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SUMMARY OF PROPERTIES OF BEDROCK TYPES

ELLINGTON QUADRANGLE, CONNECTICUT

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This table describes some of the important physical properties of bedrock exposed in the Ellington quadrangle. Geologic characteristics of the lithologic units are described in general terms. As used here, these terms do not always follow strict geologic definitions.

Bedrock properties, unless otherwise noted, apply to intact rock. However, joints, fractures, and faults resulting from various episodes of deformation are common in most rocks within the quadrangle. Open fissures along these structural features constitute a major limiting factor to the strength and tightness of bedrock in most exposures. Local abundance and orientation of these features must be included in evaluation of bedrock properties.

	SITE UTILITY AND MATERIALS USE				GEOLOGIC DESCRIPTION		
BEDROCK TYPE (Keyed to Plate I)	**DEEP EXCAVATIONS** tunnels, large masonry dams, high-rise and underground buildings, deep bridge abutments	**SHALLOW EXCAVATIONS** highway cuts, bridge abutments and piers, small dams and buildings	**TRANSMISSIVITY IN BEDROCK** Ability of the rock to transmit water. Water movement may differ in different directions; most water yield from fractures. Water quality may vary depending upon human activities.	**MATERIALS** facing stone, dimension stone, rip rap, aggregate, fill, flagstone	**LITHOLOGY**	**PLANES OF WEAKNESS** Refers to partings parallel to foliation and bedding and to joints intrinsic to the bedrock type - in massive rock, three mutually perpendicular joint sets; in layered rock, the back joint and end joint. The back joint is approximately at right angles to the dip of layering; the end joint is nearly vertical and perpendicular to the back joint. Does not include joints, fractures and fissures related to faulting. For location of prominent zones of rock weakened by faulting see Plate II.	**WEATHERING** Bedrock beneath surficial deposits is largely nonweathered although local occurrences of deeply weathered bedrock have been noted in some areas. Weathering since the last ice advance consists mostly of incipient mineral disintegration on exposed surfaces, with deepest penetration along planes of weakness.
METAMORPHIC							
Massive Gneiss	Fresh intact rock requires drilling and blasting. Rock is hard and tough but homogeneity of rock facilitates excavation operations; will stand without support in tunnels and deep excavations. Joints widely spaced and mostly tight at depths greater than 200 feet.	Characteristics similar to that for deep excavations, but unloading at shallow depth increases frequency and continuity of open joints and causes spalling. Slight weathering induces intergranular differential expansion between mineral grains; tendency for exfoliation and granulation of surface.	Little or no water yield except where severely fractured in fault zone or in areas of closely spaced joints. **Rapid surface run-off.** Low potential for movement of liquids in non-fractured rock.	Mostly suitable for dimension stone; is uniformly textured rock cut by widely-spaced through-going joints. Dark-gray, fine-grained type most suitable for crushed stone aggregate. Lighter-gray coarser gneiss generally more difficult to crush and less resistant to abrasion. Dark-gray type most suitable for rip rap because of higher specific gravity.	Weakly foliated, granular rock, characterized by weakness of compositional layering and by homogeneity of composition and texture. Granular minerals, such as quartz and feldspar, dominant. Flaky or rod-shaped minerals, such as mica and hornblende, generally amount to less than 10 percent; these are preferentially oriented, evenly distributed, and occur in thin layers in amounts less than 5 percent.	Chiefly widely spaced (2-10 ft.) joints occurring in three sets roughly at right angles to each other. Joints commonly are irregular discontinuous fractures.	Largely mechanical disintegration owing to differential properties of mineral grains. Results in granulated outcrop surfaces and only shallow penetration. Common weathering product is coarse to fine sand.
Layered Gneiss	Same as massive gneiss	Similar to massive gneiss. Slight weathering causes incipient parting along foliation surfaces rich in flaky or rodded minerals.	Similar to massive gneiss	Similar to massive gneiss	Foliated granular rock in which aggregate composition is homogeneous but characterized py planes or warped surfaces (layering) less than 2 ft. apart and generally on a scale of less than one to six inches. Preferentially oriented flaky or rod-shaped minerals generally amount to less than 10 percent, but are concentrated in layers (color banding).	Back joint and end joint prominent. The shapes of natural outcrops commonly are determined by these two joint sets and their spacing. Partings parallel to layering are less prominent than joints.	Similar to massive gneiss except for noticeable deeper penetration of weathering effects locally between bands or layers of dissimilar composition.
