SURVEY OF HIGHWAY CONSTRUCTION MATERIALS
IN THE TOWN OF WHITINGHAM, WINDHAM COUNTY, VERMONT

prepared by

Engineering Geology Section, Materials Division
Vermont Department of Highways

in cooperation with

United States Department of Transportaion
Federal Highway Administration

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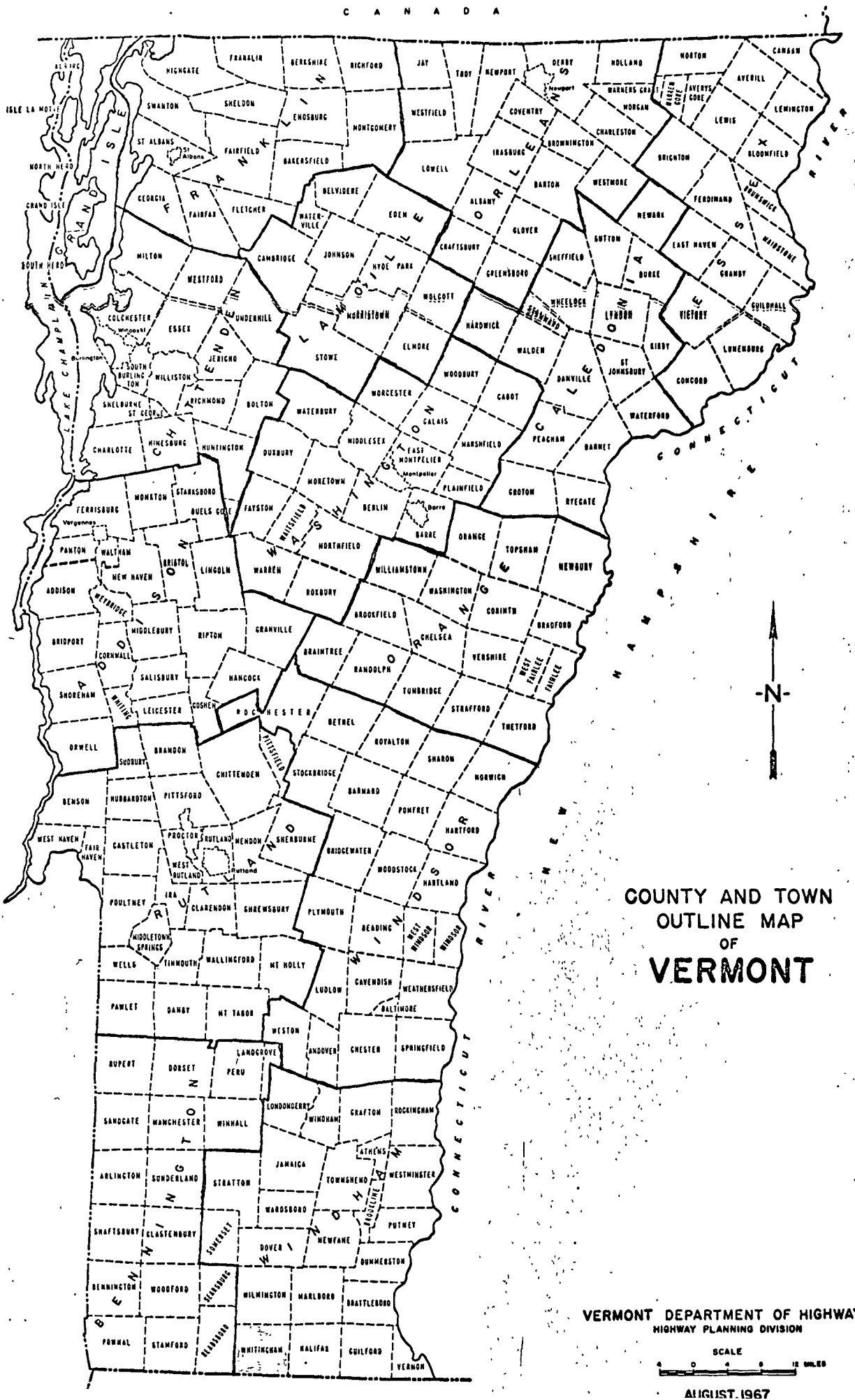
LOCATION

The town of Whitingham is situated in the southwest corner of Windham County, at the southern boundary of the state. It is bounded on the south by Massachusetts, on the north by Wilmington, on the east by Halifax, and on the west by Readsboro. (See County and Town Outline Map of Vermont on the following page.)

Whitingham lies within the Green Mountains Subdivision of the New England Physiographic Province. Topography is characterized by north-south trending mountains with sharp crests and steep slopes. Elevations vary between 2,280 feet on the Readsboro town line (about 4,600 feet south of Wilmington), and 1,102 feet at the southwestern corner of the township (high water level of Sherman Reservoir).

