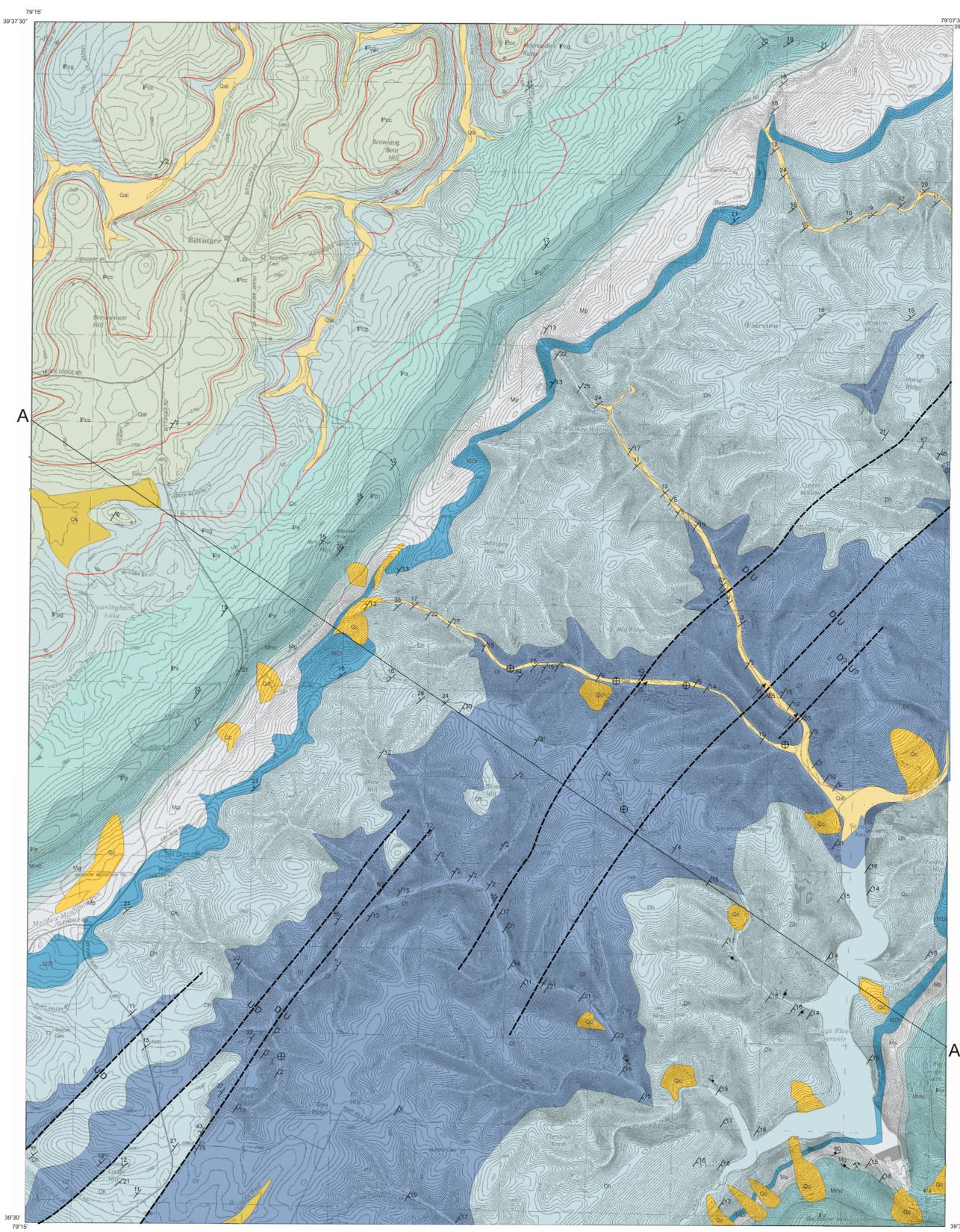


DESCRIPTION OF MAP UNITS

Qal	Alluvium Pebbles, cobbles and boulders that weather yellow, orange, and orange-brown. Although much of Savage River flows on exposed bedrock, adjacent mapped alluvium deposits include those formed along both modern and ancient streams. The thickness of alluvium varies from a thin veneer to more than 30 feet (10 m). These thicker accumulations tend to be concentrated where colluvium at the edge of valleys overlaps the alluvium.
Os	Swamp Unconsolidated dark gray to black, organic-rich matter to peat. These materials accumulated in low-lying, poorly drained areas that are remnants of late Pleistocene glades and lakes. These sediments are water-logged during parts of the year and are provide poor agricultural lands. Thickness ranges from less than three feet to nearly 10 feet (1 - 3 m).
Qcl	Colluvium/Landslide Unconsolidated and unsorted diamicton of boulders, cobbles, pebbles, sand and mud that accumulate on steep slopes or at the base of slopes as the result of mass movement. These accumulations typically have an undulating or wavy upper surface and thin upslope. Thickness ranges from several feet on steep slopes to more than 50 feet (3 to 15 m).
Conemaugh Group Interbedded, sandstone, shale, siltstone, and light gray nonmarine limestone. The aggregate thickness of the Conemaugh Group is 800 to 900 feet thick (245 to 275 m), approximately 700 feet (215 m) of the group are exposed in the Bittering Quadrangle.	
Pcc	Casselman Formation Interbedded, tan, medium- to coarse-grained, locally conglomeratic, cross-bedded sandstone, reddish gray mudstone, medium gray, silty shale, siltstone, and light gray, nonmarine limestone. The Barton (b) coal bed is the only coal bed mined in this interval in the Casselman basin. Approximately 200 feet (61 m) of the Casselman Formation are preserved in the Bittering Quadrangle.
Pcg	Glenshaw Formation Interbedded, gray, tan-weathering, micaceous, medium- to coarse-grained, cross-bedded sandstone containing abundant coaly plant fragments, reddish and reddish gray, silty shale, siltstone, light gray bioturbated nonmarine limestone, and thin, dark gray, fossiliferous marine shale. The base of the Glenshaw Formation is the top of the Upper Freeport coal bed, and the top of the formation is the top of the Ames marine shale. Several marine intervals are underlain by mined coal beds. These are the Brush Creek (bc), Lower Bakerstown (lb), and Ames (a) coals. The Glenshaw Formation is approximately 350 feet (105 m) thick.
Pa	Allegheny Formation Interbedded, medium to dark gray shale and siltstone, and tan to light gray, cross-bedded sandstone, with thin claystone near the base, and several mineable coal beds. The top of the formation is at the top of the Upper Freeport (uf) coal bed and the base of the formation is the top of the Homewood Sandstone member of the underlying Pottsville Formation. The upper Kintanning (uk) and Lower Kintanning (lk) coal beds are locally mined. The Allegheny Formation is between 200 to 250 feet thick (61 to 76 m).
Pp	Pottsville Formation Dominantly tan to light gray, medium- to coarse-grained, cross-bedded sandstone and conglomeratic sandstone with abundant coaly plant fragments and subordinate intervals of dark gray, coaly shale, siltstone, and thin coal beds. The massive, light gray, highly cross-bedded Homewood Sandstone Member constitutes a resistant, mappable sandstone layer at the top of the formation, while the conglomeratic Sharon Member forms a massive unit at the base. Total thickness for the unit is 180 to 200 feet (55 to 61 m).
