A Rapid Assessment of Sediment Delivery from Clearcut Timber Harvest Activities in the Battle Creek Watershed, Shasta and Tehama Counties, California

Appendices B through F

November, 2011

Appendices B through F

to

A Rapid Assessment of Sediment Delivery from Clearcut Timber Harvest Activities in the Battle Creek Watershed, Shasta and Tehama Counties, California

November, 2011

Report prepared at the request of

The California Resources Agency

by staff from

The California Department of Forestry and Fire Protection (CAL FIRE)

The California Department of Fish and Game (DFG)

The Central Valley Regional Water Resource Control Board (CV RWQCB)

and

The California Geological Survey (CGS)

Appendices

A - Battle Creek Turbidity Data

A.1 - Battle Creek Turbidity Data Distributed September 20, 2011
A.2 - October 3, 2011 CVRWQCB response to receipt of turbidity data
A.3 - October 3, 2011 CVRWQCB review of turbidity data

B - Figures Used to Help Scope Agency Field Investigation

C - Assessment-Area Planning-Watershed Geology Maps

D - Assessment-Area Planning-Watershed Soils maps

E - Assessment-Area THP Information

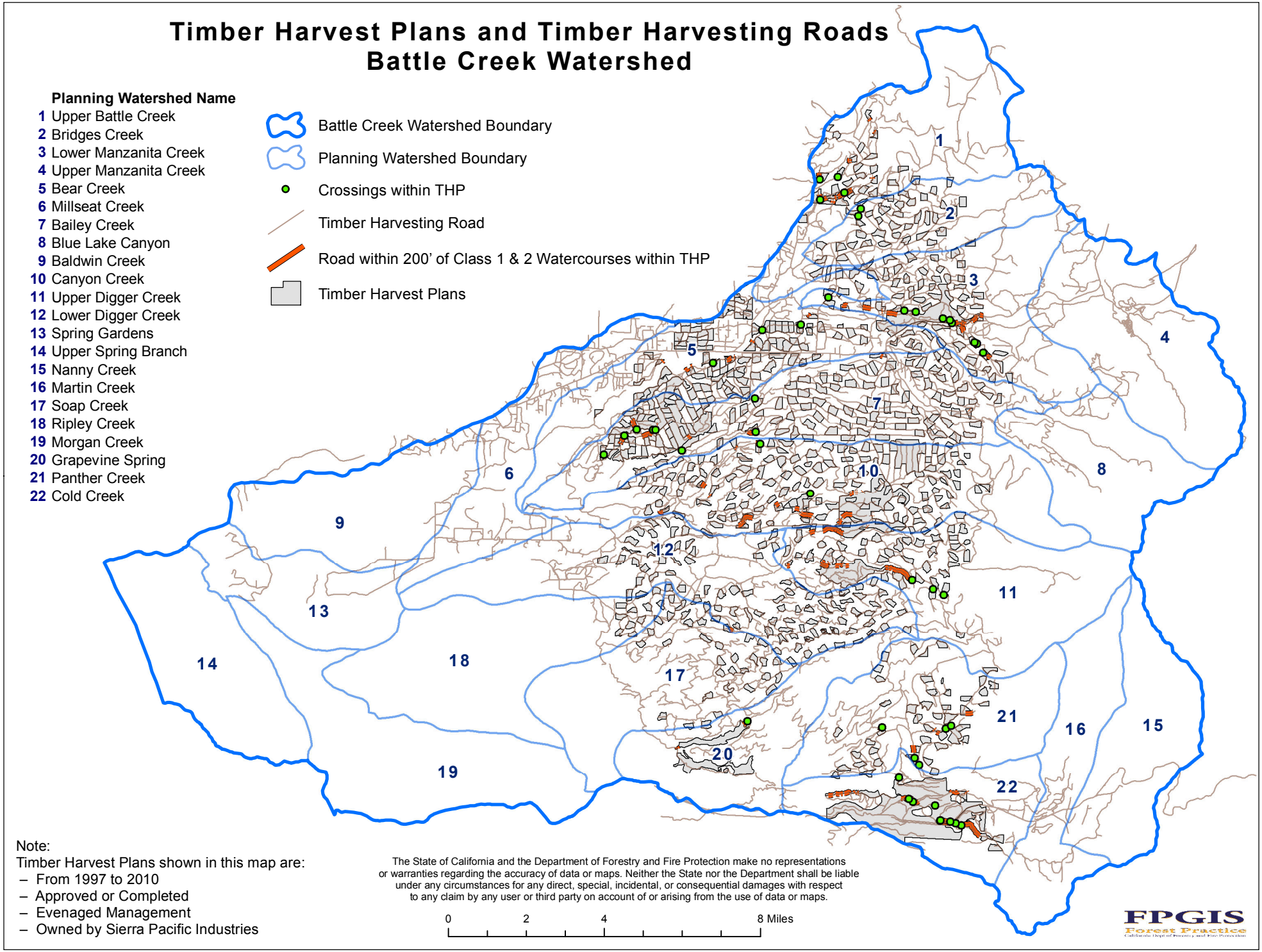
F - Field Data-Collection Form

G - Completed Data-Collection Forms

Appendix B

Figures Used to Help Scope Agency Field Investigation

Timber Harvest Plans and Timber Harvesting Roads
Battle Creek Watershed

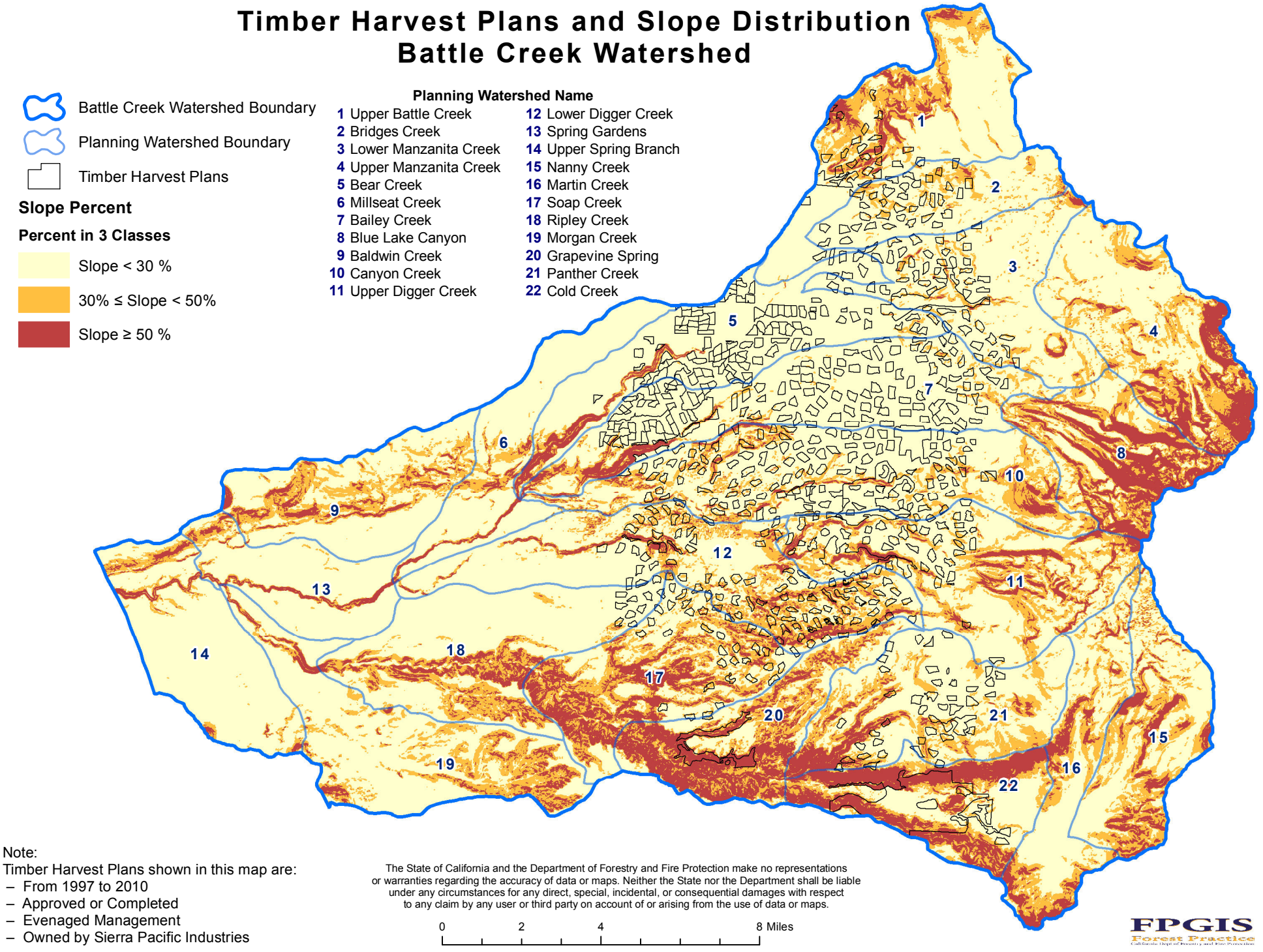


Note:
Timber Harvest Plans shown in this map are:
- From 1997 to 2010
- Approved or Completed
- Evenaged Management
- Owned by Sierra Pacific Industries

