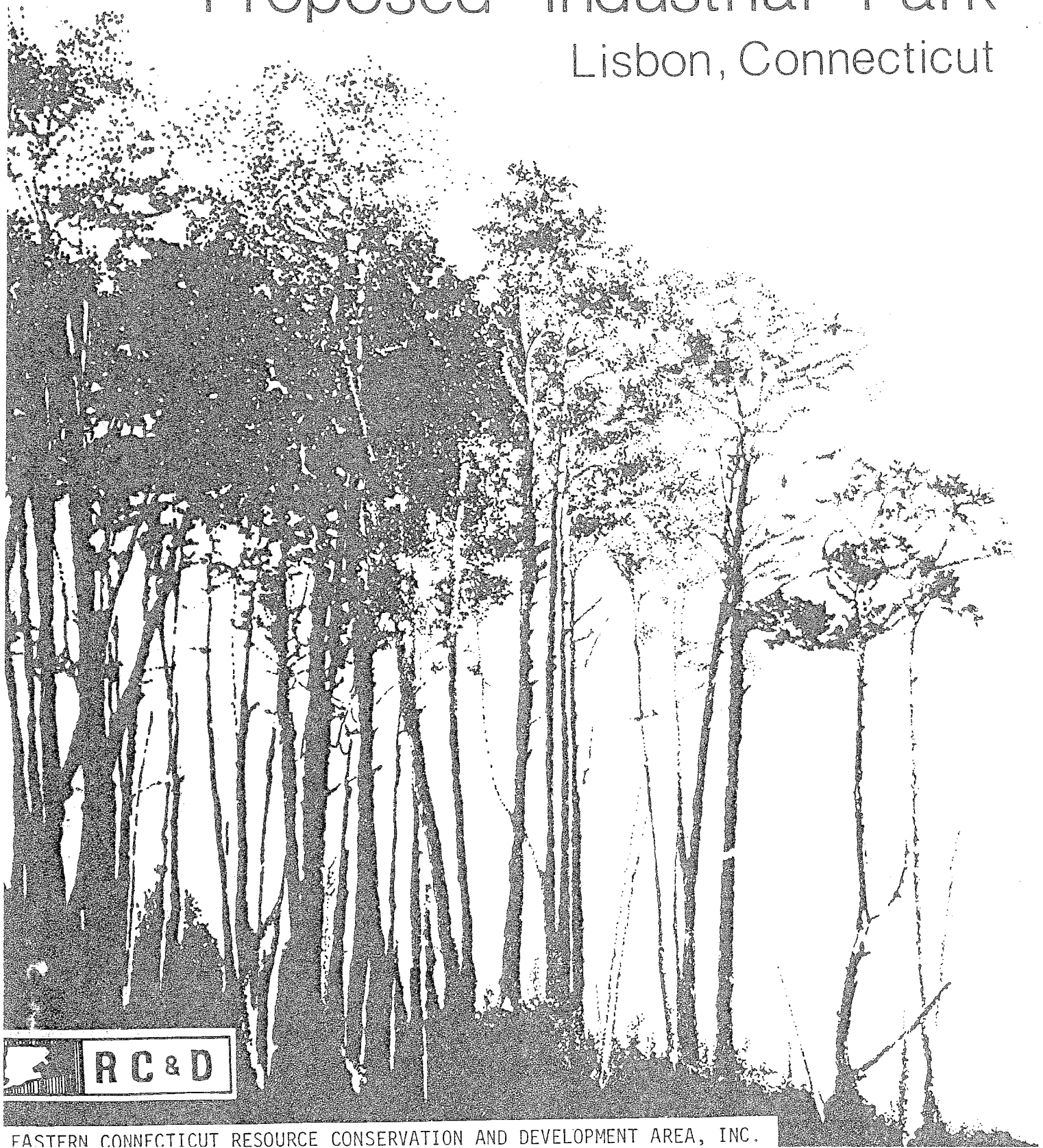
Environmental Review Team Report

Proposed Industrial Park

Lisbon, Connecticut



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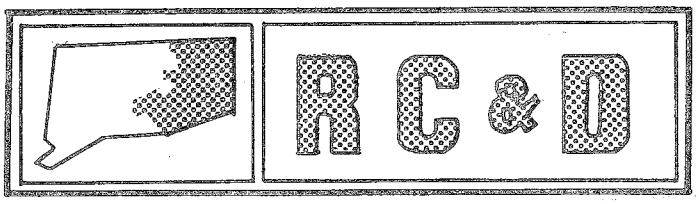
EASTERN CONNECTICUT RESOURCE CONSERVATION AND DEVELOPMENT AREA, INC.

Environmental Review Team Report
on

Proposed Industrial Park

Lisbon, Connecticut

July 1981

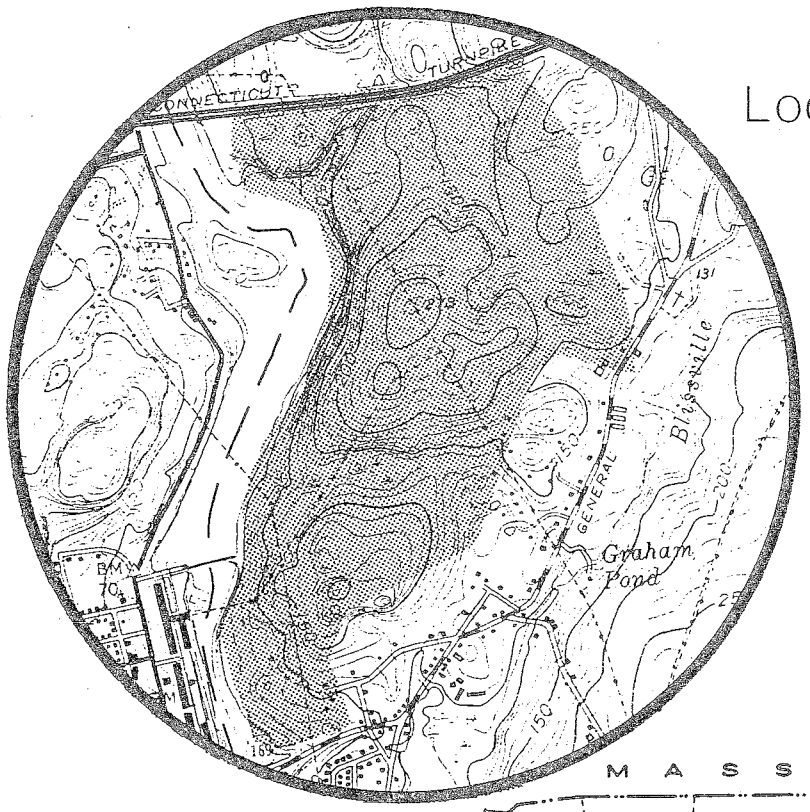


eastern connecticut resource conservation & development area

environmental review team
139 boswell avenue
norwich, connecticut 06360

Location of Study Site

PROPOSED INDUSTRIAL PARK
LISBON, CONNECTICUT



EASTERN CONNECTICUT
RESOURCE CONSERVATION AND DEVELOPMENT PROJECT

ENVIRONMENTAL REVIEW TEAM REPORT
ON
PROPOSED INDUSTRIAL PARK
LISBON, CONNECTICUT

This report is an outgrowth of a request from the First Selectman of Lisbon to the New London County Soil and Water Conservation District (S&WCD). The S&WCD referred this request to the Eastern Connecticut Resource Conservation and Development (RC&D) Area Executive Committee for their consideration and approval as a project measure. The request was approved and the measure reviewed by the Eastern Connecticut Environmental Review Team (ERT).

The soils of the site were mapped by a soil scientist of the United States Department of Agriculture (USDA), Soil Conservation Service (SCS). Reproductions of the soil survey map as well as a topographic map of the site were distributed to all ERT participants prior to their field review of the site.

