# Map Unit Properties Table – George Washington Birthplace National Monument

Colored rows indicate units mapped within George Washington Birthplace National Monument.

| Age | Unit Name (Symbol) | Features and Description | Erosion Resistance | Suitability for Development | Hazards | Paleontological Resources | Cultural Resources | Mineral Occurrence | Habitat | Recreation | Geologic Significance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| QUATERNARY (HOLOCENE) | artificial fill (af) | Mix of boulders, rip rap, unsorted fill and other materials associated with coastal features, possibly jetties and other urban development | Moderate | Material is ubiquitous with development. Some materials are used for shoreline anchoring. Avoid development. | Some units are intended to anchor shoreline areas, but may shift during heavy storms | None documented | May contain modern artifacts and information about historic shoreline evolution | None documented | Shore bird habitat | Not suitable for recreation | Unit attests to the struggle to maintain shoreline areas prone to rapid change, also records modern human development of the area. |
| QUATERNARY (HOLOCENE) | Sand (Qs) Marsh deposits (Qm) Swamp deposits (Qsw) Beach deposits (Qb) Colluvium (Qco) | ***Qs*** contains 2–8 m (7–26 ft) thick beds of pale gray to light yellowish gray poorly sorted to well-sorted sand deposits. Grain size ranges from fine to coarse and locally beds contain shell fragments and mollusks. Unit may include narrow beach sediments and sand bar and spit deposits. ***Qs*** also describes local swamp deposits containing silt, fine sand, clay and organic material on floodplain surfaces and in ponds. Layers are poorly sorted and bedded. ***Qm*** contains less than 6 m (20 ft) thick of soft mud and muddy sand. Unit is medium to dark gray with some brownish peaty layers of mud and sand. ***Qsw*** is comprised of a veneer of mud, muck and muddy sand. Unit contains abundant decaying leaf and stem material rendering the color brownish gray to grayish black. ***Qb*** contains mixtures of sand, gravel, cobbles, and boulders in planar crossbeds and washover fans in areas as much as 15 m (49 ft) wide and 1–3 m (3–10 ft) thick. ***Qc*** is a poorly sorted mix of massive sand, silt, clay, cobbles, pebbles, and boulders as reworked deposits from units ***Te***, ***Ty*** and ***Tb***. Often present as terraces a few meters thick. | Very low | Avoid marsh and stream edge/riparian areas for heavy development, especially for wastewater treatment facilities due to proximity to water and high permeability. Coarse-grained deposits may preferentially slump if undercut and are highly permeable. The unconsolidated and transient nature of the deposits hinder establishment of permanent infrastructure or trails. | ***Qs*** is associated with natural levees between the regional Rappahannock River and marsh and swamp areas as well as riparian zone areas and is associated with slumps and rapid erosion. ***Qs*** is located at the head of tidal and intertidal areas along the margins of the Popes Creek estuary and filling wetlands. Units are prone to rapid erosion and slumping. | Reworked shell fragments and whole mollusk valves, fresh to brackish water mollusks, rushes and grasslike plant fragments, leaf, stem and tree trunk material, and other organic litter | Ironstone nodules may have provided trade material. May contain artifacts and/or settlement sites along major waterways | Sand, gravel, silt, clay, peat; ironstone cemented clasts and nodules | Riparian zones and burrow habitat, beaver habitat, shore and marsh bird habitat in rush area | ***Qs*** is suitable for some trail development. | ***Qs*** contains a record of modern stream valley development throughout the Quaternary. ***Qm*** is dated from historic to 6,000 years before present. Rates of accumulation are a function of local sea level rise. ***Qc*** is graded to the base level of Pleistocene estuarine terraces. |
