SURVEY OF HIGHWAY CONSTRUCTION MATERIALS

IN THE TOWN OF HANCOCK, ADDISON COUNTY, VERMONT

Prepared by

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

ENGINEERING GEOLOGY SUBDIVISION

Montpelier, Vermont

January, 1980

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Acknowledgments

This project acknowledges the surficial geological information obtained from Professor D. P. Stewart of Miami University, Oxford, Ohio and the bedrock information from the Centennial Geologic Map of Vermont, C. G. Doll.

History

The Materials Survey Project was initiated in 1957 by the Vermont Department of Highways with the assistance of the Bureau of Public Roads to compile an inventory of highway construction materials in the State of Vermont. Previously, investigations for highway construction materials were conducted only as the immediate situation required and only limited areas were surveyed. Since no overall picture of material resources was available, highway contractors or resident engineers were required to locate the materials for their respective projects and the samples were tested by the Materials & Research Division. The additional expense of exploration for construction materials resulted in higher construction costs being paid by the State. The Materials Survey Project was formed to minimize this factor by enabling the State and the contractors to use available information on material resources and to project cost estimates. Knowledge of locations of suitable materials is an important factor in planning highways.

The sources of construction materials are located by this Project through ground reconnaissance, study of maps and aerial photographs, and geological and physiographic interpretation. Maps, data sheets and work sheets furnish information of particular use to contractors and construction personnel, and should be studied together for maximum benefit.

Enclosures

Included in this report are two surface-geology maps, one defining the location of tests on bedrock, the other defining the location of tests on granular materials. These maps are based on 15-minute or 7-½-minute quadrangles of the United States Geological Survey enlarged or reduced to 1:31250 or 1" = 2604'. The various rock formations and types are delineated on the Bedrock Map of the township. This information is obtained from: Vermont Geological Survey Bulletins, Vermont State Geologist Reports, United States Geological Survey Bedrock Maps, Centennial Geologic Map of Vermont, the Surficial Geologic Map of Vermont and other references.

The granular materials map shows areas of various types of glacial deposits (outwash, moraines, kames, kame terraces, eskers, etc.) which are potential sources of gravel and sand. This information was obtained primarily from a survey conducted by Professor D. P. Stewart of Miami University, Oxford, Ohio, who mapped the glacial features of the State of Vermont during the summer months from 1956 to 1966. Further information is obtained from the Soil Survey (Reconnaissance) of Vermont (conducted by the Bureau of Chemistry and Soils of the United States Department of Agriculture), available Soil Surveys of individual counties (by the Soil Conservation Service of the United States Department of Agriculture), Vermont Geological Survey Bulletins, United States Geological Survey Quadrangles, aerial photographs and other sources. The location of each test area is represented by a Map Identification Number.

This report contains data sheets with detailed information on each test taken in the Granular and Bedrock areas. Data is also used from an active card file compiled by the Materials & Research Division over a period of years. Some cards are not used because they are incomplete or have unusable information on the location of the deposit.

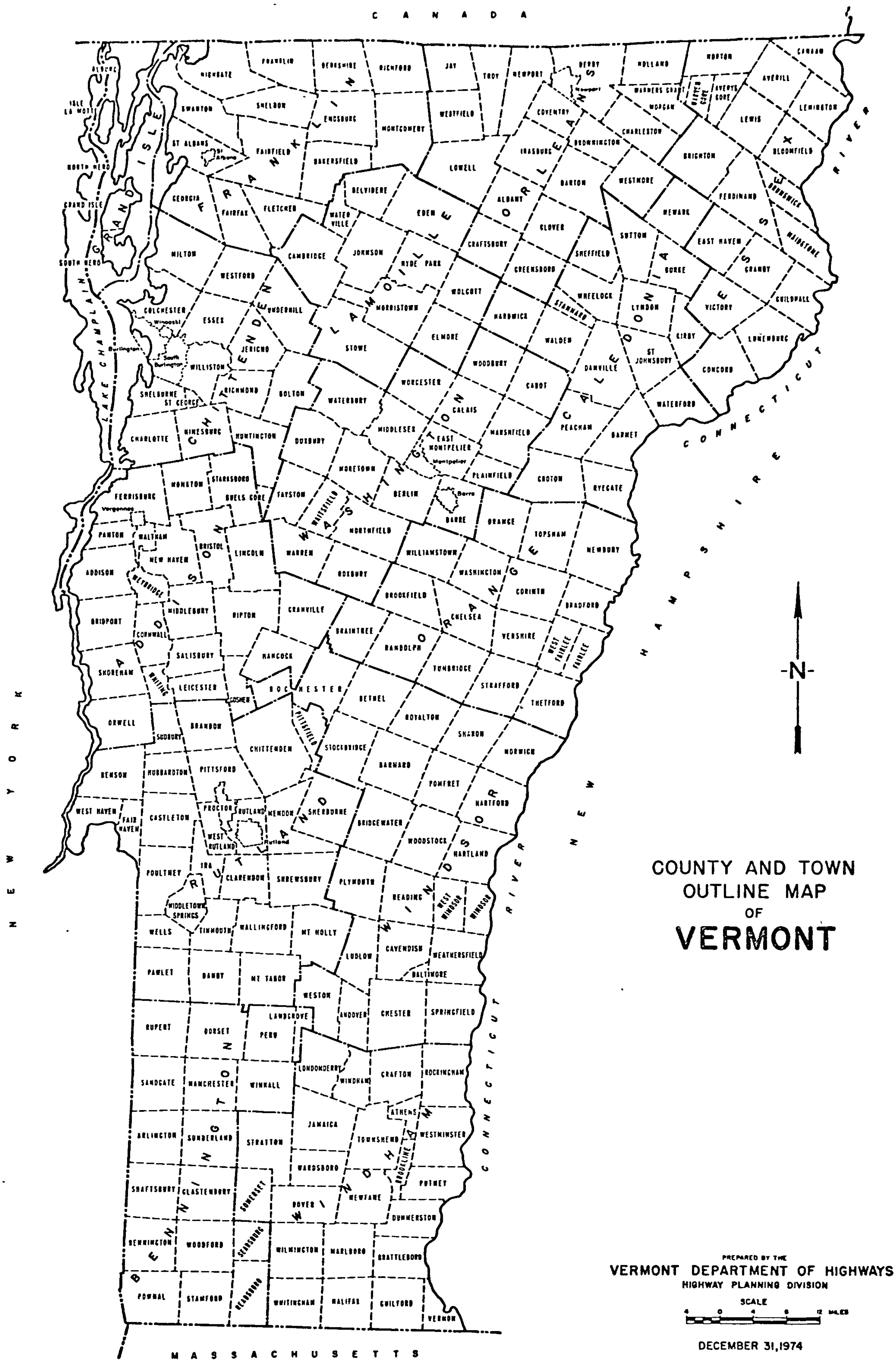
Work sheets containing more detailed information and a field sketch of the area, and laboratory test results are on file in the Materials & Research Division of the Agency of Transportation, State of Vermont.

