ML - Franklin May 1984

Analysis of [redacted] fair share allocation, zoning and planning to meet Mt. Laurel II obligations and proposed plan for "Franklin Village" - Franklin Twp, Somerset Cty, NJ.

pgs - 230

Note: includes lots of large-size maps

ANALYSIS OF FAIR SHARE ALLOCATION, ZONING AND PLANNING TO MEET MT.LAUREL II OBLIGATIONS AND PROPOSED PLAN FOR "FRANKLIN VILLAGE" -- FRANKLIN TOWNSHIP, SOMERSET COUNTY, N.J.

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ZONING ANALYSIS

Hintz/Nelessen Associates conducted a review of the zoning ordinance of Franklin Township. In January, 1984, a draft copy of a proposed ordinance was made available to the public, which was prepared by Candeub Fleissig Associates. It is still under review and discussion by the township and is presently being revised by the township council. The council, in turn, is waiting for additional studies by the consultants, E. Eugene Oross Associates, before finalizing the ordinance. Until such time that a reasonably definitive ordinance is available, we cannot make a final analysis of the ordinance.

Existing zoning for planned developments has been reduced over the years both in terms of number of acres and the gross densities permitted. Early in 1984, the Township Council amended the zoning and subdivision ordinance to require a PUD to have a minimum of 300 acres with the maximum gross density of 3.5 dwelling units per acre and a maximum net density of 5.0 dwelling units per acre. The ordinance requires a minimum of 25% open space and a minimum of 5% commercial/industrial uses to a maximum of 25% of such uses, a range of 25 to 50% of the residential uses in garden apartments and the same range for townhouses.

These gross densities are far too low to internally subsidize units, and the net densities unrealistically restrictive. The ranges of the types of units, including single family detached does not allow sufficient flexibility to meet market conditions, let alone provide the ability to build low and moderate income units.

ANALYSIS OF MASTER PLAN

The current township master plan, prepared by Dresdner Associates in April 1982 indicates that the current zoning ordinance "includes requirements within the Planned Unit Development (PUD) districts for dwellings for low and moderate income. The developer is to provide five percent of the total number of dwellings in the tract as low income units and a total of fifteen percent of the dwellings for low and moderate income families." (page 59 of the plan). The need for future housing for low and moderate income households is clearly indicated in the current Franklin master plan: "Although there are varying estimates of need, there is consensus that the need exists. The New Jersey Department of Community Affairs in its report entitled 'Low and Moderate Income Housing Need in New Jersey' defined housing need in Franklin Township in terms of the number of low and moderate

income families living in physically inadequate housing and those low and moderate income persons paying over 25% of their income for shelter. The township's resident need was estimated to be about 850 to 900 units." This statement reflects the potential present need. The master plan summarizes the present low and moderate and replacement of inadequate housing need in the following summary sentence: "Thus, both the State and Township estimate resident need to be 900 to 1000 units."

The master plan also suggests the potential future need for low and moderate income housing. This rather crude estimate is based on job generation and the guestimate as to the percentage of those jobs which would be low and moderate income. The master plan, reflecting a 20 year horizon has a capacity for nearly 20,000 future jobs. The master plan text states that "it is unclear how many of these potential employees would desire housing in the Township as compared with locations elsewhere; nevertheless, it is reasonable to assume that (i) a percentage of this labor force (perhaps 50% or 10,000 employees) would desire housing in Franklin, and (ii) of these 10,000 potential employees, up to 20% or 2000 would be in the low and moderate income range. Thus, there could be a need for about 3000 least cost and/or subsidized housing units by the time the Plan is fully implemented." (page 60 of the plan).

The master plan recommends the following policies to implement the provision for low and moderate income families: "in proper location, zone sufficient amounts of vacant land for densities and types of development which would be favorable for affordable housing. The gross density should range from eight to fifteen units per acre. The location should be in proximity of existing private and public services."(page 60).

MEDIAN INCOME/PURCHASING/UNIT PRICES

To determine the cost of units which may be qualified as acceptable for either low or moderate income households, using 1983 median family income, an analysis was conducted of the six county region which comprises the 30 minute commutershed for Franklin Township. This commutershed includes Union, Mercer, Somerset, Hunterdon, Middlesex and Monmouth Counties. HNA used the 1983 Median Household Income generated by the U.S. Department of Housing and Urban Development. The 1983 median family income is $31,610. This income number was multiplied by the total families in each county which produced an aggregate income. The total aggregate income was then divided by the total number of families to determine the median income. These numbers will have to be adjusted upwards as median family income increases. The 1983 estimated median income for Franklin Township contained in Carla Lerman's memo dated March 7, 1984, Table 20B, for the

eleven county region is $30,735. For the purposes of our analysis, the figure of $31,610 was used since the prospective need region accounts for the bulk of the fair share need in Franklin.

The low and moderate income households are defined as 0 to 50% of median income and 50 to 80% of median income respectively. To determine the threshold of low and moderate income housing affordability, 30% of annual income was used if a household rented a unit, and 28% of annual income was used if a household purchased a unit. Based on the median annual income of $31,610, the thresholds for moderate income are $15,805 to $25,288 with the mean of 65% of annual regional median or $20,546.

The low income thresholds are 0 to $15,805 with a mean of 35% of annual regional median or $11,063.50.

In order to analyze the potential purchasing or rental opportunities, both rental and purchase was determined for each group for the thresholds and the median.

Moderate income:
$15,805 to $25,288

PURCHASE

28% of annual income for principal and interest, taxes and insurance:

.28*15,805=$4,425.40/12=$368.78

.28*25,288=$7,080.64/12=$590.05

.28*20,546=$5,752.88/12=$479.41

Assuming 10% downpayment and a variable mortgage rate which averages 13% over 30 years, the following cost of a unit is possible for the ranges of moderate income:
a payment of $368.78 per month allows a mortgage of approximately $33,000. Wtih 10% down or $3667 a home valued at $36,667 is possible for the lowest threshold of moderate income.

For the upper threshold of moderate with a monthly payment of $590.05 for a variable interest rate of which averages 13% for 30 years, a $53,500 mortgage is possible. With 10% down or $5944, a unit price of $59,444 is possible. The range of moderate income is $36,667 to $59,444.

