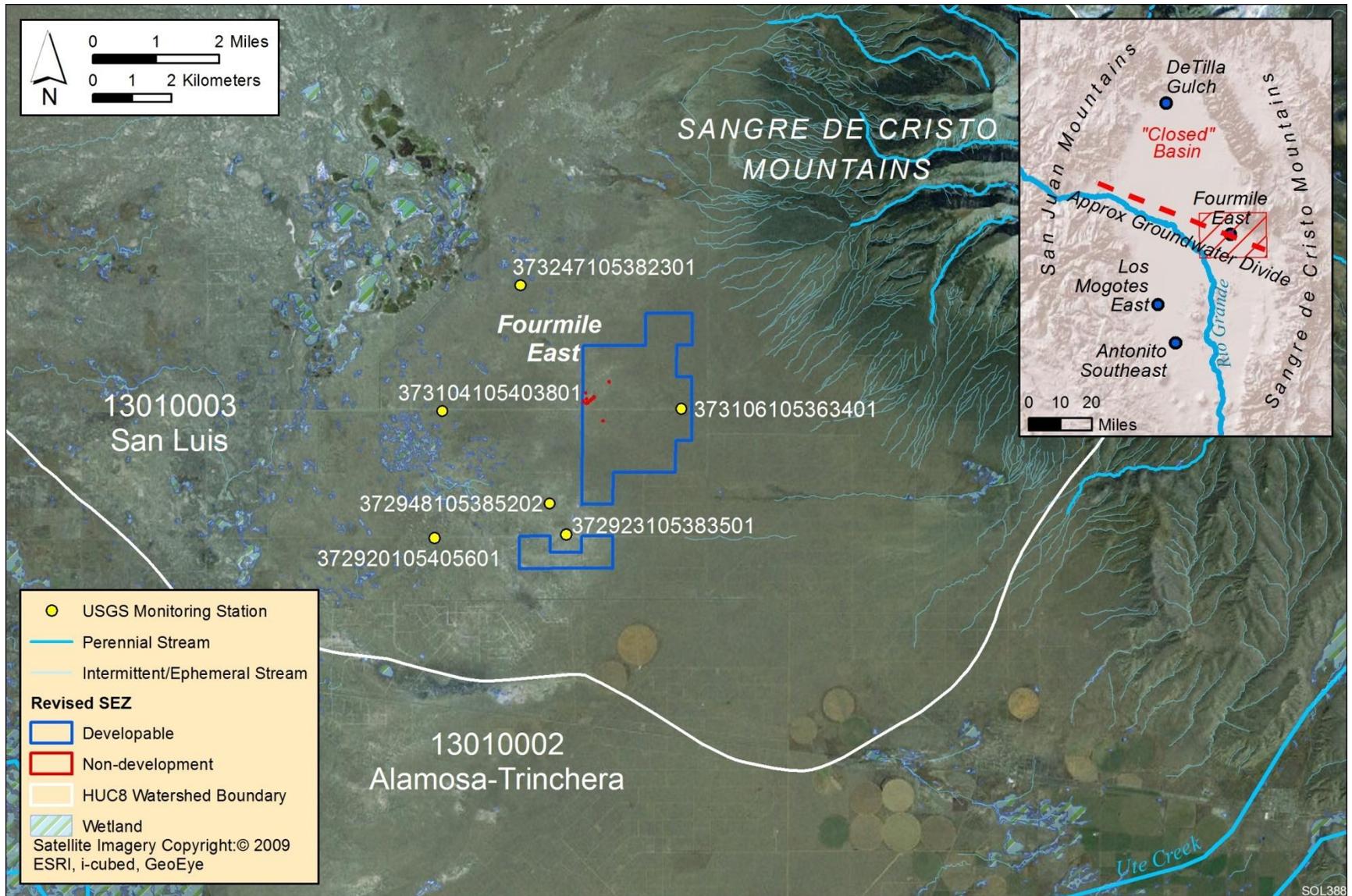


FIGURE 10.3.9.1-1 Water Features near the Proposed Fourmile East SEZ as Revised

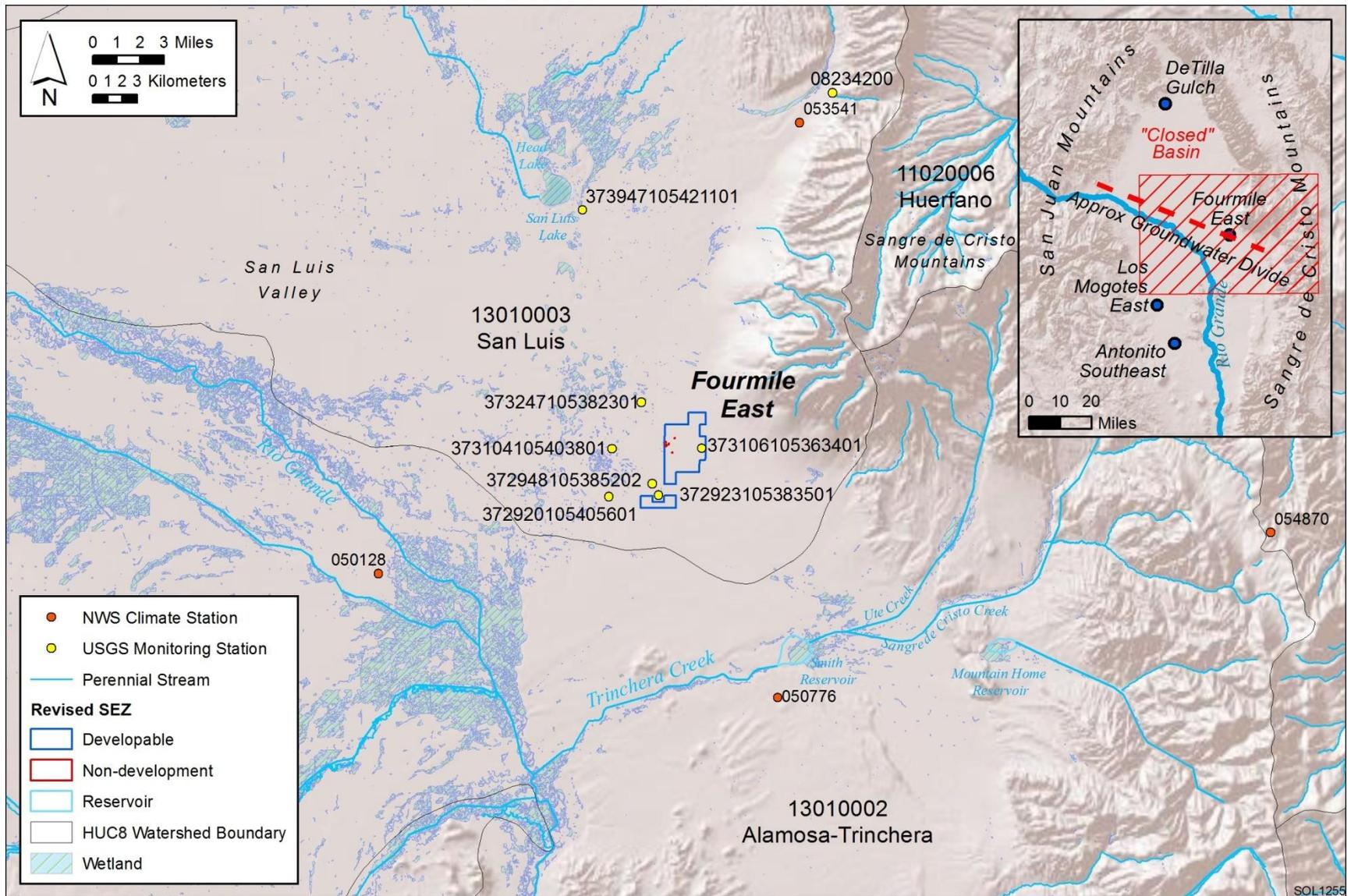


FIGURE 10.3.9.1-2 Water Features within the San Luis Watershed, Which Includes the Proposed Fourmile East SEZ as Revised

1 identified as non-development areas. Any water features within the Fourmile East SEZ
2 determined to be jurisdictional will be subject to the permitting process described in the CWA.
3
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5 **10.3.9.2 Impacts**

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8 ***10.3.9.2.1 Land Disturbance Impacts on Water Resources***

9

10 The discussion of land disturbance effects on water resources in the Draft Solar PEIS
11 remains valid. As stated in the Draft Solar PEIS, land disturbance impacts in the vicinity of
12 the proposed Fourmile East SEZ could potentially affect drainage patterns and groundwater
13 recharge. The alteration of natural drainage pathways during construction can lead to impacts
14 related to flooding, loss of water delivery to downstream regions, and alterations to riparian
15 vegetation and habitats.
16

17 Land clearing, land leveling, and vegetation removal during the development of the SEZ
18 have the potential to disrupt intermittent/ephemeral stream channels. Several programmatic
19 design features described in Section A.2.2 of Appendix A of this Final Solar PEIS would avoid,
20 minimize, and/or mitigate impacts associated with the disruption of intermittent/ephemeral water
21 features. Additional analyses of intermittent/ephemeral streams are presented in this update,
22 including an evaluation of functional aspects of stream channels with respect to groundwater
23 recharge, flood conveyance, sediment transport, geomorphology, and ecological habitats. Only
24 a summary of the results from these surface water analyses is presented in this section; more
25 information on methods and results is presented in Appendix O.
26

27 The study region considered for the intermittent/ephemeral stream evaluation relevant
28 to the Fourmile East SEZ is a subset of the San Luis watershed (HUC8), for which
29 information regarding stream channels is presented in Tables 10.3.9.1-3 and 10.3.9.1-4 of
30 this Final Solar PEIS. The results of the intermittent/ephemeral stream evaluation are shown
31 in Figure 10.3.9.2-1, which depicts flow lines from the National Hydrography Dataset
32 (USGS 2012a) labeled as low, moderate, and high sensitivity to land disturbance. Within the
33 study area, 12% of the intermittent/ephemeral stream channels had low sensitivity and 88% had
34 moderate sensitivity to land disturbance. No intermittent/ephemeral stream channels were
35 identified in the Fourmile East SEZ, but several stream reaches with moderate sensitivity to land
36 disturbance are located more than 1 mi (1.6 km) east of the SEZ, all of which drain the Sangre de
37 Cristo Mountains.
38
39

40 ***10.3.9.2.2 Water Use Requirements for Solar Energy Technologies***

41

42 Changes in the Fourmile East SEZ boundaries resulted in changes to the estimated water
43 use requirements and a reduction in the land affected by surface disturbances. This section
44 presents changes in water use estimates for the reduced SEZ area and additional analyses
45 pertaining to groundwater. The additional analyses of groundwater include a basin-scale water
46 budget and a simplified, one-dimensional groundwater model of potential groundwater

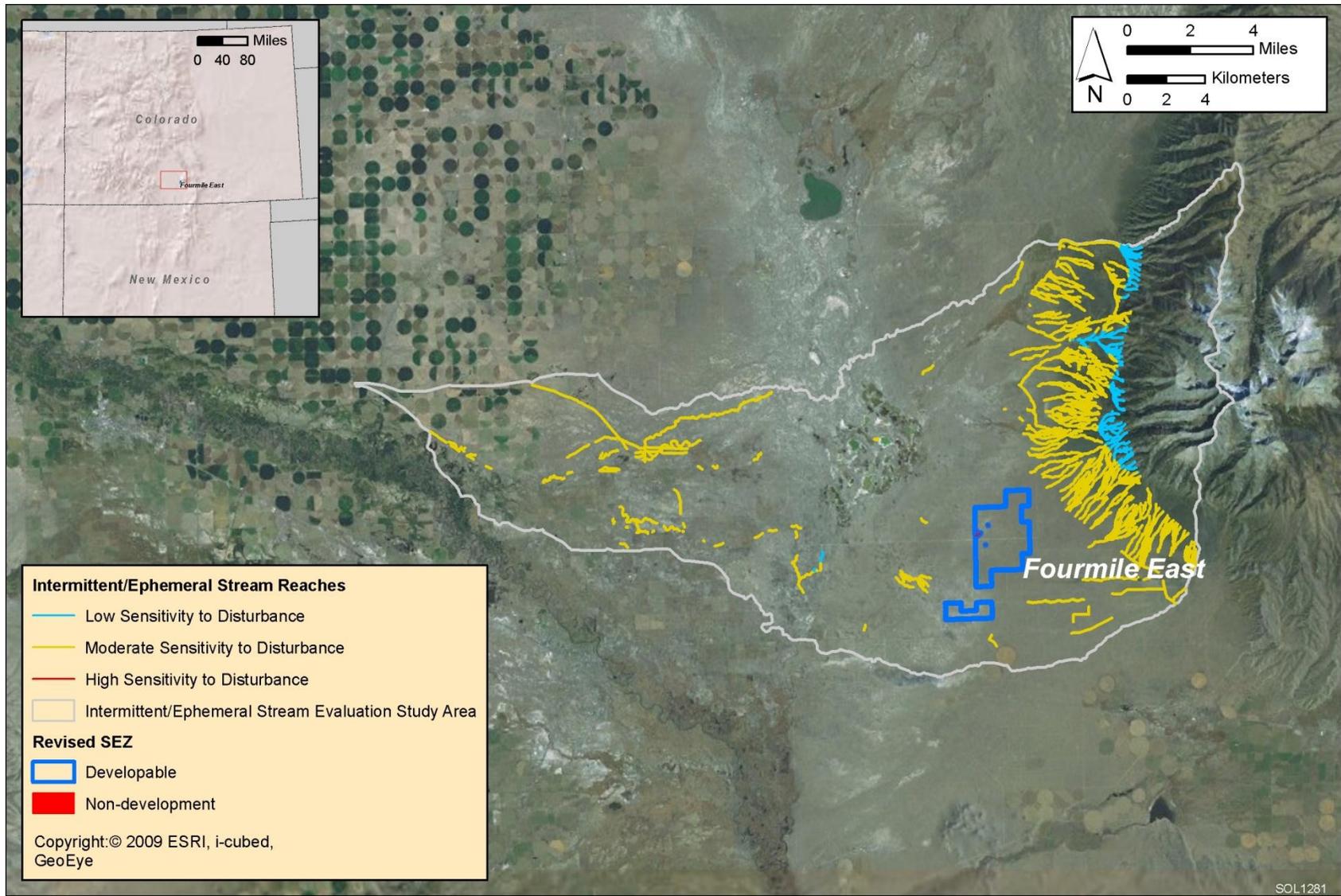


FIGURE 10.3.9.2-1 Intermittent/Ephemeral Stream Channel Sensitivity to Surface Disturbances in the Vicinity of the Proposed Fourmile East SEZ as Revised

drawdown. Only a summary of the results from these groundwater analyses is presented in this section; more information on methods and results is presented in Appendix O. Table 10.3.9.2-1 presents the revised estimates of water requirements for both construction and operation of solar facilities at the Fourmile East SEZ assuming full build-out of the SEZ and accounting for its decreased size.

The Fourmile East SEZ is located in the San Luis Valley, where both surface waters and groundwater are managed conjunctively. Previous studies on water resources in the San Luis Valley typically present a basin-scale water balance, which considers inputs and outputs of water via precipitation, surface water flows, and groundwater (e.g., Mayo et al. 2007). Table 10.3.9.2-2 presents an example water balance for the San Luis Valley that considers all water inputs and outputs from the valley. As noted by Mayo et al. (2007), it is difficult to

TABLE 10.3.9.2-1 Estimated Water Requirements for the Proposed Fourmile East SEZ as Revised^a

Activity	Parabolic Trough	Power Tower	Dish Engine	PV
Construction—Peak Year				
<i>Water use requirements</i>				
Fugitive dust control (ac-ft) ^b	612	706	706	706
Potable supply for workforce (ac-ft)	74	34	14	7
Total water use requirements (ac-ft)	686	740	720	713
<i>Wastewater generated</i>				
Sanitary wastewater (ac-ft)	74	34	14	7
Operations				
<i>Water use requirements</i>				
Mirror/panel washing (ac-ft/yr)	231	128	128	13
Potable supply for workforce (ac-ft/yr)	6	3	3	<1
Dry cooling (ac-ft/yr)	92–461	51–256	NA	NA
Wet cooling (ac-ft/yr)	2,075–6,686	1,153–3,715	NA	NA
<i>Total water use requirements</i>				
Non-cooled technologies (ac-ft/yr)	NA ^c	NA	131	13
Dry-cooled technologies (ac-ft/yr)	329–698	182–387	NA	NA
Wet-cooled technologies (ac-ft/yr)	2,312–6,923	1,284–3,846	NA	NA
<i>Wastewater generated</i>				
Blowdown (ac-ft/yr)	131	73	NA	NA
Sanitary wastewater (ac-ft/yr)	6	3	3	<1

^a See Section M.9.2 of Appendix M of the Draft Solar PEIS for methods used in estimating water use requirements.

^b To convert ac-ft to m³, multiply by 1,234.

^c NA = not applicable.

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TABLE 10.3.9.2-2 Water Budget for the San Luis Valley, Which Includes the Proposed Fourmile East SEZ as Revised

Process	Amount
<i>Inputs</i>	
Precipitation (ac-ft/yr) ^a	1,086,356
Streams draining Sangre de Cristo Mts. (ac-ft/yr)	214,839
Streams draining San Juan Mts. (ac-ft/yr)	1,321,463
Groundwater underflow (ac-ft/yr)	721,535
<i>Outputs</i>	
Evapotranspiration (ac-ft/yr)	2,245,676
Rio Grande discharge (ac-ft/yr)	332,392
Groundwater underflow (ac-ft/yr)	72,964
Groundwater pumping (ac-ft/yr) ^b	641,214
<i>Groundwater storage</i>	
Storage (ac-ft)	2,026,783

^a To convert ac-ft to m³, multiply by 1,234.

^b Colorado DWR (2004).

Source: Mayo et al. (2007).

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reconcile some of the historical water budget presented for the San Luis Valley; however, it can be generally stated that the water budget is predominately a balance of precipitation and streamflow inputs with output dominated by evapotranspiration by agricultural lands, riparian areas, and meadows.

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The estimated total water use requirements during the peak construction year are as high as 740 ac-ft/yr (912,800 m³/yr), which does not constitute a significant amount given the short duration of this water demand relative to water resources within the region. The long duration of groundwater pumping during operations (20 years) poses a greater threat to groundwater resources. This analysis considered low, medium, and high groundwater pumping scenarios that represent full build-out of the SEZ, assuming PV, dry-cooled parabolic trough, and wet-cooled parabolic trough, respectively (a 30% operational time was considered for all solar facility types on the basis of operations estimates for proposed utility-scale solar energy facilities). The low, medium, and high pumping scenarios result in groundwater withdrawals that range from 13 to 2,312 ac-ft/yr (16,000 to 2.8 million m³/yr) or 260 to 46,240 ac-ft (320,700 to 57 million m³) over the 20-year operational period. From a groundwater budgeting perspective, all pumping scenarios over the 20-year operational period represent less than 2% of the groundwater storage, and all annual pumping scenarios are less than 1% of the current withdrawals in the basin.

Examining groundwater withdrawals with respect to a basin-scale water budget allows for an assessment of potential impacts only to an order of magnitude approximation of basin-scale estimates of complex groundwater processes. In addition, a water budget approach ignores

1 the temporal and spatial components of how groundwater withdrawals affect groundwater
 2 surface elevations, groundwater flow rates, and connectivity to surface water features such as
 3 streams, wetlands, playas, and riparian vegetation. A one-dimensional groundwater modeling
 4 analysis was performed to present a simplified depiction of the spatial and temporal effects of
 5 groundwater withdrawals by examining groundwater drawdown in a radial direction around the
 6 center of the SEZ for the low, medium, and high pumping scenarios, considering pumping from
 7 the upper unconfined aquifer only. A detailed discussion of the groundwater modeling analysis is
 8 presented in Appendix O. It should be noted, however, that the aquifer parameters used for the
 9 one-dimensional groundwater model (Table 10.3.9.2-3) represent available literature data and
 10 that the model aggregates these value ranges into a simplistic representation of the aquifers.

11
 12 Depth to groundwater is typically on the order of 50 ft (15 m) below the surface in the
 13 vicinity of the Fourmile East SEZ. The one-dimensional groundwater modeling results for the
 14 upper unconfined aquifer suggest that groundwater drawdown in the vicinity of the SEZ
 15 (approximately a 2-mi [3.2-km] radius) ranges from up to 55 ft (17 m) for the high pumping
 16 scenario, up to 8 ft (2 m) for the medium pumping scenario, and less than 1 ft (0.3 m) for the
 17 low pumping scenario (Figure 10.3.9.2-2). The extent of groundwater drawdown is primarily

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 19
 20 **TABLE 10.3.9.2-3 Aquifer Characteristics and**
 21 **Assumptions Used in the One-Dimensional Groundwater**
 22 **Model for the Proposed Fourmile East SEZ as Revised**

Parameter	Value
<i>Upper, unconfined aquifer</i>	
Aquifer type/conditions	Unconfined/basin fill
Aquifer thickness (ft) ^a	125
Hydraulic conductivity (ft/day)	50
Transmissivity (ft ² /day)	6,250
Specific yield	0.15
<i>Lower, confined aquifer</i>	
Aquifer type/conditions	Confined/basin fill
Aquifer thickness (ft)	500
Hydraulic conductivity (ft/day)	15
Transmissivity (ft ² /day)	7,500
<i>Upper and lower aquifers</i>	
Storage coefficient	0.0000025
Analysis period (yr)	20
High pumping scenario (ac-ft/yr) ^b	2,312
Medium pumping scenario (ac-ft/yr)	329
Low pumping scenario (ac-ft/yr)	13

^a To convert ft to m, multiply by 0.3048.

^b To convert ac-ft to m³, multiply by 1,234.

Source: Colorado DWR (2004).

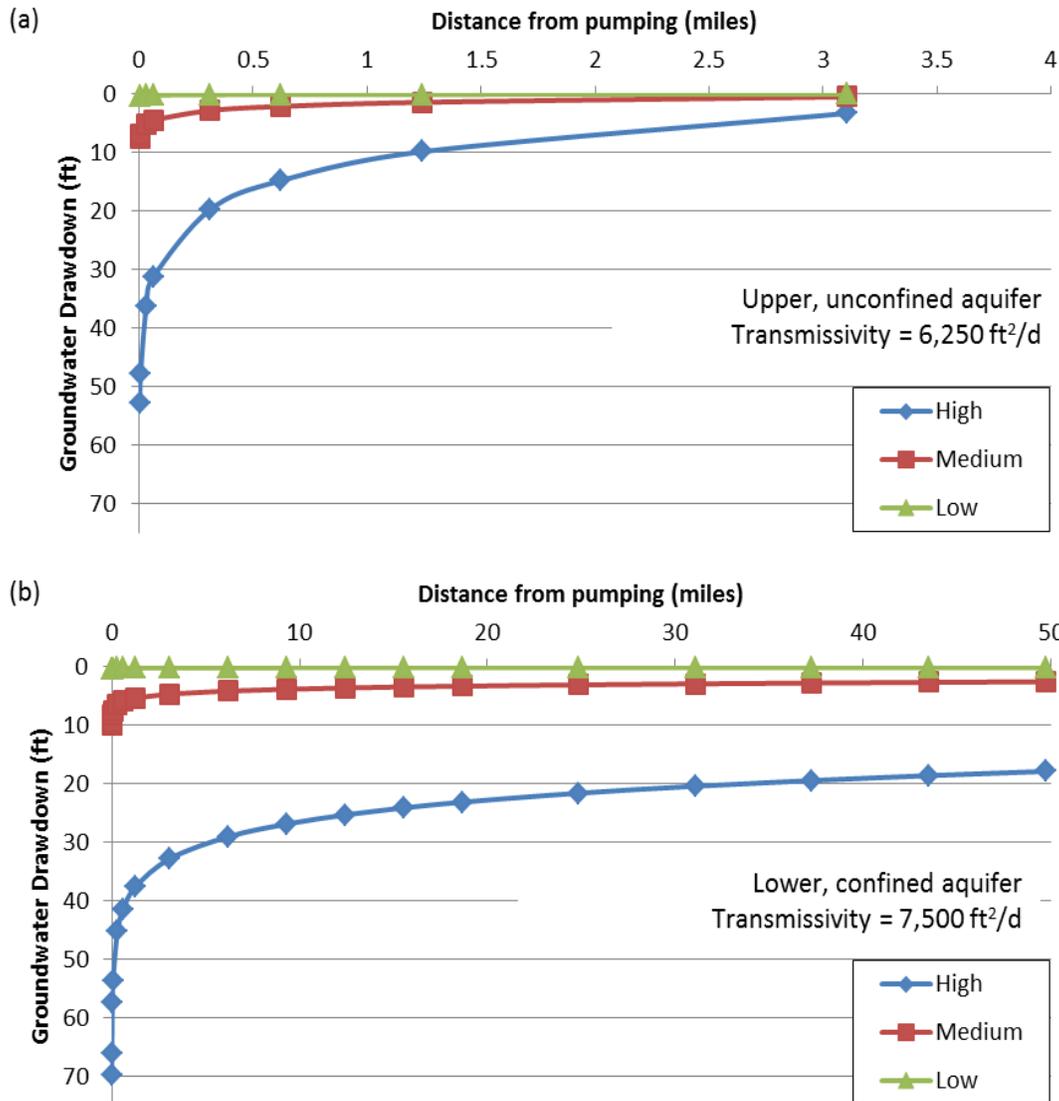


FIGURE 10.3.9.2-2 Estimated One-Dimensional Groundwater Drawdown in (a) Upper Unconfined Aquifer and (b) Lower Confined Aquifer Resulting from High, Medium, and Low Groundwater Pumping Scenarios over the 20-Year Operational Period at the Proposed Fourmile East SEZ as Revised

restricted to the vicinity of the SEZ for all pumping scenarios. The modeling results for the lower confined aquifer suggest significant groundwater drawdown for the high pumping scenario, ranging from 20 to 70 ft (6 to 21 m) and extending more than 50 mi (80 km) from the SEZ (Figure 10.3.9.2-2). The low and medium pumping scenarios have a much lower impact on groundwater drawdown, from 0 to 10 ft (0 to 3 m).

