Map Unit Properties Table

Age	Map Unit (symbol)	Unit Description	Topographic Expression	Erosion Resistance	Paleontological Resources	Mineral Resources	Cultural Resources	Hazards	Suitability for Development	Other Geological Significance
QUATERNARY	Unconsolidated material (Qta, Qal, Qt, Ql, Qlp, Qls)	Qta: stream terrace deposits & alluvium, undifferentiated. Gravel, sand, silt, & mud. Stream deposits (alluvium) found in valleys of small streams around the Tower & in the valley of the Belle Fourche R., that cuts across the monument's SE corner. NE of the Belle Fourche R., between the river & the main road, is terrace cut into the Spearfish Fm. Qal: alluvium – sand, silt, & gravel Qt: terrace alluvium – sand, silt, & gravel Ql: talus & landslide material Qlp: talus & landslide material, chiefly phonolite Qls: talus & landslide material, chiefly Hulett Sandstone	Terraces & flood plains; talus slopes	Alluvium: low; Talus: high	None	Sand & Gravel	None documented	Flash flooding	Easily eroded; unstable foundation	None
TERTIARY	White River Formation (Twr)	Light-gray & light brown medium- to coarse-grained friable sandstone & conglomeratic sandstone; locally contains calcium carbonate cement. Locally thick bedded; unconformable lower contact. Thickness averages 9 m (30 ft), range 0-15 m (0-50 ft).	Forms slopes & some ragged ledges in area	Not exposed in Devils Tower NM	Early Oligocene brontothere tooth fragment found in gravel pit N of Devils Tower (NW¼ sec. 27, T55N, R65W)	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	None
		Unconformity								
	Phonolite porphyry (Tp)	Conspicuous crystals of white feldspar in light- to dark-gray or greenish-gray very fine-grained groundmass. Feldspar commonly about 0.6-1.2 cm (0.25-0.5 in) in diameter. Weathers to light gray or brownish gray. Under the microscope, the feldspar is crudely zoned, untwined, & altered alkali feldspar (anorthoclase). Smaller dark-green pyroxene crystals are clinopyroxene, either aegerite or aegerite-augite. Similar in composition to the igneous rocks at Missouri Buttes.	Devils Tower	High	None	Feldspar (anorthoclase)	Most widely known landmark of the Northern Great Plains	Rockfall & landslide potential	Poor; many fractures; popular rock climbing routes	World renown columnar jointing
		Regional Unconformity								
LOWER CRETACEOUS	Belle Fourche Shale (Kb)	Dark-gray to black shale with numerous dark purplish-red weathering siderite concretions in lower part, & several beds of light-gray- & yellow-weathering limestone concretions in middle & upper parts; several beds of bentonite (altered volcanic ash). Not exposed in Devils Tower NM. Thickness: 210-240 m (700-800 ft)	Not exposed in Devils Tower NM	Low	Not exposed in Devils Tower NM	Siderite; Bentonite	Not exposed in Devils Tower NM	Bentonite	Bentonite may cause problems	Local commercial deposits of bentonite
	Mowry Shale (Km)	Dark-gray siliceous shale, weathers light gray; many thin bentonite beds. Thickness: 61-76 m (200-250 ft). Not exposed in Devils Tower NM.	Not exposed in Devils Tower NM	Low; Not in Devils Tower NM	Numerous fish scales along shale partings	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Bentonite	Bentonite may cause problems	Remnants of an ancient sea floor
	Newcastle Sandstone (Knc)	Discontinuous beds of light-gray sandstone siltstone & dark-gray carbonaceous shale or claystone; a few beds of impure lignite & bentonite. Gradational lower contact. Thin to thick bedded; ripple marks; low-angle cross stratification. Thickness varies within short distances, but averages 11-12 m (35-40 ft). Not exposed in Devils Tower NM.	Forms slopes with some prominent ledges	Higher than shale; lower than phonolite	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Prominent joints in sandstone & siltstone beds.	Not exposed in Devils Tower NM
	Skull Creek Shale (Ksc)	Slightly silty black greasy shale with a few ferruginous siltstone, siderite, & cone-in-cone concretions; fissile to subfissile. Gradational lower contact. Thinly laminated. Thickness averages 76 m (250 ft). Not exposed in Devils Tower NM.	Forms gentle slopes	Low	Fragmentary plesiosaur bones found in lower part of formation	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Remnants of an ancient sea floor
