SURVEY OF HIGHWAY CONSTRUCTION MATERIALS
IN THE TOWN OF WESTFORD, CHITTENDEN COUNTY, VERMONT

prepared by

Geologic Section, Materials Division,
Vermont Department of Highways

in cooperation with

United States Department of Commerce
Bureau of Public Roads

Montpelier, Vermont
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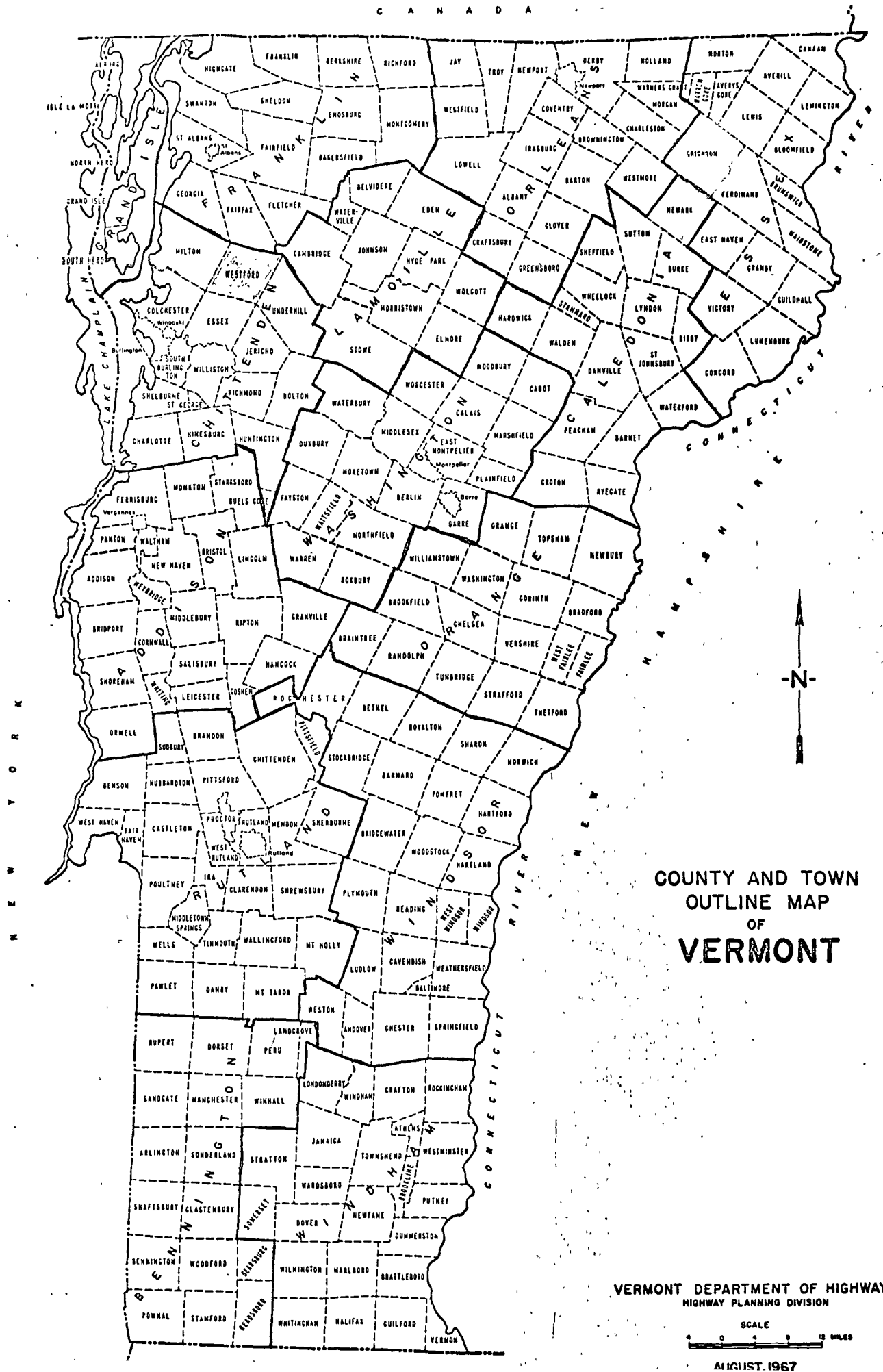
CANADA
ISLE LA MOTTE
NORTH HERO
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FRANKLIN
LAMOILLE
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WASHINGTON
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CHITTENDEN
LAKE Cchamplain
NEW YORK
CONNECTICUT RIVER
NEW HAMPSHIRE
CONNECTICUT
-N-
COUNTY AND TOWN
OUTLINE MAP
OF
VERMONT
VERMONT DEPARTMENT OF HIGHWAYS
HIGHWAY PLANNING DIVISION
SCALE
AUGUST 1967

Acknowledgments

The work of this project was greatly implemented by the cooperation and assistance of many groups and individuals. The following were particularly helpful in carrying out the project's objectives:

1. Various departments and individuals of the Vermont State Department of Highways, notably the Planning and Mapping Division and the Highway Testing Laboratory.

2. Prof. D. P. Stewart of Miami University, Oxford, Ohio.

3. Prof. Charles G. Doll, Vermont State Geologist, University of Vermont, Burlington, Vermont.

4. The United States Department of Commerce, Bureau of Public Roads.

History

The Materials Survey Project was formed in 1957 by the Vermont State Department of Highways with the assistance of the United States Bureau of Public Roads. Its prime objective was to compile an inventory of highway construction materials in the State of Vermont. Prior to the efforts of the personnel of the Survey as described in this and other reports, searches for highway construction materials were conducted only as the immediate situation required. Thus, only limited areas were surveyed and no over-all picture of material resources was available. Highway contractors or resident engineers are usually required to locate the materials for their respective projects and have samples tested by the Highway Testing Laboratory. The additional cost of exploration for construction material is passed on to the State in the form of higher construction costs. The Materials Survey Project was established to minimize or eliminate this factor by enabling the State and its

contractors to proceed with information on material sources available beforehand. Prior knowledge of locations of suitable material is an important factor in planning future 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 for reporting the findings of the project were designed, keeping in mind their intended use. These maps and data sheets were devised to furnish information of particular use to the contractor or construction man. For maximum benefit, the maps, data sheets, and this report should be studied simultaneously.

Inclosures

Included in this folder are two surface-geology maps; one defining the location of tests conducted on bedrock sources, the other defining the location of tests conducted on granular materials. These maps are derived from 15-minute quadrangles of the United States Geological Survey enlarged to 1:31250 or 1" = 2604'. Delineated on the Bedrock Map are the various rock types of the area. This information was obtained from numerous sources; i.e., Vermont Geological Society Bulletins, Vermont State Geologist Reports, United States Geological Survey Bedrock Maps, Centennial Geological Map of Vermont, as well as other references.

The Granular Materials Map depicts areas covered by various types of glacial deposits (outwash, moraines, kames, kame terraces, etc.) by which potential sources of gravel and sand may be recognized. This information was obtained primarily from a survey being conducted by Prof. D. P. Stewart of Miami University, Oxford, Ohio, who, since 1956, has been mapping the glacial features of the State of Vermont during the summer months. Further information was obtained from the Soil Survey (Reconnaissance) of Vermont, conducted by the Bureau of Chemistry and Soils of the

United States Department of Agriculture, and from Vermont Geological Survey Bulletins, United States Geological Survey Quadrangles, aerial photographs, and other sources. On both maps the areas tested are represented by Identification Numbers. Several tests are usually conducted in each area represented by an Identification Number, the number of such tests being more or less arbitrarily determined either by the character of the material tested or by the topography.

Also included in this folder are Data Sheets for both the Bedrock and Granular Materials Survey which contain detailed information for each test conducted by the Project as well as information obtained from other sources, including an active card file compiled by the Highway Testing Laboratory. It was readily apparent that the latter information was gathered over a period of years by many persons and consequently lacks the organized approach and detail required for effective use. The information in the cards varied widely in completeness. Transfer of information from the cards to the Data Sheets was made without elaboration or verification. The locations of the deposits listed in the card files have also been plotted on the maps. However, caution should be exercised wherever this information appears incomplete. Some cards in the file were not used because the information on the location of the deposit was incomplete or unidentifiable. This project does not assume responsibility for the information taken from the card files.

Work Sheets containing more detailed information of each test including a detailed sketch of each Identification Number Area are on file in the office headquarters of this Project, together with the respective Laboratory Reports

Location

The Town of Westford is located in Chittenden County in the western foothills of the Green Mountains, approximately 25 miles south of the northern boundary of the state and 8 miles east of Lake Champlain. The town is bounded on the north by

Fairfax, on the east by Underhill, on the south by Essex, and on the west by Milton. It's in an area of rolling hills and broad stream valleys with elevation varying from 500 to 1500 feet above sea level, the higher elevations occurring along the eastern edge of the town in proximity to the central range of the Green Mountains.