The upper limit of low income is a unit which costs $36,667 with a monthly "PITI" payment of $368.78. Assuming the mean income for upper threshold of low income as $15,805 and that 30% of this income is spent on housing, a total of $4,741.50 or $395.13 per month can be spent on rent. If the mean of low is used, or $11,063.50, a total of $3,319.05 or $276.59 can be spent on rent per month. The differential between the amount which can be spent on housing and the actual cost of constructing, financing and maintaining the unit will require internal and external subsidies.

The foregoing analysis was prepared in order to evaluate the potential for any existing or approved units in the township to qualify as meeting the "Mt. Laurel II" housing need. Since 1980 there have been no income qualified units which will meet the parameters for rent or sale identified above. Several projects may be proferred as qualifying, but in our opinion do not. These include: The Jewish Home for the Aged, which is a recently approved 100 unit, 6 story mid-rise. However, the minimum income is $17,000, with a payment of $821./month; Ukranian Senior Citizens Housing, under construction, but no income qualifications; Quail Brook II, recently approved, has no income qualifications, and will sell for about $69,000.

Society Hill, which is the planned development being proposed by Hovnanian, developed by Jack Field, will include 400 units,when it receives approval. At this time, therefore, it appears these will be the only units that will qualify within the analysis of low and moderate income units above.

FAIR SHARE ALLOCATION FOR FRANKLIN TOWNSHIP

There is a present need region for low and moderate income which is derived from the dilapidated housing of the region (units with inadequate plumbing, inadequate heating and overcrowded units). These needs arise from the inability of people to move from their existing unit to other units in the region. This "present need" region includes substandard units in the older suburban and urban counties.

The prospective need region is based on a commutershed region, since new jobs and housing should be closely related for reduction of societal costs. The proximity of jobs and housing recognizes the average maximum of a 30 minute commute for most workers.

Both of these are explained in more detail that follows, and represent a description of the "consensus" methodology.

PRESENT NEED

The present need housing region has been determined to be a fixed region, recognizing past commuter patterns as well as the need to solve the housing problem for the eleven county region,which includes the following counties of Bergen, Passaic, Hudson, Essex, Union, Middlesex, Somerset, Warren, Hunterdon, Sussex and Morris Counties. The Rutgers University Center for Urban Policy Research prepared a rather extensive study analyzing these regions in their publication Mount Laurel II: Challenge and Delivery of Low Cost Housing. HNA concurs with the analysis reached in defining this present need "fixed" region. The region is changing as barriers prohibiting lower cost housing are removed, thus a prospective need region should be based on a commutershed rather than a fixed region.

An analysis of the present need region's substandard housing was undertaken, following methodology developed by the "consensus" report prepared by Carla Lerman, PP, dated April 2, 1984. This firm had participated in the consensus represented in that report and while there is not agreement on every issue or methodology, the method for calculating present and indigenous need had almost complete unanimity. Those factors are collected from the census and remove any overlap from each category:

-overcrowded units (1.01 or more persons per room);
-units lacking complete plumbing for exclusive use, excluding overcrowded units;
-units lacking adequate heating systems, that are not overcrowded and with complete plumbing.

Once these numbers are derived, a multiplier of .82 is used to determine substandard units that are occupied by low and moderate income households, following the Tri-State Regional Planning Commission's study entitled "People, Dwellings and Neighborhoods (1978). The table from the consensus report is appended. The total reallocated "surplus" is 35,014 which is reallocated to those communities which have less than the regional percentage of such units. Additionally, any indigenous units within the community itself are part of the present need.

The formula used is from the consensus report, although as will be shown later, if vacant developable land were used instead of the growth area from the State Development Guide Plan, Franklin would have an even higher fair share number.

PRESENT NEED - 11 county region

Franklin Township	Region	
11,653	1,244,623	= 0.93
1982 covered jobs	1982 covered jobs in region	percent
14,451	699,163	= 2.07
municipal growth area in acres (SDGP)	11 county growth area in acres	percent

0.93 + 2.07 / 2 = 1.498

1.498 * 1.07 = 1.6055

median household income factor

0.93 + 2.07 + 1.61 = 1.535

1.54 * 35,014 = 539 municipal share of reallocated excess

Staged in 3 six year periods: 180

Including additional reallocation: 180 * 1.2 = 216

Including allowance for vacancies: 216 * 1.03 = 222

Indigenous need: 349

TOTAL PRESENT NEED BY 1990: 571

PROSPECTIVE NEED

The prospective need region is different than the present need region. It is based on the development of new jobs over the last decade and continued job growth in the future. The region is, therefore, based on the commutershed of a given municipality. Since the average commuting time for workers in the state is 20 minutes and typically no more than 30 minutes, the region is based on time/distance factors of a 30 minute commute. This delineated region, then, tries to relate jobs and future jobs to housing or place of employment with place of residence.

Factors for Calculating Fair Share Allocation

Job Growth

Job growth is a major criteria in determining the municipality's fair share allocation. If a municipality has a lower regional share of employment growth, it should have a lower numerical obligation to satisfy the regional housing need, both present and prospective need. Job growth in a municipality means a commensurate share to satisfy the regional housing need.

Those municpalities, which are entirely in nongrowth designations such as one or more of the following categories on the State Devevlopment Guide Plan, were excluded: agricultural, limited growth and conservation. Additionally, any "urban aid" municipalities are excluded since these cities have a preponderance of low and moderate income households, do not have the economic capability of meeting the demands of low and moderate income housing and, finally, in the past, urban aid communities were the ones that sought low and moderate income housing.

Franklin Township's job growth over the decade totaled 8052 jobs or 4.44% of the commutershed (prospective need) region of Union, Hunterdon, Middlesex, Monmouth, Mercer and Somerset Counties. New covered employment numbers will reflect that new jobs are being created in Franklin, where the town has approved over one million square feet of office, industrial and commercial space in the past year.

Regardless of the other factors in a fair share formula, the job change in usually significant. This factor is only used for prospective need allocation, since it becomes an indicator of where new jobs are occurring, and, thus, the need for housing to match those jobs.