LOCATION

The town of Hancock is in the southeast corner of Addison County in central Vermont. It is bounded on the northeast by Granville, on the east and south by Rochester, on the west by Goshen, and on the northwest by Ritpon. (see County and Town Outline Map of Vermont on the following page.)

Hancock is within the Green Mountains Physiographic Subdivision of the New England Upland. Its topography is characterized by steep-sided hills and mountains. Elevations vary from 3,300 feet at the summit of Worth Mountain, to 880 feet where the White River crosses the Rochester town line.

All of the town is in the White River drainage basin except the western edge which drains into the Otter Creek basin. The Hancock Branch and Tunnel Brook are White River tributaries in Hancock. Robins Branch and Piper, Taylor, Texas, and Tucker Brooks are tributaries of The Hancock Branch.



COUNTY AND TOWN
OUTLINE MAP
OF
VERMONT
PREPARED BY THE
VERMONT DEPARTMENT OF HIGHWAYS
HIGHWAY PLANNING DIVISION
SCALE
4 0 4 8 12 MILES
DECEMBER 31, 1974
-N-
CANADA
NEW YORK
MASSACHUSETTS
NEW HAMPSHIRE
CONNECTICUT RIVER
LAKE CHAMPLAIN
GRAND ISLE
FRANKLIN
ORLEANS
ESSEX
CALEDONIA
LAMOILLE
CHITTENDEN
WASHINGTON
ORANGE
ADDISON
RUTLAND
WINDSOR
BENNINGTON
WINDHAM
ALBURG
ISLE LA MOTTE
NORTH HERO
GRAND ISLE
SOUTH HERO
HIGHGATE
FRANKLIN
BERKSHIRE
RICHFORD
JAY
TROY
NEWPORT
DERBY
HOLLAND
NORTON
CANAAN
SWANTON
SHELDON
ENOSBURG
MONTGOMERY
WESTFIELD
COVENTRY
WARNERS GRANT
MORGAN
WARRENS GORE
AVERYS GORE
AVERILL
LEWIS
LEMINGTON
ST ALBANS
FAIRFIELD
BAKERSFIELD
LOWELL
IRASBURG
BROWNINGTON
CHARLESTON
BRIGHTON
BLOOMFIELD
GEORGIA
FAIRFAX
FLETCHER
BELVIDERE
EDEN
ALBANY
BARTON
WESTMORE
FERDINAND
BRUNSWICK
WATERVILLE
MILTON
CAMBRIDGE
JOHNSON
HYDE PARK
CRAFTSBURY
GLOVER
SUTTON
NEWARK
EAST HAVEN
MAIDSTONE
WESTFORD
WOLCOTT
GREENSBORO
SHEFFIELD
BURKE
GRANBY
COLCHESTER
Winooski
ESSEX
UNDERHILL
MORRISTOWN
HARDWICK
STANNARD
WHEELOCK
LYNDON
VICTORY
GUILDHALL
Burlington
South Burlington
WILLISTON
JERICHO
STOWE
ELMORE
WALDEN
KIRBY
LUNENBURG
SHELBURNE
ST GEORGE
RICHMOND
BOLTON
WATERBURY
WORCESTER
WOODBURY
CABOT
DANVILLE
ST JOHNSBURY
CONCORD
CHARLOTTE
HINESBURG
HUNTINGTON
DUXBURY
MIDDLESEX
CALAIS
MARSHFIELD
PEACHAM
BARNET
WATERFORD
EAST MONTPELIER
Montpelier
MORETOWN
PLAINFIELD
GROTON
RYEGATE
FERRISBURG
Vergennes
MONKTON
STARKSBORO
BUELS GORE
FAYSTON
WAITSFIELD
BERLIN
Barre
BARRE
ORANGE
TOPSHAM
NEWBURY
PANTON
WALTHAM
NEW HAVEN
BRISTOL
LINCOLN
WARREN
NORTHFIELD
WILLIAMSTOWN
ADDISON
WEYBRIDGE
ROXBURY
WASHINGTON
CORINTH
BRADFORD
BRIDPORT
MIDDLEBURY
RIPTON
GRANVILLE
BRAINTREE
BROOKFIELD
CHELSEA
VERSHIRE
WEST FAIRLEE
FAIRLEE
CORNWALL
SALISBURY
HANCOCK
RANDOLPH
TUNBRIDGE
SHOREHAM
WHITING
LEICESTER
GOSHEN
ROCHESTER
BETHEL
STRAFFORD
THETFORD
ORWELL
SUDBURY
BRANDON
PITTSFIELD
ROYALTON
SHARON
NORWICH
CHITTENDEN
STOCKBRIDGE
BENSON
HUBBARDTON
PITTSFORD
BARNARD
POMFRET
WEST HAVEN
FAIR HAVEN
CASTLETON
PROCTOR
RUTLAND
MENDON
SHERBURNE
BRIDGEWATER
HARTFORD
WEST RUTLAND
Rutland
WOODSTOCK
HARTLAND
POULTNEY
IRA
CLARENDON
SHREWSBURY
PLYMOUTH
READING
WEST WINDSOR
WINDSOR
MIDDLETOWN SPRINGS
WELLS
TINMOUTH
WALLINGFORD
MT HOLLY
LUDLOW
CAVENDISH
WEATHERSFIELD
BALTIMORE
PAWLET
DANBY
MT TABOR
WESTON
ANDOVER
CHESTER
SPRINGFIELD
RUPERT
DORSET
LANDGROVE
PERU
LONDONDERRY
WINDHAM
GRAFTON
ROCKINGHAM
SANDGATE
MANCHESTER
WINHALL
ATHENS
ARLINGTON
SUNDERLAND
STRATTON
JAMAICA
TOWNSHEND
WESTMINSTER
BROOKLINE
WARDSBORO
PUTNEY
SHAFTSBURY
GLASTENBURY
SOMERSET
DOVER
NEWFANE
DUMMERSTON
BENNINGTON
WOODFORD
SEARSBURG
WILMINGTON
MARLBORO
BRATTLEBORO
POWNAL
STAMFORD
READSBORO
WHITINGHAM
HALIFAX
GUILFORD
VERNON