The town is drained by two systems, the principal being that of the Browns River which flows northward in a wide level valley to the Lamoille River. A minor drainage system, that of Alder Brook, flows southward to the Winooski River.

The hills are generally heavily wooded, while most of the residential and agricultural land is located at the lower elevations. The ridge along the eastern border of the town effectively prevents direct communication with the town of Underhill to the east. A few roads over the ridge have long since been abandoned.

Procedure for Rock Survey

The routine employed by the project in the survey of possible sources of rock for highway construction is divided into two main stages; the office investigation and field investigation. The first is conducted primarily during the winter months and comprises the mapping of rock types as indicated in various reference sources. Many different sources of information were utilized, as indicated in the Bibliography. These references differ considerably in dependability due to new developments and studies contributing to the obsolescence of a number of reports. In addition, the results of samples taken by other individuals are analyzed and the location in 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 second stage of the investigation is begun in the field by making a cursory preliminary survey over the entire area. The information obtained in this survey, together with the information assimilated in the first stage of the investigation

is employed to determine the areas in which the testing and sampling will be concentrated. When a promising source is encountered as determined not only by rock type but also by volume, accessibility, and the existence of a good working face, chip samples are taken with a hammer and submitted to the Highway Testing Laboratory for testing by the Deval Method (AASHO, T-3). It is kept in mind that samples taken by the chip method are often in the weathered zone of the outcrop and consequently may show a less satisfactory test result than the fresh material deeper in the body of the rock structure. When deemed necessary, further samples are taken by drilling to a depth of approximately 3 feet and blasting across the strike or trend of the outcrop. When the material is uniform, and satisfactory tests result from the chip samples, no further drilling, blasting, or sampling is done and the material source is included as being satisfactory.

Discussion of Rock and Rock Sources

It will be observed that the information on the surface-geology bedrock map in regard to rock type is simplified. For a more detailed description of the respective rock formations, a summary is included in this report. It is apparent from this summary that each formation may not be composed of one distinct rock type, but may be a complex mixture of rock types blending into one another. For this reason, the data sheets may describe the rock tested as differing from the designation on the map.

In general, the area included in this report is comprised chiefly of schist and graywacke. A small area of dolomite and quartzite occurs in the southwestern corner of the town. Small sporadic outcrops of greenstone appear in the schist in the eastern section. However, since visual inspection indicated that the schist was of unsatisfactory quality, sampling was confined to the dolomite and quartzite in the southwest corner of the town.

Procedure for Sand and Gravel Survey

The method employed by the project in the survey of possible sources of sand and gravel for highway construction is divided into two main stages; office investigation and field investigation. 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 recognizing and locating physiographic features indicating glacial deposits and in studying drainage patterns. In addition, the location of existing pits, when known, are mapped. The locations in which samples were taken by other individuals are noted and mapped, when possible.

The second stage of the investigation is begun in the field by making a cursory preliminary survey over the entire area noting areas which show physiographic features giving evidence of glacial or fluvial deposits. These locations are later examined by digging test pits with a backhoe at a depth of approximately 11 feet and again sampling the material. The samples are submitted to the Highway Testing Laboratory where they are tested for gradation and stone wear, the latter by the Deval Method (AASHO T-4-35).

Discussion of Sand and Gravel Deposits

The granular deposits of the town of Westford occur primarily at the lower elevations. No sand or gravel deposits were mapped in the higher area along the eastern edge of the town.

Summary of Rock Formations in the Town of Westford

Cheshire Formation - very massive white to faintly pink or buff vitreous quartzite.

Dunham Formation - buff weathered siliceous dolomite pink and cream mottled or buff to gray on fresh surface. Lower part massive, upper sandy and resembles the Winooski Dolomite.

Fairfield Pond Formation - greenish quartzite schist, locally purple or red. Contains quartz sericite, albite chlorite, biotite.

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.

Tibbitt Hill Volcanic Member of the Pinnacle Formation - albite-actinolite-chlorite-epidote greenstone; locally pillowed and vesicular.

Underhill Formation - silvery, gray-green schist.

Glossary of Selected Geologic Terms

Alluvial - Pertaining to material carried or laid down by running water.

Bioherm - An organic reef.

Breccia - A rock consisting of consolidated angular rock fragments larger than sand grains.

Calcareous - Consisting of or containing calcium carbonate. As combined with rock names indicates a considerable proportion, say 50 percent, of calcium carbonate together with an equal or predominant amount of the material indicated by the rock name.

Delta - A predominantly alluvial deposit built out by a stream into the sea or other body of water. Usually having the typical form of the Greek letter delta.

Dip - The angle which a stratum, sheet, vein, fissure or similar geological feature makes with a horizontal plane, as measured in a plane normal to the strike.

Dolomite - As used in this report it applies to rocks approximating the mineral dolomite in composition or consisting predominantly of the mineral dolomite. Mineralogically, dolomite is a mineral of definite chemical composition, $Ca\ Mg\ (CO_3)_2$; carbon dioxide 47.7, lime 30.4, and magnesia 21.9 percent.

Drift - Rock material of any sort deposited in one place after having been moved from another; as river drift. Specif., a deposit of earth, sand, gravel, and boulders, transported by glaciers (glacial drift) or by running water emanating from glaciers (fluvio-glacial drift) and distributed chiefly over large portions of North America and Europe, esp. in the higher latitudes.

Dune - A heap of sand or other material accumulated by wind. The outward form may be that of a hill or a ridge.

Fluvial - Pertaining to streams or stream action.

Geode - As applied in this report, a rock cavity lined with crystals that are not separable from the surrounding rock.

Gneiss - A term originally applied to a more or less banded metamorphic rock with the mineral composition of granite. As now employed it designates a foliated metamorphic rock with no specific composition implied, but having layers that are mineralogically unlike and consisting of interlocking mineral particles that are mostly large enough to be visible to the eye. Usually gneiss displays an alteration of granular minerals and tabular or schistose minerals with the rock, tending to split along the planes where tabular or schistose minerals predominate.

Graywacke - An old rock name loosely used with a variety of related meanings. Some graywackes are massive, others show marked graded bedding and are associated with slate. In view of the diversity of usage, the term probably should not be used without specific definition.

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

Kame Terrace - An accumulation of stratified drift laid down chiefly by streams between a glacial and an adjacent valley wall.

Lacustrine - Pertaining to lakes.

Limestone - A bedded sedimentary deposit consisting chiefly of calcium carbonate. The most important and widely distributed of the carbonate rocks. The percentage of calcium carbonate ranges from 40 percent to more than 98 percent. Common impurities are clay and sand.

Marine Deposits - Sedimentary deposits laid down in the sea.

Megascopic - Characters of a material that can be perceived by the unaided eye.

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

Moraine - An accumulation of drift with an initial topographic expression of its own built within a glaciated region chiefly by the direct action of glacier ice.

Normal - Perpendicular to a surface.

Outwash - Stratified drift that is stream built beyond the glacier; laid down by meltwater streams issuing from the face of the glacier ice.

Pleistocene - The first epoch of the Quaternary Period, in general including the time and deposits of the last great glacial epoch, marked by repeated glacial advances and world-wide fluctuations of the sea level.

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.

Schistosity - The property of a foliated rock by which it can be split into thin layers or flakes. The property of splitting may be due to alternating layers of differing mineral composition or to preferred orientation and parallelism of cleavage planes of the mineral.

Siliceous - Containing or pertaining to silica (Silicon dioxide, SiO_2) or partaking of its nature.

Slate - A homogeneous, metamorphic rock, so fine-grained that no mineral grains can be seen. Slate splits with a foliation so perfect that it yields slabs having plane smooth surfaces.

Strike - The direction of a line formed by the intersection of a stratum with a horizontal plane.

Surface-Geology Map - A map showing areas of outcrop of geologic formations, both consolidated rocks and the unconsolidated sediments. Its scale is large enough that pits and quarries can be accurately shown and indexed.

Synclinal - Formed by strata dipping toward a common line or plane.

Terrace - A plain, natural or artificial, from which the surface descends on one side and ascends on the other. Terraces are commonly long and narrow, and they border seas, lakes, or interior valleys. A terrace may be built by deposition of sediment from water, it may be cut by the breaking of waves on a shore or the sweeping of currents, or it may be formed by the dislocation of rocks in crustal movements. The descent from river terraces toward the river may be very abrupt, especially in arid regions, the ascent on the other side may be only that of an extensive alluvial slope.

Till - Unsorted drift, or the mixture of rock fragments and fine materials left by melting glaciers.