Existing jobs in a municipality, expressed as a percentage of the total regional jobs in September of 1982, was a second factor used in the jobs category for the allocation formula for prospective need. This factor became particularly important for those municipalities which had a high percentage of total jobs and a low proportion of low and moderate income households.

The existing jobs was used in the present need formula as well, but has more weight since it is not in an equation with job growth like the prospective need formula.

The present jobs, as last reported by the Office of Demographics, Department of Labor and Industry, State of New Jersey, were 666,851 for the Franklin region, of which Franklin had 11,653. This represents 1.76% of the prospective need region.

Local Development Potential

It is the opinion of HNA that vacant developable land and corresponding percent of regional developable land per municipality represents a more realistic factor to assess regional need for the term "local development potential" This factor addresses the availability of land as a means of providing the places to construct needed housing. However, the only available data is from the "Housing Allocation Report" prepared by the State Department of Community Affairs in 1978, and may be out-of-date for some communities.

Growth area, used in some fair share allocation studies, considers the acreage in a municipality that is shown on the 1980 revised "State Development Guide Plan". This includes acreage that is both in the developed category as well as undeveloped. Because of this, it does not account for some very dense, urban and suburban development, where there is no room (unless existing developed lands were redeveloped) for new development. It does not also consider vacant land that may not be developed due to environmental constraints, particularly floodplain lands and land with a seasonal high water table of 0 to 1 foot below the surface.

In the case of Franklin, the growth area acres total 14,451, out of region of 615,470 acres or 2.35%. If vacant developable land were used (from the HAR), Franklin's share would be 3.09% of the prospective need region and thus, an even higher fair share would accrue to the township. HNA is in the process of gathering vacant developable land data for the region, that will be current information (within 2-3 years old) and may revise the fair share study at that time.

Concentrations of Low and Moderate Income Housing/Economic Capacity Indicator

An objective in the fair share allocation formula is to foster dispersal away from locations with prior concentrations of affordable and/or subsidized housing units. A factor was developed after working with other consultant planners which attempts to address this criterion. The rationale for the factor is: (1) the poor should be dispersed rather than concentrated in any particular geographic location, (2) locations which have existing high levels of housing for the poor are already doing a part of their fair share and (3) municipalities which have in the past excluded the poor are generally more able financially to support new housing, including low and moderate income housing.

The report prepared by Carla Lerman for Judge Eugene Serpentelli, dated April 2, 1984, describes the factor of median household income as such a surrogate:

> "The ratio of municipal median household income to regional median household income is a valid expression of financial capability that is readily available on a municipal and county level. In the sense that the Mt. Laurel decision is an economic one, the household income is a relevant factor in determining a municipality's fair share of lower income housing.
>
> "...if sound planning of an area allows the rich and middle class to live there, it must also realistically and practically allow the poor. (slip op. at 21)

> "Use of median household income as a factor in determining fair share provides one means of measuring past efforts to provide affordable housing. A municipality which has made efforts to develop assisted housing, will have a relatively lower median household income than a municipality that has been more exclusionary."

Continuing with the description, Ms. Lerman states:

> "The averaging of the first three factors, multiplied by the median income ratio listed above will provide the fourth percentage. The averaging of these four factors result in the allocation percentage, which will be applied to projected number of lower income households in that commutershed for 1990."

PROSPECTIVE NEED FORMULA

Commutershed: Monmouth, Mercer, Middlesex, Hunterdon, Somerset, Union

Franklin Township		Region		
11,653	/	667,583	=	1.75
1982 covered jobs		commutershed jobs		percent
14,451	/	615,470	=	2.35
munic. growth area in acres (SDGP)		commutershed growth area in acres		percent
8,052	/	175,925	=	4.68
municipal growth in jobs 1972-82		commutershed job growth		percent

1.75 + 2.35 + 4.68 / 3 = 2.93

2.93 * 1.06 = 3.11

median household income factor

1.75 + 2.35 + 4.68 + 3.11 / 4 = 2.97

2.97% * 61,096 = 1816

prospective need for commuter-shed region

1816 * 1.2 = 2179

additional adjustment for vacant land

2179 * 1.03 = 2244 Prospective need to 1990

vacancy adjustment factor

PROSPECTIVE NEED: 2244

PRESENT NEED: 571

TOTAL FAIR SHARE FOR FRANKLIN: 2815

This final number is the township's fair share to the year 1990, which must be met primarily through zoning sufficient land to provide for the capacity for developer's to internally subsidize units. In addition, it is the recommendation of HNA that consideration be given to the logical extension and location of housing to at least the year 2000. This provides a more rational basis to plan and design for adequate community facilities, open space and jobs to meet future needs. The Field planned community can accomplish this goal.

COMMUNITY DESIGN GOALS AND OBJECTIVES FOR NEW COMMUNITY

Every development must have goals and objectives to guide the planning and design. In a large scale developement proposal such as the one presented here, ambitious goals can be set with a realistic expectation of acheiving them. Once goals and objectives are established, the design of the project can be tested in terms of its ability to acheive them.

The goals and objectives of the Franklin Village PUD are as follows:

1. Provide housing for a variety of life styles and incomes;
2. Provide 20% of the housing for low and moderate income households, and the balance for middle and upper income;
3. Protect the natural environment and design the community with the maximum availability to open space, parks and farmland. The new community should be surrounded as much as possible by open space;
4. Improve the quality of life by incorporating the best urban design, architecture and landscape architecture;
5. Provide a full range of recreation and cultural activities;
6. Create a "sense of community" within the larger Franklin Township community;

7. The planned community should be balanced in land uses and intensities of land use, and be self-contained, i.e. provide easy vehicular and pedestrian accessibility to neighborhood commercial/retail facilities, employment and job opportunities;
8. Encourage intra-community employment to the extent possible;
9. Provide a fiscally-sound development;
10. Develop a series of neighborhoods within the new community;
11. Provide an efficient and easily accessible circulation system including pedestrian, bicycle and auto movement, and in addition, adequate parking for all uses, and intra and inter community public transportation;
12. Design for energy efficiency and conservation;
13. Design the community in phased sections, so that each phase stands by itself as a completed phase.