The ERT that field checked the site consisted of the following personnel: Gary Domian, District Conservationist, Soil Conservation Service (SCS); Mike Zizka, Geologist, Department of Environmental Protection (DEP); Rob Rocks, Forester, (DEP); Don Capellaro, Sanitarian, State Department of Health; Tom Seidel, Regional Planner, Southeastern Connecticut Regional Planning Agency; and Jeanne Shelburn, ERT Coordinator, Eastern Connecticut RC&D Area.

The Team met and field checked the site on Thursday, April 30, 1981. Reports from each Team member were sent to the ERT Coordinator for review and summarization for the final report.

This report is not meant to compete with private consultants by supplying site designs or detailed solutions to development problems. This report identifies the existing resource base and evaluates its significance to the proposed development and also suggests considerations that should be of concern to the developer and the Town of Lisbon. The results of this Team action are oriented toward the development of a better environmental quality and the long-term economics of the land use.

The Eastern Connecticut RC&D Project Committee hopes you will find this report of value and assistance in making your decisions on this particular site.

If you require any additional information, please contact: Ms. Jeanne Shelburn, Environmental Review Team Coordinator, Eastern Connecticut RC&D Area, 139 Boswell Avenue, Norwich, Connecticut 06360, 889-2324.

Topography

Site Boundary

0 1000' scale

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INTRODUCTION

The Eastern Connecticut Environmental Review Team has been requested to prepare an environmental assessment for a proposed industrial park in the Town of Lisbon. The site is approximately 375 acres in size and is located on Route 169, south of Route 52 and east of the Shetucket River. Distinctive features of the site include the sand/gravel borrow pit in the southwest corner, the Connecticut Light and Power right-of-way with associated power lines, several limited wetland areas with streamcourses connected to the river, and a generally rocky and steep terrain. A former town refuse site is located off the property near Preston Allen Road.

The site is currently in the ownership of four private parties, Leon Balbulsky, William Haviland, John Nemczuk and Anna Nemczuk. As no preliminary plans had been developed prior to the field review, the Team assessed the site in a general manner for its potential to support industrial development. During the pre-review meeting, Mr. Nemczuk discussed extending public water and sewer to the area if the project were to be developed and a potential for access to Route 52 from the site.

The site was found to have a number of natural constraints to development. Most prominent among these are the soils found on-site. In most areas, they are extremely steep, stony and have a shallow depth to bedrock. Although severe limitations to development can be overcome with proper engineering techniques, these methods can become costly, making a project financially unfeasible for a developer. If public sewer and water are incorporated into the project, potential groundwater contamination should not be a problem. Also, most stormwater runoff increases would flow directly into the Shetucket River, not causing concern for neighboring property owners. The major concern for developers of this parcel would be the extraordinary costs of site preparation due to the soil conditions on-site. The Team suggests that an economic feasibility study be undertaken to fully assess the costs of the proposed industrial development.

Surficial Geology

(adapted from U.S.G.S. Map GQ-165)

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scale

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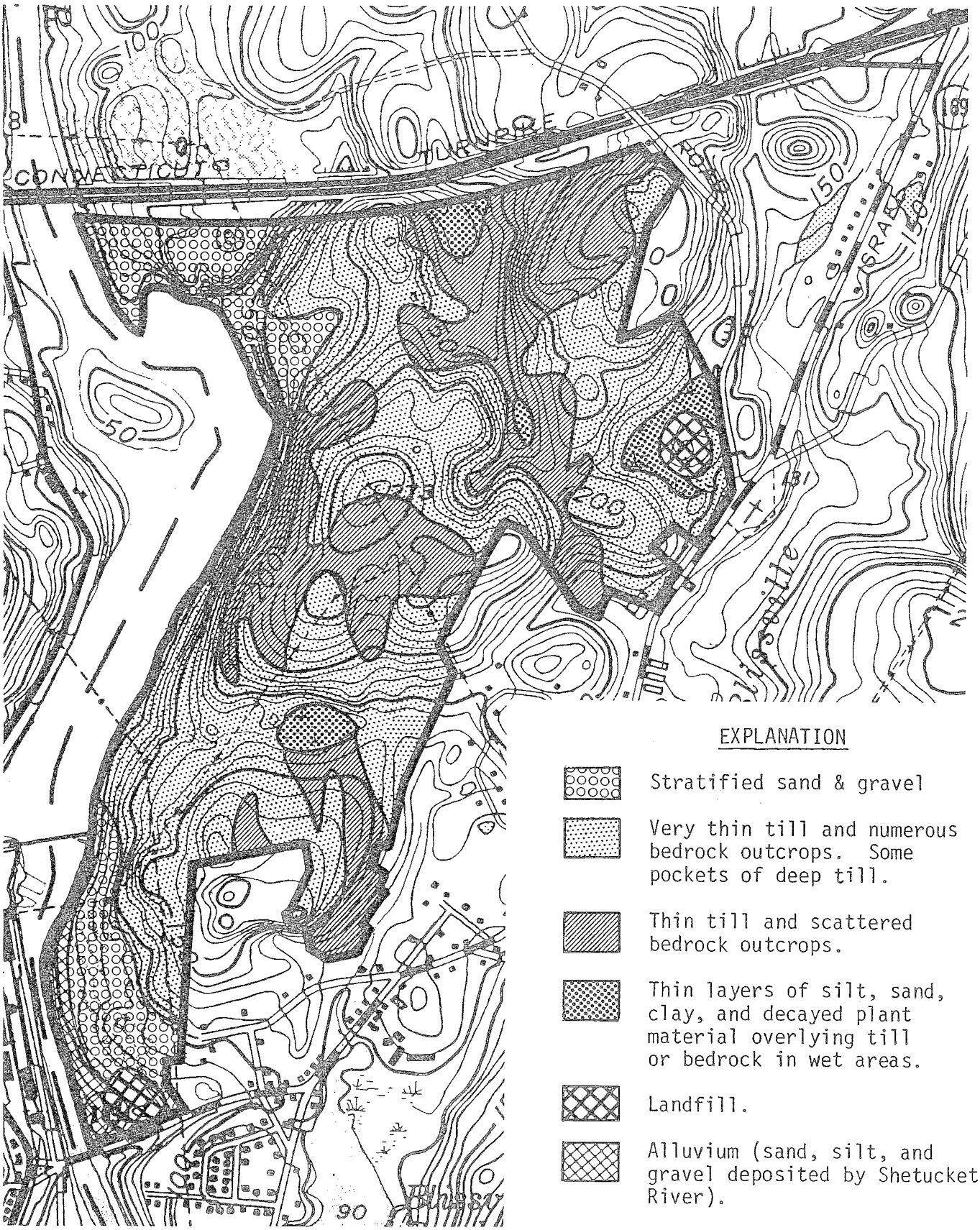

EXPLANATION

- Stratified sand & gravel
- Very thin till and numerous bedrock outcrops. Some pockets of deep till.
- Thin till and scattered bedrock outcrops.
- Thin layers of silt, sand, clay, and decayed plant material overlying till or bedrock in wet areas.
- Landfill.
- Alluvium (sand, silt, and gravel deposited by Shetucket River).

ENVIRONMENTAL ASSESSMENT

TOPOGRAPHY

Most of the site is characterized by knobby, moderately steep to very steep topography. The most extensive area of steep slopes is located in the west-central portion of the tract, bordering the Shetucket River. In this area, the slopes are consistent; that is, they are not significantly disrupted by hummocky landforms. In other areas, however, both broad hillocks and small sharply defined rock knolls form a highly irregular landscape. Flat or gently undulating topography is uncommon on the site except in restricted areas scattered among the hilly features, and in the areas of gravel excavation. Narrow, flat strips of floodplain immediately adjoin Shetucket River.

