

DRAFT

TECHNICAL MEMORANDUM

METHODOLOGY AND SOURCES OF INFORMATION

**DELINEATION OF SUBTERRANEAN STREAMS AND
POTENTIAL STREAMFLOW DEPLETION AREAS**

POLICY FOR MAINTAINING INSTREAM FLOWS IN
NORTHERN CALIFORNIA COASTAL STREAMS

MAY 16, 2008



INTRODUCTION

The purpose of this memorandum is to discuss the sources of information, methodology and guidelines followed in the preparation of 7.5 minute quadrangles showing the delineation of Subterranean Streams, Potential Stream Depletion Areas (PSDA) and Mapped Active Stream Deposits within Potential Stream Depletion Areas. The three classifications noted above are referred to collectively as delineated areas in this document.

This technical memorandum was prepared to support the February 28, 2008 technical memorandum prepared by Stetson Engineers, titled "Approach to Delineate Subterranean Streams and Determine Potential Streamflow Depletion Areas". It is the intent herein to document the specific sources of information relied upon to prepare each quadrangle map, note specific challenges presented by each source, and describe of how these issues were addressed.

The general guidelines for the selection of geologic units to be included in the delineated areas within the Policy Area are discussed below. No single set of guidelines could be applied in every situation. Due to differences in scale, each geologic map or map series varied in regard to which geologic units were included on the map, how the units were differentiated from one another, the detail of the mapping, and whether or not the geologic ages were differentiated. Each geographic region also presented its own unique set of exceptions where the guidelines discussed below could not be applied. In those cases, professional judgment was used. Specific exceptions are noted with the geologic sources listed below. An attempt has not been made to list and discuss every exception, but rather to point out the most significant characteristics and limitations of the sources used.

GENERAL METHODOLOGY

This map set, consisting of 7.5 minute quadrangles, was created by compiling selected geologic units from multiple sources to provide geologic coverage of the Policy Area. Other data used to create the maps included the National Hydrography Dataset (NHD) 1:24,000, USGS 1:24,000 Digital Line Graphs (DLG) coverages, and topographic contours and hillshade models derived from USGS 10-meter digital elevation models (DEMs). Figure 1 is an index map showing the 7.5 minute quadrangle map coverage for the Policy Area. Quadrangles that do not include delineated Subterranean Streams, PSDAs or Mapped Active Stream Deposits within Potential Stream Depletion Areas are noted in Figure 1.

Geologic sources were limited to maps published or provided by the USGS or California Geologic Survey (CGS), and maps available at the time the mapping phase of the project began. Geologic maps were obtained in digital format when possible. Sources that were not available digitally were digitized, or scanned and georeferenced, and used as a guide to trace the

delineated areas. Sources mapped at the largest scale were used as the primary reference in areas with overlapping geologic sources. The scale of the geologic source maps ranged from 1:24,000 to 1:250,000. The delineated areas are presented in a map set at a scale of 1:24,000, but it is important to note that the detail and accuracy of the delineated areas are dependent on the scale of the original source data from which it was compiled. Figure 2 is an Index of Geologic Sources used in the mapping of delineated areas.

Discrepancies between geologic sources of differing scales were resolved using topography, hillshade models, and DLGs. Where spatial adjustment was necessary, it was done on screen, at scales no smaller than 1:10,000. No adjustments were made to geologic units selected from 1:24,000 sources.

Edge matching between geologic sources was done by adjusting a smaller-scale map to match the edge of a larger scale source, using topography as a guide. Edge matching was not attempted where geologic sources were significantly different, or where the geologic unit from a formation that typically does not follow topography, such as the Glen Ellen Formation in the Petaluma-Santa Rosa area. At these edges, the delineated areas, or subdivisions of it, may appear to dead end at quadrangle or source map boundaries.

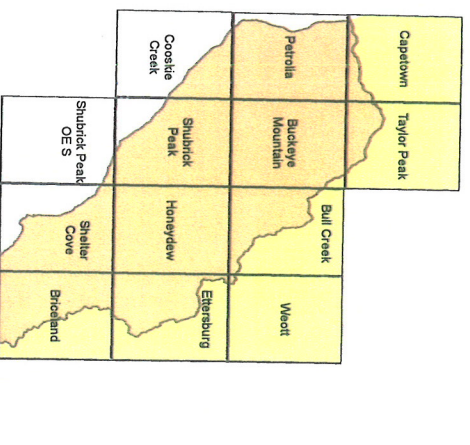
GENERAL GUIDELINES

Potentially water bearing units were chosen for inclusion in the delineated areas if a stream was present within the boundaries of the map unit, or an adjoining map unit. Streams were limited to the features identified as 'stream/river' or 'artificial path' in the USGS National Hydrography Dataset (NHD) stream dataset. Geologic units older than Tertiary (Miocene) were not included. Landslides were only included in the delineated areas if they were predominantly surrounded by other potentially water-bearing units. Professional judgment was used to make exceptions where landslides were potentially overlying alluvium, such as valley floors and the base of narrow canyons containing mapped streams. In some cases, portions of mapped landslides were included in the delineated areas, but were modified using topography to exclude areas mapped on steep slopes. Latest Holocene alluvium associated with marine deposits ('bay mud' and 'artificial fill over bay mud' for example), was generally excluded from the delineated areas. Exceptions were made where small areas of beach sand were mapped at the outlet of a potential subterranean stream. Artificial fill, artificial levee fill, artificial dam fill, and other artificial map units were included if they were surrounded by alluvium, on the edge of alluvium, or extending into (overlying) alluvium. Where artificial units extended beyond mapped alluvium, the delineated areas were mapped to exclude portions of these units over bedrock.

The delineated areas were subdivided into three areas designated as Subterranean Streams, Potential Stream Depletion Areas (PSDA), and Mapped Active Stream Deposits within

Index of Geologic Sources

(see accompanying memo for references cited)



- Gualala River Watershed, Sonoma and Mendocino Counties, California. plate 1, CGS, 2002 1:24k
- Big River Watershed, Mendocino County, California. CGS Watershed Mapping Series, map set 9, 2005 1:24k
- Albion River Watershed, Mendocino County, California. CGS Watershed Mapping Series, map set 8, 2004 1:24k
- California Geologic Survey Preliminary geologic maps - Northern Region 1:24k
- Mattole River Watershed, Humboldt and Mendocino County, California. CGS plate 1, 2002 1:24k
- North Coast Watershed Map Series, DMG CS 99-002, 1999 1:24k
- Geology and ground water in the Russian River valley areas... USGS water-supply 1548, 1965 1:62.5k
- Point Reyes National Seashore and vicinity, USGS ofr-97-456 1:48k
- Parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California. USGS mf 2337, 2000 1:75k
- Eastern Sonoma and western Napa counties. USGS SIM 2956, 2007 1:100k
- Western Sonoma, northernmost Marin, and southernmost Mendocino Counties: USGS mf-2402, 2002 1:100k
- Northeastern San Francisco Bay Region, California, USGS mf2403, 2002 1:100k
- Geologic Map of California, Ukiah Sheet, CDMG, 1960 1:250k
- Geologic Map of California, Santa Rosa Sheet, CDMG, 1963 1:250k