Principal drainage in the eastern half of the town is southeastward via tributaries of the North River. The western half of Whitingham drains northwesterly into Harriman Reservoir. Another notable body of water is Sadawga Lake in the west-central part of the town.


CANADA
NEW YORK
LAKE CHAMPLAIN
GRAND ISLE
FRANKLIN
ORLEANS
ESSEX
CALEDONIA
WASHINGTON
ORANGE
WINDSOR
WINDHAM
BENNINGTON
RUTLAND
ADDISON
CHITTENDEN
LAMOILLE
CONNECTICUT RIVER
NEW HAMPSHIRE
-N-
COUNTY AND TOWN
OUTLINE MAP
OF
VERMONT
VERMONT DEPARTMENT OF HIGHWAYS
HIGHWAY PLANNING DIVISION
SCALE
AUGUST, 1967

SURVEY OF ROCK SOURCES

Procedure for Rock Survey

The routine 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 primarily during the winter months and comprises the mapping and description of rock types as indicated in various reference sources. Many different sources of information are utilized, as indicated in the bibliography. These references differ considerably in dependability due to new developments and studies that have contributed to the obsolescense of a number of reports. In addition, the results of samples taken by other individuals are analyzed, and the location at which these samples were taken is mapped when possible. In other words, as complete a correlation as possible is made of all the information available concerning the geology of the area under consideration.

The field investigation is begun by making a cursory preliminary survey of the entire area. The information obtained in the preliminary survey, together with the information assimilated in the office investigation, is employed to determine the areas where testing and sampling will be concentrated. When a promising source has been determined by rock type, volume of material, accessibility, and adequate exposure and relief, chip samples are taken with a hammer across the strike or trend of the rock. The samples are submitted to the Material Testing Laboratory for abrasion testing both by the Deval Method (AASHO T-3) and the Los Angeles Method (AASHO T-96). It should be kept in mind that the samples taken by the chip method are often within the weathered zone of the outcrop and consequently may give a less satisfactory test result than fresh material deeper in the rock structure. When the material is uniform and acceptable abrasion tests result from the chip samples, the material source is included in this report as being satisfactory.

Discussion of Rock and Rock Sources

It should be noted that information on the Rock Materials Map is somewhat simplified. (For a more detailed description of the respective rock formations, see the Summary included in this report.) Complex metamorphic rocks comprise almost all of the lithology within the town of Whitingham.

Occasionally, rocks belonging to the same formation and exhibiting similar characteristics (i.e. color, texture, etc.) may produce different abrasion results owing to different physical and chemical properties. Therefore, in no case should satisfactory test results of an area be construed to mean that the same formation, even in the same area, will not later produce unsatisfactory material. This is especially true of metamorphic rocks.

Areal extent of the bedrock is about evenly divided between gneisses in the northern and central parts of the town, and schists, quartzite, amphibolites, greenstone, and marble in southeastern, southern and western Whitingham. Because most of the rock units in the township are covered by glacial drift, their relative positions are inferred by previous authors.

Neither the Mount Holly gneiss nor the Bull Hill gneiss was sampled because only minor outcrops were found and most of the bedrock was hidden by glacial drift. Steep slopes along Vermont Route 100, and a hillside north of Laural Lake are presumably underlain by the Mount Holly gneiss, but are heavily wooded with little or no exposure.

Dense woods, marshes, beaver ponds and glacial drift prevented the survey from sampling the mapped amphibolite near Harriman Dam and Hosley Mountain, and the greenstone on the northeast slope of Stickney Hill.

A thirty-foot thickness of alternating bands of quartzite, amphibolite and gneissoid schist is exposed on a steep slope west of Vermont Route 8-A, about

three-tenths of a mile north of its junction with Town Highway No. 53. The rock is so badly weathered that this survey could not obtain fragments large enough for testing.

Two outcrops of the Hoosac schist were noted along Town Highway No. 56 (south of the Harriman Reservoir); but the rock was too thin-bedded and heavily weathered to get large enough pieces for testing.

Favorable test results were obtained from the one area sampled, and that was in the Sherman Marble member of the Cavendish formation near the southwest corner of the town.

SURVEY OF SAND AND GRAVEL SOURCES

Procedure for Sand and Gravel Survey

The method employed by the project in a 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 primarily during the winter months and comprises the mapping of possible potentially productive areas as indicated from various references. Of these references, the survey of glacial deposits mapped by Professor Stewart proves to be valuable, particularly when used in conjunction with other references such as 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. In addition, the locations of existing pits are mapped when known. The locations in which samples were taken by other individuals are noted and mapped when possible.

The field investigation is begun by making a cursory preliminary survey of the entire town. All pits and other areas which show physiographic features that give evidence of glacial or fluvial deposition are noted. These locations are later investigated by obtaining samples of pit faces and other exposed materials. Test pits, dug with a backhoe to a depth of approximately 11 feet, are also sampled. The samples are submitted to the Materials Testing Laboratory where they are tested for gradation and stone abrasion, the latter by the Deval Method (AASHO T-4), and the Los Angeles Method (AASHO T-96).