| QUATERNARY (HOLOCENE & PLEISTOCENE) | Alluvium (Qa) | Unit is as much as 15 m (49 ft) thick and composed of a mixture of sand, gravel, silt and clay present in interbedded channel, point-bar, and flood plain deposits. Locally unit contains glauconite and pebbly sand. Clasts are primarily vein quartz, quartzite, and metamorphic rocks in well stratified to massive beds that appear heterogeneous and medium gray, tan, or brown to yellowish gray in outcrop. In the vicinity of Colonial Beach, unit contains sand, pebbles, silt, clay, organic litter, boulders, etc in channel fill and floodplain areas. | Very low | Avoid most alluvium deposits for heavy development due to instability of slopes and high permeability as well as proximity to fragile riparian stream areas | Units are associated with stream edge slopes and prone to rapid erosion and slumping | Organic litter and debris including leaves, logs, twigs, peat layers, other recent remains including ephemeral beaver ponds | May contain artifacts and/or settlement sites along major waterways | Cobbles, gravel, sand, clay, peat, silt | Underlies verdant marsh areas and floodplain and riparian habitat | Avoid areas near slopes due to likelihood of failure | Contains historic to middle Holocene age deposits. Unit records streambed and overbank deposition along major waterways for the past 10,000 years |
| QUATERNARY (PLEISTOCENE) | Tabb Formation: Poquoson Member (Qtp) Poquoson and Lynnhaven Members, undivided (Qtlp) Lynnhaven Member (Qtl) Colluvium (Qst) Sedgefield Member (Qts) | ***Qtp*** consists of medium to coarse pebbly sand grading upward into finer clayey sand and silt. Unit is light to dark gray and is 5–8 m (16–26 ft) thick below lowest terraces. ***Qtlp*** contains ***Qtp*** and ***Qtl***—a lower member of medium to coarse crossbedded sand grading upward to sand, pebbly and cobbly layers with local fining upward cycles to silts and clays as much as 12 m (39 ft) thick. ***Qst*** consists of slope deposits with poorly to non-sorted cobbles, pebbles, sand and boulders grading into ***Qts*** which contains pebbly to bouldery clasts in fine to coarse, crossbedded sand interlayered with sandy and clayey silt beds with pale to medium yellowish gray color. Unit has a maximum thickness of 15 m (49 ft), but is locally thinner. | Low | Units are fairly permeable with an iron oxide band at the base marking a contrast with the underlying Calvert Formation, this also creates a slip surface that should be avoided on slopes for development. | Units contain heterogeneous assemblages of sediments and may be unstable on slopes and if undercut. Colluvium is associated with slope processes. | Units contain abundant plant litter and organic material | May contain artifacts and/or settlement sites along major waterways | Peat, sand, silt, clay, gravel, pebbles; ironstone cemented layers | Coarser grained members underlie upland areas and support hardwood forests | Avoid areas near slopes due to likelihood of failure | ***Qtp*** records Pleistocene transgression and regression with altitude ranging from sea level to 3.5 m (11 ft). ***Qts*** records a bay mouth bar deposited across the mouth of the proto Popes Creek estuary. |

| Age | Unit Name (Symbol) | Features and Description | Erosion Resistance | Suitability for Development | Hazards | Paleontological Resources | Cultural Resources | Mineral Occurrence | Habitat | Recreation | Geologic Significance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| QUATERNARY (PLEISTOCENE) | Colluvium (Qssh) Shirley Formation (Qsh) Chuckatuck Formation (Qc) Colluvium (Qsc) Charles City Formation (Qcc) | ***Qssh*** contains massive, poorly sorted cobbles, pebbles, sand, and boulders in a finer grained matrix. Grades into ***Qsh*** which is composed of 10–20 m (33–66 ft) of fine to coarse sand with local pebble and boulder lenses grading upwards to silty beds. Unit appears light to medium gray and yellowish gray in outcrop. Locally, unit underlies terraces of Popes Creek and contains planar beds and bar deposits. ***Qc*** consists of gravelly sand, sandy silt, and clay all of which contain crossbeds. Unit appears light to medium and yellowish gray weathering orangish. Locally ***Qc*** is 5–15 m (16–49 ft) thick and grades into the cobbles, pebbles, boulders and jumbled sand of ***Qsc*** to ***Qcc***. ***Qcc*** is comprised of an upward fining sequence with basal