GEOLOGY

The proposed industrial site is located in an area that is encompassed by the Norwich topographic quadrangle. A bedrock geologic map of the quadrangle (Map GQ-144, by G.L. Snyder) and a surficial geologic map of the quadrangle (Map GQ-165, by P.M. Hanshaw and G.L. Snyder) have been published by the U.S. Geological Survey.

Bedrock crops out extensively on the site; with the exception of the gravel pit at the northwestern corner of the parcel, rock exposures were visible from virtually every part of the site. Most of the rocks are metamorphic; that is, crystalline rocks which were formed under conditions of intense heat and/or pressure. Flaky, platy, or elongate minerals are common in the rocks, and they are typically aligned to form thin bands or layers. Where these bands alternate with layers of more granular minerals and the rocks have a massive appearance, the rocks are classified as "gneisses." Where the aligned-mineral layers are abundant, giving the rocks a slabby appearance, the rocks are classified as "schists." The gneisses and schists do not form discrete zones of outcrop; rather, they grade into one another and they are often seen together in a single exposure. The major mineral components of the bedrock on the property are quartz, feldspar, biotite, and muscovite. The relative percentages of these minerals vary from place to place. Lesser mineral constituents include sillimanite, garnet, hornblende, pinite, and chlorite. No economically valuable mineral deposits have been associated with the rock types found on the site.

Surficial geologic materials are those unconsolidated rock, organic, or manmade materials that overlie the solid, continuous bedrock. They include both soil and subsoil layers, and they are also referred to as "overburden." Till, a glacial sediment, is the most widespread surficial geologic material on the tract. Till consists of nonsorted clay, silt, sand, gravel, and boulders. It is generally nonstratified (nonlayered). Till was deposited directly from glacier ice without subsequent reworking by meltwaters to any significant degree. Although it is commonly sandy and friable in the upper five to ten feet, the till may become silty and tightly compact at greater depths. On this site, however, the average thickness of the till probably is less than ten feet, so most till would presumably have a sandy texture.

SITE DRAINAGE AREA BOUNDARIES

0 2,000'
scale

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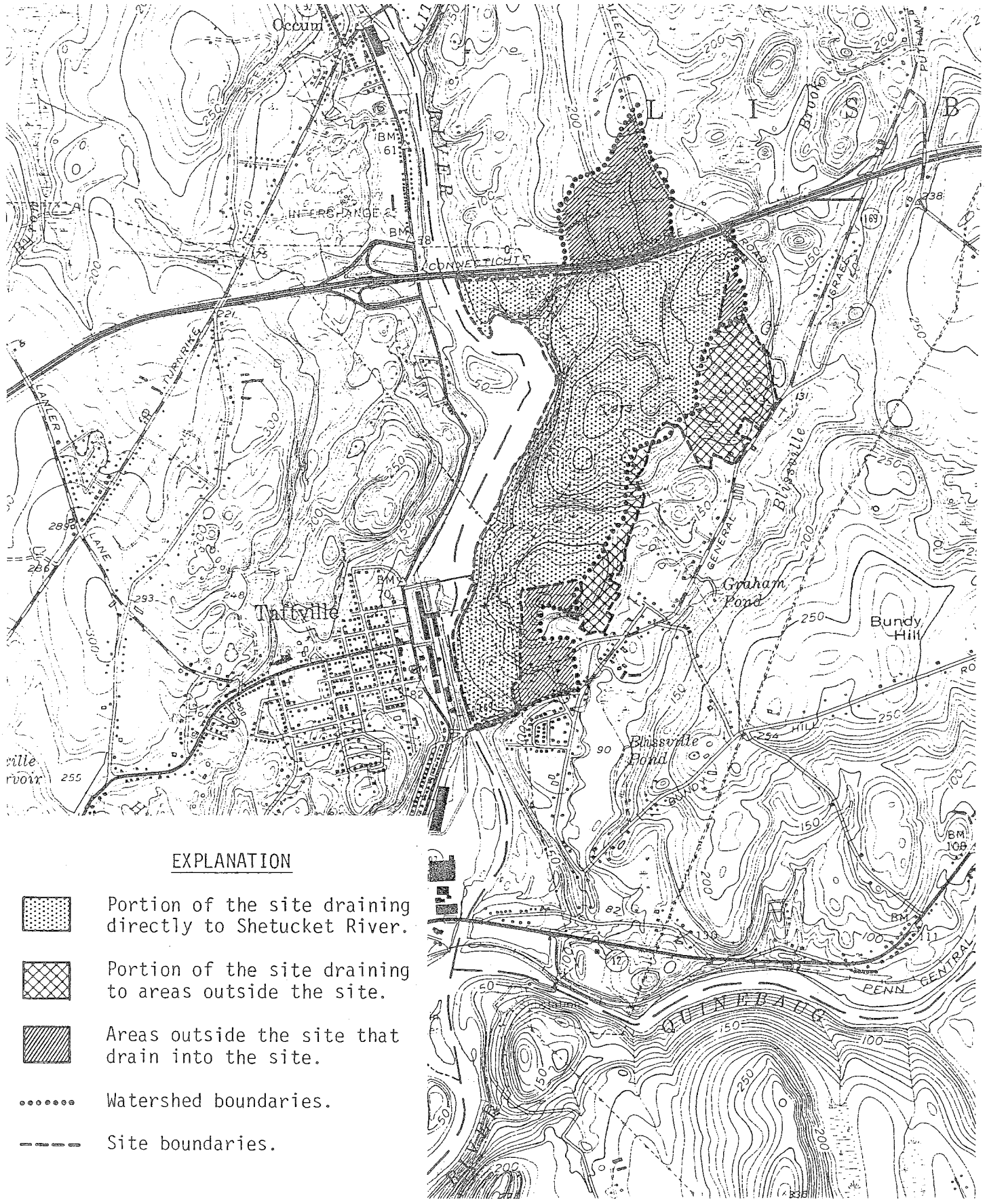


EXPLANATION

- Portion of the site draining directly to Shetucket River.
- Portion of the site draining to areas outside the site.
- Areas outside the site that drain into the site.
- ..... Watershed boundaries.
- ———— Site boundaries.

Stratified sands and gravel that were deposited by glacial streams are the thickest surficial geologic materials found on the site. These deposits are located at the northwestern and southwestern corners of the tract. They have been extensively mined. Some cobble gravel remains, particularly near the surface at the edges of the pits, but mostly sand is left. The economic value of the remaining stratified sediments is uncertain.

Two notable accumulations of organic-rich fine sediments occupy swampy basins on the property. These swamp deposits overlie either till or bedrock. Two former landfills are also located within the parcel. Both are small and were apparently used for residential wastes. Thin, relatively recently deposited sand, silt, and gravel caps glacial sediments in narrow strips of flat land bordering Shetucket River. These materials have accumulated during flood stages of the river.

From a geological perspective, it is clear that the general shallowness of the overburden in most parts of the site is the most limiting factor for development. The knobby, uneven topography may be attributed to the shallow glacial cover: the irregularly weathered and eroded bedrock surface has not been significantly blanketed by sediment. The till-bedrock areas of the sites are almost unquestionably areas that only a few decades ago would have been dismissed as completely unsuitable for development. This would still probably be true if public water and sewer facilities were not available. However, since these facilities theoretically would be available to this site, the only real limiting factor may be money. This land will be enormously expensive to develop because of the blasting, grading, and filling that will be required. A limited portion, such as the northeastern corner of the parcel, off Preston Allen Road, may not be quite so expensive to develop but the land preparation costs will still be formidable. In view of the prospective costs, if this site is to be developed at all, industrial usage appears to be more practical than residential usage.

The sand and gravel pits, in comparison to the till-bedrock areas, are ideal for industrial usage. The land in the pits is easily workable, well-drained, and more accessible from existing roads. Few practical geological limitations are present in these areas.