Mmc	Mauch Chunk Formation Interbedded, reddish brown shale, variegated, mudstone and siltstone, and reddish brown to greenish gray, medium-grained, micaceous sandstone. Sandstone intervals are cross-bedded, exhibit sharp bases, and fine upsection. Several thin greenish gray, marine calcareous shale to argillaceous limestone units are present near the base of the formation. The Mauch Chunk Formation is approximately 600 feet thick in Allegheny County and thins westward to 300 feet in thickness in western Garrett County (90-180 m).
Mg	Greenbrier Formation Light gray, cross-bedded, sandy limestone to calcareous sandstone at the base (Loyalhanna Member). The Loyalhanna Member is overlain by interbedded, reddish, fossiliferous mudstone, and tan to reddish brown, fine-grained sandstone, and reddish brown siltstone and variegated shale (Savage Dam Member). The Savage Dam Member is succeeded upward by thin- to medium-bedded, light to medium gray argillaceous, fossiliferous limestone at the top of the formation (Wynps Gap Member). The Greenbrier Formation is 150 to 200 feet thick (45-60 m).
Mp	Purslane Formation Light gray, tan, and locally reddish brown, coarse-grained to conglomeratic, thick-bedded to cross-bedded sandstone, thin beds of gray shale, and coaly shale. In the Bittering Quadrangle the base of the Purslane Formation is mapped at the base of a resistant, massive, buff-weathering, pebbly, conglomeratic sandstone above the bioturbated marine sandstone and variegated shales of the Riddlesburg Member of the Rockwell Formation. The Purslane Formation is 250 to 300 feet thick in western Garrett County (75-90 m).
MDr	Rockwell Formation Interbedded, greenish gray, argillaceous, bioturbated sandstone, and reddish gray to gray, coaly siltstone and shale and tan lenticular sandstone. The greenish gray bioturbated sandstones at the base of the formation (Oswayo Member) sharply overlie the reddish strata of the Hampshire Formation. These basal marine strata are overlain by light gray to tan thin- to medium-bedded, cross-bedded, fining upward nonmarine channel sandstone equivalent to the Cussewago Sandstone of Pennsylvania and then rooted gray mudstone. The top of the formation consists of burrowed, tan sandstone and greenish gray marine shale of the Riddlesburg Member. The Rockwell Formation is between 150 and 200 feet thick in Garrett County (45-65 m).
Dh	Hampshire Formation Interbedded, reddish gray, reddish brown, and brownish red, locally greenish gray, cross-bedded, fining upward, lenticular sandstone; reddish brown micaceous siltstone, shale, and red-brown rooted claystone. The Hampshire ranges from approximately 1,600 to 2,000 feet (500-600 m) in Garrett County but only the upper 700 to 900 feet (215 - 275 m) of the formation are present in the Bittering Quadrangle.
Df	Foreknobs Formation Interbedded, olive gray, medium- to coarse-grained, cross-bedded, bioturbated sandstone; greenish gray to dusky red, fossiliferous shale and siltstone. Top of the formation is marked by a thick-bedded, pebbly, cross-bedded, light gray to white (>30 feet, 10 m) sandstone herein considered equivalent to the Pound Sandstone Member of the Valley and Ridge Province. The base of the formation is not exposed in the Bittering Quadrangle, but elsewhere the base is marked by down section gradation from interbedded sandstone and shale to primarily shale of the underlying Sherr and Brallier formations. The Foreknobs Formation is approximately 1,500 feet (450 m) thick in Garrett County, but thickens to more than 2,000 feet (460 m) in Allegheny County, Maryland.