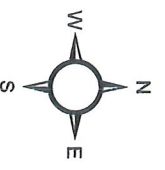
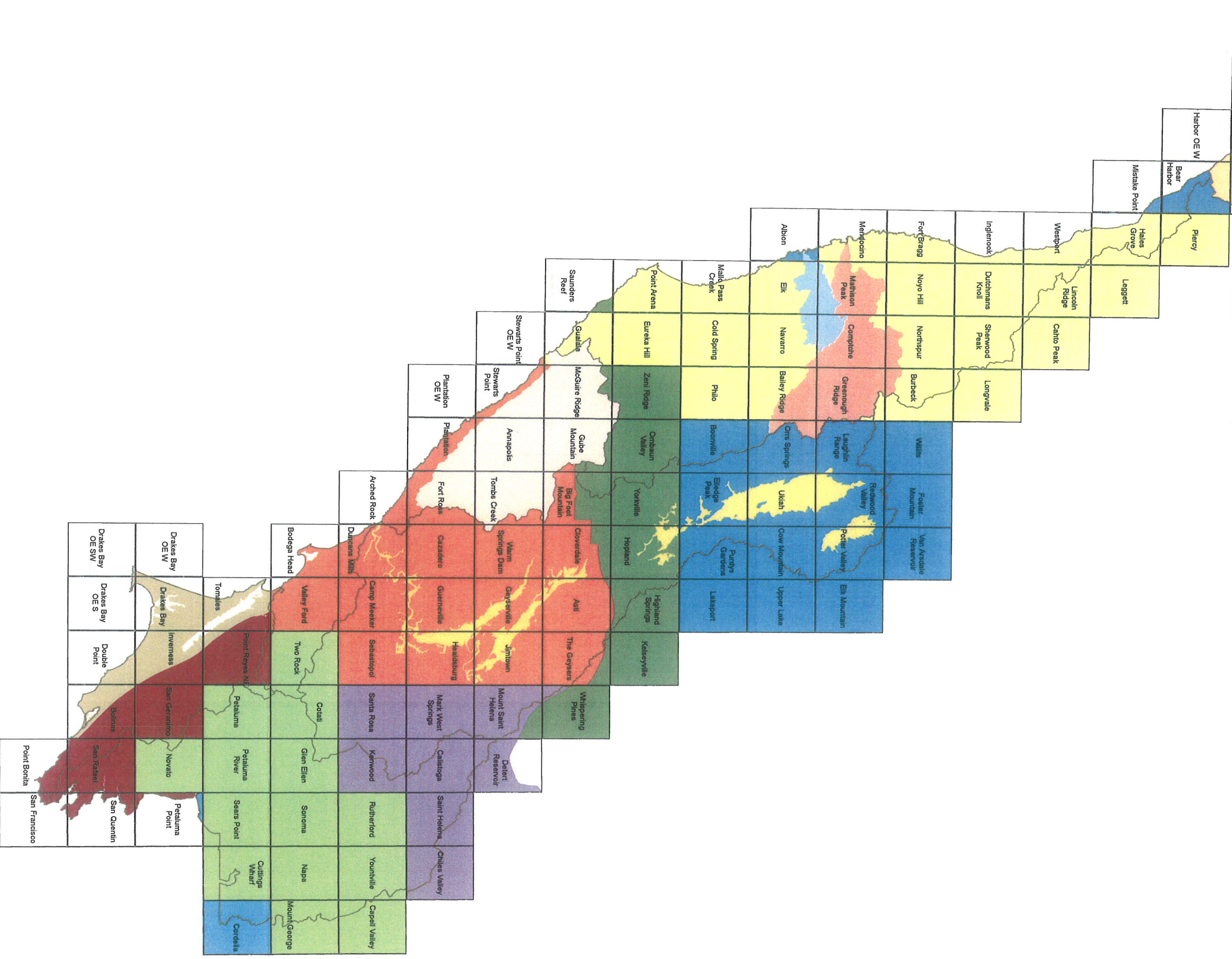


FIGURE 2

PSDA. Areas mapped as subterranean streams were compiled from Holocene alluvium and other geologic units described as Recent, Younger, or Modern. Geologic units located within clearly defined banks of bedrock were also included in this designation. Units described in source maps as “active stream”, or associated with the modern active stream, were designated as Mapped Active Stream Deposits within PSDAs. Variations in scale of the geologic sources made it exceptionally difficult to delineate the active stream deposits, as many small-scale maps did not have enough detail to differentiate the active stream deposits from other alluvial deposits. Areas that did not fit the criteria for subterranean stream flow or mapped active streams, were designated as Potential Stream Depletion Areas. Subterranean flow delineation was cut or clipped where it intersected, or became adjacent to/associated with older alluvium, and from that point on it was PSDA. Professional judgment was used to determine the designation of units where the type of alluvium or geologic age was undifferentiated on the source map.

GEOLOGIC SOURCES

This list includes units selected for each delineated area, limitations of source data where applicable, and comments and exceptions specific to each source as it applies to each 7.5 minute quadrangle mapped as part of this study.

1. The geologic unit abbreviations listed below refer only to the geologic units on the corresponding geologic map. A single abbreviation may represent different geologic units on different sources. Geologic descriptions for each abbreviated map unit must be obtained only from the source under which they are listed, and cannot be used to describe map units from any other map source on this list.
2. Comments and information regarding the geologic maps reproduced on DMG CD 99-002 North Coast Watershed Mapping are given collectively at the end of the document. The individual citations for each 7.5 minute quadrangle map that are included on the DMG CD are listed alphabetically below.
3. An asterisk (*) indicates quadrangles that contain no geologic units that could be classified as delineated areas. These quadrangles are listed here to show what sources were used to make this determination, but because they contain no delineated areas, plotted maps of these quadrangles were not included.

Bezore, S., Randolph-Loar, C.E., and Witter, R.C., 2002, Geologic Map of the Cuttings Wharf 7.5-minute quadrangle, Napa and Solano Counties, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Cuttings Wharf**

Subterranean Stream:

- Qa

Potential Stream Depletion Area:

- | | |
|-------|-------|
| • af | • Qoa |
| • Qa | • Qpf |
| • Qha | • Td |
| • Qhf | • Th |
| • Qls | • Tsp |

Mapped Active Stream Deposits:

- Qhc

Comments:

Th was not included where it was surrounded by bay mud.

Th mapped on the northern edge of the quadrangle conflicts with the southern edge of the Napa Quadrangle, where the same area is mapped as Sonoma Volcanics.

Bezore, S., Randolph-Loar, C.E., and Witter, R.C., 2002, Geologic Map of the Petaluma 7.5-minute quadrangle, Sonoma and Marin Counties, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles referencing this source:

- **Petaluma**

Subterranean Stream:

- Qa
- Qf
- Qha
- Qhc
- Qhf
- Qpf

Potential Stream Depletion Area:

- Qa
- Qf
- Qha
- Qhf
- Qhf1
- Qhf2
- Qhty
- Qoa
- Qpf
- Tp
- Twg

Mapped Active Stream Deposits:

- Qhc

Comments:

Ts (with streams present) was not included on this quadrangle.

No landslides were included from this quadrangle, even though some landslides on the geologic map are likely to be overlying alluvium.

Qpf is delineated as subterranean flow along Hicks Valley Rd., in a narrow channel with no stream mapped in it, as well as on the edge of Laguna Lake. The Qpf delineated as subterranean flow around Laguna Lake is a continuation subterranean flow delineated from Qal mapped on the Blake and others (2000).