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WESTFORD GRANULAR DATA SHEET NO. 1

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							1½"	#4	#100	#270				
1	1	1960	4.5-12	0-1	Yes		--	75.5	5.0	1.3	2	--	Gran. Borrow (Grav)	Owner: Dean Blake. Test #1 was taken in westernmost pit. 0-1' overburden, 1-4.5' fine silt, 4.5-12' clean, stony sand, 12-17' silt with bands of coarse sand (wet). Rejected for Item 201, sub-base of gravel on gradation; acceptable for granular borrow.
	2	1960	1-15	0-1	Yes		--	27.3	8.0	3.3	1½	17.6	Gravel	Test #2 taken in same pit, 150' west of Test #1. 0-1' overburden, 1-15' gravel, 15-20' silt & clay. Acceptable for Items 201 & 102A.
	3	1960	1-14	0-1	Yes		--	72.9	21.0	3.5	3	--	Gran. Borrow (Grav)	Test #3 taken in west face of same pit. 0-1' overburden, 1-14' thin bands of fine gravel & sand, 14-18' silt & clay. Rej. for sub-base of gravel, acceptable for granular borrow.
	4	1960	1.5-8	0-1.5	Yes		--	38.2	9.0	2.0	3	33.8	Gran. Borrow (Grav)	Test #4 taken in east pit, 290' from Town Road, in north face. 0-1.5' overburden, 1.5-8' dirty sandy gravel, 8-10' silt & clay. Rej. for sub-base of gravel; acceptable for granular

WESTFORD GRANULAR DATA SHEET NO. 2

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes NHD Specs.	Remarks
							1½"	#4	#100	#270				
														borrow. Possible expansion of pits are north to Town Road.
2	1	1960	0.5-7	0-0.5	No		--	70.1	--	1.5	--	--	Gran. Borrow	Owner: Francis Williams. Test #1 taken along ridge about 100' west of the brook. Sieve analysis: Sieve size % Passing 2" 100.0 1" 90.6 3/4" 88.9 3/8" 79.7 #4 70.1 #10 58.4 #40 32.0 #200 2.6 #270 1.5 Soil Type is A-1-b. Acceptable for granular borrow.
3	1	1960	0.5-3	0-0.5	No		--	Not	Sampled		--	--	--	Owner: Burton Rogers. Test #1 taken 50' north of fence, 5' east of path. Material was stony till, not sampled.
	2	1960	0.5-6	0-0.5	Yes		--	20.0	5.0	1.8	2	25.0	Gravel	Test #2 taken 285' NW of Test #1. 0-0.5' overburden, 0.5-6' gravel, 6-7.5' till. This is a very small pit, used by owner,

WESTFORD GRANULAR DATA SHEET NO. 3

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							1½"	#4	#100	#270				
														in wooded area. Material acceptable for Items 201 & 102A.
4	1	1960	2-5.5	0-2	Yes		--	43.6	1.0	0.5	1½	28.8	Gran. Borrow (Grav)	Owner: Burton Rogers. Test #1 taken in north face of pit. 0-2' overburden, 2-5.5' gravel (sampled), 5.5-9' till. Gravel is dirty with soft flat stones. Rej. for Item 201, sub-base of gravel, acceptable for granular borrow.
5	1	1960	1-10	0-1	No		--	16.9	3.0	0.75	2½	35.0	Gran. Borrow (Grav)	Owner: Burton Rogers. Test #1 taken in field just NE of end of old pit. Material is a dirty, poorly sorted gravel, many stones over 6". Acceptable for sub-base of gravel.
	2	1960	1-5.5	0-1	No		--	41.8	6.0	2.75	3	23.8	Gravel	Test #2 taken 200' NE of Test #1 in same field as Test #2. Material is alternate layers of fine sand & gravel, acceptable for sub-base of gravel.
	3	1960	1-6.5	0-1	No		--	26.8	11.0	5.8	4	31.4	Borrow	Test #3 taken 175' west of Test #2 in same field, has clay

WESTFORD GRANULAR DATA SHEET NO. 4

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														with stones at 6.5'. Rej. for sub-base of gravel and granular borrow on gradation & color.
	4	1960	1-8.0	0-1	No		100	81.7	--	37.6	--	--	--	Test #4 taken in west side of field 160' north of pit. Material is silt & stones with clay & stones at 8'. Rej. for both granular borrow & borrow.
	5	1960	1-6.0	0-1	No		--	14.3	5.0	1.75	2½	21.6	Gravel	Test #5 taken 300' from fence at east end of field, 35' south of northern edge of field. Material is dirty gravel, with till at 6'. Acceptable for sub-base of gravel
6	1	1960	1-5	0-1	No		--	38.2	10.0	5.0	3	30.8	Gran. Borrow (Grav)	Owner: Clifford Perkins. Test #1 taken 160' west of old Milton Road, 90' north of fence. 0-1' overburden, 1-5' dirty gravel, 5.5-6' till. Rej. for sub-base of gravel, acceptable for granular borrow.
	2	1960	4.5-7.5	0-1	No		--	13.8	3.0	1.5	2	15.0	Gravel	Test #2 taken south of Test #1, 50' west of road. 0-1' overburden, 1-3' stony sand, 3-4.5' till,

WESTFORD GRANULAR DATA SHEET NO. 5

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#240	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														4.5-7.5' gravel (sampled), 7.5-9' till. Material acceptable for sub-base of gravel.
	3	1960	1-3	0-1	No		--	Not	Sampled		--	--	--	Test #3 taken 100' south of brook, 185' west of power pole. Ledge was struck at 3', so hole was not sampled.
	4	1960	1-4.5	0-1	No	-	--	44.3	7.0	2.25	3½	16.8	Gravel	Test #4 taken 100' west of Test #3. Ledge was struck at 4.5'. Material acceptable for sub-base of gravel.
	5	1960	1-5	0-1	No		--	Not	Sampled		--	--	--	Test #5 taken in NW corner of field. Material was till, not sampled.
7	1	1960	1-10	0-1	No		100	97.3	22.4	1.9	2	--	Gran. Borrow (Sand)	Owner: Arthur Barcomb. Test #1 taken in small knoll in field. 0-1' overburden, 1-6' sand & small stones, 6-10' fine sand. Rej. for sub-base of sand, acceptable for granular borrow.
	2	1960	1-10	0-1	No		100	89.2	30.3	7.5	2½	--	Gran. Borrow (Sand)	Test #2 taken 195' NE of Test #1. Material similar to Test #1. 1-7' coarse sand with some stones over 1½".

WESTFORD GRANULAR DATA SHEET NO. 6

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							—				—	—		Material fails for sub-base of gravel, acceptable for granular borrow.
	3	1960	1-8	0-1	No		--	See	Remarks		--	--	Borrow (Gran. Bor.)	Test #3 taken 250' east of Test #2, 25' from Town Road #3. Sieve analysis: Sieve size % Passing 1½" 100.0 3/4" 96.8 3/8" 90.0 #4 81.1 #10 70.4 #40 54.9 #200 29.3 #270 25.1 Soil type is A-2-4. Material is rejected for granular borrow, acceptable for borrow.
8	1	1960	1-7	0-1	No		--	Not	Sampled		--	--	--	Owner: Arthur Barcomb Test #1 taken in middle of field, 100' south of north edge of field. Material was silt & clay, not sampled.
	2	1960	1-9	0-1	No		100	99.4	60.6	37.5	1	--	--	Test #2 taken in south pasture 85' west of fence at eastern end of pasture, 175' east of western fence. Material is fine sand, wet at the bottom (9'

WESTFORD GRANULAR DATA SHEET NO. 7

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
													—	Rej. for sub-base of sand & granular borrow.
9	1	1960	1-7	0-1	No		100	99.6	59.0	13.5	1½	--	Borrow (Sand)	Owner: Arthur Barcomb. Test #1 taken in SE corner of field, 100' west of Town Road. 0-1' overburden, 1-7' sand, 7-10' fine sand (wet). Material fails for both sub-base of sand & granular borrow.
	2	1960	1-6	0-1	No		--	Not	Sampled		--	--	--	Test #2 taken west of Test #1 in same field; material was fine sand to silt, not sampled.
	3	1960	1-10	0-1	No		--	66.1	8.0	1.75	1½	--	Gran. Borrow (Grav)	Test #3 taken in same field, 110' north of power pole #2962. Material was sandy gravel, with fine sand (wet) at 10'.
	4	1960	1-6	0-1	No		--	Not	Sampled		--	--	--	Test #3 fails for sub-base of gravel, acceptable for granular borrow. Test #4 was taken in NW corner of field; material was till, not sampled.
10	1	1960	0.5-7.5	0-0.5	Yes		100	98.9	21.8	2.6	1	--	Gran. Borrow (Sand)	Owner: Morton H. Reynolds. Test #1 taken in east face of pit.