The comparison of water use requirements to the basin-scale water budget and the one-dimensional groundwater modeling gives mixed results. From a groundwater budgeting perspective, the three pumping scenarios considered are not significant relative to the amounts

1 of water moved through the San Luis Valley. Groundwater modeling results suggest that the
2 high pumping scenario would have a localized groundwater drawdown effect if groundwater
3 were extracted from the unconfined aquifer, but a more significant impact extending more
4 than 50 mi (80 km) away from the SEZ if withdrawn from the confined aquifer. As stated
5 in Section 10.3.9.1, water management of the San Luis Valley is restrictive given its
6 overappropriated water rights and its obligations to maintain flows in the Rio Grande.
7 Ultimately, any proposed groundwater withdrawals for solar energy facilities would be reviewed
8 for impacts by the Colorado DWR and would be subject to the rules and court decisions outlined
9 in Case Numbers 06CV64 and 07CW52 (Colorado District Court 2010).

10.3.9.2.3 *Off-Site Impacts: Roads and Transmission Lines*

14 As stated in the Draft Solar PEIS, impacts associated with the construction of roads and
15 transmission lines primarily deal with water use demands for construction, water quality
16 concerns relating to potential chemical spills, and land disturbance effects on the natural
17 hydrology. Water needed for transmission line construction activities (e.g., for soil compaction,
18 dust suppression, and potable supply for workers) could be trucked to the construction area from
19 an off-site source. If this occurred, water use impacts at the SEZ would be negligible. The Draft
20 Solar PEIS assessment of impacts on water resources from road and transmission line
21 construction remains valid.

10.3.9.2.4 *Summary of Impacts on Water Resources*

26 The additional information and analyses of water resources presented in this update agree
27 with the information provided in the Draft Solar PEIS, which indicates that the San Luis Valley
28 is a high-elevation basin, with predominantly agricultural land use, and is the headwaters of the
29 Rio Grande, where surface water and groundwater processes are coupled and managed jointly.
30 Groundwater in the San Luis Valley is found in both the upper unconfined aquifer and the lower
31 confined aquifer, and historical diversions of both surface water and groundwater for irrigation
32 have affected streamflows and groundwater levels. Water management plays a significant role
33 in the San Luis Valley, because it pertains to ensuring river flows in the Rio Grande according to
34 the Rio Grande Compact, which is the primary responsibility of the Colorado DWR.

36 Disturbance to intermittent/ephemeral stream channels within the Fourmile East SEZ
37 should not have a significant impact on the critical functions of groundwater recharge, sediment
38 transport, flood conveyance, and ecological habitat, given the relatively small footprint of the
39 SEZ with respect to the study area and the absence of stream channels within the SEZ.
40 Groundwater withdrawals pose the greatest threat to water resources in the San Luis Valley.
41 The water budgeting and groundwater modeling analyses suggest that significant groundwater
42 drawdown could occur both locally and off-site under the high pumping scenario if groundwater
43 were extracted from either the unconfined or confined aquifer. The low and medium pumping
44 scenarios are preferable because their estimated groundwater drawdown is much less.
45 Ultimately, the process of transferring water rights established by the Colorado DWR will
46 determine how much water can be used by proposed solar facilities. As stated in the Draft Solar

1 PEIS, given the restrictive nature of water rights and the need for augmentation water reserves, it
2 would be difficult for any projects seeking more than 1,000 ac-ft/yr (1.2 million m³/yr) of water
3 to be successful in obtaining the needed water rights (McDermott 2010).
4

5 Predicting impacts associated with groundwater withdrawal is often difficult, given the
6 heterogeneity of aquifer characteristics, the long time period between the onset of pumping and
7 its effects, and limited data. Another consideration relevant to the San Luis Valley is that the
8 transfer of water rights will likely come from the purchase of existing irrigation water rights,
9 which will result in a change in the location of the point of diversion and a change in land use
10 patterns in the basin, both of which can affect groundwater processes. One of the primary
11 mitigation measures to protect water resources is the implementation of long-term monitoring
12 and adaptive management (see Section A.2.4 of Appendix A). For groundwater, this requires a
13 combination of monitoring and modeling to fully identify the temporal and spatial extent of
14 potential impacts. Water management in the San Luis Valley relies on several water monitoring
15 and modeling tools developed by the Colorado DWR and the CWCB that are a part of the
16 Colorado's Decision Support Systems (available at [http://cdss.state.co.us/Pages/
17 CDSHome.aspx](http://cdss.state.co.us/Pages/CDSHome.aspx)), and these tools should be implemented with respect to long-term monitoring
18 and adaptive management strategies for solar energy development occurring within the San Luis
19 Valley.
20

21 22 **10.3.9.3 SEZ-Specific Design Features and Design Feature Effectiveness** 23

24 Required programmatic design features that would reduce impacts on surface water
25 and groundwater are described in Section A.2.2 of Appendix A of this Final Solar PEIS.
26 Implementing the programmatic design features will provide some protection of and reduce
27 impacts on water resources.
28

29 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
30 analyses, and consideration of comments received as applicable, the following SEZ-specific
31 design feature for water resources has been identified:
32

- 33 • Groundwater analyses suggest full build-out of wet-cooled technologies is not
34 feasible; for mixed-technology development scenarios, any proposed wet-
35 cooled projects would have to reduce water requirements to less than
36 approximately 1,000 ac-ft/yr (1.2 million m³/yr) in order to secure water
37 rights and comply with water management in the San Luis Valley.
38

39 The need for additional SEZ-specific design features will be identified through the process
40 of preparing parcels for competitive offer and subsequent project-specific analysis.
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1 **10.3.10 Vegetation**

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4 **10.3.10.1 Affected Environment**

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6 Revisions to the boundaries of the proposed Fourmile East SEZ have eliminated several
7 wetlands mapped by the NWI and a playa in the southwestern portion of the SEZ. In addition,
8 several NWI-mapped wetland areas within the west-central portion of the SEZ, with a total of
9 about 1 acre (0.004 km²), were identified as non-development areas in the Supplement to the
10 Draft Solar PEIS.

11
12 As presented in Section 10.3.10.1 of the Draft Solar PEIS, 5 cover types were identified
13 within the area of the proposed Fourmile East SEZ, while 35 cover types were identified in the
14 area of indirect effects, including the previously assumed transmission line corridor and within
15 5 mi (8 km) of the SEZ boundary. For this updated assessment, a specifically located
16 hypothetical transmission line is no longer being assumed (see Section 10.3.23 for an updated
17 transmission assessment for this SEZ). Sensitive habitats on the SEZ include wetlands, sand
18 dunes, ephemeral washes, and playas. Because of the SEZ boundary changes, the Inter-Mountain
19 Basins Playa cover type no longer occurs within the SEZ. Figure 10.3.10.1-1 shows the cover
20 types within the affected area of the Fourmile East SEZ as revised.

21
22
23 **10.3.10.2 Impacts**

24
25 As presented the Draft Solar PEIS, the construction of solar energy facilities within the
26 proposed Fourmile East SEZ would result in direct impacts on plant communities because of
27 the removal of vegetation within the facility footprint during land-clearing and land-grading
28 operations. Approximately 80% of the SEZ would be expected to be cleared with full
29 development of the SEZ. As a result of the new configuration of the SEZ boundary,
30 approximately 2,306 acres (9.3 km²) would be cleared.

31
32 Overall impact magnitude categories were based on professional judgment and include
33 (1) *small*: a relatively small proportion ($\leq 1\%$) of the cover type within the SEZ region would be
34 lost; (2) *moderate*: an intermediate proportion (> 1 but $\leq 10\%$) of a cover type would be lost; and
35 (3) *large*: $> 10\%$ of a cover type would be lost.

36
37
38 **10.3.10.2.1 Impacts on Native Species**

39
40 The analysis presented in the Draft Solar PEIS for the original Fourmile East SEZ
41 developable area indicated that development would result in a small impact on all land cover
42 types occurring within the SEZ (Table 10.3.10.1-1 in the Draft Solar PEIS). Development within
43 the Fourmile East SEZ could still directly affect most of the cover types evaluated in the Draft
44 Solar PEIS, with the exception of Inter-Mountain Basins Playa; the reduction in the developable
45 area would result in reduced (and still small) impact levels on all cover types in the affected area,
46 compared to original estimates in the Draft Solar PEIS.

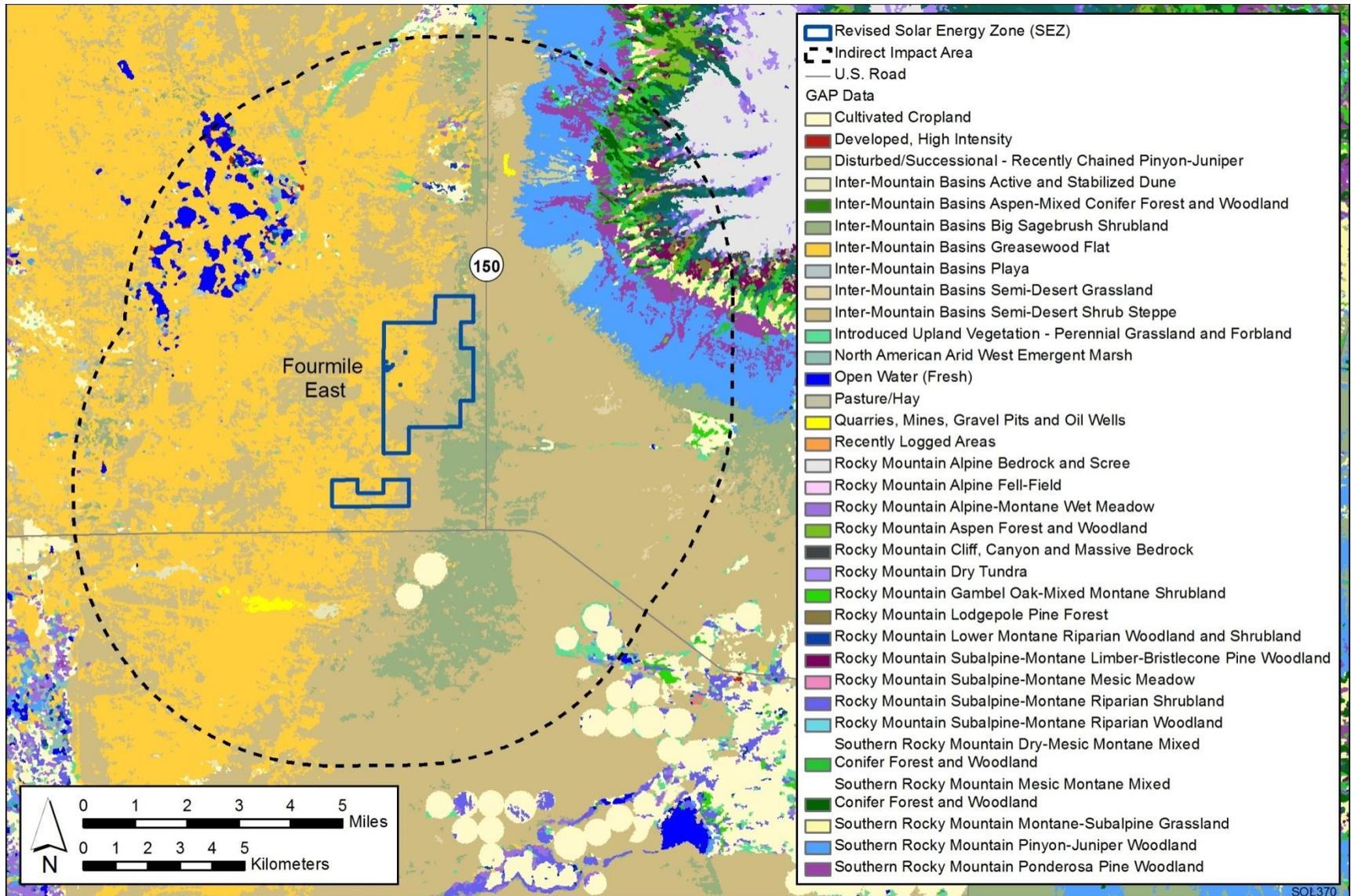


FIGURE 10.3.10.1-1 Land Cover Types within the Proposed Fourmile East SEZ as Revised

1 Direct impacts on the NWI-mapped wetlands that occur within the excluded and
2 non-developable portions of the SEZ or in the previously identified transmission corridor would
3 not occur. However, direct impacts on unmapped wetlands within the remaining developable
4 areas of the SEZ could still occur. In addition, indirect impacts on wetlands within or near the
5 SEZ, as described in the Draft Solar PEIS, could occur.
6
7

8 ***10.3.10.2 Impacts from Noxious Weeds and Invasive Plant Species*** 9

10 As presented in the Draft Solar PEIS, land disturbance from project activities and indirect
11 effects of construction and operation within the Fourmile East SEZ could potentially result in the
12 establishment or expansion of noxious weeds and invasive species populations, potentially
13 including those species listed in Section 10.3.10.1 in the Draft Solar PEIS. Impacts such as
14 reduced restoration success and possible widespread habitat degradation could still occur;
15 however, a small reduction in the potential for such impacts would result from the reduced
16 developable area of the SEZ.
17
18

19 **10.3.10.3 SEZ-Specific Design Features and Design Feature Effectiveness** 20

21 Required programmatic design features are described in Section A.2.2 of Appendix A
22 of this Final Solar PEIS. SEZ-specific species and habitats will determine how programmatic
23 design features are applied, for example:
24

- 25 • All wetland, playa, dry wash, and sand dune habitats and sand transport areas,
26 within the Fourmile East SEZ shall be avoided to the extent practicable, and
27 any impacts shall be minimized and mitigated in consultation with appropriate
28 agencies. A buffer area shall be maintained around wetlands and dry washes
29 to reduce the potential for impacts on these habitats on or near the SEZ.
30
- 31 • Appropriate engineering controls shall be used to minimize impacts on
32 wetland, playa, dry wash, and riparian habitats, including downstream
33 occurrences, resulting from surface water runoff, erosion, sedimentation,
34 altered hydrology, accidental spills, or fugitive dust deposition to these
35 habitats. Appropriate buffers and engineering controls will be determined
36 through agency consultation.
37
- 38 • Groundwater withdrawals shall be limited to reduce the potential for indirect
39 impacts on wetland habitats or springs that are associated with groundwater
40 discharge, such as the Blanca wetlands.
41

42 It is anticipated that implementation of these programmatic design features will reduce a
43 high potential for impacts from invasive species and impacts on wetlands, sand dunes, playas,
44 springs, dry washes, and riparian habitats to a minimal potential for impact. Residual impacts on
45 wetlands could result from remaining groundwater withdrawal and the like; however, it is
46 anticipated that these impacts would be avoided in the majority of instances.

1 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
2 analyses due to changes to the SEZ boundaries, and consideration of comments received as
3 applicable, no SEZ-specific design features for vegetation in the proposed Fourmile East SEZ
4 have been identified. Some SEZ-specific design features may be identified through the process
5 of preparing parcels for competitive offer and subsequent project-specific analysis.
6
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8 **10.3.11 Wildlife and Aquatic Biota**

9

10 For the assessment of potential impacts on wildlife and aquatic biota, overall impact
11 magnitude categories were based on professional judgment and include (1) *small*: a
12 relatively small proportion ($\leq 1\%$) of the species' habitat within the SEZ region would be lost;
13 (2) *moderate*: an intermediate proportion (> 1 but $\leq 10\%$) of the species' habitat would be lost;
14 and (3) *large*: $> 10\%$ of the species' habitat would be lost.
15
16

17 **10.3.11.1 Amphibians and Reptiles**

18
19

20 ***10.3.11.1.1 Affected Environment***

21

22 As presented in the Draft Solar PEIS, amphibian and reptile species expected to occur
23 within the SEZ include the Great Plains toad (*Bufo cognatus*), Woodhouse's toad (*Bufo*
24 *woodhousii*), fence lizard (*Sceloporus undulatus*), gopher snake (*Pituophis catenifer*), western
25 rattlesnake (*Crotalus viridis*), short-horned lizard (*Phrynosoma hernandesi*), and western
26 terrestrial garter snake (*Thamnophis elegans*). The reduction in the size of the Fourmile East
27 SEZ does not alter the potential for these species to occur in the affected area.
28
29

30 ***10.3.11.1.2 Impacts***

31

32 As presented in the Draft Solar PEIS, solar energy development within the Fourmile East
33 SEZ could affect potentially suitable habitats for several amphibian and reptile species. The
34 analysis presented in the Draft Solar PEIS for the original Fourmile East SEZ boundaries
35 indicated that development would result in a small overall impact on representative amphibian
36 and reptile species (Table 10.3.11.1-1 in the Draft Solar PEIS). Development within the revised
37 boundaries of the Fourmile East SEZ could still affect the same species evaluated in the Draft
38 Solar PEIS; however, the reduction in the developable area would result in reduced (and still
39 small) impact levels compared to original estimates in the Draft Solar PEIS.
40
41

42 ***10.3.11.1.3 SEZ-Specific Design Features and Design Feature Effectiveness***

43

44 Required programmatic design features that will reduce impacts on amphibian and reptile
45 species are described in Section A.2.2 of Appendix A of this Final Solar PEIS. SEZ-specific
46 species and habitats will determine how programmatic design features are applied, for example:

- Appropriate engineering controls shall be used to minimize impacts on the washes that drain off of the Sangre de Cristo Mountains and on Smith Reservoir resulting from surface water runoff, erosion, sedimentation, accidental spills, or fugitive dust deposition to these habitats.

With the implementation of required programmatic design features, impacts on amphibian and reptile species would be small.

Because of the changes to the SEZ boundaries, the SEZ-specific design feature identified in Section 11.3.11.1.3 of the Draft Solar PEIS (i.e., wetland habitats should be avoided) is no longer applicable. On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those analyses due to changes to the SEZ boundaries, and consideration of comments received as applicable, no SEZ-specific design features for amphibian and reptile species in the proposed Fourmile East SEZ have been identified. Some SEZ-specific design features may be identified through the process of preparing parcels for competitive offer and subsequent project-specific analysis.

10.3.11.2 Birds

10.3.11.2.1 Affected Environment

As presented in the Draft Solar PEIS, a large number of bird species could occur or have potentially suitable habitat within the affected area of the proposed Fourmile East SEZ. Representative bird species identified in the Draft Solar PEIS included Brewer's blackbird (*Euphagus cyanocephalus*), Brewer's sparrow (*Spizella breweri*), common nighthawk (*Chordeiles minor*), horned lark (*Eremophila alpestris*), vesper sparrow (*Pooecetes gramineus*), western meadowlark (*Sturnella neglecta*), American kestrel (*Falco sparverius*), golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), short-eared owl (*Asio flammeus*), Swainson's hawk (*Buteo swainsoni*), and mourning dove (*Zenaida macroura*). The reduction in the size of the Fourmile East SEZ does not alter the potential for these species or other bird species to occur in the affected area.

10.3.11.2.2 Impacts

As presented in the Draft Solar PEIS, solar energy development within the Fourmile East SEZ could affect potentially suitable habitats of bird species. The analysis presented in the Draft Solar PES for the original Fourmile East SEZ boundaries indicated that development would result in a small overall impact on the representative bird species (Table 10.3.11.2-1 in the Draft Solar PEIS). Development within the revised boundaries of the Fourmile East SEZ could still affect the same species evaluated in the Draft Solar PEIS; however, the reduction in the developable area would result in reduced (and still small) impact levels compared to original estimates in the Draft Solar PEIS.

1 **10.3.11.2.3 SEZ-Specific Design Features and Design Feature Effectiveness**
2

3 Required programmatic design features that would reduce impacts on bird species are
4 described in Section A.2.2 of Appendix A of this Final Solar PEIS. SEZ-specific species and
5 habitats will determine how programmatic design features are applied, for example:
6

- 7 • Appropriate engineering controls shall be used to minimize impacts resulting
8 from surface water runoff, erosion, sedimentation, accidental spills, or fugitive
9 dust deposition.
10
11 • If present, prairie dog colonies (which could provide habitat or a food source
12 for some raptor species) shall be avoided to the extent practicable.
13

14 If these programmatic design features are implemented, impacts on bird species will be
15 reduced.
16

17 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
18 analyses due to changes to the SEZ boundaries, and consideration of comments received as
19 applicable, the following SEZ-specific design feature for birds has been identified:
20

- 21 • If present, prairie dog colonies (which could provide habitat or a food source
22 for some raptor species) should be avoided to the extent practicable.
23

24 If SEZ-specific design features are implemented in addition to required programmatic
25 design features, it is anticipated that impacts on bird species would be small. The need for
26 additional SEZ-specific design features will be identified through the process of preparing
27 parcels for competitive offer and subsequent project-specific analysis.
28
29

30 **10.3.11.3 Mammals**
31

32 **10.3.11.3.1 Affected Environment**
33

34 As presented in the Draft Solar PEIS, a large number of mammal species were identified
35 that could occur or have potentially suitable habitat within the affected area of the proposed
36 Fourmile East SEZ. Representative mammal species identified in the Draft Solar PEIS included
37 Fourmile East SEZ. Representative mammal species identified in the Draft Solar PEIS included
38 (1) big game species: the American black bear (*Ursus americanus*), bighorn sheep (*Ovis*
39 *canadensis*), cougar (*Puma concolor*), elk (*Cervis canadensis*), mule deer (*Odocoileus*
40 *hemionus*), and pronghorn (*Antilocapra americana*); (2) furbearers and small game species:
41 the American badger (*Taxidea taxus*), coyote (*Canis latrans*), desert cottontail (*Sylvilagus*
42 *audubonii*), red fox (*Vulpes vulpes*), striped skunk (*Mephitis mephitis*), and white-tailed
43 jackrabbit (*Lepus townsendii*); and (3) small nongame species: the big brown bat (*Eptesicus*
44 *fuscus*), deer mouse (*Peromyscus maniculatus*), least chipmunk (*Tamias minimus*), little brown
45 myotis (*Myotis lucifugus*), northern pocket gopher (*Thomomys talpoides*), Ord's kangaroo rat
46 (*Dipodomys ordii*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), and western

1 small-footed myotis (*Myotis ciliolabrum*). The reduction in the size of the Fourmile East SEZ
2 does not alter the potential for these species or any additional mammal species to occur in the
3 affected area.
4

6 ***10.3.11.3.2 Impacts***

7

8 As presented in the Draft Solar PEIS, solar energy development within the Fourmile East
9 SEZ could affect potentially suitable habitats of mammal species. The analysis presented in the
10 Draft Solar PEIS for the original Fourmile East SEZ boundaries indicated that development
11 would result in a small overall impact on all representative mammal species analyzed
12 (Table 10.3.11.3-1 in the Draft Solar PEIS). Development within the revised boundaries for the
13 Fourmile East SEZ could still affect the same representative mammal species evaluated in the
14 Draft Solar PEIS; however, the reduction in the developable area would result in reduced (and
15 still small) impact levels compared to original estimates in the Draft Solar PEIS. The 213-acre
16 (0.9-km²) portion of the SEZ that overlapped elk summer range for the original Fourmile East
17 SEZ configuration is largely excluded from the revised SEZ.
18

20 ***10.3.11.3.3 SEZ-Specific Design Features and Design Feature Effectiveness***

21

22 Required programmatic design features are described in Section A.2.2 of Appendix A
23 of this Final Solar PEIS. SEZ-specific species and habitats will determine how programmatic
24 design features are applied, for example:
25

- 26 • Pre-disturbance surveys shall be conducted within the SEZ to determine the
27 use of the SEZ as a movement or migratory corridor or as important habitat
28 for elk, mule deer, and pronghorn. If such use is identified, mitigation using
29 spatial strategies, temporal strategies, or both shall be developed in
30 coordination with appropriate federal or state agencies.
31
- 32 • Prairie dog colonies shall be avoided to the extent practicable to reduce
33 impacts on species such as desert cottontail and thirteen-lined ground squirrel.
34

35 If the programmatic design features are implemented, impacts on mammal species will be
36 reduced. On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
37 analyses due to changes to the SEZ boundaries, and consideration of comments received as
38 applicable, the following SEZ-specific design features have been identified:
39

- 40 • To the extent practicable, construction activities should be avoided while
41 pronghorn are on their winter range within the immediate area of the proposed
42 Fourmile East SEZ.
43
- 44 • Prairie dog colonies should be avoided to the extent practicable to reduce
45 impacts on species such as desert cottontail and thirteen-lined ground squirrel.
46

1 If SEZ-specific design features are implemented in addition to required programmatic
2 design features, impacts on mammal species would be small. The need for additional SEZ-
3 specific design features will be identified through the process of preparing parcels for
4 competitive offer and subsequent project-specific analysis.
5
6

7 **10.3.11.4 Aquatic Biota**

8
9

10 ***10.3.11.4.1 Affected Environment***

11

12 There are no permanent water bodies or perennial streams within the boundaries of the
13 Fourmile East SEZ or the area of indirect effects. A number of ephemeral washes pass through
14 the SEZ that do not extend directly to nearby perennial streams. The boundaries of the Fourmile
15 East SEZ have been reduced compared to the boundaries given in the Draft Solar PEIS. Based on
16 these changes, updates to the Draft Solar PEIS include the following:
17

- 18 • Outside of the indirect effects area, but within 50 mi (80 km) of the SEZ, there
19 are approximately 967 mi (1,556 km) of perennial streams, 47 mi (76 km) of
20 intermittent streams, and 192 mi (309 km) of canals.
21
- 22 • There are approximately 6,463 acres (26.1 km²) of lake and reservoir habitat
23 within 50 mi (80 km) of the SEZ.
24
- 25 • Wetlands within the SEZ have been identified as non-development areas.
26
- 27 • The route of a new transmission line described in the Draft Solar PEIS is no
28 longer assumed.
29

30 Aquatic biota present in the SEZ have not been characterized. As stated in Appendix C
31 of the Supplement to the Draft Solar PEIS, site surveys can be conducted at the project-specific
32 level to characterize the aquatic biota, if present, in wetlands within the SEZ.
33
34

35 ***10.3.11.4.2 Impacts***

36

37 The types of impacts on aquatic habitats and biota that could occur from development
38 of utility-scale solar energy facilities are discussed in Section 5.10.3 of the Draft Solar PEIS and
39 this Final Solar PEIS. Aquatic habitats, including wetland areas, present on or near the Fourmile
40 East SEZ could be affected by solar energy development in a number of ways, including
41 (1) direct disturbance, (2) deposition of sediments, (3) changes in water quantity, and
42 (4) degradation of water quality. The impact assessment provided in the Draft Solar PEIS
43 remains valid, with the following updates:
44

- The amount of surface water features within the SEZ and in the area of indirect effects that could potentially be affected by solar energy development is less because the size of the SEZ has been reduced.
- The small emergent wetlands located along the western edge of the SEZ have been identified as non-development areas; therefore, construction activities would not directly affect wetlands. However, as described in the Draft Solar PEIS, the wetlands could be affected indirectly by solar development activities within the SEZ. The amount of aquatic habitat provided by the wetlands within the Fourmile East SEZ is less than 1% of total wetland surface area in the 50-mi (80-km) SEZ region. Consequently, the potential impacts on populations of aquatic biota from direct alteration would be small.

