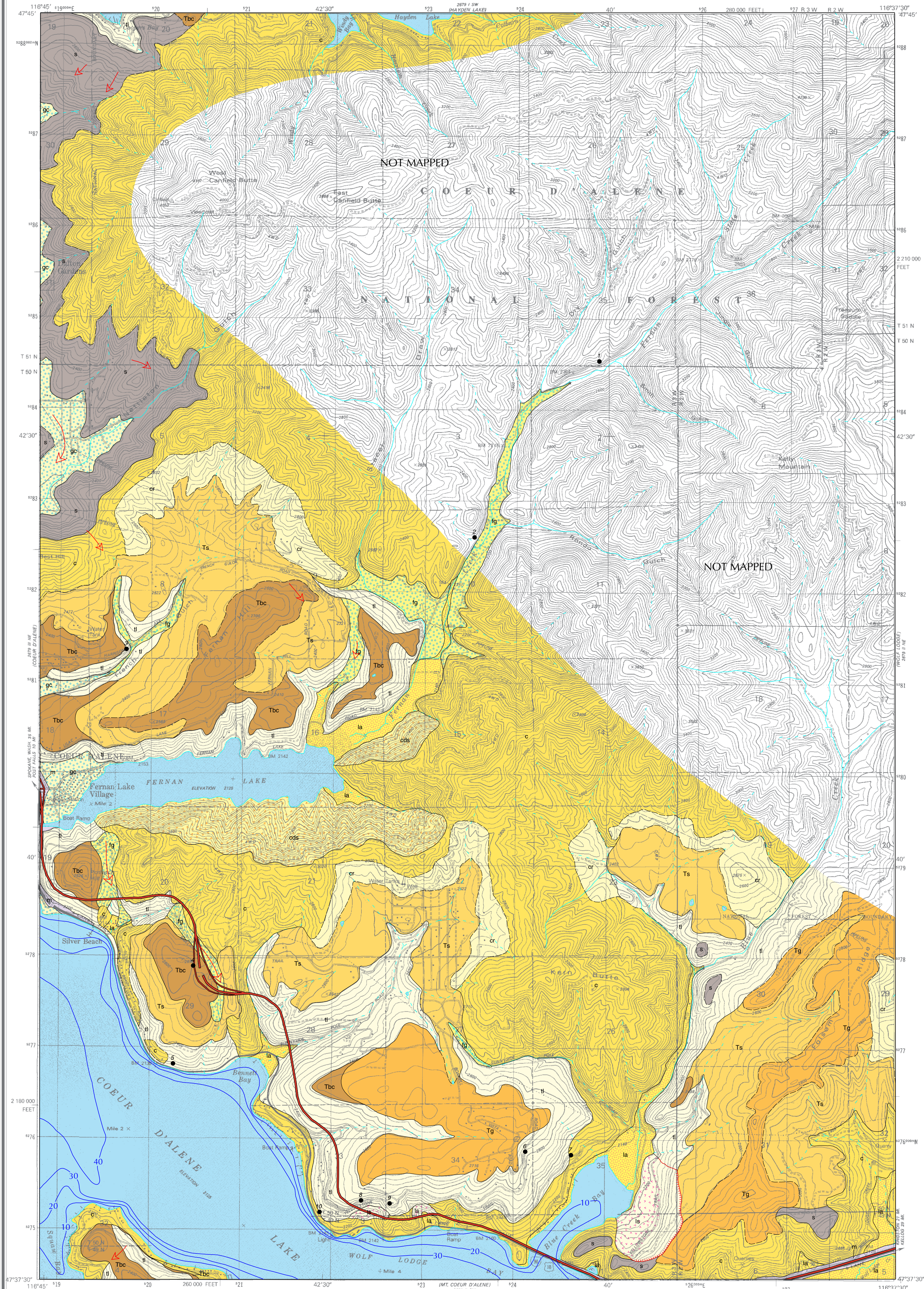


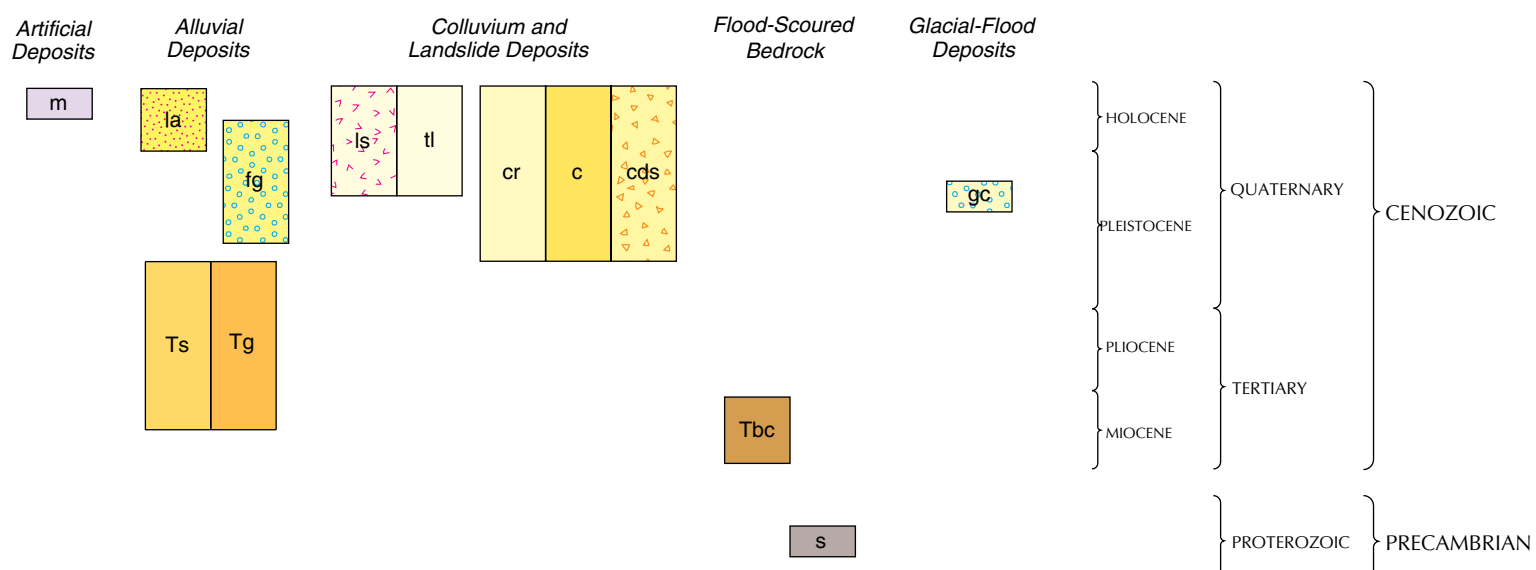
SURFICIAL GEOLOGIC MAP OF THE FERNAN LAKE QUADRANGLE, KOOTENAI COUNTY IDAHO

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CORRELATION OF MAP UNITS



INTRODUCTION

This map product addresses the increasing demand for geologic information in urban areas. The area covered by the map is experiencing some of the most rapid growth in Idaho. The geologic mapping was funded in part by STATEMAP, a national cooperative program of the U.S. Geological Survey with the state geological surveys.

The Fernan Lake quadrangle is located at the edge of the Rathdrum Prairie and the Coeur d'Alene Mountains. Elevations range from 2,238 feet at the average pool of Coeur d'Alene Lake to over 4,000 feet in the Coeur d'Alene Mountains. Both Fernan and Coeur d'Alene lakes are dammed by glacial flood gravels and provide substantial subsurface recharge to the Rathdrum aquifer. The mountains surrounding the lake on the north and east are composed of Precambrian Belt Supergroup siltites, argillites, and quartzites. The Osburn fault trends northwest through the quadrangle. It is the local extension of the western end of the Lewis Clark Line, a major crustal fault zone. The plateau west of the lake is underlain by Miocene lavas of the Columbia River Basalt Group. Most of the plateau is covered by ancient soils preserved since the Miocene and exhumed by erosion mainly from the catastrophic Pleistocene floods from glacial Lake Missoula.