SURVEY OF ROCK SOURCES

Procedure for Rock Survey

The method employed by the project in a survey of possible sources of rock for highway construction is divided into two main stages: office and field investigations.

The office investigation is conducted during the winter months and comprises the mapping and description of rock types perused from many reference sources, as acknowledged in the bibliography. These references differ considerably in dependability due to subsequent developments and studies that have contributed to the obsolescence of a number of reports. The results of samples taken by other individuals are analyzed, and their location is mapped when possible. As complete a correlation as possible is made of the available geological information concerning the area under consideration.

The field investigation is begun by making a cursory survey of the entire town. The information obtained from the preliminary survey, and that from the office investigation, is used to determine where sampling will be concentrated. When a promising source has been determined by rock type, volume of material, accessibility, adequate exposure and relief, chip samples are taken with a hammer across the strike or trend of the rock, and are submitted to the Materials & Research Division for abrasion testing by the Deval Method (AASHTO T-3) and the Los Angeles Method (AASHTO T-96). Samples taken by the chip method are often within the weathered zone of the outcrop and thus may give a less satisfactory test result than fresh material from unweathered rock. When the rock is uniform, and the chip samples yield acceptable abrasion test results, the material source is listed in this report as being satisfactory.

Discussion of Rock and Rock Sources

The information on the Rock Materials Map (Plate II) is simplified. For a more detailed description of the respective rock formations, see the Summary of Rock Formations included in this report.

Occasionally, rocks belonging to the same formation and exhibiting similar characteristics (i.e., color and texture) produce different abrasion test results owing to differing physical properties or chemical compositions. Therefore, in no case should satisfactory test results obtained in one area be construed to mean that the same formation, even in the same area, will not later produce unsatisfactory materials; this is particularly true of metamorphic rocks.

All of Hancock is underlain by metamorphic rocks that are predominantly micaceous and fissile. Fissility of phyllites and some schists causes them to break into thin flakes when crushed and yields a product unsuitable for highway construction.

Both areas tested in Hancock were in the Pinney Hollow Formation schist, and yielded excessive abrasion test results.

SURVEY OF SAND AND GRAVEL SOURCES

Procedure for Sand and Gravel Survey

The method used for conducting the survey of possible sources of sand and gravel for highway construction is divided into two main stages: office and field investigations.

The office investigation is conducted during the winter months and comprises the mapping of potentially productive areas from various references. Of these references, the survey of glacial deposits mapped by Professor Stewart is particularly helpful when used with soil-type maps, aerial photographs, and United States Geological Survey Quadrangles. The last two are used in the recognition and location of physiographic features indicating glacial deposits, and in the study of drainage patterns. The locations of existing pits are mapped, as are the locations in which samples were taken by other individuals.

The field investigation is begun by making a cursory survey of the entire town. All pits, and any areas that show evidence of glacial or fluvial deposition are noted, and later investigated by obtaining samples from pit faces and other exposed surfaces. Test holes in pit floors and extensions are later dug with a backhoe to a depth of approximately 11 feet to obtain material which is submitted to the Materials & Research Division for gradation, sieve analysis and AASHTO T-4 Method stone abrasion test.

Discussion of Sand and Gravel Deposits

The Surficial Geologic Map of Vermont indicates that granular materials in the town of Hancock consist mainly of Kamic deposits of glaciofluvial origin. The Granular Materials Map (Plate I) in this report shows these deposits in red. The orange-colored areas indicate glaciolacustrine deposition into a small post-glacial lake.

A possible kame terrace occurs north of Vermont Route 125 between the Ritpon town line and the 2,000-foot contour line. Testing was not allowed because this area is in the Green Mountain National Forest and classified as RARE II. Two other areas on National Forest land that looked favorable were inaccesible to a backhoe because bridges over Texas Brook and Hancock Branch were washed out. One area is a clearing between the 1580- and 1620-foot contours west of Texas Brook; the other is a clearing with concrete slab fireplace near the 1580-foot contour southwest of Hancock Branch.

Map Identification Nos. 1, 2 and 3 are located within a long kame terrace in the valleys of the lower reaches of the Robins and Hancock Branch Brooks. There is a depleted gravel pit, which was sampled for rock, within this feature northwest of the confluence of the two branches (Map Identification No. 1 on the Rock Materials Map "Plate II".) An isolated kame is east of the junction of Town Highway No. 11 and Town Highway No. 1.

SUMMARY OF ROCK FORMATIONS IN THE TOWN OF HANCOCK

Green Mountain Sequence

Camels Hump Group

Underhill Formation: Silvery, gray-green, quartz-sericite-albite-chlorite-biotite schist containing abundant lenticular segregations of granular white quartz; locally quartz-sericite-albite-chlorite phyllite; porphyroblasts of albite, garnet, and magnetite are common and locally very abundant in gneissic facies in axial anticline of the Green Mountain anticlinorium.

Underhill Formation (Battell Member): Carbonaceous sericite-quartz-albite-chlorite schist and schistose quartzite, also carbonaceous and non-carbonaceous limestone; quartz-sericite-chlorite-albite schist.