0 2 4 8 Miles

FPGIS
Forest Practice

Timber Harvest Plans and Slope Distribution
Battle Creek Watershed

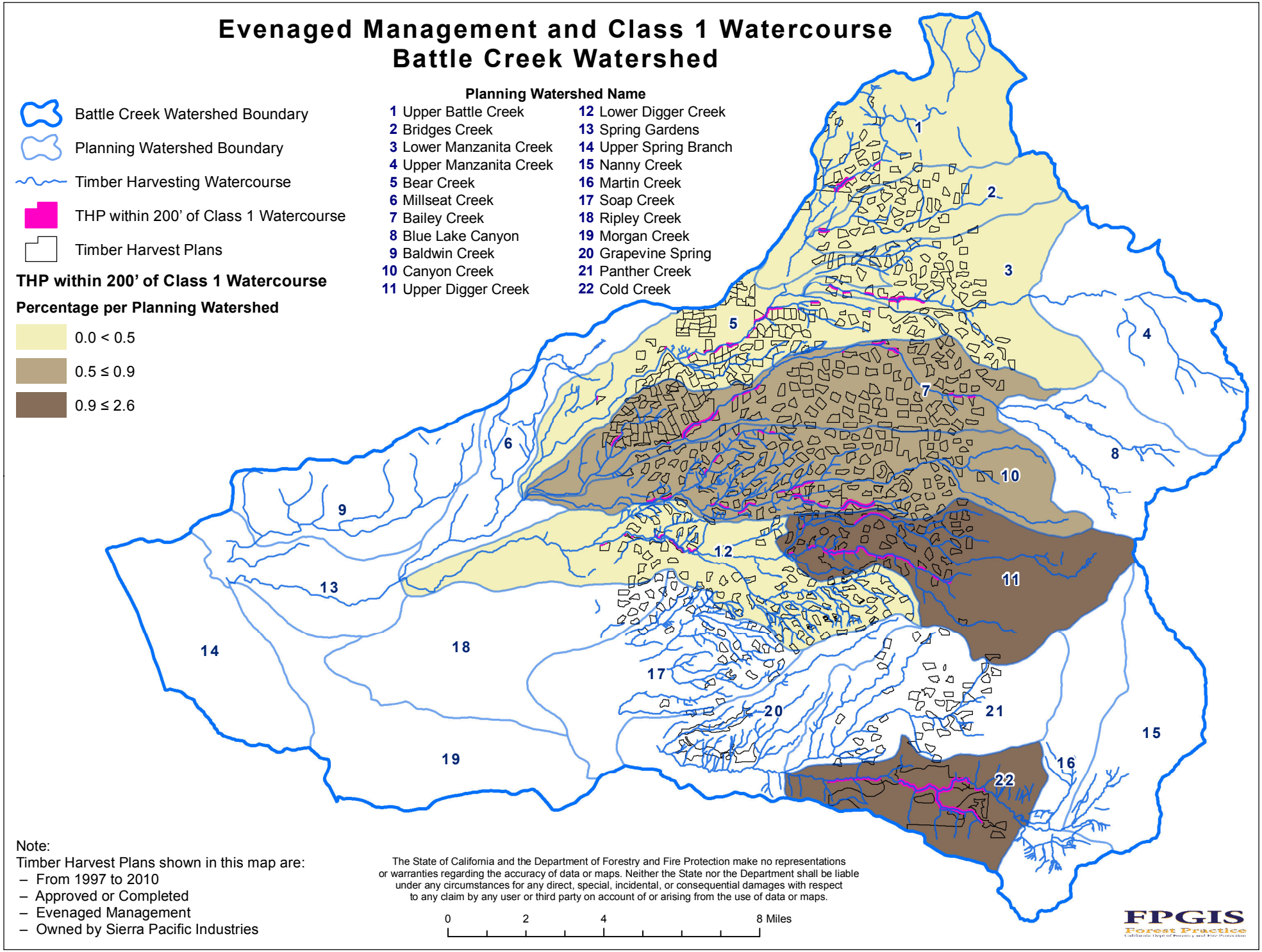


Note:
Timber Harvest Plans shown in this map are:
- From 1997 to 2010
- Approved or Completed
- Evenaged Management
- Owned by Sierra Pacific Industries

0 2 4 8 Miles

FPGIS
Forest Practice

Evenaged Management and Class 1 Watercourse
Battle Creek Watershed

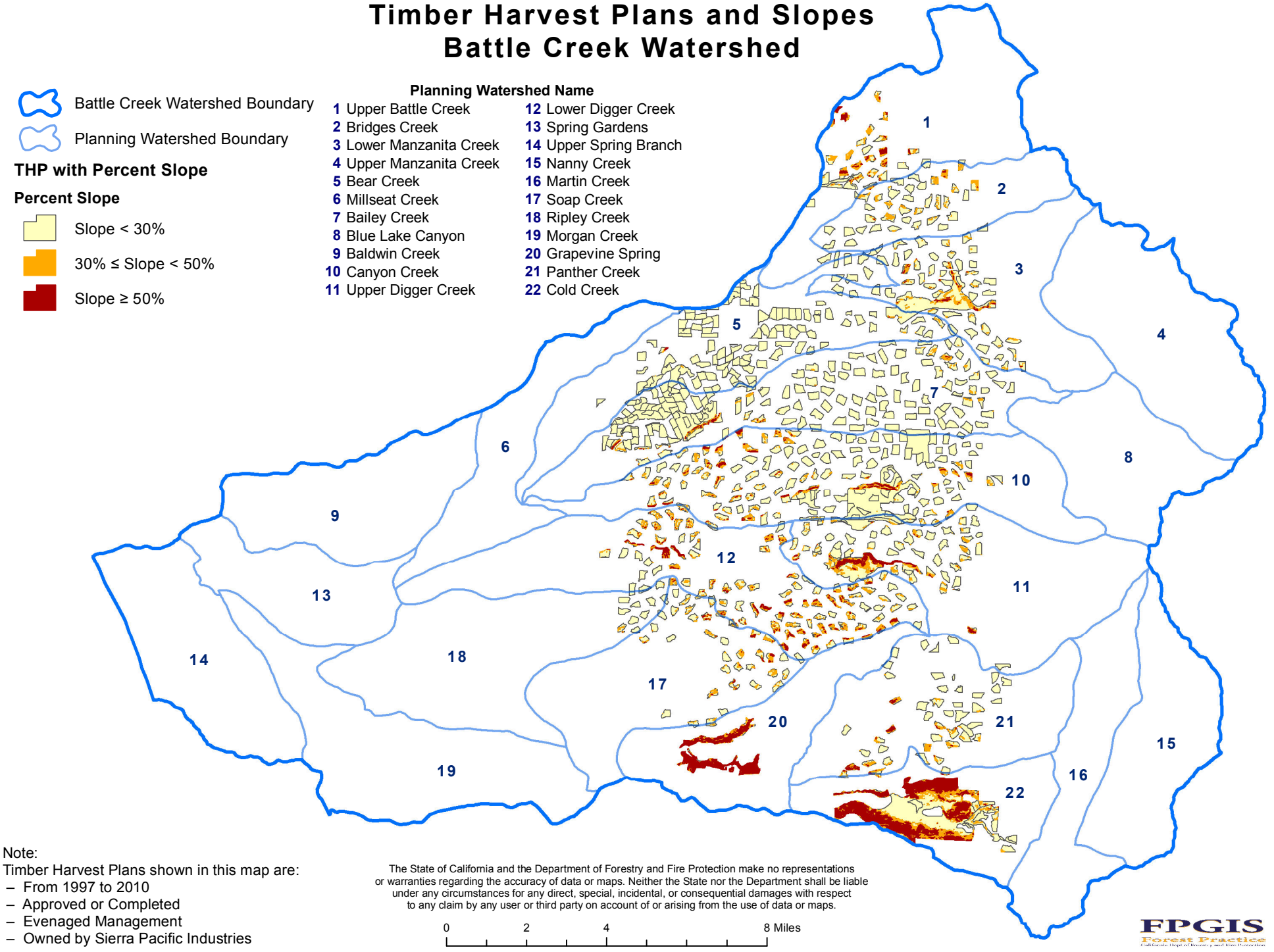


Note:
Timber Harvest Plans shown in this map are:
- From 1997 to 2010
- Approved or Completed
- Evenaged Management
- Owned by Sierra Pacific Industries

0 2 4 8 Miles

FPGIS
Forest Practice

Timber Harvest Plans and Slopes
Battle Creek Watershed



Note:
Timber Harvest Plans shown in this map are:
- From 1997 to 2010
- Approved or Completed
- Evenaged Management
- Owned by Sierra Pacific Industries

0 2 4 8 Miles

FPGIS
Forest Practice

Appendix C

Assessment-Area Planning-Watershed Geology Maps

Geology of Lower Manzanita Creek Planning Watershed

Explanation

Holocene

- Qf Alluvium
- pc Rhyodacite

Late Pleistocene

- Qou Outwash glacial
- pe Rhyodacite
- mrd Basaltic andesite and andesite
- mrm-cinders Basaltic andesite

Middle Pleistocene

- adc Andesite
- amz Andesite
- av Andesite
- rmz Rhyodacite
- am Andesite/basalt
- bec Basalt
- mhr Basaltic andesite
- pdh Andesite
- bct Basalt
- Qs82 Avalanche

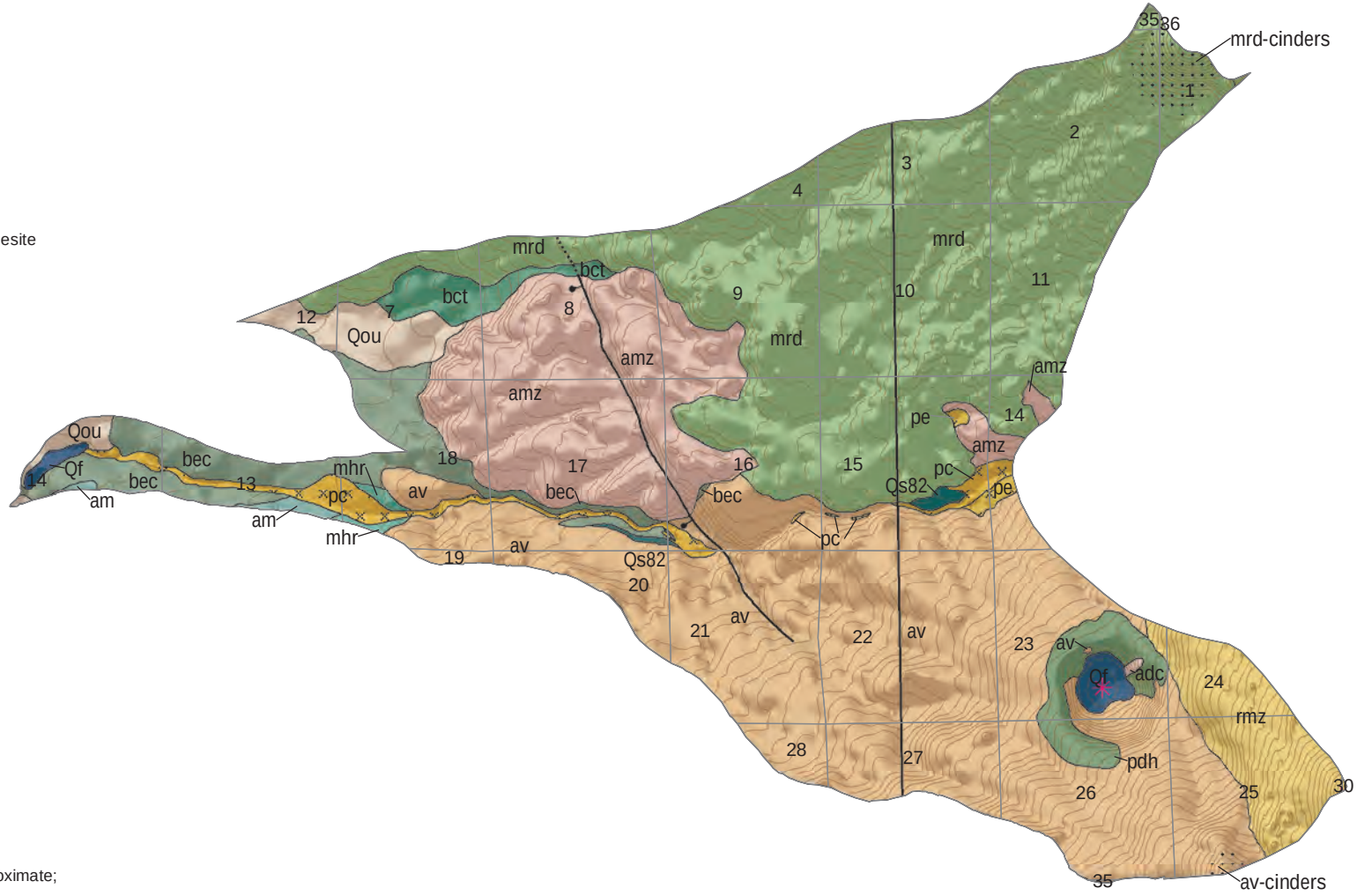
Vent

Cinder

Normal fault

Contact

Faults and contacts dashed where approximate; dotted where concealed.