Discussion of Sand and Gravel Deposits

With the exception of Map Identification Numbers 2, 3, 9 and 11, all granular areas tested in Whitingham were near depletion at the time of this survey.

Stewart and MacClintock mapped the depositional features that may yield granular materials in Whitingham as glaciofluvial or glaciolacustrine in origin. Pebbly sand, deposited in quiet, post-glacial lakes, occur south of Sadawga Lake and east of Town Highway No. 39, at Map Identification Nos. 10, 11 and 12.

Outwash gravels and kames are the two kinds of glaciofluvial deposition in Whitingham. Spillway outwash gravels along the East Branch of the North River in the vicinity of Jacksonville were sampled at Map Identification Nos. 5, 6, and 7. Other spillway gravels that occur along the Deerfield River below Harriman Reservoir were not accessible to this survey.

Kamic deposits may also occur in the town. Stewart and MacClintock mapped a kame moraine on the hillside northwest of Map Identification Number 1. This feature proved to be a good materials source in Wilmington (see Survey of Highway Construction Materials in the Town of Wilmington, Windham County, Vermont), but was not found in Whitingham. Materials in the vicinity of Map Identification Nos. 2 and 3 may be remnants of till. A large kame that was mapped northwest of the junction of Town Highway Number 53 with Vermont Route 8-A was sampled at Map Identification Nos. 8 and 9, but, was near depletion.

Flood damage subsequent to the survey has further depleted the small amounts of granular materials available in Whitingham.

SUMMARY OF ROCK FORMATIONS IN THE TOWN OF WHITINGHAM

Barnard volcanic member of the Missisquoi formation - fine- to medium- grained biotite gneiss, hornblende gneiss, and amphibolite.

Bull Hill gneiss of the Cavendish formation - quartz-plagioclase-microcline-biotite gneiss characterized in many areas by augen of microcline as much as 2 inches long; fine- to medium- grained quartz-plagioclase-biotite or biotite-muscovite gneiss.

Chester amphibolite member of the Pinney Hollow formation - thin-layered, ligniform amphibolite and hornblende schist; includes actinolitic greenstone.

Hoosac formation - Quartz-sericite-albite-chlorite schist characterized by albite porphyroblasts-biotite and garnet porphyroblasts common southward; locally carbonaceous. Amphibolite and actinolitic greenstone.

Moretown member of the Missisquoi formation - quartzite and quartz-plagioclase granulite in layers 1/8 to several inches thick, separated by "pinstripe" partings that contain muscovite, chlorite, epidote, biotite, and locally garnet, also greenish quartz-sericite-chlorite phyllite and schist, and minor carbonaceous phyllite.

Mount Holly complex - Mainly fine- to medium- grained biotite gneiss, locally muscovite, 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.

Ottauquechee formation - Black carbonaceous phyllite or schist containing interbeds of massive quartzite commonly criss-crossed by veins of white quartz; quartzite is dark gray and carbonaceous, light gray, or white; also including light green quartz-sericite-chlorite phyllite or schist, and sericite quartzite. Schist contains abundant porphyroblasts of garnet and biotite from Ludlow, south.

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; garnet porphyroblasts common south of Ottauquechee River.

Readsboro member of the Cavendish formation - quartz-muscovite schist containing biotite or chlorite and characterized by conspicuous porphyroblasts of sodic plagioclase; less commonly quartz-muscovite-paragonite schist containing chlorite, garnet, or chloritoid; and locally kyanite.

Sherman marble member of the Cavendish formation - buff dolomite; minor white to pink calcite marble.

Stowe formation - greenstone and amphibolite; epidote-albite-chlorite rocks contain actinolite and hornblende where more metamorphosed.

GLOSSARY OF SELECTED GEOLOGIC TERMS

Actinolitic - Pertaining to a variety of amphibole, occurring in greenish bladed crystals or in masses.

Albite - The sodium end member of the plagioclase feldspar group, light-colored and found in alkali rocks.

Amphibolite - A metamorphic rock, the distinguishing characters of which are that they consist partly or largely of amphibole (i.e. tremolite, actinolite, hornblende or arfvedsonite), and that they possess a more or less pronounced schistose structure. Color varies from green to black.

Augen - The German word for eyes; used as a prefix before various rock names, especially gneiss, to describe larger minerals or aggregates of minerals in contrast with the rest of the rock.

Basal Till - A compact, unsorted, unstratified, heterogeneous mixture characterized by its silt, clay and usually high enough sand content to allow water to penetrate to depth.

Bedrock - The more or less solid, undisturbed rock in place either at the surface, or beneath superficial deposits of gravel, sand, or soil.

Biotite - The mineral commonly known as black mica.

Carbonaceous - Containing carbon.

Chlorite - A general designation for a group of hydrous silicates of magnesium and iron, with or without aluminum, so named because of their green color.

Chloritoid - A brittle member of the mica mineral group.