Pinnacle Formation: Schistose graywacke, gray-to-buff, commonly striped, quartz-albite-sericite-biotite-chlorite rock predominates; quartz-cobble- and boulder-conglomerate is common, chiefly near base.

Hazens Notch Formation: Interbedded carbonaceous and non-carbonaceous quartz-sericite-albite-chlorite schist; grades to quartzite and gneiss.

Pinney Hollow Formation: Pale green quartz-sericite (muscovite-paragonite). Chlorite phyllite and schist with abundant magnetite, chloritoid phyllite and schist, quartz-sericite-albite-chlorite schist, and rare beds of carbonaceous and schistose quartzite.

Hoosac Formation: Quartz-sericite-albite-biotite-chlorite schist characterized by albite porphyroblasts--biotite and garnet porphyroblasts common southward; locally carbonaceous.

Mount Holly Complex: Mainly fine-to medium-grained biotite gneiss, locally muscovitic, and in western areas chloritic; massive and granitoid in some localities, fine-grained or schistose and compositionally layered in others; also abundant amphibolite and hornblende gneiss, and minor beds of mica schist, quartzite and calc-silicate granulite; includes numerous small bodies of pegmatite and gneissoid granitic rock.

GLOSSARY OF SELECTED GEOLOGIC TERMS

Albite: The light-colored sodium end-member of the continuous plagioclase feldspar series which is found in alkali rocks. The name is often compounded with the names of rocks containing the mineral.

Amphibolite: A green-to-black metamorphic rock consisting mostly of amphibole (i.e., tremolite, actinolite, hornblende, or arfvedsonite) and having a schistose structure.

Anticlinorium: A composite fold consisting of connected anticlines and synclines which, grouped together, form an arch. The term applies to relatively large features extending for at least several miles.

Biotite: A tabular dark silicate mineral commonly known as black mica.

Carbonaceous: Containing carbon.

Chlorite: A group of green hydrous silicates of aluminum, ferrous iron, and magnesium which occur as plate-like crystals or scales in metamorphic rocks.

Chloritoid: A brittle member of the mica mineral group.

Conglomerate: The consolidated equivalent of gravel. There may be considerable range in the size and composition of constituent fragments. The finer material between the larger fragments may be fine particulate matter or a natural cement, such as calcium carbonate, clay, iron oxide, or silica.

Contour line: A line on a map representing a line connecting points on the surface of the earth having the same elevation.

Drainage basin: A part of the surface of the earth that is occupied by a drainage system or contributes surface water to that system.

Facies: The composite nature of sedimentary deposits that reflects the conditions and environment of their origins.

Fissility: The tendency of some rocks to split into thin sheets along the bedding planes, or along cleavage planes induced by fracture or flowage.

Garnet: An important group of minerals in which aluminum, calcium, chromium, ferric and ferrous iron, magnesium, and manganese combine with a silicate. They are commonly deep red, brown or black, but may be any color except possibly blue.

Glaciofluvial: A term used to denote formation by, or relation to, streams within, upon, or emerging from glacial ice.

Glaciolacustrine: A term used to denote formation by, or pertaining to deposition in the quiet waters of a glacial lake.

Gneiss: A metamorphic rock of alternating bands of light and dark minerals. The light bands are rich in feldspar and quartz; the dark bands are rich in hornblende and mica.

Granitic: Characteristic of, composed of, pertaining to, or like granite.

Granitoid: Rocks having the characteristic texture of granite. The mineral grains may be fine or coarse, but are nearly uniform in size.

Granulite: A quartz-feldspar rock of high metamorphic grade, poor in or lacking mica, having a single plane of readily visible schistosity. Schistosity is caused by parallel orientation of coarse-grained quartz lenses set in a quartzose matrix.

Graywacke: Dark hard sandstone consisting of angular grains of quartz and feldspar in a matrix of micas, chlorite, and clay minerals.

Hornblende: A mineral approximately $Ca_2Na\ (Mg, Fe_2)_4\ (Al, Fe_3, Ti)_3\ Si_6O_{22}\ (O, OH)_2$ that is the common dark variety of amphibole.

Kame: A conical hill of poorly stratified drift deposited in contact with glacial ice by streams flowing in or on the ice.

Kame terrace: Stratified sands and gravels deposited by streams between a glacier and an adjacent valley wall.

Lenticular - Lens shaped.

Limestone: A bedded sedimentary deposit containing from 40% to more than 98% calcium carbonate; common impurities are clay and sand. It is the most important and widespread of the carbonate rocks.

Magnetite: A magnetic mineral composed of iron ferrate (Fe_3O_4 or $FeO\ Fe_2O_3$).

Mantle: The loose material at or near the surface; above bedrock.

Metamorphic rocks: Formed from pre-existing rocks that are altered by pressure, heat, or the infiltration of gases and liquids below the zones of oxidation and cementation. Metamorphic rocks are reconstructed in place while remaining essentially solid.

Micaceous: Composed of, resembling, or pertaining to mica. The term refers to thin plates or scales.

Muscovite: An important member of the mica group of minerals, known also as white mica, potash mica, and isinglass.

Paragonite: A mica similar in appearance to muscovite but containing sodium instead of potassium.

Pegmatite: A variety of crystalline igneous rock characterized by large grain size, interlocking texture and particularly great range in grain size. Pegmatites are commonly associated with large bodies of igneous rock of similar composition.

Phyllite: A fine-grained, foliated metamorphic rock. It usually has a distinctive silvery appearance caused by the presence of the mineral sericite. Practically all phyllites are derived from fine-grained sedimentary rocks by deformation and recrystallization.

Physiographic: Pertaining to the physical divisions of the earth.

Porphyroblasts: Large crystals which have grown in place within the fine-grained matrix of a metamorphic rock. They are formed by heat, pressure, and infiltrating solutions and occur later than the rocks in which they form.

Post-glacial: Occurring after glaciation.

Quartz: A mineral (SiO_2) that occurs in hexagonal crystals or amorphous masses. It may be transparent, translucent, or opaque, or may be colored depending on impurities. It is the most common mineral.

