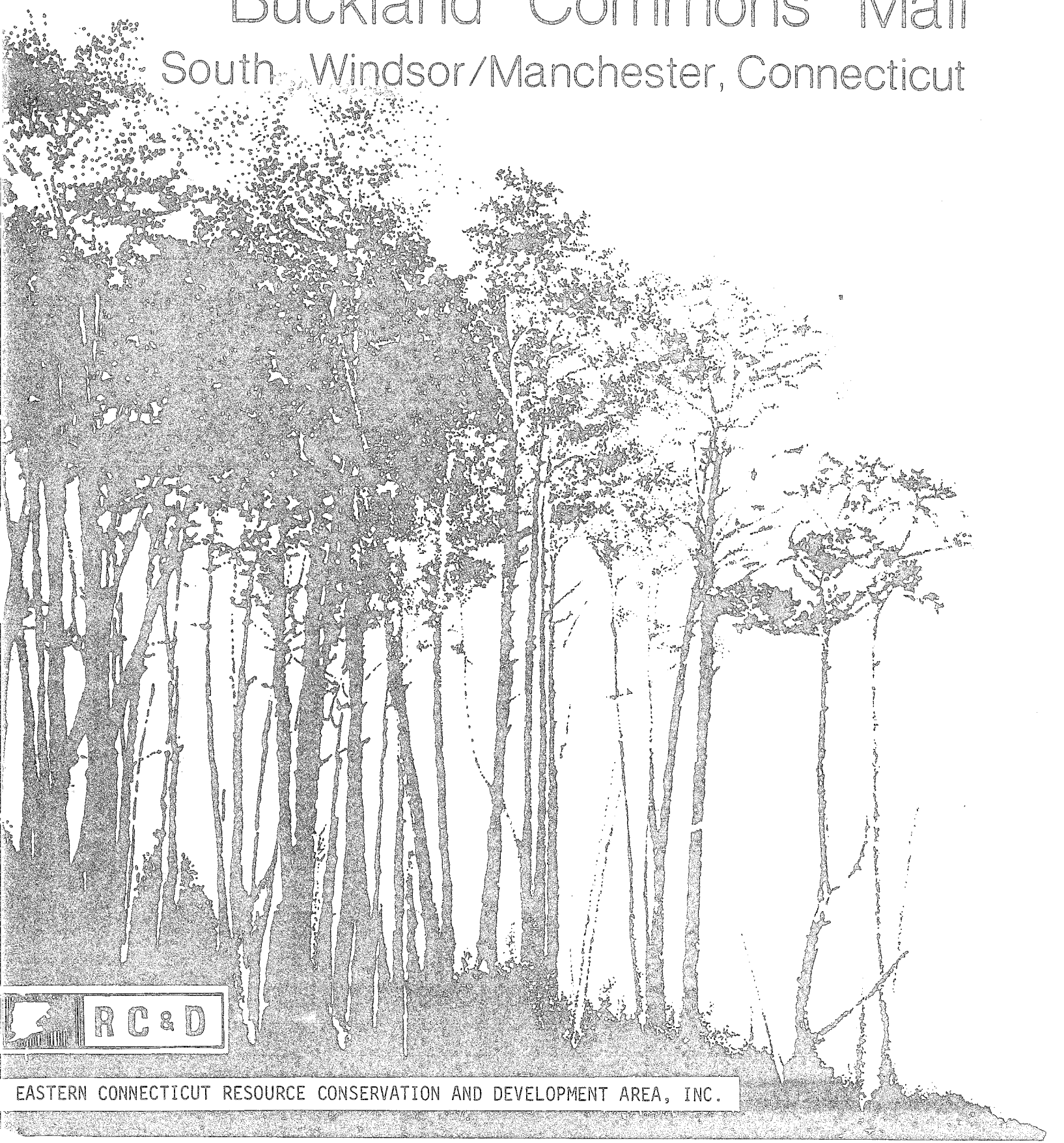
Environmental Review Team Report

Buckland Commons Mall

South Windsor/Manchester, Connecticut

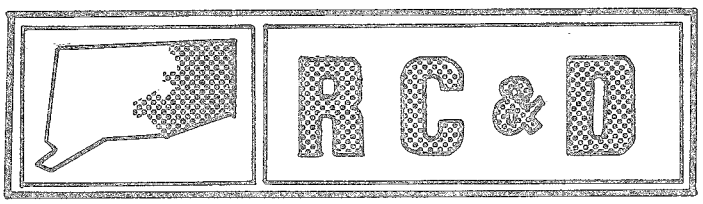


R C & D

EASTERN CONNECTICUT RESOURCE CONSERVATION AND DEVELOPMENT AREA, INC.

Environmental Review Team Report on Buckland Commons Mall South Windsor/Manchester, Connecticut

April 1981



eastern connecticut resource conservation & development area

environmental review team
139 boswell avenue
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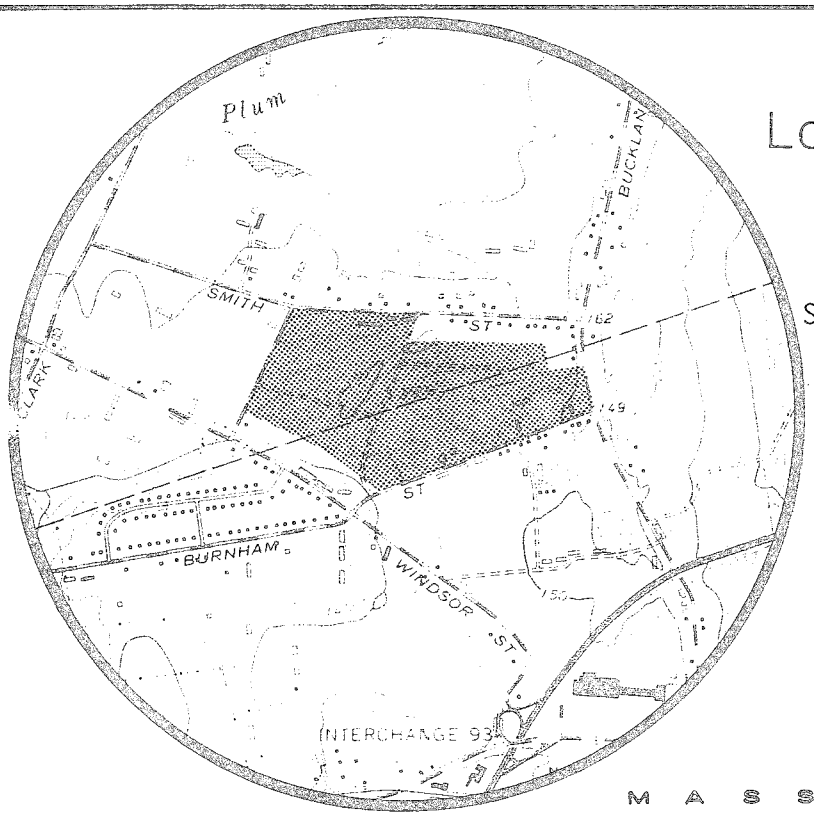
Location of Study Site

BUCKLAND COMMONS MALL
SOUTH WINDSOR/MANCHESTER, CONNECTICUT



EASTERN CONNECTICUT
RESOURCE CONSERVATION AND DEVELOPMENT PROJECT

ENVIRONMENTAL REVIEW TEAM REPORT
ON
BUCKLAND COMMONS MALL
SOUTH WINDSOR, CONNECTICUT

This report is an outgrowth of a request from the South Windsor Planning and Zoning Commission, to the Hartford 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.

