

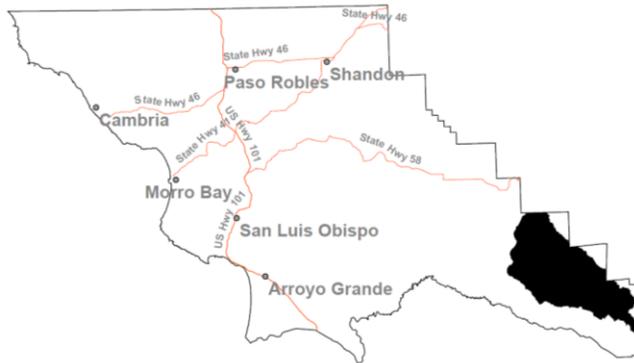
Black Sulphur Spring Watershed

Hydrologic Unit Name	Water Planning Area	Acreage	Flows to	Groundwater Basin(s)	Jurisdictions
Carrizo Plain 11	Carrizo Plain WPA 10	143,160 acres total; 137,489 acres within San Luis Obispo County	Soda Lake	Carrizo Plain	County of San Luis Obispo, Bureau of Land Management



Description:

The Black Sulphur Spring Watershed lies in the eastern portion of San Luis Obispo’s North County region and includes the southern portion of the Carrizo National Monument. The total watershed area is approximately 143,160 acres with a majority of the acreage located within San Luis Obispo County (137,489 acres). The remaining acreage is located within Kern County to the East. The watershed is bounded by Temblor Range to the east, Caliente Range and San Juan Hills to the west and drains entirely into Soda Lake. The Black Sulphur Watershed contains two major drainages: the Caliente Range and Elkhorn Plain. The highest elevation in the watershed is about 3,411 feet and the lowest elevation is approximately 1,919 feet. Elkhorn Plain is in this watershed, draining toward the basin floor. The watershed is transected by San Andreas Fault. The groundwater basin underlying the watershed, the Carrizo Plain basin, is recharged from percolation of stream flow and infiltration of precipitation. Users of the basin include a small public water system serving local school, agricultural and residential purposes, and solar farms. The dominant land use is rangeland.



Existing Watershed Plans:

No existing plans to date

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Characteristics

Physical Setting	
Rainfall	Average Annual: 7-13 in. (NRCS shapefile, 2010)
Air Temperature	Summer Range (August 1991-2012): 64°-88°F Winter Range (December 1991-2012): 39°-52°F (Carrizo NOAA National Climatic Data Center, viewed 2013)
Geology Description	<p>Carrizo Plain and Elkhorn Scarp sub-watersheds composed of flat highly infiltrative Quaternary geologic material.</p> <p>Beam Flat, Abbot Canyon, Goat Spring, and Cottonwood Spring are composed of moderate steep moderately infiltrative early to mid-Tertiary headwaters and flat highly infiltrative Quaternary inland.</p> <p>Cochora Ranch, and Simm sub-watersheds are steep moderately infiltrative early to mid-Tertiary materials (Bell, pers. comm., 2013).</p> <p>Groundwater is found in alluvium and the Paso Robles and Morales Formations. Upper Pleistocene to Holocene alluvium consists of unconsolidated to loosely consolidated sands, gravels, and silts with a few beds of compacted clays. Paso Robles Formation. The Pleistocene age Paso Robles Formation consists of poorly sorted, mostly loosely consolidated gravels, sands, and silts. The combined thickness of these deposits is more than 3,000 feet in the eastern portion of the basin along the San Andreas fault and decreases toward the west. Morales Formation. The Upper Pliocene Morales Formation consists of sands, gravels, and silts, which generally are more stratified and compacted than in the overlying Paso Robles Formation (Chipping, 1987).</p>
Hydrology	
Stream Gage	No
Hydrology Models	None
Peak Flow	No source identified
Base Flow	No source identified
Flood Reports	No source identified
Flood Control Structures	No source identified
Areas of Heightened Flood Risk	No source identified
Biological Setting	
Vegetation Cover	Primarily annual grassland and alkali desert scrub. Valley saltbush