coarse gravels and sands grading up to medium to fine sands, silts, and clays in defined beds. Unit forms terraces along major rivers as high as 28 m (92 ft) that appear dark yellowish orange and yellowish brown on weathered surfaces. Local thickness of ***Qcc*** is up to 10 m (33 ft). | Low | ***Qssh*** is associated with slope deposition. Avoid most terraced deposits for heavy development due to instability of slopes and high permeability, heterogeneity and unconsolidated nature of units may render them unstable for foundations and susceptible to gullying. | Unit thickness and presence along upper valley areas may increase likelihood of slope instability and mass wasting, units erode easily creating locally undercut areas susceptible to slides | Recent remains possible, coral *Astrangia* in ***Qsh***, peat plugs | May contain artifacts and ancient campsites | Sand, gravel, silt, clay, pebbles, peat; iron oxide cemented horizons | Upper deposits support hardwood forests | Suitable for most recreation unless high, undercut slopes are present | Units record fluvial deposition throughout the Late Pleistocene, *Astrangia* yielded a Uranium-Thorium radiometric date of 184,000 ± 20,000 years. ***Qsh*** is part of a bay mouth bar deposit across the mouth of the Popes Creek proto-estuary. ***Qc*** contains mid-level estuarine terraces channeled into into ***Qcc*** that contains a former sand spit. |
| QUATERNARY AND (OR) TERTIARY | Colluvium (QTc) Windsor Formation (QTw) | ***QTc*** consists of gravel, sand and silt in lenticular deposits on local slopes and ridge tops 9–15 m (30–49 ft) thick. Elevation ranges from 10–24 m (33–79 ft). ***QTw*** contains 12 m (39 ft) of yellowish gray to reddish brown sand, gravel, silt, and clay interbeds present as terraces from 30.5 to 35 m (100 to 115 ft) in elevation. Clasts are vein quartz, quartzite, red mudstone, basalt, diabase, gneiss, and schist. | Low | Suitable for light development, avoid for waste water treatment facility development due to high permeability | Colluvium is associated with slope processes. Heterogeneous nature of units may render them unstable on slopes; units are prone to gullying, especially at higher levels. | Plant fragments and recent remains possible | May contain artifacts | Sand, gravel, clay, pebbles, silt, boulders; many interesting cobbles transported great distances including greenstone, quartzite, vein quartz, phyllite, and schist | Units support upland forest areas along waterways | Suitable for light recreation unless highly gullied and/or undercut on a slope | Units record the movement of waterways and slope development across the landscape throughout the Tertiary–Quaternary transition |
| TERTIARY (PLIOCENE) | Moorings Unit of Oaks and Coch (1973) (Tm) Upper Chesapeake Group (Tuc) Bacons Castle Formation (Tb) Sand and gravel (Tps) Middle Chesapeake Group (Tmc) Yorktown Formation (Ty) | ***Tm*** contains quartzose sand and sandy gravel with cobbles, pebbles, and boulders present locally. Unit ranges in thickness from 3 to 9 m (10 to 30 ft) and appears white to grayish yellow in outcrop on high-level terraces. ***Tuc*** contains the fluvial sand and gravel of ***Tb*** and ***Ty***. ***Tb*** is a series of upward fining fluvial sequences with medium to coarse gravelly sand grading upward to thick bedded massive sand, silt and clay. Unit weathers gray to orangish. ***Tps*** is interlayered gravelly sand, sandy gravel, and fine to coarse sand with local trough crossbeds and yellowish orange appearance up to 18 m (59 ft) thick. ***Ty*** contains sand and gravel and is planar to crossbedded, poorly to well-sorted clay, with sand, and silt layers as interbeds. Unit contains a cap of fluvial sand and gravel with crossbeds and scour channels | Moderately low | Suitable for most development, avoid pebbly channelized layers for waste treatment facilities and avoid expandable clay rich layers for road and trail development | Massive bedding may be prone to large block slides when units are undercut along rivers and gullies. Clay rich layers provide slip surfaces when water saturated. | *Chesapecten jeffersonius*. Gastropod *Turritella plebia*, bivalves including *Isognomon* sp., *Dallarca* sp., *Ostrea compressirostra*, etc. Diatoms (including *Rhaphoneis diamantella*), fish and shark teeth, mollusk shell molds, burrows, scales, shell fragments, lignitized wood, silicoflagellates, dinocysts, plant remains among many others | Sharks teeth fossils may have been used as tools. Kaolinite may have been used for painting and dyes, chert may have provided tool material, iron oxide nodules may have prompted early smelting interest | Gravel, sand, kaolinitic clay (diatomaceous and expandable), pebbles, cobbles, phosphate pebbles; kaolinite, quartzite vein quartz, chert, iron oxide, and crystalline etched pebbles | Units cap higher hills supporting ridgetop forests | Good for most recreation unless clay rich layers are primary sediment type present | Units record Miocene age marine depositional environments, ***Tm*** was deposited in a fluvial and estuarine environment. ***Tps*** records regional paleovalleys such as the Bowling Green. ***Ty*** records a large scale regression during the upper Pliocene. *Chesapecten jeffersonius* is the state fossil of Virginia. |
| TERTIARY (MIOCENE) | Lower Chesapeake Group (Tlc) Eastover Formation (Te) Choptank Formation (Tch) Calvert Formation, undivided (Tc) | ***Tlc*** contains well-sorted marine shelf sands, silts, and clays of ***Te*** and ***Tch***. ***Te*** contains very fine to fine quartz sand with shelly layers, and clay to silt rich interbeds. Unit appears dark gray to bluish and weathers to a greenish yellow and is 3–12 m (10–39 ft) thick. ***Tch*** is fine to medium-grained sand with some clay and silt rich beds most of which are bioturbated. Some chalky, shell rich layers locally as well as phosphatic sands. Unit is as much as 38 m (125 ft) thick and appears dark to olive gray and weathers yellow and green. ***Tc*** is mostly fine to very fine quartzose sand with some variable silt and clay layers. Thickly bedded with mappable sand-silt-clay sequences. In outcrop unit appears grayish olive, light gray to white, pinkish gray and pale yellowish orange. | Moderately low | Avoid chalky layers and phosphatic sand layers for development. | Clay rich beds may provide slip surfaces for coarser grained blocks above. Massive bedding may be prone to large block slides when units are undercut along rivers and gullies. | Molluscan gastropod *Turritella plebi*, bivalves including *Isognomon* sp., *Dallarca* sp., *Ostrea* "*compressirostra*," *Chesapecten middlesexensis*, *Placopecten princepoides*, *Mercenaria* sp., and *Dosinia acetabulum*, "*Spisula*" *rappahannockensis*, common shark teeth and marine mammals | Sharks teeth fossils may have been used as tools. | Phosphatic sand, chalk, sand, clay, silt | None documented | Suitable for most forms of recreation | ***Te*** records Miocene shallow marine shelf, muddy deposition environments. |
| TERTIARY (EOCENE) | Nanjemoy Formation, undivided (Tn) | Unit contains 1 to 33 m (3 to 108 ft) thick of yellowish brown (weathered) to dark olive gray, greenish gray and olive black glauconitic quartz sand. Present in layers are fine to coarse, clayey and silty, micaceous and shelly interbeds of silty and sandy clay. Glauconite content locally approaches 40% of total rock. Bedding is mostly obscured by pervasive burrowing. | Moderately low | Suitable for most forms of development, high permeability may be unsuitable for septic systems | Glauconite cemented sand may slide off slopes in large blocks or sheets, especially if water saturated | Unit is bioturbated, contains shell fragments, mollusks including: *Venericardia poapacoensis*, *V. ascia*, *Macrocallista sumimpressa*, *Corbula aldrichi*, *Lucina dartoni*, *Lunatia* sp., *Cadulus* sp., clam shells, pollen, dinoflagellates, foraminifers, ostracodes | Iron sulfide concretions may have provided fire making materials | Sand, gravel, silt, clay, glauconite; iron sulfide nodules | None documented | Suitable for most forms of recreation unless very clay rich layers are present | Unit records Eocene marine depositional environments |

# Map Unit Properties Table – Thomas Stone National Historic Site

Colored rows indicate units mapped within Thomas Stone National Historic Site.