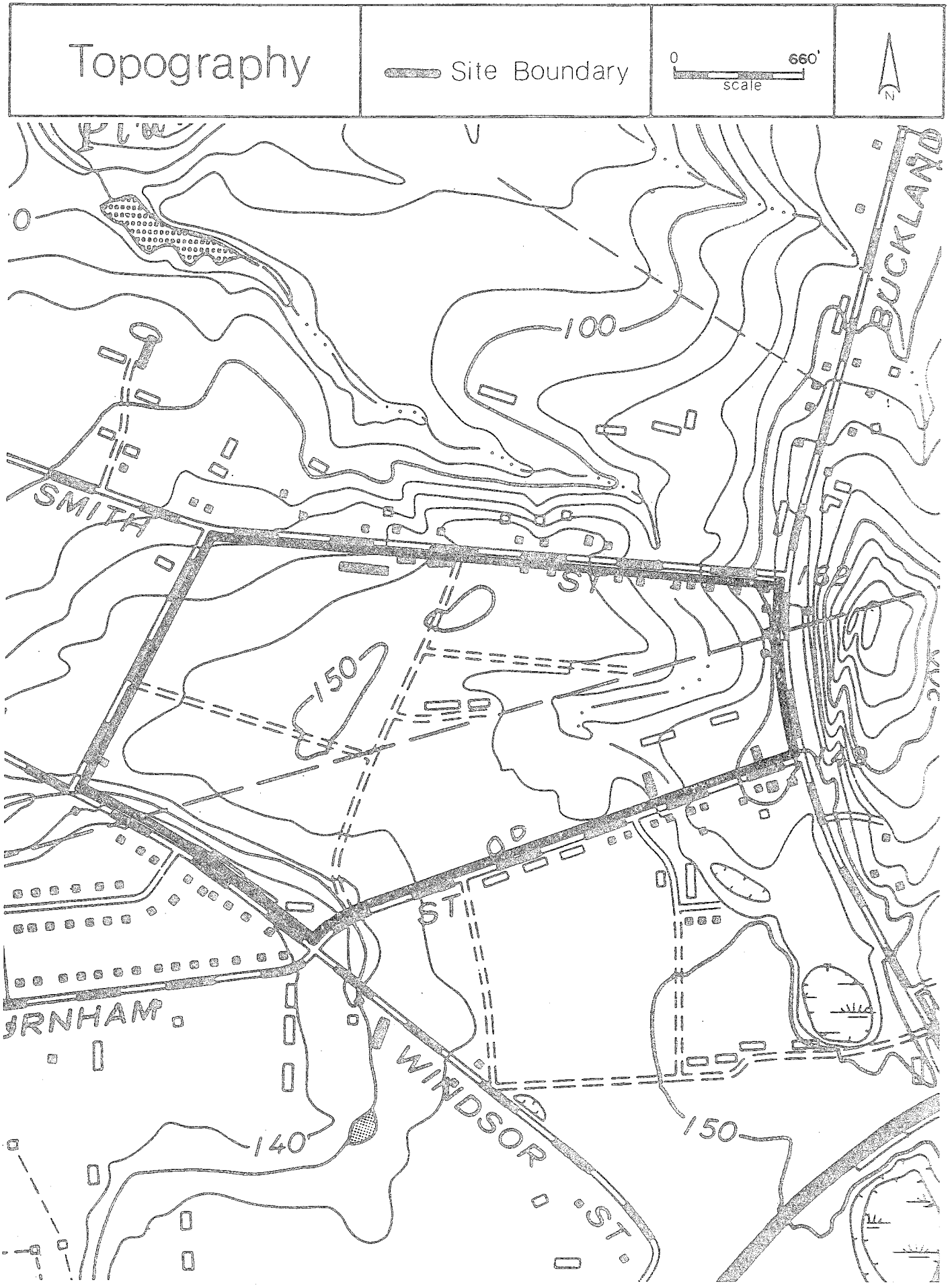
The ERT that field-checked the site consisted of the following personnel: Michael Zizka, Geologist, State Department of Environmental Protection (DEP); Dwight Southwick, Engineer, SCS; Vern Anderson, District Conservationist, SCS; Thom Hooper, Air Quality Planner, Capital Region Council of Governments, and Jeanne Shelburn, ERT Coordinator, Eastern Connecticut RC&D Area.

The Team met and field-checked the site on Thursday, April 2, 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 South Windsor. 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
660'
scale
N
BUCKLAND
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INTRODUCTION

The Eastern Connecticut Environmental Review Team was asked to prepare an environmental assessment for the proposed Buckland Commons Mall in the towns of South Windsor and Manchester. The project area is approximately 93 acres in size. It straddles the South Windsor-Manchester town line. Fifty-five acres of the parcel lie in South Windsor, while the remaining acreage is in Manchester. The town of South Windsor is in the process of reviewing this property for a zone change to accommodate the proposed mall. Acreage in Manchester is appropriately zoned at present. The property is currently in the private ownership of the Hartman Tobacco Company and is being used for agricultural purposes. The preliminary development plans have been prepared by Buckland Associates of King of Prussia, Pennsylvania.

Preliminary plans show development of a regional shopping mall of approximately 1.2 million square feet of gross floor area ($\pm$ 30 acres). The remaining portions of the site would be paved for parking area. Stormwater management systems would tie in with those of the J.C. Penney warehouse on a neighboring site, as well as establishment of additional detention basins on the project site. Public sewer and water are available to the site.

The site was recently used for vegetable crops, remnants of this vegetation were apparent on the day of the field review. Several large tobacco sheds or warehouses are presently established on the site. Topography is generally gently sloping on the major section of the parcel. Soils typical of the site include the Enfield series, the Manchester series, and the Merrimac series. Each of these soils is noted for their agricultural importance by the USDA, Soil Conservation Service.

The Team is concerned with the effect of the proposed development on the natural resource base of this site. The town of South Windsor was specifically concerned with the impact of this proposal on the soils, hydrology, water quality and air quality of the site and surrounding area. These issues are addressed in detail in the following sections of this report.

Generally, the Team has found that the proposal will result in slight increases in the carbon monoxide (CO) levels in the air in the immediate area; there should be adequate consideration given to the highly erosive nature of the soils on site, by both water and wind, and precautions for minimizing erosion and subsequent sedimentation should be taken during the construction of this project; the effect on the water quality of the underlying aquifer will be questionable and the Team recommends additional consultation with the Long Island office of the United States Geological Survey. The aquifer itself is composed primarily of fine grained sediments which generally are not suitable for large scale water supply development, however, it should be noted that the Manchester Water Company's well fields have been developed in an area consisting primarily of fine grained sands.