Dolomite - A rock consisting predominantly of the mineral calcium magnesium carbonate (dolomite), containing carbon dioxide 47.7%, lime 30.4% and magnesia 21.9%.

Drainage - The manner in which the water of an area passes off by surface streams and rivers, or by subsurface channels.

Epidote - A mineral, calcium aluminum iron silicate that usually occurs in rocks as formless grains and masses. The color is usually some shade of green, - pistachio-green or yellowish-green being the most characteristic.

Glacio-fluvial - 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 quiescent waters of glacial lakes.

Gneiss - Originally meaning a more or less banded metamorphic rock with the mineral composition of granite. The term now designates a foliated metamorphic rock with no specific composition implied, but having layers that are mineralogically unlike and consisting of particles visible to the eye. Usually gneiss displays an alternation of granular minerals and schistose minerals with the rock tending to split along the schistose bands.

Gneissic, Gneissoid - Having the banded, streaked, and foliated appearance and texture of gneiss which is a more or less banded metamorphic rock with the mineral composition of granite.

Granulite - According to the current usage of the term in Europe, a granulite is a quartz-feldspar rock of high metamorphic grade, poor or lacking in mica, and characterized structurally by a single regular plane of schistosity, which is easily visible to the eye. The schistosity is determined mainly by parallel orientation of flat lenses of coarse-grained quartz set in a quartzose matrix of smaller equidimensional grains. The term has appeared in older literature with a variety of other meanings and should not be used without explanation.

Greenstone - A field name for rocks that have been so metamorphosed or otherwise so altered that they have assumed a distinctive color owing to the presence of chlorite, epidote, or actinolite.

Hornblende - A common member of the amphibole group of minerals. The color is usually black, dark-green, or brown. The hardness is 5 to 6 and the specific gravity about 3.0. The mineral commonly occurs in prismatic masses and is found in both igneous and metamorphic rocks.

Kame - A conical hill of stratified drift, deposited at a glacial terminus by glacial streams flowing in or on the ice.

Kame Moraine - An accumulation of material deposited directly from the frontal portion of the glacial ice and partially sorted by water action. Deposits may take the form of coalescent knolls, hummocks, ridges, etc.

Kyanite - A mineral, an aluminum silicate, occurring usually in blue thin-bladed crystalline aggregates.

Ligniform - Resembling the structure of wood cells.

Marble - A soft, white rock being the metamorphic form of limestone in which the calcium carbonate (calcite) is recrystallized and the calcite crystals are overgrown and interlocked with additional calcite. Commercially it is a trade name applied to any carbonate rock of good color and texture and hard enough to take a polish.

Metamorphic Rocks - Rocks that owe their distinctive characteristics to the transformation of pre-existing rocks, either through intense heat or pressure or both.

Microcline - A potash feldspar mineral. It is the common feldspar mineral of granitic pegmatites.

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

Outcrop - A part of a body of rock that appears, bare and exposed, at the surface of the ground. In a more general sense the term applies also to areas where the rock formation occurs next beneath the soil, even though it is not exposed.

Outwash - Stratified sands and gravels that are stream-built beyond the glacier; deposited by meltwater streams issuing from the face of the glacial ice.

Paragonite - A mica, similar in appearance and composition to muscovite but containing sodium instead of potassium.

Pegmatite - A vein-, pipe-, dike-like, or irregular igneous body associated with large intrusives of similar composition. It is characterized by large average grain size, interlocking texture, and unusually great range in grain size.

Phyllite - A fine-grained, foliated metamorphic rock intermediate between the mica schists and slates into which it may grade. The foliation is made possible by the development of a large amount of potash mica, sericite, which also gives the rock a distinctive silvery appearance.

Physiographic - Pertaining to the physical divisions of the earth.

Plagioclase - The group of common rock-forming feldspar minerals of the albite-anorthite isomorphous series.

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

Quartzite - A firm, compact rock composed of grains of quartz so firmly united that fracture takes place across the grains instead of around them. A metamorphosed sandstone.

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

Sericite - A mineral very similar to, if not identical with, muscovite mica. It occurs in small flakes and scales in metamorphic rocks such as sericite schists and sericite gneisses.

Spillway Gravel - Outwash gravel deposited in a valley that acted as a spillway for a melting glacier.

Till - An unsorted, unstratified, and unconsolidated heterogeneous mixture of clay, silt, sand, gravel, and boulders deposited directly by glacial ice.

Weathered - Showing the effects of exposure to the atmosphere.

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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 in July, 1971.

DIVISION 700 - MATERIALS

Section 703, Soils and Borrow 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 - Gradation Requirements

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. 10C		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, and organic material.

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

Table 703.05A - Gradation Requirements

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.

Section 704, Aggregate

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 - Gradation Requirements

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Total Sample	Sand Portion
No. 4	(20-60)	100
No. 100		0-10
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 AASHO T 4, or more than 40 when tested in accordance with AASHO 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 - Gradation Requirements

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 AASHO T 3, or the crushed stone a percent of wear of not more than 40 when tested in accordance with AASHO T 96.