The map represents the geology of the materials and soils exposed near the earth's surface. The thickness of these deposits varies from a few feet in the upland areas to hundreds of feet in the Rathdrum Valley. The map is useful for determining the type and characteristics of the geologic materials found at the surface and in the shallow subsurface by agricultural activities, building excavations, construction material excavations, ditches, and well bores. The information can be used by government, industry, and the public for planning, development, and resource characterization. The map can be used as a guide for site locations but is not intended as a substitute for a detailed, site-specific geotechnical evaluation. This is particularly true in the more urbanized areas where access and exposures are limited and human activity has concealed the geology.

Most users of geologic maps are familiar with traditional lithologic descriptions of bedrock units. Surficial maps show units with more diverse characteristics than rock type or lithology. Most surficial deposits are geologically young. Quaternary in age, and unconsolidated. The Quaternary units are subdivided on the basis of their physical characteristics and the boundaries between them (allostratigraphy). In many places, the boundaries between these units are manifested by morphologic features.

DESCRIPTION OF MAP UNITS

ARTIFICIAL DEPOSITS

m **Made ground (historical)**—Manmade deposits include disturbed, transported, and emplaced construction materials derived from various local sources. Includes the I-90 right-of-way where earthmoving has changed the landscape morphology. This unit is not mapped along parts of I-90 where the topographic base map does not reflect till areas. Many smaller areas of made ground have not been mapped and include berms and fills along the waterfronts and beachfronts of Coeur d'Alene Lake.

ALLUVIAL DEPOSITS

Ia **Lacustrine sediments and alluvium (Holocene)**—Silt and sand deposits in bays of Coeur d'Alene Lake and Fernan Lake. The deposits are mainly located within the lakes' high-water zones and are interbedded with and grade upstream into alluvium of tributary streams. Soils are deep and poorly drained and include much of the Pywell series and silt loams of the Cald, Cougar Bay, Pywell, and Ramsdell series (Weisel, 1981).

Fluvial Gravels (Pleistocene and Tertiary)

Ts **Relict alluvium (Tertiary)**—Cobbly and pebbly sand and silt derived from Precambrian Belt Supergroup rocks. Matrix composed of weathered saprolite and clay (plinitic) paleosols (McDaniel and others, 1998a, 1998b, 1998c) of the Mokins series (Weisel, 1981). The unit forms a flat to gently sloping upland surface, 2,400–2,600 feet in elevation, that is underlain by Priest Rapids Basalt. The unit grades into a thick colluvium and residuum (cr) overlying pre-Tertiary rocks. Some relict surfaces are as high as 2,800 feet in elevation. The alluvial deposits are probably graded to high base levels formed when the Miocene plateau basalts blocked and diverted stream drainages (Othberg and Breckenridge, 1998). The unit is finer grained than Tertiary gravels (Tg). Thickness ranges from several tens of feet to less than 10 feet. Generally, the deposit thins away from the foothill source areas. Where eroded, soils are cobbly loam of the Chatcolet series (Weisel, 1981).

Tg **Lag gravels on relict alluvial surfaces (Tertiary)**—Cobble and pebble gravel composed of mature rounded quartzites, siltites, and argillites derived from the Precambrian Belt Supergroup. Matrix is weathered saprolite. Forms low ridges such as Folsom Ridge in the southeast corner of the quadrangle. The gravel surfaces probably are graded to the blockages caused by the Miocene plateau basalts. Generally, the deposit is thin, 1 to 5 feet, and at depth grades into saprolite soils or Miocene paleosols. Soils are Mokins and Chatcolet series (Weisel, 1981).