Miles
0 0.5 1

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

References

Clynne, M.A., and Muffler, L.J.P., 2010, Geologic map of Lassen Volcanic National Park and vicinity, California: US Geological Survey Scientific Investigations Map 2899, 3 sheets, 116 p. pamphlet, scale 1:50,000.

Geology of the West Half of Bailey Creek Planning Watershed

Explanation

Helley and Harwood, 1985

Pleistocene

- Qab Andesite
- Qar Rhyolitic ash flow
- Qcb Basalt

Pliocene

- Tpa Andesite
- Tt Tuscan Formation

- Contact
- Fault

Faults and contacts dashed where approximate; dotted where concealed.

Clynne and Muffler, 2010

Holocene

- Qf Alluvium

Late Pleistocene

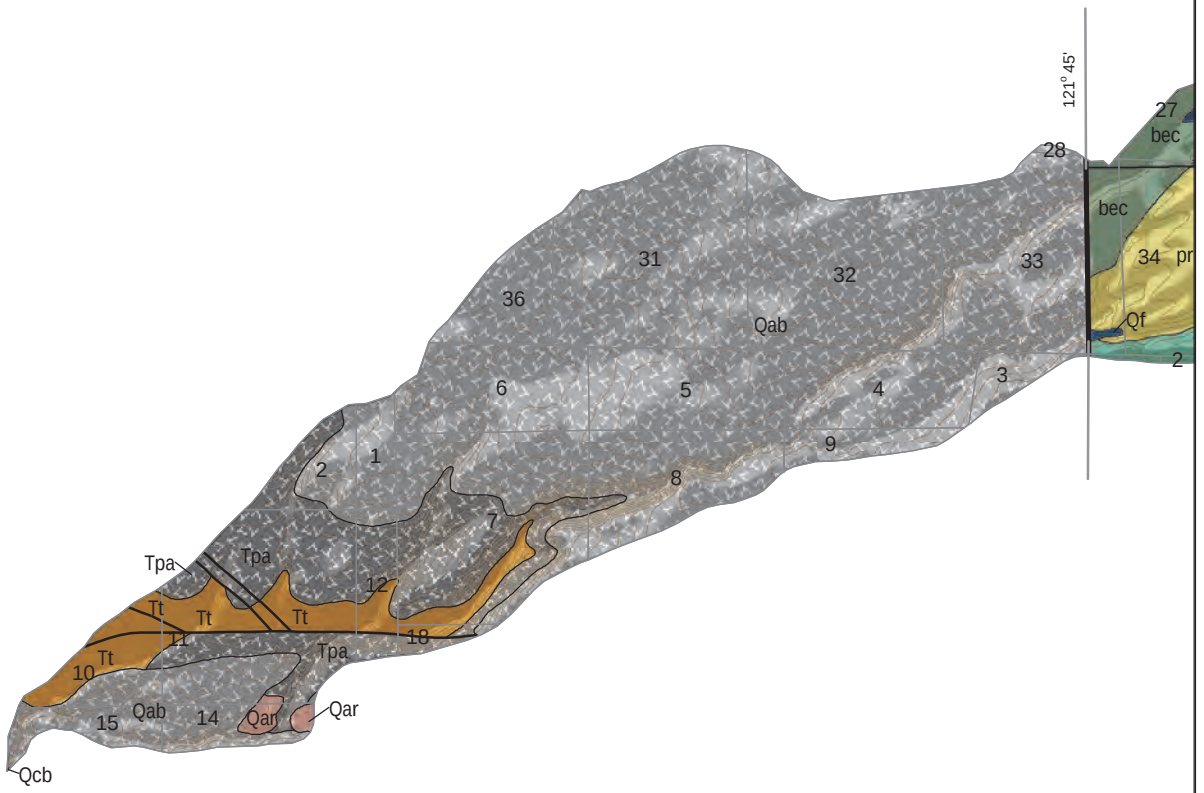
- Qtr Till glacial
- Qou Outwash glacial
- Qto Till Glacial

Middle Pleistocene

- adc Andesite
- ad Andesite
- av Andesite
- pr Rhyolitic ash flow
- bec Basalt
- mhr Basaltic andesite

- Contact
- Moraine crest

Faults and contacts dashed where approximate; dotted where concealed.



References

Helley, E.J., and Harwood, D.S., 1985 Geologic map of the late Cenozoic deposits of the Sacramento Valley and northern Sierra foothills, California: US Geological Survey Miscellaneous Field Studies Series Map MF-1790, scale 1:62,500.

Clynne, M.A., and Muffler, L.J.P., 2010, Geologic map of Lassen Volcanic National Park and vicinity, California: US Geological Survey Scientific Investigations Map 2899, 3 sheets, 116 p. pamphlet, scale 1:50,000.

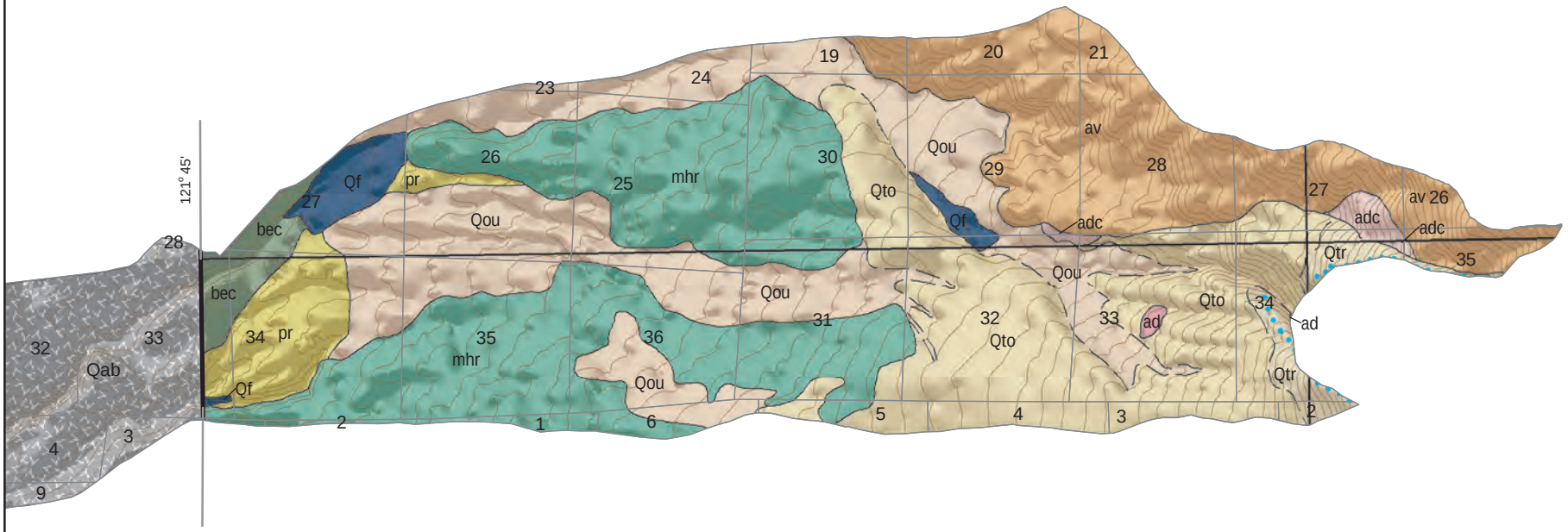
0 1 2 Miles

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

Geology of the East Half of Bailey Creek Planning Watershed



Explanation

Helley and Harwood, 1985

Pleistocene

- Qab Andesite
- Qar Rhyolitic ash flow
- Qcb Basalt

Pliocene

- Tpa Andesite
- Tt Tuscan Formation

Contact

Fault

Faults and contacts dashed where approximate; dotted where concealed.

Clynne and Muffler, 2010

Holocene

- Qf Alluvium

Late Pleistocene

- Qtr Till glacial
- Qou Outwash glacial
- Qto Till Glacial

Middle Pleistocene

- adc Andesite
- ad Andesite
- av Andesite
- pr Rhyolitic ash flow
- bec Basalt
- mhr Basaltic andesite

Contact

Moraine crest

Faults and contacts dashed where approximate; dotted where concealed.

References

Helley, E.J., and Harwood, D.S., 1985 Geologic map of the late Cenozoic deposits of the Sacramento Valley and northern Sierra foothills, California: US Geological Survey Miscellaneous Field Studies Series Map MF-1790, scale 1:62,500.

Clynne, M.A., and Muffler, L.J.P., 2010, Geologic map of Lassen Volcanic National Park and vicinity, California: US Geological Survey Scientific Investigations Map 2899, 3 sheets, 116 p. pamphlet, scale 1:50,000.

0 1 2 Miles

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

Geology of the West Half of Canyon Creek Planning Watershed

Explanation

Helley and Harwood, 1985

Pleistocene

- Qab Andesite
- Qar Rhyolitic ash flow
- Qcb Basalt

Pliocene

- Tpa Andesite

Contact

Faults and contacts dashed where approximate; dotted where concealed.