	Fall River Formation (Kr)	Gray to light-brown very fine grained thin- to thick-bedded sandstone with a few gray to light-brown silty claystone & clayey siltstone beds in upper part; gray to light-brown thinly laminated carbonaceous clayey siltstone & silty claystone layered with very fine to fine-grained sandstone in lower part. Unconformable lower contact. Thin to thick bedded; even bedded, locally lenticular, ripple marks; low-angle cross-stratification; sandstone bars & channel-fill deposits. Thickness avg 40 m (130 ft), range 37-44 m (120-145 ft). Not exposed in Devils Tower NM.	Forms ledges & cliffs separated by moderately steep slopes	Relatively high	Trails & tubes of soft-bodied organisms	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Prominent joints in sandstone & some siltstone beds	Locally contains disseminated uranium minerals
		Unconformity								
	Lakota Formation (Kl)	Variegated sandy claystone & clayey sandstone, gray dense siltstone, lenticular gray to light-brown sandstone & conglomeratic sandstone; contains highly polished pebbles of varicolored chert, red & white quartzite, & white quartz. Unconformable lower contact, but locally gradational. No apparent fractures or joints. Thin- to thick-bedded, locally massive; rare ripple marks; low- to high-angle, medium-scale tabular & lenticular cross-stratification; lenticular sandstones common. Thickness avg 55 m (180 ft), range 35-79 m (115-260 ft). Not exposed in Devils Tower NM.	Forms moderately steep slopes with a few ledges and cliffs	Relatively high	Marine invertebrate fossil debris in polished pebbles & cobbles (*Psaronius* of Pennsylvanian or Permian age; *Favosites* sp. of Late Ordovician to Devonian age)	Uranium minerals	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Locally contains disseminated uranium minerals
		Regional Unconformity								

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UPPER JURASSIC	Fuson& Lakota, Formations, undifferentiated (KJu)	Light yellowish-gray to white fine- to coarse-grained sandstone & conglomeratic sandstone, irregularly layered with red, green, yellow, gray, & black claystone; thickness variable within short distances. Thickness: 18-67 m (60-220 ft). Not exposed in Devils Tower NM.	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Coal	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Locally contains coal beds near base
	Morrison Formation (Jm)	Green, greenish gray, & grayish-red structureless limy claystone & slightly sandy claystone with a few thin discontinuous light-gray limestone & sandstone beds; locally consists entirely of light-gray very fine-grained sandstone that weathers to rounded knobs. Gradational lower contact. No apparent fractures or joints. Thin- to thick-bedded sandstone, lenticular & massive, rare ripple marks; low-angle medium-scale lenticular cross-stratification. Thickness avgs 24 m (80 ft), range 0-30 m (0-100 ft). Not exposed in Devils Tower NM.	Weathers to rounded knobs & grass-covered slopes	Relatively low	Locally contains ostracodes, gastropods, & vertebrate remains	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	Not exposed in Devils Tower NM	At Barlow Canyon Dome locally truncated by angular unconformity at base of Lakota Fm
	Sundance Fm.: Redwater Shale Member (Jsr)	Greenish-gray shale with thin discontinuous fossiliferous sandy limestone & limy siltstone beds in upper part; topmost bed is orange-brown limy siltstone. Gradational lower contact. No apparent fractures or joints. Thin-bedded limestone; ripple marks common in topmost sandstone beds. Thickness avg 52 m (170 ft), range 12-55 m (40-180 ft). Jsrls: fossiliferous limestone beds in the upper part of the Redwater Shale Member	Forms grass-covered slopes; encircles Devils Tower; mostly covered by talus	Low	Fragments of marine invertebrates: ammonites, belemnites (squids), crinoid stems, & pelecypods (clams & oysters)	None documented	Unknown	None documented	Easily scared by off road vehicles; erosion potential from development	Best exposures are on Fossil Hill, NW of Devils Tower, & in NW corner of the monument.