ENVIRONMENTAL ASSESSMENT

GEOLOGY

The site proposed for the new shopping mall is located in an area encompassed by the Manchester topographic quadrangle. A geologic map of the quadrangle, prepared in 1965 by R.B. Colton, has been published by the U.S. Geological Survey (Map GQ-433). Colton identified the surficial geologic materials on the site as a combination of glaciofluvial and glacial deltaic sediments. Glaciofluvial sediments consist of materials that were deposited by streams of glacial meltwater. These are usually coarse-grained sediments, primarily sand and gravel. The deltaic sediments were deposited in a former glacial lake by an aggrading meltwater stream or streams. These sediments are usually finer-grained, consisting primarily of sand, silt, and gravel.

Geological logs of several wells and test borings in the vicinity of the site have provided some information about the nature of the subsurface geology. These logs indicate that bedrock is within 20 feet of the surface at the eastern boundary of the tract (Buckland Street in Manchester), but that it is as much as or more than 200 feet below the surface at the western boundary (Wheeler Road in Windsor). The logs also indicate that the bedrock is within 100 feet of the surface in the Burnham Street-Croft Drive area. Evidently, glacial sediments have filled a deep bedrock valley whose axis passes north-northwest to south-southeast beneath the western section of the tract. The site forms part of a fairly extensive plain in the Buckland area. The plain can be traced southward from Smith Street for a distance of more than a mile; it terminates at an escarpment just south of the Penn Central railroad in Buckland. An examination of the scarp face showed a few feet of coarse sand and gravel at the surface, overlying horizontally bedded fine sands, very fine sands, silt, and clay. This stratigraphy is probably fairly consistent throughout most of the plain, including the western section of the proposed mall site. The fine-grained nature of the sediments and the horizontal layering tend to confirm the prior existence of a glacial lake in the area, into which streams from wasting ice blocks carried a tremendous load of shattered rock particles. Although most glacial lake sediments in the area are fine-grained, coarser layers, which would indicate periods of expecially rapid glacial streamflow, are probably interbedded to some extent (well logs in the Croft Drive-Windsor Street area reported up to 80 feet of "sand and gravel" over bedrock).

The local bedrock is sedimentary, consisting largely of sandstone, siltstone, and shale. These rocks were formed during the early Jurassic Period, about 180 million years ago. Outcrops of the rock occur east of the site near Buckland Road. Till, another type of glacial sediment that is most commonly known as "hardpan," covers the bedrock in most areas east of Buckland Road for a distance of approximately one-half to one and one-half miles. Till was deposited directly from the ice, rather than by meltwater streams; consequently, till is non-sorted and contains particles of all sizes from clay to boulders. It seems likely that till, generally less than 15 feet thick, directly overlies bedrock beneath the proposed mall site. Well logs along Smith Street do not contain completely consistent geological descriptions, but the various designations of "clay," "hardpan," "sand," and so forth are probably due more to different usages among well drillers than to actual differences in geology. The general trend of the descriptions still implies that a thin layer of coarse sand and gravel overlies fine-grained lake sediments and till.

HYDROLOGY

A major concern of the town of South Windsor appeared to be the possible effects of the proposed mall on a prospective water-supply aquifer under and in the vicintiy of the site. The term "aquifer" does not refer to any specific geologic deposit, but merely is applied to any earth material that is capable of supplying useful quantities of groundwater. In effect, all of Connecticut is an aquifer, since the underlying bedrock is itself a common source of water supply. Bedrock, however, generally will not supply yields of more than 30 gallons per minute (higher yields can be obtained in some places, but such yields are rare). Coarse-grained glaciofluvial sediments, on the other hand, may supply several hundred gallons per minute, depending upon the thickness of the saturated zone and the areal extent of the deposit. Consequently, areas known to be underlain by stratified drift deserve the closest examination.

Although there are thick stratified drift (glacial meltwater) deposits beneath the proposed mall site and surrounding areas, subsurface data shows that most of these sediments are fine-grained. It is therefore not as likely that the surficial material (the overburden) would be suitable for large-scale water supply development. This does not mean, however, the the deposits are necessarily unsuitable. Even fine sand has proven to be a valuable groundwater-supply source where the saturated section is thick. It is known that wells near the western section of the site have penetrated more than 200 feet of overburden; hence, the possibility of at least a moderate yield from the stratified drift on the site cannot be dismissed. It should be noted in this regard that the Manchester Water Company's well field off New State Road is located in sediments that were logged as consisting predominantly of fine sand.

The question of existing water quality is even more problematic. A chemical analysis from a stratified drift well near the site showed levels of nitrate that were much higher than the recommended maximum for drinking-water. However, the analysis was dated July, 20, 1954. It is not known whether this analysis represented an isolated occasion of elevated nitrate levels or whether it was symptomatic of a continuing problem. Since the reading was taken in a period when fertilizer applications may have been particularly heavy and when recent recharge from precipitation may have been low, and also because of the substantial lapse of time since the reading, the reported chemical data is of questionable value. More recent chemical data would be helpful. It may be presumed, however, that the historical usage of the area for agricultural purposes has affected the local groundwater to some extent. The effects would be expected to decrease with depth.

As to the potential impact of the shopping mall itself, it seems clear that the principal source of possible groundwater contamination would be runoff from the parking lots. Most of the surface runoff from the mall would be directed to detention basins, which would have permeable bases. Contaminants from the paved areas could percolate down to the water table from these basins. The town may wish to consult the Long Island branch of the U.S. Geological Survey to discuss this matter. The Survey has considerable experience in this type of situation: drainage from many commercial centers on Long Island was returned to the ground via retention pits in order to assure sufficient recharge to the groundwater. The Survey has monitored the groundwater in some of these areas for many years and would be able to offer pertinent information about the effects of the artificial recharge. Since the total amount of paved area contributing to the basins in Buckland Commons would be large (approximately 150 acres,

including the J.C. Penney facility), the Team recommends that the Long Island USGS office be consulted.

The large area of land that would be covered by impermeable surfaces, including the Penney facility, would have some effect on groundwater recharge. If none of the rainfall reaching the impermeable surfaces were returned to the ground, the loss of recharge would probably be in the range of 50 million to 100 million gallons of water per year. This volume of groundwater could sustain a well with a continuous yield of about 95 to 190 gallons per minute. Actually, some of the surface water would be transmitted through the ground, either through the bottoms of the detention basins or through the bases of local stream channels, but it seems likely that most of the natural recharge from the covered area would be lost. The general effect of this loss would be to lower the average elevation of the water table underneath and in the vicinity of the mall site. The domestic wells surrounding the site appear to be generally deep and within the underlying bedrock. These wells should not be noticeably affected by the loss of recharge. If there are wells in the vicinity that tap only the upper 10 feet or so of the saturated zone of stratified drift, they may be adversely affected, but the Team has no information to suggest that this type of well does exist near the site.

The loss of recharge entailed in the development of the mall should not have serious repercussions in terms of the quantity of groundwater available unless plans were ultimately finalized for a public-supply well in the vicinity of the site. As discussed above, the local overburden appears to be predominantly fine-grained and may not be suitable for such a well. In addition, public water mains are available to serve the area. Nevertheless, the Buckland area has undergone and will probably continue to undergo substantial growth and the long-range needs of the area must be considered. In particular, the proposed mall should not be regarded solely by itself; it should be related to other future developments that seem likely to occur. For example, it has been stated that the impervious area associated with the mall would account for only a small percentage of the available recharge to the groundwater. The same argument may have been made for the Penney complex or may be made for future developments. Ultimately, a series of developments, each by itself accounting for only a small percentage, can block out a substantial portion of recharge area. Also, the actual area of recharge for a well placed on the site or nearby depends to some extent upon the level of the saturated zone that it taps: the higher the tap, in general, the smaller the recharge area.