WESTFORD GRANULAR DATA SHEET NO. 8

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														Material was alternate layers of sand, to wet fine sand & silt. Rejected for sub-base of sand, acceptable for granular borrow.
11	1	1960	2-5	0-2	No		--	Not	Sampled		--	--	--	Owner: Morton H. Reynolds. Test #1 taken 30' from boulder. Material was till, with ledge at 5', not sampled.
12	1	1960	1-9	0-1	No		100	95.5	6.6	1.8	1½	--	Sand	Owner: Rollin Irish. Test #1 taken 80' west of fence along brook. Material was sand, silt & stone. 0-1' overburden, 1-2' gravel (large stones & dirt). Acceptable for sub-base of sand.
	2A	1960	0.5-6.5	0-0.5	No		--	36.8	6.0	2.0	1½	7.4	Gravel	Test #2A taken in southern part of field, 50' north of a 24" ash tree. Test #2A was upper part of hole, good clean gravel, acceptable for sub-base of gravel.
	2B	1960	6.5-11	0-6.5	No		100	99.6	7.0	5.0	1	--	Sand	Test #2B was the lower part of the hole, sand acceptable for sub-base of sand.

WESTFORD GRANULAR DATA SHEET NO. 9

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							1½"	#4	#100	#270				
3A	3A	1960	1-4	0-1	No		--	29.7	6.0	1.0	2½	20.2	Gravel	Test #3A was taken in SW corner of field, 60' north of a large white birch, 55' east of fence. Test #3A was upper 4' of the hole, material acceptable for sub-base of gravel.
	3B	1960	4-9.5	0-4	No		100	99.3	30.7	1.9	1	--	Gran. Borrow (Sand)	Test #3B was from 4-9.5' depth, material was sand failing for sub-base of sand, being too fine. Acceptable for granular borrow.
	4A	1960	0.5-5	0-0.5	No		--	50.2	9.0	1.3	3	24	Gravel	Test #4A was taken 250' north of Test #3 60' east of fence. Test #4A was upper part of hole to 5' depth. Material was gravel, acceptable for sub-base of gravel. From 5-9' is sand and silt.
	4B	1960	5-9	0-5	No		100	97.8	32.2	10.9	1	--	Borrow	Test #4B, rejected for sub-base of sand & granular borrow (on fineness).
13	1A	1960	11-18	0-11	Yes		--	40.8	3.0	1.0	1½	20.6	Gravel	Owner: Rollin Irish. Test #1A taken in south face of pit, represents lower part of hole. Gravel acceptable for sub-base of gravel.

WESTFORD GRANULAR DATA SHEET NO. 10

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
	1B	1960	0-11	0	Yes		100	97.9	24.4	1.8	1	--	Gran. Borrow (Sand)	Test #1B represents the upper portion, sand (fine) rejected for sub-base of sand.
	2	1960	1-6	0-1	No		--	Not	Sampled		--	--	--	Test #2 taken just north of sugar house; fine sand, not sampled.
	3	1960	1-8.5	0-1	No		100	83.0	12.4	0.8	2½	--	Gran. Borrow (Sand)	Test #3 taken 35' west of Town Road; material was fine sand & silt, not sampled.
	4	1960	1-9.5	0-1	No		100	83.0	12.4	0.8	2½	--		Test #4 taken 205' west of Test #3, 45' east of fence. Material was sand & sand with stones, failing for sub-base of sand (on gradation), acceptable for granular borrow.
14	1	1960	14-25.5	0-14	Yes		--	19.0	11.0	2.3	1	19.0	Gravel	Owner: Gerald E. Moulton. Test #1 taken in NE face of pit. (14' overburden-fine sand, silt & some poorly sorted gravel). Material in pit is not in horizontal layers, cross-bedding is prominent & most contacts between materials are sloped steeply. Test #1 passes for sub-

WESTFORD GRANULAR DATA SHEET NO. 11

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1¼"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														base of gravel.
	2	1960	2.5-14.5	0-2.5	Yes		100	99.4	22.8	1.8	1	--	Gran. Borrow (Sand)	Test #2 taken 35' west of Test #1. Material here is sand, rejected for sub-base of sand, (too fine). Ok for granular borrow.
	3	1960	0-6	0	Yes		100	98.7	44.4	5.0	1	--	Gran. Borrow (Sand)	Test #3 was taken in pit to north of lower pits. Material was horizontal bands of silt & sand to hard-packed silt in bottom; rej. for sub-base of sand, acceptable for granular borrow.
	4	1960	1-9	0-1	No		100	98.8	38.5	2.7	1	--	Gran. Borrow (Sand)	Test #4 was taken NE of lower pits; material was similar to Test #3, material rej. for sub-base of sand (too fine), acceptable for granular borrow.
	5	1960	4.5-10	0	Yes		--	53.5	2.0	0.5	1	--	--	Test #5 was taken in upper pit near Town Road. 0-4.5' sand (no overburden), 4.5-10' gravel; gravel bottom.
	6	1960	0-7.5	0	Yes		--	Not	Sampled		--	--	--	Test #6 was taken in floor of middle pit. Surface was stripped, 0-2' sand, 2-4' gravel, 4-7.5' sand,

WESTFORD GRANULAR DATA SHEET NO. 12

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														silt & stones. Water (1" stream) at 7', hole not sampled.
	7A	1960	1-4.5	0-1	No		--	47.8	9.0	2.3	3½	24.8	Gravel	Test #7 was taken 75' east of stone wall, 15' north of path. Test #7A represents the upper portion of the hole, dirty gravel, passing for sub-base of gravel.
	7B	1960	4.5-8	0-4.5	No		100	100	26.0	4.7	2	--	Gran. Borrow (Sand)	Test #7B is the lower portion of the hole, sand failing for sub-base of sand (too fine), acceptable for granular borrow.
	8	1960	7-15	0-7	Yes		100	90.4	8.1	0.9	2	--	Sand	Test #8 taken in north face of pit near stripped area & stone wall. Material around top of pit is too coarse (many stones over 6"). Material at depth is sand with large stones. 7-15' sampled, passes for sub-base of sand.
	9	1960	0.5-4	0-0.5	No		--	Not	Sampled		--	--	--	Test #9 was taken west of Test #8, 45' NW of path. Material was dirt & stones, not sampled.
	10	1960	0-5	0	No		--	24.1	5.0	2.0	3½	23.6	Gravel	Test #10 taken 85° NE of small test pit, 100' west of a lone maple.

WESTFORD GRANULAR DATA SHEET NO. 13

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														Material was coarse gravel & sand, acceptable for sub-base of gravel.
	11	1960	0-9	0	No		--	11.5	6.0	4.8	2	29.0	Gran. Borrow (Grav)	Test #11 was taken 125' north of Test #10, 70' west of ston wall. Material was dirty gravel, coarse at top, finer in bottom, rej. for sub-base of gravel (abrasion = 29%), ok for granular borrow.
	12	1960	8-8.5	0-1	No		100	93.4	50.4	13.5	1	--	Borrow (Sand)	Test #12 was taken 250' from small pit which is north of lower pits, & 15' from stone wall in knoll. Material was sand & silt, rej. for sub-base of sand & granular borrow (too fine).
	13	1960	3-8	0-0.5	No		100	91.4	15.5	1.0	1½	20.2	Gravel Borrow (Sand)	Test #13 was taken 200' NW of Test #12, 85' SE of stone wall in knoll. 0-0.5' overburden, 0.5-3' dirty gravelly sand, 3-8' sand, 809.5' silty sand (3-8' sampled). Rej. for sub-base of sand.
	14	1960	2-7	0-1	No		--	23.6	2.0	1.0	1	20.2	Gravel	Test #14 taken 200' SW of Test #13. 0-1' overburden, 1-2' silt, 2-7' gravel, (sampled)

WESTFORD GRANULAR DATA SHEET NO. 14

ient. lo.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
	15	1960	1-4.5	0-1	No	--	--	Not	Sampled		--	--	--	Acceptable for sub-base of gravel. Test #15 taken 150' SW of Test #14, 55' SE of wall. Material was till with large stones, not sampled.
15	1	1960	1-5	0-1	No		--	Not	Sampled		--	--	--	Owner: Francis L. Hall Test #1 taken 89' north of fence row, 160' west of drainage ditch. Material was silt & clay with stones; not sampled.
16	1	1960	1-10	0-1	No		--	44.3	15	4.0	1½	--	Gran. Bor. (Grav)	Owner: Donald Tucker. Test #1 was taken just south of the edge of pit. 1-10' was gravel, meeting grading requirements for sub-base of gravel, but containing insufficient stone for the percent of wear test. This was also the case with Test Nos. 2 & 7.
	2	1960	10-25	0-1	Yes		--	46.2	1.0	0.75	1½	--	Gran. Borrow (Grav)	Test #2 was taken in NE face of pit. 10-25' depth was sampled. Top of pit extended 10' above start of sampling zone.

