Surficial Geologic Map of the Sixmile Creek Quadrangle, Clearwater, Idaho, and Lewis Counties, Idaho

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2003

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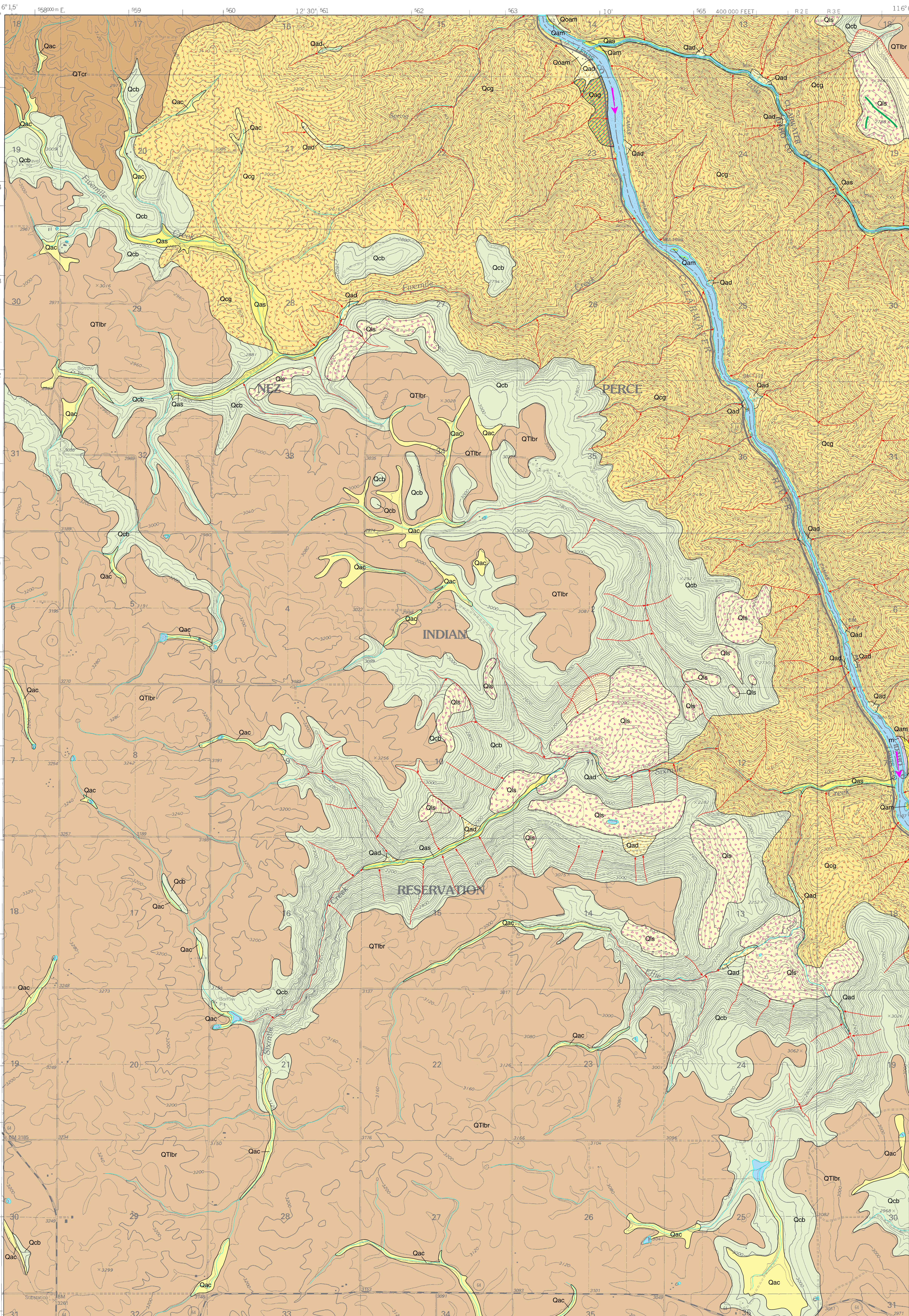


Base map scanned from USGS film-positive base, 1994.