Since a productive groundwater well field is likely to be more reliable than surface water supplies, as recent drought conditions in the state have made clear, the possibility of utilizing the stratified drift on or near the proposed mall site should not be dismissed unless the town is convinced it has ample supply potential to meet projected long-range demands. Perhaps one or two test wells could be drilled on the site. If the deposits are shown to have some useful potential, this would not rule out the mall but it could suggest that more detailed work should be done on determining the boundaries of the local groundwater system and on the effects of both loss of recharge and the possible contamination resulting from the absorption of parking lot runoff. Again, the Long Island branch of the U.S. Geological Survey would be a useful source of information in this process.

Another hydrologic concern relating to the proposed mall is the effect on runoff and local peak streamflows. Rainfall that is no longer able to penetrate

the ground will run off to artificial or natural basins or streams. The soils on the site (i.e., the upper portion of the overburden) are coarse-grained and are consequently more absorptive than most other types of soil in the state. As a consequence, the increase in surface runoff from the areas made impervious would be maximal. On the other hand, because the existing use of the land is agricultural, the runoff increase would be smaller than if the site were presently forested. As an example of the expected increases, it may be estimated that the site would generate approximately 1.77 inches of runoff during a 2-inch rainfall after development, whereas it would generate less than 0.2 inch under present conditions. The developers have recognized the need for runoff controls and have prepared plans for a drainage system that will serve to maintain peak flows at present levels for all storms up to the 100-year frequency storm. This system will be effected by detention basins with multiple outlets. The developers' design in this regard appears to address the problem in a more-than-adequate fashion. The design would require the burial of an intermittent drainage swale in the eastern section of the tract. Runoff through the swale is presently creating problems for a homeowner on Smith Street; the new system would alleviate this problem while simultaneously taking over the natural function of the swale. Burial of the swale should not have adverse consequences.

A concern was expressed about possible effects of runoff on a wetland just north of Smith Street and the proposed mall site. Since the detention basin upstream from the wetland would control peak flows, any impact would most likely be related to sediment or other foreign substances derived from the parking lots. Much of the sediment would undoubtedly be trapped in the basin. Dissolved salts, oils, or other liquid contaminants would be of greater concern. The developer has addressed this concern to some extent. It is difficult to evaluate the degree of risk involved since so much depends upon the nature and success of the mitigative measures that are employed.

SOILS

A detailed soils map of this site is 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 660'/inch, the soil boundary lines should not be viewed as absolute boundaries, but as guidelines to the distribution of soil types of 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 Soil Survey: Hartford County, Connecticut, 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.

A shopping mall is proposed to be located on 28 acres of this 93-acre parcel. A total of 55 acres is located in South Windsor and 38 acres in Manchester. Most of the remaining acreage will be parking area.

All of the 93 acres, except for a total of 18 acres in three small parcels on steeper slopes, is "prime farmland." The remaining 18 acres is considered "important farmland," as defined by the USDA, Soil Conservation Service. The present use is for agricultural crops. J.C. Penney Warehouse exists to the south. Much of the remaining area around the site is residential.

Generally, three different soils exist on the parcel. These soils vary in degree of steepness and are well drained to excessively drained.

The Enfield Series (EsA, EsB, EsB2, EsC2) consists of deep, well-drained soils on terraces. They formed in silt-mantled outwash material. Typically, these soils have a dark brown silt loam surface layer eight inches thick. The subsoil layers, from eight to twenty-four inches, are yellowish-brown and brown silt loam. The substratum, from 24 to 60 inches, is reddish-brown stratified sand and gravel. Slopes range from 0 to 5 percent.

The Merrimac Series (MrA) consists of deep, somewhat excessively drained soils on outwash plains, valley trains, kames, eskers and high terraces. They formed in water-sorted material. Typically, these soils have a very dark grayish brown fine sandy loamy surface layer 10 inches thick. The subsoil layers from 10 to 26 inches are brown fine sandy loam, dark yellowish brown sandy loam and dark yellowish brown gravelly loamy sand. The substratum from 26 to 60 inches is dark grayish brown stratified sand and gravel. Slopes range from 0 to 35 percent.

The Manchester Series (MgC, MhC) consists of deep, excessively drained soils on terraces. They formed in glacial outwash deposits. Typically these soils have a reddish brown gravelly sandy loam surface layer 6 inches thick. The yellowish red subsoil from 6 to 10 inches is gravelly sandy loam and from 10 to 16 inches is gravelly loamy sand. The substratum from 16 to 60 inches is reddish brown stratified sand and gravel. Slopes range from 0 to 45 percent.

There are no inland-wetland soils located on the property. An inland-wetland is not delineated on Soil Survey Maps if the area is generally less than one acre in size.

Erosion and Sedimentation Controls

The Enfield silt loam soils are highly erosive and will erode easily during and after rains if left unvegetated. The Manchester and Merrimac soils will also erode easily during peak runoffs, if left unprotected.

All soils on this site will move easily by wind action when no vegetation is covering the soil surface. Soil movement by wind will be a major concern during the fall, winter and spring months.

A spring or fall temporary cover is either 3 1/2 bushels of rye per acre or 60 pounds of perennial ryegrass per acre broadcast or drilled over the disturbed areas. A good summer seeding is three bushels of oats broadcast over the unvegetated areas.

A permanent grass mix to use for areas not needing high maintenance is 25 pounds of Kentucky 31 Tall Fescue and 25 pounds of Creeping Red Fescue per acre.

For areas to be frequently mowed, a mix of 25 pounds Kentucky Bluegrass and 25 pounds Creeping Red Fescue per acre can be used. A mix of 35 pounds Fescue to 15 pounds Kentucky Bluegrass per acre in the droughtier soils areas would be appropriate.

Apply 600 pounds of 10-10-10 fertilizer per acre to all areas before seeding. Also apply 2 tons of lime per acre before seeding. A hay or straw mulch can be applied to steeper areas after seeding at 1 1/2 to 2 tons per acre. Consideration should be given to using a hydroseeder, especially when seeding the slopes.

WATER COURSES AND WETLANDS

J.C. Penney Company and Buckland Industrial Park are the major developments located to the south of the site in the town of Manchester. Much earth moving was done in this area prior to and during construction. The natural drainage areas have been altered. At least a portion of this development area now drains into Quarry Brook. Much of the acreage of the proposed shopping mall will also be enptied into Quarry Brook.

Most of the watershed drains eventually into Mill Pond on the Podunk River. A delicate inland-wetland area exists in the drainage area between Mill Pond and the proposed development. With precautionary measures during construction of this project and future developments within the Podunk River Watershed, the wetland area of the watercourse basin can generally be protected to maintain its existing natural vegetation and wildlife habitat.

The inland-wetlands of the Plum Gully Brook branch and Quarry Brook begins a distance downstream from the property. Any increased water flow or polluted runoff water can change the vegetation and use of this wetland area significantly. It will be important to install properly designed basins for stormwater management and control of downstream sediment runoff if the wetlands are going to be protected to any degree.