| Age | Unit Name (Symbol) | Features and Description | Erosion Resistance | Suitability for Development | Hazards | Paleontological Resources | Cultural Resources | Mineral Occurrence | Habitat | Recreation | Geologic Significance |
|---|---|---|---|---|---|---|---|---|---|---|---|
| QUATERNARY (HOLOCENE) | artificial fill (af) | Mix of boulders, rip rap, unsorted fill and other materials associated with coastal features, possibly jetties and other urban development | Moderate | Units are used for shoreline anchoring, avoid for development | Units are intended to anchor shoreline areas, but may shift during heavy storms | None documented | May contain modern artifacts and information about historic shoreline evolution | None documented | Shore bird habitat | Not suitable for recreation | Unit attests to the struggle to maintain shoreline areas prone to rapid change |
| QUATERNARY (HOLOCENE) | Sand (Qs) Marsh deposits (Qm) Swamp deposits (Qsw) Marsh and swamp deposits (Qmsw) | ***Qs*** contains 2–8 m (7–26 ft) thick of pale gray to light yellowish gray sand deposits in poorly sorted to well-sorted beds. Grain size ranges from fine to coarse and locally unit contains shell fragments and mollusk valves. Unit may include narrow beach sediments and sand bars and spits. ***Qm*** contains less than 6 m (20 ft) thick of soft mud and muddy sand. Unit is medium to dark gray with some brownish peaty layers of mud and sand. ***Qsw*** is comprised of a veneer of mud, muck and muddy sand. Unit contains abundant decaying leaf and stem material rendering the color brownish gray to grayish black. | Very low | Avoid marsh and stream edge/riparian areas for heavy development, especially for wastewater treatment facilities due to proximity to water and high permeability; the unconsolidated and transient nature of the deposits hinder establishment of permanent infrastructure or trails. | ***Qs*** is associated with natural levees between the regional Rappahannock River and marsh and swamp areas as well as riparian zone areas and is associated with slumps and rapid erosion | Reworked shell fragments and whole mollusk valves, fresh to brackish water mollusks, rushes and grasslike plant fragments, leaf, stem and tree trunk material | May contain artifacts and/or settlement sites along major waterways | Sand, gravel, silt, clay, peat | Riparian zones and burrow habitat, beaver habitat, shore and marsh bird habitat in rush area | ***Qs*** is suitable for some trail development | ***Qs*** contains a record of modern stream valley development throughout the Quaternary |
| QUATERNARY (HOLOCENE & PLEISTOCENE) | Alluvium (Qal) | Unit is as much as 15 m (49 ft) thick and composed of a mixture of sand, gravel, silt and clay present in interbedded channel, point-bar, and flood plain areas. Locally unit contains glauconite and pebbly sand. Clasts are primarily vein quartz, quartzite, and metamorphic rocks in well stratified to massive beds that appear heterogeneous and medium gray, tan, or brown to yellowish gray in outcrop. | Very low | Avoid most alluvium deposits for heavy development due to instability of slopes and high permeability as well as proximity to fragile riparian stream areas | Units are associated with stream edge slopes and prone to rapid erosion and slumping | Organic debris including leaves, logs, twigs, peat layers, other recent remains | May contain artifacts and/or settlement sites along major waterways | Cobbles, gravel, sand, clay, peat, silt | Underlies verdant marsh areas and floodplain and riparian habitat | Avoid areas near slopes due to likelihood of failure | Unit records streambed and overbank deposition along major waterways for the past 10,000 years |
| QUATERNARY (PLEISTOCENE) | Tabb Formation, Sedgefield Member (Qts) Maryland Point Formation, unit 1 (Qmp1) unit 2 (Qmp2) | ***Qts*** contains as much as 15 m (49 ft) of crossbedded sand grading upward to sandy and clayey silt. Appears pale gray to medium and yellowish gray with some pebbles and boulders present locally. ***Qmp1*** contains terrace deposits reaching 6.5 m (21 ft) in altitude of fine to medium grained, poorly to moderately well sorted gray sand with clayey and silty layers present locally. ***Qmp2*** contains 14 m (46 ft) of gray sand that weathers orangish in outcrop. Some silty clay interbeds between fine to coarse, poorly to well-sorted massive sands. | Low | Avoid for most development due high permeability as well as proximity to water as high terraces that may be undercut and unstable | Presence of unconsolidated unit as terraces may be prone to mass wasting and slumping along major rivers | Diatoms, oyster (*Crassostrea virginica*), abundant plant fragments | May contain artifacts | Clay, sand, gravel, pebbles | Burrow habitat | Units should be avoided for heavy development due to the instability of terrace deposits | Unit contains record of a brackish water depositional environment during the Pleistocene |