Clynne and Muffler, 2010

Holocene

- Qf Alluvium

Late Pleistocene

- Qto Till glacial
- Qou Outwash glacial
- Qtr Till glacial
- Qty Till glacial

Middle Pleistocene

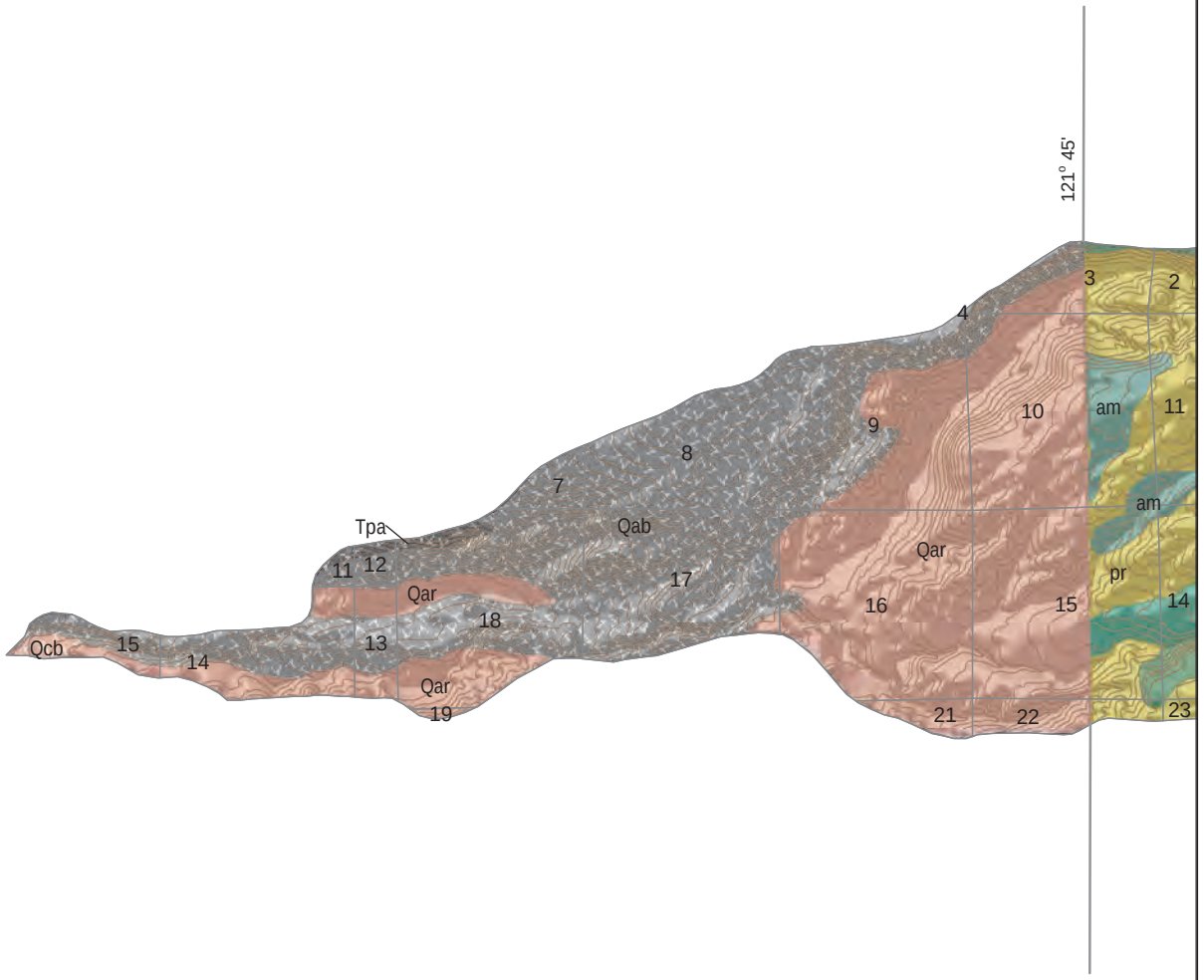
- adc Andesite
- pr Rhyolitic ash flow
- am Andesite/basalt
- mr Basaltic andesite
- mhr Basaltic andesite
- mcf Basaltic andesite
- ao Andesite
- acs Andesite
- Qwb Debris-flow deposit

Vents

Contact

Moraine crest

Faults and contacts dashed where approximate; dotted where concealed.



References

Helley, E.J., and Harwood, D.S., 1985 Geologic map of the late Cenozoic deposits of the Sacramento Valley and northern Sierra foothills, California: US Geological Survey Miscellaneous Field Studies Series Map MF-1790, scale 1:62,500.

Clynne, M.A., and Muffler, L.J.P., 2010, Geologic map of Lassen Volcanic National Park and vicinity, California: US Geological Survey Scientific Investigations Map 2899, 3 sheets, 116 p. pamphlet, scale 1:50,000.

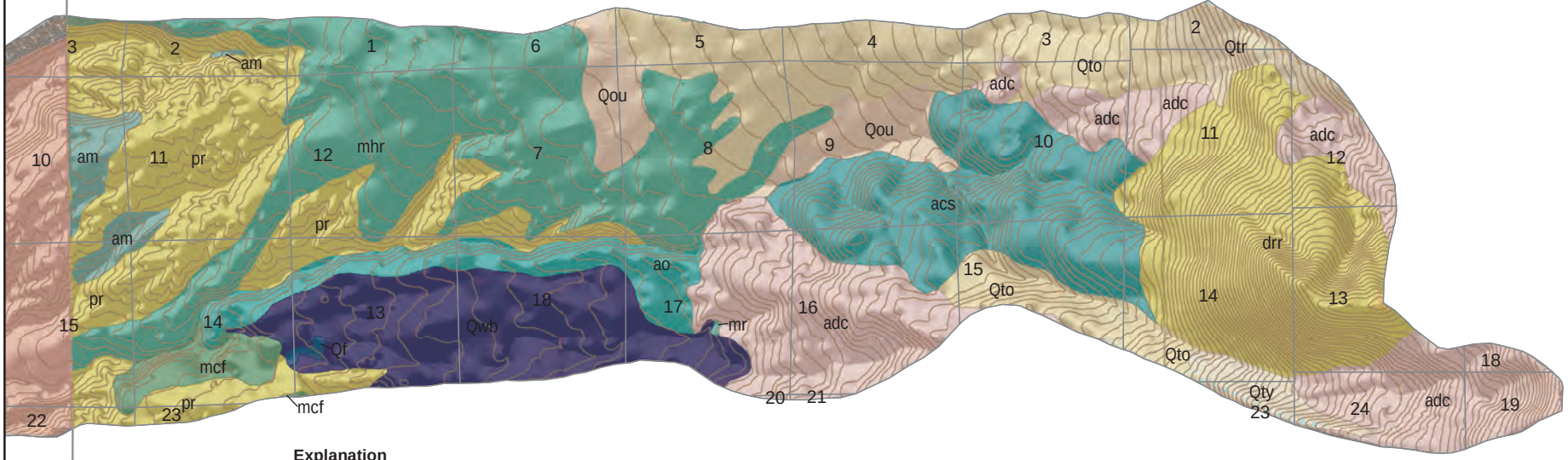
0 1 2 Miles

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

Geology of the East Half of Canyon Creek Planning Watershed



Explanation

Helley and Harwood, 1985

Pleistocene

- Qab Andesite
- Qar Rhyolitic ash flow
- Qcb Basalt

Pliocene

- Tpa Andesite

Contact

Clynne and Muffler, 2010

Holocene

- Qf Alluvium

Late Pleistocene

- Qto Till glacial
- Qou Outwash glacial
- Qtr Till glacial
- Qty Till glacial

Middle Pleistocene

- adc Andesite
- pr Rhyolitic ash flow
- am Andesite/basalt
- mr Basaltic andesite
- mhr Basaltic andesite
- mcf Basaltic andesite
- ao Andesite
- acs Andesite
- Qwb Debris-flow deposit

- Vents
- Contact
- Moraine crest

Faults and contacts dashed where approximate; dotted where concealed.

References

Helley, E.J., and Harwood, D.S., 1985 Geologic map of the late Cenozoic deposits of the Sacramento Valley and northern Sierra foothills, California: US Geological Survey Miscellaneous Field Studies Series Map MF-1790, scale 1:62,500.

Clynne, M.A., and Muffler, L.J.P., 2010, Geologic map of Lassen Volcanic National Park and vicinity, California: US Geological Survey Scientific Investigations Map 2899, 3 sheets, 116 p. pamphlet, scale 1:50,000.