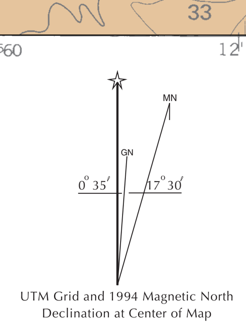
Topography by photogrammetric methods from aerial photographs taken 1966. Revised from aerial photographs taken 1990. Partial field check by US Forest Service 1994.

1927 North American Datum.

Projection and 10,000-foot grid ticks based on Idaho coordinate system, west zone.

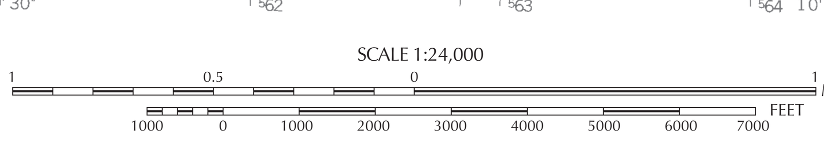
1000-meter Universal Transverse Mercator grid ticks, zone 11.

National geodetic vertical datum of 1929.

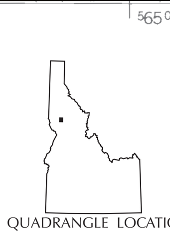


UTM Grid and 1994 Magnetic North Declination at Center of Map

SCALE 1:24,000



Contour interval 40 feet
Supplementary contour interval 20 feet



QUADRANGLE LOCATION

Field work conducted 2002.

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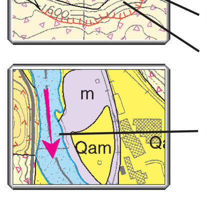
Digital cartography by B. Benjamin E. Studer and Loudon R. Stanford at the Idaho Geological Survey's Digital Mapping Lab.

Map version 6-26-2003.

SYMBOLS



Contact: Line showing the approximate boundary between one map unit and another. The apparent ground width of the line representing the contact is about 80 feet at this scale (1:24,000).

Debris-flow chute in canyons: Thin and discontinuous alluvial-fan and debris-flow deposits (*Qad*) may be present, but are not mappable at this scale. High-energy, short duration floods and debris flows may occur in these chutes in response to severe climatic conditions, such as thunderstorms and rain-on-snow events. Debris flows can also be triggered by landslides. These events are historically infrequent, dependent on weather, with a recurrence cycle on the order of years to decades. The most prominent debris-flow chutes are shown on the map, but any steep-gradient valley sides and canyon bottoms have the potential for these catastrophic events.

Landslide block: Green line traces crest of block. Primarily large, nearly intact blocks that have been rotated and moved downslope from a steep, headwall-exposed section of basalt.

Landslide scarp: Ticks show top of scarp.

Landslide headwall.

Flow direction of Missoula Floods backwater inundation.

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ACKNOWLEDGMENT

Glenn Hoffman (Soil Survey Party Leader, U.S. Department of Agriculture, Natural Resources Conservation Service, Orofino, Idaho) provided preliminary soil survey data for Clearwater County.

CORRELATION OF MAP UNITS

DESCRIPTION OF MAP UNITS

INTRODUCTION

The surficial geologic map of the Sixmile Creek quadrangle identifies earth materials on the surface and in the shallow subsurface. It is intended for those interested in the area's natural resources, urban and rural growth, and private and public land development. The information relates to assessing diverse conditions and activities, such as slope stability, construction design, sewage drainage, solid waste disposal, and ground-water use and recharge.

The geology was intensively investigated during a one-year period. Natural and artificial exposures of the geology were examined and selectively collected. In addition to field investigations, aerial photographs were studied to aid in identifying boundaries between map units through photogeologic mapping of landforms. In most areas map-unit boundaries (contacts) are approximate and were drawn by outlining well-defined landforms. It is rare that contacts between two units can be seen in the field without excavation operations which are beyond the purpose and scope of this map. The contacts are inferred where landforms are poorly defined and where lithologic characteristics grade from one map unit into another. The precision of a contact with respect to actual topography also depends on the accuracy and scale of the topographic base. Details depicted at this scale, therefore, provide an overview of the area's geology. Further intensive analyses at specific locations should be arranged through independent geotechnical specialists.