10.3.11.4.3 SEZ-Specific Design Features and Design Feature Effectiveness

Required programmatic design features applicable to aquatic species are described in Section A.2.2 of Appendix A of this Final Solar PEIS. SEZ-specific resources and conditions will determine how programmatic design features are applied, for example:

- Undisturbed buffer areas and sediment and erosion controls shall be maintained around the wetlands along the western boundary of the SEZ.
- Development shall avoid any additional wetlands identified during future site-specific fieldwork.
- The use of heavy machinery and pesticides shall be avoided within the immediate catchment basins for the wetlands along the western boundary of the SEZ.

It is anticipated that implementation of the programmatic design features will reduce impacts on aquatic biota, and if the utilization of water from groundwater or surface water sources is adequately controlled to maintain sufficient water levels in nearby aquatic habitats, the potential impacts on aquatic biota from solar energy development at the Fourmile East SEZ would be small.

On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those analyses due to changes to the SEZ boundaries, and consideration of comments received as applicable, no SEZ-specific design features for water resources have been identified. Some SEZ-specific design features may be identified through the process of preparing parcels for competitive offer and subsequent project-specific analysis.

1 **10.3.12 Special Status Species**

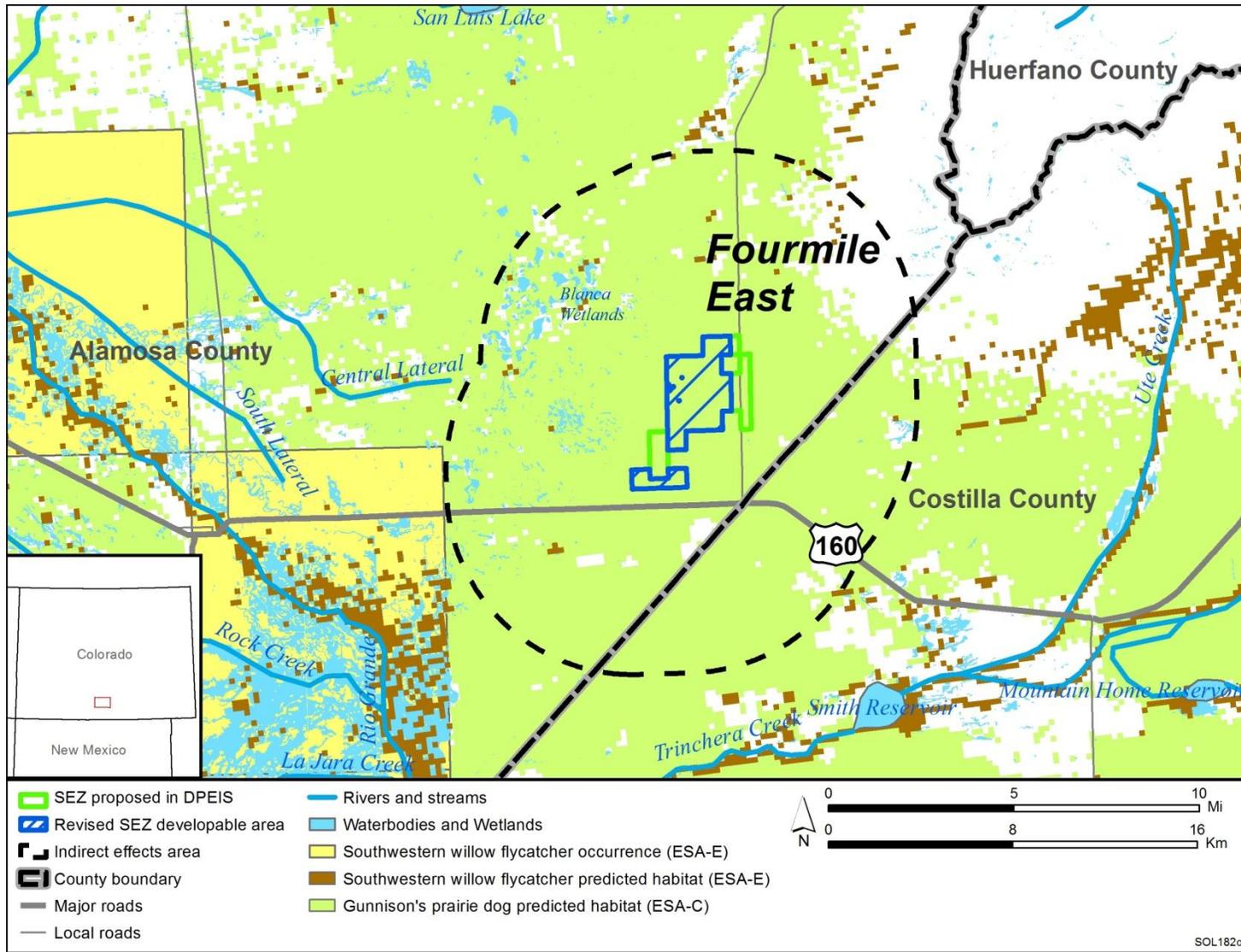
2
3
4 **10.3.12.1 Affected Environment**

5
6 As presented in the Draft Solar PEIS, 59 special status species were identified that could
7 occur or have potentially suitable habitat within the affected area of the proposed Fourmile East
8 SEZ. The reduction in the size of the Fourmile East SEZ does not alter the potential for these
9 species or any additional special status species to occur in the affected area. However, field
10 surveys conducted for the BLM following the publication of the Draft Solar PEIS have indicated
11 that one additional special status bat species could occur in the SEZ affected area—the fringed
12 myotis (*Myotis thysanodes*). Figure 10.3.12.1-1 shows the known or potential occurrences of
13 species in the affected area of the revised Fourmile East SEZ that are listed, proposed, or
14 candidates for listing under the ESA.

15
16 Following the publication of the Draft Solar PEIS, the BLM conducted field surveys for
17 special status bat species, as well as Gunnison prairie dog (*Cynomys gunnisoni*) and western
18 burrowing owl (*Athene cunicularia*), in the Fourmile East SEZ. Surveys for bat species were
19 conducted in the SEZ by using passive and active acoustic monitoring techniques at various
20 times between June 16, 2011, and October 15, 2011 (Rodriguez 2011). Survey results indicated
21 high bat activity during night hours within the SEZ. The big free-tailed bat (*Nyctinomops*
22 *macrotis*) was the only special status bat species recorded on the SEZ. However, the documented
23 presence of the fringed myotis in the De Tilla Gulch SEZ suggests that the fringed myotis could
24 occur throughout the San Luis Valley and potentially within the Fourmile East SEZ. No roosting
25 habitat for any bat species was observed on the SEZ (Rodriguez 2011). Additional life ecological
26 and natural history information for the fringed myotis is provided below.

27
28 Field surveys for Gunnison prairie dog and western burrowing owl were conducted on
29 July 14, 2011 (Garcia and Harvey 2011). No Gunnison prairie dog activity was recorded in any
30 portion of the SEZ. However, there are established Gunnison prairie dog colonies 10 mi (16 km)
31 north of the SEZ. Burrowing owls were not recorded on the SEZ during the field surveys.
32 However, burrowing owls may nest among prairie dog colonies surrounding the SEZ; the
33 Fourmile East SEZ may occur within the home range of any of these individuals (Garcia and
34 Harvey 2011).

35
36
37 **Fringed Myotis.** The fringed myotis is a year-round resident in western Colorado, where
38 it forages in a variety of habitats including ponderosa pine woodlands, greasewood flats,
39 oakbrush, and shrublands. This species was not evaluated for the Fourmile East SEZ in the
40 Draft Solar PEIS. The species roosts in caves, rock crevices, or in buildings. The fringed
41 myotis was not recorded on the Fourmile East SEZ during field surveys conducted in 2011
42 (Rodriguez 2011). However, fringed myotis was recorded on the De Tilla Gulch SEZ, suggesting
43 that the species could occur elsewhere in the San Luis Valley and potentially within the revised
44 area of the Fourmile East SEZ. According to the SWReGAP habitat suitability model, potentially
45 suitable foraging habitat for the fringed myotis could occur on the revised area of the Fourmile
46



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FIGURE 10.3.12.1-1 Developable Area for the Proposed Fourmile East SEZ as Revised and Known or Potential Occurrences of Species Listed as Threatened or Endangered, Proposed, or Candidates for Listing under the ESA

1 East SEZ and throughout portions of the area of indirect effects (Table 10.3.12.1-1). There is no
2 potentially suitable roosting habitat (rocky cliffs and outcrops) in the area of direct effects.
3

4 5 **10.3.12.2 Impacts** 6

7 Overall impact magnitude categories were based on professional judgment and include
8 (1) *small*: a relatively small proportion ($\leq 1\%$) of the special status species' habitat within the
9 SEZ region would be lost; (2) *moderate*: an intermediate proportion (> 1 but $\leq 10\%$) of the special
10 status species' habitat would be lost; and (3) *large*: $> 10\%$ of the special status species' habitat
11 would be lost.
12

13 As presented in the Draft Solar PEIS, solar energy development within the Fourmile East
14 SEZ could affect potentially suitable habitats of special status species. The analysis presented
15 in the Draft Solar PEIS for the original Fourmile East SEZ boundaries indicated that
16 development would result in no impact or a small overall impact on all special status species
17 (Table 10.3.12.1-1 in the Draft Solar PEIS). Development within the revised area of the Fourmile
18 SEZ could still affect the same 59 species evaluated in the Draft Solar PEIS; however, the
19 reduction in the developable area would result in reduced (and still small) impact levels
20 compared to original estimates in the Draft Solar PEIS.
21

22 Field surveys conducted for the BLM following the publication of the Draft Solar PEIS
23 indicated that one additional special status bat species could occur in the SEZ affected area—the
24 fringed myotis. Impacts on this species are described below.
25
26

27 **Fringed Myotis.** The fringed myotis is a year-round resident in southwestern Colorado
28 and is known to occur within the San Luis Valley. Although this species is not known to occur in
29 the proposed Fourmile East SEZ, field surveys conducted in 2011 documented the presence of
30 this species in the De Tilla Gulch SEZ (Rodriguez 2011). According to the SWReGAP habitat
31 suitability model, approximately 2,800 acres (11.3 km²) of suitable foraging habitat on the
32 revised area of the Fourmile East SEZ may be directly affected by construction and operations
33 (Table 10.3.12.1-1). This direct effects area represents less than 0.1% of potentially suitable
34 habitat in the SEZ region. About 83,000 acres (336 km²) of potentially suitable habitat occurs in
35 the area of indirect effects; this area represents about 2.2% of the available suitable habitat in the
36 region (Table 10.3.12.1-1). Most of the potentially suitable habitat in the affected area is foraging
37 habitat represented by desert shrubland. There is no potentially suitable roosting habitat (rocky
38 cliffs and outcrops) in the area of direct effects; however, it is possible for individuals to roost in
39 nearby habitats within the area of indirect effects (Rodriguez 2011).
40

41 The overall impact on the fringed myotis from construction, operation, and
42 decommissioning of utility-scale solar energy facilities within the revised area of the Fourmile
43 East SEZ is considered small, because the amount of potentially suitable foraging habitat for this
44 species in the area of direct effects represents less than 1% of potentially suitable foraging
45 habitat in the SEZ region. The implementation of design features is expected to be sufficient to
46 reduce indirect impacts on this species to negligible levels. Avoidance of all potentially suitable

1 **TABLE 10.3.12.1-1 Habitats, Potential Impacts, and Potential Mitigation for Special Status Species That Could Be Affected by Solar**
 2 **Energy Development on the Proposed Fourmile East SEZ as Revised^a**

Common Name	Scientific Name	Listing Status ^b	Habitat ^c	Maximum Area of Potential Habitat Affected ^d		Overall Impact Magnitude ^g and Species-Specific Mitigation ^h
				Within SEZ (Direct Effects) ^e	Outside SEZ (Indirect Effects) ^f	
Mammals						
Fringed myotis	<i>Myotis thysanodes</i>	BLM-S; FWS-SC	Summer or year-round resident in wide range of habitats, including woodland, riparian, and shrubland habitats. Roosts in caves, crevices, and buildings. About 3,800,000 acres ⁱ of potentially suitable habitat occurs within the SEZ region.	2,800 acres of potentially suitable habitat lost (<0.1% of available potentially suitable habitat)	83,000 acres of potentially suitable habitat (2.2% of available potentially suitable habitat)	Small overall impact; direct impact on foraging habitat only. Avoidance of direct impacts on foraging habitat is not feasible because suitable foraging habitat is widespread in the area of direct effects.

^a The species presented in this table represent new species identified following publication of the Draft Solar PEIS or a re-evaluation of those species that were determined to have moderate or large impacts in the Draft Solar PEIS. The other special status species for this SEZ are identified in Table 10.3.12.1-1 of the Draft Solar PEIS.

^b BLM-S = listed as a sensitive species by the BLM; FWS-SC = USFWS species of concern.

^c Potentially suitable habitat was determined using SWReGAP habitat suitability models (USGS 2007). Area of potentially suitable habitat for each species is presented for the SEZ region, which is defined as the area within 50 mi (80 km) of the SEZ center.

^d Maximum area of potential habitat that could be affected relative to availability within the analysis area. Habitat availability for each species within the analysis area was determined using SWReGAP habitat suitability models (USGS 2007). This approach probably overestimates the amount of suitable habitat in the project area.

^e Direct effects within the SEZ consist of the ground-disturbing activities associated with construction and the maintenance of an altered environment associated with operations.

^f Area of indirect effects was assumed to be the area adjacent to the SEZ and within 5 mi (8 km) of the SEZ boundary. Indirect effects include effects from surface runoff or dust from the SEZ, but do not include ground-disturbing activities. The potential degree of indirect effects would decrease with increasing distance away from the SEZ.

^g Overall impact magnitude categories were based on professional judgment and include (1) *small*: ≤1% of the population or its habitat would be lost, and the activity would not result in a measurable change in carrying capacity or population size in the affected area; (2) *moderate*: >1 but ≤10% of the population or its habitat, would be lost and the activity would result in a measurable but moderate (not destabilizing) change in carrying capacity or population size in the affected area; and (3) *large*: >10% of a population or its habitat would be lost and the activity would result in a large, measurable, and destabilizing change in carrying capacity or population size in the affected area. Note that much greater weight was given to the magnitude of direct effects because those effects would be difficult to mitigate. Design features would reduce most indirect effects to negligible levels.

^h Species-specific mitigations are suggested here, but final mitigations should be developed in consultation with state and federal agencies and should be based on pre-disturbance surveys.

ⁱ To convert acres to km², multiply by 0.004047.

1 foraging habitats is not feasible, because potentially suitable habitat is widespread throughout the
2 area of direct effects and readily available in other portions of the SEZ region.
3
4

5 **10.3.12.3 SEZ-Specific Design Features and Design Feature Effectiveness** 6

7 Required programmatic design features are described in Section A.2.2 of Appendix A of
8 this Final Solar PEIS. SEZ-specific resources and conditions will determine how programmatic
9 design features are applied, for example:
10

- 11 • Pre-disturbance surveys shall be conducted within the SEZ to determine the
12 presence and abundance of special status species, including those identified in
13 Table 10.3.12.1-1 of the Draft Solar PEIS, as well as the fringed myotis.
14 Disturbance to occupied habitats for these species shall be avoided or
15 minimized to the extent practicable. If avoiding or minimizing impacts on
16 occupied habitats is not possible, translocation of individuals from areas of
17 direct effects or compensatory mitigation of direct effects on occupied habitats
18 may be used to reduce impacts. A comprehensive mitigation strategy for
19 special status species that uses one or more of these options to offset the
20 impacts of development shall be developed in coordination with the
21 appropriate federal and state agencies.
22
- 23 • Avoiding or limiting groundwater withdrawals for solar energy development
24 on the SEZ shall be employed to reduce impacts on groundwater-dependent
25 special status species, including those species that may occur in riparian or
26 aquatic habitats supported by groundwater. These species include the
27 southwestern willow flycatcher and western snowy plover.
28
- 29 • Coordination with the USFWS and CDOW shall be conducted to address the
30 potential for impacts on the Gunnison’s prairie dog, a candidate for listing
31 under the ESA. Coordination would identify an appropriate survey protocol,
32 avoidance measures, and, potentially, translocation or compensatory
33 mitigation.
34

35 If the programmatic design features are implemented, it is anticipated that the majority of
36 impacts on the special status species from habitat disturbance and groundwater use would be
37 reduced.
38

39 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
40 analyses due to changes to the SEZ boundaries, and consideration of comments received as
41 applicable, no SEZ-specific design features for special status species in the proposed Fourmile
42 East SEZ have been identified. Some SEZ-specific design features may be identified through the
43 process of preparing parcels for competitive offer and subsequent project-specific analysis.
44
45

1 **10.3.13 Air Quality and Climate**

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3
4 **10.3.13.1 Affected Environment**

5
6 Except as noted below, the information on air quality and climate presented in the
7 affected environment section of the Draft Solar PEIS remains valid.

8
9
10 **10.3.13.1.1 Existing Air Emissions**

11
12 The Draft Solar PEIS presented Alamosa County emissions data for 2002. More recent
13 data for 2008 (CDPHE 2011) were reviewed. The two emissions inventories are from different
14 sources and assumptions. In the more recent data, emissions of NO_x, CO, and VOCs were lower,
15 while emissions of SO₂, PM₁₀ and PM_{2.5} were higher. These changes would not affect modeled
16 air quality impacts presented in this update.

17
18
19 **10.3.13.1.2 Air Quality**

20
21 The calendar quarterly average NAAQS of 1.5 µg/m³ for lead (Pb) presented in
22 Table 10.3.13.1-2 of the Draft Solar PEIS has been replaced by the rolling 3-month standard
23 (0.15 µg/m³). The federal 24-hour and annual SO₂, 1-hour O₃, and annual PM₁₀ standards have
24 been revoked as well (EPA 2011). All Colorado SAAQS, except 3-hour SO₂ standard of
25 700 µg/m³, have been revoked since publication of the Draft Solar PEIS. These changes will not
26 affect the modeled air quality impacts presented in this update.

27
28 The size of the proposed Fourmile East SEZ was reduced by about 26%, from
29 3,882 acres (15.7 km²) to 2,882 acres (11.7 km²). However, distances to the nearest Class I areas
30 remain the same as in the Draft Solar PEIS.

31
32
33 **10.3.13.2 Impacts**

34
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36 **10.3.13.2.1 Construction**

37
38
39 **Methods and Assumptions**

40
41 Except for the area disturbed at any one time during construction, the methods and
42 assumptions have not changed from those presented in the Draft Solar PEIS. Based on the
43 reduction in the area of the proposed Fourmile East SEZ, air quality for this Final Solar PEIS
44 was remodeled assuming that 2,306 acres (9.3 km²), 80% of the updated developable area,
45 would be disturbed at any one time. The Draft Solar PEIS assumed disturbance of an area of
46 3,000 acres (12.1 km²).

1 **Results**

2
3 Since the annual PM₁₀ standard has been rescinded, the discussion of annual PM₁₀
4 impacts in the Draft Solar PEIS is no longer applicable. Table 10.3.13.2-1 has been updated for
5 this Final Solar PEIS. The concentration values in the table are based on updated air quality
6 modeling reflecting the updated boundaries of the proposed SEZ.
7

8 Given the reduced area of the proposed SEZ, the concentrations predicted for this Final
9 Solar PEIS are less than or equal to those predicted in the Draft Solar PEIS, but the conclusions
10 presented in the Draft Solar PEIS remain valid.¹ Predicted 24-hour PM₁₀ and 24-hour PM_{2.5}
11 concentration levels could exceed NAAQS levels used for comparison at the SEZ boundaries
12 and in the immediately surrounding area during the construction phase of a solar development.
13 These high particulate levels would be limited to the immediate area surrounding the SEZ
14 boundaries and would decrease quickly with distance. Predicted total concentrations for annual
15 PM_{2.5} would be below the standard level used for comparison.
16

17 At the nearest residence, about 0.8 mi (1.3 km) southwest of the proposed SEZ, predicted
18 maximum 24-hour PM₁₀ concentration increments would be about 107 µg/m³; predicted
19 concentrations at the nearby towns of Alamosa, Blanca, Estrella, Mosca, Fort Garland, La Jara,
20 and Sanford would be less than 16 µg/m³. The conclusion of the Draft Solar PEIS that total
21 particulate levels (background plus the increment due to construction activities) at these locations
22 would not exceed standard levels remains valid.
23

24 Consistent with the conclusions of the Draft Solar PEIS, construction activities could
25 result in concentrations above Class I PSD PM₁₀ increment levels at the nearest federal Class I
26 area (the Great Sand Dunes WA), but the PM₁₀ increments would not be exceeded at other
27 nearby Class I areas (La Garita WA and Weminuche WA, and Wheeler Peak WA, New Mexico).
28

29 Overall, predicted 24-hour PM₁₀ and 24-hour PM_{2.5} concentration levels could exceed
30 standard levels used for comparison at the SEZ boundaries and immediately surrounding areas
31 during the construction phase of a solar development. To reduce potential impacts on ambient air
32 quality and in compliance with BLM design features, aggressive dust control measures would be
33 used. Potential air quality impacts on neighboring communities would be much lower. Predicted
34 total concentrations for annual PM_{2.5} would be below the standard level. Modeling indicates that
35 construction activities could result in concentrations above Class I PSD PM₁₀ increment levels at
36 the nearest federal Class I area, Great Sand Dunes WA. However, construction activities are not
37 subject to the PSD program; the comparison is made as an indicator of possible dust levels in the
38 WA during the limited construction period and as a screen to gage the size of the potential

¹ At this programmatic level, detailed information on construction activities, such as facility size, type of solar technology, heavy equipment fleet, activity level, work schedule, and so on, is not known; thus air quality modeling cannot be conducted. It has been assumed that 80% of the developable area of 2,882 acres (9.3 km²) would be disturbed continuously; thus, the modeling results and discussion here should be interpreted in that context. During the site-specific project phase, more detailed information would be available and more realistic air quality modeling analysis could be conducted. It is likely that impacts on ambient air quality predicted for specific projects would be much lower than those presented in this Final Solar PEIS.

1 **TABLE 10.3.13.2-1 Maximum Air Quality Impacts from Emissions Associated with**
 2 **Construction Activities for the Proposed Fourmile East SEZ as Revised**

Pollutant ^a	Averaging Time	Rank ^b	Concentration (µg/m ³)				Percentage of NAAQS	
			Maximum Increment ^b	Background	Total	NAAQS	Increment	Total
PM ₁₀	24 hours	H6H	428	27.0	455	150	285	303
PM _{2.5}	24 hours	H8H	29.5	16.0	45.5	35	84	130
	Annual	- ^c	7.1	4.0	11.1	15	47	74

^a PM_{2.5} = particulate matter with a diameter of ≤2.5 µm; PM₁₀ = particulate matter with a diameter of ≤10 µm.

^b Concentrations for attainment demonstration are presented. H6H = highest of the sixth-highest concentrations at each receptor over the 5-year period. H8H = highest of the multiyear average of the eighth-highest concentrations at each receptor over the 5-year period. For the annual average, multiyear averages of annual means over the 5-year period are presented. Maximum concentrations are predicted to occur at the site boundaries.

^c A dash indicates not applicable.

Source: Chick (2009) for background concentration data.

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impact. Therefore, it is anticipated that the potential impacts of construction activities on ambient air quality would be moderate and temporary.

8 With the reduced size of the Fourmile East SEZ, emissions from construction equipment
 9 and vehicles would be less than those estimated in the Draft Solar PEIS. Any potential impacts
 10 on AQRVs at nearby federal Class I areas would be less; thus the conclusions in the Draft Solar
 11 PEIS remain valid. Emissions from construction-related equipment and vehicles are temporary
 12 and could cause some unavoidable but short-term impacts.