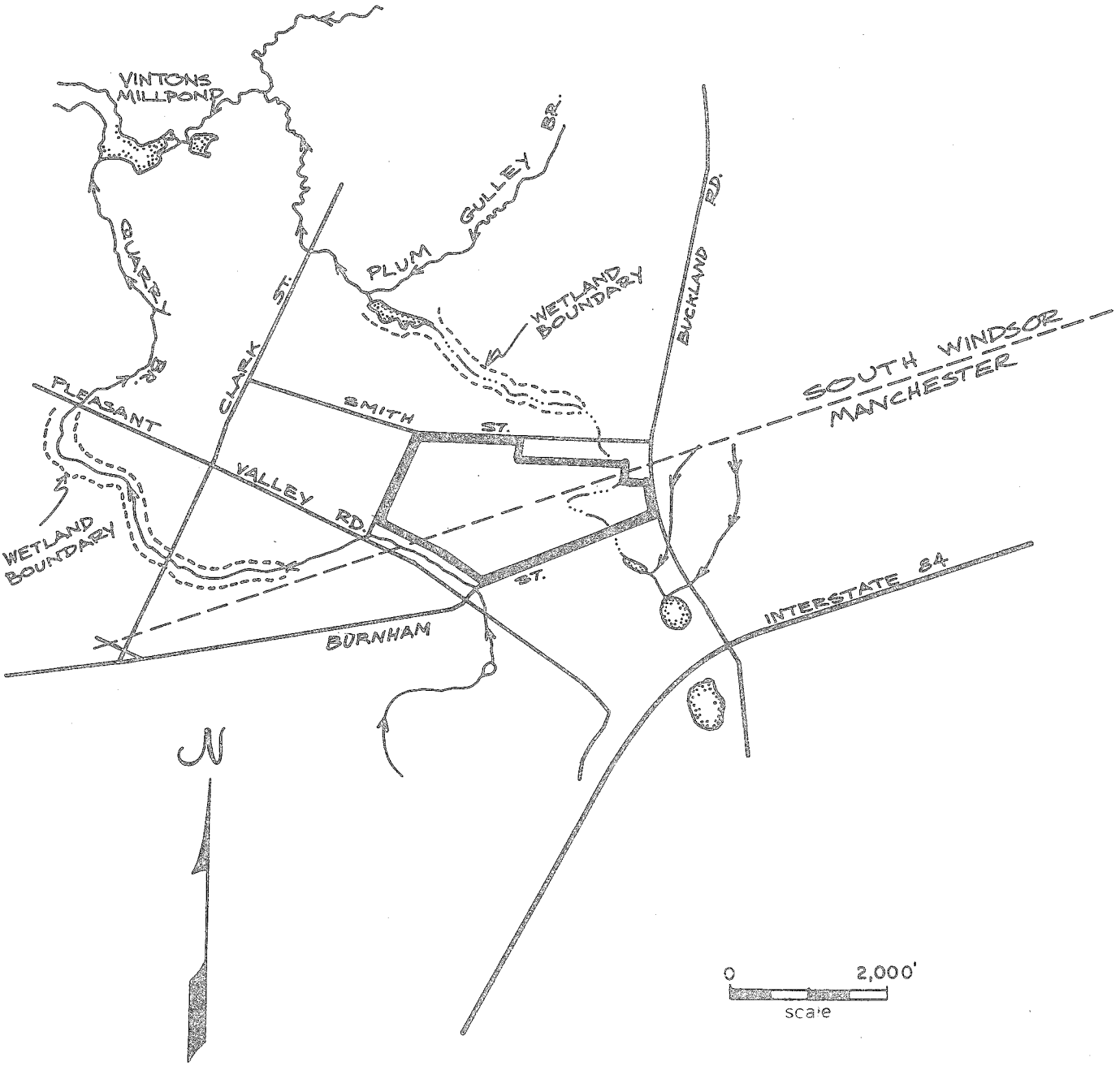
Prior to construction, consider the effect of soil sedimentation to the brooks, the pond on the Plum Gully Brook branch and to Mill Pond on the Podunk River. Evaluation of the effect of parking lot runoff to the downstream watercourses is also important.

FLOOD BOUNDARIES/STORMWATER RUNOFF

The U.S. Department of Housing and Urban Development flood boundary maps of 5/1/80 show the fifty and one hundred year flood boundaries for Quarry Brook and Plum Gully Brook. The study does not show any flood lines of the brooks on or immediately off the property.

It can be assumed that there will be increased downstream stormwater runoff flows as the watershed acreage becomes developed. The storm runoff water of the proposed shopping mall will be directed into new detention basins and the existing basins of J.C. Penney Company. Detention basins and other measures for stormwater

WATERCOURSES IN THE VICINITY OF THE PROPOSED
BUCKLAND COMMONS MALL



storage will be essential to help alleviate downstream flooding. The use of dry wells will also aid in stormwater control. The dry wells will work especially well in the excessively drained deep sands.

Whenever water is discharged into the ground there is a possibility of groundwater pollution. Detention basins, sediment basins and dry wells can contribute to groundwater pollution. It is therefore important to control the possible contaimination of runoff waters from storms. Oil films from the parking areas along with sands and salts applied during winter months are possible pollutants.

AIR QUALITY/TRANSPORTATION

The proposed development is a 1.2 million square foot retail shopping area located on 93 acres of undeveloped farmland in the towns of South Windsor and Manchester. In order to full evaluate the air quality consequences of such a large development, site specific and detailed traffic data would be required.

The need of this site specific information arises due to the inherent nature of transportation related air pollutants. There are three primary pollutants associated with the operation of a motor vehicle: Non-Methane Hydrocarbons (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NO_X). One of these mobile source pollutants, CO, is an extremely localized phenomenon associated with congested roadways and the slow operating speeds of motor vehicles. The physical properties of CO also contribute to its overall significance in this analysis. Because carbon monoxide is a primary product of combustion, relatively inert, and released near the ground, the highest ambient concentrations are typically found in the immediate vicinity of the emission source.

Hence, studies of CO problems must focus on local analyses with site specific data rather than areawide analyses of the type undertaken for other pollutants like HC and NO_X. Since CO is of a localized nature, and produced by the inefficient operation of the transportation system, it is the pollutant of most concern during the analysis of the proposed shopping center. While CO will be the primary concern, it would be inappropriate for the analysis to be undertaken without the inclusion of the pollutants HC and NO_X.

With extensive site specific data, numerous computer generated analyses and programmable calculator methods could be utilized in the investigation of the Buckland Commons development. Unfortunately, at this stage of the development proposal, most of this information has yet to be developed. While the information presented is adequate to evaluate the overall merits of most of the development criteria normally required, specific items essential to the air quality analysis are unavailable.

While this might preclude the more sophisticated/technical analysis techniques, other methods are available which can give us some gross emission figures for the purposes of estimating the effect of the proposed shopping center on the location's air quality.

Based on the description of the proposed retail development and a past study of the Buckland Commons development conducted by CRCOG (Capitol Region Council of Governments) in April, 1980, travel impacts associated with the shopping area were calculated. Table I summarizes the effect of developing the current site as proposed on the region's automobile trips.