Quartzite: A common siliceous rock composed of quartz grains so firmly cemented that fracture occurs with equal ease across both grains and cement.

RARE II: Roadless Areas Review and Evaluation (for the second time).

Schist: A crystalline rock with a secondary foliation or lamination based on the parallelism of platy or needlelike grains. The name refers to a tendency to split along the foliation.

Segregation: The concentration of one or more minerals that have formed together during crystallization of a molten rock in place.

Sericite: A mineral very similar to muscovite that occurs in minute flakes or scales in rocks such as schist, phyllite and gneiss.

Strike: The direction of a line formed by the intersection of a bedding plane, vein, fault, cleavage or similar geologic structure with a horizontal plane.

Topography: The configuration of a surface, including its relief, the position of its streams, lakes, roads, cities, etc.; hence, loosely, natural or physical features collectively (Merriam-Webster).

BIBLIOGRAPHY

Flint, Richard F. Glacial Geology and the Pleistocene Epoch. New York: John Wiley and Sons, Inc., 1947.

Heinrich, E. W. Microscopic Petrography. New York: McGraw-Hill Co., Inc., 1956.

Kemp, James F. A Handbook of Rocks. New York: D. Van Nostrand Co., Inc., 1949.

National Academy of Sciences. National Research Council. Highway Research Board. Soil Exploration and Mapping, Highway Research Board Bulletin 28. Washington, D. C.: National Academy of Sciences - National Research Board 1950.

Pirsson, L. V. Rock and Rock Minerals. New York: John Wiley and Sons, Inc., 1949.

Stokes, William L., and Varnes, David J. Glossary of Selected Geologic Terms, Colorado Scientific Proceedings, Vol. 16. Denver, Colorado: Colorado Scientific Society, 1955.

U. S. Department of Agriculture. Bureau of Chemistry and Soils. Soil Survey (Reconnaissance) of Vermont, by K. V. Goodman, W. J. Latimer, F. R. Lesh, S. O. Perkins, and L. R. Smith (1930).

U. S. Department of the Interior. Geological Survey. Bedrock Geology of the Lincoln Mountain Quadrangle, Vermont, by Cady, W. M., Albee, A. L., and Murphy, J. F., Geological Quadrangle Maps of the United States, Map GQ-164, 1962.

U. S. Department of the Interior. Geological Survey. Rochester Quadrangle, Vermont, 15 Minute Series (Topographic) (1917).

Vermont. Department of Water Resources. Geological Survey. Surficial Geologic Map of Vermont, edited by Charles G. Doll (1970).

Vermont. Department of Water Resources. Geological Survey. The Surficial Geology and Pleistocene History of Vermont, by David P. Stewart and Paul MacClintock, Bulletin No. 31 (1969).

Vermont. Development Department. Geological Survey. Centennial Geologic Map of Vermont, edited by Charles G. Doll (1961).

Vermont. Development Department. Geological Survey. The Glacial Geology of Vermont, by David P. Stewart, Bulletin No. 19 (1961).

PARTIAL SPECIFICATIONS FOR HIGHWAY CONSTRUCTION MATERIALS

Listed below are partial specifications for Highway Construction Materials as they apply to this report at date of publication. For a complete list of specifications see Standard Specifications for Highway and Bridge Construction, approved and adopted by the Vermont Department of Highways, March, 1976.

DIVISION 700 - MATERIALS

703.03 SAND BORROW AND CUSHION. Sand borrow shall consist of material reasonably free from silt, loam, clay, or organic matter. It shall be obtained from approved sources and shall meet the requirements of the following table:

TABLE 703.03A - SAND BORROW AND CUSHION

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
2"	100	
1½"	90-100	
½"	70-100	
No. 4	60-100	100
No. 100		0- 30
No. 200		0- 12

703.05 GRANULAR BORROW. Granular borrow shall be obtained from approved sources, consisting of satisfactorily graded, free draining, hard, durable stone and coarse sand reasonably free from loam, silt, clay, or organic material.

The Granular Borrow shall meet the requirements of the following table:

TABLE 703.05A - GRANULAR BORROW

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
No. 4	20-100	100
No. 200		0- 15

The maximum size stone particles of the Granular Borrow shall not exceed 2/3 of the thickness of the layer being spread.

704.05 GRAVEL FOR SUB-BASE. Gravel for Sub-base shall consist of material reasonably free from silt, loam, clay, or organic matter. It shall be obtained from approved sources and shall meet the following requirements:

(a) Grading. The gravel shall meet the requirements of the following table:

TABLE 704.05A - GRAVEL FOR SUB-BASE

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
No. 4	20-60	100
No. 100		0- 18
No. 200		0- 8

The stone portion of the gravel shall be uniformly graded from coarse to fine, and the maximum size stone particles shall not exceed 2/3 the thickness of the layer being placed.

(b) Percent of Wear. The percent of wear of the gravel shall be not more than 25 when tested in accordance with AASHTO T-4, or more than 40 when tested in accordance with AASHTO T-96.

704.06 CRUSHED STONE FOR SUB-BASE. Crushed stone for sub-base shall consist of clean, hard, crushed stone, uniformly graded, reasonably free from dirt, deleterious material, pieces which are structurally weak and shall meet the following requirements:

(a) Source. This material shall be obtained from approved sources and the area from which this material is obtained shall be stripped and cleaned before blasting.

(b) Grading. This material shall meet the requirements of the following table:

TABLE 704.06A - CRUSHED STONE FOR SUB-BASE

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE
4½"	100
4"	90-100
1½"	25- 50
No. 4	0- 15

(c) Percent of Wear. The percent of wear of the parent rock shall be not more than 8 when tested in accordance with AASHTO T-3, or the crushed stone a percent of wear of not more than 40 when tested in accordance with AASHTO T-96.

(d) Thin and Elongated Pieces. Not more than 30 percent, by weight, of thin and elongated pieces will be permitted.

Thin and elongated pieces will be determined on the material coarser than the No. 4 sieve.

(e) Filler. The filler shall be obtained from approved sources and shall meet the requirements as set up for Sand Cushion, Subsection 703.03.