Mapped active stream deposits delineated on the southern edge of the Cotati quadrangle is not continued on this quadrangle.

Delineated subterranean flow ends at the quadrangle edge.

Qal mapped on the Blake and others (2000) is delineated as subterranean flow, and dead ends at this quadrangle edge where it is mapped as Franciscan Fm.

Bezore, S.P., Clahan, K.B., Sowers, J.M., and Witter, R.C., 2005, Geologic Map of the Yountville 7.5-minute quadrangle, Napa County, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Yountville**

Subterranean Stream:

- Qa
- Qha
- Qhc
- Qpf

Potential Stream Depletion Area:

- af
- alf
- Qf
- Qha
- Qf
- Qhfy
- Qht
- Qhty
- Qoa
- Qpf

Mapped Active Stream Deposits:

- ac
- Qhc

Comments:

Qpf in the southwestern area of the quadrangle is designated as subterranean flow rather than PSDA.

Bezore, S.P., Koehler, R.D., and Witter, R.C., 2003, Geologic Map of the Two Rock 7.5-minute quadrangle, Sonoma County, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Two Rock**

Applicable Geologic Units (Refer to reference for description of geologic unit)

Subterranean Stream:

- ac
- af
- Qa
- Qf
- Qha
- Qhay
- Qhc
- Qhf

Potential Stream Depletion Area:

- af
- Qf
- Qha
- Qhay
- Qhf
- Qls
- Qoa
- Qpf
- Twg

Mapped Active Stream Deposits:

- ac
- Qhc

Comments:

The areas delineated from this source were consistent with the methods used for delineating the other CGS 1:24k preliminary geologic maps (Northern Region). Only the eastern edge of this source is aligned with other 1:24k sources. The geology from this source does not match the geology mapped from smaller scale sources on the other three edges. The discrepancies were large enough that no correction was attempted on these edges.

Delineating the mapped active stream deposits from this source was especially difficult because all of the non Tertiary alluvium could technically be included in this designation, and the inclusion would resolve many discrepancies with the small scale sources at the edges, but using the same criteria on the other 1:24k maps from this set would have lead to more ambiguous decisions on other quads. Considering the large scale of this source and the need for consistency, the decision was made to include only the geologic unit mapped as active stream (ac) from these sources in the delineation of Mapped Active Stream Deposits”, rather than try to define “associated alluvial deposits” for these sources.

Bezore, S.P., Sowers, J.M., and Witter, R.C., 2004, Geologic Map of the Mt. George 7.5-minute quadrangle, Napa and Solano Counties, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Mount George**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qa
- Qhc

Potential Stream Depletion Area:

- Qa
- Qoa
- Qof
- Qpf
- Th

Mapped Active Stream Deposits:

- Qhc

Blake, M.C., Graymer, R.W., and Stamski, R.E., 2002, Geologic Map and Map Database of Western Sonoma, Northernmost Marin, and Southernmost Mendocino Counties, California: U.S. Geological Survey, Miscellaneous Field Studies Map MF-2402, scale 1:100,000.

Quadrangles using this source:

- **Annapolis**
- **Arched Rock**
- **Asti**
- **Big Foot Mountain**
- **Bodega Head**
- **Camp Meeker**
- **Cazadero**
- **Cloverdale**
- **Duncans Mills**
- **Fort Ross**
- **Geyserville**
- **Gube Mountain**
- **Guerneville**
- **Healdsburg**
- **Highland Springs**
- **Jimtown**
- **McGuire Ridge**
- **Plantation***
- **Plantation OE W***
- **Sebastopol**
- **Stewarts Point**
- **Stewarts Point OE W***
- **The Geysers***
- **Tombs Creek**
- **Valley Ford**
- **Warm Springs Dam**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qal [The geology from this source is superseded by the Russian River watershed map (Cardwell, 1965) where they overlap, and although the area mapped as Qal is included as subterranean flow, the actual zone designation was not based on this source.]

Potential Stream Depletion Area:

- Qtge
- Qt [Qt mapped on this source was superseded by the Russian River watershed map (Cardwell, 1965), and although it is included within the PSDA, the designation was not based on this source.]

Mapped Active Stream Deposits:

- Qal

Comments:

Limitations of the source:

The alluvium mapped on this source is largely undifferentiated with regard to geologic age.

No active stream or modern stream channel deposits are mapped on this source.

Small scale.

Adjustments or corrections to the source:

Spatial adjustment was guided by topography and alignment with streams and landmarks on the quadrangles using this source. Data used to aid this adjustment included, DLGs, NHD streams and waterbodies data, and hillshade models.

Adjustments were generally made within the margin of error of the source. In some cases the delineated areas were extended beyond this into areas mapped as bedrock, based on consistency with overlapping sources, adjoining quads, and professional judgment. Examples of these exceptions can be seen on the Big Foot Mountain, Stewarts Point, Annapolis, and Cazadero quadrangles.

This source was adjusted to match adjoining quads to maintain consistency with overlapping sources.

Qt was not included if it was clearly a marine rather than fluvial terrace.

One area mapped as Qal was not included on the Cloverdale and Asti quadrangles.

Qal was delineated inconsistently in Healdsburg and Sebastopol quadrangles where some parts of the quadrangles it is included as subterranean flow, and other areas it is delineated as mapped active stream deposits. Qal was included as mapped active

stream deposits in portions of the quadrangles, but it was ended at broad valleys and designated in those areas as PSDA.

In order to maintain consistency with the majority of adjoining sources, this map was not adjusted to match the larger scale CGS preliminary Northern Region maps.

Blake, M.C., Graymer, R.W., Jones, D.L., and Soule, A., 2000, Geologic Map and Map Database of Parts of Marin, San Francisco, Alameda, Contra Costa, and Sonoma Counties, California: U.S. Geological Survey, Miscellaneous Field Studies Map MF-2337, scale 1:75,000.

Quadrangles using this source:

- **Bolinas**
- **Inverness**
- **Petaluma Point**
- **Point Bonita**
- **Point Reyes NE**
- **San Francisco North**
- **San Geronimo**
- **San Quentin***
- **San Rafael**
- **Tomales**

Subterranean Stream:

- Qal
- Qoal

Potential Stream Depletion Area:

- Qal
- Qu
- Twg

Mapped Active Stream Deposits:

- none

Comments:

Weaknesses or limitations of the source:

No active stream is differentiated on this source. The alluvium mapped has very broad descriptions and is largely undifferentiated.

Use of this source was limited by its small scale, and inconsistencies in spatial resolution, especially in the southern part of the map.

Spatial adjustment was guided by topography and alignment with streams and landmarks on the quadrangles using this source. Data used to aid this adjustment included DLGs, NHD streams and waterbodies data, and hillshade models.

In some cases the delineated areas were extended beyond the mapped alluvium to match larger scale or more detailed sources. The edge adjoining the Two Rock Quadrangle was not adjusted for reasons described above.

Qal was not included on the northern edge of the San Rafael quadrangle.

Large areas mapped as Qls may be overlying alluvium, and could potentially have subterranean stream flow.

PSDA zones were mapped over bedrock on the San Geronimo and Point Reyes NE quads to match the Novato quadrangle and other preliminary CGS 1:24k Northern Region sources. The delineated areas defined for the San Rafael quad was also adjusted to match the Novato quad.

