

NOMENCLATURE OF EARLIER WORKERS	SYSTEM	SERIES	FORMATION, MEMBER, AND BED	LITHOLOGY	THICKNESS, IN FEET	DESCRIPTION
Pottsville	PENNSYLVANIAN	Lee Formation	Alluvium	0-25	Silt, sand and gravel. Flood plains underlain by dark brown to yellowish brown silt and clay silt with variable amount of organic material. Stream channel deposits are silt, sand, and gravel, gravel composed of fragments chiefly of siltstone, sandstone, and chert, locally including limestone and dolomite. Small bedrock exposures locally in stream beds not mapped separately.	
			Landslide deposits	0-20'	Large blocks and masses of black shale slumped from steep slopes underlain by Onk. Shale, interbedded sandstone and siltstone fragments mostly derived from Farmers Member of Borden Formation. Shale commonly highly weathered.	
Brodhead Formation	MISSISSIPPIAN	Borden Formation	Cowbell Member	22+	Sandstone and conglomerate. Sandstone: light brown to dark reddish-brown, fine to medium-grained, grains subangular to rounded, fairly well sorted, thin bedded, locally cross-bedded, quartzose, ferruginous, friable. Conglomerate composed of very light gray angular to subrounded chert gravel and fragments as much as 1 foot long, with a medium to coarse-grained sandstone matrix; forms basal few feet of unit. Sparingly fossiliferous, contains brachiopods and crinoid columns in chert fragments, which were presumably derived from Newman Limestone (Mississippian). Unconformably overlies siltstone of the Borden Formation; contact not exposed. Caps three hills in northeast corner of quadrangle. Upper part not present.	
			Ohio Shale	260-310	Siltstone and shale. Siltstone: light brownish-gray to light gray, irregularly bedded, thin- to medium-bedded, slightly ferruginous and micaceous, iron-stained along fractures; weathers to large irregular blocks and shagreened chips and slabs; forms ledgy outcrops on steep slopes, particularly in upper 150 feet of unit. Shale: silty, olive-gray, apparently forms less than 25 percent of unit, more abundant in lower part, interbedded with siltstone; present in middle and upper part as one or two thick sequences, appears to intertongue with and grade into siltstone. Unit contains ironstone concretions, more common near base, and curly worm's trails and <i>Zoophoria</i> ("Towara") locally in siltstone beds, fossiliferous near top, including brachiopods, bryozoans, and crinoid columns. Unit poorly exposed, especially lower half, gradational with underlying unit; contact not exposed, placed so as to separate more silty beds above from more clayey beds below, in most places basal contact marked by a prominent slope break with steeper slope above. Unit approximately correlative with siltstone member of Borden Formation as mapped on adjacent Burtonville quadrangle (Morris, 1965).	
New Providence Formation	MISSISSIPPIAN	Borden Formation	Nancy Member	150-195	Shale, siltstone and sandstone. Shale: bluish to greenish-gray, weathers olive gray to grayish orange; slightly to very silty, poorly fissile, ironstone concretions as much as 18 inches in diameter common. Siltstone: shaly, in minor amounts, occurs mostly near top of unit. Sandstone: yellowish-brown, very fine grained, evenly bedded, similar to sandstone of underlying unit; occurs near base in two or three lensing beds as much as several feet thick and locally in thin beds and stringers; thicker beds exposed as ledges or indicated by float, mapped locally. Unit poorly exposed; forms clayey soil, poorly drained, plastic when wet. Forms gentler slopes than unit above and below. Lower contact placed at base of lowest shale sequence 3 feet or more thick between sandstone beds. Unit approximately correlative with shale member of Borden Formation, but locally includes upper part of sandstone member of Borden Formation, as mapped on adjacent Burtonville quadrangle (Morris, 1965).	
			Farmers Member	33-95	Sandstone and minor shale. Sandstone: light brownish-gray to yellowish-brown, very fine grained, well-sorted, well-indurated, medium- to thick-bedded tabular, quartzose, beds as much as 4 feet thick, thickest near base. <i>Zoophoria</i> and worm's trails common to shale of underlying unit; occurs as partings and interbeds less than 3 feet thick, thickest and most abundant in upper part. Forms steep slopes with abundant ledgy outcrops, rims flat topped ridges throughout most of quadrangle. Unit thickens uniformly to northeast. Contact with Henley Bed sharp, possibly intertonguing locally. Farmers Member correlative with most of sandstone member of Borden Formation on adjacent Burtonville quadrangle, which locally includes interval to top of sandstone marker beds of Nancy Member (Morris, 1965).	
Sunbury Shale	DEVONIAN	Upper Devonian	Sunbury Shale	15-20	Shale, greenish-gray, clayey; commonly contains a few sandstone beds or lenses 1 to 2 inches thick in upper part, and one or more thin ferruginous siltstone lenses. Locally poorly exposed, generally covered with float from overlying sandstone beds; commonly occurs as thin, steeply dipping benches. Basal contact fairly sharp, rarely exposed but readily inferred from marked change in soil type at contact.	
			Bedford Shale	10-40	Shale, dark gray to black, highly carbonaceous, highly fossiliferous, sparsely pyritic. Forms steep to moderate slopes, with thin soil cover containing abundant shale chips. Locally exposed. Basal contact sharp, generally covered. Thickness notably uniform throughout quadrangle.	
Ohio Shale	DEVONIAN	Upper Devonian	Ohio Shale	150-200	Shale, commonly greenish-gray to light olive-gray silty clay shale, weathers reddish to yellowish brown; contains pyritic nodules and numerous very thin siltstone lenses. Locally a thin bed or lens of very fine grained sandstone occurs several feet above base. Basal few feet common, composed of interbedded dark gray and olive gray shale with thin siltstone ribs. Fossils poor, weathers to irregularly shaped chips. Unit generally covered, occurs prominent bench on topographic noses and most hillsides. Basal contact is accurately indicated in most places by abrupt break in slope and by nature of shale chips in soil.	
			Bisher Limestone	0-14	Dolomite, light bluish-gray to medium-dark gray, dominantly coarse-grained, joints widely spaced to irregularly thin bedded, commonly obscurely bedded, silty, pyritic, fossiliferous, including abundant crinoid columns and some horn corals; petrifactions, surfaces weather to a reddish brown limonitic rind, soil conspicuously reddish orange. Occurs only in northeastern part of quadrangle, pinches out to west and south. Generally well exposed, forms ledge near base of steep slopes, iron-rich springs and seeps common at base. Contacts sharp.	
Estill Shale	SILURIAN	Middle Silurian	Estill Shale	80-130	Clay shale, mostly greenish-gray to gray, with thin zones of brownish red to brownish yellow, bedding indistinct, mostly poorly fissile, relatively impermeable, very plastic when wet. Fine beds of dolomitic siltstone as much as 8 inches thick near top, thin, rubbly weathering dolomite beds locally near base. Unit poorly exposed, forms gentle to moderate, commonly hummocky and gullied slopes. Lowermost few inches variegated, glauconitic; lower contact sharp, locally well exposed, placed above persistent dolomite ledge.	
			Preachersville Member of Drakes Formation	40-65	Dolomite and clay shale. Dolomite, medium-light gray, weathers rusty brown, micropaginated to medium-grained, some beds bedded, irregularly to evenly thin to medium bedded, thick bedded near base, locally cross-bedded, ripple marked; weathers to highly fossiliferous, contains brachiopods, bryozoans, crinoid columns, horn corals, distinctive "cog-wheel" crinoids occur near middle of unit. Thick bedded dolomite contains very light gray nodular to lenticular chert, overlies 4 to 5 feet of argillaceous, glauconitic, thin bedded dolomite at base. Top of unit formed by persistent fine-grained dolomite ledge ranging in thickness from 5 inches to about 3 feet. Clay shale, greenish-gray to gray, poorly bedded, poorly fissile, plastic when wet, poorly exposed, interbedded with dolomite. Shale commonly increases upward. Unit forms moderate to steep slopes; clayey dolomite forms prominent ledges. Lower contact sharp, locally well exposed in roadcuts and cut banks of streams, accurately located elsewhere by means of cherty dolomite ledges.	
Whitewater	ORDOVICIAN	Upper Ordovician	Whitewater	35-55	Clay shale and dolomite. Clay shale: greenish-gray, poorly bedded, poorly fissile, dolomitic in part; sparsely fossiliferous to barren, plastic when wet. Dolomite: gray to reddish-brown, fine to medium grained, thin bedded, interbedded, with shale; more abundant near base. Unit poorly exposed, forms moderate slopes, commonly gullied, gradational with underlying unit; contact placed at top of highest fossiliferous limestone. Unit correlative with shale and upper part of limestone of Ordovician sedimentary rocks as mapped on adjacent Burtonville quadrangle (Morris, 1965).	
			Bull Fork Formation	10+	Shale, gray to greenish-gray, calcareous, fossiliferous, with interbedded gray, medium- to coarse-grained, thin bedded, bioclastic limestone. Unit occurs in test and banks of Bluebank Branch in northwest corner of quadrangle, lower part not exposed.	