(f) Leveling Material. The leveling material shall be obtained from approved sources and may be either crushed gravel or stone screening produced by the crushing process. The material shall consist of hard durable particles, reasonably free from silt, loam, clay or organic matter.

This material shall meet the requirements of the following table:

TABLE 704.06B - LEVELING MATERIAL

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE
3/4"	100
1/2"	70-100
No. 4	50- 90
No. 100	0- 20
No. 200	0- 10

704.07 CRUSHED GRAVEL FOR SUB-BASE. Crushed gravel for sub-base shall consist of material reasonably free from silt, loam, clay or organic matter. It shall be obtained from approved sources and shall meet the following requirements:

(a) Grading. The crushed gravel shall be uniformly graded from coarse to fine and shall meet the requirements of the following table:

TABLE 704.07A - CRUSHED GRAVEL FOR SUB-BASE

GRADING	Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
COARSE	4"	100	
	No. 4	25- 50	100
	No. 100		0- 20
	No. 200		0- 12
FINE	2"	100	
	1½"	90-100	
	No. 4	30- 60	100
	No. 100		0- 20
	No. 200		0- 12

(b) Percent of Wear. The percent of wear of the parent gravel shall be not more than 20 when tested in accordance with AASHTO T-4, or the crushed gravel a percent of wear of not more than 35 when tested in accordance with AASHTO T-96.

(c) Fractured Faces. At least 30 percent, by weight, of the stone content shall have at least one fractured face.

Fractured faces will be determined on the material coarser than the No. 4 sieve.

704.09 DENSE GRADED CRUSHED STONE FOR SUB-BASE. Dense graded crushed stone for sub-base shall consist of clean, hard, crushed stone, uniformly graded, reasonably free from dirt, deleterious material and pieces which are structurally weak, and shall meet the following requirements:

(a) Source. This material shall be obtained from approved sources and the area from which this material is obtained shall be stripped and cleaned before blasting.

(b) Grading. This material shall meet the requirements of the following table:

TABLE 704.09A - DENSE GRADED CRUSHED STONE FOR SUB-BASE

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE
3½"	100
3"	90-100
2"	75-100
1"	50- 80
½"	30- 60
No. 4	15- 40
No. 200	0- 10

(c) Percent of Wear. The percent of wear of the parent rock shall be not more than 8 when tested in accordance with AASHTO T-3, or the crushed stone a percent of wear of not more than 40 when tested in accordance with AASHTO T-96.

(d) Thin and Elongated Pieces. Not more than 30 percent, by weight, of thin or elongated pieces will be permitted.

Thin and elongated pieces will be determined on the material coarser than the No. 4 sieve.

704.10 GRAVEL BACKFILL FOR SLOPE STABILIZATION. Gravel backfill for slope stabilization shall be obtained from approved sources, consisting of satisfactorily graded, free draining, hard, durable stone and coarse sand reasonably free from loam, silt, clay, and organic material.

The gravel backfill shall meet the requirements of the following table:

TABLE 704.10A - GRAVEL BACKFILL FOR SLOPE STABILIZATION

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
No. 4	20-50	100
No. 100		0- 20
No. 200		0- 10

The stone portion of the gravel backfill shall be uniformly graded from coarse to fine, and the maximum size stone particles shall not exceed 2/3 the thickness of the layer being placed.

704.11 GRANULAR BACKFILL FOR STRUCTURES. Granular backfill for structures shall be obtained from approved sources, consisting of satisfactorily graded, free draining granular material reasonably free from loam, silt, clay, and organic material.

The granular backfill shall meet the requirements of the following table:

TABLE 704.11A - GRANULAR BACKFILL FOR STRUCTURES

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
3"	100	
2½"	90-100	
No. 4	50-100	100
No. 100		0- 18
No. 200		0- 8

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STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION - GEOLOGY SUB-DIVISION

HANCOCK GRANULAR DATA SHEET NO. 1

TABLE I

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-Burden (Ft)	Existing Pit	Sieve Analysis % Passing						Abrasion AASHTO T-4-35	Passes AOT Spec.	Remarks
						2"	1-1/2"	1/2"	#4	#100	#200			
1	1	1979	0-3	-	Yes	85	76	48	33	12	7	12.1%	Gravel	Owner: Dorothy Cronan. Area is an inactive, 210' X 90' pit in field south of the Hancock Branch and Vermont Route 125 and 0.06 mile west of the Town Highway No. 21 juncion. Owner has no intention of reopening pit, and only allowed hand shovel sampling. Pit formerly worked by Ernest Bowen and sons, contractor, who forded river north of pit for access. Pit contains coarse gravel. Test No. 1 was in south bank of river east of pit ramp. Material is: 0-3', sandy coarse gravel; bottom, stonier toward river.
2	1	1979	2.5-10	0-2.5	No	100	100	86	75	57	40	-	-	Owner: Everett Bettis. Area is the east slope of a wooded knoll 75 feet north of Vermont Route 125 and 0.41 mile east of Town Highway No. 15 junction. Slope is crossed by an east-west telephone line. Test No. 1 was near middle of

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HANCOCK GRANULAR DATA SHEET NO. 2

TABLE I

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-Burden (Ft)	Existing Pit	Sieve Analysis % Passing						Abrasion AASHTO T-4-35	Passes AOT Spec.	Remarks
						2 "	1-1/2"	1/2"	#4	#100	#200			
														cleared slope, 100' west of fence. Material is: 0'-2.5', overburden; 2.5'-10', sandy silt with stones; bottom, silt-clay.
	2	1979	2.5-9.5	0-2.5	No	100	83	79	64	63	49	-	-	Test No. 2 was below and 50' east of Test No. 1. Material is: 0-2.5' overburden; 2.5'-9.5', gray silt-clay with sand and stones; bottom, same.
	3	1979	1-7	0-1	No	95	72	60	47	60	44	-	-	Test No. 3 was below and 30' east-northeast of Test No. 2. Mate-erial is: 0-1' overburden; 1-7', gravelly silt; bottom, silt-clay.
3	1	1979	1-8	0-1	No	82	82	68	59	55	39	-	-	Owner: John Seeger. Area is a field north of Vermont Route 125 with access gate 0.49 mile east of the junction of Town Highway No. 15. Feature is an east-west trending knoll 500' from highway. Test No. 1 was in high point at west end of knoll. Material is: 0-1', overburden; 1-8', gravelly silt with boulders, bottom silt-clay. An estimated 25% of the stones were larger than 4" and not included in sample.