WESTFORD GRANULAR DATA SHEET NO. 15

ient. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							1½"	#4	#100	#270				
	3A	1960	1-7.5	0-1	Yes		--	38.1	22.0	8.75	2½	--	Gran. Borrow (Grav)	Test #3A taken in south face of pit, material was taken from 1-7.5' (dirty gravel); rej. on gradation for sub-base of gravel.
	3B	1960	7.5-14	0-7.5	Yes		--	24.9	10.0	2.75	1	28.0	Gran. Borrow (Grav)	Test #3B was taken in same hole, from 7.5-14' depth. Material was cleaner gravel than upper portion, but was rejected for sub-base of gravel on percent of wear (28%).
	4	1960	0-12	0	Yes		--	50.3	2.0	1.0	2	41.0	Gran. Borrow (Grav)	Test #4 was taken in western face of pit, 14' from fence. 0-4' gravel, 4-12' gravelly sand. Large boulders in material over 2' in diameter. Rej. for sub-base of gravel on percent of wear (41%).
	5	1960	2.5-10	0-1	No		100	97.5	9.7	0.9	2	--	Sand	Test #5 was taken at eastern edge of pit (5' east of edge). 0-1' overburden, 1-2.5' dirty gravel, 2.5-10' sand (sampled). Passes for sub-base of sand.

WESTFORD GRANULAR DATA SHEET NO. 16

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							1½"	#4	#100	#270				
	6	1960	1-10	0-1	No		--	53.0	6.0	1.5	2	24.0	Gravel	Test #6 taken 77' west of fence & stone wall, 100' SE of kettle hole. Beds dip to east (sand & stones). Material from 1-10' sampled, acceptable for sub-base of gravel.
	7	1960	1-7	0-1	No		--	54.4	4.0	1.0	2½	--	Gravel	Test #7 taken 160' SW of Test #6, 110' from fence & stone wall. Beds dip to west, material is similar to Test #6. Grading was acceptable but there were insufficient stones for the percent of wear test.
	8	1960	0.5-11	0-0.5	No		100	91.3	12.9	2.7	1	--	Sand	Test #8 was taken 20' north of easternmost pit, 110' SE of Test #7. 0-0.5' overburden, 0.5-4' dirty gravel, small stones, 4-11' sand (fine to coarse) Material acceptable for sub-base of sand.
	9	1960	1-21	0-1	Yes		--	60.1	13.0	4.0	1	--	Gran. Borrow (Grav)	Test #9 taken at western edge of easternmost pit. 0-1' overburden, 1-6' gravel dipping to the west, 6-21' sand with stone & silt layers

WESTFORD GRANULAR DATA SHEET NO. 17

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														(wet). Rej. for sub-base of gravel on gradation (only 39.9% stone).
17	1	1960	1.5-9	0-1.5	No	--	--	See	Remarks		--	--	Gran. Borrow	Owner: Francis Hall. Test #1 was taken in knoll just east of drainage brook. Material is alternate bands of silt, sand, & some gravel, passing for granular borrow. Sieve analysis: Sieve size % Passing 3/4" 100.0 3/8" 96.5 #4 90.9 #10 84.1 #40 66.9 #200 10.4 #270 6.2 Soil type is A-2-4.
	2	1960	1-5	0-1	No		--	20.0	10.0	3.8	3½	20.0	Gravel	Test #2 was taken 216' south of east-west trending stone wall, 25° west of north-south trending stone wall. Material is dirty gravel, acceptable for sub-base of gravel.
	3	1960	1-9	0-1	No		100	83.2	--	10.6	--	--	Borrow	Test #3 was taken 200' south of Test #2 35° east of stonewall Material was dirty

WESTFORD GRANULAR DATA SHEET NO. 18

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														gravel, ledge bottom at 9'. Rej. for granular borrow, acceptable for borrow.
	4	1960	1-7.5	0-1	No		98.3	80.9	3.2	1.6	3	--	Gran. Borrow (Sand)	Test #4 was taken 125' south of edge of stone wall. Material is sand & stones (large stones at bottom). Material is rejected for sub-base of sand, acceptable for granular borrow.
	5A	1960	1-6.5	0-1	No		100	99.5	15.0	2.9	3	--	Sand	Test #5 was taken 50' south of edge of stone wall.
	5B	1960	6.5-9.5	0-6.5	No		--	43.8	5.0	2.25	2½	26.2	Gran. Borrow (Grav)	Test #5B represents 6.5-9.5' depth (gravel), rej. for sub-base of gravel. Test #5A represents 1-6.5' depth (sand) passes for sub-base of sand.
	6	1960	1-7	0-1	No		92.7	74.4	--	8.0	--	--	Borrow	Test #6 was taken 200' east of edge of stone wall. Material was silt & stone, rej. for granular borrow, acceptable for borrow. Soil type is A-1-b. Sieve analysis: Sieve size % Passing 3" 100.0 1½" 92.7 3/4" 84.6 3/8" 80.7

WESTFORD GRANULAR DATA SHEET NO. 19

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							1½"	#4	#100	#270				
														#4 74.4 #10 65.6 #40 47.5 #200 11.9 #270 8.0
	7	1960	1-4.5	0-1	No		100	83.6	--	14.7	--	--	Borrow	Test #7 taken south of Test #6 just north of Harold White pit, between two large elms. Material was silt & stone, rej. for granular borrow, acceptable for borrow Soil type is A-2-4. Sieve analysis: Sieve size % Passing 1½" 100.0 3/4" 94.5 3/8" 88.8 #4 83.6 #10 75.0 #40 57.8 #200 21.8 #270 14.7
18	1A	1960	1.5-4.5	0-1.5	Yes		--	31.1	3.0	1.0	2½	24.6	Gravel	Owner: Harold G. White. Test #1 was taken in old small pit. Entire area is very rocky (with large boulders). Test #1A represents 1.5-4.5' depth. Material is gravel, acceptable for sub-base of gravel.

WESTFORD GRANULAR DATA SHEET NO. 20

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
	1B	1960	4.5-5.5	0-4.5	Yes		--	See	Remarks		--	--	Gran. Borrow	Test #1B represents 4.5-5.5' depth (sand), acceptable for granular borrow. Sieve analysis: Sieve size % Passing 3/4" 100.0 3/8" 99.7 #4 98.1 #10 96.7 #40 95.5 #200 15.3 #270 8.2 Soil type is A-2-4.
19	1	1960	1-6	0-1	No		--	Not	Sampled		--	--	--	Owner: Francis Hall. Test #1 taken in field east of house & barn, 55° NW of power pole, 170° from northwestern stone wall. Material was till, not sampled.
	2	1960	1-9	0-1	No		100	90.6	44.4	9.0	2	--	Gran. Borrow (Sand)	Test #2 taken 65' east of ditch, 110' west of stone wall, in NE corner of field. Material is sand, rej. for sub-base of sand (too fine).
20	1A	1960	0.5-25	0-0.5	Yes		100	56.2	--	1.1	--	--	Gran. Borrow	Owner: Glenn Hunter. This was quite an extensive area, containing several depleted pits. Material extends eastward. Test

WESTFORD GRANULAR DATA SHEET NO. 21

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimte (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														#1A taken in east face of pit across Town Road from abandoned house. Material acceptable for granular borrow. Sieve analysis Sieve size % Passing 1½" 100.0 1" 96.1 3/4" 90.9 3/8" 74.7 #4 56.2 #10 41.5 #40 14.0 #200 1.4 #270 1.1 Soil type is A-1-a.
	1B	1960	10-14	--	Yes		96.4	63.3	3.2	0.8	3	--	Gran. Borrow (Sand)	Test #1B was taken in same face. 10-14' were sampled. Material was sand, rejected for sub-base of sand, ok for granular borrow.
	2	1960	10-14	0-1	No		--	19.0	21.0	9.5	1	--	Gran. Borrow (Grav)	Test #2 was taken north of pit. 1-9' sand, 9-10' silt, 10-14' gravel, 14-17' fine sand. Material (10-14') sampled, rej for sub-base of gravel (gradation & wear).

WESTFORD GRANULAR DATA SHEET NO. 22

ient. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
	3	1960	1-16	0-1	Yes		100.0	85.0	19.4	3.2	2	--	Gran. Borrow (Sand)	Test #3 taken in north face of northernmost pit. 1-6' fine sand, 6-13' coarse sand, 13-16' fine sand, 16-19' gravel. Material was rejected for sub-base of sand (on gradation).
	4	1960	0-10	0	Yes		--	Not	Sampled		--	--	--	Test #4 was taken in floor of pit. There was a hole 5-6' west of Test #4 with water in bottom. 0-3' coarse sand, 3-8' fine sand interbedded with coarse sand, 8-10' stony clay, not sampled.
21	1	1960	1-10	0-1	No		100	95.5	50.0	25.0	1	--	--	Owner: Waldo Cutting. Test #1 taken in NE part of sand knoll, near brook. Material rej. for sub-base of sand & granular borrow (too fine).
	2	1960	1-10.5	0-1	No		100	99.8	40.0	10.0	1	--	Gran. Borrow (Sand)	Test #2 taken 100' SE of Test #1 in same sand knoll. Material was also sand, rej. for sub-base of sand, acceptable for granular borrow.