13
14

15 **10.3.13.2.2 Operations**

16
 17 The reduction in the size of the proposed Fourmile East SEZ by about 26%, from
 18 3,882 acres (15.7 km²) to 2,882 acres (11.7 km²), reduces the generating capacity and annual
 19 power generation and thus reduces the potentially avoided emissions presented in the Draft Solar
 20 PEIS. Total revised power generation capacity ranging from 256 to 461 MW is estimated for the
 21 Fourmile East SEZ for various solar technologies. As explained in the Draft Solar PEIS, the
 22 estimated amount of emissions avoided for the solar technologies evaluated depends only on
 23 the megawatts of conventional fossil fuel-generated power avoided. Updated estimates for
 24 emissions potentially avoided by a solar facility can be obtained from the table in the Draft
 25 Solar PEIS by reducing the tabulated estimates by about 26%, as shown in the revised

1 Table 10.3.13.2-2. For example, for the technologies estimated to require 9 acres/MW (power
2 tower, dish engine, and PV), up to 684 tons per year (= 74.25% × the low-end value of 922 tons
3 per year tabulated in the Draft Solar PEIS) of NO_x could be avoided by full solar development of
4 the proposed Fourmile East SEZ as revised for this Final Solar PEIS. Although the total
5 emissions avoided by full solar development of the proposed Fourmile East SEZ are reduced
6 from those presented in the Draft Solar PEIS, the conclusions of the Draft Solar PEIS remain
7 valid. Solar facilities built in the Fourmile East SEZ could avoid relatively more fossil fuel
8 emissions than those built in other states with less reliance on fossil fuel-generated power.
9

10 **10.3.13.2.3 Decommissioning and Reclamation**

11 The discussion in the Draft Solar PEIS remains valid. Decommissioning and reclamation
12 activities would be of short duration, and their potential impacts on air quality would be
13 moderate and temporary.
14

15 **10.3.13.3 SEZ-Specific Design Features and Design Feature Effectiveness**

16 Required programmatic design features that would reduce air quality impacts are
17 described in Section A.2.2 of Appendix A of this Final Solar PEIS. Limiting dust generation
18 during construction and operations is a required programmatic design feature under the BLM
19 Solar Energy Program. These extensive fugitive dust control measures would keep off-site PM
20 levels as low as possible during construction.
21

22 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
23 analyses due to changes to the SEZ boundaries, and consideration of comments received as
24 applicable, no SEZ-specific design features for air quality for the proposed Fourmile East SEZ
25 have been identified. Some SEZ-specific design features may be identified through the process
26 of preparing parcels for competitive offer and subsequent project-specific analysis.
27

28 **10.3.14 Visual Resources**

29 **10.3.14.1 Affected Environment**

30 The boundaries of the proposed Fourmile East SEZ have been revised to eliminate
31 999 acres (4 km²), mainly along the eastern boundary of the SEZ, as well as a small area on
32 the west side of the proposed SEZ. The proposed SEZ is now approximately 2.5 mi (4.0 km)
33 north to south (at its greatest extent) and 1.8 mi (2.9 km) east to west (at its greatest extent). The
34 remaining developable area within the SEZ is 2,882 acres (11.7 km²). Because of the reduction
35 in size of the SEZ, the total acreage of the lands visible within the 25-mi (40-km) viewshed of
36 the SEZ has decreased.
37

1 **TABLE 10.3.13.2-2 Annual Emissions from Combustion-Related Power Generation Avoided by**
 2 **Full Solar Development of the Proposed Fourmile East SEZ as Revised**

Area Size (acres) ^a	Capacity (MW) ^b	Power Generation (GWh/yr) ^c	Emissions Avoided (tons/yr; 10 ³ tons/yr for CO ₂) ^d			
			SO ₂	NO _x	Hg	CO ₂
2,882	256–461	449–808	594–1,068	684–1,232	0.004–0.007	443–798
Percentage of total emissions from electric power systems in the state of Colorado ^e			0.94–1.7%	0.94–1.7%	0.94–1.7%	0.94–1.7%
Percentage of total emissions from all source categories in the state of Colorado ^f			0.50–0.91%	0.17–0.30%	– ^g	0.43–0.77%
Percentage of total emissions from electric power systems in the six-state study area ^e			0.24–0.43%	0.19–0.33%	0.13–0.24%	0.17–0.30%
Percentage of total emissions from all source categories in the six-state study area ^f			0.13–0.23%	0.03–0.05%	–	0.05–0.10%

- a To convert acres to km², multiply by 0.004047.
- b It is assumed that the SEZ would eventually have development on 80% of the lands and that a range of 5 acres (0.020 km²) per MW (for parabolic trough technology) to 9 acres (0.036 km²) per MW (power tower, dish engine, and photovoltaic technologies) would be required.
- c Assumed a capacity factor of 20%.
- d Composite combustion-related emission factors for SO₂, NO_x, Hg, and CO₂ of 2.64, 3.05, 1.71 × 10⁻⁵, and 1,976 lb/MWh, respectively, were used for the state of Colorado.
- e Emission data for all air pollutants are for 2005.
- f Emission data for SO₂ and NO_x are for 2002, while those for CO₂ are for 2005.
- g A dash indicates not estimated.

Sources: EPA (2009a,b); WRAP (2009).

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Because of the reduction in land available for development in the eastern portions of the SEZ, CO 150 no longer passes through the SEZ. It now runs parallel to the eastern boundary of the SEZ, at a distance of approximately 0.25 mi (0.40 km). This portion of CO 150 is also designated as the Los Caminos Antiguos Scenic Byway.

An updated VRI map for the SEZ and surrounding lands is shown in Figure 10.3.14.1-1; it provides information from the BLM's 2009 VRI, which was finalized in October 2011 (BLM 2011a). The value for the SEZ still is VRI Class III.

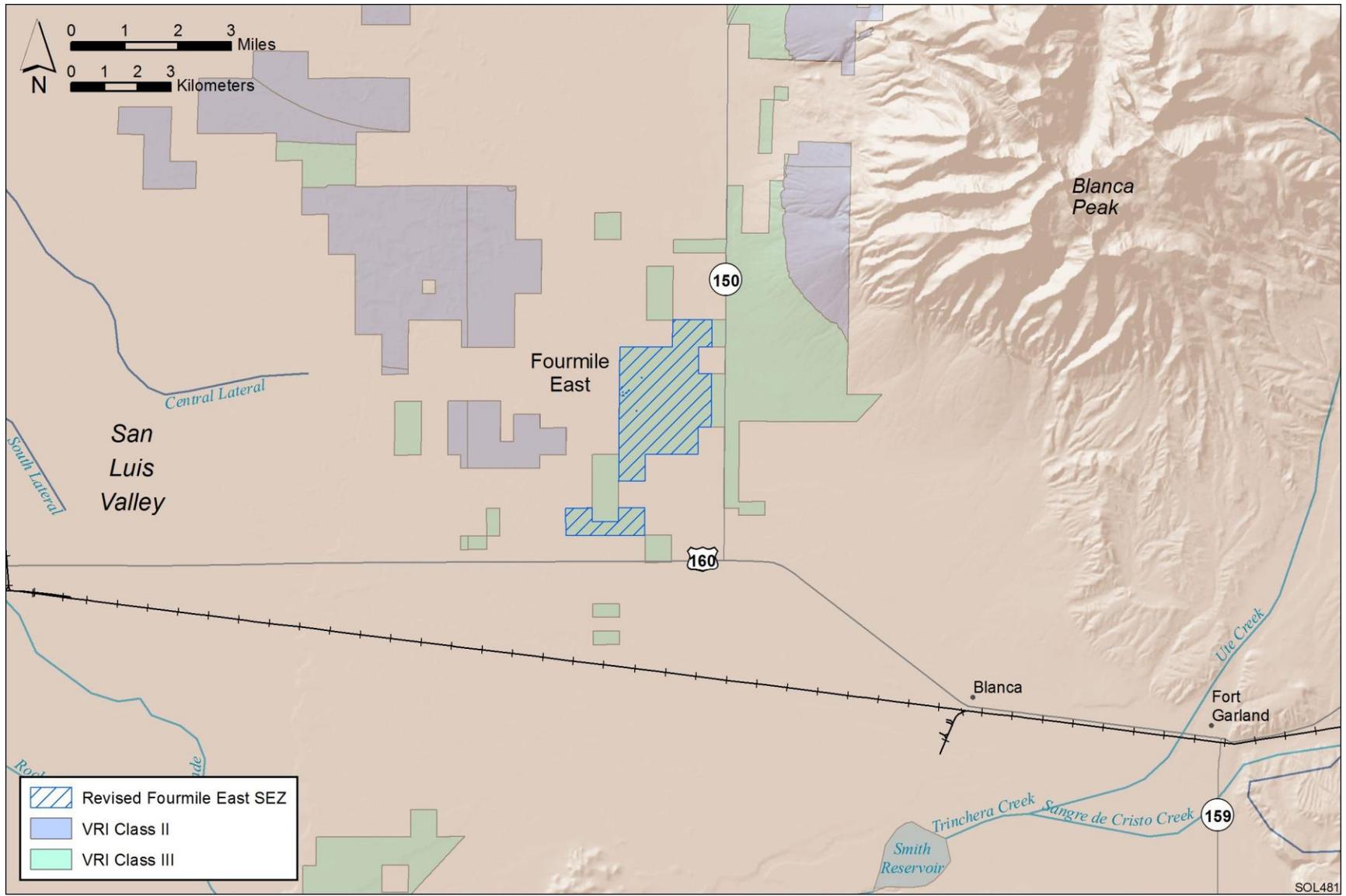


FIGURE 10.3.14.1-1 Visual Resource Inventory Values for the Proposed Fourmile East SEZ as Revised

1 Lands in the La Jara Field Office within the 25-mi (40-km), 650-ft (198-m) viewshed of
2 the revised SEZ include 21,087 acres (85.3 km²) of VRI Class II areas; 18,436 acres (74.6 km²)
3 of VRI Class III areas; and 21 acres (0.1 km²) of VRI Class IV areas.
4
5

6 **10.3.14.2 Impacts**

7

8 The reduction in size of the SEZ would reduce the total visual impacts associated with
9 solar energy development in the SEZ. It would limit the total amount of solar facility
10 infrastructure that would be visible and would reduce the geographic extent of the visible
11 infrastructure.
12

13 The reduction in size of the SEZ proposed in the Supplement to the Draft Solar PEIS
14 eliminated approximately 26% of the original SEZ. The resulting visual contrast reduction for
15 any given point within view of the SEZ would vary greatly depending on the viewpoint's
16 distance and direction from the SEZ. Contrast reduction generally would be greatest for
17 viewpoints closest to the portions of the SEZ that were eliminated and especially for those that
18 had broad, wide-angle views of these areas. In general, contrast reductions also would be larger
19 for elevated viewpoints relative to non-elevated viewpoints, because the reduction in area of the
20 solar facilities would be more apparent when looking down at the SEZ than when looking
21 across it.
22
23

24 ***10.3.14.2.1 Impacts on the Proposed Fourmile East SEZ***

25

26 Although the reduction in size of the SEZ would reduce visual contrasts associated with
27 solar development, solar development still would involve major modification of the existing
28 character of the landscape; it likely would dominate the views from most locations within the
29 SEZ. Additional impacts would occur as a result of the construction, operation, and
30 decommissioning of related facilities, such as access roads and electric transmission lines. In
31 general, strong visual contrasts from solar development still would be expected for viewing
32 locations within the SEZ.
33
34

35 ***10.3.14.2.2 Impacts on Lands Surrounding the Proposed Fourmile East SEZ***

36

37 For the Draft Solar PEIS, preliminary viewshed analyses were conducted to identify
38 which lands surrounding the proposed SEZ could have views of solar facilities in at least some
39 portion of the SEZ (see Appendices M and N of the Draft Solar PEIS for important information
40 on assumptions and limitations of the methods used). Four viewshed analyses were conducted,
41 assuming four different heights representative of project elements associated with potential solar
42 energy technologies: PV and parabolic trough arrays, 24.6 ft (7.5 m); solar dishes and power
43 blocks for CSP technologies, 38 ft (11.6 m); transmission towers and short solar power towers,
44 150 ft (45.7 m); and tall solar power towers, 650 ft (198.1 m).
45

1 These same viewsheds were recalculated in order to account for the boundary changes
2 described in the Supplement to the Draft Solar PEIS. Figure 10.3.14.2-1 shows the combined
3 results of the viewshed analyses for all four solar technologies. The colored portions indicate
4 areas with clear lines of sight to one or more areas within the SEZ and from which solar facilities
5 within these areas of the SEZ would be expected to be visible, assuming the absence of screening
6 vegetation or structures and adequate lighting and other atmospheric conditions. The light brown
7 areas are locations from which PV and parabolic trough arrays located in the SEZ could be
8 visible. Solar dishes and power blocks for CSP technologies would be visible from the areas
9 shaded light brown and the additional areas shaded light purple. Transmission towers and short
10 solar power towers would be visible from the areas shaded light brown and light purple and the
11 additional areas shaded dark purple. Power tower facilities located in the SEZ could be visible
12 from areas shaded light brown, light purple, and dark purple and at least the upper portions of
13 power tower receivers could be visible from the additional areas shaded medium brown.
14
15

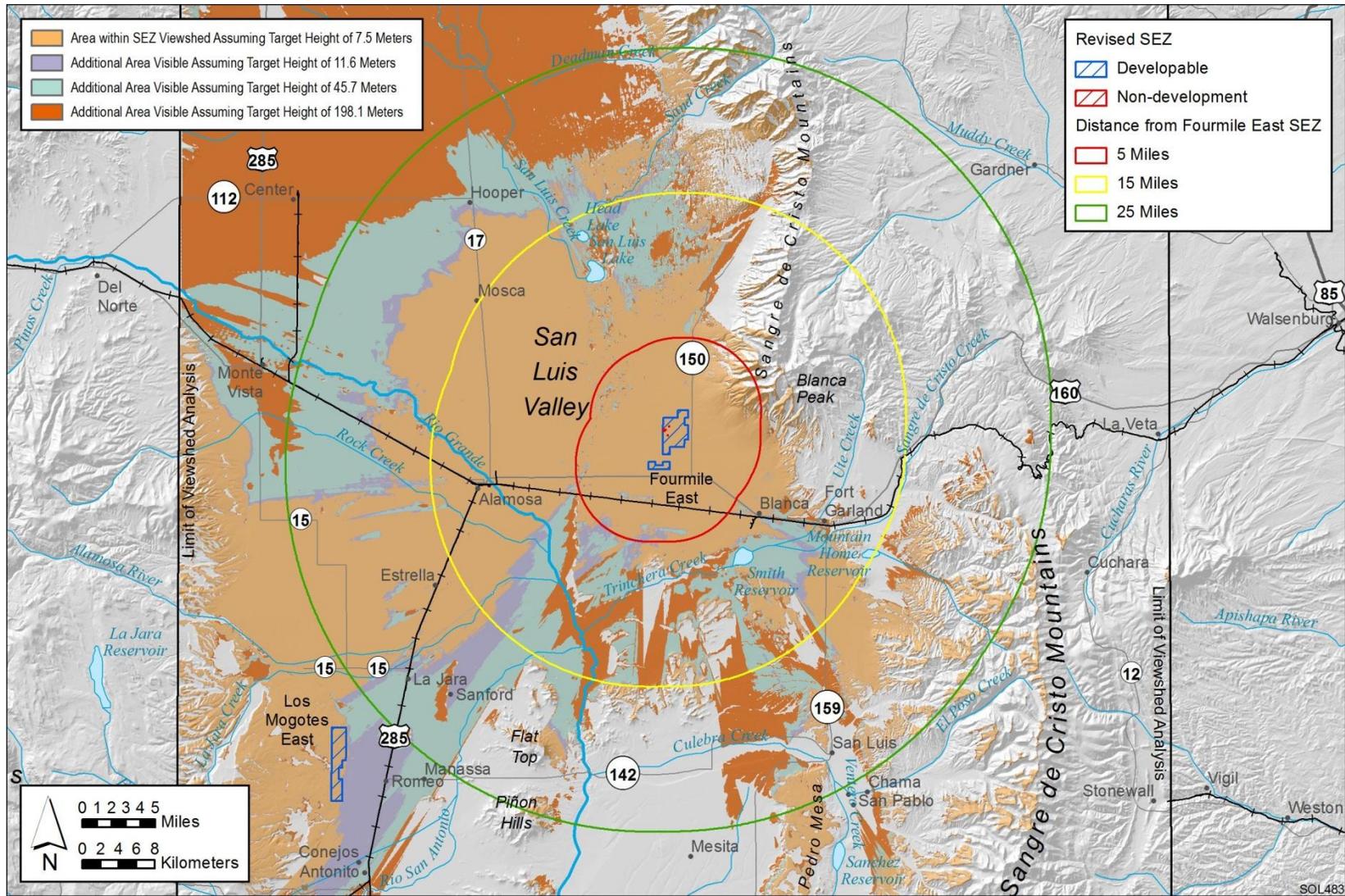
16 ***10.3.14.2.3 Impacts on Selected Federal-, State-, and BLM-Designated Sensitive*** 17 ***Visual Resource Areas and Other Lands and Resources*** 18

19 Figure 10.3.14.2-2 shows the results of a GIS analysis that overlays selected federal-,
20 state-, and BLM-designated sensitive visual resource areas onto the combined tall solar power
21 tower (650 ft [198.1 m]) and PV and parabolic trough array (24.6 ft [7.5 m]) viewsheds, in order
22 to illustrate which of these sensitive visual resource areas could have views of solar facilities
23 within the SEZ and therefore potentially would be subject to visual impacts from those facilities.
24 Distance zones that correspond with BLM's VRM system-specified foreground-middleground
25 distance (5 mi [8 km]), background distance (15 mi [24.1 km]), and a 25-mi (40.2-km) distance
26 zone are shown as well, in order to indicate the effect of distance from the SEZ on impact levels,
27 which are highly dependent on distance. A similar analysis was conducted for the Draft Solar
28 PEIS.
29

30 The scenic resources included in the analysis were as follows:

- 31
- 32 • National Parks, National Monuments, National Recreation Areas, National
33 Preserves, National Wildlife Refuges, National Reserves, National
34 Conservation Areas, National Historic Sites;
- 35
- 36 • Congressionally authorized Wilderness Areas;
- 37
- 38 • Wilderness Study Areas;
- 39
- 40 • National Wild and Scenic Rivers;
- 41
- 42 • Congressionally authorized Wild and Scenic Study Rivers;
- 43
- 44 • National Scenic Trails and National Historic Trails;
- 45
- 46 • National Historic Landmarks and National Natural Landmarks;

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FIGURE 10.3.14.2-1 Viewshed Analyses for the Proposed Fourmile East SEZ as Revised and Surrounding Lands, Assuming Viewshed Heights of 24.6 ft (7.5 m), 38 ft (11.6 m), 150 ft (45.7 m), and 650 ft (198.1 m) (shaded areas indicate lands from which solar development and/or associated structures within the SEZ could be visible)

- 1 • All-American Roads, National Scenic Byways, State Scenic Highways, and
- 2 BLM- and USFS-designated scenic highways/byways;
- 3
- 4 • BLM-designated Special Recreation Management Areas; and
- 5
- 6 • ACECs designated because of outstanding scenic qualities.
- 7

8 The results of the GIS analysis are summarized in Table 10.3.14.2-1. The change in size
9 of the SEZ alters the viewshed, such that the visibility of the SEZ and solar facilities within the
10 SEZ from the surrounding lands would be reduced. With the reduction in size of the SEZ, solar
11 energy development within the SEZ would be expected to create minimal or weak visual
12 contrasts for viewers within many of the surrounding scenic resource areas and other resources
13 listed in Table 10.3.14.2-1. Exceptions include the Sangre de Cristo Wilderness Area, the Old
14 Spanish National Historic Trail, Blanca Wetlands Special Recreation Management Area, Zapata
15 Falls SRMA, and the Los Caminos Antiguos Scenic Byway. In these areas, moderate or strong
16 visual contrasts still could occur.

17
18 Solar development on lands in the SEZ visible from and in close proximity to the Sangre
19 de Cristo WA and portions of the Old Spanish National Historic Trail has a higher potential to
20 cause visual impacts on these areas. As such, the BLM has identified areas in the SEZ visible
21 from and within 3 mi (4.8 km) of the Sangre de Cristo WA and of the centerline of the high-
22 potential segment of the Old Spanish National Historic Trail as potential high visual sensitivity
23 areas, where solar development would be subject to specific additional design features that will
24 be identified when project-specific environmental analyses are conducted. The BLM also has
25 identified areas in the SEZ visible from and between 3 mi (4.8 km) and 5 mi (8 km) of the
26 Sangre de Cristo WA and of the centerline of the high-potential segment of the Old Spanish
27 National Historic Trail as potential moderate visual sensitivity areas, where solar development
28 also would be subject to specific, additional design features to be identified in conjunction with
29 project-specific analysis.

30
31 In addition to these areas, impacts on other lands and resources were evaluated: the
32 surrounding communities of Alamosa, Blanca, and Mosca; the West Fork of the North Branch of
33 the Old Spanish National Historic Trail; Blanca Peak; and the Rio Grande Scenic Railroad.

34 35 36 ***10.3.14.2.4 Summary of Visual Resource Impacts for the Proposed Fourmile*** 37 ***East SEZ*** 38

39 The visual contrast analysis in the Draft Solar PEIS determined that because there could
40 be multiple solar facilities within the Fourmile East SEZ, a variety of technologies employed,
41 and a range of supporting facilities required, solar development within the SEZ would make it
42 essentially industrial in appearance and would contrast strongly with the surrounding, mostly
43 natural-appearing landscape.

44
45 The elimination of acreage within the SEZ would reduce the visual contrast associated
46 with solar facilities as seen both within the SEZ and from surrounding lands in both daytime and

1 **TABLE 10.3.14.2-1 Selected Potentially Affected Sensitive Visual Resources within a 25-mi**
 2 **(40-km) Viewshed of the Proposed Fourmile East SEZ as Revised, Assuming a Target Height of**
 3 **650 ft (198.1 m)**

Feature Type	Feature Name (Total Acreage/ Linear Distance) ^{a,b}	Feature Area or Linear Distance ^c		
		Visible within 5 mi	Visible Between	
			5 and 15 mi	15 and 25 mi
National Park	Great Sand Dunes (80,913 acres)	0 acres	34,678 acres (43%)	23,153 acres (29%)
National Preserve	Great Sand Dunes (41,670 acres)	0 acres	48 acres (0%)	5,866 acres (14%)
National Historic Trail	Old Spanish ^d (2,700 mi)	12 mi (0%)	19.7 mi (1%)	13.1 mi (0%)
National Historic Landmark	Pike's Stockade (4 acres)	0 acres	0 acres	4 acres (100%)
WAs	Great Sand Dunes (32,846 acres)	0 acres	8,629 acres (26%)	9,174 acres (28%)
	Sangre de Cristo (217,695 acres)	1,194 acres (1%)	2,339 acres (1%)	6,623 acres (3%)
WSAs	San Luis Hills (10,896 acres)	0 acres	0 acres	956 acres (9%)
	Sand Castle (1,097 acres)	0 acres	884 acres (81%)	67 acres (6%)
NWRs	Alamosa (12,098 acres)	0 acres	11,215 acres (93%)	0 acres
	Monte Vista (14,761 acres)	0 acres	0 acres	10,230 acres (69%)
	Baca (92,596 acres)	0 acres	928 acres (1%)	46,249 acres (50%)
ACECs	San Luis Hills (39,421 acres)	0 acres	0 acres	5,489 acres (14%)
	Rio Grande River Corridor (4,644 acres)	0 acres	0 acres	132 acres (3%)
Scenic Highways/Byways	Los Caminos Antiguos ^e (129 mi)	13.1 mi (10%)	45.0 mi (35%)	8.4 mi (7%)

TABLE 10.3.14.2-1 (Cont.)

Feature Type	Feature Name (Total Acreage/ Linear Distance) ^{a,b}	Feature Area or Linear Distance ^c		
		Visible within 5 mi	Visible Between	
			5 and 15 mi	15 and 25 mi
SRMAs	Blanca Wetlands (8,598 acres)	7,515 acres (87%)	1,065 acres (12%)	0 acres
	Rio Grande River Corridor (4,367 acres)	0 acres	0 acres	320 acres (7 %)
	Zapata Falls (3,702 acres)	20 acres (1%)	2,315 acres (63%)	0 acres

^a To convert acres to km², multiply by 0.004047.

^b To convert mi to km, multiply by 1.609.

^c Percentage of total feature acreage or road length viewable.

^d Source: BLM (2011b).

^e Source: America's Byways (2011).

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nighttime views. The reductions in visual contrast resulting from the revision can be summarized as follows:

- Within the Fourmile East SEZ: Contrasts experienced by viewers within the eastern portion of the SEZ and within a small portion of the west side of the SEZ would be reduced due to the elimination of 999 acres (4.0 km²) from the SEZ. However, strong contrasts still would result in the remaining developable area.
- Great Sand Dunes National Park (NP): A very slight reduction in contrasts would be anticipated; solar development within the SEZ still would cause weak contrasts. Contrast levels still would generally be higher at higher elevation viewpoints and at viewpoints in the western portion of the national park.
- Great Sand Dunes National Preserve: A very slight reduction in contrasts would be anticipated; solar development within the SEZ still would cause minimal to weak contrasts.
- Great Sand Dunes WA: A very slight reduction in contrasts would be anticipated; solar development within the SEZ still would cause weak contrasts.