TABLE I
SUPPLEMENT

HANCOCK PROPERTY OWNERS - GRANULAR	Map Identification No.
Bettis, Everett	2
Cronan, Dorothy	1
Seeger, John	3

STATE OF VERMONT
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MATERIALS & RESEARCH DIVISION
ENGINEERING GEOLOGY SUB-DIVISION

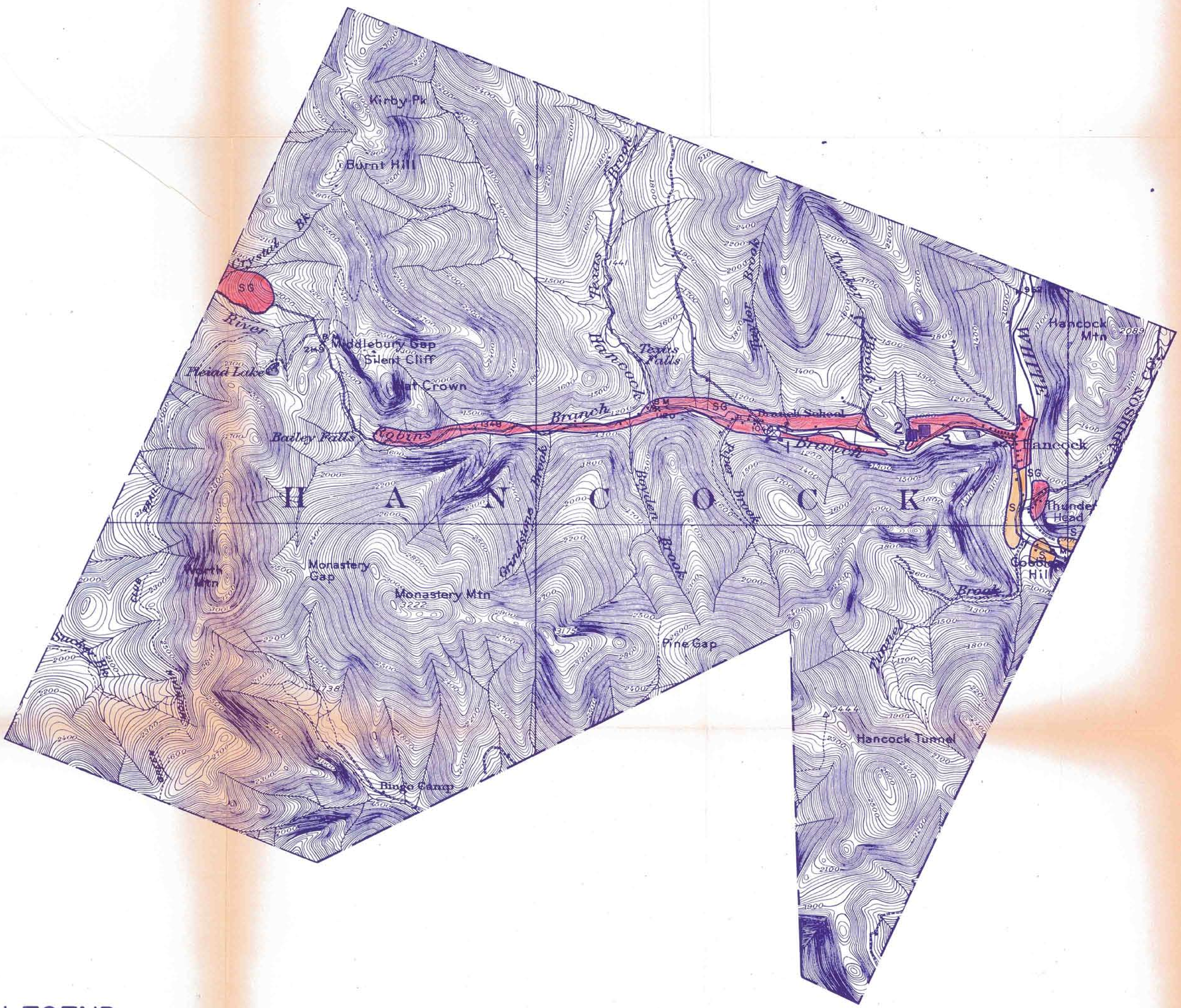
HANCOCK ROCK DATA SHEET NO. 1

TABLE II

Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHTO T-3	Abrasion AASHTO T-96	Remarks
1	1	1979	Schist	No	Chip	-	43.9	Owners: Joseph and Ello Benoit. Area is west of Town Highway No. 2 and 0.13 mile north of the junction with Vermont Route 125. Area is a depleted gravel pit that has been stripped to bedrock on a sloping hillside with many boulders and small deciduous trees. Pale green schist outcrops in an area 235' X 190' with 75 feet of relief. Schist strikes north-northeast. Test No. 1 was sampled for 60' across the strike in the northeast corner of the area.
2	1	1979	Schist	No	Chip	-	49.9	Owners: Yorgi Borboroglu and Peter Charoglu. Area is west of Vermont Route 100 from Town Highway No. 7 northward for 120 feet. Area is uncut meadow with scattered trees on hillside sloping up to the west. Pale green schist was sampled along the south 30 feet of rock cut that was subsequently removed by District Engineer.