Qoal was not included in Tomales quadrangle.

Subterranean flow is delineated along Walker Creek, where the geology source shows bedrock.

Qal in northern areas of this source was delineated as PSDA, but where more detailed sources are available and overlapping this source (such as Two Rock), the same areas mapped as Qal on this source are designated as subterranean flow based on more detailed mapping on other sources.

Qu and Qal are designated inconsistently on the Point Bonita quadrangle.

An area designated as subterranean flow along Walker Creek is mapped as bedrock on the Point Reyes NE and Tomales quadrangle.

Qal along the highway was not included on the San Geronimo quadrangle.

Qal designated inconsistently on the San Rafael Quadrangle.

Braun, D.R., Curless, J.M., Fresnel, K.W., McGuire D.J., and Short, W.R., 2005, Maps and GIS Data for the Watershed Mapping Series, Map Set 9, Big River Watershed, Mendocino County, California: California Geological Survey, CD 2005-02, scale 1:24,000.

Quadrangles using this source:

- **Bailey Ridge**
- **Burbeck**
- **Comptche**
- **Greenough Ridge**
- **Laughlin Range**
- **Mathison Peak**
- **Mendocino**
- **Navarro**
- **Northspur**
- **Orrs Springs**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qbs
- Qe
- Ql
- Qrt
- Qsc
- Qtc

Potential Stream Depletion Area:

- none

Mapped Active Stream Deposits:

- none

Comments:

All non-marine quaternary alluvium within clearly defined bed and banks, was delineated as zone one.

Small areas of Qctu, generally less than 1000 feet in length, were not included on the Comptche and Mathison Peak quadrangles, but all Qctu mapped included in other quadrangles.

Cardwell, G.T., 1965, Geology and Ground Water in Russian River Valley Areas and in Round, Laytonville, and Little Lake Valleys, Sonoma and Mendocino Counties, California: U.S. Geological Survey, Water-Supply Paper 1548, scale 1:62,500.

Quadrangles using this source:

- Asti
- Camp Meeker
- Cazadero
- Cloverdale
- Duncans Mills
- Elledge Peak
- Geyserville
- Guerneville
- Healdsburg
- Hopland
- Jimtown
- Laughlin Range
- Potter Valley
- Purdys Gardens
- Redwood Valley
- Sebastopol
- Ukiah
- Warm Springs Dam
- Yorkville

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qal
- Qrc
- Qt

Potential Stream Depletion Area:

- Qal
- Qdal
- Qt
- Qty
- Qtc
- Qt

Mapped Active Stream Deposits:

- Qrc

Comments:

General Criteria used to define zones and units included within each:

This source was only used within the boundaries of the alluvium on this map.

Qtc included as PSDA where it is surrounded by or adjacent to other units included as PSDA, but not included in the delineated areas where they were isolated.

Areas mapped as bedrock were not referenced on this source because these areas were largely undefined, and other sources had more detailed geologic mapping.

Weaknesses or limitations of the source:

Extensive spatial adjustment was necessary for this source due to the fact that it was not available in digital format, and the age of the source.

Spatial adjustment was guided by topography and alignment with streams and landmarks on the quadrangles using this source. Data used to aid this adjustment included, DLGs, NHD streams and waterbodies data, and hillshade models.

Qtc was not included in the delineated areas.

Qty was not included in the delineated areas in the Laughlin Range and Redwood Valley quadrangles.

Qal was delineated as PSDA, rather than subterranean flow, on the portions of the Camp Meeker, Guerneville, and Healdsburg, quadrangles, but it is not included in the delineated areas in the southern portion of Mount St. Helena, Northern portion of the Healdsburg quadrangle, and parts of the Sebastopol quadrangle. Some Narrow strips of Qal are not included in other quadrangles.

Clahan, K.B, Wagner, D.L., Bezore, S.P., Sowers, J.M., and Witter, R.C., 2005, Geologic Map of the Rutherford 7.5-minute quadrangle, Sonoma and Napa Counties, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Rutherford**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qha
- Qhc
- Qhf
- Qht

Potential Stream Depletion Area:

- af
- alf
- Qf
- Qha
- Qhay
- Qhf
- Qhl
- Qht
- Qhty
- Qpf
- Th

Mapped Active Stream Deposits:

- Qhc

Comments:

Based on geologic age alone, all the areas included from this source would be designated as subterranean flow. Professional judgment was used to make exceptions.

Qc was only mapped on a few sources. It was mapped very extensively on the CGS preliminary Northern Region 1:24k geologic maps of the Novato and Petaluma quadrangles. In order to maintain as much overall consistency with the general use of this unit, as well as the areas delineated on other sources, the delineation of Qc was determined on a case by case basis.

Qls included within delineated areas anywhere on this quadrangle, and may be overlying alluvium.

Qa mapped on the southern portion of the Rutherford quadrangle and northern part of the Sonoma quadrangle is not included in delineated areas. There are discrepancies between overlapping geologic sources in this area.

Clahan, K.B., Bezore, S.P., Koehler, R.D., and Witter, R.C., 2003, Geologic Map of the Cotati 7.5-minute quadrangle, Sonoma County, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Cotati**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qhc
- Tpm

Potential Stream Depletion Area:

- | | |
|--------|--------|
| • Qa | • Qofv |
| • Qf | • Qt |
| • Qha | • Tco |
| • Qhay | • Tp |
| • Qhb | • Tpm |
| • Qhf | • Tpu |
| • Qhff | • Trt |
| • Qhfy | • Ts |
| • Qht | • Tsd |
| • Qhty | • Tt |
| • Qls | • Twg |
| • Qoa | |

Mapped Active Stream Deposits:

- ac
- Qhc

Comments:

Tpm is mapped only to the edge of the Glen Ellen quadrangle.

Qoal dead ends at the edge of the quadrangle.

Qls was not consistently delineated in this quadrangle.

Tpm is delineated as subterranean flow.

Clahan, K.B., Wagner, D.L., Saucedo, G.J., Randolph-Loer, C.E., and Sowers, J.M., 2004, Geologic Map of the Napa 7.5-minute quadrangle, Napa County, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Napa**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- | | |
|-------|-------|
| • af | • Qht |
| • Qa | • Qoa |
| • Qhc | • Qpa |
| • Qhf | |

Potential Stream Depletion Area:

- | | |
|--------|--------|
| • af | • Qhf2 |
| • Qa | • Qhfy |
| • Qc | • Qht |
| • Qf | • Qhty |
| • Qha | • Qls |
| • Qhf | • Qoa |
| • Qhf1 | • Qof |

- Qot
- Qpa
- Qpf
- Th

Mapped Active Stream Deposits:

- Qhc

Comments:

Qot not included as a delineated area where it is not connected to other units included in the delineated area.

Qoa was delineated as subterranean flow in Congress Valley.

Qpa was delineated as subterranean flow in Carneros Valley.

Qc and Qhf south of Browns Valley (north of Congress Valley) potentially have subterranean flow, but are not included in the delineated areas.

Qls was generally included in the delineated areas in Carneros valley.

Artificial fill was delineated as subterranean flow where it appears to follow the old active stream bed, and where it connects to an active stream.