The canyon of the Clearwater River and a segment of the Camas Prairie are the prominent features on this map. Camas Prairie is a portion of the Columbia River Plateau and is composed of Miocene basalt flows of the Columbia River Basalt Group. The Clearwater River has cut a deep canyon into the Camas Prairie, and the canyon exposes pre-Miocene granitic and metamorphic rocks that compose the underlying basement rocks and the nearby Northern Rocky Mountains. During the Miocene, lava flows of the Columbia River Basalt Group filled ancestral stream valleys eroded into the basement rocks. The flows created volcanic embayments that now form the eastern edge of the Columbia River Plateau where the relatively flat region meets the mountains. Pleistocene loess mantles the weathered and slightly eroded plateau. In the late Pleistocene, multiple Lake Missoula Floods inundated the Clearwater River valley, locally depositing silt, sand, and ice-rafted cobbles and boulders in the lower elevations of the canyon.

SURFICIAL DEPOSITS

m — **Made ground (Holocene)**—Artificial fills composed of excavated, transported, and emplaced construction materials of highly varying composition, but typically derived from local sources.

Qam — **Alluvium of mainstreams (Holocene)**—Channel and flood-plain deposits of the Clearwater River that are actively being formed on a seasonal or annual basis. Two grain-size suites are typically present: Well-sorted and rounded sandy gravels of river bars and islands, and coarse sand forming thin shoreline deposits. The channel gravel includes clasts of basalt, granite, and gneiss. Mainstream alluvium is called riverwash in the Kooskia soil survey (Webb and others, 1971), and includes the Bridgewater and Joseph series in Lewis County (Hahn, 2001; U.S. Department of Agriculture, Natural Resources Conservation Service, 1999).

Qoam — **Older alluvium of mainstreams (Holocene)**—Fine- to coarse-grained bedded sand and silty sand overlying river channel gravel. These alluvial deposits form one or more levels of old point bars and terrace remnants of the Clearwater River which are younger than the Lake Missoula Floods backwater deposits, but older than alluvium of the present river. Surface heights above present mean water level range from 20 to 40 feet. Relative heights suggest a late Holocene age.

Qas — **Alluvium of side streams (Holocene)**—Channel and flood-plain deposits of tributaries to the Clearwater River. Primarily coarse channel gravel deposited during high-energy stream flows. Subrounded to rounded pebbles, cobbles, and boulders of basalt, granite, and gneiss in a sand matrix. Moderately stratified and sorted. Includes intercalated colluvium and debris-flow deposits from steep side slopes. Soils developed in side-stream alluvium include Bridgewater, Itzee, Lapwai, Nicodemus, and Tombeall series (Hahn, 2001; U.S. Department of Agriculture, Natural Resources Conservation Service, 1999; Webb and others, 1971; Glenn Hoffman, written comm., 2001).

Qac — **Alluvium and colluvium (Holocene)**—Stream, slope-wash, and gravity deposits. Predominantly beds of silt, clay, sand, and gravel derived from erosion of adjacent units. Stream deposits typically are thin and interfinger with laterally thickening deposits of slope wash and colluvium derived from local loess deposits and weathered basalt, granite, and gneiss. Soils developed in these deposits include the Wilkins series (Hahn, 2001; U.S. Department of Agriculture, Natural Resources Conservation Service, 1999).

Qad — **Alluvial-fan and debris-flow deposits (Holocene and Pleistocene)**—Primarily crudely bedded, poorly sorted brown muddy gravel shed from canyon slopes of basalt colluvium. Gravel is composed of angular to subrounded pebbles, cobbles, and boulders of basalt in a matrix of granules, sand, silt, and clay. Where pre-Miocene granitic and gneissic rocks form most of canyon walls, the deposits are lighter in color and predominantly composed of those rock types. May include beds of silt and sand derived from reworked loess, Mazama ash, and Lake Missoula Flood backwater deposits. Thickness varies, but typically ranges from 6-50 feet. Fans composed of alluvium and debris-flow deposits commonly occur in canyon bottoms below steep debris-flow chutes (see Symbols).