HYDROLOGY

Drainage on the site is largely self-contained: little comes from and little moves onto adjoining land parcels (drainage boundaries are shown in an accompanying illustration). For this reasons, the substantial runoff increases that would result from industrial development would have little effect on nearby landowners. Most of the runoff now flows and would continue to flow directly to Shetucket River. If development occurs, steps should be taken to prevent large quantities of sediment from washing into the mill reservoir. Sediment would be expected to be a serious problem in view of the cutting and filling operations that would be necessary to develop the till-bedrock areas.

Groundwater should not be of great concern for the most part unless public sewer and water facilities ultimately are not available or are financially unfeasible. It may be presumed that some of the industries being sought by the landowner for this site would generate liquid wastes (in addition to septic leachate) that would either be discharged to the ground or discharged to Shetucket River. It may also be presumed that the appropriate state and local regulatory agencies, such as the Water Compliance Unit of DEP, would take measures to assume that no significant contamination of ground or surface waters would occur. This does not mean that there would be no deterioration of water quality; however, any decrease in quality should be well within limits that are acceptable for this site. In this regard, the hydrologic isolation of much of this parcel from surrounding land holdings should be considered an asset - it minimizes the risk that development on the parcel would affect other areas. The proximity of the site to a major river is also a likely boon to industrial development since the river's substantial flows could provide significant dilution for surface wastewater discharges. On the other hand, if industrial development does occur, the industries should be diversified enough so that numerous discharges of wastewater would not be needed.

If public water and sewer facilities proved to be unavailable for some reason, the gravel pit areas should still be acceptable for carefully planned industrial development. On the other hand, industrial development of the till bedrock areas could be very risky, since the natural soils are generally too thin to provide adequate renovation for septic leachate or other discharges. Addition of fill might help to alleviate some of these concerns, but filling alone should not be viewed as a cure-all for the natural limitations of the site. The engineering measures that would be required in much of the till bedrock area to preserve well-water quality could prove to be prohibitive to industrial usage.

SOILS

A detailed soils map of this site and detailed soils descriptions are included in the Appendix to this report, accompanied by a chart which indicates soil limitations for various urban uses. As the soil map is an enlargement from the original 1,320'/inch scale to 1000'/inch, the soil boundary lines should not be viewed as absolute boundaries, but as guidelines to the distribution of soil types on the site. The soil limitation chart indicates the probable limitations of each of the soils for on-site sewage disposal, buildings with basements, streets and parking, and landscaping. However, limitations, even though severe, do not preclude the use of the land for development. If economics permit large expenditures for land development and the intended objective is consistent with the objectives of local and regional development, many soils and sites with difficult problems can be used. The soils map, with the publication, New London County Interim Soil Survey Report, can aid in the identification and interpretation of soils and their uses on this site. "Know Your Land: Natural Soil Groups for Connecticut" can also give insight to the development potentials of the soils and their relationship to the surficial geology of the site.

Upland Glacial Till Soils

The moderately steep to steep land forms adjacent to the highest elevations in the landscape are occupied by Charlton-Hollis fine sandy loams, very rocky. The soil mapping unit is 17LD. The letter "L" denotes very rocky, and "D" denotes a slope range of 15 to 45 percent. Both soils are well drained. Charlton soils formed in deep, friable glacial till, and the Hollis soils formed in shallow glacial till less than 20 inches over bedrock. Charlton soils have moderate to moderately rapid permeability and Hollis soils have moderate permeability. Surface runoff is medium to very rapid for Hollis soils and medium to rapid for Charlton soils.

The gently sloping to sloping land forms adjacent to the highest elevations in the landscape are occupied by Charlton-Hollis fine sandy loams, very rocky. The soil mapping unit symbol is 17LC. The letter "L" denotes very rocky, and "C" denotes a slope range of 3 to 15 percent. Both these soils are well drained. Charlton soils formed in deep, friable glacial till and the Hollis soils formed in shallow glacial till less than 20 inches deep over bedrock. Charlton soils have moderate to moderately rapid permeability and Hollis soils have moderate permeability. Surface runoff is medium to very rapid for Hollis soils and medium to rapid for Charlton soils.

The gently sloping to sloping landforms that are bedrock controlled are occupied by Hollis-Charlton-Rock outcrop complex. The soils are designated by mapping unit symbol 17MC. The letter "M" denotes rock outcrop and the letter "C" denotes a 3 to 15 percent slopes. Hollis soils formed in glacial till less than 20 inches thick over bedrock, Charlton soils formed in deep loamy glacial till, and Rock outcrop is exposed, weathered or unweathered rock. The Hollis soils have moderate permeability and the Charlton soils have moderate to moderately rapid permeability. Hollis soils have medium to very rapid surface runoff and Charlton soils have medium to rapid surface runoff.

The moderately steep to steep landforms that are bedrock controlled are occupied by Hollis-Charlton-Rock outcrop complex. The soils are designated by the mapping unit symbol 17MD. The letter "M" denotes rock outcrop and the letter "D" denotes a 15-35 percent slopes. Hollis soils formed in glacial till less than 20 inches thick over bedrock, Charlton soils formed in deep loamy glacial till, and Rock outcrop is exposed, weathered and unweathered rock. The Hollis soils have moderate permeability and the Charlton soils have moderate to moderately rapid permeability. Hollis soils have medium to very rapid surface runoff and Charlton soils have medium to rapid surface runoff.

The nearly level to gently sloping landforms on the uplands are occupied by Sutton very stony fine sandy loam. The soil mapping unit is 41XB. The letter "X" denotes very stony surface conditions and the letter "B" denotes a slope range of 0 to 8 percent. Sutton soils are moderately well drained. Sutton soils formed in friable glacial till. These soils have moderate or moderately rapid permeability and a seasonal high water table at 18 to 24 inches. Surface runoff is slow to medium.

The symbol "GP" is an ad hoc symbol that denotes excavated soil areas that have been used for sand and gravel.

Outwash Soils

The nearly level terraces or outwash plains are occupied by Tisbury silt loam. The soil mapping unit symbol is 45A. The letter "A" denotes a 0-3 percent slopes. Tisbury soils formed in silt-mantled glacial outwash. The soils are moderately well drained and have a seasonal high water table that is 18 to 24 inches below the surface. Surface runoff is slow to moderate.

The moderately steep to steep terraces or outwash plains are occupied by Hinckley gravelly sandy loam. The soil mapping unit symbol is 60D. The letter "D" denotes a slope range of 15 to 35 percent. Hinckley soils formed in water sorted outwash. The soils are excessively drained and have rapid permeability in the surface layer and subsoil and very rapid permeability in the substratum. Runoff is slow.

Wetland Soils

The nearly level depressional areas and bogs within outwash plains, glacial moraines and glacial till plains are occupied by Carlisle muck. The soil mapping unit symbol is 92. Carlisle muck is very poorly drained. The soil formed in muck deposits greater than 51 inches thick. Carlisle soils have slow to rapid permeability and a high water table at or near the surface 9 to 10 months out of the year. Surface runoff is very slow to ponded. These soils are designated as wetland soils and are regulated under Public Act 155.

The nearly level depressional areas within outwash plains, glacial moraines and glacial till plains are occupied by Adrian and Palms mucks. The soil mapping unit symbol is 91. Adrian muck and Palms muck are very poorly drained. Adrian muck formed in mucky organic deposits, 16 to 51 inches thick, over sandy mineral deposits. Palms muck also formed in mucky organic deposits, 16 to 51 inches thick over loamy mineral deposits. Adrian soils have rapid permeability and a high water table at or near the surface 9 to 10 months of the year. Palms soils have moderately slow permeability and a high water table at or near the surface 9 to 10 months of the year. Surface runoff is very slow to ponded for both of these soils. These soils are designated as wetland soils and are regulated under Public Act 155.

