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Green Valley fault (Class A) No. 37

Last Review Date: 2002-06-12

Compiled in cooperation with the California Geological Survey

citation for this record: **Bryant, W.A., and Cluett, S.E., compilers, 2002, Fault number 37, Green Valley fault, in Quaternary fault and fold database of the United States: U.S. Geological Survey website, https://earthquakes.usgs.gov/hazards/qfaults, accessed 12/14/2020 03:10 PM.**

Synopsis	Holocene active dextral strike-slip fault. The Green Valley fault, which is the easternmost strike-slip fault of larger San Andreas system in the San Francisco Bay area, is characterized by aseismic creep and has been monitored by Galehouse (1992 #5333; 1999 #5500) since 1984. Detailed reconnaissance-level mapping exists for most of the fault as are geologic and geomorphic data (Weaver, 1949 #5317; Sims and others, 1973 #5263; Dooley, 1973 #5331; Bryant, 1982 #5327; 1992 #5328; Frizzell and Brown, l976 #5332). Several site-specific studies in compliance with Alquist-Priolo Act (Hart and Bryant, 1997 #4856) have documented the location and approximate time of the most recent faulting. Preliminary data from the Lopes Ranch

	paleoseismic site [37-1] indicates that the Green Valley fault has produced multiple surface-rupturing events in the past 2.7 k.y. and has minimum late Holocene dextral slip rate of 3.8–4.8 mm/yr (Baldwin and Lienkaemper, 1999 #5325).
Name comments	Fault first mapped, but not named, by Lawson (1908 #4969). Wood (1916 #5259) named it the Suisun fault, whereas the southern part of fault was referred to as the Mt. Diablo Thrust by Tolman (1931 #5322). Weaver (1949 #5317) used the name Green Valley fault, which currently is the more commonly used name. The fault extends from Wooden Valley south to Suisun Bay. Location of the fault north of Wooden Valley is conjectural, although a linear zone of seismicity suggests a northward subsurface continuation of the fault zone. Baldwin and others (1998 #5324) reported that the apparent termination of the Green Valley fault at Wooden Valley may indicate a transfer of some amount of dextral slip west across contractional structures in the Howell Mountains and northward onto the Maacama fault [30]. **Fault ID:** Refers to number 154 (Green Valley fault) of Jennings (1994 #2878) and number C4 (Green Valley fault) of Working Group on Northern California Earthquake Potential (1996 #1216).
County(s) and State(s)	NAPA COUNTY, CALIFORNIA SOLANO COUNTY, CALIFORNIA
Physiographic province(s)	PACIFIC BORDER
Reliability of location	Good Compiled at 1:24,000 scale. *Comments:* Location of fault traces based on digital revisions to Jennings (1994 #2878) using original mapping by Dooley (1973 #5331), Frizzell and Brown (l976 #5332), and Bryant (1982 #5327; 1992 #5328) at 1:24,000 scale.
Geologic setting	This dextral fault borders the eastern side of the Sulpher Springs Mountains. Location of the fault north of Wooden Valley is conjectural, although a linear zone of seismicity suggests a northward continuation of the fault zone. Baldwin and others (1998 #5324) reported that the apparent termination of the Green Valley fault at Wooden Valley may indicate a transfer of some amount of dextral slip west across contractional structures in the Howell Mountains and northward onto the Maacama fault [30].