DESCRIPTION OF FRANKLIN VILLAGE PLANNED COMMUNITY

The following portrays the new community as it has been planned and designed, meeting the set of goals and objectives.

GOAL 1. Provide Housing for a Variety of Life Styles.

Residential compact groupings are planned for the community in four basic forms: village center, retirement village, neighborhood residential and low-density clusters. The majority of the housing will be provided for middle income households. A

small percentage of the housing will be available for upper income households. While it is true that the housing crisis in the region does not affect the upper middle and upper income families to the same extent that ie affects the low and moderate income households, this plan seeks to offer a variety of prices and rents in order to have a more balanced community. This also enables the community to shift the cost of some of the community facilities and amenities to those residents who are most able to afford them, and to lower the costs of the low and moderate income units by internally subsidizing them with the higher priced units.

The proposed village center will offer higher density housing where these units will be located closest to all of the amenities, shopping and cultural facilities. The center will also be the hub of the proposed public transportation transfer system. An average density of 10 dwelling units per acre is proposed which will consist of duplex apartments and townhouses, and mixed use loft/flats above shops and/or offices.

The neighborhood residential areas are planned as a series of clusters containing townhouses and one and two story flats. These residential units are oriented to open space and parks and will be designed inside a series of superblocks to provide easy vehicular access and parking.

Low density clusters are planned on the periphery of the community area which will provide more expensive, single family detached housing. The single family will interface with the green belt surrounding the development.

There is an immediate need for an adult village community, which will contain subsidized and unsubsidized senior citizen housing. The demographics of the low and moderate income households for this region indicate that 31.1 percent of the present and prospective need will be for persons 65+ and no longer in the work force.

GOAL 2. Provide Low and Moderate Income Housing.

Franklin Village will result in the construction of 1987 needed low and moderate income housing units through the use internal subsidies by the developer/builder, and the use of federal and state and local subsidies, when and if they become available. Cost reductions begin with the more compact site plan of a new community, including manufactured and mobile homes and smaller unit sizes generally.

The township has a constitutional obligation to provide a balanced variety and choice of housing types under the doctrine of the Mt. Laurel II decision. There is a need for 2815 low and moderate income units (Franklin's fair share as calculated elsewhere in this report) to the year 1990, and additional units will be needed in the future (2000 year). This proposed project, Franklin Village, will provide a significant number of those units in the context of a planned new community. Aside from the 1987 low and moderate income units planned, there will be additional units of least cost or affordable housing. The ideal is to provide neighborhoods whose residents' income levels correlate roughly to the same income levels to those found in the township and region. This ideal can be met if 20% of the units are made available to lower income families.

GOAL 3. Protect the Natural Environment.

The concept plans have been developed after completing extensive environmental analysis. This analysis provides for the protection and management of land and water resources including the Delaware and Raritan Canal, the proposed Six Mile Run Reservoir and the existing streams, and other environmentally sensitive areas. All stream corridors will be protected and preserved forever.

Stringent air and water quality standards promulgated by the State will be observed, including the adherence to Delaware and Raritan Canal Commission's requirements.

GOAL 4. Improve the Quality of Life through the Highest Quality Urban Design, Architecture and Landscape Architecture.

The community will incorporate the highest standards of urban design and by taking advantage of the project scale, this proposal can provide social, cultural and personal amenities to its residents, which are typically not found in conventional development.

By providing and arranging an improved physical environment, residents will find their livestyle more manageable. Studies have shown that housing satisfaction and satisfaction with community livability are positively related with the quality of life. The planned recreational activities have been found to improve the use of free time. The accessibility to recreational activities is often considered a key factor in gauging the resident satisfaction. Recreational facilities, including vast amounts of open parkland and community-owned indoor facilities such as the community center, will be located close to users and are designed to promote sociability among neighborhood residents, while reducing the need for intra-community trips.

The new self-contained community will "make life easier" for residents by providing coordinated transportation systems, jobs on-site, schools, medical, professional and personal services, and housing that satisfies various life styles and economic requirements. Energy and maintenance requirements for individual homeowners will be minimized, again providing for more leisure time. The new community will result in a safe environment that will save time that is normally lost in travelling to schools, recreation, services and work.

GOAL 5. Provide a Full Range of Recreational and Cultural Activities.

Land for open space and recreation will be created through the stream corridors, the Radburn type open space linkages and other natural preservation areas including farmland.

Active recreation sports such as tennis, handball and swimming pool facilities are planned to be within easy access of various residential neighborhoods. Cultural facilities, such as theater and the arts, can be supported on site with a community of this size and scale. A branch library can be possible due to the size of the development.

GOAL 6. Create a "Sense of Community" Within the Larger Franklin Township Community.

The community design, facilities, and amenities will create a great sense of pride and prestige not only for new community residents but also for the entire township. Franklin Township's self-image, which is not being fostered by current development trends along Route 27, will be greatly enhanced by the development of this urban design and well-planned new community Because of the sincere commitment of the developer, combined with good design, planning and development standards, this can be achieved while providing affordable housing within the community. One of the first planned suburban communities in the United States, Radburn, New Jersey, is receiving national attention on its fifty-fifth anniversary. This new community will follow that great tradition, employing similar design and open space planning principles.

GOAL 7. "Balanced" and "Self-Contained" Concept.

The planned community of Franklin Field is "balanced" and "self-contained" to the fullest extent possible. A full range of housing and employment opportunities are proposed together with recreational/cultural, educational, transportation, social, health, commercial and professional services. The planned community, however, by reality, does have interdependencies with

the existing metropolitan areas. The new community is located conveniently between New York, Philadelphia, Princeton and New Brunswick. The planned community will be dependent upon employment centers, shopping centers and cultural activiteis in the surrounding regions. The planned community concept attempts to reduce the amount of routine daily and weekly activity done outside the community. The majority of families' needs can be provided by walking to shops, markets, social and community facilities, schools and recreation, and in addition, low density office, research uses, in close proximity to residents, will provide some jobs.

GOAL 8. Development of On-Site Employment.