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	<p>scrub with juniper and California sagebrush are common (SLO County vegetation shapefile, 1990) <i>Data limited due to age of shapefile</i></p> <p>CNPS recently (2013) completed a vegetation survey of the Carrizo Plain National Monument. Mapped vegetation characterized stands to the alliance level. Desert scrub, alkaline/scrub, coastal scrub, chaparral, woodlands, saline and alkali marshes, grasslands and herblands, and arroyo wash alliances were all represented. Juniper and blue oak woodlands are primarily on the southwestern edge of the watershed in the hills. Alkali, desert, and coastal scrub are common on eastern hills. Goldfield-plantain-fescue fields are common along the basin floor. Alkali wetlands and marsh vegetation are patchy in the northern watershed south of soda lake. Many additional alliances are mapped in small patches. The CNPS inventory provides high-resolution vegetation data at fine scale for this watershed.</p> <p>Vernal pools, alkali wetlands, and rare arid-land plant communities are important resources with small areal extent in this watershed (Althouse and Meade, 2013). <i>Data limited to observations, not complete inventory</i></p>
<p>Invasive Species</p>	<p>Slim oat (<i>Avena barbata</i>), Common wild oat (<i>Avena fatua</i>), Black Mustard (<i>Brassica nigra</i>), Bromegrass (<i>Bromus Diandrus</i>), Red brome (<i>Bromus rubens</i>), Italian thistle (<i>Carduus pycnocephalus</i>), Spear thistle (<i>Cirsium vulgare</i>), Cut-leaved cranesbill (<i>Geranium dissectum</i>), Farmer's foxtail (<i>Hordeum marinum</i>), Italian ryegrass (<i>Lolium multiflorum</i>), Foxtail fescue (<i>Vulpia myuros</i>), Tamarisk (<i>Tamarix</i> spp.) (California Native Plant Society, 2011) <i>Data limited to observations, not complete inventory</i></p>
<p>Special Status Wildlife and Plants</p>	<p>Key: FE - Federal endangered, FT - Federal threatened, SE - State endangered, ST - State threatened, SSC - State Species of Special Concern; FP- Fully Protected, SA – Special Animal, CRPR – CA rare plant rank (CNDDDB, viewed August, 2013)</p> <p>Locations listed refer to USGS 7.5' quadrangle names. Only the portion overlapping the watershed boundary was considered. <i>Data limited to observations, not complete inventory</i></p>

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Species	Status	BALLINGER CANYON	CALIENTE MTN	CUYAMA	ELKHORN HILLS	FELLOWS	MARICOPA	MCKITTRICK SUMMIT	PAINTED ROCK	PANORAMA HILLS	REWARD	WELLS RANCH
		Animals										
<i>American badger</i>	SSC								X			X
<i>blunt-nosed leopard lizard</i>	FE; SE; FP	X			X		X	X	X	X		X
<i>burrowing owl</i>	SSC				X				X			
<i>California condor</i>	FE; SE	X										
<i>giant kangaroo rat</i>	FE; SE	X	X	X	X		X		X	X		X
<i>Kern primrose sphinx moth</i>	FT	X	X	X	X	X				X		X
<i>Morrison's blister beetle</i>	SA				X							
<i>mountain plover</i>	SSC (Wintering)				X				X	X		X
<i>Nelson's antelope squirrel</i>	ST				X				X	X		X
<i>pallid bat</i>	SSC								X			
<i>prairie falcon</i>	SA (Nesting)	X	X	X				X	X	X		X
<i>San Joaquin kit fox</i>	FE; ST	X		X	X		X	X	X	X		X
<i>San Joaquin whipsnake</i>	SSC	X							X			
<i>short-nosed kangaroo rat</i>	SSC									X		X
<i>Swainson's hawk</i>	ST			X	X							
<i>Tulare grasshopper mouse</i>	SSC									X		X
<i>western spadefoot</i>	SSC	X										
Plants												
<i>California jewel-flower</i>	FE; SE				X				X			X
<i>chaparral ragwort</i>	CRPR 2B.2									X		
<i>Coulter's goldfields</i>	CRPR 1B.1				X				X	X		
<i>Jared's pepper-grass</i>	CRPR 1B.2				X				X	X		X
<i>Kern mallow</i>	FE				X				X	X		X
<i>Lemmon's jewel-flower</i>	CRPR 1B.2		X						X			