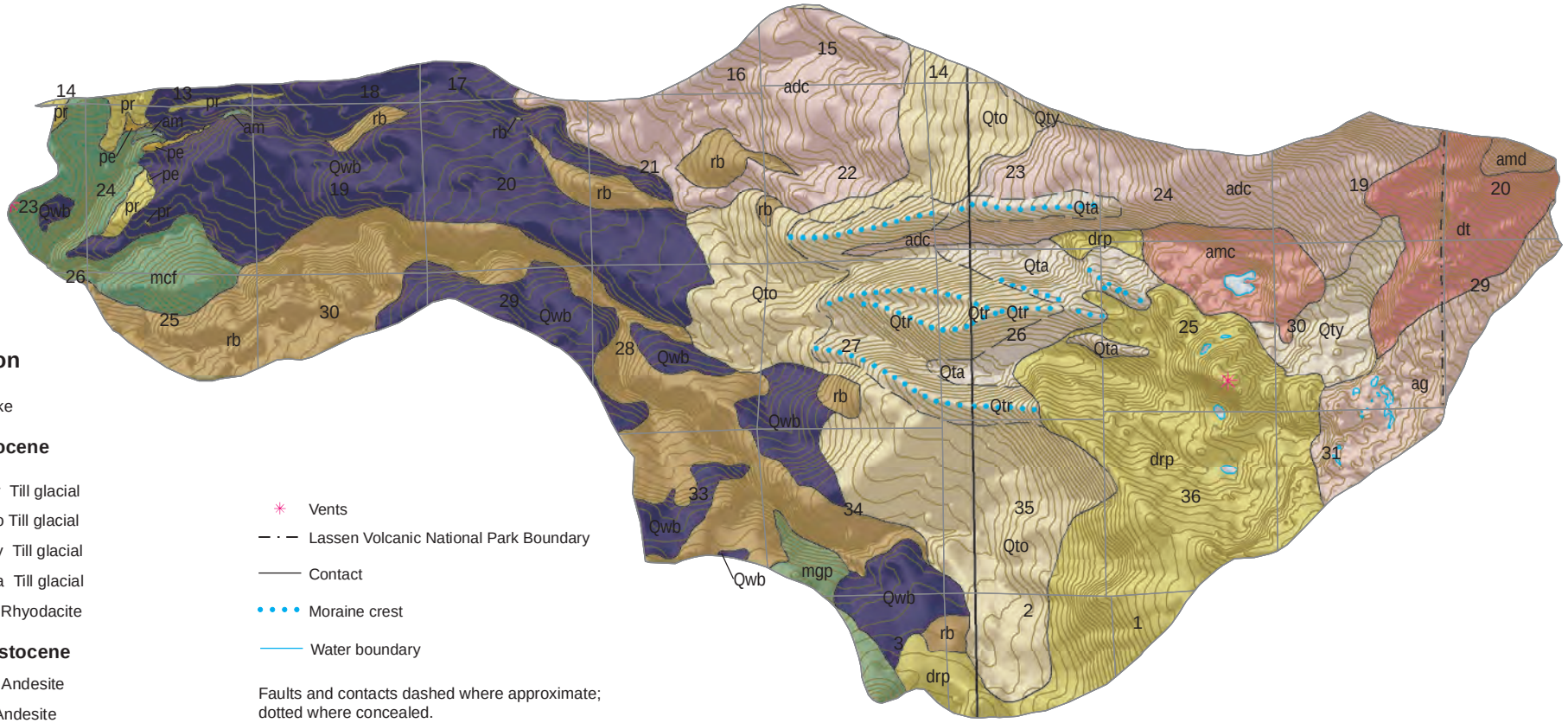
0 1 2 Miles

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

Geology of Upper Digger Creek Planning Watershed



Explanation

Lake

Late Pleistocene

- Qtr Till glacial
- Qto Till glacial
- Qty Till glacial
- Qta Till glacial
- pe Rhyodacite

Middle Pleistocene

- adc Andesite
- ag Andesite
- amd Andesite
- amc Andesite
- dt Basaltic andesite
- am Andesite/basalt
- mcf Basaltic andesite
- Qwb Debris-flow deposit

Early Pleistocene

- drp Dacite / pr Rhyolitic ash flow
- rb Rhyolite
- mgp Basaltic andesite

Vents

Lassen Volcanic National Park Boundary

Contact

Moraine crest

Water boundary

Faults and contacts dashed where approximate; dotted where concealed.

References

Clynne, M.A., and Muffler, L.J.P., 2010, Geologic map of Lassen Volcanic National Park and vicinity, California: US Geological Survey Scientific Investigations Map 2899, 3 sheets, 116 p. pamphlet, scale 1:50,000.

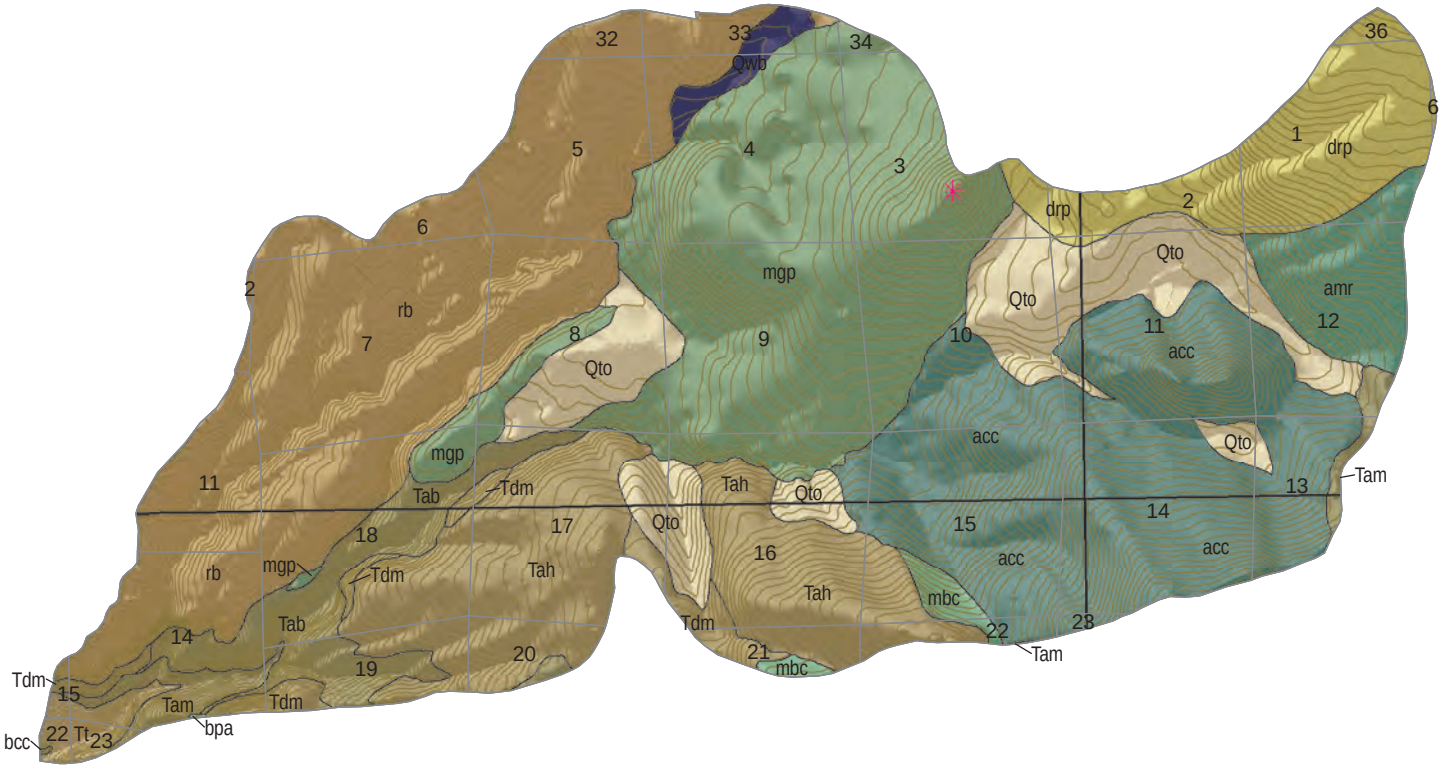
Miles
0 1 2

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

Geology of Panther Creek Planning Watershed



Explanation

Late Pleistocene

- Qto Till glacial

Middle Pleistocene

- Qwb Debris-flow deposit
- bcc Basalt

Early Pleistocene

- rb Rhyolite
- mgp Basaltic andesite
- acc Andesite
- drp Dacite
- amr Andesite
- mbc Basaltic andesite
- bpa Basalt

Late Pliocene

- Tdm Dacite
- Tam Andesite

Pliocene

- Tt Tuscan Formation

- ✳ Vents
- Contact

Faults and contacts dashed where approximate; dotted where concealed.

References

Clynne, M.A., and Muffler, L.J.P., 2010, Geologic map of Lassen Volcanic National Park and vicinity, California: US Geological Survey Scientific Investigations Map 2899, 3 sheets, 116 p. pamphlet, scale 1:50,000.

0 1 2 Miles

CONTOUR INTERVAL 40 FEET

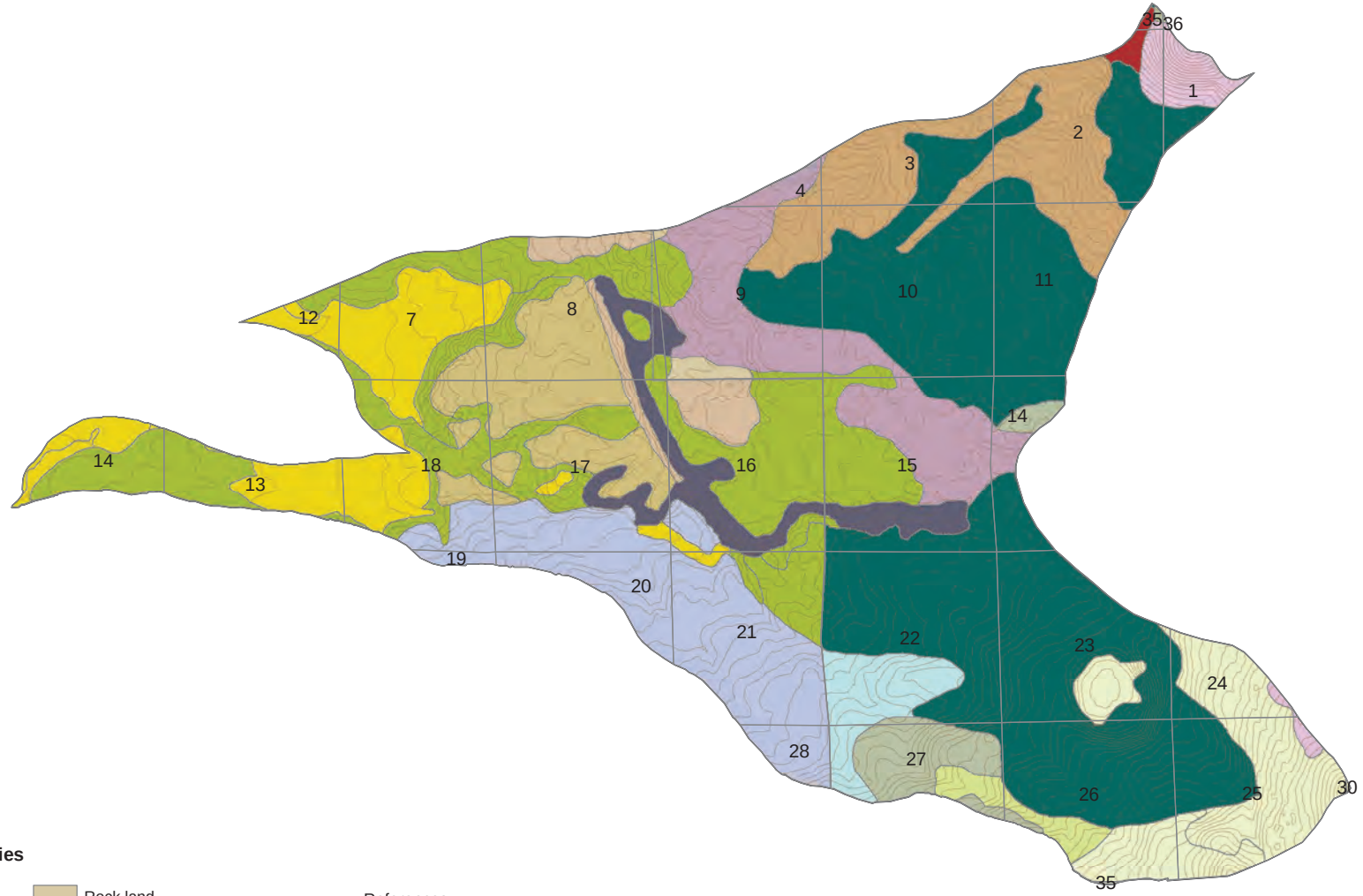
SCALE 1:62 500

N

Appendix D

Assessment-Area Planning-Watershed Soils maps

Generalized Soils Map of the Lower Manzanita Creek Planning Watershed



Soil Series

- Cohasset
- Inville
- Inville-Yallani
- Lava flow
- Litih Xerumbrepts - rock outcrop
- Lyonsville-Jiggs
- Nanny
- Nanny-Windy
- Rock land
- Sheld
- Skalan-Holland
- Typic
- Washougal
- Windy and McCarthy
- Yallani

References

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2009, Soil Survey Geographic (SSURGO) database for Lassen National Forest Area, California, August 14, 2009.