Many new employment opportunities for primary and secondary wage earners are possible within the new community. A major corporation considered the new community as the site for its executive training and conference center. Unfortunately, this was lost by the Township but is indicative of the type of development that would desire this site location. Additional employment would be available through the community's proposed commercial center with retail tores, services and offices. Research facilities are also being planned. This diversity of job offerings is expected to provide a range of job opportunities to residents with a minimum of home-to-work travel.

The relationship between the worker/resident and the marketing of residential and commercial sites will be mutually reinforcing. Key employers will initially provide jobs which will generate housing demand. The residents, in turn, will require services generating support for an increasing number of employees.

GOAL 9. Provide a Fiscally-Sound Development.

The new community will be a revenue-generator for Franklin Township. The development of Franklin Village will be planned in a way to assist the tax base of the municipality by generating ratables, while providing infrastructure at no cost to the township.

The vast majority of Franklin Township's land, especially in the southern half of the township, produces very little revenue to help balance the municipal budget. Since most of the land is not Class 1 agricultural soils, much of the land is unsuited for agricultural uses and the land with crop-producing capability has little realistic possibility of remaining in crop land for any substantial length of time. A small percentage of this land developed in a small new community can provide revenues to balance the municipal budget and provide housing opportunities within the township and the region.

The overall housing development will be self-sustaining in terms of cost/revenue projections; that is, the costs for providing services to the housing, such as police, educational, recreational, etc., are offset by the tax revenues received by the units.

GOAL 10. Encouragement of Social Contact Within Neighborhood.

All housing units will be built in residential groupings of approximately 12 units. Studies have shown that such unit grouping tends to promote social contact through personal communication. At the same time, these clusters allow greater security through surveillance by neighbors. Friendly neighbors watch out for each other more than residents in larger, open-ended road networks typical of recent subdivisions.

These relatively self-contained neighborhoods will have easy access to services such as schools, churches, shopping facilities, recreation facilities and community center through provision of an internal pathway system. The pathways access schools (elementary), recreation, community and commercial facilities as well as the public transportation system linking the new community to cities and the surrounding area.

GOAL 11. Facilitate an Efficient and Easily Accessible Circulation System.

All proposed units will have either direct access to open space areas or be less than one hundred yards away from the open-space area. The community's pedestrian and vehicular circulation systems will be separate. The vehicular circulation system will include limited access systems which make use of specified traffic routes with perimeter streets carying through traffic and neighborhood streets carrying only local traffic.

A separation of circulation systems is planned. The major roadways will be designed as divided parkways with berming and landscaping to create an attractive visual environment.

To reduce dependency on the automobile, an inter-community mini-bus system is proposed once the community grows beyond reasonable walking distances, to be connected at the community center to an intra-community transit system.

GOAL 12. Develop an Energy-Efficient Environment.

Through use of inter and intra community transportation and walking there can be a reduction in private automobile usage, although each unit will be planned and sited to include up to 2.0 parking spaces per dwelling unit.

The new community will be oriented and sited to take optimum advantage of passive solar energy in accordance with New Jersey Municipal Land Use Law C40:55D-2L. By maximizing structure orientation and building insulation, significant amounts of energy can be conserved each year by each single-family unit.

Further energy savings will result when more compact housing patterns shelter each other. The BTU's per person per degree day drop significantly with a more compact pattern.

Landscaping will be designed to buffer against winds and sun. For instance, evergreen trees will be planted at north and northwest sites to block against winter winds. Earth berming will also protect these exposures and permit the flow of cool summer breezes. Shade trees will be planted at southern exposures to reduce heat from the summer sun.

Every unit in the new development will be designed as a passive solar receiver, which can reduce heating and cooling costs by as much as 50%. Greenhouses will be provided for many units. In addition, many of the units will be designed with optional active solar systems that will heat, cool and heat water.

Building plans will be prepared to provide maximum energy efficiency. Extra insulation will be added into each unit. A minimum amount of windows in the development will face north.

Convenience of services will decrease dependence on fossil fuels for transportation. Clustered development makes maximum utilization of walking and mass transit facilities to and from regional centers, such as Princeton, New Brunswick and the Route 287 industrial corridor.

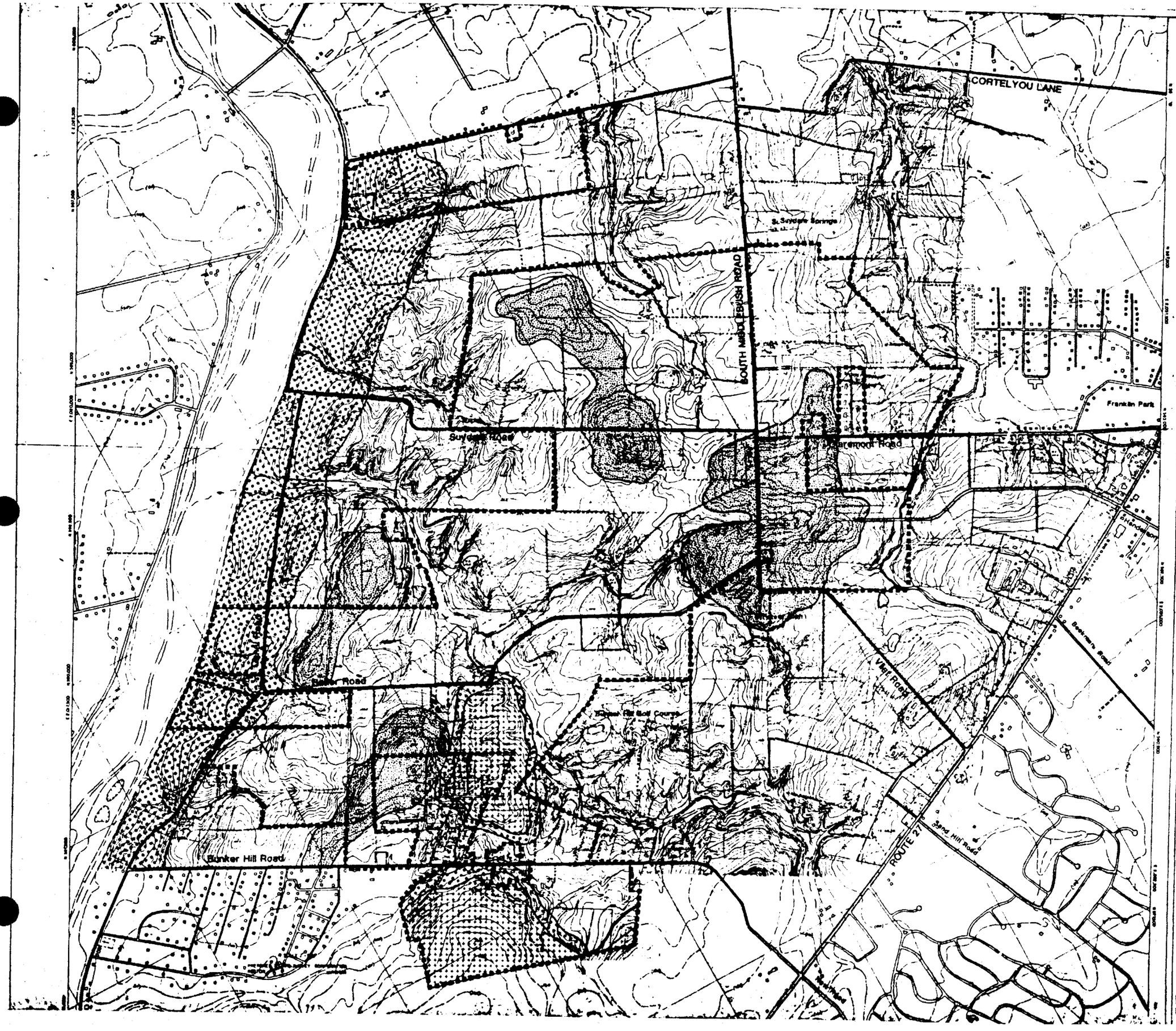
13. Design the Community in Phased Sections, so that each Phase Stands by Itself as a Completed Phase.