(d) Thin and Elongated Pieces
Not more than 30 percent, by weight, of thin and elongated peices 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 - Gradation Requirements

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves Total Sample
1"	100
3/4"	90-100
1/2"	50- 90
No. 4	30- 70
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 - Gradation Requirements

Grading	Sieve Designation	Percentage by Weight Passing Square Mesh Sieves Total Sample	Sand Portion
	4"	100	
Coarse	No. 4	25- 50	100
	No. 100		0- 20
	No. 200		0- 12
	2"	100	
	1½"	90-100	
Fine	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 AASHO T 4, or the crushed gravel a percent of wear of not more than 35 when tested in accordance with AASHO 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 - Gradation Requirements

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 AASHO T 3, or the crushed stone a percent of wear of not more than 40 when tested in accordance with AASHO 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 - Gradation Requirements

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 - Gradation Requirements

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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WHITINGHAM GRANULAR DATA SHEET NO. 1

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
1	1	1973	1.5-6	0-1.5	Yes	92	80	58	45	4	2	----	Gravel	Owner - Stuart Brown Area is a shallow pit west of Vermont Route 100. Access road to pit is 0.12 mile north of the junction of Town Highway No. 18 and Vermont Route 100. Pit is nearly depleted but some material might remain in the southward extension. Test No. 1 was in the southwest face. Material was: 0-1.5', overburden; 1.5'-6', well-packed fine gravel with 3" to 4" stones; bottom, silt.
	2	1973	1.5-5	0-1.5	Yes	79	73	56	43	10	5	22.7%	Gravel	Test No. 2 was in middle of east face. Material was: 0-1.5', overburden; 1.5'-5', well-packed fine gravel with cobble layers at 2.5' and 4'; bottom, sloughed material. Floor of pit at 8' was covered with water.
2	1	1973	1-6	0-1	Yes	---	100	99	98	24	8	----	Sand	Owner - Stuart Garland Area is a pit in the woods northeast of Town Highway No. 24. Access road is 0.25 mile east of intersection of Town Highway Nos. 20, 22 and 24. Several culverts need repair on the 0.4 mile access road.

WHITTINGHAM GRANULAR DATA SHEET NO. 2

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
														Test No. 1 was in west face of north lobe of pit. Material was a fine or silty sand.
	2	1973	2-8	0-2	Yes	---	85	77	64	15	5	----	Sand	Test No. 2 was located 70' S.70°E. of Test No. 1 in east face of north lobe. Material was: 0-2', overburden; 2'-3', gravel; 3'-4', silt seam; 4'-5', silty sand; 5'-6', gravel 6'-8', silt; bottom, stones.
	3	1973	1-7	0-1	Yes	90	76	55	42	11	8	19.6%	Gravel	Test No. 3 was in north face of east lobe of pit. Material was a hard-packed, fine to cobbly gravel that bottoms on boulders and silt.
	4	1973	1.5-6	0-1.5	Yes	---	88	77	69	28	13	----	Gran. Borrow (Sand)	Test No. 4 was in northeast face of south lobe of pit, 50' southwest of Test No. 3. Material was a sandy till with angular stones.
	5	1973	1-5	0-1	Yes	---	76	49	36	23	14	----	Gran. Borrow (Gravel)	Test No. 5 was in east face of lobe of pit, 90' southwest of Test No. 4. Material was angular stones and rock fragments with silt.
	6	1973	1-7.5	0-1	Yes	---	100	93	85	17	6	----	Sand	Test No. 6 was in east face of small diggings north of pit. Material was: 1'-3', sand with small angular stones; 3'-5.5', hard-packed angular stones; 5.5'-7.5', clean sand (water table at 7.5')

WHITINGHAM GRANULAR DATA SHEET NO. 3

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
3	1	1973	1-5	0-1	Yes	73	70	52	40	18	10	27.9%	Gran. Borrow (Gravel)	Owner - Stuart Garland Area is a small pit near a beaver pond in the woods about 0.3 mile east of Map Identification Number 2. Test No. 1 was in northeast face of pit. Material was an unsorted stony till.
4	1	1973	1.5-10	0-1.5	Yes	---	89	71	57	32	18	----	-----	Owner - Mrs. Blanche Mills Area is depleted pit east of Town Highway No. 22 about 0.48 mile north of its junction with Town Highway No. 41. Test No. 1 was in northeast face of pit. Material was: 1.5'-5', stony till; 5'-10', hard-packed silt with angular stones and boulders.