	Sundance Fm.: Lak Member (Jsl)	Yellow to pink siltstone & very fine-grained sandstone & siltstone. Minor thin gray-green sandy shale partings. Poorly cemented. Gradational lower contact. No apparent fractures or joints. Thin-bedded sandstone in lower part. Thickness averages 14 m (45 ft), range 11-20 m (35-65 ft).	Weathers to gentle slopes covered with vegetation	Soft sandstone & siltstone	None documented	None documented	Unknown	None documented	Potential scaring by off road vehicles	None
	Sundance Fm.: Hulett Sandstone Member (Jsh)	Yellowish-brown very fine-grained glauconitic calcareous sandstone. Gradational lower & upper contacts. Sandstone in lower 1.5-3 m (5-10 ft) in beds from less than 2.54 cm-0.6 m (1 in-2 ft) thick separated by shale partings less than 2.54 cm-15 cm (1-6 in) thick; ripple marks. Middle part of mbr has massive sandstone beds 1.5-6 m (5-20 ft) thick. Upper 1.5-3 m (5-10 ft) is thin bedded, locally shale, & poorly cemented. Thickness averages 24 m (80 ft), range 18-27 m (60-90 ft).	Forms massive near-vertical, well-cemented cliff	High; resistant to weathering	None documented	None documented	Unknown	Rockfall & landslide potential	Prominent jointing may cause problems	Cliff nearly encircles Devils Tower
	Sundance Fm.: Stockade Beaver Shale Member (Jssb)	Thin sandstone at base contains black or dark-gray water-worn chert pebbles with a maximum dimension of about 5 cm (2 in). Above basal sand, lower half of mbr is mostly gray-green shale. Upper half is dark-gray to gray-green shale with interbedded fine-grained calcareous sandstone ranging from less than 0.3-1.8 m (1-6 ft) thick. Unconformable lower contact; gradational upper contact. No apparent fractures or joints. Thin-bedded; a few ripple marks. Thickness averages 21 m (70 ft), range 18-24 m (60-80 ft).	Poor to fair exposures; forms slopes	Low	None documented	None documented	Unknown	None documented	Easily scared by off road vehicles; erosion potential from development	None
	Sundance & Gypsum Spring Formations, undifferentiated (Jsg)	(see individual units)								
		Regional (J-2) Unconformity								
MIDDLE JURASSIC	Gypsum Spring Formation (Jgs)	White massive gypsum interbedded with red gypsiferous claystone & siltstone; a few beds of gray cherty limestone & dolomite near top of formation. Laminated to thin bedded. Unconformable lower contact. Thickness averages 5-11 m (15 to 35 ft)	Good exposures; forms bare slopes	Low	None documented	Gypsum	Unknown	Gypsum karst outside monumtne; minor slumps & slides	Local joints in cherty lmstone & dolomite, gypsum karst, & bare slopes may present problems	Thick gypsum beds; caps some oil reservoirs in Wyoming
		Regional (J-1) Unconformity								
TRIASSIC / PERMIAN	Spearfish Formation* (TRPs)	Red clayey siltstone, siltstone, & sandstone with red sandy shale; beds of massive white gypsum in lower half; lower part not exposed. Poorly cemented. Thin to thick-bedded. Some joints in sandstone beds. Base not exposed. Uppermost 30 m (100 ft) exposed in Devils Tower NM.	Good exposures; forms bare slopes or conspicuous brownish-red to maroon cliffs	Low; weathers very easily	None found in Devils Tower but fossils of Triassic land vertebrates found in Wyoming	Gypsum	Unknown	None documented	Poorly cemented; Potential scarring from development	Massive gypsum Locally but not in monument

Robinson, Charles S. 1956. *Geology of Devils Tower National Monument, Wyoming*. Bulletin 1021-I. Denver, CO: U.S. Geological Survey.
* Robinson considered the Spearfish Formation to be a Triassic unit. Since 1956, the Spearfish Formation has been found to extend into the Permian.