The low lying, nearly level areas along drainageways in the uplands are occupied by Ridgebury, Leicester and Whitman extremely stony fine sandy loams. The soils are designated by the mapping unit symbol 43M. The letter "M" denotes extremely stony. The Ridgebury and Whitman soils formed in compact glacial till; the Leicester soils formed in friable glacial till. The Ridgebury and Leicester soils have moderate to moderately rapid permeability in the surface layer and subsoil and slow or very slow permeability in the substratum (fragipan). The Leicester soils have moderately rapid permeability throughout. The seasonal high water table for Ridgebury and Leicester soils is at or near the surface 7 to 9 months of the year. The Whitman soil has a high water table at or near the surface 9 to 10 months of the year. Whitman soils have high runoff potential. Runoff is slow to medium in Ridgebury soils and slow in Leicester soils. This soil is designated as a wetland soil and is regulated under Public Act 155.

The nearly level, moderately well drained flood plains are occupied by Pootatuck Variant fine sandy loam. This soil is designated by soil mapping unit symbol 816. Pootatuck Variant fine sandy loam formed in recent alluvial sediments. Permeability is moderately rapid or rapid. The soils are subject to brief but common flooding and have a seasonal high water table at 18 to 24 inches. Surface runoff is slow. Pootatuck Variant fine sandy loam is designated as a regulated wetland soil according to P.A. 155. This soil also qualifies as a Prime Farmland soil in the State of Connecticut.

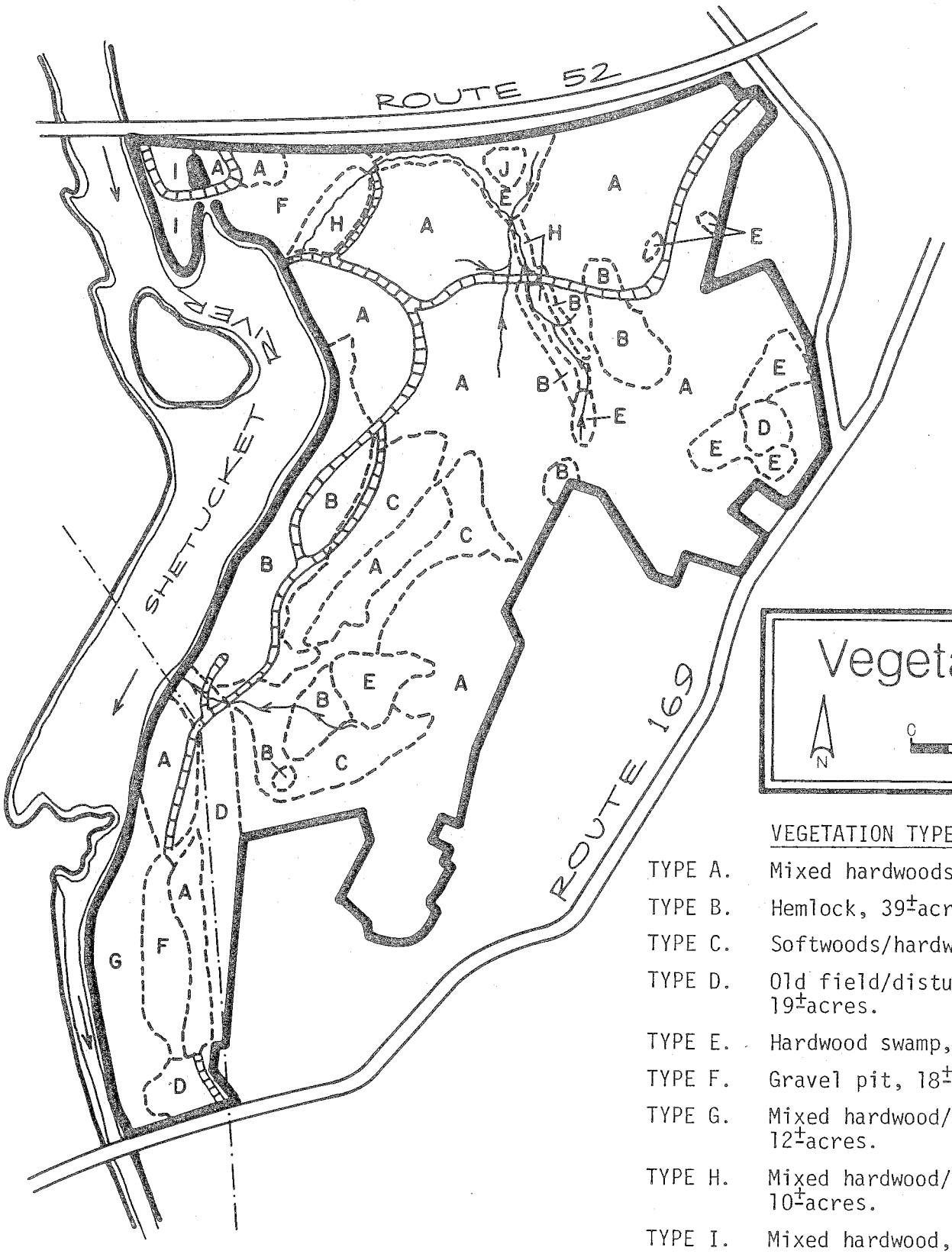
The site has natural limitations to industrial use due primarily to slope and a large area of soils that are shallow to bedrock and have numerous rock outcrops. The intensity of development on this parcel of land will be influenced by these limitations. Over 50 percent or approximately 200 acres of the site are mapped as Hollis-Charlton rock outcrop soils (17MC, 17MD) that have moderate to severe limitations to most building uses because of slope and bedrock conditions. Site location will be limited in these soils and can require rock removal by blasting and major land regrading.

The soils mapped as Charlton-Hollis (17LC, 17LD) account for approximately 23 percent or approximately 87 acres. The deeper Charlton soils are dominate in this mapping unit, however, the Hollis soils which are shallow also occur within the mapping unit. The deeper Charlton soils will have moderate to severe limitations due to slope, however, where Hollis soils occur, limitations for most industrial uses and development uses will be severe. The soils mapped as 17LC will have the less severe limitations to site location and development.

Wetland soils occupy approximately 23 acres or 5 percent of the soils of the site. The wetlands occupy depressions and watercourses at the base of slopes and range from poorly and very poorly drained mineral soils to poorly and very poorly drained muck soils. The wetland soils in major watercourses should not be filled because they allow a channel through which runoff water can travel. The large bog areas of muck soils, which comprise approximately 3 percent or 14 acres, should also be left in a natural state to provide natural stormwater storage and to retain natural areas for wildlife. A narrow band of flood plain soils occur along the river in the southwest section of the property. These soils are prone to flooding and should not be filled in or altered in any way.

The soil areas mapped as Hinckley (60D) are currently being used as a source of sand and gravel, which has resulted in large gravel pits (GP). The operation of sand and gravel removal will continue for an indefinite amount of time. When complete, the pits can be graded off and used as prime sites for industrial and commercial development. The sand and gravel pits occupy approximately 32 acres of this site and the Hinckley soils occupy approximately 16 acres of the site.

Other soils that occupy the site are Tisbury soils and Sutton soils. Each of these soils occupies shallow depressions or low lying landforms adjacent to wetlands. The major limitations to development in these soils are a seasonal high water table and potential frost heaving. Subsurface drainage can overcome these limitations. Filling in these areas can impede surface runoff that would normally run through these soils to an outlet, usually a wetlands or body of water. If the areas are filled, engineering considerations will be necessary to plan rerouting the natural runoff water through conduits.



LEGEND

- Road
- Property Boundary
- Vegetation Type Boundary
- Stream
- Gravel Road
- Utility Line

VEGETATION TYPE DESCRIPTIONS*

TYPE A.	Mixed hardwoods, 217±acres.
TYPE B.	Hemlock, 39±acres.
TYPE C.	Softwoods/hardwoods, 34±acres.
TYPE D.	Old field/disturbed area, 19±acres.
TYPE E.	Hardwood swamp, 19±acres.
TYPE F.	Gravel pit, 18±acres.
TYPE G.	Mixed hardwood/flood plain, 12±acres.
TYPE H.	Mixed hardwood/stream belt, 10±acres.
TYPE I.	Mixed hardwood, 5±acres.
TYPE J.	Open swamp, 2±acres.