- 1 • Sangre de Cristo WA: A slight reduction in contrasts would be anticipated;
2 solar development within the SEZ still would cause weak to strong contrasts,
3 depending on viewer location in the WA. Stronger contrasts would be
4 observed from elevated viewpoints, in which viewers would look down onto
5 the SEZ.
6
- 7 • San Luis Hills WSA: A very slight reduction in contrasts would be
8 anticipated; solar development within the SEZ still would cause minimal to
9 weak contrasts.
10
- 11 • Sand Castle WSA: A very slight reduction in contrasts would be anticipated;
12 solar development within the SEZ still would cause weak contrasts.
13
- 14 • Old Spanish National Historic Trail: A reduction in contrasts would result due
15 to the elimination of acreage to the east and west of CO 150. The Old Spanish
16 National Historic Trail was approximately 1 mi (1.6 km) east of the SEZ, as it
17 was originally proposed in the Draft Solar PEIS. It is now approximately
18 1.3 mi (2.1 km) away at the point of closest approach. Solar development
19 within the SEZ still would cause strong contrasts for Trail users immediately
20 to the east of the SEZ, where generally open views of the solar development
21 would be present. Lower contrasts would be observed from locations on the
22 Trail farther from the SEZ.
23
- 24 • Pike’s Stockade National Historic Landmark: No reduction in contrasts would
25 be anticipated; solar development within the SEZ still would cause minimal
26 contrasts.
27
- 28 • Alamosa NWR: No reduction in contrasts would be anticipated; solar
29 development within the SEZ still would cause weak contrasts.
30
- 31 • Baca NWR: No reduction in contrasts would be anticipated; solar
32 development within the SEZ still would cause minimal to weak contrasts.
33
- 34 • Monte Vista NWR: No reduction in contrasts would be anticipated; solar
35 development within the SEZ still would cause minimal contrasts.
36
- 37 • Rio Grande River Corridor ACEC: No reduction in contrasts would be
38 anticipated; solar development within the SEZ still would cause minimal
39 contrasts.
40
- 41 • San Luis Hills ACEC: A very slight reduction in contrasts would be
42 anticipated; solar development within the SEZ still would cause minimal to
43 weak contrasts.
44

- 1 • Blanca Wetlands SRMA: A slight reduction in contrasts would be anticipated;
2 solar development within the SEZ still would cause weak to strong contrasts,
3 dependent on the viewer location within the SRMA.
4
- 5 • Rio Grande Corridor SRMA: See above for the Rio Grande River Corridor
6 ACEC.
7
- 8 • Zapata Falls SRMA: A slight reduction in contrasts would be anticipated;
9 solar development within the SEZ still would cause weak to moderate
10 contrasts.
11
- 12 • Los Caminos Antiguos Scenic Byway: Portions of the byway were located
13 within the SEZ as it was originally proposed in the Draft Solar PEIS. Portions
14 of this byway are now approximately 0.25 mi (0.4 km) from the SEZ at the
15 point of closest approach. A reduction in contrasts would be anticipated in
16 those locations that once were part of the SEZ, as solar development would no
17 longer be immediately adjacent to the byway; however, solar development
18 within the SEZ still would cause strong contrasts for byway travelers on those
19 portions of the byway nearest to the SEZ, where generally open views of the
20 solar development would be present. Lower contrasts would be observed from
21 locations on the byway farther from the SEZ.
22
- 23 • West Fork of the North Branch of the Old Spanish Trail: No reduction in
24 contrasts would be anticipated; solar development within the SEZ still would
25 cause minimal contrasts.
26
- 27 • Blanca Peak: A slight reduction in contrasts would be anticipated. Views from
28 Blanca Peak would have full visibility of the SEZ; therefore, solar
29 development within the SEZ still would cause moderate contrasts.
30
- 31 • Alamosa: A very slight reduction in contrasts would be anticipated; solar
32 development within the SEZ still would cause minimal to weak contrasts.
33
- 34 • Blanca: A slight reduction in contrasts would be anticipated; solar
35 development within the SEZ still would cause weak contrasts.
36
- 37 • Mosca: A very slight reduction in contrasts would be anticipated; solar
38 development within the SEZ still would cause minimal to weak contrasts.
39
- 40 • Rio Grande Scenic Railway: A slight reduction in contrasts would be
41 anticipated; solar development within the SEZ still would cause strong
42 contrasts for some points on the railroad.
43

44 In addition to these areas, the Trujillo Homestead National Historic Landmark is located
45 within the 650-ft (198.1-m) viewshed. The landmark was designated in early 2012, although the
46 property was listed on the NRHP since February 2004 (DOI 2012; History Colorado 2011). The

1 property is located approximately 7.5 mi (12.1 km) east of Hooper. Because of the distance and
2 the relative elevation of the homestead as compared to the SEZ, the expected contrast levels
3 would be minimal.
4
5

6 **10.3.14.3 SEZ-Specific Design Features and Design Feature Effectiveness**

7

8 Required programmatic design features that would reduce impacts on visual resources are
9 described in Section A.2.2 of Appendix A of this Final Solar PEIS. While application of the
10 programmatic design features would reduce potential visual impacts somewhat, the degree of
11 effectiveness of these design features could be assessed only at the site- and project-specific
12 level. Given the large scale, reflective surfaces, and strong regular geometry of utility-scale solar
13 energy facilities and the lack of screening vegetation and landforms within the SEZ viewshed,
14 siting the facilities away from sensitive visual resource areas and other sensitive viewing areas
15 would be the primary means of mitigating visual impacts. The effectiveness of other visual
16 impact mitigation measures generally would be limited. Utility-scale solar energy development
17 using any of the solar technologies analyzed in this Final Solar PEIS and at the scale analyzed
18 would be expected to result in large adverse visual impacts that could not be mitigated.
19

20 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
21 analyses due to changes to the SEZ boundaries, and consideration of comments received as
22 applicable, the following SEZ-specific design features for visual resources in the proposed
23 Fourmile East SEZ have been identified:
24

- 25 • The development of power tower facilities should be prohibited within the
26 SEZ. The San Luis Valley is a regionally important tourist destination and is
27 an area with many small communities and numerous important historic,
28 cultural, and recreational resources. The valley contains numerous historic
29 sites, two scenic railways, two scenic highways, several wildlife refuges,
30 Great Sand Dunes NP and Preserve, the Rio Grande WSR, congressionally
31 designated WAs, the Sangre de Cristo NHA, and various other attractions that
32 draw tourists to the region. A number of these areas overlook the San Luis
33 Valley from the surrounding mountains and include elevated viewpoints that
34 would have clear views of power tower facilities in the Valley. The height of
35 solar power tower receiver structures, combined with the intense light
36 generated by the receivers atop the towers, would be expected to create strong
37 visual contrasts that could not be effectively screened from view for most
38 areas surrounding the SEZ. The effective area of impact from power tower
39 structures is much larger than that for comparably rated lower height facilities,
40 which makes it more likely that they would conflict with the growing tourism
41 focus of the Valley. In addition, for power towers higher than 200 ft (61 m),
42 hazard navigation lighting that could be visible for very long distances would
43 likely be required. Prohibiting the development of power tower facilities
44 would remove this source of impacts, thus substantially reducing potential
45 visual impacts on the Old Spanish National Historic Trail, Sangre de Cristo
46 WA, and the Los Caminos Antiguos Scenic Byway.

- Special visual impact mitigation shall be considered for solar development on lands in the SEZ visible from and within 5 mi (8 km) of the Sangre de Cristo WA and of the centerline of the high-potential segment of the Old Spanish National Historic Trail. Solar development on lands in the SEZ visible from and in close proximity to the Sangre de Cristo WA and portions of the Old Spanish National Historic Trail has a higher potential to cause visual impacts on the roadway. As such, the BLM has identified areas in the SEZ visible from and within 3 mi (5 km) of the Sangre de Cristo WA and of the centerline of the high-potential segment of the Old Spanish National Historic Trail as potential high visual sensitivity areas, where solar development would be subject to specific additional design features that will be identified when project-specific environmental analyses are conducted. The BLM also has identified areas in the SEZ visible from and between 3 mi (5 km) and 5 mi (8 km) of the Sangre de Cristo WA and of the centerline of the high-potential segment of the Old Spanish National Historic Trail as potential moderate visual sensitivity areas, where solar development also would be subject to specific, additional design features to be identified in conjunction with project-specific analysis.

The need for additional SEZ-specific design features may be identified through the process of preparing parcels for competitive offer and subsequent project-specific analysis.

10.3.15 Acoustic Environment

10.3.15.1 Affected Environment

The size of the proposed Fourmile East SEZ was reduced by about 26%, from 3,882 acres (15.7 km²) to 2,882 acres (11.7 km²). As noted below, with this change in the proposed boundaries, distances to the sensitive receptors are greater than or equal to those in the Draft Solar PEIS.

10.3.15.2 Impacts

Based on the boundary changes and reduced size of the proposed Fourmile East SEZ, noise impacts from construction and operations were remodeled for this Final Solar PEIS. The distance to the nearest residence remained the same as in the Draft Solar PEIS.

10.3.15.2.1 Construction

Except as noted below for impacts on specially designated areas, the conclusions in the Draft Solar PEIS remain valid for this Final Solar PEIS.

1 The distance to the closest residence is about 0.8 mi (1.3 km) southwest of the SEZ. For
2 construction activities occurring near the closest residence, estimated noise levels at this
3 residence would be about 44 dBA, which is somewhat higher than a typical daytime mean rural
4 background level of 40 dBA. However, estimated 43 dBA L_{dn} at this residence falls well below
5 the EPA guideline of 55 dBA L_{dn} for residential areas.
6

7 On the basis of comments received and recent references as applicable, this Final Solar
8 PEIS used an updated approximate significance threshold of 55 dBA corresponding to the onset
9 of adverse physiological impacts (Barber et al. 2010) to update the analysis of potential noise
10 impacts on terrestrial wildlife in areas of special concern. As a result of this updated analysis, the
11 conclusion in the Draft Solar PEIS that wildlife would not be adversely affected has been
12 updated for this Final Solar PEIS as follows. With construction activities occurring near the
13 western SEZ boundary, estimated noise level at the boundary of the Blanca Wetlands
14 SRMA/ACEC (about 0.5 mi [0.8 km] to the west) is about 50 dBA. This estimated level is below
15 the updated significance threshold; thus noise from construction in the proposed Fourmile East
16 SEZ is not anticipated to adversely affect wildlife in the nearby specially designated area.
17 However, as discussed in Section 5.10.2 of this Final Solar PEIS, there is the potential for other
18 effects to occur at lower noise levels (Barber et al. 2011). With these impacts and the potential
19 for impacts at lower noise levels, impacts on terrestrial wildlife from construction noise would
20 have to be considered on a project-specific basis, including site-specific background levels and
21 hearing sensitivity for site-specific terrestrial wildlife of concern.
22

23 With the updated boundaries, the distance to the Old Spanish National Historic Trail
24 increased to about 1.2 mi (2.0 km) east of the SEZ boundary. For construction activities
25 occurring near the northeastern SEZ boundary, the updated estimated noise level at the Old
26 Spanish National Historic Trail would be about 42 dBA, which is just above the typical daytime
27 mean rural background level of 40 dBA but less than a just noticeable difference of 3 dBA.
28 The conclusion in the Draft Solar PEIS that construction occurring near the eastern SEZ
29 boundary would result in minor noise impacts on the Old Spanish National Historic Trail is
30 updated for this Final Solar PEIS to conclude that the noise impacts would be negligible and
31 temporary.
32

33 Overall, construction activities would cause some unavoidable but localized short-term
34 impacts on neighboring communities, particularly for activities occurring near the southwestern
35 proposed SEZ boundary, close to nearby residences. No adverse vibration impacts are
36 anticipated from construction activities, including pile driving for dish engines.
37
38

39 ***10.3.15.2.2 Operations***

40
41 With the decrease in size of the proposed SEZ, the updated noise estimates in this Final
42 Solar PEIS remain the same as or less than as those in the Draft Solar PEIS, and, except as noted
43 below for wildlife impacts in specially designated areas, the conclusions presented in the Draft
44 Solar PEIS remain valid.
45
46

Parabolic Trough and Power Tower

If TES were not used for parabolic trough and power tower technologies (12 hours of daytime operations only), the estimated noise level from the power block would be about 42 dBA at the nearest residence, located 0.8 mi (1.3 km) from the SEZ boundary, which is a little higher than the typical daytime mean rural background level of 40 dBA. The day-night average noise level of 43 dBA L_{dn} would be well below the EPA guideline of 55 dBA L_{dn} for residential areas. If TES were used, the estimated nighttime noise level of 52 dBA at the nearest residence would be higher than the typical nighttime mean rural background level of 30 dBA. The day-night average noise level is estimated to be about 53 dBA L_{dn} , which is lower than EPA guideline of 55 dBA L_{dn} for residential areas. The assumptions are conservative in terms of operating hours, and no credit was given to other attenuation mechanisms. Thus it is likely that noise levels would be lower than 53 dBA L_{dn} at the nearest residence, even if TES were used at a solar facility. Nonetheless, operating parabolic trough or power tower facilities using TES and located near the southwestern SEZ boundary could result in noise impacts on the nearest residence, depending on background noise levels and meteorological conditions.

As stated above under construction impacts, for this Final Solar PEIS an updated approximate significance threshold of 55 dBA was used to evaluate potential noise impacts on terrestrial wildlife in areas of special concern. With TES operating near the western SEZ boundary, estimated daytime and nighttime noise levels at the boundary of the Blanca Wetlands SRMA/ACEC (about 0.5 mi [0.8 km] to the west) would be about 45 and 55 dBA, respectively. These estimated levels are below and the same as the significance threshold, respectively; thus noise from operations of a parabolic trough or power tower facility equipped with TES in the proposed Fourmile East SEZ is not anticipated to adversely affect wildlife in the nearby specially designated area. However, as discussed in Section 5.10.2, there is the potential for other effects to occur at lower noise levels (Barber et al. 2011). With these impacts and the potential for impacts at lower noise levels, noise impacts on terrestrial wildlife from a parabolic trough or power tower facility equipped with TES would have to be considered on a project-specific basis, including site-specific background levels and hearing sensitivity for site-specific terrestrial wildlife of concern.

Associated with operations of a parabolic trough or power tower facility equipped with TES occurring at the northeastern SEZ, the estimated daytime and nighttime noise levels at the Old Spanish National Historic Trail (about 1.2 mi [2.0 km] to the east) would be about 39 and 49 dBA, respectively, which are just below and far above the typical daytime and nighttime mean rural background levels of 40 and 30 dBA. Accordingly, a parabolic trough or power tower facility located near the northeastern SEZ boundary could result in noise impacts on the Old Spanish National Historic Trail during nighttime hours.

Dish Engines

The reduced size of the proposed SEZ would reduce the maximum potential number of dish engines. The estimated noise level at the nearest residence, about 0.8 mi (1.3 km) from the SEZ boundary, would be about 42 dBA, which is somewhat higher than the typical daytime

1 mean rural background level of 40 dBA, and the estimated 43 dBA L_{dn} at this residence is well
2 below the EPA guideline of 55 dBA L_{dn} for residential areas. On the basis of other attenuation
3 mechanisms, noise levels at the nearest residence would be lower than the values estimated
4 above. The conclusion in the Draft Solar PEIS that noise from dish engines could adversely
5 affect the nearest residence is updated for this Final Solar PEIS to conclude that noise from dish
6 engines could minimally affect the nearest residence, depending on background noise levels and
7 meteorological conditions.

8
9 As stated above under construction impacts, for this Final Solar PEIS an updated
10 approximate significance threshold of 55 dBA was used to evaluate potential noise impacts on
11 terrestrial wildlife in areas of special concern. The estimated noise level from operation of a dish
12 engine solar facility at the boundary of the Blanca Wetlands SRMA/ACEC (about 0.5 mi
13 [0.8 km] to the west) would be about 46 dBA. This estimated level is below the significance
14 threshold; thus noise from operations in the proposed Fourmile East SEZ is not anticipated to
15 adversely affect wildlife in the nearby specially designated area. However, as discussed in
16 Section 5.10.2, there is the potential for other effects to occur at lower noise levels (Barber et al.
17 2011). With these impacts and the potential for impacts at lower noise levels, noise impacts on
18 terrestrial wildlife from a dish engine facility would have to be considered on a project-specific
19 basis, including consideration of site-specific background levels and hearing sensitivity for site-
20 specific terrestrial wildlife of concern.

21
22 Assuming full build-out of the SEZ with dish engine facilities, the estimated noise level
23 at the Old Spanish National Historic Trail, about 1.2 mi (2.0 km) to the east of the SEZ, would
24 be about 43 dBA, which is above the typical daytime mean rural background level of 40 dBA but
25 comparable to a just noticeable difference of 3 dBA. Thus, dish engine noise from the proposed
26 Fourmile East SEZ is unlikely to affect users of the Old Spanish National Historic Trail.

27
28 Changes in the proposed Fourmile East SEZ boundaries would not alter the discussions
29 of vibration, transformer and switchyard noise, and corona discharge presented in the Draft Solar
30 PEIS. Noise impacts from transmission line corona discharge would be negligible.

31 32 33 ***10.3.15.1.3 Decommissioning and Reclamation***

34
35 The discussion in the Draft Solar PEIS remains valid. Decommissioning and reclamation
36 activities would be of short duration, and their potential noise impacts would be minor and
37 temporary. Potential noise and vibration impacts on surrounding communities would be minimal.

38 39 40 **10.3.15.3 SEZ-Specific Design Features and Design Feature Effectiveness**

41
42 Required programmatic design features that would reduce noise impacts are described in
43 Section A.2.2 of Appendix A of this Final Solar PEIS. Implementing the programmatic design
44 features will provide some protection from noise impacts.

1 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
2 analyses due to changes to the SEZ boundaries, and consideration of comments received as
3 applicable, no SEZ-specific design features for noise for the proposed Fourmile East SEZ have
4 been identified. Some SEZ-specific design features may be identified through the process of
5 preparing parcels for competitive offer and subsequent project-specific analysis.
6
7

8 **10.3.16 Paleontological Resources**

10 **10.3.16.1 Affected Environment**

11 Data provided in the Draft Solar PEIS remain valid, with the following update:
12

- 13 • The BLM Regional Paleontologist may have additional information regarding
14 the paleontological potential of the SEZ and be able to verify the PFYC of the
15 SEZ as Class 1 and 4/5 as used in the Draft Solar PEIS.
16
17
18

19 **10.3.16.2 Impacts**

20 The assessment provided in the Draft Solar PEIS remains valid. Impacts on significant
21 paleontological resources are possible in those areas where the Alamosa Formation is determined
22 to be at a depth that could be affected by solar energy development. However, a more detailed
23 look at the geological deposits is necessary to determine whether a paleontological survey is
24 warranted.
25
26
27

28 **10.3.16.3 SEZ-Specific Design Features and Design Feature Effectiveness**

29 Required programmatic design features are described in Section A.2.2 of Appendix A
30 of this Final Solar PEIS. Impacts would be minimized through the implementation of required
31 programmatic design features, including a stop-work stipulation in the event that paleontological
32 resources are encountered during construction, as described in Section A.2.2 of Appendix A.
33
34
35

36 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
37 analyses due to changes in the SEZ boundaries, and consideration of comments received as
38 applicable, the following SEZ-specific design feature for paleontological resources has been
39 identified:
40

- 41 • The depth of the Alamosa Formation within the proposed Fourmile East SEZ
42 should be determined to identify any design features that might be needed in
43 that area if solar energy development occurs.
44

45 The need for and nature of additional SEZ-specific design features will depend on results
46 of future paleontological investigations. Some SEZ-specific design features may be identified

1 through the process of preparing parcels for competitive offer and subsequent project-specific
2 analysis.

3
4 As additional information on paleontological resources (e.g., from regional
5 paleontologists or from new surveys) becomes available, the BLM will post the data to the
6 project Web site (<http://solareis.anl.gov>) for use by applicants, the BLM, and other stakeholders.
7

8 9 **10.3.17 Cultural Resources**

10 11 **10.3.17.1 Affected Environment**

12 Data provided in the Draft Solar PEIS remain valid, with the following updates:
13

- 14
15
16 • The six archaeological sites located in the footprint of the proposed Fourmile
17 East SEZ in the Draft Solar PEIS are no longer located in the SEZ; however,
18 the potential exists for additional cultural resources to be discovered in the
19 SEZ.
- 20
21 • The distance to the Old Spanish National Historic Trail, located to the east of
22 the proposed Fourmile East SEZ, has been increased from 1 mi (1.6 km) to
23 about 1.3 mi (2.1 km).
- 24
25 • The Trujillo Homestead National Historic Landmark, designated in January
26 2012, encompasses approximately 35 acres (0.14 km²) of land about 15 mi
27 (24 km) north of the Fourmile East SEZ and consists of two nineteenth-
28 century Hispanic ranch properties (see Section 10.1.17.1 of this Final Solar
29 PEIS for details).
- 30
31 • Additional information may be available to characterize the SEZ and its
32 surrounding area in the future (after this Final Solar PEIS is completed), as
33 follows:
 - 34 – Results of an ethnographic study currently being conducted by TRC
35 Solutions, which focuses on Native American use of lands being analyzed
36 for solar development within the San Luis Valley. The study will discuss
37 sensitive and traditional use areas. Interviews with tribal members and
38 field visits will facilitate the identification of resources and sites of
39 traditional and religious importance to tribes.
 - 40 – Results of a Class II sample survey of the SEZ designed to obtain a
41 statistically valid sample of archeological properties and their distribution
42 within the SEZ. Results from the ethnographic study and the sample
43 inventory can be combined to project cultural sensitivity zones as an aid in
44 planning future solar developments.
 - 45 – Identification of the location of the Old Spanish National Historic Trail in
46 the vicinity of the SEZ and viewshed analyses from key observation points

1 along the Trail. A high potential segment of the Trail has been identified
2 directly to the northeast from Crestone, Colorado, to the SEZ. It is clearly
3 within the viewshed of the SEZ and would be affected visually. A
4 mitigation strategy would need to be developed to address unavoidable
5 impacts on the Old Spanish National Historic Trail.

- 6 – Continuation of government-to-government consultation as described in
7 Section 2.4.3 of the Supplement to the Draft Solar PEIS and IM 2012-032
8 (BLM 2011c), including follow-up to recent ethnographic studies covering
9 some SEZs in Nevada and Utah with tribes not included in the original
10 studies to determine whether those tribes have similar concerns.

11 12 13 **10.3.17.2 Impacts**

14
15 Impacts on significant cultural resources are highly likely in the proposed Fourmile East
16 SEZ. Cultural resource surveys would need to be conducted to identify significant cultural
17 prehistoric and historic resources, and a survey of the Old Spanish National Historic Trail would
18 need to occur to determine the location, integrity, and significance of portions of the Trail from
19 which future potential development in the SEZ could be viewed. The assessment provided in the
20 Draft Solar PEIS remains valid, with the following updates:

- 21
22 • The increase in distance from the SEZ boundary to the Old Spanish National
23 Historic Trail from 1 mi (1.6 km) to about 1.3 mi (2.1 km) is not sufficient to
24 mitigate potential visual impacts from solar energy development on the Trail
25 (see Section 10.3.14.2).
- 26
27 • Little to no visual contrast is expected from the viewpoint of the Trujillo
28 Homestead National Historic Landmark toward the Fourmile East SEZ;
29 therefore no adverse effect on this historic property is anticipated.
- 30
31 • Impacts on significant cultural resources and cultural landscapes associated
32 with American Latino heritage are possible throughout the San Luis Valley.

33 34 35 **10.3.17.3 SEZ-Specific Design Features and Design Feature Effectiveness**

36
37 Required programmatic design features that would reduce impacts on cultural resources
38 are described in Section A.2.2 of Appendix A of this Final Solar PEIS. Programmatic design
39 features will be applied to address SEZ-specific resources and conditions, for example:

- 40
41 • For projects in the Fourmile East SEZ that are located within the viewshed
42 of the Old Spanish National Historic Trail, a National Trail inventory will
43 be required to determine the area of possible adverse impact on resources,
44 qualities, values, and associated settings of the trail; to prevent substantial
45 interference; and to determine any areas unsuitable for development. Residual
46 impacts will be avoided, minimized, and/or mitigated to the extent practicable

1 according to program policy standards. Programmatic design features have
2 been included in BLM's Solar Energy Program to address impacts on
3 National Historic Trails (see Section A.2.2.23 of Appendix A).
4

5 Programmatic design features also assume that the necessary surveys, evaluations, and
6 consultations will occur. Ongoing consultation with the Colorado SHPO and the appropriate
7 Native American governments would be conducted during the development of the proposed
8 Fourmile East SEZ. It is likely that some adverse effects on significant resources in the valley
9 could be mitigated to some degree through such efforts, although not enough to eliminate the
10 adverse effects unless significant resources are avoided entirely.
11

12 Even assuming the implementation of programmatic design features, adverse effects on
13 historic properties in the proposed Fourmile East SEZ are likely to occur. Factors in addition to
14 those addressed above for the Old Spanish National Historic Trail that lead to this conclusion
15 include the following: (1) the area's high potential to contain significant cultural sites, including
16 Native American human remains and associated cultural items; and (2) its proximity to (and
17 visual impacts on) at least three areas previously identified as traditionally significant to the
18 Navajo and the Tewa Clans of the Upper Rio Grande Pueblos, and possibly the Ute and Jicarilla
19 Apache (i.e., the Great Sand Dunes, San Luis Lakes, and Blanca Peak).
20

21 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
22 analyses due to changes to the SEZ boundaries, and consideration of comments received as
23 applicable, the following SEZ-specific design features for cultural resources in the proposed
24 Fourmile East SEZ have been identified:
25

- 26 • Development of an MOA may be needed among the BLM, Colorado SHPO,
27 and other parties, such as the ACHP, to address the adverse effects of solar
28 energy development on historic properties. The agreement may specify
29 avoidance, minimization, or mitigation measures. Should an MOA be
30 developed to resolve adverse effects on the Old Spanish National Historic
31 Trail, the Trail Administration for the Old Spanish Trail (BLM-NMSO and
32 National Park Service [NPS] Intermountain Trails Office, Santa Fe) should be
33 included in the development of that MOA.
34
- 35 • The possibility of encountering Native American human remains in the
36 vicinity of the proposed Fourmile East SEZ should be discussed during
37 consultation. Tribal participation in the Section 106 process will take place
38 according to the Solar Programmatic Agreement (PA), including opportunities
39 for tribal input regarding inventory design and treatment decisions and
40 procedures for inadvertent discoveries during construction and operations.
41

42 The need for and nature of additional SEZ-specific design features would depend on
43 the findings of future investigations. Some SEZ-specific design features may be established
44 through the process of preparing parcels for competitive offer and subsequent project-specific
45 analysis.
46

1 **10.3.18 Native American Concerns**

2
3
4 **10.3.18.1 Affected Environment**

5
6 Data provided in the Draft Solar PEIS remain valid but will be supplemented in the
7 future by the results of the ethnographic study being completed in the San Luis Valley (see
8 Section 10.1.17.1).

9
10
11 **10.3.18.2 Impacts**

12
13 The description of potential concerns provided in the Draft Solar PEIS remains valid. No
14 direct impacts from solar energy development are likely to occur on known culturally significant
15 areas (i.e., San Luis Lakes, the Great Sand Dunes, and Blanca Peak); however, indirect visual
16 and auditory impacts are possible. Because tribes typically regard archaeological sites and the
17 remains of their ancestors as culturally important, the high probability of prehistoric resources in
18 the SEZ could be a concern to Native Americans. It is likely that traditional plant and animal
19 habitats would be directly affected with solar energy development in the proposed Fourmile
20 East SEZ.

21
22
23 **10.3.18.3 SEZ-Specific Design Features and Design Feature Effectiveness**

24
25 Required programmatic design features that would reduce impacts on Native American
26 concerns are described in Section A.2.2 of Appendix A of this Final Solar PEIS. For example,
27 impacts would be minimized through the avoidance of sacred sites, water sources, and tribally
28 important plant and animal species. Programmatic design features require that the necessary
29 surveys, evaluations, and consultations would occur. The tribes would be notified regarding the
30 results of archaeological surveys, and they would be contacted immediately upon any discovery
31 of Native American human remains and associated cultural items.

32
33 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
34 analyses due to changes in SEZ boundaries, and consideration of comments received as
35 applicable, no SEZ-specific design features to address Native American concerns in the proposed
36 Fourmile East SEZ have been identified. The need for and nature of SEZ-specific design features
37 would be determined during government-to-government consultation with affected tribes as part
38 of the process of preparing parcels for competitive offer and subsequent project-specific analysis.
39 Potentially significant sites and landscapes in the vicinity of the SEZ associated with Blanca
40 Peak, Great Sand Dunes, and San Luis Lakes, as well as trail systems, mountain springs, mineral
41 resources, burial sites, ceremonial areas, water resources, and plant and animal resources, should
42 be considered and discussed during consultation.