TABLE II
SUPPLEMENT

HANCOCK PROPERTY OWNERS - ROCK	Map Identification No.
Benoit, Joseph and Ello	1
Borboroglu, Yorgi and Charoglu, Peter	2



N

LEGEND

- ○ GRAVEL, ACCEPTABLE FOR ITEM 704.05 **(gravel for sub-base)**
- ● GRAVEL, DEPLETED OR NOT ACCEPTABLE FOR ITEM 704.05
- △ SAND, ACCEPTABLE FOR ITEM 703.03 **(sand borrow and cushion)**
- ▲ SAND, DEPLETED OR NOT ACCEPTABLE FOR ITEM 703.03
- □ GRANULAR BORROW, ITEM 703.05
- ■ MATERIAL NOT ACCEPTABLE FOR ITEM 703.05
- ⚒ EXISTING PIT
- SG SAND & GRAVEL DEPOSIT
- S SAND DEPOSIT
- 3 IDENTIFICATION NUMBER (refer to data sheets)

HANCOCK

SCALE 1:31,250

1 .5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1979

GRANULAR MATERIALS MAP

BY

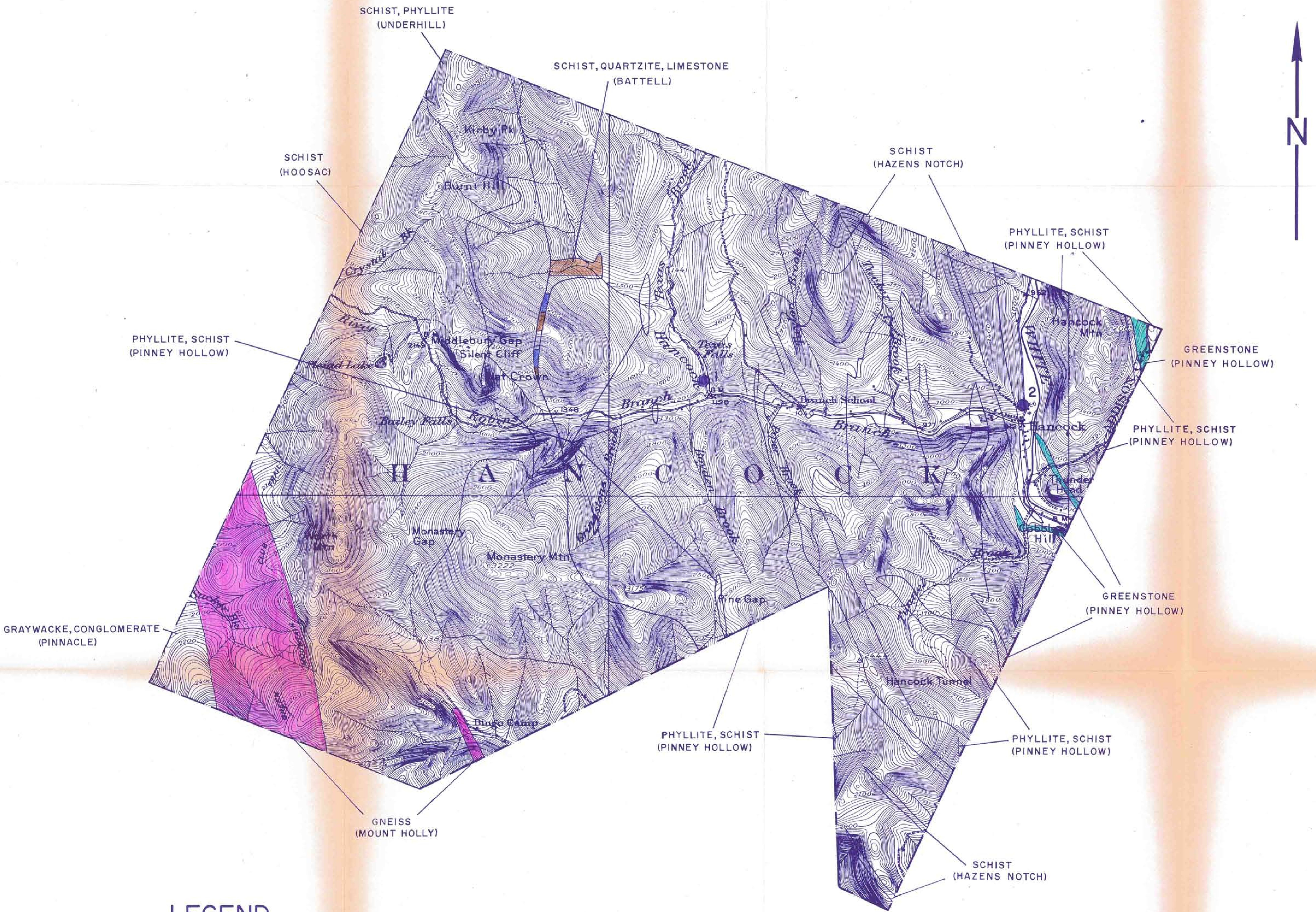
VERMONT AGENCY OF TRANSPORTATION

MATERIALS AND RESEARCH DIVISION

NOTE: BASED ON U.S.G.S. TOPOGRAPHIC MAPS

PLATE I

GRANULAR



LEGEND

○	ROCK, ACCEPTABLE FOR ITEM **704.06 (crushed stone for sub-base)**
●	ROCK, NOT ACCEPTABLE FOR ITEM **704.06**
⚒	EXISTING QUARRY
(orange)	GRANITE TO DIORITE (light to intermediate igneous rocks)
(teal)	AMPHIBOLITE, GABBRO, DIABASE, METADIABASE, GREENSTONE, TRAP DIKES (basic or dark igneous rocks)
(red)	PERIDOTITE, PYROXENITE, SERPENTINITE (ultra-basic igneous rocks)
(magenta)	GNEISS
(brown)	QUARTZITE
(purple)	DOLOMITE
(blue)	MARBLE, LIMESTONE
(white)	SCHISTS, SLATES, PHYLLITES, SHALES, CONGLOMERATES
3	IDENTIFICATION NUMBER (refer to data sheets)

HANCOCK

SCALE 1:31,250

1 0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1979

PLATE II

ROCK MATERIALS MAP

BY

VERMONT AGENCY OF TRANSPORTATION

MATERIALS AND RESEARCH DIVISION

ROCK

NOTE: BASED ON U.S.G.S. TOPOGRAPHIC MAPS