WESTFORD GRANULAR DATA SHEET NO. 23

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							1½"	#4	#100	#270				
22	1	1960	0.5-9.5	0-0.5	No		--	29.1	5.0	2.0	1	21.2	Gravel	Owner: Oscar Young. Test #1 taken on a N-S trending ridge, 50' north of stone wall. Material was gravel, acceptable for sub-base of gravel.
	2A	1960	0.5-5.5	0-0.5	No		--	59.1	4.0	1.0	2½	--	Gran. Borrow (Grav)	Test #2 taken to west of ridge 220' west of Test #1. Test #2A represents 0.5-5.5' depth. Material was gravel, meeting grading requirements (but not containing enough stone for the percent of wear test) for sub-base of gravel.
	2B	1960	5.5-10.5	0-5.5	No		100	94.4	22.0	10.4	1	--	Borrow (Sand)	Test #2B represents 5.5-10.5' depth. Material was sand, rej. for sub-base of sand & granular borrow (too fine).
	3	1960	0.5-7	0-0.5	No		100	95.8	74.0	28.0	2½	--	--	Test #3 was taken on ridge 200' north of Test #1. Material was sand with large stones at 7'. Rej. for sub-base of sand & granular borrow (too fine).
	4	1960	0.5-5	0-0.5	No		100	93.4	24.0	4.0	3	--	Gran. Borrow (Sand)	Test #4 was taken on ridge near ledge outcrop 200' north of Test #3. Material was

WESTFORD GRANULAR DATA SHEET NO. 24

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														sand with ledge at 5'. Material rej. for sub-base of sand, acceptable for granular borrow.
	5	1960	0-7	0	No		--	62.8	6.0	2.0	1½	--	Gran. Borrow (Grav)	Test #5 taken in cut bank at side of field road 190' south of hedge row. Material was gravel & sand to fine sand at 7-13'. Rej. for sub-base of gravel (gradation), acceptable for granular borrow.
	6	1960	0.5-10.5	0-0.5	No		100	99.4	70.0	25.0	1	--	--	Test #6 was taken 175' NW of Test #5 50' south of hedge row. Material was fine sand, rej. for sub-base of sand & granular borrow (too fine).
23	1	1960	0.5-3	0-0.5	No		--	Not	Sampled		--	--	--	Owner: Roland Howard. Test #1 was taken in top of knoll to east of old road & north of cemetery. Material was dirty gravel with stones. Not sampled.
24	1	1960	1-4	0-1	No		100	99.5	49.0	6.8	3	--	Gran. Borrow (Sand)	Owner: Foster Blondin. Test #1 was taken in SE corner of pit area 135' north of fence, 75' SW of pine tree.

WESTFORD GRANULAR DATA SHEET NO. 25

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														Material was fine sand with clay at 4'. Rej. for sub-base of sand (too fine), acceptable for granular borrow.
	2	1960	0.5-14	0-0.5	Yes		--	56.9	5.0	0.75	2½	--	Gran. Borrow (Grav.)	Test #2 was taken in west face of northernmost pit. 0-0.5' overburden, 0.5-14' gravel 14-24' fine sand & stones. Meets grading requirements for sub-base of gravel, not enough stone for percent of wear test.
	3	1960	12-28	0-0.5	Yes		100	85.6	2.4	0.4	1	--	Sand	Test #3 taken in east face of same pit as Test #2. 0-0.5' overburden, 0.5-12' silt with thin bands of sand, 12-28' sandy gravel. Material acceptable for sub-base of sand.
25	1	1960	4-21		Yes		--	See	Remarks		--	--	--	Owner: Robert Jackson. Test #1 was taken in north face of pit east of town road; material was gravel & sand. Results of this test were lost.
	2	1960	1-3	0-1	No		--	Not	Sampled		--	--	--	Test #2 was taken north of Test #1. Material was clay & silt, not sampled.

WESTFORD GRANULAR DATA SHEET NO. 26

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							1½"	#4	#100	#270				
26	1	1960	3-8	0-1	Yes		100	99.7	37.9	5.5	1	--	Gran. Borrow	Owner: Norman Spiller. Test #1 was taken in north face of pit. 0-1' overburden, 1-3' gravel (very stony), 3-8' sand, 8-11' silty till.
	2	1960	1-8	0-1	No		--	Not	Sampled		--	--	--	Test #2 was taken east of Test #1.
	3	1960	1-4	0-1	No		--	Not	Sampled		--	--	--	Test #3 taken west of Test #1. Both tests were silty sand with large stones, not sampled.
27	1	1960	9-32	0-9	Yes		--	27.2	2.0	0.75	1	15.4	Gravel	Owner: Cyrus Perry. Test #1 was taken in NW face of pit. Material was fine, well-graded gravel. 0-1' overburden, 1-9' silt till & fine sand, 9-32' gravel. Acceptable for sub-base of gravel.
	2	1960	0-5	0	Yes		--	26.7	7.0	2.0	1	18.6	Gravel	Test #2 was taken 15' east of Test #1 in floor of pit. Water at 4'. Material was gravel, acceptable for sub-base of gravel.
	3	1960	0-8	0	No		--	Not	Sampled		--	--	--	Test #3 was taken SE of pit area. Material was silt, clay & stone, not sampled.

WESTFORD GRANULAR DATA SHEET NO. 27

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
							1½"	#4	#100	#270				
	4	1960	1-10	0-1	No		--	35.9	12.0	2.5	3½	21.4	Gravel	Test #4 was taken 100' SW of pile of overburden, 90' east of ledge. Material was sandy gravel, acceptable for sub-base of gravel.
28	1	1960	13-24	0-1	Yes		--	55.2	4.0	1.0	1½	17.0	Gravel	Owner: Rollin A. Bixby Test #1 taken in east face of pit. Backhoe could not reach top of bank. 0-1' overburden, 1-7' (dirty gravel?) Material acceptable for sub-base of gravel.
	2	1960	1-4	0-1	No		--	Not	Sampled		--	--	--	Test #2 was taken in field, 25' from edge of pit, 150' from Vt Route 128. Material was dirty gravel with till & clay at 4', not sampled.
	3A	1960	10-17	0-1	Yes		--	48.5	2.0	0.5	1	20.2	Gravel	Test #3 was taken in south face of pit. Test #3A represents 10-17' depth, material was gravel; acceptable for sub-base of gravel. 0-10' could not be reached.
	3B	1960	17-19	0-10	Yes		100	99.6	8.1	0.4	1½	--	Sand	Test #3B represents 17-19' depth, material was sand; acceptable for sub-base of sand.

WESTFORD GRANULAR DATA SHEET NO. 28

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
	4	1960	1-4.5	0-1	No		--	Not	Sampled		--	--	--	Test #4 was taken 35' west of path, 100' south of pit. Material was stony silt, with ledge at 4.5'; not sampled.
	5	1960	1-9.5	0-1	No		--	Not	Sampled		--	--	--	Test #5 was taken 40' west of path, 175' north of Perry property fence. Material was stony silt, not sampled.
	6	1960	1-10	0-1	No		--	Not	Sampled		--	--	--	Test #6 was taken SW of Test #5, 75' north of Perry property fence. Material was silt & clay with some bands of gravel; not sampled.
29	1	1960	1-10	0-1	No		--	52.9	3.0	1.0	1½	16.0	Gravel	Owner: Rollin A. Bixby Test #1 taken 60' south of Shambo prop. fence, north of brook. Material was fine gravel (nice & clean), acceptable for sub-base of gravel.
	2	1960	5-10	0-5	No		100	100	42.0	6.3	2½	--	Gran. Borrow (*Sand*)	Test #2 was taken 24' south of Shambo prop. fence, 120' NW of Test #1. 0-5' clay & silt, 5-10' fine sand, rej. for sub-base of sand (too fine), acceptable for granular borrow.

WESTFORD GRANULAR DATA SHEET NO. 29

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
	3	1960	11-31	0-3	Yes		--	39.0	22.0	6.0	1½	17.6	Gran. Borrow (Gran)	Test #3 was taken in west face of pit. 0-3' overburden, 3-31' alternate bands of sand & gravel. Very coarse stones & boulders in bottom; impossible to reach above 20' mark on face of pit with backhoe.
	4	1960	0-5.5	0	Yes		--	Not	Sampled		--	--	--	Test #4 was taken in floor of pit. Material was dirty gravel, poorly sorted; hard-packed sandy till in bottom; not sampled.
	5	1960	1-15	0-1	No		--	27.6	4.0	2.25	2½	15.4	Gravel	Test #5 was taken in bank of brook. Material was good-looking gravel, acceptable for Items 201 & 102A.
	6	1960	0-8.5	0	No		--	Not	Sampled		--	--	--	Test #6 was taken south of Test #5, just east of pit. Material was clay & till to stony till at 8.5'; not sampled.
	7	1960	0-7	0	No		--	Not	Sampled		--	--	--	Test #7 was taken 220' south of Vt Route 128, on top of slope. Material was silt & clay, not sampled.
	8	1960	0-5	0	No		--	Not	Sampled		--	--	--	Test #8 was taken 200' south of Test #7. Material was silt & clay, not sampled.