Platy Schist	Similar to massive gneiss except platyness of rock may cause unpredicted problems of excavation. Slightly greater overbreak potential and possibility of water inflow along foliation partings than in gneiss units above.	Partings tend to open along foliation planes in slightly weathered rock; exposed rock may scale, particularly in zone of fluctuating water table. Alternate freeze-thaw action tends to open seams along joints and foliation surfaces.	Moderate ~~to excellent~~ water yield as deep as 400 feet where joints and foliation surfaces are sufficiently open and closely spaced to provide capacity. Near surface leakage of solid-waste leachate and liquid waste likely to move down dip.	Fresh rock suitable for fill or rip rap. Where weathered sufficiently to work with power shovel, useful as borrow for fill. Possible use as flagstone if esthetically suitable.	Fine-grained granular foliated rock characterized by layering less than 1/16 in. thick. Flaky and rod-shaped minerals, preferentially oriented parallel to foliation, amount to more than 10 percent. Foliation generally is parallel to layering (banding). Ease of parting parallel to foliation determines the degree of inhomogeneity of rock.	Back joints and end joints prominent, but greater tendency than layered gneiss to part along foliation surfaces and layering. Planes inconspicuous in fresh, intact rock except that color banding may define foliation and layering.	Weathering creates incipient parting along surfaces of foliation and layering. Conspicuous brown and orange stains may extend to depths of several tens of feet along steeply dipping foliation surfaces rich in flaky or rod-shaped minerals.
Mica-rich Schist	Similar to platy schist but micaceous minerals may clog drilling bits. In addition represents potential squeezing ground in tunnel as friction resistance may be extremely weak owing to water inflow along foliation partings.	Hydration of mica-rich layers greatly decreases coefficient of friction along parting surfaces so that rock slabs will slide down dip.	Ground water potential similar to that of platy schist. Tendency for leakage of liquid pollutants down dip of foliation.	Similar to platy schist	Strongly foliated rock characterized by the presence of flaky minerals (mica) sufficiently coarse and abundant to form continuous sheets along foliation surfaces. Flaky and rod-shaped minerals amount to more than 20 percent and occur as lamination on folia or in layers 1/64 to 6 in. thick. Rock commonly ribbed by more resistant granular layers and lenses.	Layering in fresh rock commonly manifested by distinctive variations in composition. Planes of weakness conspicuous along mica-rich layers. Back joint and end joint sets, which determine the shapes of outcrops, also prominent.	Weathering along mica-rich layers cause separation and discoloration to depths of several tens of feet. More susceptible to deeper penetration of weathering than platy schists under comparable conditions.
Sulfidic Schist	Similar to mica-rich schist except that oxidation and hydration of sulfide bearing layers tends to weaken the rock rapidly after exposure to air and circulating waters. Formation of sulfuric acid may cause pollution where air circulation is restricted.	Severe slaking as a result of brief exposure creates unstable rock faces along which massive sliding may occur where rocks dip into excavation.	Water supply at relatively shallow depth likely to be moderate but invariably rusty and commonly has strong sulfur taste. Greater problem with leakage of liquid pollutants than in mica-rich schist.	Unsuitable for most uses because of slaking characteristics.	Strongly to weakly foliated rock characterized by the presence of sulfide. Sulfide generally amounts to less than one percent; it may occur as discrete crystals as much as 1 mm dia., but is more common as thin films associated with flaky mineral in mica-rich schists.	Pattern of incipient planes of weakness same as mica-schist; determined by features other that presence of sulfide.	Sulfide-bearing rocks are most susceptible to weathering. Hard fresh intact rock containing sulfide may weather along composition layers and joints, producing incoherent rubble in a period of several months. Concentration of sulfide along mica-rich layers in amounts greater than 5 percent promotes slaking and formation of bright yellow efflorescence.
Quartzite	Fresh intact quartzite extremely competent and hard, but rock is greatly weakened by soft mica-schist laminae and layers. Strata inclined into excavations are subject to sliding down dip.	Same as mica-rich schist but slabs are more coherent and larger.	Similar to platy schist; where competent rock is highly fractured may act as aquifer between less fractured schist.	Excellent for flagstone and facing stone where joints are not closely spaced. Difficult to crush for aggregate. Suitability for concrete aggregate is impared by presence of micaceous minerals.	Hard, competent rock composed almost entirely of interlocking quartz grains. Occurs mostly in layers 1-6 in. thick; separated by mica-rich laminae or layers as much as 1 ft. thick.	Prominent parting along layers. Conspicuous back joints, and end joints; frequency roughly inversely proportional to thickness of layers.	Extremely resistant to weathering; forms hogback ridges. Strong contrast in weathering susceptibility between quartzite and mica-rich schist interlayers. Where quartzite layers are thin and joints closely spaced, quartzite tends to break down into rubble of angular quartzite fragments.
SEDIMENTARY							