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2008, Soil Survey Geographic (SSURGO) database for Shasta County Area, California, May 21, 2008.

0 0.5 1 Miles

CONTOUR INTERVAL 40 FEET

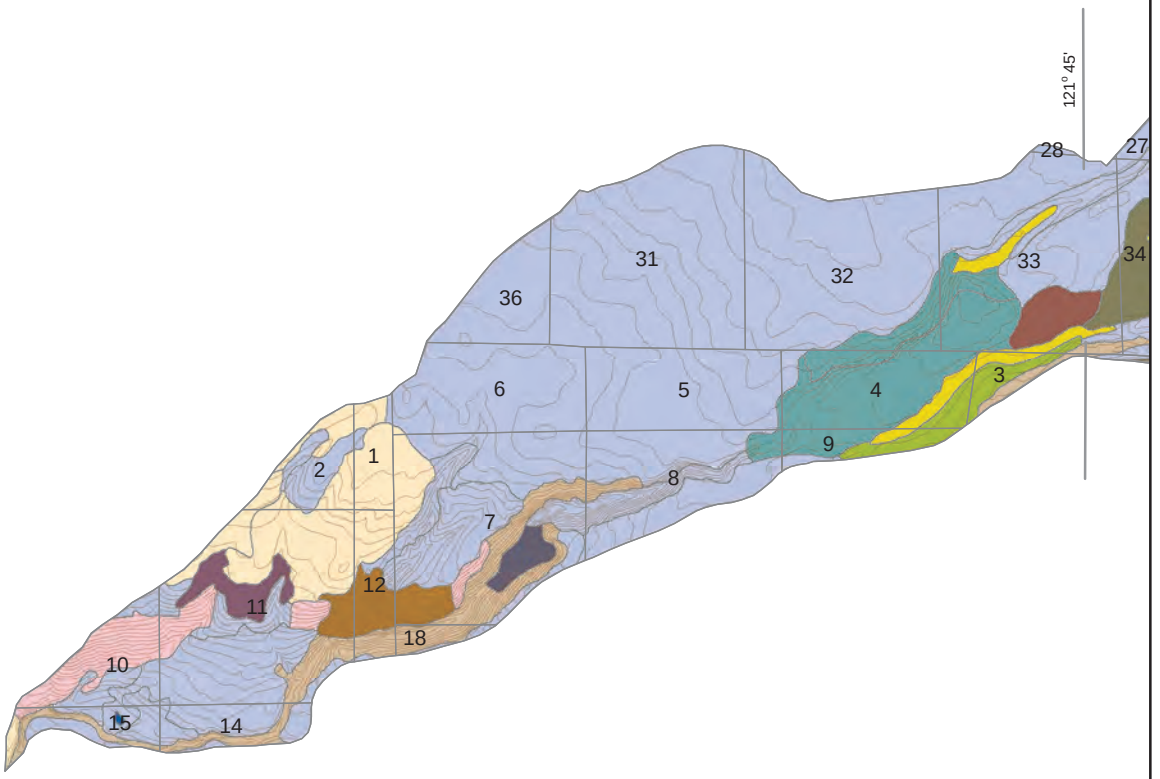
SCALE 1:62 500

N

Generalized Soils Map of the West Half of Bailey Creek Planning Watershed

Soil Series

- Aiken
- Cohasset
- Cohasset-McCarthy
- Colluvial land
- Forward
- Inks
- Josephine
- Lyonsville and Jiggs
- Nanny
- Rock Land
- Supan
- Windy and McCarthy



0 1 2 Miles

CONTOUR INTERVAL 40 FEET

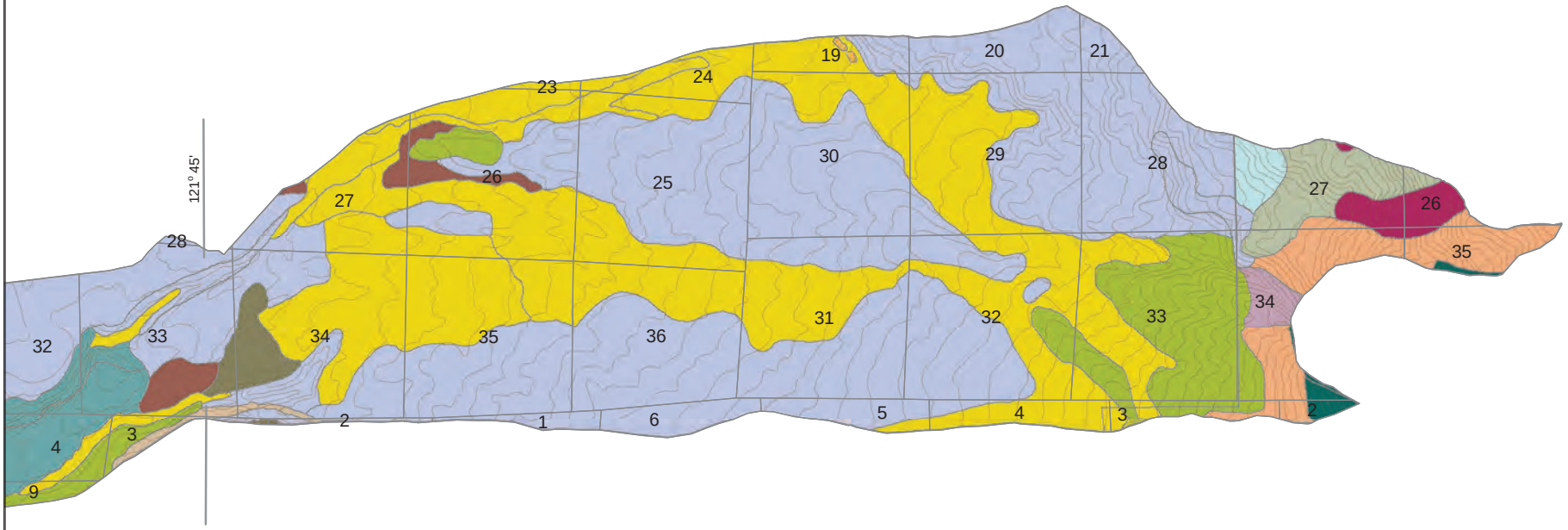
SCALE 1:62 500

N

References

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2008, Soil Survey Geographic (SSURGO) database for Shasta County Area, California, May 21, 2008.

Generalized Soils Map of the East Half of Bailey Creek Planning Watershed



Soil Series

- Aiken
- Cohasset
- Cohasset-McCarthy
- Colluvial land
- Forward
- Inks
- Inville-Sheld
- Inville-Yallani
- Josephine
- Lyonsville and Jiggs
- Nanny
- Rock land
- Sheld
- Skalan-Holland
- Supan
- Washougal
- Windy and McCarthy
- Yallani-Sheld

References

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2009, Soil Survey Geographic (SSURGO) database for Lassen National Forest Area, California, August 14, 2009.

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2008, Soil Survey Geographic (SSURGO) database for Shasta County Area, California, May 21, 2008.