Clark, J.C. and Brabb, E.E., 1997, Geology of Point Reyes National Seashore and Vicinity, California; A digital database: U.S. Geological Survey, Open-File Report OF-97-456, scale 1:48,000.

Quadrangles using this source:

- **Bolinas**
- **Double Point***
- **Drakes Bay**
- **Drakes Bay OE S***
- **Drakes Bay OE SW***
- **Drakes Bay OE W***
- **Inverness**
- **Tomales**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qal

Potential Stream Depletion Area:

- Qal
- Qoc
- Twg

Mapped Active Stream Deposits:

- none

Comments:

General Criteria used to define zones and units included within each:

Qt, and some Qal was not included in the delineated areas.

Alluvium was not included in the delineated areas if it was geographically limited to the beach or shoreline, or isolated on tops of hills with no streams.

Qal was delineated as subterranean flow within clearly defined bed and banks.

This source was limited by the small scale.

Spatial adjustment was guided by topography and alignment with streams and landmarks on the quadrangles using this source. Data used to aid this adjustment included, DLGs, NHD streams and waterbodies data, and hillshade models.

In some areas the delineated areas were extended to match mapped alluvium on the adjoining source.

What areas would be most likely overlooked for this source (where might subterranean flow be where it is not indicated by our maps):

Qt was not included in some areas (other than the beach or hills mentioned above) where it is adjoining Qal.

Qal on the northern end of the Inverness quadrangle was not included.

Qoc was only included in the delineated areas in the southeastern portion of the Inverness quadrangle. It is not included on any other quads referencing this source.

The subterranean flow delineation dead ends into bedrock at the edge of the Tomales Quadrangle.

Qoal was not included in the delineated areas on the Tomales Quadrangle.

Qmi not included in delineated areas.

Very small units of Qal and Qt associated with streams was not included in the delineated areas.

Davenport, C.W., 1984, Geology and Geomorphic Features Related to Landsliding, Eureka Hill 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-47, reproduced on DMG CD 99-002, scale 1:24,000.

- **Eureka Hill**

Davenport, C.W., 1984, Geology and Geomorphic Features Related to Landsliding, Gualala 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-48, reproduced on DMG CD 99-002, scale 1:24,000.

- **Gualala**

Davenport, C.W., 1984, Geology and Geomorphic Features Related to Landsliding, Point Arena 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-46, reproduced on DMG CD 99-002, scale 1:24,000.

- **Point Arena**

Davenport, C.W., Delattre, M.P., Dell’Osso, D.R., Falls, J.N., Curless, J.M., Haydon, W.D., and Thornburg, J., 2002, Maps, GIS Data and Geologic Report for the Watershed Mapping Series, Map Set 7, Mattole River Watershed, Humboldt and Mendocino Counties, California: California Geological Survey, CD 2002-09, scale 1:24,000.

Quadrangles using this source:

- **Bear Harbor**
- **Bear Harbor OE W**
- **Briceland**
- **Buckeye Mountain**
- **Bull Creek**
- **Capetown**
- **Cooskie Creek**
- **Ettersburg**
- **Honeydew**
- **Petrolia**
- **Shelter Cove**
- **Shubrick Peak**
- **Shubrick peak OE S**
- **Taylor Peak**
- **Weott***

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qal
- Qbs
- Qds
- Qf
- Qoal
- Qrt
- Qscu

Potential Stream Depletion Area:

- Qal
- Qf
- Qt
- Qtr

Mapped Active Stream Deposits:

- Qal
- Qscu

Comments:

Qf was delineated as subterranean flow when mapped in a channel with clearly defined bed and banks.

Qbs and Qds were included if they were located at the outlet of a stream channel that was otherwise included in the delineated areas.

Qbs was cut arbitrarily to only include stream extension to the outlet.

All mapped Quaternary units are undifferentiated with regard to geologic age, so applying criteria to designate the alluvium on this source was somewhat ambiguous.

Modern or Recent alluvium could not be implied by the geographic relationship to the present stream on this source.

The delineation of stream terrace deposits was determined on a case by case basis, where terraces were included based on their relationship to streams and professional judgment. Some terrace deposits very near streams were not included, while others were.

On the Petrolia quadrangle, all delineations within the delineated areas are inconsistent with the general criteria used to make this map set, and the other quadrangles referencing this source. PSDA was only designated on the Petrolia quadrangle for example, even though the geology is similar on all quadrangles referencing this source.

On the Buckeye Mountain and Shubrick Peak quadrangles, all Qscu, Qrt, at, af, Qal were delineated as subterranean flow, which is inconsistent with their designation on the Petrolia quadrangle.

Qal was extended to the beach on a case by case basis.

On the Buckeye Mountain quadrangle, some isolated units of Qrt, not associated with streams, was delineated as subterranean flow.

Portions of Q mapped on an overlapping geologic source, were included on the Taylor peak quadrangle.

Delattre, M. P., Wagner, D. L., Higgins, C. T., Witter, R. C., Sowers, J. M., 2007, Geologic Map of the Kenwood 7.5-minute quadrangle, Sonoma and Napa Counties, California; PDF: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Kenwood**

Comments:

All areas within this quadrangle were delineated using the Graymer and others (2007) as a primary reference.

This map was not available at the beginning of the project. The PDF became available during the project, but the digital files were not available at the time this area was completed. Heads up digitizing was to extend some alluvium from the E. Sonoma map to match this source.

Areas where the primary source differs from this source, and adjustments were not made, include the Southeastern corner of the quad along Bennett Valley Road and Enterprise Road, areas around Agua Caliente and Nunns Creek Canyon, the area around Adobe Creek, and Sulfur Canyon in the Northeastern corner of the map.

Delattre, M.P., and Sowers, J.M, 2006, Geologic Map of the Capell Valley 7.5-minute quadrangle, Napa County, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Capell Valley**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qa
- Qf
- Qha

Potential Stream Depletion Area:

- Qf

Mapped Active Stream Deposits:

- none

Fuller, M.S., Curless, J.M., Custis, K., and Purcell, M.G., 2004, Maps and GIS Data for the Albion River Watershed, Mendocino County, California, Watershed Mapping Series, Map Set 8: California Geological Survey CD 2004-03, scale 1:24,000.

Quadrangles using this source:

- **Albion**
- **Comptche**
- **Elk**
- **Mathison Peak**
- **Navarro**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qc
- Qoal
- Qrt
- Qscu

Potential Stream Depletion Area:

- Qoal

Mapped Active Stream Deposits:

- none

Comments:

Qc - Colluvium (Holocene-Pleistocene) Talus and slope wash deposits were not included in the delineated areas.

Qc was delineated as subterranean flow if a stream was mapped on it.

Qscu and Qc, with streams, was not included on the northern Navarro quadrangle.

Qoal was delineated as subterranean flow and PSDA on a case by case basis.

The inclusion of Qscu on this source is generally inconsistent with the Gualala Watershed map (Fuller and others, 2002). All Qscu units (except one unit on the Navarro quadrangle) are included from this source, while only larger Qscu units were included on the Gualala watershed map.

Fuller, M.S., Haydon, W.D., Purcell, M.G., and Custis, K., 2002, Maps, GIS Data and Geologic Report for the Watershed Mapping Series, Map Set 5, Gualala River Watershed, Sonoma and Mendocino Counties, California: California Geological Survey, CD 2002-08, scale 1:24,000.