The planned development is just that --- planned to built is phases and sections of phases, that are complete unto themselves, supported by infrastructure and services, including recreation. A development of this size will probably take several years to finally complete, thus it is important that it be geared to meet changing market conditions and the need to provide low and moderate income housing.

DEVELOPMENT SUITABILITY

A complete environmental analysis was prepared for the property, relying on considerable data and previous studies, including a study prepared by Wallace McHarg Roberts and Todd, dated April, 1979. While the natural features of the property have not changed, new mapping was prepared by Hintz/Nelessen Associates due to changes in the property configuration since 1979. Those maps are appended to this report.

The natural features considered and analyzed include: geology, soils, depth to seasonal high water table, permeability, wildlife, vegetation, topography, surface hydrology, erodibility, depth to bedrock and microclimate. Once these environmental factors were mapped, they were overlain and the resulting development suitability determined. The constraints encountered on the site (bedrock, seasonal high water table) suggest that about half the site has basement limitations, requiring slab-on-grade construction. Other than that, limitations are minimal.



GEOLOGY

DIABASE: IGNEOUS DIKE WITH BAKED SHALE FRINGE

BRUNSWICK: SEDIMENTARY SANDSTONES SILTSTONES & SHALES

PENNSAUCKEN: THIN INTERGLACIAL SANDS & GRAVELS

MILLSTONE TERRACES: REMNANTS OF INTERGLACIAL & RIVER ALLUVIUM

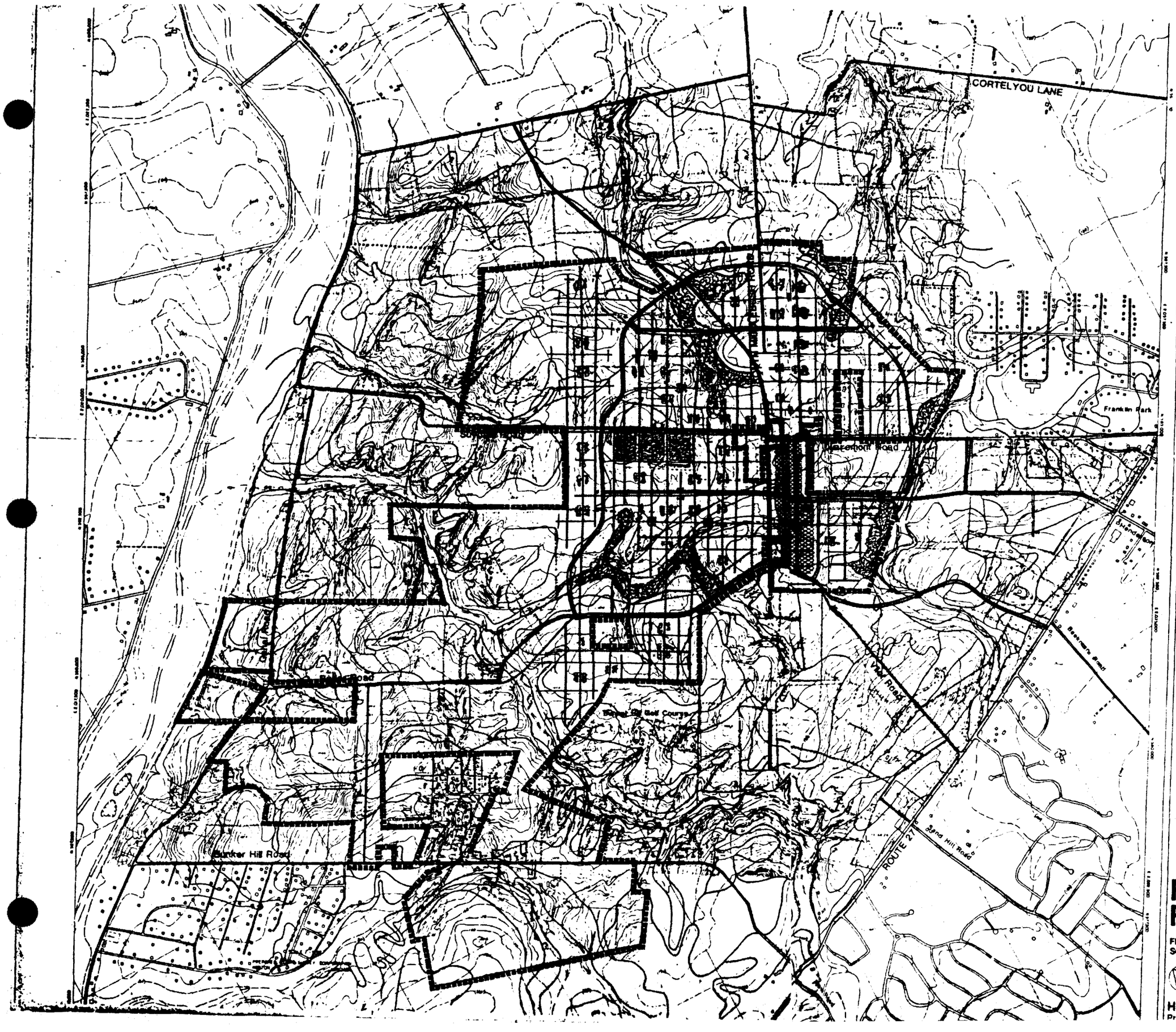
Source: WMRT, 1976

FRANKLIN FIELDS

FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY

HINTZ-NELESSEN Assoc.
Princeton, New Jersey


CORTELYOU LANE
Franklin Park
Somerset Road
Baker Road
Bunker Hill Road
Sand Hill Road
ROUTE 27
Beekmans Brook
Deer Run
Development Suitability
Good
Moderate
Severe
SOURCE: Soil Survey of Somerset County, N.J., SCS., U.S.D.A., Oct 1976
W.M.R.I., 1977
Acres %
Good 1281.71 69.7
Moderate 361.66 19.6
Severe 194.63 10.5
FRANKLIN FIELDS
FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY
HINTZ-NELESSEN Assoc.



Community Facilities

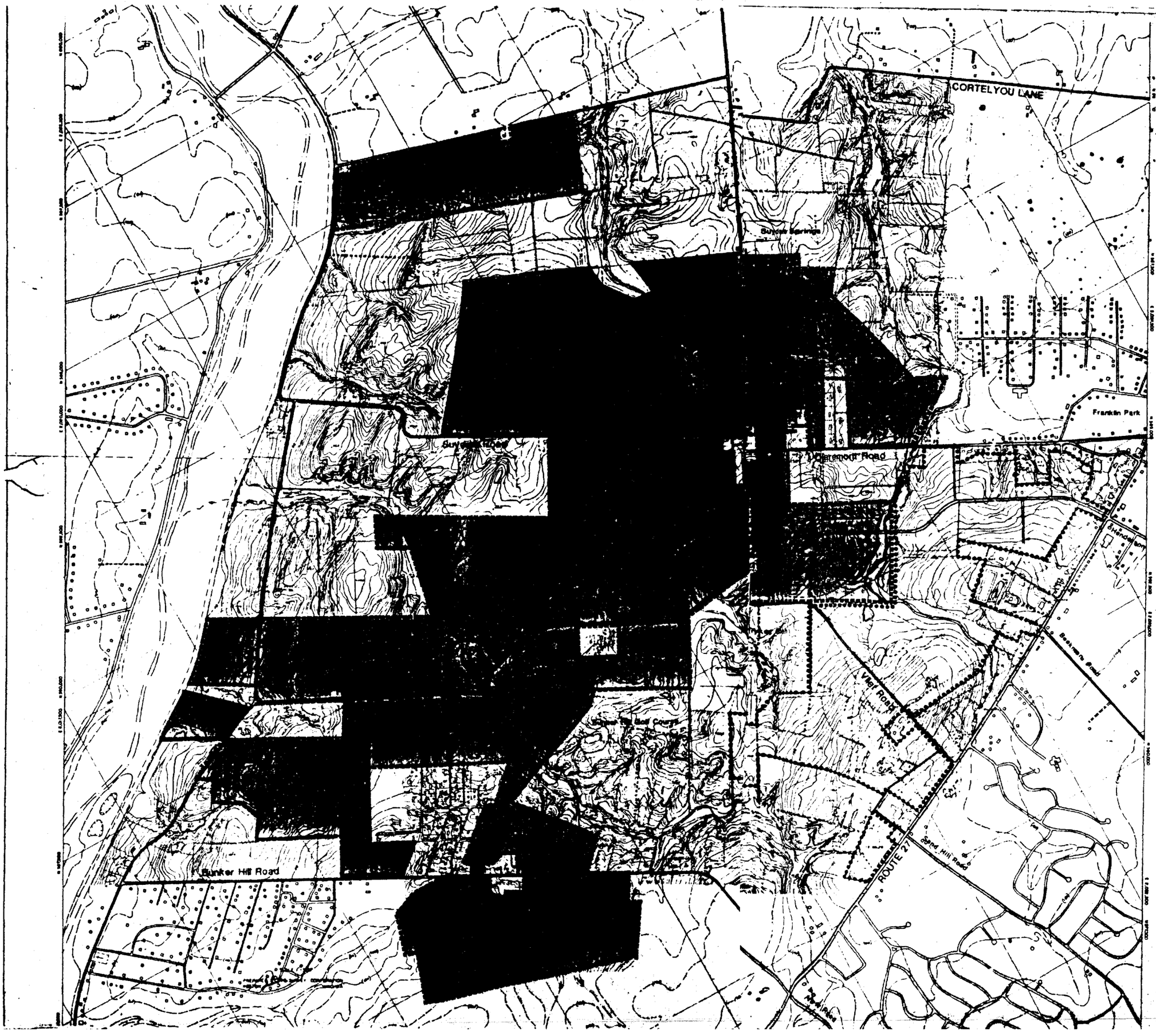
- Boundary
- Community Center
- School
- Parks
- Intersection Control

FRANKLIN FIELDS

FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY

0 500 1000 2000 ft

HINTZ-NELESSEN Assoc.



Property

Franklin Field
1835 acres
P.U.D. 396 acres

SOURCE: Base Map Conklin & Rossant
W.M.R.T. 1977

FRANKLIN FIELDS

FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY

0 500 1000 2000 ft

HINTZ-NELESSEN Assoc.
Princeton, New Jersey

Three suitability ranges were designated, ranging from most suitable to least suitable.