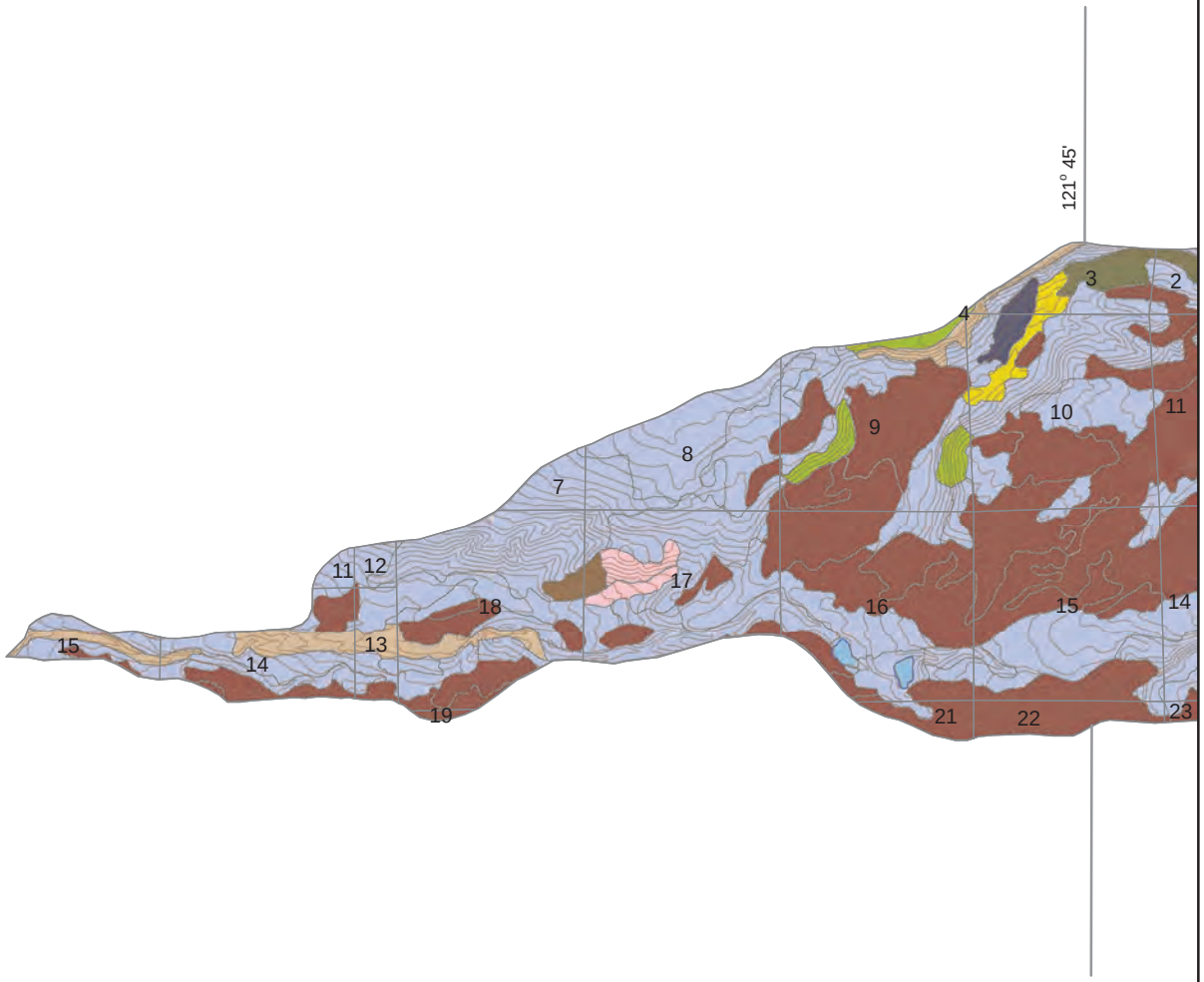
0 1 2 Miles

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

Generalized Soils Map of the West Half of Canyon Creek Planning Watershed



Soil Series

- Aiken
- Cohasset
- Forward
- Josephine
- Lyonsville-Jiggs
- Nanny
- Rock land
- Shingletown
- Supan
- Toomes
- Windy and McCarthy
- Water

0 1 2 Miles

CONTOUR INTERVAL 40 FEET

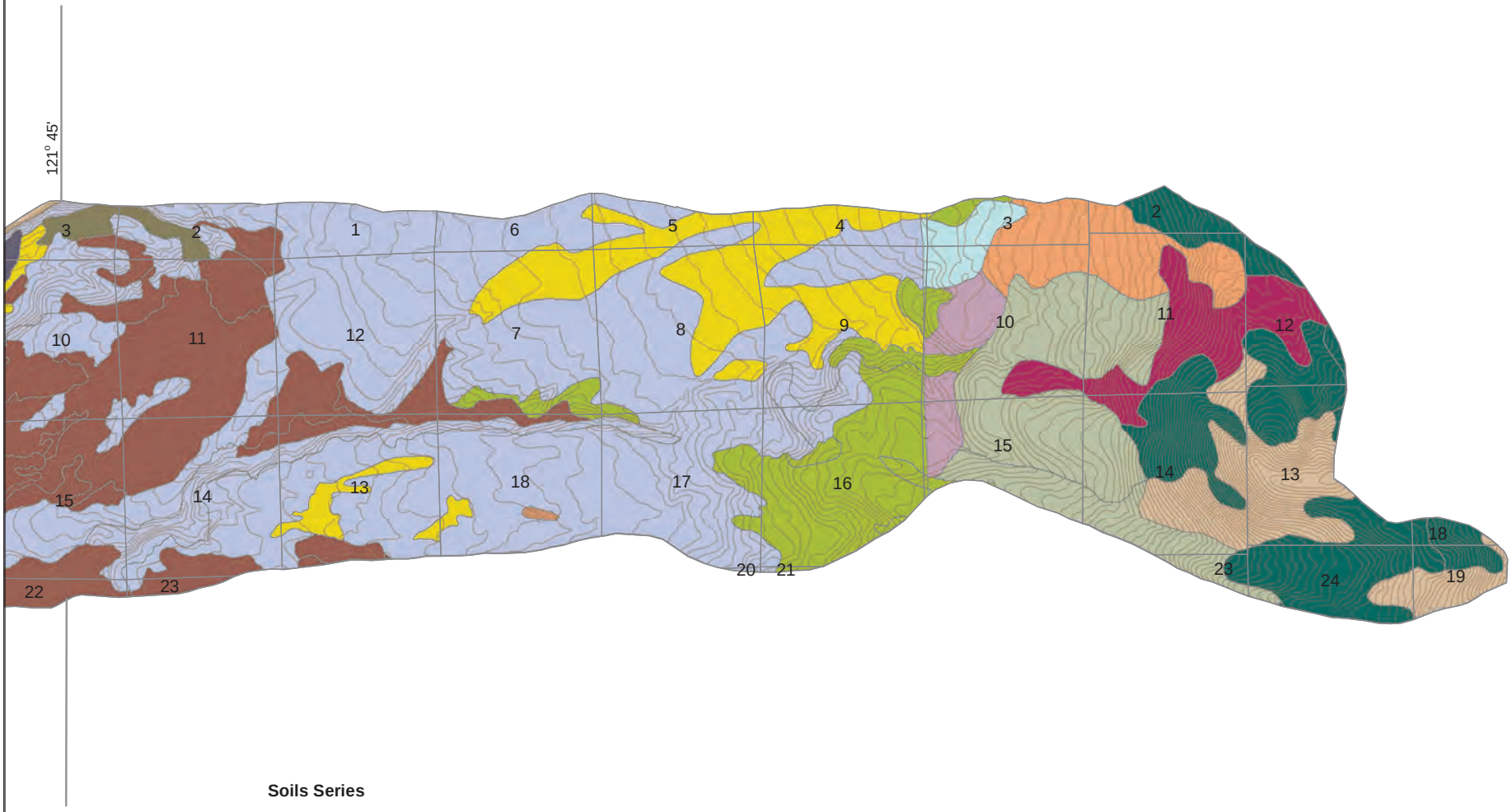
SCALE 1:62 500

N

References

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2008, Soil Survey Geographic (SSURGO) database for Shasta County Area, California, May 21, 2008.

Generalized Soils Map of the East Half of Canyon Creek Planning Watershed



Soils Series

- Aiken
- Cohasset
- Forward
- Inville-Sheld
- Inville-Yallani
- Josephine
- Lyonsville-Jiggs
- Nanny
- Rock land
- Sheld
- Shingletown
- Skalan-Holland
- Supan
- Toomes
- Washougal
- Windy and McCarthy
- Yallani-Sheld
- Water

References

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2009, Soil Survey Geographic (SSURGO) database for Lassen National Forest Area, California, August 14, 2009.

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2008, Soil Survey Geographic (SSURGO) database for Shasta County Area, California, May 21, 2008.

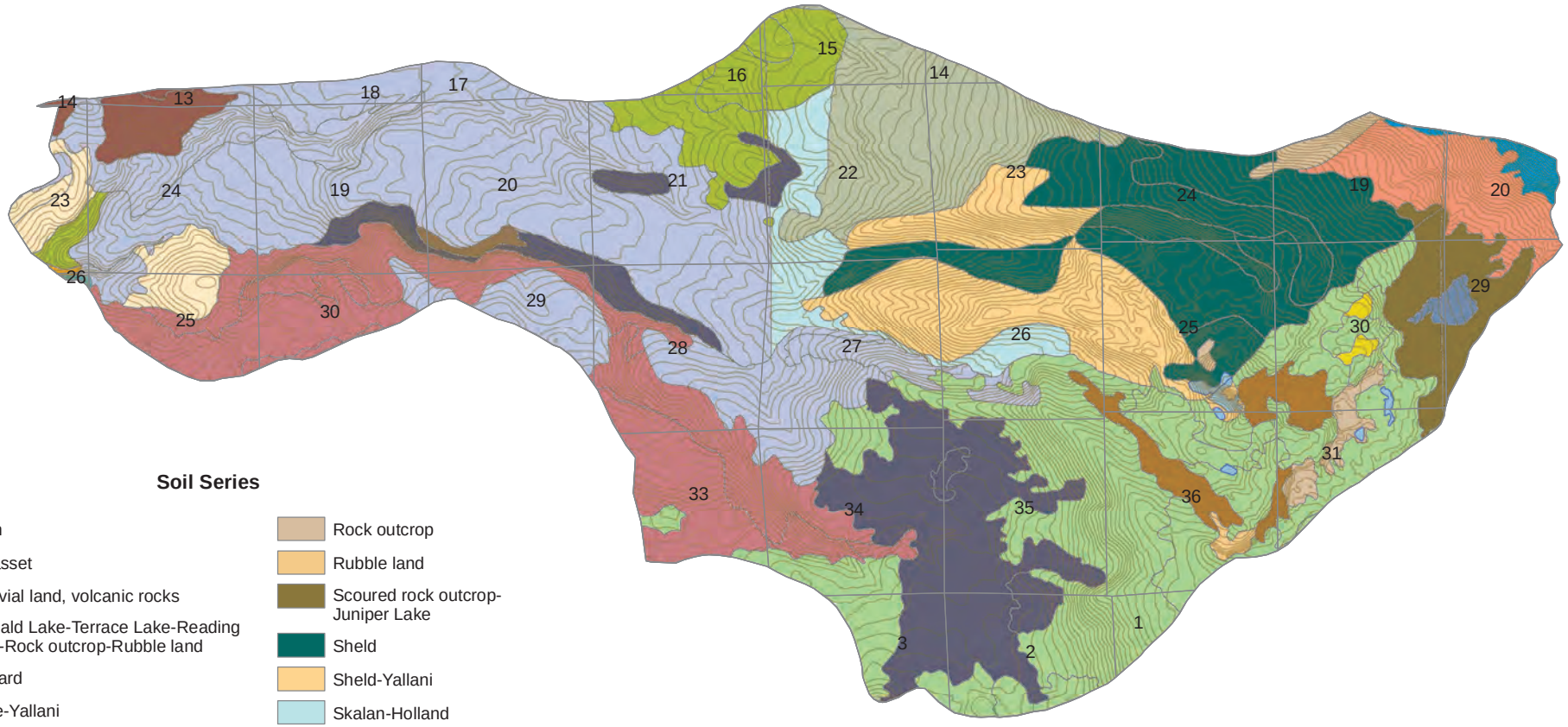
0 1 2 Miles

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

Generalized Soils Map of Upper Digger Creek Planning Watershed



Soil Series

- Aiken
- Cohasset
- Colluvial land, volcanic rocks
- Emerald Lake-Terrace Lake-Reading Peak-Rock outcrop-Rubble land
- Forward
- Inville-Yallani
- Jiggs
- Juniper Lake
- Lyonsville-Jiggs
- Manton
- McCarthy
- Nanny
- Rock outcrop
- Rubble land
- Scoured rock outcrop-Juniper Lake
- Sheld
- Sheld-Yallani
- Skalan-Holland
- Toomes
- Windy
- Windy and McCarthy
- Xeric vitricryands, Tephra over till-Terrace Lake-Rock outcrop-xeric vitricryands, cirque floor
- Water

0 1 2 Miles

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

References

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2009, Soil Survey Geographic (SSURGO) database for Lassen National Forest Area, California, August 14, 2009.

