

Physical Setting Site SC#1: Soft and Intensively Deformed Franciscan Assemblage Mélange and Sheared Serpentinite terrain (Franciscan mélange); Deep-seated Landslides; 1995 vineyards and roads

Notes:

- 1) The property has experienced the conversion of its natural vegetative cover. As a result, the hillside vineyards and roads experience excessive soil moisture conditions, requiring extensive subsurface drainage;
- 2) 95% of the vineyard is in a heavily engineered terrace;
- 3) Most of vineyard acreage (87ac) is replanted;
- 4) One of the blocks is located on a large and active rotational-translational landslide (pic. no. 2906). This landslide has been active since the late 1990s, when the vineyard was built, but it experienced an acceleration in March 2011. As a result, several slumps and cracks formed in the vineyard terraces on the upper slopes of the landslide (in the down-dropped hillside surface or in a fresh scarp) (pics. nos. 2897, 2904), and a large crack developed within the landslide toe (pic. no. 2896). A few trees were toppled due to the slumping of the toe. It is likely that the toe will collapse in less than 2 years, likely delivering 100-200m³ of sediment to the on-site creek. In the event of the re-activation of the entire landslide, an estimated 50,000m³ or more of sediment could be delivered, burying the creek at its toe;
- 5) One road-watercourse crossing was rebuilt in 2010, 30m downstream from this landslide (pic. no. 2893). Hydrologically-connected road segments were shortened, by building rolling dips, in order to decrease surface erosion and sediment delivery.
- 6) At another road-repair site, the creek was stabilized with the installment of new drainage pipes, which were built at the creek level, to prevent formation of scour pools (pics. nos. 2900, 2903);
- 7) The spillway of the 'lower reservoir' pond was recently stabilized by placing pipes in the large hillside gully which formed in the period 1995-2005. The gully void is estimated to amount to 4,000-6,000m³ (pics. nos. 2908, 2911, 2912);
- 8) The toe bank downstream of the on-channel pond referred to as Reservoir 1 been experiencing groundwater seepage. This has resulted in 4-6m³ of mass wasting over the past 25 years. The creek bed is armored with boulders and cobbles, and is stable (no signs of response to bedload capture were observed, partly due to the fact that the actively unstable toe downstream of the dam delivers coarse material annually, perhaps partially compensating for the bedload capture by the reservoir) (pic. no. 2915);
- 9) The roads are grass-seeded and generally non-erosive;
- 10) There is high- to very-high density cover crop (75-90%);
- 11) The property is certified by the Fish-Friendly Farming® (FFF) program;
- 12) All vineyard drainage pipes are mapped correctly on the FFF farm plan.





No. 2900



No. 2901



No. 2902



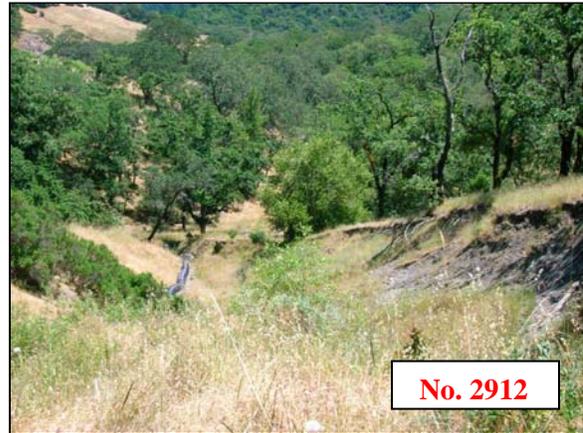
No. 2903



No. 2904



No. 2906



Physical Setting SG#2: Soft and Intensively Deformed Franciscan Assemblage Mélange and Sheared Serpentinite terrain (Franciscan mélange); Deep-seated Landslides; undeveloped (only roads)

Notes:

- 1) The property roads experience pervasive instability, namely involving: a) the formation of rills within the road tread (pics. nos. 2949, 2954), b) flow concentration in road ditches (pic. no. 2955), and c) flow concentration downslope of the road-watercourse crossings and formation of hillside gullies (pic. no. 2956);
- 2) The following hillside gullies have been observed downslope of the road-watercourse crossings on the main property road, with a 100% sediment delivery to the nearest watercourse:
 - a) Length=50m, Width=0.4m, and Depth=0.2m;
 - b) Length=30m, Width=0.3m, and Depth=0.3m;
 - c) Length=7m, Width=0.7m, and Depth=0.4m;
 - d) Length=70m, Width=2.5m, and Depth=2m;
 - and e) Length=500m, Width=1m, and Depth=0.5;
- 3) No evidence of accelerated bank scour was observed, due to the increased delivery of road-related runoff. This is due to the resistant nature of the channel bed (bedrock, boulder, and cobble substrate) (pic. no. 2953);
- 4) No evidence of channel incision was observed, in response to bedload cutoff below the on-site ponds. As above, this is likely due to the presence of coarse substrate in the channel bed (pic. no. 2947).





Physical Setting HD#3: Soft Ash-flow Tuffs terrain (SW of Huichica Creek) and Hard Volcanic Lava-flow Rocks terrain (NE of Huichica Creek); no Deep-seated Landslides; Alluvial-deposits terrain (by Hwy 121); vineyards and roads developed in 1990

Notes:

- 1) prior to vineyard development, the property had a long history of livestock grazing.
- 2) All vineyard blocks are drained by subsurface pipes that are routed all the way to the bank (even through the bank) of Huichica Creek (pic. no. 2932);
- 3) The drainage area of the hillside vineyards is about 10ac;
- 4) It appears that the creek has downcut about 0.5-to-1 m since 1990, leaving some of the subsurface drainage pipes ‘hanging.’ As a result, minor bank scour (2m3) has occurred at the base of each pipe location, due to flow scour;
- 5) The banks support recently constructed rock energy dissipators, at the base of the pipe outlets;
- 6) In one case, the drainage-pipe outlet is located by the base of a large tree to which the pipe runoff was designed to discharge (pic. no. 2928). This appears to be a good solution, preventing the scour of the bank;
- 7) In other cases, the drainage-pipe outlets were placed in 1990 within the pre-1990 grazing-related gullies (150m3) (pic. no. 2931). These gullies show no sign of fluvial action due to the pipe runoff under the current conditions, indicating that the hillside vineyard may no longer be producing runoff. It is likely that such cessation of excess hillside runoff is due to the presence of high-density permanent cover crop. Considering that bank scour may be forming locally due to eddy formation related to the pipes, it may be practical to remove the drainage pipes (at replant) which no longer function as originally designed;
- 8) The roads are grass-seeded and generally non-erosive;
- 9) There is high-density cover crop (75%),
- 10) The property is certified by the Fish-Friendly Farming® (FFF) program;
- 11) All vineyard drainage pipes are mapped correctly on the FFF farm plan.





Physical Setting HS#4: Variably Hard and Deformed Sedimentary Rocks terrain (Domengine sandstone); no Deep-seated Landslide terrain; no Alluvial-deposits terrain; 1991 vineyards and roads

Notes:

- 1) The property experienced the conversion of the annual grasslands;
- 2) The property vineyards and roads are well drained, with each drainage pipe receiving runoff from up to 2 acres. All excess runoff is designed to be routed to a large (plastic-lined) off-channel reservoir;
- 3) The drainage pipes are stable (bank scour has been noted at the base of the drainage pipes, but no corresponding hillside erosion);
- 4) The main access road parallels an unnamed creek. It is rock-surfaced, and shows minor signs of erosion (pic. no. 2965);
- 5) The seasonal BMPs (straw wattles, silt fences, etc.) appear to do little to prevent overland flow which forms along the riparian access road from discharging into the watercourse channel. This overland flow was observed to cause bank ravel and delivery (pic. no. 2963), which indicates that a filter strip should be built along the road;
- 6) The vineyard avenues are densely seeded with grass and non-erosive;
- 7) There is moderate- to high-density cover crop (60-75%);
- 8) The property is certified by the Fish-Friendly Farming® (FFF) program;
- 9) All vineyard drainage pipes are mapped correctly on the FFF farm plan.