Tg **Fluvial gravels (Pleistocene and Holocene)**—Sandy gravel and sandy silt in abandoned drainageways of the last Lake Missoula floods. The Coeur d'Alene Lake basin was inundated by the largest releases from glacial Lake Missoula (Dort, 1965; O'Connor and Baker, 1992), and erosion by flood water was limited. This unit is mostly reworked Miocene sediments and colluvium that were deposited by the lower energy floodwaters in slackwater areas. Includes varied thicknesses of Holocene alluvium and wetland bog deposits. Soils mainly are poorly drained silt loams of the Polatch series (Weisel, 1981). Thickness up to 10 feet.

COLLUVIUM AND LANDSLIDE DEPOSITS

tl **Talus and landslide deposits of Columbia River Basalt Group (Holocene and late Pleistocene)**—Poorly sorted and poorly stratified angular basalt cobbles and boulders mixed with silts and clays. Mass-movement slope deposits mainly associated with basalt rimrock and the interbedded sediments. Locally may include basalt columns from either mass movements or Lake Missoula floods. Gradations from talus to smaller landslide deposits are present and difficult to distinguish. Thickness as much as 40 feet.

La **Landslide deposits (Holocene and late Pleistocene)**—Mixture of unconsolidated angular rock fragments and finer matrix materials derived from local outcrops. Mostly larger areas of discrete landslides mapped within unit (tl). Thickness as much as 50 feet. Red ticks indicate top of scarp.

cr **Colluvium and residuum (Quaternary and Tertiary)**—Colluvium is composed of angular to subrounded pebble and cobble gravel in a silty sand matrix, 1 to 4 feet thick. The coarseness of the gravel and the matrix typically increases with depth as the colluvium grades into Precambrian argillite, siltite, and quartzite. Residuum is a clayey to silty, sandy saprolite, typically more than 6 feet thick, that grades with depth into bedrock. The residuum is relict from Tertiary weathering of bedrock and is thickest on stable remnant surfaces where it is associated with Tertiary alluvium (Ts). The unit is predominant on lower, gentler foothill slopes and grades into colluvium and common small rock outcrops (c). Areas of gentle, south- and west-facing slopes have a discontinuous thin mantle of loess. Pleistocene in age, that buries clayey soil (McCrone series of Weisel, 1981).

c **Colluvium and common small rock outcrops (Quaternary)**—Colluvium is composed of angular pebble and cobble gravel in a sandy silt matrix that overlies relatively unweathered argillite, siltite, and quartzite. Includes areas of bedrock that form linear, erosion-resistant ridges. Where slopes are steep, the unit may include landslide and debris flow deposits. Typically lacks a mantle of loess and well-developed soil horizons (Ardenvoir and Tekoa series of Weisel, 1981). Thickness of colluvium up to 6 feet.

cds **Colluvium, debris-flow, and solifluction deposits (Quaternary)**—Colluvium is composed of angular pebble and cobble gravel in a sandy silt matrix that overlies relatively unweathered argillite, siltite, and quartzite. Debris flows and solifluction deposits occur on steep, north-facing slopes on the south side of Fernan Lake. Probably periglacial in origin and Pleistocene in age. Soils have characteristics similar to Ardenvoir, Tekoa, and Vassar series (Weisel, 1981).

GLACIAL FLOOD AND PERIGLACIAL DEPOSITS

Gravels of Rathdrum Prairie

The gravel deposits are the result of repeated catastrophic flood releases from Pleistocene glacial Lake Missoula that persisted until about 12,000 years ago. Coeur d'Alene is about 30 miles downstream from the Pleistocene Clark Fork ice dam and 20 miles from the end of Lake Pend Oreille where most of the flood waters were channeled. Early geologists in the region interpreted the valley gravels as glacial deposits. The actual limits of the Pleistocene advances of the Purcell Trench lobe are unknown due to catastrophic floods sweeping the area. C.S. Savage (unpublished reports, Idaho Geological Survey) noted glacial erratics on Fernan Hill and along Mullan Road south of Fernan Lake. Richmond and others (1965) interpreted deposits in the adjacent Hayden Lake quadrangle as pre-Wisconsin till. Today's understanding of the repeated glacial surges has led most researchers to consider the gravels as local, not glacial, in origin; yet the pre-late Wisconsin ice margin is unclear.