WESTFORD GRANULAR DATA SHEET NO. 30

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
	9	1960	1-10	0-1	Yes		100	83.5	13.3	0.8	1½	--	Gran. Borrow (Sand)	Test #9 was taken in NW face of old pit west of brook. Material was sand, rej. for Item 202 on gradation, acceptable for Item 102A.
	10	1960	0.5-19	0-0.5	No		--	20.2	4.0	0.75	1	23.0	Gravel	Test #10 taken north of old pit. Material was poorly stratified gravel, very coarse at top. Acceptable for Items 201A & 102A.
	11	1960	3-9	0-1	No		--	51.7	14.0	4.0	2	28.6	Gran. Borrow (Grav)	Test #11 taken north of Test # 10. 0-1' overburden, 1-3' silty sand, 3-9' sandy gravel with coarser stones toward bottom. Rej. for Item 201A on abrasion, acceptable for Item 102A.
	12	1960	1-5	0-1	No		--	Not Sampled			--	--	--	Test #12 taken west of Test #11, 50' east of fence. Material was fine silty sand & stone, with ledge at 5', not sampled.
	13A	1960	1-5	0-1	No		--	42.4	10.0	2.0	2	15.6	Gravel	Test #13 taken south of Test #12. Test #13A represents 1-5' depth; gravel acceptable for Items 201A & 102A.
	B	1960	5-8	0-1	No		100	85.0	27.2	5.9	3	--	Gran. Borrow (Sand)	Test #13B represents 5-8' depth. Material was sand, rej. for

WESTFORD GRANULAR DATA SHEET NO. 31

dent. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														Item 202 (too fine), acceptable for Item 102A.
	14	1960	1-8	0-1	No		--	Not	Sampled		--	--	--	Test #14 was taken in SE corner of field, material was clay & silt, not sampled.
30	1	1960	0-10.5	0	Yes		--	20.7	4.0	1.75	2½	19.2	Gravel	Owner: Louis Shambo. Test #1 taken in north face of pit. Material was gravel with large cobbles at the bottom. Acceptable for Items 201A & 102A.
	2	1960	1-8	0-1	No		--	38.7	5.0	2.25	2½	8.2	Gravel	Test #2 was taken on ridge west of Test #1. Material was good-looking gravel. The overburden varies in thickness (average about 1'). Acceptable for Items 201A & 102A.
	3	1960	1-6	0-1	No		--	Not	Sampled		--	--	--	Test #3 was taken SE of Test #2, off ridge. Material was clay, not sampled.
	4	1960	1-8	0-1	No		--	22.7	8.0	3.25	3	18.8	Gravel	Test #4 was taken south of pit area of Test #1, 210' west of a large elm tree. Material was gravel, acceptable for Items 201A & 102A.
	5	1960	0.5-10	0-1	No		--	Not	Sampled		--	--	--	Test #5 was taken north of Test #1, 50' south of a large

WESTFORD GRANULAR DATA SHEET NO. 32

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														maple tree. 0-1' overburden, 1-6.5' clay & silt, 6.5-10' sand, not sampled.
	6	1960	1-9	0-1	No		100	98.8	8.1	1.8	2½	--	Sand	Test #6 taken in pasture north of Test #1, 20' from north edge, 20' from west edge. Material was sand, acceptable for Items 202 & 102A.
	7	1960	1-9	0-1	No		--	Not	Sampled		--	--	--	Test #7 was taken west of (across fence from) Test #6. The material was clay & silt, not sampled.
	8	1960	6-18	0-1	Yes		--	20.0	8.0	3.5	2½	14.8	Sand	Test #8 taken in westernmost pit in meadow north of pasture of Test #6. 0-1' overburden, 1-6' sand 6-18' gravel (sampled) Acceptable for Items 201A & 102A.
	9	1960	3-10.5	0-1	No		--	19.4	1.0	0.3	1	8.4	Gravel	Test #9 taken 90' east of pit, 90' north of fence. Material was gravel, acceptable for Items 201A & 102A.
	10	1960	1-9	0-1	No		--	Not	Sampled		--	--	--	Test #10 taken 160' north of Test #9. The material was clay & till, not sampled.
	11	1960	0.5-9	0-0.5	No		--	37.3	3.0	1.5	2½	17.2	Gravel	Test #11 taken 110' west of Test #10, 75'

WESTFORD GRANULAR DATA SHEET NO. 33

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														NE of easternmost pit in meadow. 0-0.5' overburden, 0.5-9' excellent gravel. Acceptable for Items 201A & 102A.
	12	1960	3-13	1-3	Yes		--	23.4	4.0	1.3	1	28.8	Gran. Borrow (Grav)	Test #12 taken in SW face of pit. Material was gravel with wet sand at 13'. Rej. for Item 201A on abrasion; acceptable for Item 102A.
	13	1960	0.5-9	0-0.5	No		--	53.7	6.0	1.5	2½	20.8	Gravel	Test #13 taken 100' west of pit. 0-0.5' overburden, 0.5-2.5' gravel, 2.5-5' sand, 5-9' gravel. Acceptable for Items 201A and 102A.
	14	1960	0-7	0	No		--	Not	Sampled		--	--	--	Test #14 taken west of pit of Test #1, 140' south of a ledge outcrop. Material was silt & clay, not sampled.
	15	1960	0-9	0	No		--	Not	Sampled		--	--	--	Test #15 taken south of cemetery on ridge, behind L. Shambo farm buildings. Material was fine silty sand & clay; not sampled.
31	1	1960	0-4	0	No		100	100	61.0	12.0	2½	--	Borrow (Sand)	Owner: R. Lamelle. Test #1 was taken just west of private road to old abandoned

WESTFORD GRANULAR DATA SHEET NO. 34

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-Burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Specs.	Remarks
														sawmill. Material was sand, becoming coarser at bottom. Rej. for Items 202 & 102A (too fine).
32	1	1960	0-15	0	Yes		100	100	50.0	11.3	1	--	Borrow (Sand)	Owner: Potvin. Test #1 taken in east face of pit across town road from dump. Material was sand, rej. for Items 202 & 102A (too fine).