	The southern end of the fault probably connects with the Concord fault [38] along an approximately 1-km-wide extensional jog south across Suisun Bay. Maximum dextral offset along fault is unknown, but may be several kilometers based on strong geomorphic expression of fault zone and apparent dextral offset of several kilometers of Pliocene Sonoma Volcanics (Bryant, 1982 #5327; 1991 #5326). Vertical offset may total 150 m, down to the east (Weaver, 1949 #5317; Dooley, 1973 #5331).
Length (km)	39 km.
Average strike	N14°W
Sense of movement	Right lateral *Comments:* Dextral reported by Dooley (1973 #5331) and Frizzell and Brown (l976 #5332).
Dip	59° E. to 89° SW. *Comments:* Fourteen site-specific fault rupture investigations have exposed near-surface vertical to near vertical dips in unconsolidated alluvial and colluvial deposits. Attitudes are variable and dips range from 59° E. to 89° SW. No instrumentally recorded earthquakes greater than ML 4 have occurred along fault, so representative focal-plane solutions are not available. Surface traces and geomorphic expression of fault indicate near vertical dextral strike-slip fault.
Paleoseismology studies	Lopes Ranch site (37-1). Sims (cited in Baldwin and Lienkaemper, 1999 #5325) were involved in the excavation of three fault-normal and five fault-parallel trenches at the Lopes Ranch site. Sims reported that a 310-year-old paleochannel was dextrally offset about 1.2–1.5 m across the fault. Baldwin and Lienkaemper (1999 #5325) re-interpreted the data and suggested that the measured displacement reflects only a minimum value of offset. Multiple surface-rupturing events in the past 2.7 k.y. were identified based on truncated units, upward fault terminations, and tilted stratigraphic deposits. Because of the preliminary nature of the investigations, the timing of the most recent event is not constrained.
Geomorphic expression	Fault delineated by geomorphic features indicative of Holocene dextral offset including closed depressions, ponded alluvium,

	dextrally offset drainages, linear troughs, sidehill benches, and scarps on young alluvium (Dooley, 1973 #5331; Bryant, 1982 #5327; 1992 #5328; Frizzell and Brown, l976 #5332). Extensive, massive landslides locally conceal fault traces along the northern extent of the fault in Wooden Valley and locally obscure fault traces between Suisun Bay and Interstate Highway 80.
Age of faulted surficial deposits	Faulted alluvium and soil are exposed in trenches in several site-specific investigations. Age of offset deposits generally is estimated on basis of soil profile development (*e.g.*, Cole and Pratt, 1991 #5329). Dames and Moore (1972 #5330) exposed a faulted A horizon containing an obsidian flake (presumed to be Indian artifact) that they reported to be of late Holocene age.
Historic earthquake	
Most recent prehistoric deformation	latest Quaternary (<15 ka) *Comments:* Timing of most recent paleoevent not determined, but it is probably late Holocene based on trench data reported by Baldwin and Lienkaemper (1999 #5325). Earlier, Cole and Pratt (1991 #5329) interpreted an offset soil horizon with weak Stage I pedogenic carbonate development to be 5–9 ka (middle to early Holocene). Conversely, Baldwin and Lienkaemper (1999 #5325) identified multiple surface-rupturing events in the past 2.7 k.y.
Recurrence interval	
Slip-rate category	Between 1.0 and 5.0 mm/yr *Comments:* Bryant (1982 #5327; 1991 #5326) estimated a long-term Quaternary slip rate of 3 mm/yr based on unconstrained dextral separation of Pliocene Sonoma Volcanics mapped by Sims and others (1973 #5263). Wesnousky (1986 #5305) reported a slip rate of 4 mm/yr for the Green Valley fault, however this rate is actually the creep rate for the Concord fault as reported by Harsh and Savage (1982 #5323). Baldwin and Lienkaemper (1999 #5325) reported a minimum late Holocene dextral slip rate of 3.8–4.8 mm/yr, based on 1.2–1.5 m dextral offset (minimum) of a 310-year-old paleochannel. This slip rate value is a minimum because (1) the measurement of the offset channel is uncertain and may itself be a minimum value, and (2) additional fault traces to the east have not been accounted for in the displacement value.

	The Green Valley fault is characterized by aseismic creep, which is highly episodic. Galehouse (1999 #5500) reported an average dextral creep rate of 4–5 mm/yr for the past 14 years along the Green Valley fault.
Date and Compiler(s)	2002 William A. Bryant, California Geological Survey Sereyna E. Cluett, California Geological Survey
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