Quadrangles using this source:

- **Annapolis**
- **Big Foot Mountain**
- **Fort Ross**
- **Gualala**
- **Gube Mountain**
- **McGuire Ridge**
- **Ornbaum Valley**
- **Plantation**
- **Stewarts Point**
- **Tombs Creek**
- **Warm Springs Dam**
- **Zeni Ridge***

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qbs
- Qf
- Qrt
- Qsc1
- Qscu

Potential Stream Depletion Area:

- none

Mapped Active Stream Deposits:

- none

Comments:

Most alluvium that extended .5 miles or less was not included from this source.

Small areas of discontinuous Qscu, Qt, and Qoal were not included.

Qscu and selected units of Qrt and Qscu were not included on the McGuire Ridge quadrangle.

Graymer, R.W., Brabb, E.E., Jones, D.L., Barnes, J., Nicholson, R.S., and Stamski, R.E., 2007, Geologic Map and Map Database of Eastern Sonoma and Western Napa Counties, California: U.S. Geological Survey, Scientific Investigations Map SIM-2956, scale 1:100,000.

Quadrangles using this source:

- **Calistoga**
- **Chiles Valley**
- **Detert Reservoir ***
- **Kenwood**
- **Mark West Springs**
- **Mount Saint Helena**
- **Saint Helena**
- **Santa Rosa**
- **Whispering Pines**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- af
- Qa
- Qf
- Qha
- Qhay
- Qhc
- Qhf
- Qht
- Qpa

Potential Stream Depletion Area:

- af
- Qa
- Qf
- Qha
- Qhay
- Qhb
- Qhf
- Qhff
- Qhl
- Qht
- Qls
- Qlso
- Qlsr
- Qoa
- Qpa
- Qpf

- Qtge
- Qthg
- Tc
- Tp

Mapped Active Stream Deposits:

- Qa
- Qha (when connected with Qhc only)
- Qhc
- Qhf
- Qt

Comments:

Qhc was the only unit designated as active stream. This is not consistent with the delineation of the West Sonoma source (Blake and others, 2002), but consistent with CGS sources.

The presence of clearly defined bed and banks was the primary criteria used to delineate the delineated areas from this source.

Small, isolated alluvial units were not included as subterranean flow.

The small scale of this source was a limitation of its use. There was no detailed or comprehensive mapping of the active or modern stream, and the geologic ages many units were undifferentiated. Spatial adjustment was guided by topography and alignment with streams and landmarks on the quadrangles using this source. Data used to aid this adjustment included, DLGs, NHD streams and waterbodies data, and hillshade models. Inconsistencies with the map source created issues with deciding which units to place in which delineations.

This source was adjusted to match the edges of the CGS 1:24k preliminary Northern Region maps if there was a discrepancy.

Qhc was the only unit delineated as mapped active stream, unlike the West Sonoma source (Blake and others, 2002). The Qhc on this source is not mapped consistently on the whole map. For example, it dead ends at the edge of the Kenwood quadrangle, even though it is the same source map on both sides of the quadrangle boundary. The delineation of mapped active stream deposits on the Santa Rosa Quadrangle was inconsistent with other quadrangles referencing the same source because of inconsistencies with the mapping of Qhc on the source map. Qa was also not delineated consistently on this quadrangle.

Qpa was delineated as subterranean flow, and the delineation of Qa was inconsistent on the St. Helena Quadrangle.

Qhf was delineated as mapped active stream deposits in the Calistoga Quadrangle.

Qls, Qa, and Qht were delineated inconsistently on the Mount Saint Helena Quadrangle.

Isolated pieces of Qha were not included in the delineated areas on the Kenwood quadrangle.

Qa on the edge of this source was cut at the Rutherford Quadrangle edge. It was included in delineated areas on the Kenwood quadrangle, but not the Rutherford quadrangle. The same Qa was delineated as PSDA rather than subterranean flow.

Graymer, R.W., Jones, D.L., and Brabb, E.E., 2002, Geologic Map and Map Database of Northeastern San Francisco Bay Region, California - Most of Solano County and Parts of Napa, Marin, Contra Costa, San Joaquin, Sacramento, Yolo, and Sonoma Counties: U.S. Geological Survey, Miscellaneous Field Studies Map MF-2403, scale 1:100,000.

Quadrangles using this source:

- **Cordelia**
- **Petaluma Point**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qa (Petaluma Point quadrangle)
- Qpf (Cordelia quadrangle)

Potential Stream Depletion Area:

- Qfp
- Qhf
- Qoa

Mapped Active Stream Deposits:

- Qhc

Comments:

Some small areas of Late Pleistocene alluvium were delineated as subterranean flow.

The small scale of this source was a limitation in its use. Spatial adjustment was guided by topography and alignment with streams and landmarks on the quadrangles using this source. Data used to aid this adjustment included, DLGs, NHD streams and waterbodies data, and hillshade models.

Some landslides mapped along streams, which may be overlying alluvium, were not included in the delineated areas on the Kenwood quadrangle.

Some Qpf was delineated as subterranean flow.

The delineated areas were extended beyond mapped Qpf into bedrock to match connect with other mapped alluvial units.

**Jennings, C.W. and Strand, R.G., 1960, Geologic Map of California, Ukiah Sheet:
California Division of Mines and Geology, scale 1:250,000.**

Quadrangles using this source:

- **Albion**
- **Bear Harbor**
- **Boonville**
- **Cow Mountain**
- **Elk Mountain***
- **Elledge Peak**
- **Lakeport***
- **Laughlin Range**
- **Mistake Point ***
- **Orrs Springs**
- **Potter Valley**
- **Purdys Gardens**
- **Redwood Valley**
- **Ukiah**
- **Upper Lake***

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- **Qal**

Potential Stream Depletion Area:

- Qal
- Qt

Mapped Active Stream Deposits:

- none

Comments:

This source was not available digitally and was scanned and georeferenced for the use of this project. This source was a much smaller scale than the scale of the final map set. Significant spatial adjustment of geologic units was required. Georeferencing and spatial adjustment was guided by topography and alignment with streams and landmarks. Data used to aid this adjustment included, DLGs, NHD streams and waterbodies data, and hillshade models. The alluvial units mapped on the Russian River watershed map (Cardwell, 1965) were also used as a guide for georeferencing.

The geologic age of the alluvium was largely undifferentiated on this source.

Pleistocene and undifferentiated alluvium was designated in the PSDA.

The delineated areas were extended beyond mapped alluvium in some areas due to extremely limited detail provided by a map of this scale. Most of this adjustment was within the error of the map source. Professional judgment was used where exceptions were made.

What areas would be most likely overlooked for this source (where might subterranean flow be where it is not indicated by our maps):

Many narrow canyons along river valleys and other small areas of alluvial deposits potentially containing subterranean streams may not be included in the delineated areas on quads compiled from this source because they could not be mapped at the scale of the source map.

This source was not used in areas where the Russian River watershed map (Cardwell, 1965) overlapped it. Delineation in those areas was determined by the Russian River watershed map.

Kelley, F.R., 1983, Geology and Geomorphic Features Related to Landsliding, Dutchman's Knoll 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 83-33, reproduced on DMG CD 99-002, scale 1:24,000.

- **Dutchmans Knoll**

Kelley, F.R., 1983, Geology and Geomorphic Features Related to Landsliding, Inglenook 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 83-31, reproduced on DMG CD 99-002, scale 1:24,000.