TABLE I

TOTAL DAILY TRIPS

District	Base Condition	Buckland Attractions	Change
Buckland Common	34,600	76,205	41,605
Mnch., Vernon, S.W.	206,600	177,700	-28,900
Wi., W.L., Suff., Enfld.	289,500	289,850	350
Blm., Gr., E Gr., Sims.	168,900	168,550	-350
Htfd., W.H., Ave., Cant.	610,100	607,750	-2,350
Farm., Plnvl., N.B.	417,900	417,200	-700
Nwgt., Rcky. Hill, Weth.	236,100	235,400	-700
Glas., Marl., Hebron	91,300	89,900	-1,400
Bolton, Andover	10,800	10,600	-200
Ell., Tolland, Somers, Coventry, Stafford	110,600	111,800	1,200
CAPITOL REGION (Adjusted)	2,176,400	2,184,955	8,555

The proposed retail development would result in a projected increase of 41,605 vehicle trips to the Buckland Commons area if developed. While the development would attract a substantial amount of trips over the base condition, not all of the identified trips would be induced entirely by the shopping center. What is inferred from Table I is that a substantial number of the trip attractions would be diverted from other areas of the region. In reality, only 8,555 trips out of the projected total of 41,605 would be "new" trips destined for the development.

Based on this finding, forecasts for the other nine districts were adjusted to reflect the increased growth in the development area. With the development of the Buckland Commons area, a 14% decrease in travel to other areas in the Manchester, Vernon and South Windsor district would result. Given the sensitivity of the analysis techniques, the impact of the shopping center on travel attractions to other districts would be minimal.

Additional forecasts were necessary to obtain a work trip/non-work trip split for inclusion in the analysis. The results of this study are summarized in Table II.

TABLE II

Trip Attractions to Buckland Commons

Trip Purpose	Base Condition	Developed Condition
Work trip	2,500	11,000
Non-work trip	32,100	30,605
Total:	34,600	41,605

Transportation related pollution concentrations occurring in the immediate vicinity of a major development are generally considered to be comprised of two components, including (1) a concentration directly attributable to the nearby development, and (2) a background component that is attributable to all other emission sources. Further refinements are required to the transportation related emissions generated by the development. Total vehicle emissions are comprised of both the emissions generated by the moving vehicle and the start-up and evaporative emissions produced by the vehicle. Utilizing the travel data developed in Tables I and II as well as standard air quality related assumptions suited for the Capitol Region, emission estimates for the three pollutants were developed. The accompanying worksheets document the emission forecasts for both the base alternative and the developed condition.

Worksheet VI-C is used to estimate the start-up and evaporative emissions while worksheet VI-D calculates the auto travel emissions. Sheet VI-E combines these estimates to develop the total emissions of each condition and the forecasted changes due to the proposed shopping center. While the specific development area was utilized for this analysis, a total regionwide change was also developed to place the target area forecasts in the correct perspective. Table III was developed to summarize the results identified on worksheets VI-C, VI-E and VI-D for the Buckland Commons area while Table IV represents the Capitol Region.

TABLE III

Projected Changes in Air Quality for the Buckland Commons Area*

	Base Emissions	Revised Emissions	Total Emissions	% Change
CO	6,997,700	6,011,922	13,009,622	+85
HC	559,200	499,260	1,058,460	+89
NO_X	796,620	611,593	1,508,213	+76

TABLE IV

Projected Changes in Air Quality For the Capitol Region*

	Base Emissions	Revised Emissions	Total Emissions	% Change
CO	216,470,000	1,236,195	217,706,195	+.571
HC	15,837,000	102,658	15,939,658	+.648
NO_X	44,127,000	125,765	44,252,765	+.285

* Grams/Day

Based on the estimates obtained utilizing the preceeding information, an approximate increase in carbon monoxide for the Buckland Commons area of 85% can be expected. An increase as large as this can be justified when one considers the current state of development of the site.

VI-C. AUTO START-UP AND EVAPORATIVE EMISSIONS

☑ Base Alternative

☐ Revised Alternative

Policy: Buckland Commons

Forecast Year: 1987

Temperature: 50° F

	Work Trips						Non-Work Trips			
(1) Population Subgroup	(2) % Cold Starts (VI-B)[1]	(3) Trips (IV-A)	Pollutant[2]	From[3] Table	(4) Start-Up Factors	(5) Emissions = Col. 3 X Col. 4 (grams)	(6) % Cold Starts (VI-B)	(7) Trips (VI-A)	(8) Start-Up Factors	(9) Emissions = Col. 3 X Col. 4 (grams)
Buckland Commons Area	35%	2,500	HC(c)	D.3	5.6	14,000	35%	32,100	5.6	179,760
			CO(c)	D.4	55.7	139,250			55.7	1,787,970
			NOx(c	D.5	1.9	4,750			1.9	60,990
			HC(h)	D.6						
			HC(c)	D.3						
			CO(c)	D.4						
			NOx(c	D.5						
			HC(h)	D.6						
			HC(c)	D.3						
			CO(c)	D.4						
			NOx(c	D.5						
			HC(h)	D.6						

TOTALS

TOTALS $\sum$ Subgroups

	Work Trip Start-Up Emissions (grams)
HC	14,000
CO	139,250
NOx	4,750

+

$\sum$ Subgroups

	Non-Work Trip Start-Up Emissions (grams)
HC	179,760
CO	1,787,970
NOx	60,990

=

Total Start-Up Emissions (grams)
193760
1,927,220
65,740

[1] Source Worksheets are indicated in parentheses where applicable

[2] (c) indicates cold start factor

(h) indicates hot soak factor

[3] both work and non-work start-up factors obtained from the indicated tables

VI-C. AUTO START-UP AND EVAPORATIVE EMISSIONS

☐ Base Alternative

☑ Revised Alternative

Policy: Buckland Commons

Forecast Year: 1987

Temperature: 50° F

	Work Trips						Non-Work Trips					
(1) Population Subgroup	(2) % Cold Starts (VI-B)[1]	(3) Trips (IV-A)	Pollutant[2]	From Table[3]	(4) Start-Up Factors	(5) Emissions = Col. 3 X Col. 4 (grams)	(6) % Cold Starts (VI-B)	(7) Trips (VI-A)	(8) Start-Up Factors	(9) Emissions = Col. 3 X Col. 4 (grams)		
Buckland Commons Area	35%	11,000	HC(c)	D.3	5.6	61,600	35%	30,605	5.6	171,388		
			CO(c)	D.4	55.7	612,700			55.7	1,704,698		
			NOx(c	D.5	1.9	20,900			1.9	58,149		
			HC(h)	D.6								
Capitol Region (Adjusted)	35%	2261	HC(c)	D.3	5.6	12,661	35%	6,294	5.6	35,246		47,907
			CO(c)	D.4	55.7	125,937			55.7	350,575	=	476,512
			NOx(c	D.5	1.9	4,295			1.9	11,958		16,253
			HC(h)	D.6								
			HC(c)	D.3								
			CO(c)	D.4								
			NOx(c	D.5								
			HC(h)	D.6								
TOTALS			TOTALS Σ Subgroups	HC		61,600			Σ Subgroups	HC	171,388	232,988
				CO		612,700				CO	1,704,698	= 2,317,398
				NOx		20,900				NOx	58,149	79,049
						Work Trip Start-Up Emissions (grams)					Non-Work Trip Start-Up Emissions (grams)	Total Start-Up Emissions (grams)