1 **10.3.19 Socioeconomics**

2
3
4 **10.3.19.1 Affected Environment**

5
6 Although the boundaries of the Fourmile East SEZ have been reduced compared to the
7 boundaries given in the Draft Solar PEIS, the socioeconomic ROI, the area in which site
8 employees would live and spend their wages and salaries, and into which any in-migration would
9 occur, includes the same counties and communities as described in the Draft Solar PEIS; that is,
10 no updates to the affected environment information given in the Draft Solar PEIS are required.
11

12
13 **10.3.19.2 Impacts**

14
15 Socioeconomic resources in the ROI around the SEZ could be affected by solar energy
16 development through the creation of direct and indirect employment and income, the generation
17 of direct sales and income taxes, SEZ acreage rental and capacity payments to BLM, the
18 in-migration of solar facility workers and their families, and impacts on local housing markets
19 and on local community service employment. The impact assessment provided in the Draft Solar
20 PEIS remains valid, with the following updates.
21

22
23 **10.3.19.2.1 Solar Trough**

24
25
26 **Construction**

27
28 Total construction employment impacts in the ROI (including direct and indirect impacts)
29 from the use of solar trough technologies would be 2,156 jobs (Table 10.3.19.2-1). Construction
30 activities would constitute 9.2% of total ROI employment. A solar development would also
31 produce \$117.3 million in income. Direct sales taxes would be \$0.1 million; direct income taxes,
32 \$4.6 million.
33

34 With the scale of construction activities and the low likelihood that the entire
35 construction workforce in the required occupational categories would be available in the ROI,
36 construction of a solar facility would mean that some in-migration of workers and their families
37 from outside the ROI would be required, with up to 1,405 persons in-migrating into the ROI.
38 Although in-migration may potentially affect local housing markets, the relatively small number
39 of in-migrants and the availability of temporary accommodations (hotels, motels, and mobile
40 home parks) would mean that the impact of solar facility construction on the number of vacant
41 rental housing units is not expected to be large, with up to 485 rental units expected to be
42 occupied in the ROI. This occupancy rate would represent 35.5% of the vacant rental units
43 expected to be available in the ROI.
44

1
2
3

TABLE 10.3.19.2-1 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Fourmile East SEZ as Revised with Trough Facilities

Parameter	Maximum Annual Construction Impacts ^a	Annual Operations Impacts ^b
Employment (no.)		
Direct	1,262	100
Total	2,156	151
Income ^c		
Total	117.3	4.9
Direct state taxes ^c		
Sales	0.1	0.1
Income	4.6	0.1
BLM payments ^c		
Rental	NA ^d	0.2
Capacity ^e	NA	3.0
In-migrants (no.)	1,405	64
Vacant housing ^f (no.)	485	40
Local community service employment		
Teachers (no.)	19	1
Physicians (no.)	2	0
Public safety (no.)	2	0

^a Construction impacts were based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 461 MW (corresponding to 2,306 acres [9 km²] of land disturbance) could be built.

^b Operations impacts were based on full build-out of the site, producing a total output of 461 MW.

^c Values are reported in \$ million 2008.

^d NA = not applicable.

^e The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

^f Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

1 In addition to the potential impact on housing markets, in-migration would affect
2 community service employment (education, health, and public safety). An increase in such
3 employment would be required to meet existing levels of service in the ROI. Accordingly, up to
4 19 new teachers, 2 physicians, and 2 public safety employees (career firefighters and uniformed
5 police officers) would be required in the ROI. These increases would represent 2.9% of total
6 ROI employment expected in these occupations.

7 8 9 **Operations**

10
11 Total operations employment impacts on the ROI (including direct and indirect
12 impacts) of a full build-out of the SEZ using solar trough technologies would be 151 jobs
13 (Table 10.3.19.2-1). Such a solar development would also produce \$4.9 million in income.
14 Direct sales taxes would be \$0.1 million; direct income taxes, \$0.1 million. Based on fees
15 established by the BLM (BLM 2010), acreage rental payments would be \$0.2 million, and solar
16 generating capacity payments, at least \$3.0 million.

17
18 As for the construction workforce, operation of a solar facility likely would require
19 some in-migration of workers and their families from outside the ROI, with up to 64 persons
20 in-migrating into the ROI. Although in-migration may potentially affect local housing markets,
21 the relatively small number of in-migrants and the availability of temporary accommodations
22 (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation
23 on the number of vacant owner-occupied housing units is not expected to be large, with up to
24 40 owner-occupied units expected to be occupied in the ROI.

25
26 In addition to the potential impact on housing markets, in-migration would affect
27 community service (education, health, and public safety) employment. An increase in such
28 employment would be required to meet existing levels of service in the ROI. Accordingly, one
29 new teacher would be required in the ROI.

30 31 32 **10.3.19.2.2 Power Tower**

33 34 35 **Construction**

36
37 Total construction employment impacts in the ROI (including direct and indirect impacts)
38 from the use of power tower technologies would be 859 jobs (Table 10.3.19.2-2). Construction
39 activities would constitute 3.7% of total ROI employment. Such a solar development would
40 also produce \$46.7 million in income. Direct sales taxes would be less than \$0.1 million; direct
41 income taxes, \$1.8 million.

42
43 With the scale of construction activities and the low likelihood that the entire
44 construction workforce in the required occupational categories would be available in the local
45 workforce, construction of a solar facility would mean that some in-migration of workers and
46 their families from outside the ROI would be required, with up to 590 persons in-migrating into

1
2
3

TABLE 10.3.19.2-2 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Fourmile East SEZ as Revised with Power Tower Facilities

Parameter	Maximum Annual Construction Impacts ^a	Annual Operations Impacts ^b
Employment (no.)		
Direct	503	52
Total	859	72
Income ^c		
Total	46.7	2.2
Direct state taxes ^c		
Sales	<0.1	<0.1
Income	1.8	0.1
BLM payments ^c		
Rental	NA ^d	0.2
Capacity ^e	NA	1.7
In-migrants (no.)	590	33
Vacant housing ^f (no.)	193	21
Local community service employment		
Teachers (no.)	8	0
Physicians (no.)	1	0
Public safety (no.)	1	0

^a Construction impacts were based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 256 MW (corresponding to 2,306 acres [9 km²] of land disturbance) could be built.

^b Operations impacts were based on full build-out of the site, producing a total output of 256 MW.

^c Values are reported in \$ million 2008.

^d NA = not applicable.

^e The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

^f Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

1 the ROI. Although in-migration may potentially affect local housing markets, the relatively small
2 number of in-migrants and the availability of temporary accommodations (hotels, motels, and
3 mobile home parks) would mean that the impact of solar facility construction on the number of
4 vacant rental housing units is not expected to be large, with up to 193 rental units expected to be
5 occupied in the ROI. This occupancy rate would represent 14.1% of the vacant rental units
6 expected to be available in the ROI.

7
8 In addition to the potential impact on housing markets, in-migration would affect
9 community service (education, health, and public safety) employment. An increase in such
10 employment would be required to meet existing levels of service in the ROI. Accordingly, up to
11 eight new teachers, one physician, and one public safety employee (career firefighters and
12 uniformed police officers) would be required in the ROI. These increases would represent 1.2%
13 of total ROI employment expected in these occupations.

14 15 16 **Operations**

17
18 Total operations employment impacts on the ROI (including direct and indirect
19 impacts) of a full build-out of the SEZ using power tower technologies would be 72 jobs
20 (Table 10.3.19.2-2). Such a solar development would also produce \$2.2 million in income.
21 Direct sales taxes would be less than \$0.1 million; direct income taxes, \$0.1 million. Based on
22 fees established by the BLM (BLM 2010), acreage rental payments would be \$0.2 million, and
23 solar generating capacity payments, at least \$1.7 million.

24
25 As for the construction workforce, operation of a solar facility likely would require
26 some in-migration of workers and their families from outside the ROI, with up to 33 persons
27 in-migrating into the ROI. Although in-migration may potentially affect local housing markets,
28 the relatively small number of in-migrants and the availability of temporary accommodations
29 (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation
30 on the number of vacant owner-occupied housing units is not expected to be large, with up to
31 21 owner-occupied units expected to be required in the ROI.

32
33 No new community service employment would be required to meet existing levels of
34 service in the ROI.

35 36 37 ***10.3.19.2.3 Dish Engine***

38 39 40 **Construction**

41
42 Total construction employment impacts on the ROI (including direct and indirect
43 impacts) from the use of dish engine technologies would be 349 jobs (Table 10.3.19.2-3).
44 Construction activities would constitute 1.5% of total ROI employment. Such a solar
45 development would also produce \$19.0 million in income. Direct sales taxes would be less than
46 \$0.1 million; direct income taxes, \$0.7 million.

1
2
3

TABLE 10.3.19.2-3 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Fourmile East SEZ as Revised with Dish Engine Facilities

Parameter	Maximum Annual Construction Impacts ^a	Annual Operations Impacts ^b
Employment (no.)		
Direct	204	50
Total	349	70
Income ^c		
Total	19.0	2.2
Direct state taxes ^c		
Sales	<0.1	<0.1
Income	0.7	0.1
BLM payments ^c		
Rental	NA ^d	0.2
Capacity ^e	NA	1.7
In-migrants (no.)	227	32
Vacant housing ^f (no.)	79	20
Local community service employment		
Teachers (no.)	3	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts were based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 256 MW (corresponding to 2,306 acres [9 km²] of land disturbance) could be built.

^b Operations impacts were based on full build-out of the site, producing a total output of 256 MW.

^c Values are reported in \$ million 2008.

^d NA = not applicable.

^e The BLM annual capacity payment was based on a fee of \$6,570 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010), assuming a solar facility with no storage capability, and full build-out of the site. Projects with three or more hours of storage would generate higher payments, based on a fee of \$7,884 per MW.

^f Construction activities would affect vacant rental housing; operations activities would affect vacant owner-occupied housing.

1 With the scale of construction activities and the low likelihood that the entire
2 construction workforce in the required occupational categories would be available in the local
3 workforce, construction of a solar facility would mean that some in-migration of workers and
4 their families from outside the ROI would be required, with up to 227 persons in-migrating into
5 the ROI. Although in-migration may potentially affect local housing markets, the relatively small
6 number of in-migrants and the availability of temporary accommodations (hotels, motels, and
7 mobile home parks) would mean that the impact of solar facility construction on the number of
8 vacant rental housing units is not expected to be large, with up to 79 rental units expected to be
9 occupied in the ROI. This occupancy rate would represent 5.8% of the vacant rental units
10 expected to be available in the ROI.

11
12 In addition to the potential impact on housing markets, in-migration would affect
13 community service (education, health, and public safety) employment. An increase in such
14 employment would be required to meet existing levels of service in the ROI. Accordingly, up to
15 three new teachers would be required in the ROI. This increase would represent 0.5% of total
16 ROI employment expected in this occupation.

17 18 19 **Operations**

20
21 Total operations employment impacts in the ROI (including direct and indirect
22 impacts) of a full build-out of the SEZ using dish engine technologies would be 70 jobs
23 (Table 10.3.19.2-3). Such a solar development would also produce \$2.2 million in income.
24 Direct sales taxes would be less than \$0.1 million; direct income taxes, \$0.1 million. Based on
25 fees established by the BLM (BLM 2010), acreage rental payments would be \$0.2 million, and
26 solar generating capacity payments, at least \$1.7 million.

27
28 As for the construction workforce, operation of a solar facility likely would require
29 some in-migration of workers and their families from outside the ROI, with up to 32 persons
30 in-migrating into the ROI. Although in-migration may potentially affect local housing markets,
31 the relatively small number of in-migrants and the availability of temporary accommodations
32 (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation
33 on the number of vacant owner-occupied housing units is not expected to be large, with up to
34 20 owner-occupied units expected to be required in the ROI.

35
36 No new community service employment would be required to meet existing levels of
37 service in the ROI.

38 39 **10.3.19.2.4 Photovoltaic**

40 41 42 43 **Construction**

44
45 Total construction employment impacts in the ROI (including direct and indirect impacts)
46 from the use of PV technologies would be 163 jobs (Table 10.3.19.2-4). Construction activities

1
2
3

TABLE 10.3.19.2-4 ROI Socioeconomic Impacts Assuming Full Build-out of the Proposed Fourmile East SEZ as Revised with PV Facilities

Parameter	Maximum Annual Construction Impacts ^a	Annual Operations Impacts ^b
Employment (no.)		
Direct	95	5
Total	163	7
Income ^c		
Total	8.9	0.2
Direct state taxes ^c		
Sales	<0.1	<0.1
Income	0.3	<0.1
BLM payments ^c		
Rental	NA ^d	0.2
Capacity ^e	NA	1.3
In-migrants (no.)	106	3
Vacant housing ^f (no.)	37	2
Local community service employment		
Teachers (no.)	1	0
Physicians (no.)	0	0
Public safety (no.)	0	0

^a Construction impacts were based on the development at the site in a single year; it was assumed that several facilities with a combined capacity of up to 256 MW (corresponding to 2,306 acres [9 km²] of land disturbance) could be built.

^b Operations impacts were based on full build-out of the site, producing a total output of 256 MW.

^c Values are reported in \$ million 2008.

^d NA = not applicable.

^e The BLM annual capacity payment was based on a fee of \$5,256 per MW, established by the BLM in its Solar Energy Interim Rental Policy (BLM 2010), assuming full build-out of the site.

^f Construction activities would affect vacant rental housing; operations activities would affect owner-occupied housing.

4
5

1 would constitute 0.7% of total ROI employment. Such a solar development would also produce
2 \$8.9 million in income. Direct sales taxes would be less than \$0.1 million; direct income taxes,
3 \$0.3 million.

4
5 With the scale of construction activities and the likelihood of local worker availability
6 in the required occupational categories, construction of a solar facility would mean that some
7 in-migration of workers and their families from outside the ROI would be required, with up to
8 106 persons in-migrating into the ROI. Although in-migration may potentially affect local
9 housing markets, the relatively small number of in-migrants and the availability of temporary
10 accommodations (hotels, motels, and mobile home parks) would mean that the impact of solar
11 facility construction on the number of vacant rental housing units is not expected to be large,
12 with up to 37 rental units expected to be occupied in the ROI. This occupancy rate would
13 represent 2.7% of the vacant rental units expected to be available in the ROI.

14
15 In addition to the potential impact on housing markets, in-migration would affect
16 community service (education, health, and public safety) employment. An increase in such
17 employment would be required to meet existing levels of service in the ROI. Accordingly,
18 one new teacher would be required in the ROI. This increase would represent 0.2% of total
19 ROI employment expected in this occupation.

20 21 22 **Operations**

23
24 Total operations employment impacts in the ROI (including direct and indirect impacts)
25 of a full build-out of the SEZ using PV technologies would be 7 jobs (Table 10.3.19.2-4). Such a
26 solar development would also produce \$0.2 million in income. Direct sales taxes would be less
27 than \$0.1 million; direct income taxes, less than \$0.1 million. Based on fees established by the
28 BLM (BLM 2010), acreage rental payments would be \$0.2 million, and solar generating capacity
29 payments, at least \$1.3 million.

30
31 As for the construction workforce, operation of a solar facility likely would require some
32 in-migration of workers and their families from outside the ROI, with up to three persons
33 in-migrating into the ROI. Although in-migration may potentially affect local housing markets,
34 the relatively small number of in-migrants and the availability of temporary accommodations
35 (hotels, motels, and mobile home parks) would mean that the impact of solar facility operation
36 on the number of vacant owner-occupied housing units is not expected to be large, with up to
37 two owner-occupied units expected to be required in the ROI.

38
39 No new community service employment would be required to meet existing levels of
40 service in the ROI.

41 42 43 **10.3.19.3 SEZ-Specific Design Features and Design Feature Effectiveness**

44
45 Required programmatic design features that would reduce socioeconomic impacts are
46 described in Section A.2.2 of Appendix A of this Final Solar PEIS. Implementing the

1 programmatic design features will reduce the potential for socioeconomic impacts during all
2 project phases.

3
4 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
5 analyses due to changes to the SEZ boundaries, and consideration of comments received as
6 applicable, no SEZ-specific design features to address socioeconomic impacts in the proposed
7 Fourmile East SEZ have been identified. Some SEZ-specific design features may be identified
8 through the process of preparing parcels for competitive offer and subsequent project-specific
9 analysis.

10 11 12 **10.3.20 Environmental Justice**

13 14 15 **10.3.20.1 Affected Environment**

16
17 The data presented in the Draft Solar PEIS have changed due to the change in boundaries
18 of the proposed Fourmile East SEZ. The affected environment information presented in the Draft
19 Solar PEIS has also changed, as reflected in the following discussion.

20
21 The data in Table 10.3.20.1-1 show the minority and low-income composition of the total
22 population located within a 50-mi (80-km) radius of the proposed SEZ based on 2000 Census
23 data and CEQ guidelines (CEQ 1997). Individuals identifying themselves as Hispanic or Latino
24 are included in the table as a separate entry. However, because Hispanics can be of any race, this
25 number also includes individuals also identifying themselves as being part of one or more of the
26 population groups listed in the table.

27
28 A large number of minority and low-income individuals are located in the 50-mi (80-km)
29 area around the boundary of the SEZ. Within the 50-mi (80-km) radius in Colorado, 43.2% of
30 the population is classified as minority, while 18.5% is classified as low-income. The number of
31 minority or low-income individuals does not exceed the state average by 20 percentage points or
32 more and does not exceed 50% of the total population in the radius; that is, there are no minority
33 or low-income populations in the Colorado portion of the 50-mi (80-km) area based on
34 2000 Census data and CEQ guidelines.

35
36 Within the 50-mi (80-km) radius in New Mexico, 55.6% of the population is classified as
37 minority, while 17.4% is classified as low-income. Although the number of minority individuals
38 does not exceed the state average by 20 percentage points or more, the number of minority
39 individuals exceeds 50% of the total population in the radius area, meaning that there are
40 minority populations in the 50-mi (80-km) radius based on 2000 Census data and CEQ
41 guidelines. The number of low-income individuals does not exceed the state average by
42 20 percentage points or more and does not exceed 50% of the total population in the radius; that
43 is, there are no low-income populations in the New Mexico portion of the 50-mi (80 km) area.

44
45 In the Colorado portion of the 50-mi (80-km) radius, more than 50% of the population in
46 all but one of the block groups in Conejos County is made up of minority population groups,

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**TABLE 10.3.20.1-1 Minority and Low-Income Populations
within the 50-mi (80-km) Radius Surrounding the Proposed
Fourmile East SEZ as Revised**

Parameter	Colorado	New Mexico
Total population	66,670	9,859
White, non-Hispanic	37,871	4,374
Hispanic or Latino	26,485	5,147
Non-Hispanic or Latino minorities	2,314	338
One race	1,464	171
Black or African American	404	18
American Indian or Alaskan Native	666	93
Asian	262	30
Native Hawaiian or other Pacific Islander	26	3
Some other race	106	27
Two or more races	850	167
Total minority	28,799	5,485
Low-income	11,886	1,720
Percentage minority	43.2	55.6
State percentage minority	25.5	55.3
Percentage low-income	18.5	17.4
State percentage low-income	9.3	18.4

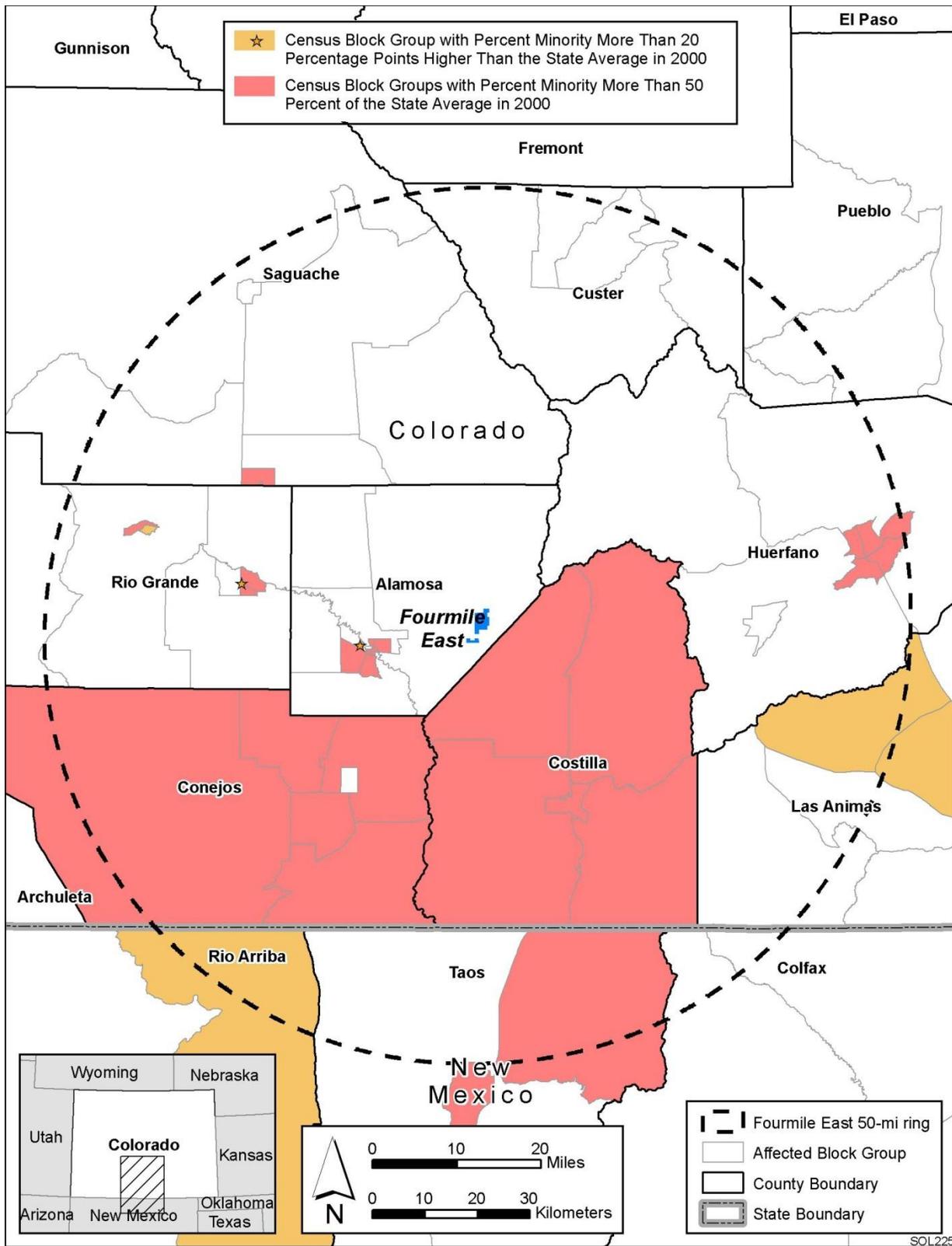
Sources: U.S. Bureau of the Census (2009a,b).

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together with all the block groups in adjacent Costilla County. Block groups in the cities of Alamosa (Alamosa County), Monte Vista and Del Norte (both in Rio Grande County), Center (Saguache County), and Walsenburg (Huerfano County) are also more than 50% minority. In the New Mexico portion of the radius, Rio Arriba County has one block group in which the minority population is more than 20 percentage points higher than the state average, while there are two block groups with more than a 50% minority in Taos County.

Low-income populations in the 50-mi (80-km) radius are limited to two block groups in the Colorado portion, in the cities of San Luis (Costilla County) and Alamosa, both of which have low-income population shares that are more than 20 percentage points higher than the state average.

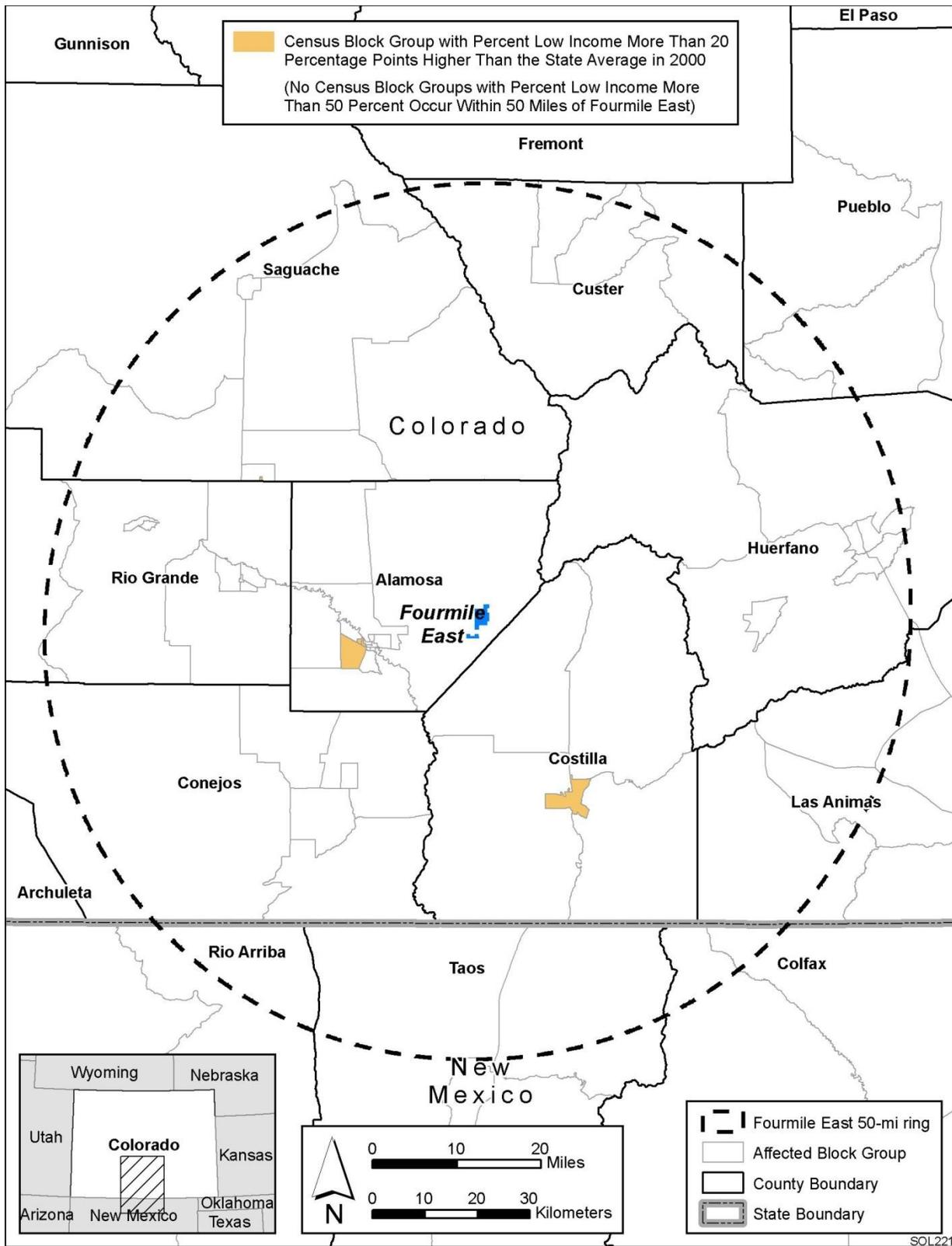
Figures 10.3.20.1-1 and 10.3.20.1-2 show the locations of minority and low-income population groups in the 50-mi (80-km) radius around the boundary of the SEZ.