Qls — **Landslide deposits (Holocene and Pleistocene)**—Poorly sorted and poorly stratified angular basalt cobbles and boulders mixed with silt and clay. Landslide deposits include debris slides as well as blocks of basalt (see *Landslide block* under Symbols), sedimentary interbeds, and pre-Miocene rocks that have been rotated and moved downslope. Debris slides mainly composed of unstratified, unsorted gravel rubble in a clayey matrix. In addition to the landslide deposit, the unit may include the landslide scarp and the headwall (steep area without pattern, adjacent to and below the landslide scarp) from which material broke away (see Symbols). The headwall area may include talus formed after landslide movement. Location of landslide deposits in canyons is controlled by the presence of sedimentary interbeds, the hydrogeologic regime, and the occurrence of basalt overlying clay-rich weathered basement rocks. The largest landslides occur where canyon-cutting has exposed landslide-prone sediments to steep topography. Slope failures have occurred where the fine-grained sedimentary interbeds and weathered clay-rich basement rocks are saturated by ground water moving toward the valleys. The landslides range in age from ancient, relatively stable features, to those that have been active within the past few years. The factors that cause landslides have been prevalent in the region for thousands of years. The frequency of landsliding may have been greatest in the Pleistocene. Today, initiation and reactivation of landslides is closely tied to unusual climatic events and slope changes. Even small landslide activity on the upper parts of canyon slopes can transform into high-energy debris flows that endanger roads, buildings, and people below (see Debris-flow chute under Symbols). Landslide debris is highly unstable when modified through natural variations in precipitation, artificial cuts, fills, and changes to surface drainage and ground water.

Qcb — **Colluvium from basalt (Holocene and Pleistocene)**—Primarily poorly sorted brown muddy gravel composed of angular and subangular pebbles, cobbles, and boulders of basalt in a matrix of sand, silt, and clay. Emplaced by gravity movements on steep-sided canyons and gullies cut into Columbia River basalt. Includes outcrops of basalt that are common on steep, dry, southerly aspects where colluvium is thinner and the more erosion-resistant basalt flows form laterally traceable ledges. More gently sloping areas are mantled with thin loess, (typically 1-5 feet thick), especially where unit grades laterally into loess and basalt residuum (QTlbr). Distribution and thickness of colluvium is dependent on slope aspect, upper and lower slope position, basalt and sediment stratigraphy, and association with landslides. Colluvium is thin and associated with many basalt outcrops on dry, southerly facing slopes. Colluvium is thicker on north- and east-facing slopes, and is associated with landslides (Qls) and debris-flow chutes (see Symbols), especially where more moisture is retained and where sedimentary interbeds are present. Areas of thicker colluvium have fewer outcrops of basalt, and the surface may have a patterned ground of crescent-shaped lobes of colluvium, probably relicts of Pleistocene solifluction. Unit includes landslides too small to map separately, and talus below cliffs and ledges of basalt. Colluvium typically increases in thickness toward the base of slopes where it interfingers with alluvium in valley bottoms. May include all of valley-bottom sediment where streams have little discharge or are ephemeral. Soils developed in basalt colluvium include the Gwin, Hooverton, Kettenback, Klicker, Klickson, and Melhorn series (Hahn, 2001; U.S. Department of Agriculture, Natural Resources Conservation Service, 1999; Webb and others, 1971; Glenn Hoffman, written comm., 2001).

Qcg — **Colluvium from granitic rocks (Holocene and Pleistocene)**—Primarily poorly sorted muddy gravel composed of angular and subangular pebbles, cobbles, and boulders in a matrix of sand, silt, and clay. Emplaced by gravity movements in canyons where there are outcrops of granite and gneiss. Includes local debris-flow deposits and isolated outcrops. May include areas of thin loess, and colluvium and debris-flow deposits from upslope basalt sections. Grades laterally, as slope gradients decrease, into areas where thin loess mantles bedrock. Distribution and thickness of colluvium depend on slope, aspect, upper and lower slope position, and association with landslide deposits. Colluvium typically increases in thickness toward the base of slopes and may interfinger with alluvium in valley bottoms. Soils developed in granitic colluvium include the Ahsahka, Dragnot, Fordcreek, Johnson, Rudo, Texascreek, Whiskeycreek, and Yakus, series (Hahn, 2001; U.S. Department of Agriculture, Natural Resources Conservation Service, 1999; Webb and others, 1971; Glenn Hoffman, written comm., 2001).