| QUATERNARY (PLEISTOCENE) | Alluvial terrace deposits (Qatu) Shirley Formation, unit 1 (Qsh) Omar Formation (Qo) Charles City Formation (Qcc) Chicamuxen Church Formation (Qcm) | ***Qatu*** contains 1 to 6 m (3–20 ft) thick interlayered sand, clayey sand, gravel, silt, and clay on low level terraces. Unit appears tan, brown and gray in outcrop with massive to lenticular bedding. Some colluvium present locally. ***Qsh*** is composed of 10–20 m (33–66 ft) of fine to coarse sand with local pebble and boulder lenses grading upwards to silty beds. Unit appears light to medium gray and yellowish gray in outcrop. ***Qo*** contains basal gravels grading upwards into fine sand, and sandy silt and clay. Weathers to a yellowish gray to reddish brown and is as much as 15 m (49 ft) thick. ***Qcc*** is comprised of an upward fining sequence with basal coarse gravels and sands to medium to fine sands, silts, and clays in defined beds. Unit forms terraces along major rivers as high as 28 m (92 ft) that appear dark yellowish orange and yellowish brown on weathered surfaces. ***Qcm*** contains coarse gravelly sand with clay-silt interbeds grading upward to clayey and silty fine sand. Unit is 11–17 m (36–56 ft) thick and weathers to a grayish yellow, orangish to brown color. | Low | Avoid most alluvial terrace deposits for heavy development due to instability of slopes and high permeability, heterogeneity and unconsolidated nature of units may render them unstable for foundations and susceptible to gullying. | Unit thickness and presence along upper valley areas may increase likelihood of slope instability and mass wasting, units erode easily creating locally undercut areas susceptible to slides | Recent remains possible, coral *Astrangia* in ***Qsh***, peat plugs | May contain artifacts and ancient campsites | Sand, gravel, silt, clay, pebbles, peat | Upper deposits support hardwood forests | Suitable for most recreation unless high, undercut slopes are present | Units record fluvial deposition throughout the Late Pleistocene, *Astrangia* yielded a Uranium-Thorium radiometric date of 184,000 ± 20,000 years. ***Qo*** contains fluvial-estuarine terrace remnant |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| QUATERNARY AND (OR) TERTIARY | Windsor Formation (QTw) Ravens Crest Formation (QTr) | ***QTw*** contains 12 m (39 ft) of yellowish gray to reddish brown sand, gravel, silt, and clay inter beds present as terraces from 30.5 to 35 m (100 to 115 ft) in elevation. Clasts are vein quartz, quartzite, red mudstone, basalt, diabase, gneiss, and schist. ***QTr*** is composed of gravelly sand interlayered with sand and clay. Unit is coarse to fine grading upward to silty and clayey sand and weathers to pink, pale brown, and yellowish orange. Larger clasts are gneiss, schist, sandstone, red mudstone, and quartzite. | Low | Suitable for light development, avoid for waste water treatment facility development due to high permeability | Heterogeneous nature of units may render them unstable on slopes, units are prone to gullying, especially at higher levels. | Plant fragments and recent remains possible | May contain artifacts | Sand, gravel, clay, pebbles, silt, boulders; some interesting cobbles transported great distances | Units support upland forest areas along waterways | Suitable for light recreation unless highly gullied and/or undercut on a slope | Units record the movement of waterways across the landscape throughout the Tertiary–Quaternary transition |
| TERTIARY (PLIOCENE) | Moorings Unit of Oaks and Coch (1973) (Tm) Upland gravel 4 (Tug4) Calvert Formation, undivided (Tc) | ***Tm*** contains quartzose sand and sandy gravel with cobbles, pebbles, and boulders present locally. Unit ranges in thickness from 3 to 9 m (10 to 30 ft) and appears white to grayish yellow in outcrop on high-level terraces. ***Tug4*** is composed of 21 m (69 ft) of sand, pebbly sand, and gravel interbedded and capped by a sandy loam. Coarser beds grade upward to fine silty sand and lenticular layers of silty clay and sandy silt that is gray to pink in color. Unit weathers to a grayish yellow and orange color. ***Tc*** is mostly fine to very fine quartzose sand with some variable silt and clay layers. Unit is thickly bedded with mappable sand-silt-clay sequences. In outcrop unit appears grayish olive, light gray to white, pinkish gray and pale yellowish orange. | Moderately low | Suitable for most development, avoid pebbly