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Species	Status	BALLINGER CANYON	CALIENTE MTN	CUYAMA	ELKHORN HILLS	FELLOWS	MARICOPA	MCKITTRICK SUMMIT	PAINTED ROCK	PANORAMA HILLS	REWARD	WELLS RANCH
<i>Lost Hills crowscale</i>	CRPR 1B.2								x			x
<i>Munz's tidy-tips</i>	CRPR 1B.2				x				x			x
<i>oval-leaved snapdragon</i>	CRPR 4.2		x									x
<i>pale-yellow layia</i>	CRPR 1B.1				x			x			x	x
<i>recurved larkspur</i>	CRPR 1B.2								x	x		
<i>round-leaved filaree</i>	CRPR 1B.1		x									x
<i>San Joaquin woollythreads</i>	FE		x		x	x			x	x		x
<i>showy golden madia</i>	CRPR 1B.1				x							x
<i>stinkbells</i>	CRPR 4.2		x									x
<i>Temblor buckwheat</i>	CRPR 1B.2				x					x		
Steelhead Streams	None											
Stream Habitat Inventory	None											
Fish Passage Barriers	No source identified, fish populations not historically supported											
Designated Critical Habitat	None											
Habitat Conservation Plans	Yes; Carrizo Plain Natural Area Plan, Stewardship Council Land Conservation Plan											
Other Environmental Resources	Carrizo Plains National Monument and Ecological Reserve and Soda Lake, San Andreas Fault Zone of Eastern San Luis Obispo County, Caliente Wildlife Area (SLO County Flood Control and Water Conservation District, 2007)											
Land Use												
Jurisdictions & Local Communities	County of San Luis Obispo, BLM - Carrizo Plains National Monument											
% Urbanized	0% (Land Use Category GIS Layer)											
% Agricultural	62% (SLO County Land Use Category GIS Layer)											
% Other	38% (Rural) (SLO County Land Use Category)											
Planning Areas	Shandon-Carrizo Planning Area											
Potential growth areas	None Identified											

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Facilities Present	None identified
Commercial Uses	Agriculture, tourism
Demographics	
Population	2 (US Census Block, 2010)
Race and Ethnicity	Latinos represent 100%.
Income	MHI \$65,482 in watershed (US Census Tracts, 2010, spans 11 watersheds)
Disadvantaged Communities	No; 7.0% of individuals are below poverty level in watershed (US Census Tracts, 2010, spans 11 watersheds)
Water Supply	
Water Management Entities	None; users served by individual wells
Groundwater	Carrizo Plain (total storage capacity is estimated at 400,000 af)
Surface Water	No public reservoirs in the watershed.
Imported Water	None
Recycled/Desalinated Water	None
Key groundwater percolation area(s)	No key percolation areas identified - Recharge to the basin is largely by percolation of stream flow and infiltration of rainfall to the valley floor (Ca. Dept of Water Resources, 2003)
Water budget performed	Yes; Aspen Environmental Group, 2011 for Topaz Solar Farm. <i>Data limited to region affected by the Topaz Solar Farm, which is similar to, but not included in this watershed</i>
Water Uses	
Beneficial Uses	<i>Soda Lake</i> - Industrial Service Supply (IND), Non-Contact Water Recreation (REC-2), Wildlife Habitat (WILD), Warm Fresh Water Habitat (WARM), Significance (BIOL), Rare, Threatened, or Endangered Species (RARE) and Commercial and Sport Fishing (COMM) (CCRWQB, 2011)
Other Unique Characteristics	
San Andreas Fault Zone	The San Andres Fault traverses the eastern portion of the county and is one of the most seismically active faults in North America. The fault zone is important from a botanical and geological standpoint. The San Andres Fault in the Carrizo Plain has the largest post-early Miocene offset and is the oldest reach of the entire active fault system. (The sag ponds along the fault have special ecological significance (Pollard et. al., 1995).