[1] Source Worksheets are indicated in parentheses where applicable

[2] (c) indicates cold start factor

(h) indicates hot soak factor

[3] both work and non-work start-up factors obtained from the indicated tables

VI-D. AUTO TRAVEL EMISSIONS

☑ Base Alternative

☐ Revised Alternative

Policy: Buckland Commons

Forecast Year: 1987

	Work Trips					Non-Work Trips			
(1) Population Subgroup	(2) Average Speed	(3) VMT (VI-A)[1]	(4) Auto Travel Factors (Table D.7)	(5) Emissions = Col. 3 X Col. 4 (grams)	(6) Average Speed	(7) VMT (VI-A)	(8) Auto Travel Factors (Table D.7)	(9) Emissions = Col. 7 X Col. 8 (grams)
Buckland Commons Area	26 mph	200,000	HC .8	160,000	26 mph	256,800	HC .8	205,440
			CO 11.1	2,220,000			CO 11.1	2,850,480
			NOx 1.6	320,000			NOx 1.6	410,880
			HC				HC	
			CO				CO	
			NOx				NOx	
			HC				HC	
			CO				CO	
			NOx				NOx	
			HC				HC	
			CO				CO	
			NOx				NOx	
			HC				HC	
			CO				CO	
			NOx				NOx	
			HC				HC	
			CO				CO	
			NOx				NOx	

TOTALS	Σ Subgroups	HC	160,000	+ Σ Subgroups	HC	205,440	= 365,440
		CO	2,220,000		CO	2,850,480	5,070,480
		NOx	320,000		NOx	410,880	730,880
			Work Trip Travel Emissions (grams)			Non-Work Trip Travel Emissions (grams)	Total VMT Travel Emissions (grams)

[1] Source Worksheets are indicated in parentheses where applicable

VI-D. AUTO TRAVEL EMISSIONS

☐ Base Alternative

☑ Revised Alternative

Policy: Buckland Commons

Forecast Year: 1987

	Work Trips					Non-Work Trips				
(1) Population Subgroup	(2) Average Speed	(3) VMT (VI-A)[1]	(4) Auto Travel Factors (Table D.7)	(5) Emissions = Col. 3 X Col. 4 (grams)		(6) Average Speed	(7) VMT (VI-A)	(8) Auto Travel Factors (Table D.7)	(9) Emissions = Col. 7 X Col. 8 (grams)	
Buckland Commons Area	26 mph	88,000	HC .8	70,400		26 mph	244,840	HC .8	195,872	
			CO 11.1	976,800				CO 11.1	2,717,724	
			NOx 1.6	140,800				NOx 1.6	391,744	
Capitol Region (Adjusted)	26 mph	18,088	HC .8	14,470		26 mph	50,352	HC .8	40,281	54,751
			CO 11.1	200,776				CO 11.1	558,907	= 759,683
			NOx 1.6	28,949				NOx 1.6	80,563	109,512
			HC					HC		
			CO					CO		
			NOx					NOx		
			HC					HC		
			CO					CO		
			NOx					NOx		
			HC					HC		
			CO					CO		
			NOx					NOx		
			HC					HC		
			CO					CO		
			NOx					NOx		
TOTALS			Σ Subgroups	HC	70,400		+ Σ Subgroups	HC	195,872	= 266,272
				CO	976,800			CO	2,717,724	3,694,524
				NOx	140,800			NOx	391,744	532,544
				Work Trip Travel Emissions (grams).				Non-Work Trip Travel Emissions (grams)		Total VMT Travel Emissions (grams)

[1] Source Worksheets are indicated in parentheses where applicable

VI-E. SUMMARY OF CHANGES IN EMISSIONS

Revised Alternative

Policy: Buckland Commons

Forecast Year: 1987

(1) Population Subgroup		Base Emissions (2) Trip-Related (VI-C)[1]	(3) Travel (VI-D)	(4) Total (Col. 2 + Col. 3)	Revised Emissions (5) Trip-Related (VI-C)	(6) Travel (VI-D)	(7) Total (Col. 5 + Col. 6)	(8) Total Emissions (Col. 4 + Col. 7)	(9) Percent Change in Emissions (Col. 8/Col. 4) x 100
Buckland Commons Area	HC	193,760	365,440	559,200	232,988	266,272	499,260	1,058,460	+ 89
	CO	1,927,220	5,070,480	6,997,700	2,317,398	3,694,524	6,011,922	13,009,622	+ 85
	NOx	65,740	730,880	796,620	79,049	532,544	611,593	1,408,213	+ 76
Capitol Region	HC			15,837,000	47,907	54,751	102,658	15,939,658	+ .648
	CO			216,470,000	476,512	759,683	1,236,195	217,706,195	+ .571
	NOx			44,127,000	16,253	109,512	125765	44252765	+ .285
	HC								
	CO								
	NOx								
	HC								
	CO								
	NO_x								

TOTALS							
Σ Sub-groups	HC		Σ Sub-groups	HC		Percent Change, Total Emissions
	CO			CO		
	NOx			NOx		
	Total Base Emissions (grams)			Total Change in Emissions (grams)		

[1] Source Worksheets are indicated in parentheses where applicable

At first, an increase for the pollutant carbon monoxide of 85% would appear to be significant. Upon further investigation, the increase has been shown to be only minimal at best. As stated earlier, the calculation of air pollution emissions from a development such as this is comprised of two components: (1) concentrations directly attributable to the site, and (2) a background concentration attributable to all other emission sources.

For the purpose of this analysis, recent Connecticut Department of Transportation air quality monitoring for CO of a comparable location which revealed an average background concentration of approximately one part per million (PPM) was used. It is believed that a one PPM concentration is representative of a semi-rural to rural area in the Capitol Region. For comparison sake, recent analyses conducted in the State utilized an average concentration of 2.9 PPM for urbanized areas such as downtown Hartford.

Using one PPM as the background or base emission level and adding the projected 85% increase in CO levels, would result in approximate CO level of 1.85 PPM (for our purposes we will call it 2 PPM). The current eight hour standard for the pollutant CO is 9 PPM which is significantly higher than the projected 2 PPM from the Buckland Commons area. To reinforce this minimal increase, the entire Capitol Region would expect to gain only .571% in its CO inventory.

While the consequences of developing this farm property as a shopping mall would increase the area's CO burden by some 85%, only a minor degradation in the air quality inventory would result.

This fact is even more evident when one considers the pollutants HC and NO_X. With roughly the same increase projected based on the development proposal, it is estimated that the real increase of these two pollutants would be less than that for CO. These results are brought about due to the characteristics of the particular pollutants. While CO is a relatively stable pollutant and a localized problem, HC and NO_X are highly reactive and regionwide in nature. Therefore, emissions of HC and NO_X will not be concentrated in the development site as CO tends to be, but these emissions will be spread out over the region.

It would be inappropriate to estimate the concentrations of HC and NO_X at the Buckland site as was done for CO precisely due to this difference in the pollutants' characteristics. It would be safe to assume that for the pollutants HC and NO_X only a marginal increase for the "area" could be expected.