1

2 **FIGURE 10.3.20.1-1 Minority Population Groups within the 50-mi (80-km) Radius Surrounding**

3 **the Proposed Fourmile East SEZ as Revised**



1

2 **FIGURE 10.3.20.1-2 Low-Income Population Groups within the 50-mi (80-km) Radius**
 3 **Surrounding the Proposed Fourmile East SEZ as Revised**

1 **10.3.20.2 Impacts**

2
3 Potential impacts (e.g., from noise and dust during construction and operations, visual
4 impacts, cultural impacts, and effects on property values) on low-income and minority
5 populations could be incurred as a result of the construction and operation of solar facilities
6 involving each of the four technologies. Although impacts are likely to be small, there are
7 minority populations defined by CEQ guidelines (CEQ 1997) (see Section 10.3.20.1 of the Draft
8 Solar PEIS) within the New Mexico portion of the 50-mi (80-km) radius around the boundary of
9 the SEZ; thus any adverse impacts of solar projects would disproportionately affect minority
10 populations. Further analysis of these impacts would be included in subsequent NEPA reviews of
11 individual solar projects. Because there are no low-income populations within the 50-mi (80-km)
12 radius, according to CEQ guidelines, there would be no impacts on low-income populations.
13

14
15 **10.3.20.3 SEZ-Specific Design Features and Design Feature Effectiveness**

16
17 Required programmatic design features that would reduce potential environmental justice
18 impacts are described in Section A.2.2 of Appendix A of this Final Solar PEIS. Implementing the
19 programmatic design features will reduce the potential for environmental justice impacts.
20

21 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
22 analyses due to changes to the SEZ boundaries, and consideration of comments received as
23 applicable, no SEZ-specific design features for environmental justice in the proposed Fourmile
24 East SEZ have been identified. Some SEZ-specific design features may be identified through the
25 process of preparing parcels for competitive offer and subsequent project-specific analysis.
26

27
28 **10.3.21 Transportation**

29
30
31 **10.3.21.1 Affected Environment**

32
33 The reduction in size of the SEZ does not change the information on affected
34 environment for transportation provided in the Draft Solar PEIS.
35

36
37 **10.3.21.2 Impacts**

38
39 As stated in the Draft Solar PEIS, the primary transportation impacts are anticipated to be
40 from commuting worker traffic. U.S. 160 provides a regional traffic corridor that could
41 experience moderate impacts for projects that may have up to 1,000 daily workers with an
42 additional 2,000 vehicle trips per day (maximum). Some parts of U.S. 160 could experience
43 approximately a 50% increase in the daily traffic load, and the amount of traffic currently on
44 CO 150 could increase approximately threefold. Local road improvements would be necessary in
45 any portion of the SEZ along U.S. 160 that might be developed so as not to overwhelm the local

1 roads near any site access point(s). CO 150 and any other access roads connected to it would
2 require road improvements to handle the additional traffic.

3
4 Solar development within the SEZ would affect public access along OHV routes that are
5 designated open and available for public use. Although open routes crossing areas granted
6 ROWs for solar facilities could be redesignated as closed (see Section 5.5.1 of the Draft Solar
7 PEIS), a programmatic design feature has been included under Recreation (Section A.2.2.6.1 of
8 Appendix A) that requires consideration of replacement of lost OHV route acreage and of access
9 across and to public lands.

10 11 12 **10.3.21.3 SEZ-Specific Design Features and Design Feature Effectiveness**

13
14 Required programmatic design features that would reduce transportation impacts are
15 described in Section A.2.2 of Appendix A of this Final Solar PEIS. The programmatic design
16 features, including local road improvements, multiple site access locations, staggered work
17 schedules, and ride-sharing, will all provide some relief to traffic congestion on local roads
18 leading to the SEZ. Depending on the location of solar facilities within the SEZ, more specific
19 access locations and local road improvements could be implemented.

20
21 On the basis of impact analyses conducted for the Draft Solar PEIS, updates to those
22 analyses due to changes to the SEZ boundaries, and consideration of comments received as
23 applicable, no SEZ-specific design features to address transportation impacts in the proposed
24 Fourmile East SEZ have been identified. Some SEZ-specific design features may be identified
25 through the process of preparing parcels for competitive offer and subsequent project-specific
26 analysis.

27 28 29 **10.3.22 Cumulative Impacts**

30
31 The analysis of potential impacts in the vicinity of the proposed Fourmile East SEZ
32 presented in the Draft Solar PEIS is still generally applicable for this Final Solar PEIS, although
33 the impacts would be decreased because the size of the proposed SEZ has been reduced to
34 2,883 acres (11.7 km²). The following sections include an update to the information presented in
35 the Draft Solar PEIS regarding cumulative effects for the proposed Fourmile East SEZ.

36 37 38 **10.3.22.1 Geographic Extent of the Cumulative Impacts Analysis**

39
40 The geographic extent of the cumulative impact analysis has not changed. The extent
41 varies on the basis of the nature of the resource being evaluated and the distance at which
42 an impact may occur (thus, e.g., air quality impacts may have a greater regional extent than
43 cultural resources impacts). Lands around the SEZ are privately owned or administered by the
44 USFS, NPS, or the BLM. The BLM administers approximately 11% of the lands within a 50-mi
45 (80-km) radius of the Fourmile East SEZ.

1 **10.3.22.2 Overview of Ongoing and Reasonably Foreseeable Future Actions**
2

3 The proposed Fourmile East SEZ decreased from 3,882 acres (15.7 km²) to 2,883 acres
4 (11.7 km²). The Draft Solar PEIS included three other proposed SEZs in Colorado: Antonito
5 Southeast, De Tilla Gulch, and Los Mogotes East. All these proposed SEZs are being carried
6 forward to the Final Solar PEIS; the areas of the De Tilla Gulch and Los Mogotes East SEZs
7 have been decreased.
8

9 The ongoing and reasonably foreseeable future actions described below are grouped into
10 two categories: (1) actions that relate to energy production and distribution, including potential
11 solar energy projects under the proposed action (Section 10.3.22.2.1); and (2) other ongoing and
12 reasonably foreseeable actions, including those related to electric power generation and
13 distribution, wildlife management, and military facility improvement (Section 10.3.22.2.2).
14 Together, these actions and trends have the potential to affect human and environmental
15 receptors within the geographic range of potential impacts over the next 20 years.
16
17

18 **10.3.22.2.1 Energy Production and Distribution**
19

20 The list of reasonably foreseeable future actions near the proposed Fourmile East SEZ
21 has been updated and is presented in Table 10.3.22.2-1. Projects listed in the table are shown in
22 Figure 10.3.22.2-1.
23

24 Xcel Energy (Public Service Company of Colorado) has submitted a transmission
25 planning report to the Colorado Public Utility Commission stating that it intends to end its
26 involvement in the proposed San Luis Valley–Calumet-Comanche Transmission project
27 (Heide 2011). The project itself has not been cancelled.
28
29

30 **10.3.22.2.2 Other Actions**
31

32 None of the major ongoing and foreseeable actions within 50 mi (80 km) of the proposed
33 Fourmile East SEZ that were listed in Table 10.3.22.2-3 of the Draft Solar PEIS have had a
34 change in their status.
35
36

37 **10.3.22.3 General Trends**
38

39 The information on general trends presented in the Draft Solar PEIS remains valid.
40
41

42 **10.3.22.4 Cumulative Impacts on Resources**
43

44 Total disturbance over 20 years in the proposed Fourmile East SEZ would be about
45 2,306 acres (9.4 km²) (80% of the entire proposed SEZ). This development would contribute
46 incrementally to the impacts from other past, present and reasonably foreseeable future actions

1 **TABLE 10.3.22.2-1 Ongoing and Reasonably Foreseeable Future Actions Related to Energy**
 2 **Development and Distribution near the Proposed Fourmile East SEZ as Revised and in the San**
 3 **Luis Valley^a**

Description	Status	Resources Affected	Primary Impact Location
<i>Renewable Energy Development</i>			
San Luis Valley Generation Development Area (GDA) (Solar) Designation	Ongoing	Land use	San Luis Valley
Xcel Energy/SunEdison Project, 8.2-MW PV	Operating	Land use, ecological resources, visual	San Luis Valley GDA
San Luis Valley Solar Ranch (formerly Alamosa Solar Generating Project), 30-MW PV	Operating^b	Land use, ecological resources, visual	San Luis Valley GDA
Greater Sandhill Solar Project, 19-MW PV	Operating^b	Land use, ecological resources, visual	San Luis Valley GDA
San Luis Valley Solar Project, Tessera Solar, 200-MW dish engine, changed to 145-MW, 1,500 acres^c	New proposal^d	Land use, ecological resources, visual, cultural	San Luis Valley GDA
Solar Reserve; 200-MW solar tower	Application submitted for land-use permit^e	Land use, ecological resources, visual	San Luis Valley GDA (Saguache)
Alamosa Solar Generating Project (formerly Cogentrix Solar Services), 30-MW high-concentration PV	Under construction^b	Land use, ecological resources, visual	San Luis Valley GDA
Lincoln Renewables, 37-MW PV	County Permit approved	Land use, ecological resources, visual	San Luis Valley GDA
NextEra, 30-MW PV	County Permit approved	Land use, ecological resources, visual	San Luis Valley GDA
<i>Transmission and Distribution Systems</i>			
San Luis Valley–Calumet–Comanche Transmission Project	Proposed^f	Land use, ecological resources, visual, cultural	San Luis Valley (select counties)

^a Projects with status changed from that given in the Draft Solar PEIS are shown in bold text.

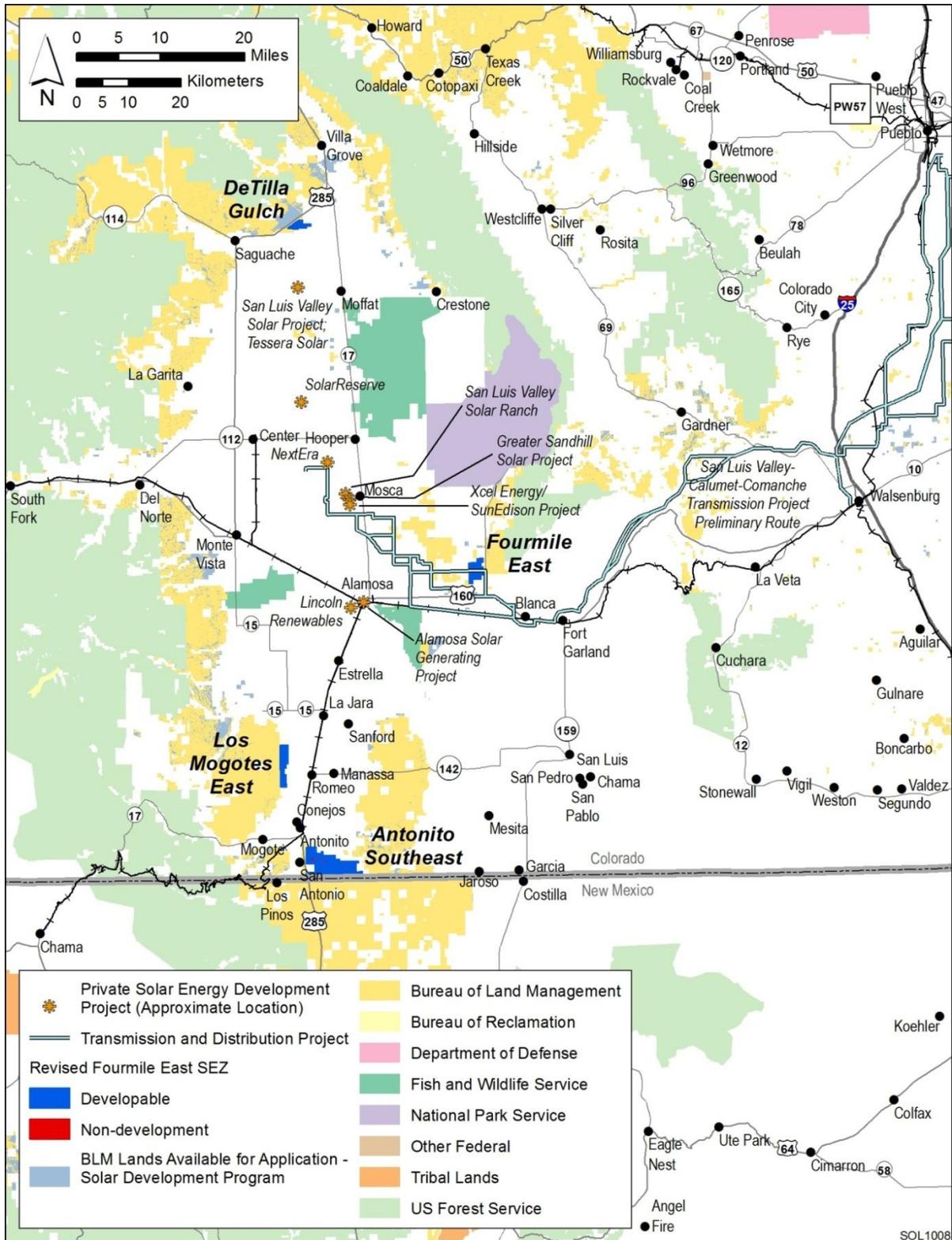
^b See SEIA (2012) for details.

^c To convert acres to km², multiply by 0.004047.

^d See Solar Feeds (2012) for details.

^e See Tetra Tech EC, Inc. (2011).

^f See Heide (2011) for details.



1
2 **FIGURE 10.3.22.2-1 Locations of Existing and Reasonably Foreseeable Renewable Energy**
3 **Projects on Public Land within a 5-mi (80-km) Radius of the Proposed Fourmile East SEZ**
4 **as Revised**

1 in the region as described in the Draft Solar PEIS. Primary impacts from development in the
2 Fourmile East SEZ may include impacts on water quantity and quality, air quality, ecological
3 resources such as habitat and species, cultural and visual resources, and specially designated
4 lands.

5
6 No additional major actions have been identified within 50 mi (80 km) of the SEZ. As a
7 result of the reduction in the developable area of the SEZ, the incremental cumulative impacts
8 associated with development in the proposed Fourmile East SEZ during construction, operation,
9 and decommissioning are expected to be the same or less than those projected in the Draft Solar
10 PEIS.

11
12 On the basis of comments received on the Draft Solar PEIS, cumulative impacts on
13 recreation in the San Luis Valley have been reconsidered. While it is unlikely that the proposed
14 Fourmile East SEZ would have a large impact on recreational use or tourism throughout the
15 Valley, cumulative impacts could occur because it is one of four potential SEZs totaling about
16 16,300 acres (66 km²) on public lands, and there are additional solar energy developments on
17 private land. The location of the SEZ along the main route into Great Sand Dunes National Park
18 has the potential of influencing the impressions of recreational visitors traveling to the park.
19 Because most of the land on the valley floor of the San Luis Valley is private and is heavily
20 developed for agricultural use, undeveloped public lands around the valley provide accessible
21 areas for public recreation. Although it is believed the recreation use of the proposed SEZ is low,
22 the loss of public access to such areas cumulatively leads to an overall reduction in the
23 availability of recreation that can become significant.

24 25 26 **10.3.23 Transmission Analysis**

27
28 The methodology for this transmission analysis is described in Appendix G of this Final
29 Solar PEIS. This section presents the results of the transmission analysis for the Fourmile East
30 SEZ, including the identification of potential load areas to be served by power generated at the
31 SEZ and the results of the DLT analysis. Unlike Sections 10.3.2 through 10.3.22, this section is
32 not an update of previous analysis for the Fourmile East SEZ; this analysis was not presented in
33 the Draft Solar PEIS. However, the methodology and a test case analysis were presented in the
34 Supplement to the Draft Solar PEIS. Comments received on the material presented in the
35 Supplement were used to improve the methodology for the assessment presented in this Final
36 Solar PEIS.

37
38 On the basis of its size, the assumption of a minimum of 5 acres (0.02 km²) of land
39 required per MW, and the assumption of a maximum of 80% of the land area developed, the
40 Fourmile East SEZ is estimated to have the potential to generate 461 MW of marketable solar
41 power at full build-out.

1 **10.3.23.1 Identification and Characterization of Load Areas**
2

3 The primary candidates for Fourmile East SEZ load areas are the major surrounding
4 cities. Figure 10.3.23.1-1 shows the possible load areas for the Fourmile East SEZ and the
5 estimated portion of their market that could be served by solar generation. Possible load areas for
6 the Fourmile East SEZ include Pueblo, Colorado Springs, and Denver, Colorado; Farmington,
7 Albuquerque, and Santa Fe, New Mexico; Salt Lake City, Utah; Phoenix, Arizona; and
8 Las Vegas, Nevada.
9

10 The two load area groups examined for Fourmile East SEZ are as follows:

- 11
12 1. Pueblo, Colorado Springs, and Denver, Colorado, and
13
14 2. Farmington and Albuquerque, New Mexico.
15

16 Figure 10.3.23.1-2 shows the most economically viable transmission scheme for the
17 Fourmile East SEZ (transmission scheme 1), and Figure 10.3.23.1-3 shows an alternative
18 transmission scheme (transmission scheme 2) that represents a logical choice should
19 transmission scheme 1 be infeasible. As described in Appendix G, the alternative shown in
20 transmission scheme 2 represents the optimum choice if one or more of the primary linkages in
21 transmission scheme 1 are excluded from consideration. The groups provide for linking loads
22 along alternative routes so that the SEZ’s output of 461 MW could be fully allocated.
23

24 Table 10.3.23.1-1 summarizes and groups the load areas according to their associated
25 transmission scheme and provides details on how the megawatt load for each area was estimated.
26

27
28 **10.3.23.2 Findings for the DLT Analysis**
29

30 The DLT analysis approach assumes that the Fourmile East SEZ will require all new
31 construction for transmission lines (i.e., dedicated lines) and substations. The new transmission
32 lines(s) would directly convey the 461-MW output of the Fourmile East SEZ to the prospective
33 load areas for each possible transmission scheme. The approach also assumes that all existing
34 transmission lines in the WECC region are saturated and have little or no available capacity to
35 accommodate the SEZ’s output throughout the entire 10-year study horizon.
36

37 Figures 10.3.23.1-1 and 10.3.23.1-2 display the pathways that new dedicated lines might
38 follow to distribute solar power generated at the Fourmile East SEZ via the two identified
39 transmission schemes described in Table 10.3.23.1-1. These pathways parallel existing 500-,
40 345-, 230-kV, and lower voltage lines. The intent of following existing lines is to avoid pathways
41 that may be infeasible due to topographical limitations or other reasons.
42

43 For transmission scheme 1, serving load centers to the north, a new line would be
44 constructed to connect with Pueblo (52 MW), Colorado Springs (210 MW), and Denver
45 (1,272 MW), so that the 461-MW output of the Fourmile East SEZ could be fully utilized
46 (Figure 10.3.23.1-2). This particular scheme has three segments. The first segment is from the

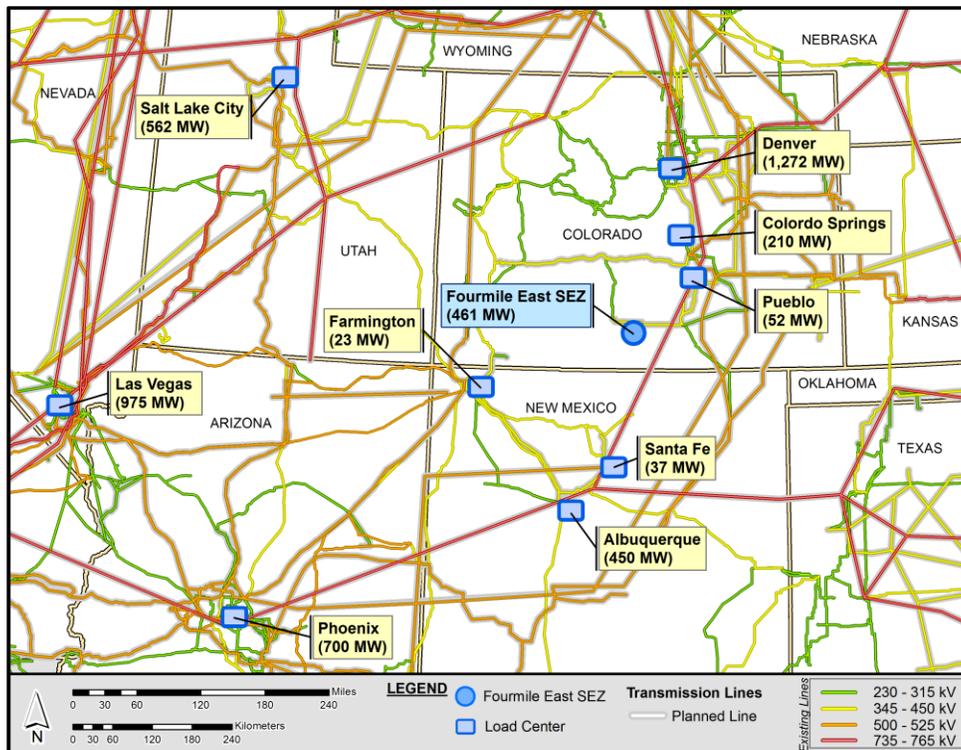


FIGURE 10.3.23.1-1 Location of the Proposed Fourmile East SEZ and Possible Load Areas (Source for background map: Platts 2011)

SEZ, running about 105 mi (169 km) northeast to Pueblo. On the basis of engineering and operational considerations, this segment would require a single-circuit 345-kV bundle of two conductor (Bof2) transmission design. The second leg goes north about 43 mi (69 km) from Pueblo to Colorado Springs. The third and final leg extends 63 mi (101 km) farther north to Denver. The transmission configuration options were determined by using the line “loadability” curve provided in American Electric Power’s *Transmission Facts* (AEP 2010). Appendix G documents the line options used for this analysis and describes how the load area groupings were determined.

For transmission scheme 2, serving load centers to the southwest, Figure 10.3.23.1-3 shows that new lines would be constructed to connect with Farmington (23 MW) and Albuquerque (450 MW), so that the 461-MW output of the Fourmile East SEZ could be fully utilized. This scheme has two segments. The first segment, from the SEZ to Farmington, is 331 mi (533 km) long, and the second segment, from Farmington to Albuquerque, is about 173 mi (278 km) long. Again, the transmission configuration for each leg, or segment, varies and was determined by using the line “loadability” curve provided in American Electric Power’s *Transmission Facts* (AEP 2010), with the constraint that the full output of the SEZ (461 MW) would be completely marketed.

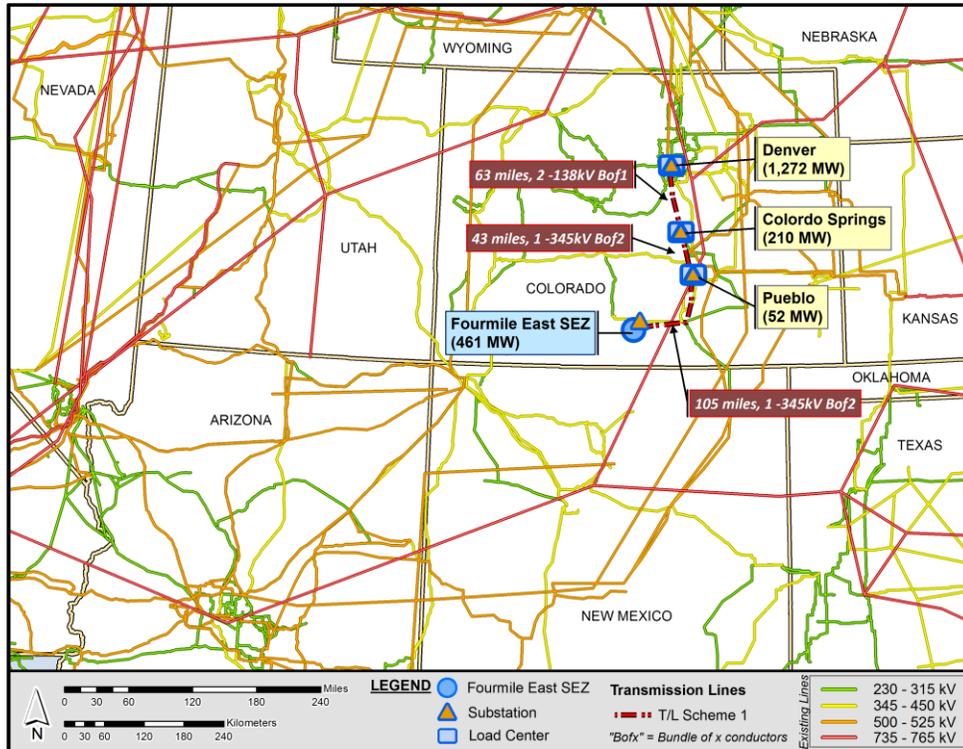
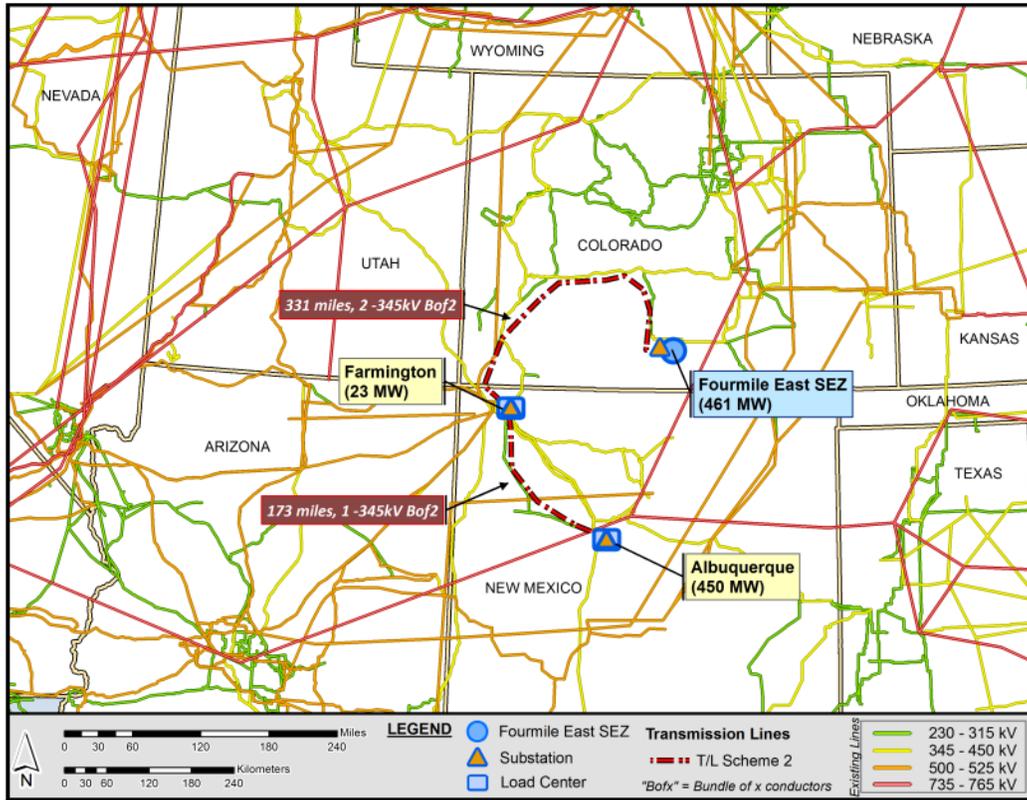


FIGURE 10.3.23.1-2 Transmission Scheme 1 for the Proposed Fourmile East SEZ (Source for background map: Platts 2011)

Table 10.3.23.2-1 summarizes the distances to the various load areas over which new transmission lines would need to be constructed, as well as the assumed number of substations that would be required. One substation is assumed to be installed at each load area and an additional one at the SEZ. Thus, in general, the total number of substations per scheme is simply equal to the number of load areas associated with the scheme plus one. Substations at the load areas would consist of one or more step-down transformers, while the originating substation at the SEZ would consist of several step-up transformers. The originating substation would have a rating of at least 461 MW (to match the plant's output), while the combined load substations would have a similar total rating of 461 MW. For schemes that require the branching of the lines, a switching substation is assumed to be constructed at the appropriate junction. In general, switching stations carry no local load but are assumed to be equipped with switching gears (e.g., circuit breakers and connecting switches) to reroute power as well as, in some cases, with additional equipment to regulate voltage.