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	Carrizo Plain National Monument	A cooperative effort since 1985 between Bureau of Land Management, California Fish and Wildlife and the Nature Conservancy. 250,000 acres of relatively undisturbed habitat.
	Elkhorn Plain Ecological Reserve	A 160 acre, semi-desert state reserve with many unusual plants: the endangered San Joaquin wooly threads, desert boxthorn, cottony and spotted buckwheat, Arizona popcorn flower, Kern Tarplant and thistle sage. Has a population of blunt nose leopard lizard.
	Caliente National Cooperative Land and Wildlife Management Area	Includes 58,000 acres of Bureau of Land Management property. Caliente Mountain, part of the Cuyama River Watershed, is the highest peak in the county at more than 5,100 feet. Partially or entirely in the range of the California Condor and Blunt Nosed Leopard Lizard, endangered species, and San Joaquin Kit Fox, a rare species.
	Vernal Pools	Present in the Black Sulphur Spring watershed. These pools are more alkaline than pools of the Paso Region. Rare plants and wildlife utilize vernal pool habitat in the Carrizo.
	San Joaquin Kit Fox	Carrizo Plain supports a core population of federally endangered San Joaquin Kit Fox. Additionally, giant kangaroo rat precincts are known from Black Sulphur Spring watershed. Blunt nose leopard lizard and Nelson’s antelope squirrel are known from the Elkhorn Plain. Rare plants of limited extent in the state and globally are reported from this watershed.
	Wildflower Fields	Mid-March to mid-April is the usual time for wildflower season, but it is dependent on the weather and varies from season to season. Temperature and rainfall affect which flowers bloom. Every year is not spectacular and only a few flowers may prevail in some years. Typical species include: goldenbush shrubs, bush lupine, pale yellow astragalus, locoweed, filaree, yellow tropidocarpum, white popcorn flower, orange fiddleneck, poppies, hillside daises, sun cups and baby-blue eyes. One of the three remaining habitats for the California jewelflower as well as other special status plants (BLM, 2013)
	Climate Change Considerations	
		Saltbrush and other native shrubs are expected to decline and marginal farmland may become less productive and retired in the Carrizo Plain area. Pronghorn and Tule elk populations could decline. (ClimateWise, 2010). See IRWMP, 2014 Section H. Climate Change <i>General County data, not watershed specific</i>

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Watershed Codes

CalWater / DWR Number	HA	Hydrologic Area Name	HSA	Hydrologic sub-area name	SWRCB Number	CDF Super Planning	Sub-watersheds (CDF Watershed Name)
3311.000103	0	Undefined	0	Undefined	311.00	Panorama Hills	Old Cooper Ranch
3311.000201	0	Undefined	0	Undefined	311.00	Elkhorn Plain	South of Cochoro ranch
3311.000202	0	Undefined	0	Undefined	311.00	Elkhorn Plain	Beam Flat
3311.000203	0	Undefined	0	Undefined	311.00	Elkhorn Plain	Elkhorn Scarp
3311.000204	0	Undefined	0	Undefined	311.00	Elkhorn Plain	Cochora Ranch
3311.000301	0	Undefined	0	Undefined	311.00	Caliente Range	Abbot Canyon
3311.000302	0	Undefined	0	Undefined	311.00	Caliente Range	Goat Spring
3311.000303	0	Undefined	0	Undefined	311.00	Caliente Range	Cottonwood Spring
3311.000304	0	Undefined	0	Undefined	311.00	Caliente Range	Lawson Spring
3311.000404	0	Undefined	0	Undefined	311.00	West of Soda Lake	Simm
3311.000500	0	Undefined	0	Undefined	311.00	Soda Lake	Soda Lake / Carrizo Plain (ptn)