- **Inglenook**

Kelley, F.R., 1983, Geology and Geomorphic Features Related to Landsliding, Westport 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 83-32, reproduced on DMG CD 99-002, scale 1:24,000.

- **Westport**

Kelley, F.R., 1984, Geology and Geomorphic Features Related to Landsliding, Hales Grove 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-15, reproduced on DMG CD 99-002, scale 1:24,000.

- **Hales Grove**

Kelley, F.R., 1984, Geology and Geomorphic Features Related to Landsliding, Lincoln Ridge 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-14, reproduced on DMG CD 99-002, scale 1:24,000.

- **Lincoln Ridge**

Kelley, F.R., 1984, Geology and Geomorphic Features Related to Landsliding, Piercy 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-16, reproduced on DMG CD 99-002, scale 1:24,000.

- **Piercy***

Kilbourne, R.T., 1982, Geology and Geomorphic Features Related to Landsliding, Glenblair NW (Noyo Hill) 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 82-25, reproduced on DMG CD 99-002, scale 1:24,000.

- **Noyo Hill**

Kilbourne, R.T., 1982, Geology and Geomorphic Features Related to Landsliding, Northspur Peak 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 82-19, reproduced on DMG CD 99-002, scale 1:24,000.

- **Northspur**

Kilbourne, R.T., 1983, Geology and Geomorphic Features Related to Landsliding, Cahto Peak 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 83-39, reproduced on DMG CD 99-002, scale 1:24,000.

- **Cahto Peak***

Kilbourne, R.T., 1983, Geology and Geomorphic Features Related to Landsliding, Comptche 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 83-21, reproduced on DMG CD 99-002, scale 1:24,000.

- **Comptche**

Kilbourne, R.T., 1983, Geology and Geomorphic Features Related to Landsliding, Fort Bragg 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 83-05, reproduced on DMG CD 99-002, scale 1:24,000.

- **Fort Bragg**

Kilbourne, R.T., 1983, Geology and Geomorphic Features Related to Landsliding, Mathison Peak 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 83-20, reproduced on DMG CD 99-002, scale 1:24,000.

- **Mathison Peak**

Kilbourne, R.T., 1983, Geology and Geomorphic Features Related to Landsliding, Mendocino 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 83-15, reproduced on DMG CD 99-002, scale 1:24,000.

- **Mendocino**

Kilbourne, R.T., 1983, Geology and Geomorphic Features Related to Landsliding, Sherwood Peak 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 83-38, reproduced on DMG CD 99-002, scale 1:24,000.

- **Sherwood Peak**

Kilbourne, R.T., 1984, Geology and Geomorphic Features Related to Landsliding, Boonville NW (Bailey Ridge) 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-42, reproduced on DMG CD99-002, scale 1:24,000.

- **Bailey Ridge**

Kilbourne, R.T., 1984, Geology and Geomorphic Features Related to Landsliding, Burbeck 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-19, reproduced on DMG CD 99-002, scale 1:24,000.

- **Burbeck**

Kilbourne, R.T., 1984, Geology and Geomorphic Features Related to Landsliding, Greenough Ridge 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-20, reproduced on DMG CD 99-002, scale 1:24,000.

- **Greenough Ridge**

Kilbourne, R.T., 1984, Geology and Geomorphic Features Related to Landsliding, Longvale 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-18, reproduced on DMG CD 99-002, scale 1:24,000.

- **Longvale***

Koenig, J.B., 1963, Geologic Map of California, Santa Rosa sheet: California Division of Mines and Geology, scale 1:250,000.

Quadrangles using this source:

- **Asti**
- **Big Foot Mountain**
- **Cloverdale**
- **Gube Mountain**
- **Highland Springs**
- **Hopland**
- **Kelseyville***
- **McGuire Ridge**
- **Ornbaum Valley**
- **Saunders Reef***
- **The Geysers***
- **Yorkville**
- **Zeni Ridge***

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qal

Potential Stream Depletion Area:

- none

Mapped Active Stream Deposits:

- none

Comments:

This source was not available digitally and was scanned and georeferenced for the use of this project. This source was a much smaller scale than the scale of the final map set. Significant spatial adjustment of geologic units was required. Georeferencing and spatial adjustment was guided by topography and alignment with streams and landmarks. Data used to aid this adjustment included, DLGs, NHD streams and waterbodies data, and hillshade models. The alluvial units mapped on the Russian River watershed map (Cardwell, 1965) were also used as a guide for georeferencing.

The geologic age of the alluvium was largely undifferentiated on this source.

Pleistocene and undifferentiated alluvium was designated in the PSDA.

The delineated areas were extended beyond mapped alluvium in some areas due to extremely limited detail provided by a map of this scale. Most of this adjustment was within the error of the map source. Professional judgment was used where exceptions were made.

Many narrow canyons along river valleys and other small areas of alluvial deposits potentially containing subterranean streams may not be included in the delineated areas on quads compiled from this source because they could not be mapped at the scale of the source map.

This source was not used in areas where the Russian River watershed map (Cardwell, 1965) overlapped it. Delineation in those areas was determined by the Russian River map.

Qt mapped on the southern edge of the Highland Springs quadrangle was not included, and the adjoining mapped stream on the Asti source dead ends at the edge.

Considerable areas mapped as bedrock are delineated as subterranean flow on the Big Foot Mountain quadrangle.

Some Qt was not included in the delineated areas on the Hopland Quadrangle.

Manson, M.W., 1984, Geology and Geomorphic Features Related to Landsliding, Cold Springs 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-45, reproduced on DMG CD 99-002, scale 1:24,000.

- Cold Springs

Manson, M.W., 1984, Geology and Geomorphic Features Related to Landsliding, Elk 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-12, reproduced on DMG CD 99-002, scale 1:24,000.

- Elk

Manson, M.W., 1984, Geology and Geomorphic Features Related to Landsliding, Mallo Pass Creek 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-13, reproduced on DMG CD 99-002, scale 1:24,000.

- Mallo Pass Creek

Manson, M.W., 1984, Geology and Geomorphic Features Related to Landsliding, Navarro 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-44, reproduced on DMG CD 99-002, scale 1:24,000.

- Navarro

Manson, M.W., 1984, Geology and Geomorphic Features Related to Landsliding, Philo 7.5' Quadrangle, Mendocino County, California: DMG Open-File Report 84-43, reproduced on DMG CD 99-002, scale 1:24,000.

- **Philo**

Rice, S.R., Smith, T.C., Strand, R.G., Wagner, D.L., Randolph-Loar, C.E., Witter, R.C., and Clahan, K.B., 2002, Geologic Map of the Novato 7.5-minute quadrangle, Marin and Sonoma Counties, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Novato**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- | | |
|-------|-------|
| • af | • Qhf |
| • Qc | • Qht |
| • Qha | • Qoa |
| • Qhc | |

Potential Stream Depletion Area:

- | | |
|-------|-------|
| • Qc | • Qht |
| • Qha | • Qoa |
| • Qhf | • Qpf |

Mapped Active Stream Deposits:

- Qhc

Comments:

Isolated Qha mapped in the southwest corner of this source was not included in the delineated areas. There are no streams mapped within the boundaries of this unit. It is adjacent to a reservoir on one side, and bay mud on the other edge.