Geologic Map of the Bittering Quadrangle, Garrett County, Maryland

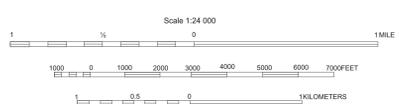
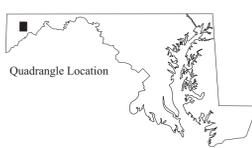
U.S. Geological Survey (USGS) US Topo 7.5-minute Series
 Bittering, MD quadrangle, 2014
 Maryland State Plane Coordinate System 1983
 (Projection: Lambert Conformal Conic, 1980 geodetic reference system)
 (Horizontal Datum: North American Datum 1983)
 Geographic coordinates (latitude-longitude). Shown near corners
 Reported magnetic north declination (center of Bittering quadrangle): 9.4°W
 To determine current magnetic declination see: (<http://www.ngdc.noaa.gov/gomag/declination.shtml>)

By
 David K. Brezinski
 2017

Adjoining 7.5-minute quadrangles (Bittering quadrangle shaded)

1	2	3
4	5	6
7	8	

1 Accident
 2 Grantsville
 3 Avillion
 4 McHenry
 5 Barton
 6 Deer Park
 7 Kitzmiller
 8 Westport



Contour Interval 20 Feet
 National Geodetic Vertical Datum of 1929
 (To convert elevations to North American Vertical Datum of 1988, subtract 1 foot)
 (To convert from feet to meters, multiply by 0.3048)

Explanation of Map Symbols

Contacts
 Geologic contacts, definite, approximate, and concealed location

Planar Features
 Inclined bedding strike and degree of dip shown
 Horizontal bedding
 Vertical bedding
 Inclined joint strike and degree of dip shown
 Vertical joint strike shown

Faults
 Fault: approximately located. D refers to down thrown side, U to the up thrown side.

Folds
 Minor anticline

Coal Beds
 Projected outcrop trace of coal bed

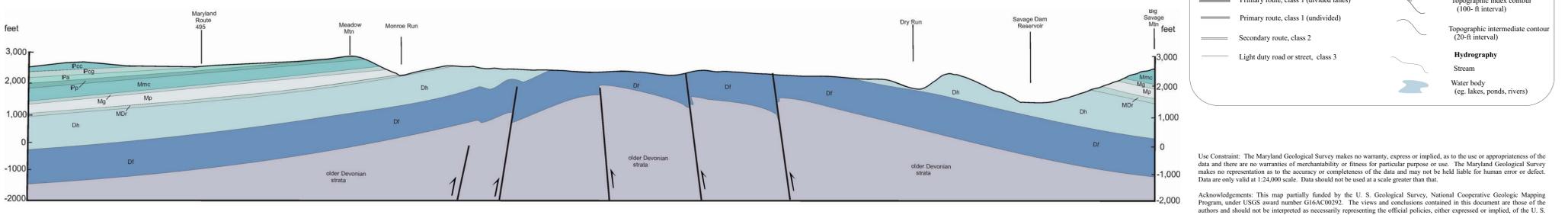
Quarry

Base Map Symbols

Transportation
 Primary route, class 1 (divided lanes)
 Primary route, class 1 (undivided)
 Secondary route, class 2
 Light duty road or street, class 3

Topography
 Topographic index contour (100-ft interval)
 Topographic intermediate contour (20-ft interval)

Hydrography
 Stream
 Water body (eg. lakes, ponds, rivers)



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Geologic field mapping conducted in 2016-2017.

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