Qm — **Lake Missoula Floods backwater deposits (Pleistocene)**—Rhythmites deposited when Lake Missoula Floods backwaters inundated the Clearwater River valley. Primarily alternating thin beds of gray sand and pale brown silt. Similar depositional environment, sedimentology, and age as Lake Missoula Floods rhythmites of eastern Washington (Smith, 1993; Waitt, 1980, 1985). Commonly reworked into sandy, silty colluvium. Found only near mouth of Lolo Creek at 1,120- 1,200 feet in elevation, which is near the maximum flood level. Mapped as a pattern to show that the rhythmites mantle Pleistocene alluvial gravel (Qag). Lake Missoula Floods temporarily reversed the course of the Clearwater River within the area of backwater inundation (see Flow direction in symbols). Soils developed in Lake Missoula Flood backwater deposits include the Uhlig series (Hahn, 2001; U.S. Department of Agriculture, Natural Resources Conservation Service, 1999).

Qag — **Alluvial gravel (Pleistocene)**—Well-rounded pebble and cobble gravel of remnant point bars about 60 feet above the Clearwater River. Gravel poorly exposed owing to mantle of Lake Missoula Floods backwater sediments (Qm). Interfingers with colluvium and debris-flow deposits at toe of canyon slope. The gravel was deposited by the ancestral Clearwater River prior to the latest Lake Missoula Floods and may have formed during periodic greater discharges of the river during the Wisconsin glaciation. Soils in the unit include the Uhlig series (Hahn, 2001; U.S. Department of Agriculture, Natural Resources Conservation Service, 1999).

QTlbr — **Loess and basalt residuum (Quaternary and Tertiary)**—Thin Quaternary loess mantling Tertiary residuum on remnant surfaces of the basalt plateau. Loess 1-10 feet in thickness mantles basalt which ranges from angular to spheroidally weathered. Loess is thinnest on steep, south-facing slopes where sheet wash erosion is common. In areas where angular basalt is found, the basalt is commonly broken clasts of weathered rock. Most weathered spheroids have indurated cores of basalt which grade outward into yellowish and reddish color. Fresh basalt is often near or at the present surface. Where loess is thin, spheroidally weathered basalt boulders are seen in man made piles and lag boulders of weathered spheroids are encountered in plowed fields. Includes gravelly basalt colluvium on local steeper slopes where stream incision has occurred, and local deposits of thin alluvium to small in area to show at this scale. Soils in the unit include the Driscoll, Mohler, Nez Perce, Southwick, and Uhlorn series (Hahn, 2001; U.S. Department of Agriculture, Natural Resources Conservation Service, 1999).

QTcr — **Colluvium and residuum from metamorphic rocks (Holocene and Pleistocene)**—Primarily grus and colluvium derived from grus. Poorly sorted fine gravel primarily composed of angular and subangular granules to cobbles of granitic and gneissic rock in a matrix of sand, silt, and clay. Grades laterally, as slope gradients decrease, into areas where matrix predominates and areas of saprolite associated with Tertiary sediments. Residuum is a yellowish clay-rich grus (saprolite) weathered in place by the warm- and wet-climate of the late Tertiary. Quartz grains are present in the saprolite, and exposures may show foliation, veins, and other parent-rock textures. On valley sides includes isolated rock outcrops and debris-flow deposits from the upslope basalt section. Distribution and thickness depend on degree of weathering of parent rock, slope, aspect, and upper and lower slope positions. Rock outcrops and gravelly colluvium are more common on steep slopes and at higher elevations, and rare at lower elevations and gentle slopes. At lower elevations a mantle of thin loess is common (typically less than 5 feet). Soils developed in these deposits include the Lauby series (Hahn, 2001; U.S. Department of Agriculture, Natural Resources Conservation Service, 1999).

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