Qc was mapped more extensively on this source than other sources, with the exception of the Petaluma River Quadrangle source. The inclusion or exclusion of Qc was determined on a case by case basis, generally only including portions of the unit mapped on well defined valley floors, or where it was mapped where it was adjoining and mapped alluvium in a well defined canyon, and extending up the canyon beyond the other alluvial unit.

Qoa was delineated as subterranean flow at the margin of the source map. The Qoa dead ends at the edge of the adjacent source map. The corresponding area is mapped as 'sp' on the adjoining source.

Wagner, D.L., Clahan, K.B., Randolph-Loar, C.E., and Sowers, J.M., 2003, Geologic Map of the Sonoma 7.5-minute quadrangle, Sonoma and Napa Counties, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Sonoma**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- | | |
|------|-------|
| • ac | • Qhc |
| • af | • Qhf |
| • Qa | • Qof |

Potential Stream Depletion Area:

- | | |
|------|-------|
| • af | • Qfc |
| • Qa | • Qg |
| • Qf | • Qha |

- Qhf
- Qhly
- Qht
- Qhty
- Qls
- Qoa
- Qtge
- Qtu
- Th
- Tus

Mapped Active Stream Deposits:

- Qhc

Comments:

What areas would be most likely overlooked for this source (where might subterranean flow be where it is not indicated by our maps):

Qt and Qa in the vicinity of Carneros Creek were not included in the delineated areas, but could potentially contain subterranean stream flow.

A small area mapped as Qa was also left out of the delineated areas near Mission Highlands.

Qhc mapped on the Glen Ellen Quadrangle was not mapped on this source, and the corresponding delineated area dead ends at the quadrangle boundary, and is not mapped on the Sonoma Quadrangle.

Wagner, D.L., Randolph-Loar, C.E., Bezore, S.P., Witter, R.C., and Allen, J., 2002, Geologic Map of the Sears Point 7.5-minute quadrangle, Sonoma, Solano, and Napa Counties, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Sears Point**

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Qha
- Qhc
- Qhf
- Tpl

Potential Stream Depletion Area:

- af
- Qf
- Qha
- Qhay
- Qhf
- Qhly
- Qhty
- Qls
- Qof
- Qofv
- Qpf
- Qtu
- Th
- Tpl
- Tpm
- Ts

Mapped Active Stream Deposits:

- Qhc

Comments:

An area delineated as mapped active stream deposits on the Sonoma Quadrangle ends at the quadrangle edge and is mapped as water on this source.

Isolated Qha and Qoa, located near Lee Lake, were not included in the delineated areas. They are associated with streams.

afbm, af, and alf were included in the delineated areas if they were surrounded by, or potentially overlying water bearing units in the delineated areas.

Wagner, D.L., Randolph-Loar, C.E., Witter, R.C., and Huffman, M.E., 2003, Geologic Map of the Glen Ellen 7.5-minute quadrangle, Sonoma County, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Glen Ellen**

Applicable Geologic Units (Refer to reference for description of geologic unit)

Subterranean Stream:

- ac
- af
- Qhc

Potential Stream Depletion Area:

- | | |
|--------|--------|
| • af | • Qoa |
| • Qa | • Qof |
| • Qf | • Qofv |
| • Qfc | • Qols |
| • Qg | • Qt |
| • Qha | • Qtge |
| • Qhf | • Qtu |
| • Qht | • Tpm |
| • Qhty | • Tsdi |
| • Qls | |

Mapped Active Stream Deposits:

- Qhc

Comments:

Qols, Qls, Tp, and Ts were not included near the middle of this quadrangle.

Isolated alluvium along Rogers Creek fault was not included in the delineated areas, but may have subterranean stream flow.

An area delineated as subterranean flow dead ends at the edge of the adjacent Cotati quadrangle.

More Qls was included in the delineated areas from this source because it is mapped extensively on valley floors. It was cut at the valley margins where it was potentially overlying alluvium to exclude portions mapped on steep slopes.

Wagner, D.L., Rice, S.R., Bezore, S., Randolph-Loar, C.E., Allen, J., and Witter, R.C., 2002, Geologic Map of the Petaluma River 7.5-minute quadrangle, Marin and Sonoma Counties, California; A digital database: California Geological Survey, Preliminary Geologic Maps, scale 1:24,000.

Quadrangles using this source:

- **Petaluma River**

Applicable Geologic Units (Refer to reference for description of geologic unit)

Subterranean Stream:

- | | |
|--------|--------|
| • af | • Qhc |
| • Qa | • Qhf |
| • Qc | • Qht |
| • Qf | • Qhty |
| • Qha | • Qoa |
| • Qhay | • Qpf |
| • Qhb | |

Potential Stream Depletion Area:

- | | |
|-------|-------|
| • Qc | • Qhb |
| • Qf | • Qhf |
| • Qha | • Qls |

- Tp
- Tpl
- Tpm
- Tpu
- Trt

Mapped Active Stream Deposits:

- ac
- Qhc

Comments:

What areas would be most likely overlooked for this source (where might subterranean flow be where it is not indicated by our maps).

Qhc left out of Mapped Active Stream Deposits in NW on Highway 101

Qc was mapped more extensively on this source than other sources, with the exception of the Novato Quadrangle source. The inclusion or exclusion of Qc was determined on a case by case basis, generally only including portions of the unit mapped on well defined valley floors, or where it was mapped where it was adjoining mapped alluvium in a well defined canyon, and extending up the canyon beyond another adjacent alluvial unit.

Isolated Ts associated with stream was not included in the delineated areas in the southwestern portion of this source map.

Qha was clipped somewhat arbitrarily on this source for inclusion in different delineated areas.

Qha associated with streams was not included NW of Lakeview School.

Qhc alternates with Tpm in north, and although it appears to follow the active stream channel, Is not delineated as subterranean.

Qls was included where surrounded, or mostly surrounded by alluvium.

Qoa delineated as subterranean flow was included in a small corner in the northwestern area of this source.

Qpf in the southwestern portion of the quad was delineated as subterranean flow.

North Coast watershed map series -- DMG CD 99-002

Quadrangles using this source:

- All quads cited above as reproduced from DMG CD 99-002 (see above citation list for individual citations for each quadrangle.)

Applicable Geologic Units: (Refer to reference for description of geologic unit)

Subterranean Stream:

- Q
- Qac
- Qbs
- Qe
- Qf
- Qrt
- Qsc

Potential Stream Depletion Area:

- Q
- Qac
- Qaf
- Qf
- Qoe
- Qrt
- Qta

Mapped Active Stream Deposits:

- Qsc

Comments:

Qrt was delineated as subterranean flow in selected areas where it was adjoining other delineated areas.

Qbs delineated as subterranean flow was included in some areas where it was the extension of an adjoining delineated area and stream to the outlet of the stream. Most Qbs was not included from this source.

Qt from this source is within the delineated areas, but the delineations for this unit were based on data from the Big River (Braun and others, 2005) and Albion (Fuller and others, 2004) sources.

Qrt could have been delineated as subterranean flow on this source.

The information used to compile these maps lacked detailed geologic descriptions, making the interpretation of the appropriate designation for each unit more ambiguous than most other sources.

Small, isolated units of Qac were not consistently included within the delineated areas from this source.

All areas mapped as Q could be delineated as subterranean flow, but some were not.