Sedimentary Rocks, general	Fresh intact rock requires drilling and blasting; moderately difficult to excavate. Slope instability dependent upon frequency and attitude of clay-rich interbeds.	Cuts in weathered rock tend to crumble and exhibit poor slope stability where dips are greater than 30 degrees into excavation. Strong susceptibility to sliding along clay-rich partings particularly after heavy rain when pore-water pressures are increased and shear resistance along clayey layers is reduced.	Generally good water storage capacity and good potential for artesian aquifers in these gently dipping beds of alternating permeable and impermeable rock. High potential for pollution leakage controlled largely by dip of bedding.	See below	See below	Bedding planes commonly planes of weakness, particularly between beds of contrasting grain size. Two conspicuous joint sets roughly perpendicular to bedding commonly intersect at angles between 60 and 85 degrees.	Clay matrix tends to disaggregate where exposed to repeated wetting and drying, and freezing and thawing. Deep penetration occurs only along contacts between dipping beds of contrasting grain size and along open joints.
Conglomerate	Contrasting competence of crystalline clasts and weakly-bonded matrix induces mechanical disintegration under differential stress.	Tends to disaggregate to gravel on weathering; conglomerate blocks may slide as coherent mass on clay-rich layers.	Same as general statement (Sedimentary rocks) above	Possible use for crushed stone, but contains wide variety of stones some of which may be undesirable. Matrix fines also undesirable and commonly must be washed out.	Clastic rock containing at least 50 percent clasts greater than 1 cm diameter. Commonly in lenticular beds 1 in. to 5 ft. thick. Clasts mostly quartz and feldspar but include shale and metamorphic rock fragments. Matrix generally well-graded sand, silt and clay.	Widely spaced irregular joints. Partings parallel to bedding, weak or absent.	Weathers readily to gravel by disaggregation of matrix between pebbles and cobbles.
Sandstone	Will stand with minimal support and low overbreak potential where clayey interlayers are rare or absent.	Massive beds stand up moderately well in weathered exposures.	Most abundant water at depths of less than 400 feet from closely spaced parting along bedding planes and joints.	Suitable for dimension stone where thickly bedded. Easily cut with diamond saw. Adequate for rock fill especially where weathered sufficiently to work with heavy equipment.	Clastic rock including pebbly sandstone consisting chiefly of sand grains 0.1-2mm diameter. Bedding commonly differentiated by variation in grain size. Beds range in thickness from a fraction of an inch to several feet.	Closely spaced jointing and bedding commonly give exposures a blocky appearance.	Generally more resistant to weathering than conglomerate because of more uniform grading of material. Disaggregation occurs at a slower rate.
Siltstone and Shale	Moderate ease of excavation but ~~where abundant,~~ clayey material may clog drilling bits. Low frictional resistance favors squeezing and swelling ground. Beds may bow out in tunnels; excessive overbreak potential may prevent adequate rock bolt anchorage.	Exposures generally scale severely and beds are prone to sliding when wet even at very low dips.	Commonly contains impervious layers which may be sufficiently extensive to confine large artesian water supply down dip in more porous conglomerate and sandstone.	Unsuitable for most uses. May be used as fill, except water sorption capacity commonly too high.	Fine grained clastic rock composed chiefly of particles less than 0.1 mm diameter. Beds range in thickness from laminations to several feet.	Fissility produced by thin bedding and lamination. Closely spaced joints common.	Swelling and shrinking of micaceous materials facilitates disaggregation.
OTHER							
Diabase	Fresh intact rock excavated with difficulty; will stand vertically without support in tunnels and in deep excavations.	More resistant to surface weathering than adjacent rock types. Closely spaced open joints, common at shallow depths, facilitate excavation. Vertical contacts and near horizontal joints provide excellent slope stability in excavations. Tendency to break along contacts and joints may cause overbreak or underbreak.	Not an aquifer because of narrow width, vertical attitude, and infrequency of open joints at depths greater than 50 feet. Can act as a barrier to ground water circulation or to passage of liquid pollutants.	Excellent for crushed stone and aggregate, but narrow width and vertical attitude of unit limits available tonnage.	Dense, very hard non-foliated fine grained rock; rings when fresh rock struck with hammer.	Three mutually perpendicular joint sets, one of which parallels border of unit. Joint spacing roughly decreases with thickness of unit. Rock tends to break into oblong blocks.	Rock is strongly resistant to weathering but commonly forms 1 cm thick grayish-brown rind on exposed surfaces. Because of blocky condition of exposed rock, it is easy to quarry.
Silicified Rock	Fresh intact rock hard and brittle but usually occurs in broken ground of fault zone that requires continuous shoring in tunnel or excavation.	Same as for deep excavations except that weathering of enclosing broken ground more pervasive near surface.	Silicified rock itself is impervious, but it may be in fractured and faulted zone which ~~xxxxxxxxx~~ commonly is a high-yield source of water. If leachate from solid or liquid waste is channeled into zone it may contaminate water supply for considerable lateral distance.	No construction uses. Useful as a guide to metallic mineralization.	Angular rock fragments cemented by silica to form hard resistant rock.	Healed fault breccia generally fractured by later movement in fault zone.	Silicified rock is strongly resistant to weathering, but brecciated country rock in zone in which it occurs may be altered to great depth by circulating ground water and thermal solutions.

Connecticut (Ellington quad.). Lithology. 1:24,000. 1972.
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