WHITINGHAM GRANULAR DATA SHEET NO. 4

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing 2"	1½"	½"	#4	#100	#200	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
5	1	1973	2-8	0-2	Yes	---	100	82	66	25	13	----	Gran. Borrow (Sand)	Owner - Allan R. Bartlett Area is a nearly depleted small (50' x 70') borrow pit east of intersection of Town Highways No. 21 and 31 with Vermont Route 100. Probably less than 300 yards of gravel remains east of the present face. Test No. 1 was in the southeast face. Material was: 0-2', overburden; 2'-8', till with sand patches
	2	1973	3-9	0-3	Yes	100	96	69	49	17	9	24.4%	Gravel	Test No. 2 was in northeast face o pit. Material was: 0-3', overburden 3'-9', well-packed, poorly-sorted, stony till.
6	--	1973	----	---	Yes	--	NOT	SAMPLED						Owner - E. J. Roberts & Son Area includes two overgrown borrow pits northeast of Vermont Route 112 about 0.02 mile south of its junction with Town Highway No. 44. Because bedrock shows at the surface in several places no samples were taken.

WHITINGHAM GRANULAR DATA SHEET NO. 5

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
7	--	1973	----	---	Yes	NOT		SAMPLED						Owner - E. J. Roberts & Son Area is a pit filled with junked cars east of Vermont Route 112 about 0.4 mile north of its junction with Town Highway No. 46. Two low boulder-strewn borrow pits were considered depleted and not worth sampling.
8	1	1973	1-7	0-1	Yes	--	100	--	63.7	27.3	16.0	----	-----	Owner - Albert Butterfield Area is depleted pit north of Town Highway No. 53; access is 0.23 mile west of its junction with Vermont Route 8-A. Test No. 1 in the face at north end of pit was silty sand.
9	1	1973	2-7	0-2	Yes	77	72	51	33	14	7	20.5%	Gravel	Owner - Carthusians, Inc. (formerly: Whitingham Farms.) Area is a pit in the woods 0.2 mile northwest of Town Highway No. 53. Access road is 0.25 mile west of Vermont Route 8-A. Test No. 1 was in upper east face near a stonewall. Material was: 0-2', overburden; 2'-7', well-packed, poorly sorted gravel.

WHITINGHAM GRANULAR DATA SHEET NO. 6

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
	2	1973	0-8	---	Yes	100	90	74	62	33	20	----	-----	Test No. 2 was in lower face at north end of pit where a thin skim of gravel overlies angular stones and silt.
10	1	1973	1.5-7	0-1.5	Yes	---	100	94	91	30	9	----	Sand	Owner - Arnold Shippee Area is a depleted pit located south of a bend on Town Highway No. 39 about 0.41 mile south of its junction with Vermont Route 100. Area is extremely limited; floor of pit is very near level of a beaver pond. Test No. 1 was in west face of pit. Material was: 0-1.5', overburden; 1.5'-4.5', compact silty sand; 4.5'-5', pebbly layer; 5'-7', sand.
11	1	1973	0-7	----	Yes	--	100	96	95	56	19	----	-----	Owner - Arnold Kingsley Area is in the woods south of Town Highway No. 39 about 0.31 mile east of its junction with Town Highway No. 38. Not much material left in the area.

WHITINGHAM GRANULAR DATA SHEET NO. 7

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
														Test No. 1 was in 8' west face of central digging. Material is silty fine sand.
12	1	1973	0-4	---	Yes	100	90	75	60	19	12	---	Sand	Owner - Arnold Kingsley Area is a depleted pit, 0.33 mile southeast of Town Highway No. 39. Access road from Town Highway No. 39 i is 0.27 mile east of Town Highway No. 38. Area is overgrown and has boulders and strippings. There was much water on floor. Test No. 1 was in low face on southwest slope of stripped area. Material was poorly sorted, dirty coarse sand.
13	1	1973	0-5	---	Yes	100	62	50	42	10	5	---	Gran. Borrow (Gravel)	Owner - Town of Whitingham Pit is west of Town Highway No. 36 and 0.16 mile south of junction with Town Highway No. 40. Two 4' to 6' deep pools of water covered much of the floor.

WHITTINGHAM GRANULAR DATA SHEET NO. 8

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
														Test No. 1 was in east face of small depleted borrow pit. Material is a well-packed till with angular stones, sand, silt and rotten rock fragments.

TABLE I
SUPPLEMENT

WHITINGHAM PROPERTY OWNERS - GRANULAR	MAP IDENTIFICATION NUMBER
Bartlett, Allan	5
Brown, Stuart	1
Butterfield, Albert	8
Carthusians, Inc.	9
Garland, Stuart	2, 3
Kingsley, Arnold	11, 12
Mills, Blanche (Mrs.)	4
Roberts, E. J., and Son	6, 7
Shippee, Arnold	10
Whitingham, Town of	13