Within the Rathdrum Prairie, the proximal deposits consist mostly of boulder gravels with interbedded sands deposited by high flow regimes. Crude bedding and clast-supported boxwork textures are common. Tributary valleys along the sides of the Rathdrum Prairie are filled with more finely bedded flood deposits of sands and gravel. We now know they are giant eddy bars. These gravels are irregularly mantled with loess, volcanic ash, and a component of silt from glacial Lake Missoula. They are also sporadically cemented with calcium carbonate in varying stages of development, from thin rinds on the bottom of clasts to a nearly complete fillings of the pore space (Breckenridge and others, 1997b).

gc **Channel gravels undivided (Pleistocene)**—Latest Wisconsin flood and outwash gravels and sands deposited in channelways cut into high energy fans and bar features. Moderately sorted and stratified from lower flow regimes. The channels are commonly developed at the margin of the prairie because the larger boulders armor the center of the flood path. Locally includes angular basalt columns derived from the basalt rimrock. Surface soils are gravelly loam of the McGuire, Marble, and Kootenai series (Weisel, 1981). Thickness 10 to 40 feet.

FLOOD-SCOURED BEDROCK

Tbc **Basalt scored by Missoula Floods (Miocene)**—Columbia River Basalt Group. Forms sporadic rimrock along the margins of Rathdrum Prairie and around Coeur d'Alene Lake. Mostly eroded by Pleistocene glaciation and repeated Lake Missoula Floods. May be present in the subsurface of Rathdrum Prairie (Breckenridge and others, 1997a). The Priest Rapids Basalt and Grande Ronde Basalt are recognized in the area. Shallow surface soils are stony clay loam of the Lacey-Bobbitt association (Weisel, 1981). Locally scattered flood erratics are common. Surface deposits are 2 to 15 feet thick and grade into flood-modified surface of Tertiary alluvium (Ts).

s **Precambrian metamorphic rocks of the Belt Supergroup scored by Missoula Floods (Precambrian)**—Mapped as the Burke Formation and the Priesthood Formation by Griggs (1973). Soils are shallow to bedrock and have characteristics similar to the Ardenvoir and Tekoa series (Weisel, 1981).

SYMBOLS

- Contact: dashed where approximately located.
- Abandoned channels of Lake Missoula flood drainageways; generally erosional pathways occupied by eddy flows of floods.
- Basalt sample location.
- Bathymetric contours in meters (Woods and Berenbrock 1994).

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Basalt Analyses				
Map Number	Location	Chemical Type	Magnetic Polarity	
	Latitude	Longitude		
Non-Columbia River Basalt dike samples				
1	47° 42' 56"	116° 40' 06.5"	---	---
2	47° 41' 55"	116° 41' 11"	---	---
Columbia River Basalt samples				
3	47° 41' 13"	116° 44' 13"	GR	N
4	47° 39' 22"	116° 43' 39"	PR	R
5	47° 38' 41.5"	116° 43' 50"	GR	R
6	47° 38' 15.5"	116° 40' 45"	PR	R
7	47° 38' 13.5"	116° 40' 21"	GR	R
8	47° 37' 58"	116° 42' 11"	GR	N
9	47° 37' 57"	116° 41' 55"	GR	N
10	47° 37' 54"	116° 42' 32.5"	GR	R

GR = Grande Ronde Basalt; PR = Priest Rapids Basalt; N = Normal polarity; R = Reversed polarity.



Idaho Department of Lands digital orthophoto

Field work conducted 1998-1999.
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Digital cartography by Jane S. Freed at the Idaho Geological Survey's Digital Mapping and GIS Lab.
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QUADRANGLE LOCATION