* Seedling-size = Trees less than 1 inch in diameter at 4 1/2 feet above the ground (d.b.h.)
Sapling-size = Trees 1 to 5 inches in d.b.h.
Pole-size = Trees 5 to 11 inches in d.b.h
Sawtimber-size = Trees 11 inches and greater in d.b.h.

VEGETATION

The parcel which was evaluated for industrial development is approximately 375 acres in size and may be divided into ten distinctive vegetation types. These include four mixed hardwood areas, totaling approximately 244 acres; hemlock areas totaling 39± acres; softwood/hardwood areas, 34± acres; old field/disturbed area, 19± acres; gravel pit, 18± acres; and an open swamp area, 2± acres. (For location and description of these vegetation types, please see the vegetation type map and vegetation type descriptions.)

The acreages and boundaries of these vegetation types are for the most part approximate. The difficulty in vegetation type mapping of this site results from the wide transition zones which are present between many of the vegetation types.

Vegetation Type Descriptions

Type A. (Mixed Hardwoods) This mixed hardwood stand occupies approximately 217 acres of the entire tract. It is made up of predominantly black oak, red oak, white oak, black birch, shagbark hickory, red maple and occasional sugar maple and American Beech. This stand is over-stocked with pole and sawtimber-size trees which are declining in health and vigor due to their crowded condition. Flowering dogwood, blue beech, maple-leaved viburnum, azalea, mountain laurel, witch hazel, sassafras and eastern hemlock are present in this stand's understory. Ground cover consists of lowbush blueberry, huckleberry, Pennsylvania sedge, club moss, Canada mayflower, pipsissewa, striped pipsissewa, rattlesnake plantain, partridge berry, Christmas fern, bracken fern, marginal wood fern and occasional rock polypody.

Type B. (Hemlock) This 39± acre fully-stocked stand is made up of pole and occasional sawtimber-size eastern hemlock with black oak, white oak, scarlet oak, black birch and shagbark hickory intermixed. The understory is dominated by hemlock seedlings and patches of mountain laurel where sunlight is able to penetrate the dense canopy. Ground cover vegetation is sparce, however, in some places Canada mayflower, Christmas fern and rock polypody have become established.

Type C. (Softwoods/Hardwoods) Pole size black oak, scarlet oak, white oak, hemlock, black birch and red maple are present in this fully-stocked 34± acre stand. The trees in this stand are beginning to show signs of crowding. Understory species include hemlock, witch hazel, maple-leaved viburnum, flowering dogwood, blue beech, highbush blueberry and hardwood tree seedlings. Ground cover is made up of Canada mayflower, club moss, huckleberry, striped pipsissewa, partridge berry, bracken fern and hayscented fern.

Type D. (Old Field/Disturbed Area) Sapling-size cottonwood, quaking aspen, gray birch, sassafras, eastern red cedar and occasional black oak and red oak are present in these under-stocked areas which total 19± acres. The shrub species which are present include hazelnut, highbush blueberry, arrow-wood, gray stemmed dogwood, multiflora rose, pussy willow, staghorn sumac and smooth sumac. Fox grape, poison ivy and Virginia creeper are the vine species which are present in these areas. Ground cover consists of several species of

cinquefoil, common mullein, bush clover, grasses, goldenrod, aster, evening primrose, sweet fern, barberry, bayberry, black raspberry, spirea, mountain mint, dewberry, bracken fern and hayscented fern.

Type E. (Hardwood Swamp) Several hardwood swamp areas are present within this property; they total approximately 19 acres. Poor quality pole to sawtimber-size red maple with occasional yellow birch and black gum are present in these stands which are predominantly under-stocked. Spice bush, highbush blueberry and sweet pepper bush form a dense understory with scattered swamp rose and poison sumac intermixed. Ground cover in these areas is made up of skunk cabbage, tussock sedge, sphagnum moss, marsh violet, marsh marigold, jack-in-the-pulpit, wild geranium and false hellebore.

Type F. (Gravel Pit) Approximately 18 acres of this tract has been mined for gravel. Topsoil has not been replaced and, therefore, only plant species such as gray birch, aspen, sweet fern and raspberry have become established. No vegetation is growing on the heavily traveled areas.

Type G. (Mixed Hardwoods/Flood Plain) Sapling to sawtimber-size red oak, sugar maple, white ash, red maple and sycamore are present in this $12\pm$ acre fully-stocked all aged stand. The understory is dominated by spice bush, with minor components of highbush blueberry and witch hazel. Deertongue, Virginia creeper, poison ivy, fox grape, barberry, Soloman's seal, false Soloman's seal, jack-in-the-pulpit, skunk cabbage, wild violet, wild geranium, yellow daylily, slender nettle, tall meadow rue and early meadow rue form the ground cover in this stand.

Type H. (Mixed Hardwood/Stream Belt) This $10\pm$ acre area is vegetated with pole to sawtimber-size red maple, yellow birch, black birch, sugar maple and occasional white ash. The trees in this area are becoming crowded, but are still reasonably healthy. Spice bush comprises the understory in this area. Ground cover consists of skunk cabbage, false hellebore, marsh marigold, dwarf ginseng, cinnamon fern and sensitive fern.

Type I. (Mixed Hardwoods) This $5\pm$ acre under-stocked stand is made up of poor quality pole to sawtimber red maple, yellow birch, white ash and black birch. Spice bush, withe-rod, arrowwood and highbush blueberry form the understory in this stand which is seasonally flooded by the Shetucket River. Ground cover consists of hayscented fern, cinnamon fern, sensitive fern, New York fern, marsh fern, Virginia creeper, poison ivy, blue marsh violet, clematis, jack-in-the-pulpit, trout lily, wild geranium, wild leek, bellwort, Canada mayflower and wood anemone.

Type J. (Open Swamp) This $2\pm$ acre open swamp is under-stocked with seedling to sapling-size red maple, American elm and scattered black gum. Once these trees grow past the sapling-size, the soil substrate can no longer support them. Other woody species which are present include sweet pepperbush, buttonbush and arrowwood. Herbaceous vegetation present in this area includes skunk cabbage, tussock sedge, cattail, common reed, cinnamon fern and marsh fern.

The high water table and saturated soils which are present in the Hardwood Swamp (Vegetation Type E) and the Open Swamp (Vegetation Type J) limit tree species to those that are tolerant of excessive moisture. The red maple and scattered black gum, which are present in the hardwood swamp, are growing

extremely slowly and are of poor quality. Tree species such as these, which are larger than sapling size, are unable to survive in the open swamp because the saturated soils are not suitable for large trees to become securely anchored.

At present, the lack of top soil in the gravel pit areas limit the establishment of most tree species. Those which have become established are predominantly pioneer species which are the first to move into disturbed areas. These areas may be grated and planted to Eastern white pine and larch (see Vegetation Management Section of this report).

Tree growth rates are somewhat limited on the droughty knolls which are present throughout this property. (See topographic map.) The shallow to bedrock and somewhat excessively drained nature of the soils in this area do not provide the trees which are present with adequate moisture. This lack of moisture causes trees to be slow growing and stunted in appearance.

The excessively drained soils located along the Shetucket River also have a low moisture holding capacity and dry out rapidly in the spring. These moisture deficiencies reduce the length of the rapid growth season and cause the hemlock which are present to be slow growing.

Windthrow is a potential hazard in the hardwood swamp areas (Vegetation Type E), hemlock areas (Vegetation Type B), and also parts of the mixed hardwood area (Vegetation Type A). Trees in the hardwood swamps are very susceptible to windthrow. The soils in these areas are saturated with water for the greater part of the year, causing soil aeration to be poor. This condition results in the establishment of shallow root systems which are usually unable to securely anchor trees.