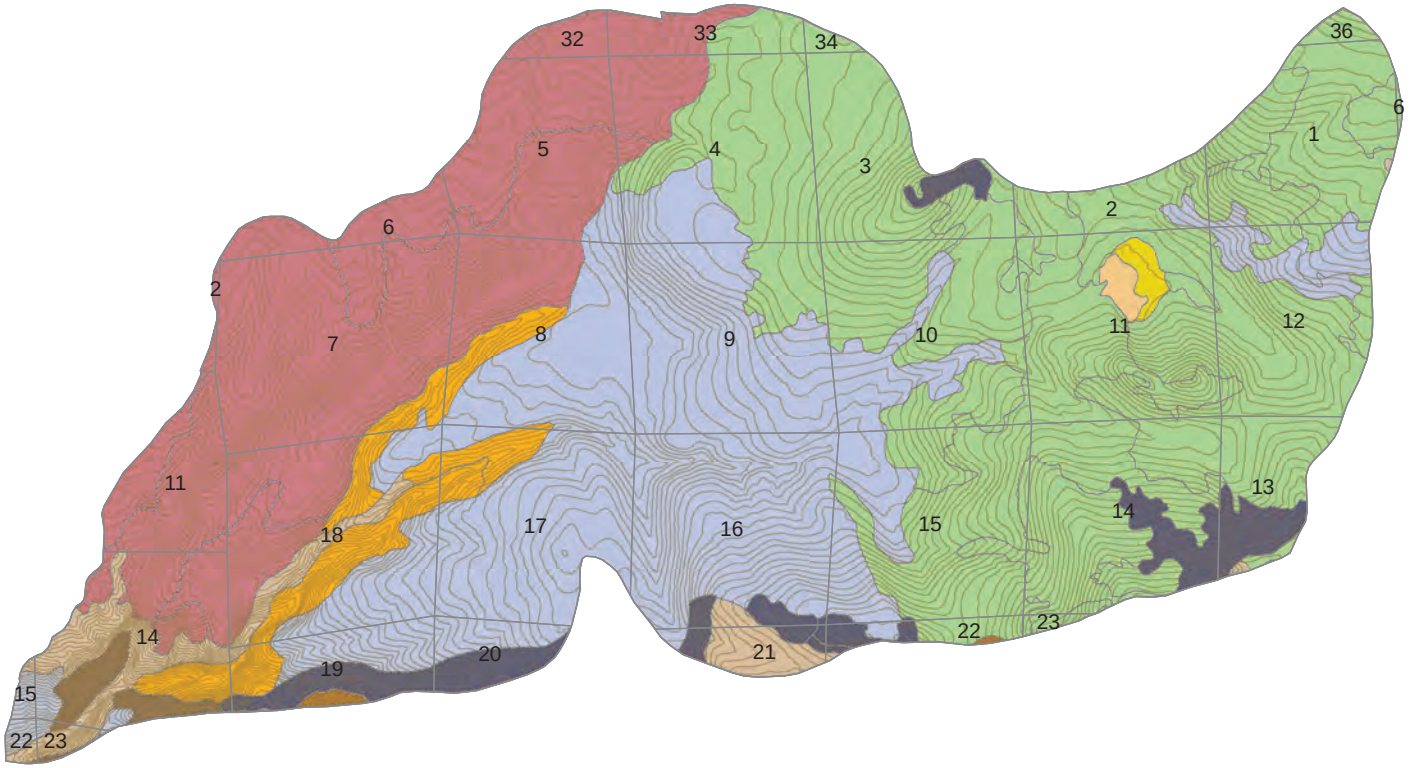
Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2010, Soil Survey Geographic (SSURGO) database for Lassen Volcanic National Park, California, February 11, 2010.

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2008, Soil Survey Geographic (SSURGO) database for Shasta County Area, California, May 21, 2008.

Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2011, Soil Survey Geographic (SSURGO) database for Tehama County, California, January 6, 2011.

CGS
CALIFORNIA GEOLOGICAL SURVEY

Generalized Soils Map of the Panther Creek Planning Watershed



Soil Series

- Chummy
- McCarthy
- Cohasset
- Nanny
- Colluvial land
- Rock land
- Jiggs
- Toomes
- Lyonsville and Jiggs
- Windy

References
Modified from U.S. Department of Agriculture, Natural Resources Conservation Service, 2011, Soil Survey Geographic (SSURGO) database for Tehama County, California, January 6, 2011.

0 1 2 Miles

CONTOUR INTERVAL 40 FEET

SCALE 1:62 500

N

Appendix E

Assessment-Area THP Information

Summary of Assessment-Area THP Status and Violations as of September 2011					
THP Number	**THP Name**	**THP Status (R) In Review (A) Approved (M) In Maint-enance Period (E) Expired**	**Violations? (Y/N)**	**Code Section(s) Violated**	**Sampled in 2011-09 or not sampled, reason why not sampled**
2-10-067-TEH (5)	Blue Ridge	R	N	N/A	Not sampled, THP not yet approved
2-10-003-TEH (5)	Dry Gulch	A	N	N/A	Not sampled, no timber operations
2-09-027-SHA (4)	Plateau Flat	A	N	N/A	Not sampled, active in 2011, not overwintered
2-08-097-TEH (5)	Long Ridge	A	N	N/A	Not sampled, Active in 2011, not overwintered
2-06-173-TEH (5)	Lookout	A	N	N/A	Not sampled, active in 2011, not overwintered
2-05-125-SHA (4)	Manzanita Flat	E	Y	CCR943.4c CCR934.6b	Sampled
2-04-181-TEH (5)	Willow Spring	E	N	N/A	Sampled
2-04-166-TEH (5)	Hazen	M	Y	CCR936.3 CCR936.4c3 CCR943.4m CCR1035.3d **Civil Penalty**	Sampled
2-03-162-SHA (4)	Rock Flat	E	Y	CCR943.4	Sampled
2-03-158-TEH (5)	Digger	A	N	N/A	Sampled
2-02-185-SHA (4)	Onion Flat	E	Y	CCR1035.1a1 PRC4585.a CCR943.4j **Civil Penalty**	Sampled
2-02-030-SHA (4)	Deer Flat	E	N	N/A	Sampled
2-00-073-TEH (5)	Grapevine	E	N	N/A	Not sampled, >10 years old
2-99-247-SHA (4)	Long Hay Flat	E	N	N/A	Sampled
2-98-314-SHA (4)	Spring Creek	E	N	N/A	Not sampled, >10 years old

Appendix F

Field Data-Collection Form

General Information

Site I.D.[1]:

Date: _____ Time: _____ Team#: _____ THP# _____

Watershed #: _____ GPS[2]: _____ / _____

Sec. _____ Township: _____ Range: _____

Camera I.D.: _____ Photo number(s): _____

Sediment Delivery

Has sediment delivered? ☐ Yes ☐ No ☐ Maybe ☐ Deliv. through buffer ☐ ft. Buffer dist.

Receiving Watercourse Type? ☐ Class I ☐ Class II ☐ Class III ☐ Class IV

Associated with timber operations? ☐ Yes ☐ No ☐ Maybe

Provide range of estimated volume delivered: ☐ ≤1 cy ☐ 1≤5 cy ☐ 5≤10 cy ☐ >10 cy ☐ cy[3]

Erosion Source

Surface Erosion	Fluvial Erosion	Mass Wasting		Other
☐ Sheet wash	☐ Gully (>6"x6")	☐ Rotational	☐ Debris slide	☐ w/ explanation
☐ Rill (≤ 6"x6")	☐ Bank failure	☐ Translational	☐ Debris torrent/flow	

Explanation: _____

Relative age of source: ☐ ≤1 yr ☐ 1≤5 yr ☐ 5≤10 yr ☐ >10 yr ☐ Continuous

Sediment Source Association

☐ Clearcut Unit

Unit ID: _____ Average Slope: _____ %

Yarding method: ☐ Tractor ☐ Cable

Contour ripped? ☐ yes ☐ No

Soil type / Parent material: _____

Percent veg. cover: ☐ 0-25% ☐ 26-50% ☐ 51-75% ☐ 76-100%

☐ Road

Road name/I.D.: _____

Ownership: ☐ Private ☐ Public

Gated: ☐ Yes ☐ No

In the WLPZ/ELZ? ☐ Yes ☐ No

Surface: ☐ Rocked ☐ Paved ☐ Native

Soil type / Parent material: _____

Road shape: ☐ Insloped ☐ Outsloped ☐ Crowned ☐ Other

Approx. length of road drainage to discharge point? _____ ft.

Average road grade? _____ %

☐ Other w/ explanation

Explanation: _____

☐ Watercourse Crossing/Drafting Site

Crossing name/I.D.: _____

Road name/I.D.: _____

Ownership: ☐ Private ☐ Public

Type: ☐ Bridge ☐ Tractor crossing

☐ Culvert: Diameter: _____ in.

☐ Ford: ☐ Rocked ☐ Native

☐ Dip: ☐ Rocked ☐ Native

☐ Other: _____

Functioning (partial failure=failure): ☐ Yes ☐ No

Approaches: ☐ Rocked ☐ Paved ☐ Native ☐ Other: _____

Combined road approach length: _____ ft.

☐ Landing

Adequate drainage: ☐ Yes ☐ No

In the WLPZ/ELZ? ☐ Yes ☐ No

Percent veg. cover: ☐ 0-25% ☐ 26-50% ☐ 51-75% ☐ 76-100%

Soil type / Parent material: _____

General Recommendations

_____

_____

Regulations

Were obviously known State Regulations/Laws violated? ☐ Yes ☐ No

Provide description of violation: _____

Comments (back of page)

Notes:

1. Sediment Association - Sediment I.D. Number - Road Segment Alphabetical Designator (Example: R-15-b).
   U = Unit; R = Road; X = Crossing; O = Other; a, b, c, etc = Road Segment designator.
2. GPS datum use NAD 83, Zone 10
3. Use to provide volume estimate for sites that exceed 10 cy and are determined to be significant to report.