WESTFORD ROCK DATA SHEET NO. 1

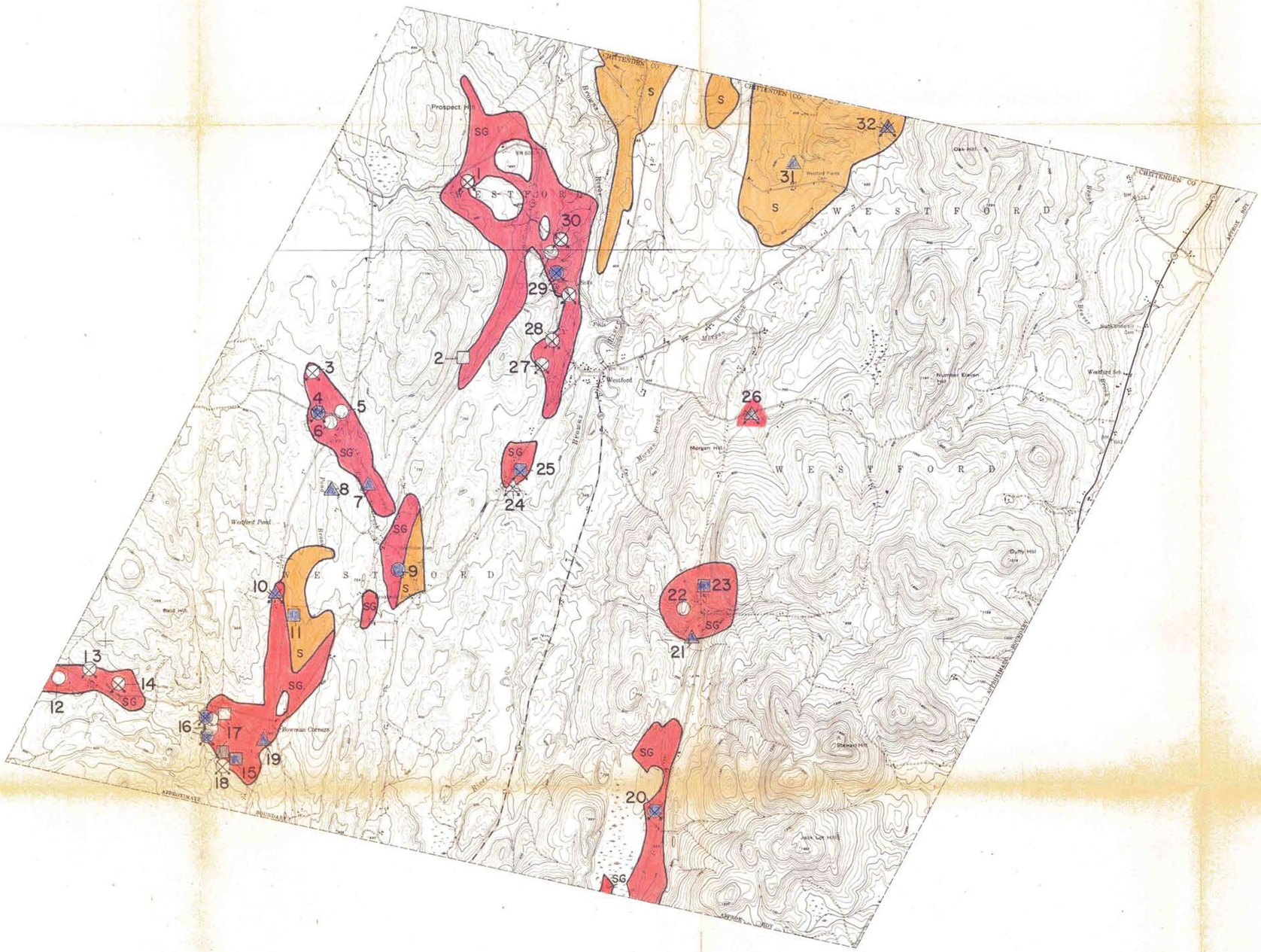
Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T-3	Distance Between Samples (ft)	Remarks
1	1	1960	Quartzite	No	Chip	3.0	--	Owner: Rollin Irish. Test #1 was taken in ledge NW of barn. This is a large area of many outcrops with good relief. Rock was quartzite, acceptable for Item 204, sub-base of crushed rock.
2	1	1960	Quartzite & Dolomite	No	Chip	6.8	200' (across strike)	Owner: Donald Tucker. Test #1 was taken on a small ridge just west of Donald Tucker's house for 200' across strike. The rock is impure dolomite and quartzite with a tendency to break in flat pieces. The rock strikes north-south and outcrops both north and south of the Town Road. The rock meets the abrasion requirements for sub-base of Crushed Rock, Item 204.

WESTFORD GRANULAR PROPERTY OWNERS

PROPERTY OWNERS	IDENT. NO.
Barcomb, Arthur	7, 8, 9
Bixby, Rollin A.	28, 29
Blake, Dean	1
Blodin, Foster	24
Cutting, Waldo	21
Hall, Francis L.	15, 17, 19
Howard, Roland	23
Hunter, Glenn	20
Irish, Rollin	12, 13
Jackson, Robert	25
Lamelle, R.	31
Moulton, Gerald E.	14
Perkins, Clifford	6
Perry, Cyrus	27
Potvin	32
Reynolds, Morton H.	10, 11
Rogers, Burton	3, 4, 5
Shambo, Louis	30
Spiller, Norman	26
Tucker, Donald	16
White, Harold G.	18
Williams, Francis	2
Young, Oscar	22

WESTFORD ROCK PROPERTY OWNERS

PROPERTY OWNERS	IDENT. NO.
Irish, Rollin	1
Tucker, Donald	2



LEGEND

- ○ GRAVEL, ACCEPTABLE FOR ITEM 201 (sub-base of gravel)
- ◉ GRAVEL, DEPLETED OR NOT ACCEPTABLE FOR ITEM 201
- △ SAND, ACCEPTABLE FOR ITEM 202 (sub-base of sand)
- ▲ SAND, DEPLETED OR NOT ACCEPTABLE FOR ITEM 202
- □ GRANULAR BORROW, ITEM 102-A
- ▣ BORROW, ITEM 102
- ✕ EXISTING PIT
- SG SAND & GRAVEL DEPOSIT
- S SAND DEPOSIT
- 3 IDENTIFICATION NUMBER (refer to data sheets)

WESTFORD

SCALE 1:31,250

0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1961

GRANULAR MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

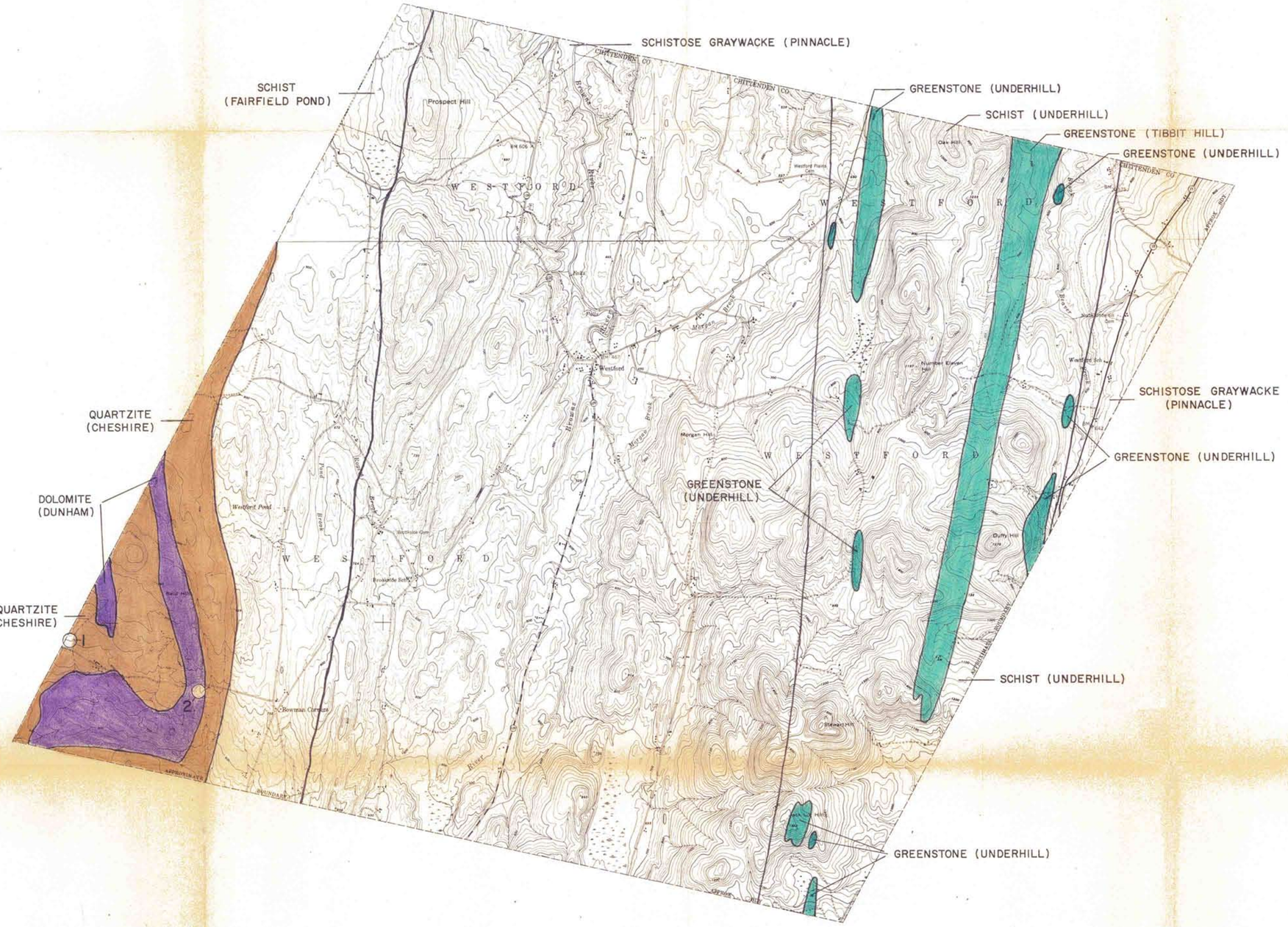
NOTE: BASED ON U.S.G.S. TOPOGRAPHIC MAPS

PLATE I GRANULAR

CHITTENDEN COUNTY VT. HWY. DISTRICT NO. 8

REVISIONS

DATE							
BY							



LEGEND

- ROCK, ACCEPTABLE FOR ITEM 204 (sub-base of crushed rock)
- ROCK, NOT ACCEPTABLE FOR ITEM 204
- 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 text)

WESTFORD

SCALE 1:31,250

0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1961

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 2

ROCK

CHITTENDEN COUNTY VT. HWY. DISTRICT NO. 8

REVISIONS

DATE						
BY						