Based on the above analysis, a significant (85%) increase in CO emissions might be expected at the Buckland Commons site should it be developed as proposed. Although such a large increase might be expected, in reality only a marginal increase in the CO inventory would result. This increase in CO might cause some health problems to individuals with acute health problems exposed to the emissions on a daily basis, but should pose very few problems to most individuals. With a projected concentration of approximately 2 PPM, major emission increases in the area could be accommodated before the 9 PPM standard would be approached. With the further design of the proposed development and the surrounding roadway system, positive measures could and should be made which would mitigate most of the projected air quality problems. It would be the responsibility of the towns of South Windsor and Manchester to monitor these continued design features closely so that every attempt possible is made to provide for an efficient transportation system, thereby reducing the negative air quality effects of the development.

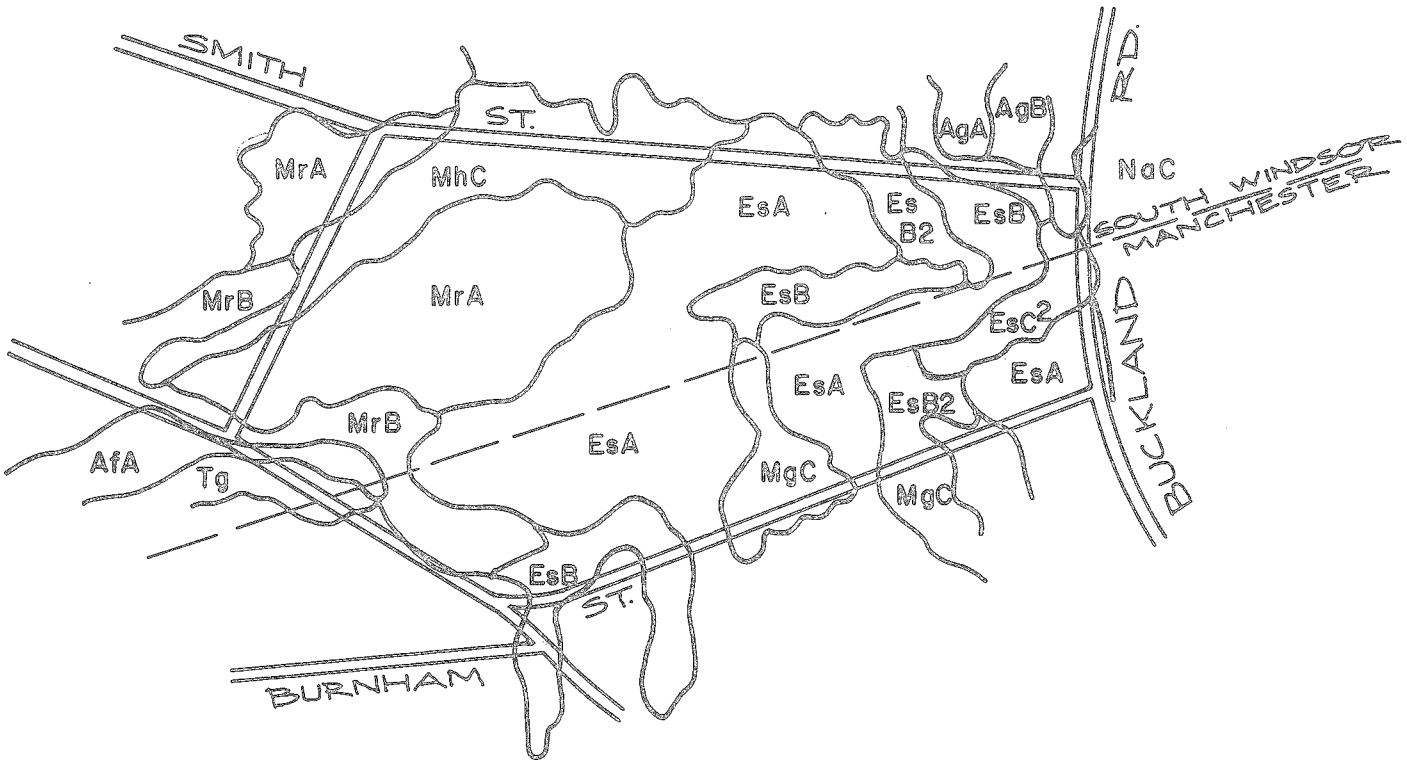
The pollutants of HC and NO_X on the other hand should be of very little concern in the evaluation of this proposal.

Appendix

Soils

0 660'
SCALE

N



	Soil Name/ Texture	Slope	Prime Farmland	Important Farmland	Hydrologic Soil Group	Erosion Hazard	LIMITATIONS FOR: Septic Systems	Shallow Excavations	Roads	Lawns, Landscaping	Small Commercial Buildings
	Enfield-silt loam	0-3%	yes	-	"	High	Slight	"	Moderate	Slight	Moderate Frost action
	Enfield-silt loam	3-8%	yes	-	"	"	"	"	"	"	"
2	Enfield-silt loam eroded	"	yes	-	"	"	"	"	"	"	"
2	Enfield-silt loam eroded	8-15%	no	yes	"	"	moderate (slope)	"	moderate (slope frost action)	moderate (slope)	severe (slope)
	Manchester gravelly sandy loam	3-15%	no	yes	A	low to medium	slight to moderate	"	slight to moderate	severe (droughty)	slight to moderate
	Manchester loamy sand	3-15%	no	yes	"	"	"	"	"	"	"
	Merrimac-fine sandy loam	0-3%	yes	-	"	"	severe (poor filter)	"	slight	slight	slight
	"	3-8%	yes	-	"	"	"	"	"	"	moderate

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.

About the Team

The Eastern Connecticut Environmental Review Team (ERT) is a group of professionals in environmental fields drawn together from a variety of federal, state, and regional agencies. Specialists on the Team include geologists, biologists, foresters, climatologists, soil scientists, landscape architects, archeologists, recreation specialists, engineers and planners. The ERT operates with state funding under the supervision of the Eastern Connecticut Resource Conservation and Development (RC&D) Area.

The Team is available as a public service at no cost to Connecticut towns.

PURPOSE OF THE TEAM

The Environmental Review Team is available to help towns and developers in the review of sites proposed for major land use activities. To date, the ERT has been involved in reviewing a wide range of projects including subdivisions, sanitary landfills, commercial and industrial developments, sand and gravel operations, elderly housing, recreation/open space projects, watershed studies and resource inventories.

Reviews are conducted in the interest of providing information and analysis that will assist towns and developers in environmentally sound decision-making. This is done through identifying the natural resource base of the project site and highlighting opportunities and limitations for the proposed land use.

REQUESTING A REVIEW

Environmental reviews may be requested by the chief elected officials of a municipality or the chairman of town commissions such as planning and zoning, conservation, inland wetlands, parks and recreation or economic development. Requests should be directed to the Chairman of your local Soil and Water Conservation District. This request letter should include a summary of the proposed project, a location map of the project site, written permission from the landowner allowing the Team to enter the property for purposes of review, and a statement identifying the specific areas of concern the Team should address. When this request is approved by the local Soil and Water Conservation District and the Eastern Connecticut RC&D Executive Council, the Team will undertake the review on a priority basis.

For additional information regarding the Environmental Review Team, please contact Jeanne Shelburn (889-2324), Environmental Review Team Coordinator, Eastern Connecticut RC&D Area, 139 Boswell Avenue, Norwich, Connecticut 06360.