The hemlock trees which are present in Vegetation Type B are relatively shallow rooted and somewhat susceptible to windthrow because of the unstable steep slopes near the river and the shallow to bedrock soils to the east of the river. In many places throughout Vegetation Type A, the soils are shallow to bedrock. In these areas, trees are susceptible to windthrow because tree roots are unable to penetrate deep enough for adequate anchorage. The windthrow potential is reduced where underlying bedrock is highly fractured. In these areas, tree roots can penetrate deeper allowing trees to become more stable.

The windthrow potential may be aggravated if openings are made within or along side these areas which allow wind to pass through rather than over the trees in these stands. The windthrow potential can also be intensified if the suggested thinnings are too heavy, leaving large openings for wind to blow through. Such openings should be avoided if at all possible.

Another potential hazard, which may be encountered with development of this property is the mortality of hemlock trees resulting from sunscald. Sunscald may occur where abrupt openings are made which allow direct sunlight to reach mature trees and the soil which covers their roots. Sudden rises in soil temperature may kill the delicate feeder roots, in turn lowering vigor and eventually causing mortality, especially in weaker trees. Ideally, complete clearings, which result in abrupt and total exposure of hemlock to sunlight, should not be made.

Suggested Management Techniques

If industrial development of this tract will not occur in the near future, management of the timber resources which are present would be advisable.

The trees in Vegetation Type A, Mixed Hardwoods, are crowded and are not growing at or near their full potential. Under these conditions, of declining vigor and health, trees are more susceptible to damage by insects, diseases and adverse weather conditions. A commercial thinning (intermediate harvest) of approximately one-third of the total volume would reduce the crowded condition and allow the trees which remain to respond over time by improved growth. This thinning should be focused on the removal of poor quality trees (damaged trees, deformed trees) and trees larger than 22" in diameter at 4 1/2 feet above the ground. Small pole-sized trees which are of poor quality, and also the tops left from the timber harvest, should be utilized as fuelwood. This thinning should produce approximately fifteen hundred board feet per acre. A thinning in all accessible portions of this stand does not have to be implemented all in one year. Phasing of this thinning over several years would be more desirable.

The trees which are present in Vegetation Type C (Softwood/Hardwood) are also beginning to decline in health and vigor. A fuelwood thinning in this stand would reduce competition between residual trees for space, sunlight, water and nutrients resulting in greater health and stability over time. Up to one-third of the total volume could be removed for this thinning. Only the poor quality and unhealthy trees, however, should be removed. Those which are healthy should be left to form the residual stand. This thinning will produce between four and six cords per acre.

The reestablishment of vegetation within the gravel pit areas to improve aesthetic quality and to reduce erosion problems should be considered. Cut banks should be graded and all suitable areas should be planted to a combination of Eastern white pine and larch, available each spring from the State Nursery. These trees should be planted at a spacing of approximately eight feet by eight feet to ten feet by ten feet. These species can grow well on excessively drained soils in direct sunlight. The steep banks which were produced by the excavation could be stabilized with grass species such as tall fescue or little blue stem. These grass species are drought tolerant and grow well in low fertility acidic soils.

If the above thinnings or plantings are desired, a private forester or public service forester should be contacted to provide further technical assistance. Revenues from the proposed thinnings will be significantly greater than consultant costs.

AESTHETIC CONSIDERATIONS

Many large high quality trees are present in Vegetation Type A (Mixed Hardwoods). These trees are both desirable from an aesthetic standpoint, if the area is developed, and a future sawtimber standpoint, if the area is to be managed for timber and not completely developed.

Those trees which are to be retained on site should be protected during construction. Care should be taken not to disturb the soil within the driplines of trees that are to be retained. The dripline area corresponds to the entire area under a tree's crown. Excavating, filling and grading in close proximity to trees may significantly alter the balance between soil moisture level, soil aeration and soil composition. These changes may cause a decline in tree health and vigor and perhaps tree mortality within three to five years. Mechanical injury to trees may cause the same results. Stressing the trees in this way makes them more susceptible to damage by insects and disease. If it is feasible, trees that are to be retained should be temporarily, but clearly marked so that damage may be avoided during construction. Retaining trees in groups or small "islands" will also help to insure their health and assure avoidance by large machinery.

Flowering shrubs such as mountain laurel, flowering dogwood and azalea are also present in this mixed hardwood stand. These shrubs have high aesthetic value and could be retained to improve the overall aesthetic quality of the area. The flowering of these shrubs could be stimulated if full sunlight were to reach them. Development of the proposed nature should provide adequate sunlight for flower production.

WATER SUPPLY/SEWAGE DISPOSAL

At the present time, the property has neither water nor sewer facilities available. However, it is understood that public facilities would be obtained for development of the property. As the town of Lisbon does not have such facilities, water main and sanitary sewer extension could be made available from the Norwich side of the Shetucket River. A general engineering feasibility study with projected costs should be undertaken. It appears that pumping facilities would be needed as major components for possible water and sewer extensions.

PLANNING CONCERNS

The proposed industrial park is located in southwest Lisbon, north and west of Route 169, and south of Route 52 (the Connecticut Turnpike). The site borders the east bank of the Shetucket River which is also the town line with Norwich. Moderate density residential uses are located along the southern portion of Route 169 and low density residential uses along the northern portion of Route 169 and Preston Allen Road. The former town landfill is located at the intersection of Route 169 and Preston Allen Road and an old landfill of the former Ponemah Mills Company of Taftville is located at the southwest corner of the proposed site. The Ponemah Mill buildings are now used by other industrial and commercial users and are located directly across the Shetucket River from the southern end of the proposed park. A transmission line of the Connecticut Light and Power Company (two circuits) traverses the southwest portion of the site.

The Norwich Industrial Park is located about five miles west of this site. As the Norwich Industrial Park develops, other suitably equipped sites will be needed. To compete successfully with the Norwich Industrial Park, it will be

necessary to have utilities available on site. The Norwich Shetucket River sewer interceptor extends north along Route 97 on the west bank of the Shetucket River to the village of Occum. This offers the possibility of serving most of the proposed park which is located in the Shetucket River drainage basin. Small areas of the eastern section of the proposed park drain into the Blissville Brook basin. Norwich public water is available as far north as the village of Taftville which is located on the west side of the Shetucket River across from the southern end of the site. The town of Lisbon and the developer should consult the Norwich Public Utilities Department about the possibility of purchasing utility services from Norwich. Items such as capacities, potential uses and volumes, and cross river connections will have to be addressed.

Primary access to the proposed site would be from Route 169 at the southern end. Other possibilities would be John Street off of Route 169, the general area south of the intersection of Route 169 and Preston Allen Road, and off of Preston Allen Road. Exit 83 of the Connecticut Turnpike is located about one and one-half miles north of the southern end of the site via Route 97 in Norwich. Exit 83a in Lisbon is about one-half to one mile north of the upper Route 169-Preston Allen Road section of the site. For comparison purposes, Exit 82 is located about one-half mile from the entrance to the Norwich Industrial Park.

Exit 83a is not a full interchange with only an eastbound exit and a westbound entrance. The State Department of Transportation should be consulted concerning any possible new interchange between exits 83 and 83a at the northern end of the proposed park which would provide direct access. Exits 83 and 83a are about one and one-half miles apart. In the past, the Department of Transportation has been reluctant to add new interchanges to the interstate system.

A rail spur line of the Providence and Worcester railroad is located about 2000 feet south of the intersection of Routes 169 and 97 in Norwich on the west side of the Shetucket River. At one time, this line extended north to serve the former Ponemah Mill Company across the Shetucket River from the southern end of the proposed park.