Table 10.3.23.2-2 provides an estimate of the total land area disturbed for construction of new transmission facilities under each of the schemes evaluated. The most favorable transmission scheme with respect to minimizing costs and the area disturbed would be scheme 1, which would serve Pueblo, Colorado Springs, and Denver and for which the construction of new transmission lines and substations is estimated to disturb about 3,761 acres (15.2 km²) of land. The less favorable transmission scheme with respect to minimizing costs and the area disturbed would be scheme 2 (serving Farmington and Albuquerque). For this scheme, the construction of



1

2 **FIGURE 10.3.23.1-3 Transmission Scheme 2 for the Proposed Fourmile East SEZ**
 3 **(Source for background map: Platts 2011)**

4

5

6

6 **TABLE 10.3.23.1-1 Candidate Load Area Characteristics for the Proposed Fourmile East SEZ**

Transmission Scheme	City/Load Area Name	Position Relative to SEZ	2010 Population ^c	Estimated Total Peak Load (MW)	Estimated Peak Solar Market (MW)
1	Pueblo, Colorado ^a	North	105,000	262	52
	Colorado Springs, Colorado ^a	North	420,000	1,050	210
	Denver, Colorado ^b	North	2,543,000	6,358	1,272
2	Farmington, New Mexico ^a	Southwest	46,000	115	23
	Albuquerque, New Mexico ^b	South	900,000	2,269	450

^a The load area represents the city named.

^b The load area represents the metropolitan area (i.e., the identified city plus adjacent communities).

^c City and metropolitan area population data are from 2010 Census data (U.S. Bureau of the Census 2010).

7

8

1 **TABLE 10.3.23.2-1 Potential Transmission Schemes, Estimated Solar Markets, and Distances to**
 2 **Load Areas for the Proposed Fourmile East SEZ**

Transmission Scheme	City/Load Area Name	Estimated Peak Solar Market (MW) ^c	Total Solar Market (MW)	Sequential Distance (mi) ^d	Total Distance (mi) ^d	Line Voltage (kV)	No. of Substations
1	Pueblo, Colorado ^a	52	1,534	105	211	345, 138	4
	Colorado Springs, Colorado ^a	210		43			
	Denver, Colorado ^b	1,272		63			
2	Farmington, New Mexico ^a	23	473	331	504	345	3
	Albuquerque, New Mexico ^b	450		173			

^a The load area represents the city named.

^b The load area represents the metropolitan area (i.e., the identified city plus adjacent communities).

^c From Table 10.3.23.1-1.

^d To convert mi to km, multiply by 1.6093.

3
4

5 **TABLE 10.3.23.2-2 Comparison of the Various Transmission Line Configurations with Respect to**
 6 **Land Use Requirements for the Proposed Fourmile East SEZ**

Transmission Scheme	City/Load Area Name	Total Distance (mi) ^c	No. of Substations	Land Use (acres) ^d		
				Transmission Line	Substation	Total
1	Pueblo, Colorado ^a	211	4	3,750.3	10.2	3,760.5
	Colorado Springs, Colorado ^a					
	Denver, Colorado ^b					
2	Farmington, New Mexico ^a	504	3	10,690.9	10.2	10,701.1
	Albuquerque, New Mexico ^b					

^a The load area represents the city named.

^b The load area represents the metropolitan area (i.e., the identified city plus adjacent communities).

^c To convert mi to km, multiply by 1.6093.

^d To convert acres to km², multiply by 0.004047.

7
8

1 new transmission lines and substations is estimated to disturb a land area on the order of
2 10,701 acres (43.3 km²).
3

4 Table 10.3.23.2-3 shows the estimated NPV of both transmission schemes and takes into
5 account the cost of constructing the lines, the substations, and the projected revenue stream over
6 the 10-year horizon. A positive NPV indicates that revenues more than offset investments. This
7 calculation does not include the cost of producing electricity.
8

9 The most economically attractive configuration (transmission scheme 1) has the highest
10 positive NPV and serves the Colorado cities of Pueblo, Colorado Springs, and Denver. The
11 secondary case (transmission scheme 2), which excludes one or more of the primary pathways
12 used in scheme 1, is less economically attractive and focuses on delivering power to Farmington
13 and Albuquerque. For the assumed utilization factor of 20%, scheme 2 exhibits a negative NPV,
14 implying that this option may not be economically viable under the current assumptions.
15

16 Table 10.3.23.2-4 shows the effect of varying the value of the utilization factor on the
17 NPV of the transmission schemes. The table shows that at about 50% utilization, NPVs for both
18 schemes are positive. It also shows that as the utilization factor is increased, the economic
19 viability of the lines also increases. Utilization factors can be raised by allowing the new
20 dedicated lines to market other power generation outputs in the region in addition to that of its
21 associated SEZ.
22

23 The findings of the DLT analysis for the proposed Fourmile East SEZ are as follows:
24

- 25 • Transmission scheme 1, which identifies the cities of Pueblo, Colorado
26 Springs, and Denver (in that specific sequence) as the primary markets,
27 represents the most favorable option based on NPV and land use
28 requirements. This scheme would result in new land disturbance of about
29 3,761 acres (15.2 km²).
30
- 31 • Transmission scheme 2, which represents an alternative configuration,
32 identifies Farmington and Albuquerque as the primary market. In terms of
33 defining potential upper-bound impacts of new transmission infrastructure
34 development, this configuration would result in new land disturbance of about
35 10,701 acres (43.3 km²). In terms of NPV, however, this scheme may not be
36 economically viable under the current assumptions.
37
- 38 • Other load area configurations are possible but would be less favorable than
39 scheme 1 in terms of NPV and, in most cases, also in terms of land use
40 requirements. If new electricity generation at the proposed Fourmile East SEZ
41 is not sent to either of the two markets identified above, the potential upper-
42 bound impacts in terms of cost would be greater.
43
- 44 • The analysis of transmission requirements for the proposed Fourmile East
45 SEZ would be expected to show lower costs and less land disturbance if solar-
46 eligible load assumptions were increased, although the magnitude of those

1 **TABLE 10.3.23.2-3 Comparison of Potential Transmission Lines with Respect to NPV (Base Case)**
 2 **for the Proposed Fourmile East SEZ**

Transmission Scheme	City/Load Area Name	Present Value Transmission Line Cost (\$ million)	Present Value Substation Cost (\$ million)	Annual Sales Revenue (\$ million)	Present Worth of Revenue Stream (\$ million)	NPV (\$ million)
1	Pueblo, Colorado ^a Colorado Springs, Colorado ^a Denver, Colorado ^b	373.7	28.0	74.3	573.6	171.9
2	Farmington, New Mexico ^a Albuquerque, New Mexico ^b	1,208.1	28.0	74.3	573.6	-662.5

^a The load area represents the city named.

^b The load area represents the metropolitan area (i.e., the identified city plus adjacent communities).

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TABLE 10.3.23.2-4 Effect of Varying the Utilization Factor on the NPV of the Transmission Schemes for the Proposed Fourmile East SEZ

Transmission Scheme	City/Load Area Name	NPV (\$ million) at Different Utilization Factors					
		20%	30%	40%	50%	60%	70%
1	Pueblo, Colorado ^a Colorado Springs, Colorado ^a Denver, Colorado ^b	171.9	458.7	745.6	1,032.3	1,319.1	1,605.9
2	Farmington, New Mexico ^a Albuquerque, New Mexico ^b	-662.5	-375.7	-88.9	197.9	484.7	771.5

^a The load area represents the city named.

^b The load area represents the metropolitan area (i.e., the identified city plus adjacent communities).

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changes would vary due to a number of factors. In general, for cases such as the Fourmile East SEZ that show multiple load areas being served to accommodate the specified capacity, the estimated costs and land disturbance would be affected by increasing the solar-eligible load assumption. By increasing the eligible loads at all load areas, the transmission routing and configuration solutions can take advantage of shorter line distances and deliveries to fewer load areas, thus reducing costs and land disturbed. In general, SEZs that show the greatest number of load areas served and greatest distances required for new transmission lines (e.g., Riverside East) would show the greatest decrease in impacts as a result of increasing the solar-eligible load assumption from 20% to a higher percentage.

1 **10.3.24 Impacts of the Withdrawal**
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3 The BLM is proposing to withdraw 2,883 acres (12 km²) of public land comprising the
4 proposed Fourmile East SEZ from settlement, sale, location, or entry under the general land
5 laws, including the mining laws, for a period of 20 years (see Section 2.2.2.2.4 of the Final Solar
6 PEIS). The public lands would be withdrawn, subject to valid existing rights, from settlement,
7 sale, location, or entry under the general land laws, including the mining laws. This means that
8 the lands could not be appropriated, sold, or exchanged during the term of the withdrawal, and
9 new mining claims could not be filed on the withdrawn lands. Mining claims filed prior to the
10 segregation or withdrawal of the identified lands would take precedence over future solar energy
11 development. The withdrawn lands would remain open to the mineral leasing, geothermal
12 leasing, and mineral material laws, and the BLM could elect to lease the oil, gas, coal, or
13 geothermal steam resources, or to sell common-variety mineral materials, such as sand and
14 gravel, contained in the withdrawn lands. In addition, the BLM would retain the discretion to
15 authorize linear and renewable energy ROWs on the withdrawn lands.
16

17 The purpose of the proposed land withdrawal is to minimize the potential for conflicts
18 between mineral development and solar energy development for the proposed 20-year
19 withdrawal period. Under the land withdrawal, there would be no mining-related surface
20 development, such as the establishment of open pit mining, construction of roads for hauling
21 materials, extraction of ores from tunnels or adits, or construction of facilities to process the
22 material mined, that could preclude use of the SEZ for solar energy development. For the
23 Fourmile East SEZ, the impacts of the proposed withdrawal on mineral resources and related
24 economic activity and employment are expected to be negligible because the mineral potential of
25 the lands within the SEZ is low (BLM 2012). There has been no documented mining within the
26 SEZ, and there are no known locatable mineral deposits within the land withdrawal area.
27 According to the LR2000 (accessed in January 2012), there are no recorded mining claims
28 within the land withdrawal area.
29

30 Although the mineral potential of the lands within the Fourmile East SEZ is low, the
31 proposed withdrawal of lands within the SEZ would preclude many types of mining activity over
32 a 20-year period, resulting in the avoidance of potential mining-related adverse impacts. Impacts
33 commonly related to mining development include increased soil erosion and sedimentation,
34 water use, generation of contaminated water in need of treatment, creation of lagoons and ponds
35 (hazardous to wildlife), toxic runoff, air pollution, establishment of noxious weeds and invasive
36 species, habitat destruction or fragmentation, disturbance of wildlife, blockage of migration
37 corridors, increased visual contrast, noise, destruction of cultural artifacts and fossils and/or their
38 context, disruption of landscapes and sacred places of interest to tribes, increased traffic and
39 related emissions, and conflicts with other land uses (e.g., recreational).
40

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42 **10.3.25 References**
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44 *Note to Reader:* This list of references identifies Web pages and associated URLs where
45 reference data were obtained for the analyses presented in this Final Solar PEIS. It is likely that
46 at the time of publication of this Final Solar PEIS, some of these Web pages may no longer be

1 available or the URL addresses may have changed. The original information has been retained
2 and is available through the Public Information Docket for this Final Solar PEIS.

3
4 AEP (American Electric Power), 2010, *Transmission Facts*. Available at <http://www.aep.com/about/transmission/docs/transmission-facts.pdf>. Accessed July 2010.

6
7 America's Byways, 2011, *Los Caminos Antiguos*. Available at <http://byways.org/explore/byways/2111>. Accessed Feb. 22, 2012.

9
10 Barber, J.R., et al., 2010, "The Costs of Chronic Noise Exposure for Terrestrial Organisms,"
11 *Trends in Ecology and Evolution* 25(3):180–189.

12
13 Barber, J.R., et al., 2011, "Anthropogenic Noise Exposure in Protected Natural Areas:
14 Estimating the Scale of Ecological Consequences," *Landscape Ecol.* 26:1281–1295.

15
16 BLM (Bureau of Land Management), 2010, *Solar Energy Interim Rental Policy*,
17 U.S. Department of the Interior. Available at http://www.blm.gov/wo/st/en/info/regulations/Instruction_Memos_and_Bulletins/nationalinstruction/2010/IM_2010-141.html.

19
20 BLM, 2011a, *Final Visual Resource Inventory for the Saguache, Colorado Field Office*,
21 prepared for U.S. Department of the Interior, BLM Saguache Field Office, Saguache, Colo., Oct.

22
23 BLM, 2011b, *Old Spanish National Historic Trail*. Available at http://www.blm.gov/az/st/en/prog/blm_special_areas/hist_trails/old_span_tr.html. Accessed Feb. 22, 2012.

25
26 BLM, 2011c, *Instruction Memorandum 2012-032, Native American Consultation and Section*
27 *106 Compliance for the Solar Energy Program Described in Solar Programmatic Environmental*
28 *Impact Statement*, Washington, D.C., Dec. 1.

29
30 BLM, 2012, *Assessment of the Mineral Potential of Public Lands Located within Proposed Solar*
31 *Energy Zones in Colorado*, prepared by Argonne National Laboratory, Argonne, Ill., July.
32 Available at <http://solareis.anl.gov/documents/index.cfm>.

33
34 BLM and DOE (BLM and U.S. Department of Energy), 2010, *Draft Programmatic*
35 *Environmental Impact Statement for Solar Energy Development in Six Southwestern States*,
36 DES 10-59, DOE/EIS-0403, Dec.

37
38 BLM and DOE, 2011, *Supplement to the Draft Programmatic Environmental Impact Statement*
39 *for Solar Energy Development in Six Southwestern States*, DES 11-49, DOE/EIS-0403D-S, Oct.

40
41 CDPHE (Colorado Department of Public Health and Environment), 2011, *2008 Air Pollutant*
42 *Emissions Inventory*. Available at http://www.colorado.gov/airquality/inv_maps_2008.aspx.
43 Accessed Nov. 22, 2011.

1 CEQ (Council on Environmental Quality), 1997, *Environmental Justice: Guidance under the*
2 *National Environmental Policy Act*, Executive Office of the President, Dec. Available at
3 <http://ceq.hss.doe.gov/nepa/regs/ej/justice.pdf>.
4
5 Chick, N., 2009, personal communication from Chick (Colorado Department of Public Health
6 and Environment, Denver, Colo.) to Y.-S. Chang (Argonne National Laboratory, Argonne, Ill.),
7 Sept. 4.
8
9 Colorado District Court, 2010, Case Number 06CV64 & 07CW52, *In the Matter of the*
10 *Rio Grande Water Conservation District, in Alamosa County, Colorado and Concerning the*
11 *Office of the State Engineer's Approval of the Plan of Water Management for Special*
12 *Improvement District No. 1 of the Rio Grande Water Conservation District*, District Court,
13 Water Division No. 3.
14
15 Colorado DWR (Division of Water Resources), 2004, *Preliminary Draft: Rio Grande Decision*
16 *Support System, Phase 4 Ground Water Model Documentation*. Available at <http://cdss.state.co.us/Pages/CDSSHome.aspx>.
17
18
19 DOI (U.S. Department of Interior), 2012, "Salazar Designates the Trujillo Homesteads in
20 Colorado as a National Historic Landmark," press release, Jan. 3. Available at <http://www.doi.gov/news/pressreleases/Salazar-Designates-the-Trujillo-Homesteads-in-Colorado-as-a-National-Historic-Landmark.cfm>. Accessed Feb. 22, 2012.
21
22
23
24 EPA (U.S. Environmental Protection Agency), 2009a, *Energy CO₂ Emissions by State*. Last
25 updated June 12, 2009. Available at [http://www.epa.gov/climatechange/emissions/state_](http://www.epa.gov/climatechange/emissions/state_energyco2inv.html)
26 [energyco2inv.html](http://www.epa.gov/climatechange/emissions/state_energyco2inv.html). Accessed June 23, 2009.
27
28 EPA, 2009b, *eGRID*. Last updated Oct. 16, 2008. Available at [http://www.epa.gov/cleanenergy/](http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html)
29 [energy-resources/egrid/index.html](http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html). Accessed Jan. 12, 2009.
30
31 EPA, 2011, *National Ambient Air Quality Standards (NAAQS)*. Last updated Nov. 8, 2011.
32 Available at <http://www.epa.gov/air/criteria.html>. Accessed Nov. 23, 2011.
33
34 Garcia, M., and L.A. Harvey, 2011, "Assessment of Gunnison Prairie Dog and Burrowing Owl
35 Populations on San Luis Valley Solar Energy Zone Proposed Areas," San Luis Valley Public
36 Lands Center, Dec.
37
38 Heide, R., 2011, "Xcel Is Out, but Transmission Line Is Not," *Valley Courier*, Nov. 2. Available
39 at http://www.alamosanews.com/v2_news_articles.php?heading=0&page=72&story_id=22489.
40 Accessed Nov. 20, 2011.
41
42 History Colorado, 2011, *Alamosa County*, March 22. Available at <http://www.historycolorado.org/content/alamosa-county>. Accessed Feb. 22, 2012.
43
44
45 Mayo, A.L., et al., 2007, "Groundwater Flow Patterns in the San Luis Valley, Colorado, USA
46 Revisited: An Evaluation of Solute and Isotopic Data," *Hydrogeology Journal* (15):383–408.

1 McDermott, P., 2010, personal communication from McDermott (Engineer with Colorado
2 Division of Water Resources, Division 3) to B. O'Connor (Argonne National Laboratory,
3 Argonne, Ill.), Aug. 9.
4

5 NOAA (National Oceanic and Atmospheric Administration), 2012, *National Climatic Data
6 Center (NCDC)*. Available at <http://www.ncdc.noaa.gov/oa/ncdc.html>, Accessed Jan. 16, 2012.
7

8 NRCS (Natural Resources Conservation Service), 2008, *Soil Survey Geographic (SSURGO)
9 Database for Alamosa County, Colorado*. Available at <http://SoilDataMart.nrcs.usds.gov>.
10

11 NRCS, 2009, *Custom Soil Resource Report for Alamosa County (covering the proposed
12 Fourmile East SEZ), Colorado*, U.S. Department of Agriculture, Washington, D.C., Aug. 21.
13

14 Platts, 2011, POWERmap, Strategic Desktop Mapping System, The McGraw Hill Companies.
15 Available at <http://www.platts.com/Products/powermap>.
16

17 Rodriguez, R.M., 2011, *Front Range District Bat Surveys of Solar Energy Zones within the
18 San Luis Valley, Colorado*, Draft Final Report, prepared by Zotz Ecological Solutions, LLC, for
19 the Bureau of Land Management, Oct.
20

21 SEIA (Solar Energy Industries Association), 2012, *Utility-Scale Solar Projects in the
22 United States Operating, under Construction, or under Development*, Jan. 12. Available at
23 <http://www.seia.org/galleries/pdf/Major%20Solar%20Projects.pdf>. Accessed Feb. 22, 2012.
24

25 Solar Feeds, 2012, *Tessera Submits Second Proposal for Colorado Solar Plant*. Available at
26 <http://www.solarfeeds.com/tessera-submits-second-proposal-for-colorado-solar-plant>. Accessed
27 Feb. 22, 2012.
28

29 Tetra Tech EC, Inc., 2011, *Saguache Solar Energy Project, Final 1041 Permit Application,
30 Saguache County, Colorado*, Oct. Available at [http://www.saguachecounty.net/images/
31 Saguache_1041_text_2011_10_16_Final_for_submission.pdf](http://www.saguachecounty.net/images/Saguache_1041_text_2011_10_16_Final_for_submission.pdf). Accessed March 19, 2012.
32

33 U.S. Bureau of the Census, 2009a, *Census 2000 Summary File 1 (SF 1) 100-Percent Data*.
34 Available at <http://factfinder.census.gov>.
35

36 U.S. Bureau of the Census, 2009b, *Census 2000 Summary File 3 (SF 3) – Sample Data*.
37 Available at <http://factfinder.census.gov>.
38

39 U.S. Bureau of the Census, 2010, *American FactFinder*. Available at [http://factfinder2.
40 census.gov](http://factfinder2.census.gov). Accessed April 6, 2012.
41

42 USDA (U.S. Department of Agriculture), 1968, *Soil Survey of Alamosa Area, Colorado*, Soil
43 Conservation Service, Washington, D.C.
44

45 USDA, 2004, *Understanding Soil Risks and Hazards—Using Soil Survey to Identify Areas with
46 Risks and Hazards to Human Life and Property*, G.B. Muckel (editor).

1 USGS (U.S. Geological Survey), 2007, *National Gap Analysis Program, Digital Animal-Habitat*
2 *Models for the Southwestern United States*, Version 1.0, Center for Applied Spatial Ecology,
3 New Mexico Cooperative Fish and Wildlife Research Unit, New Mexico State University.
4 Available at <http://fws-nmcfwru.nmsu.edu/swregap/HabitatModels/default.htm>. Accessed
5 March 15, 2010.
6
7 USGS, 2012a, *National Hydrography Dataset (NHD)*. Available at <http://nhd.usgs.gov>.
8 Accessed Jan. 16, 2012.
9
10 USGS, 2012b, *National Water Information System (NWIS)*. Available at: <http://waterdata.usgs.gov/nwis>. Accessed Jan. 16, 2012.
11
12
13 WRAP (Western Regional Air Partnership), 2009, *Emissions Data Management System*
14 *(EDMS)*. Available at <http://www.wrapedms.org/default.aspx>. Accessed June 4, 2009.
15
16
17

1 **10.3.26 Errata for the Proposed Fourmile East SEZ**

2
3 This section presents corrections to material presented in the Draft Solar PEIS and the
4 Supplement to the Draft. The need for these corrections was identified in several ways: through
5 comments received on the Draft Solar PEIS and the Supplement to the Draft (and verified by
6 the authors), through new information obtained by the authors subsequent to publication of the
7 Draft Solar PEIS and the Supplement to the Draft, or through additional review of the original
8 material by the authors. Table 10.3.26-1 provides corrections to information presented in the
9 Draft Solar PEIS and the Supplement to the Draft.

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TABLE 10.3.26-1 Errata for the Proposed Fourmile East SEZ (Section 10.3 of the Draft Solar PEIS and Section C.3.3 of the Supplement to the Draft Solar PEIS)

Section No.	Page No.	Line No.	Figure No.	Table No.	Correction
10.3.3.1	10.3-23	35–36			“Portions of State Highways 17, 150, and 159 and Alamosa County Road 6N have been designated by the state and the BLM as part of the Los Caminos Antiguos Scenic Byway,” should read, “Portions of State Highways 17, 150, and 159 and Alamosa County Road 6N have been designated as part of the Los Caminos Antiguos Scenic Byway by the Colorado Scenic and Historic Byway Commission with final approval by the Colorado Transportation Commission.”
10.3.11.2					All uses of the term “neotropical migrants” in the text and tables of this section should be replaced with the term “passerines.”
10.3.14.2.2	10.3-3	22–23			“It is located 5.1 mi (8.2 km) east–southeast of the SEZ at the closest point of approach,” should read, “It is located 5.0 mi (8.0 km) west–southwest of the SEZ at the closest point of approach.”
10.3.14.22	10.2-214	13–15			“At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from the location in the National Park,” should read, “At night, if sufficiently tall, power towers in the SEZ could have red or white flashing hazard navigation lighting that would likely be visible from the location in the WA.”
10.3.14.22	10.2-214	19–21			“Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create strong visual contrasts for viewers within the national park,” should read, “Under the 80% development scenario analyzed in this PEIS, solar energy development within the SEZ would be expected to create strong visual contrasts for viewers within the WA.”