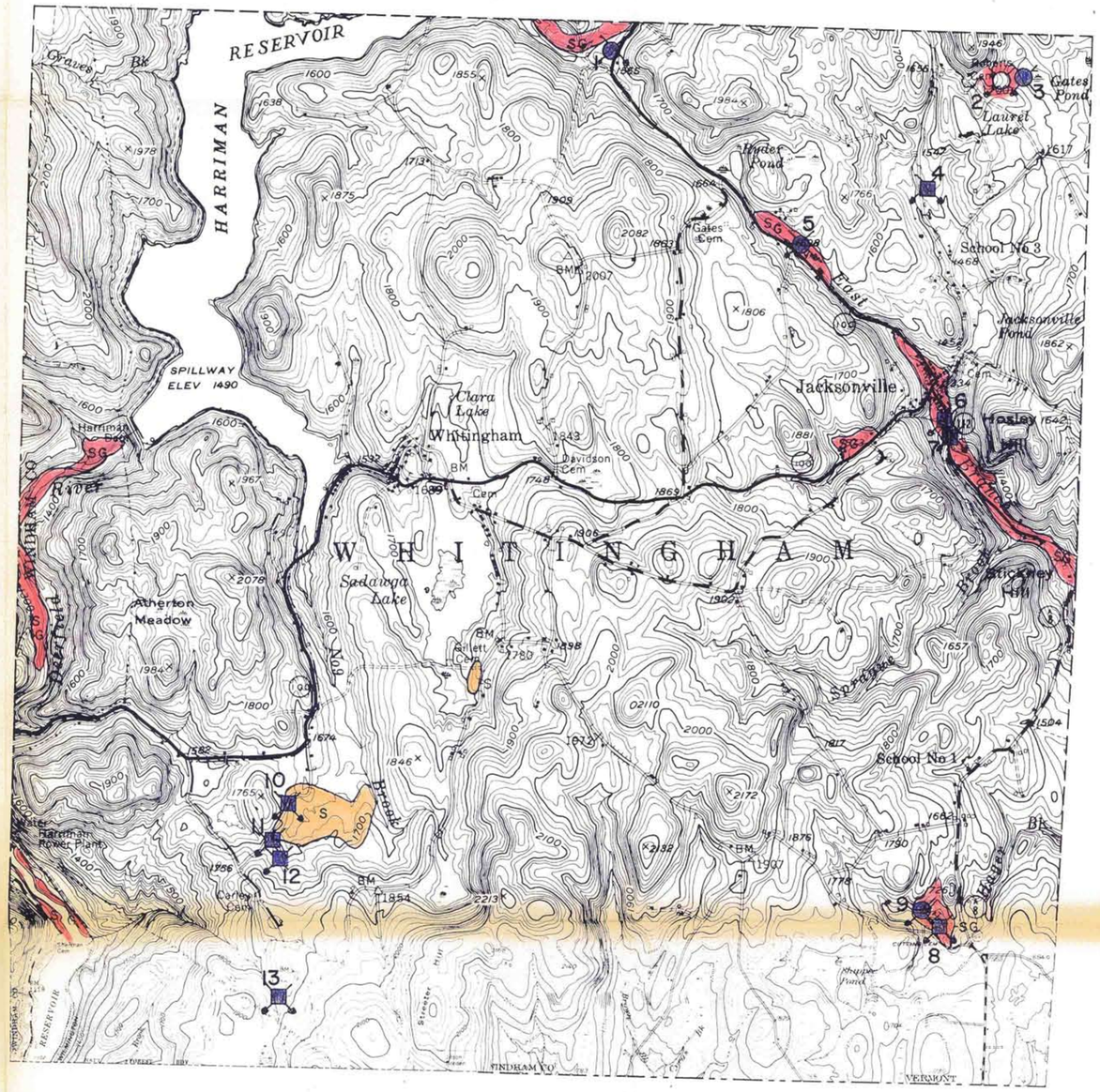
TABLE II

WHITINGHAM ROCK DATA SHEET NO. 1

Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T-3	Abrasion AASHO T-96	Remarks
1	1A	1973	Marble	No	Chip	6.8%	61.5%	Owner - New England Power Company Area is adjacent to heavy duty haul road east of the Sherman Reservoir. It is just south of ruins of an old limekiln, and about 2¼ miles south of Vermont Route 100. Rock was marble of the Sherman marble member of the Cavendish formation. The ends of the 400-foot long outcrop would be the most favorable for establishment of a quarry. There seems to be adequate material to warrent exploitation. However, until escavation created a working space away from the road, quarrying might interfere with through traffic.
	1B	1973	Marble	No	Chip	4.8%	53.7%	Test No. 1B' was a southward continuation along the outcrop for an additional 200 feet.