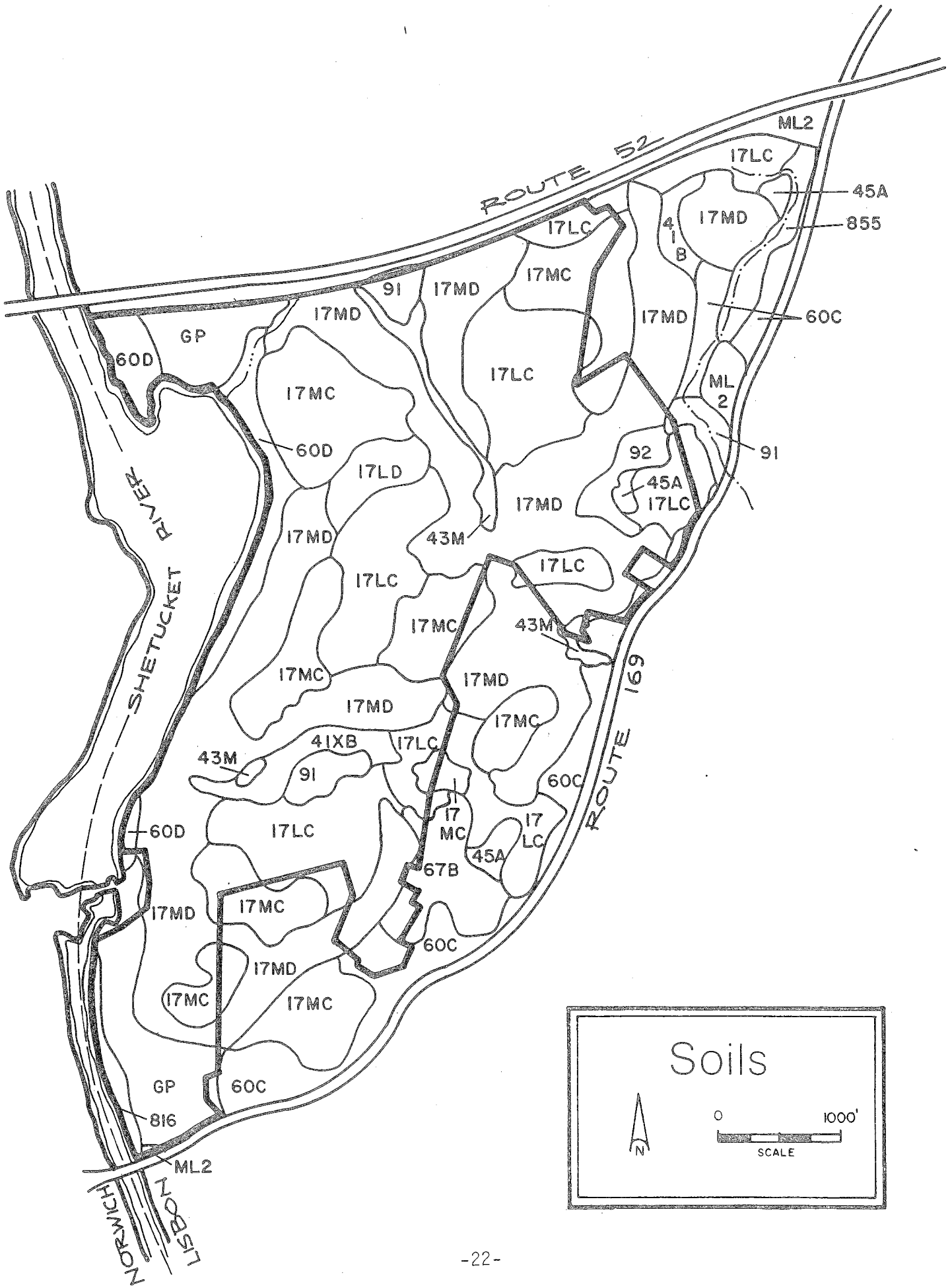
The regional Plan of Development was developed in part based on natural resource information. For this area, low density uses were recommended for the soils with most limitations for development, while the better soils were recommended for medium density mixed urban (economic and residential) uses. This latter category assumed the availability of public sewer and water utilities.

It would be prudent for the town to adopt industrial park regulations similar to those used by Norwich and Franklin in their zoning regulations for development in the Norwich Industrial Park. This could help ensure development in an open, park-like setting with the preservation of open space and natural features. Public utilities should be required on site. Good site design criteria should be incorporated into any new regulations.

The best areas for development appear to be the former sand and gravel area at the southern end of the site and the areas of the Charlton-Hollis (17LC) soils with the Charlton part presenting the least problems. The sand and gravel areas at the northern end of the site on either side of the Connecticut Turnpike may also offer some potential. The installation of roads

and utilities to connect the scattered areas of these soils could make the project expensive, with steep slopes and bedrock outcrops the major limiting factors to construction. To better understand potential development costs, the town and developer should review in some detail the history of the Norwich Industrial Park. Overall, about six million dollars has been spent since 1968 on the development of the Norwich park which currently contains seventeen firms and employs about 1,700 persons.

Appendix


ROUTE 52
ROUTE 169
SHETUCKET RIVER
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LISBON
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45A
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17MD
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INDUSTRIAL PARK
LISBON, CONNECTICUT

PROPORTIONAL EXTENT OF SOILS AND THEIR LIMITATIONS FOR CERTAIN LAND USES

Soil Series	Soil Symbol	Approx. Acres	Percent of Acres	Principal Limiting Factor	Urban Use Limitations*			
					On-Site Sewage	Buildings with Basements	Streets & Parking	Land-Scaping
Adrian-Palms	91	9.2	2%	Wetness, cut banks, cave	3	3	3	3
Carlisle	92	4.6	1%	Floods, excess humus	3	3	3	3
Charlton-Hollis	17LC	80.5	21%	Slope, large stones				
Charlton part					2	2	2	2
Hollis part					3	3	3	3
Charlton-Hollis	17LD	6.9	2%	Slope, large stones	3	3	3	3
Gravel Pit	GP	32.2	9%	Limitations determined on site				
Hinckley	60D	16.1	4%	Slope, droughty, unstable	3	3	3	3
Hollis-rock outcrop	17MC	66.7	18%	Depth to rock	3	3	3	3
Hollis-rock outcrop	17MD	133.4	36%	Depth to rock	3	3	3	3
Ridgebury, Leicester and Whitman	43M	9.2	2%	Large stones, wetness	3	3	3	3
Pootatuck	816	6.9	2%	Floods, wetness	3	3	3	3
Tisbury	45A	2.3	1%	Wetness, frost action, unstable	3	3	3	1
Sutton	41XB	6.9	2%	Wetness	3	3	2	1
		375.0	100%					

Limitations: 1 = slight; 2 = moderate; 3 = severe.

SOIL INTERPRETATIONS FOR URBAN USES

The ratings of the soils for elements of community and recreational development uses consist of three degrees of "limitations:" slight or no limitations; moderate limitations; and severe limitations. In the interpretive scheme various physical properties are weighed before judging their relative severity of limitations.

The user is cautioned that the suitability ratings, degree of limitations and other interpretations are based on the typical soil in each mapping unit. At any given point the actual conditions may differ from the information presented here because of the inclusion of other soils which were impractical to map separately at the scale of mapping used. On-site investigations are suggested where the proposed soil use involves heavy loads, deep excavations, or high cost. Limitations, even though severe, do not always preclude the use of land for development. If economics permit greater expenditures for land development and the intended land use is consistent with the objectives of local or regional development, many soils and sites with difficult problems can be used.

Slight Limitations

Areas rated as slight have relatively few limitations in terms of soil suitability for a particular use. The degree of suitability is such that a minimum of time or cost would be needed to overcome relatively minor soil limitations.

Moderate Limitations

In areas rated moderate, it is relatively more difficult and more costly to correct the natural limitations of the soil for certain uses than for soils rated as having slight limitations.

Severe Limitations

Areas designated as having severe limitations would require more extensive and more costly measures than soils rated with moderate limitations in order to overcome natural soil limitations. The soil may have more than one limiting characteristic causing it to be rated severe.