Source: Excerpt from California Interagency Watershed Map of 1999, Calwater 2.2.1 (CA Resource Agency, 2004 Update)

Major Changes in the Watershed

- 4000-8000 years before present – The Carrizo Plains were a meeting place for Salinan, Yokut, Chumash and other Indian tribes. Vaqueros Formation rock monoliths are decorated with art that is being protected today.
- 1780 – First contact by Europeans. Large herds of sheep, horse and cattle brought into the area by Spanish. Introduce non-native species to the Carrizo grasslands
- 1857 – Major earthquake that shaped much of the natural landscape of the Carrizo Plains area (Pollard et. al., 1995)
- 1876 – First homesteads established on Carrizo Plains. Dry grain farming was intensive after invention of mechanized agricultural equipment in 1912, resulting in as much as 2 feet of top soil loss in some field margins
- 1939 to Post World War II – A combination of good weather and post War expansion led to increased profitability and productivity of the areas farms and ranches.

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- 1964 – Creation of California Valley. Chicote Ranch, a 7,500 acre ranch just south of 58, was divided into two-and-a half acre parcels which were promoted all over the state as retirement homes.
- 2001 – Carrizo Plain National Monument created by President Clinton under the authority of the Antiquities Act of 1906.

Source: Santa Margarita Historical Society, http://www.santamargaritahistoricalsociety.org/pages/carrisa_plains.html unless otherwise noted

Watershed Health by Major Tributary

Tributary Name	Ephemeral / Perennial	303d Listed/ TMDLs	Pollution Sources NP (non-point) MP (Major Point)
Abbot Canyon	Unknown	None	n/a
Beam Flat	Unknown	None	n/a
Carrizo Plain	Unknown	None	n/a
Cochora Ranch	Unknown	None	n/a
Cottonwood Spring	Perennial	None	n/a
Elkhorn Scarp	Unknown	None	n/a
Goat Spring	Unknown	None	n/a
Simm	Unknown	None	n/a

Watershed Health by Major Groundwater Basin

Groundwater Basin	Estimated Safe Yield	Water Availability Constraints	Drinking Water Standard Exceedance	Water Quality Objective Exceedance, Table 3-8
Carrizo Plain	8000-11,000 AF (Carollo, 2012)	Physical limitations and environmental demand. The shallow alluvial deposits are typically more susceptible to drought impacts (Carollo, 2012).	Yes; see description below.	Exceeds usable mineral quality for total dissolved solids, chloride, sulfate, boron, sodium, and nitrogen (CCRWQB, 2011).

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Groundwater Quality Description: Analyses of groundwater from 79 wells in this basin during 1957 through 1985 show Total Dissolved Solids (TDS) content ranging from 161 to 94,750 ppm. A highly mineralized groundwater zone is found in the lower part of the alluvium and the upper part of the Paso Robles Formation where they underlie Soda Lake. Water in a deeper zone Paso Robles Formation is of higher quality and confined in the vicinity of Soda Lake. Groundwater in the Morales Formation is likely to be brackish. Locally high nitrate and salinity concentrations as well as high Selenium and Arsenic as result of geology (Carollo, 2012).

Primary Issues

Issue	Potential Causes	Referenced from
Groundwater quality		Carollo, 2012
Groundwater Quantity	Physical Limitations	Carollo, 2012
Outdated Studies of the GW basins		Carollo, 2012

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