layers for waste treatment facilities and avoid expandable clay rich layers for road and trail development | Massive bedding may be prone to large block slides when units are undercut along rivers and gulleys. Clay rich layers provide slip surfaces when water saturated. | Diatoms (including *Rhaphoneis diamantella*), fish and shark teeth, mollusk shell molds, burrows, scales, shell fragments, lignitized wood, silicoflagellates, dinocysts, plant remains | Kaolinite may have been used for painting and dyes, chert may have provided tool material | Gravel, sand, kaolinitic clay (diatomaceous and expandable), pebbles, cobbles, phosphate pebbles; kaolinite, quartzite and crystalline etched pebbles | Units cap higher hills supporting ridgetop forests | Good for most recreation unless clay rich layers are primary sediment type present | Units record Miocene age marine depositional environments, ***Tm*** was deposited in a fluvial and estuarine environment |
| TERTIARY (EOCENE) | Nanjemoy Formation, undivided (Tn) | Unit contains 1 to 33 m (3 to 108 ft) thick of yellowish brown (weathered) to dark olive gray, greenish gray and olive black glauconitic quartz sand. Present in layers are fine to coarse, clayey and silty, micaceous and shell rich interbeds of silty and sandy clay. Glauconite content approaches 40% of total rock locally. Bedding is mostly obscured by pervasive burrowing. | Moderately low | Suitable for most forms of development, high permeability may be unsuitable for septic systems | Glauconite cemented sand may slide off slopes in large blocks or sheets, especially if water saturated | Unit is bioturbated, contains shell fragments, mollusks including: *Venericardia poapacoensis*, *V.ascia*, *Macrocallista sumimpressa*, *Corbula aldrichi*, *Lucina dartoni*, *Lunatia* sp., *Cadulus* sp., clam shells, pollen, dinoflagellates, foraminifers, ostracodes | Iron sulfide concretions may have provided fire making materials | Sand, gravel, silt, clay, glauconite; iron sulfide nodules | None documented | Suitable for most forms of recreation unless very clay rich layers are present | Unit records Eocene marine depositional environments |
| TERTIARY (PALEOCENE) | Marlboro Clay (Tm) | Unit is a conspicuous layer of dense gray clay and yellow silt rich clay with lenses of silt present locally. It appears brittle or slightly plastic with fine laminations and other massive areas and weathers to a reddish or brownish gray. Lignitic silt interbeds show micaceous partings. Unit thickness ranges from 1 to 10 m (3 to 33 ft). | Moderately low | Avoid for most development as unit is slippery on slopes and acts as an aquitard locally | Unit may precipitate mass wasting on slopes when water saturated | Lignitic coal remains, small mollusks, foraminifera, calcareous nannoplankton, dinoflagellates | Clay may have been used to make pots, paint | Clay, lignite | None documented | Unit makes a slippery trail base, avoid for most recreation development | Unit is a widespread marker bed, conspicuous in the regional stratigraphic column and records a very shallow marine or brackish water tidal flat environment |
| TERTIARY (PALEOCENE) | Aquia Formation (Ta) | ***Ta*** is as much as 35 m (115 ft) thick and is nearly massive micaceous glauconitic quartz sand. Unit contains 5 to 30% glauconite and locally some very micaceous layers. Thickly bedded, fine to medium sands are interlayered with some clay and silt rich beds, as well as lenses of carbonaceous sands and shell rich limestone. Fresh surfaces are dark olive gray and greenish black, whereas weathered exposures are tan to yellowish gray to brownish orange (in patches or mottles). Unit supports an important freshwater aquifer. | Moderately low | Suitable for most forms of development unless highly permeable layers are present, or significant heterogeneity exists locally which may cause unit to be unstable. | Glauconite cemented sand may slide off slopes in large blocks or sheets, especially if water saturated or undercut by poorly consolidated shelly layer | Mollusks (*Cucullaea gigantea*, *Ostrea alepidota, Crassatellites* sp., and *Dosiniopsis* sp), *Ophiomorpha*-type burrows, gastropod *Turitella mortoni*, bivalves *Ostrea sinuosa*, *Crassatellites alaeformis*, and *Cucullaea* sp., foraminifera, dinocysts, nannofossils, pollen, burrows, molds and casts of pelecypods, taeniodont molar fragment | None documented | Sand, glauconite, silt, clay, ilmenite | Poor cementation may provide burrowing habitat | Suitable for most forms of recreation unless very clay rich layers are present | Unit records shoaling water and shallow marine shelf deposition (probably less than 70 m [230 ft] of water) during the Paleocene |