**EXPLANATION**  
Geologic information

- Qal Alluvium
- Old Landslide deposits
- Phi Lee Formation
- UNCONFORMITY
- Mbc Borden Formation
- Mbn Borden Member
- Mbf Borden Member
- Msu Sunbury Shale
- MDbd Bedford Shale
- Do Ohio Shale
- UNCONFORMITY
- Sbl Bisher Limestone
- Scb Upper part of Crab Orchard Formation
- Scu Lower part of Crab Orchard Formation and Brassfield Formation
- UNCONFORMITY
- Odb Preachersville Member of Drakes Formation
- Ob Bull Fork Formation

**Hydrologic information**

- DR-U, DU-U, U, W Well drilled (DR) or dug (DU), and whether unused (U) or water withdrawn for use (W). Lower letters denote interval of rock units penetrated (inclusive), as determined from depth and position on geologic map. See descriptions below for letter symbols. (N) Nancy Member, (F) Farmers Member, (H) Henley Bed, (S) Sunbury Shale, (B) Bedford Shale, (O) Ohio Shale, (Bl) Bisher Limestone, (UCO) Upper part of Crab Orchard Formation, (LCO) Lower part of Crab Orchard Formation. If no data for any characteristic, is left blank.
- Upper number denotes depth to water, in feet, referenced to ground level. Lower number denotes total depth of well, in feet, referenced to ground level. (R) following a number denotes data reported by owner. If value is unknown, is left blank.
- Location of well.
- CISTERN - Some cisterns are concrete structures. Most are dug wells. All receive part or all water supply from downspouts off roofs, or transport by vehicle.
- Spring. Letter denotes whether spring water unused (U) or withdrawn for use (W).

**Other symbols:**

- Contact or marker bed
- Strikes of vertical joints
- Strikes of vertical joint sets
- Structure contours
- Inactive quarry
- Glacial erratic

**Geology from R. C. McDowell, J. H. Peck, and J. W. Mytton, 1971 and R. C. McDowell, 1975.**

**Scale:** 1:24,000  
CONTOUR INTERVAL 20 FEET  
DATUM IS MEAN SEA LEVEL

**Study area**

Figure 2.--Geology of Maxey Flats and surrounding area with well and spring locations.