Physical Setting RH #5: Variably Hard and Deformed Sedimentary Rocks terrain (Great Valley Sequence); Deep-seated Landslide terrain (landslides not mapped properly by USGS); no Alluvial-deposits terrain; 1990-2009 vineyards and roads

Notes:

- 1) The property has experienced the conversion of its natural forest cover. As a result, the hillside vineyards and roads experience excessive soil moisture conditions, requiring extensive subsurface drainage;
- 2) The vineyards and roads are well drained, with each drainage pipe receiving runoff from up to 4 acres. All excess runoff is designed to be routed to either a large off-channel (plastic-lined) reservoir or a small detention/sediment basin (pic. no. 2988). The basins are located about 50-100m above the channel heads of the on-site headwater watercourses;
- 3) In one case, the runoff from the detention basin is discharged into an old (1990) scar within the headwater watercourse (pic. no. 2982). Minor recent channel enlargement below the drainage outlet was observed (dimensions: Width=0.4m, Depth=0.15m) (pic. no. 2984);
- 4) The legacy scars along headwater channels was recently stabilized by the placement of large boulders;
- 5) Despite the extensive drainage, the road surface in one road segment experiences minor surface erosion, since it is not grass-seeded or rock-surfaced;
- 6) Many non-drained road segments have been grass-seeded recently, and exhibit – with a few exceptions – non-erosive conditions;
- 7) There is high-density cover crop (75%);
- 8) The property is certified by the Fish-Friendly Farming® (FFF) program;
- 9) There were no underground pipes at two locations where shown on the FFF farm maps, only surface runoff which is designed to discharge into rock berms (pics. nos. 2975, 2976), located above the channel heads.









Physical setting# RS6: Hard Volcanic Lava-flow Rocks terrain; no Deep-seated Landslides; no Alluvial-deposits; 1995-2009 vineyards and roads

Notes:

- 1) The property has experienced the conversion of its natural chaparral and woodland vegetative cover;
- 2) Many drainage pipes appear to have been rebuilt recently, and function very well (no scour or bank widening). The pipes typically discharge into small contoured swales located on the bank of the creek (pics. nos. 2917, 2923, 2927). The swales are partly armored with rock, and act as detention ponds (with 0.5m³ storage);
- 3) In the case of one drainage pipe, minor recent gullying was observed downstream from the pipe outlet (dimensions: Width=1m, Depth=0.2m) (pic. no. 2924);
- 4) Many road segments have been rock-surfaced and grass-seeded recently;
- 5) There is high- to very high-density cover crop (75%-90%);
- 6) Overall, no erosional problems were observed in the vineyards and along the roads;
- 7) The property is certified by the Fish-Friendly Farming® (FFF) program;
- 8) One of the pipe outlets shown on the FFF farm map does not exist.





Physical Setting #CE7: Variably Hard and Deformed Sedimentary Rocks terrain (Great Valley Sequence); no Deep-seated Landslide terrain; extensive Alluvial-deposit terrain; 30-year-old vineyard and roads

Notes:

- 1) The property has experienced the conversion of its moderately-high-density natural vegetative cover on hillsides, and low-density natural vegetative cover in the valley floor 30 years ago;
- 2) The drainage areas of the hillside vineyards range from 2ac to 6ac;
- 3) The drainage pipes installed on the property are perforated and stable (no erosion);
- 4) No bank scour was noted at the base of the drainage pipes, nor any hillside erosion noted;
- 5) Based on vegetative evidence, the creek incision was arrested about 40 years ago;
- 6) The road surfaces are typically barren, with minor signs of sheetwash erosion;
- 7) There is moderate-density cover crop (50-60%);
- 8) The property is certified by the Fish-Friendly Farming® (FFF) program;
- 9) All vineyard drainage pipes are mapped correctly on the FFF farm plan.



Physical Setting DG#8: Hard Volcanic Lava-flow Rocks terrain; no Deep-seated Landslides; no alluvial-deposits; 1992-2009 vineyards and roads

Notes:

- 1) The property has experienced the conversion of its moderate-density woodland vegetative cover 5-20 years ago;
- 2) There are no drainage pipes;
- 3) The property hillside vineyards and creek are stable, no effects of the older (1992-1998) and the recent (2009) vineyards were observed;
- 4) There is very high-density cover crop (90%);
- 5) The vineyard avenues are grass-seeded, exhibiting no surface erosion;
- 6) The property is not certified by the Fish-Friendly Farming® program.