TABLE II
SUPPLEMENT

WHITINGHAM PROPERTY OWNERS - ROCK	MAP IDENTIFICATION NUMBER
New England Power Company	1



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)

WHITINGHAM

SCALE 1:31,250

.5 0 1 MILE

CONTOUR INTERVALS 10 AND 20 FEET

1973

GRANULAR MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

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

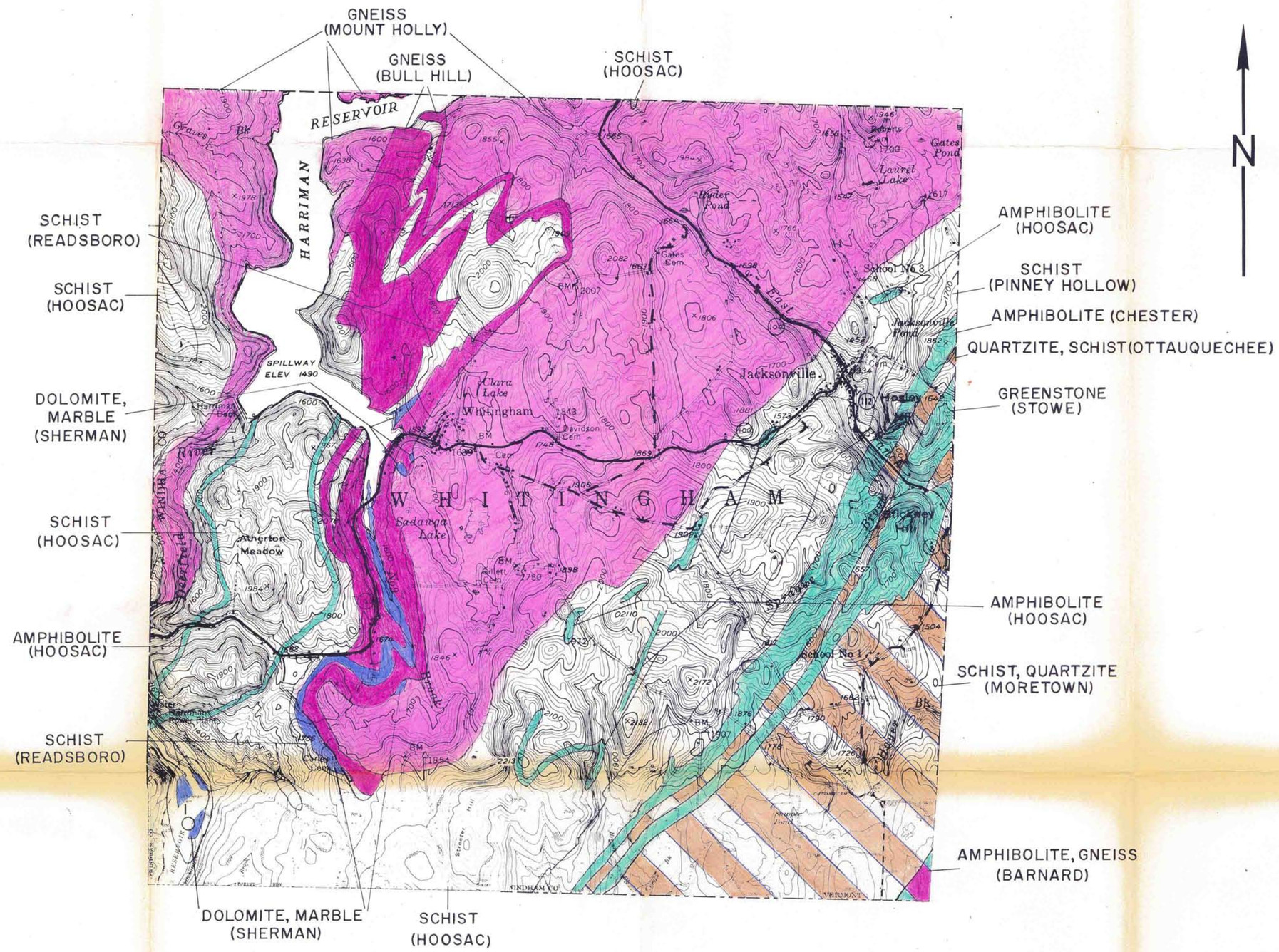
PLATE I

GRANULAR

WINDHAM COUNTY VT. HWY. DISTRICT NO. 1

REVISIONS

DATE						
BY						



LEGEND

- ○ ROCK, ACCEPTABLE FOR ITEM **704.06 (crushed stone for sub-base)**
- ◉ ROCK, NOT ACCEPTABLE FOR ITEM **704.06**
- ⚒ EXISTING QUARRY

- GRANITE TO DIORITE (light to intermediate igneous rocks)
- AMPHIBOLITE, GABBRO, DIABASE, METADIABASE, GREENSTONE, TRAP DIKES (basic or dark igneous rocks)
- PERIDOTITE, PYROXENITE, SERPENTINITE (ultra-basic igneous rocks)
- GNEISS
- QUARTZITE
- DOLOMITE
- MARBLE, LIMESTONE
- SCHISTS, SLATES, PHYLLITES, SHALES, CONGLOMERATES

3 IDENTIFICATION NUMBER (refer to data sheets)

WHITINGHAM

SCALE 1:31,250

0.5 0 1 MILE

CONTOUR INTERVALS 10 AND 20 FEET

1973

ROCK MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

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

PLATE II

ROCK

WINDHAM COUNTY VT. HWY. DISTRICT NO. 1

REVISIONS

DATE						
BY						