Most suitable.....1281 acres (69.7%)
Moderately suitable...362 acres (19.7%)
Least suitable.....194 acres (10.6%)

These categories are explained below.

Most Suitable.

Areas suitable for development, including structures and roads, and structures with basements; water table is usually greater than 5 feet. These areas will allow capacity for low-rise and mid-rise structures.

Moderately Suitable.

Areas suitable for development, but where the seasonal high water table is between 1 to 4 feet below the surface in the spring months and/or where depth to bedrock is 1.5 feet below the surface. Basements are not recommended, but instead, slab construction should be used. In other areas, erosion potential requires the use of erosion prevention techniques, and specific planting types be installed.

Least Suitable.

These are the areas within the 100 year flood zones and with a 0 to 1 foot seasonal high water table. No construction is recommended in these areas, even though engineering could lessen some of the constraints. These areas will be preserved as open space.

DETAILED ENVIRONMENTAL SUITABILITY ANALYSIS

Lithology

Four major formations are found on the site: diabase intrusions, the Triassic Brunswick formation, the Pleistocene Pennsuaken formation and stream and channel alluvial deposits. The diabase a volcanic rock, occurs along discontinuous linear ridges at the southern portion of the Field site along Bunker Hill Road. This material is highly resistant to weathering and results in a weathered layer of varying thickness composed generally of large, rounded boulders mixed with soil.

The complexity of this boulder/soil mixture, frequently three to ten feet from the ground surface, results in a bearing capacity in this layer of two tons per square foot. In the unweathered zone, the diabase has great strength, with bearing capacities at depths over ten feet of 20 tons per square foot.

Triassic Brunswick Formation

Brunswick shale, a red, easily-weathered soft shale, covers acres on the site. This shale is occasionally interbedded with fine grained sandstone and siltstone layers. The thickness of this shale may exceed 6000 feet. The Brunswick shale dips 12 degrees to 15 degrees to the northwest and often contains fossils and ripplements. Fracture patterns intersect this formation resulting in increased secondary permeability. This shale has a characteristic weathering pattern, which consists of frequent, uneven, and closely-spaced joints. Bearing capacity for structures in the formation varies depending upon the depth of the rock from the surface. In the three feet to eight feet subsurface range, the bearing capacity is two to eight tons per square foot. At greater depth than eight feet, the rock strength increases due to the fractured nature of the material.

Pennsauken Formation

Thin remnants of the Pennsauken formation appear sporadically at the site as unconsolidated gravels and sands with smaller amounts of silts and clays. The parent materials that form the sand and pebble-sized particles include quartz, shale, sandstone, quartzite and other crystalline rocks. The thickness of the

Pennsauken varies rom 0 to 90 feet and is typically found in stream valleys as a thin sequence of gravels through clays. Thin formations are also found on several low promontories on the site and are not considered as load-bearing strata.

Colluvium

These are poorly graded sands and silty gravels found along the Millstone River on the western edge of the Field site. These deposits may be classified as reworked glacial outwash and alluvium and the remnants of major flood events. Bearing capacties of colluvium are extremely variable due to a lack of stratification of the sand and gravel materials. Load-bearing capacity is not favorable without substantial engineering for structures.

Subsurface Hydrology

Several wells in the proposed Franklin Village are known to be good producers of potable water. These wells, however, may be located in major crack intersections in the Brunswick formation, which are fed from aquifer recharge areas at higher topographic regions outside the site boundaries. Aquifer recharge is extremely limited on the site due to the sparseness of the Pleistocene deposits and the paucity of deep, permeable soils. Further, the joint patterns of the Brunswick formation seem to indicate that water would flow toward the Millstone River rather than be trapped in the cracks.

Topography and Landform

Site elevations range from about 40 feet in the lower areas to 203 feet at the higher areas. The highest point on the site is near Bunker Hill Road on the diabase outcropping.

The site has many aesthetically pleasing views of gently rolling uplands with an interesting relief of hills and stream valleys. The steepest slopes are those found along the stream banks. A river terrace forms the edge of the site along the Delaware and Raritan Canal.

SURFACE HYDROLOGY

Streams meander through the site, including the Simonson Brook, Ten Mile Run and tributaries of the Six Mile Run. These all flow in a generally northwesterly direction, are piped underneath the D&R Canal and feed into the Millstone River. The canal forms the western boundary of the site.

Flooding occurs naturally in the stream corridors. These flood-prone areas have all been identified on the attached exhibit. All areas subject to flooding will remain in their natural state as shown on the proposed development plan. A storm water management plan will be prepared once more detailed planning of the site is required.

A series of drainage divides result in sub-basins throughout the site. The larger drainage basins include the Simonson Brook, Ten Mile Run and Six Mile Run.

The Millstone River and D&R Canal are part of the State park system. The canal serves as a major potable water supply in this region. Both are regulated by the D&R Canal Commission. The proposed Six Mile Run Reservoir is north of the site. The reservoir has been scheduled for eventual development to improve water storage capacity for the area's potable water supply.

WILDLIFE

The wildlife found on the site is similar to other central New Jersey areas. Wildlife species vary with the vegetation, levels of cover, varieties of plants for food, etc., and, therefore, provide predictable habitats for wildlife. There are seven categories of vegetation noted:

-upland woodland
-lowland woodland
-cropland
-meadow
-swales/marshes
-old fields
-grasses

The site is inviting to small creatures and inhospitable to larger ones due to the recurring pattern of cropland and hedgerow. However, narrow bands of woody vegetation, which alternate with the pastures' grassy or seasonal crops, do provide an ideal habitat for certain larger animals.

White-tailed deer have been observed on the site's wooded lowlands, uplands and old fields. These deer frequently cross over the site's cropland, meadowland, swales/marshes and grasses.

The most common, medium-sized mammals observed at the site are red fox and woodchuck. Red fox have a preference for open fields and woods. Woodchucks have a preference for herbaceous plants.

Raccoons are prevalent at the site and are observed in the lowland and upland woodlands and swales/marshes. These mammals, which prefer dense trees and rock outcrops, are considered to be beneficial and have commercial value. Raccoons seem to benefit and flourish from the devlopment of land.

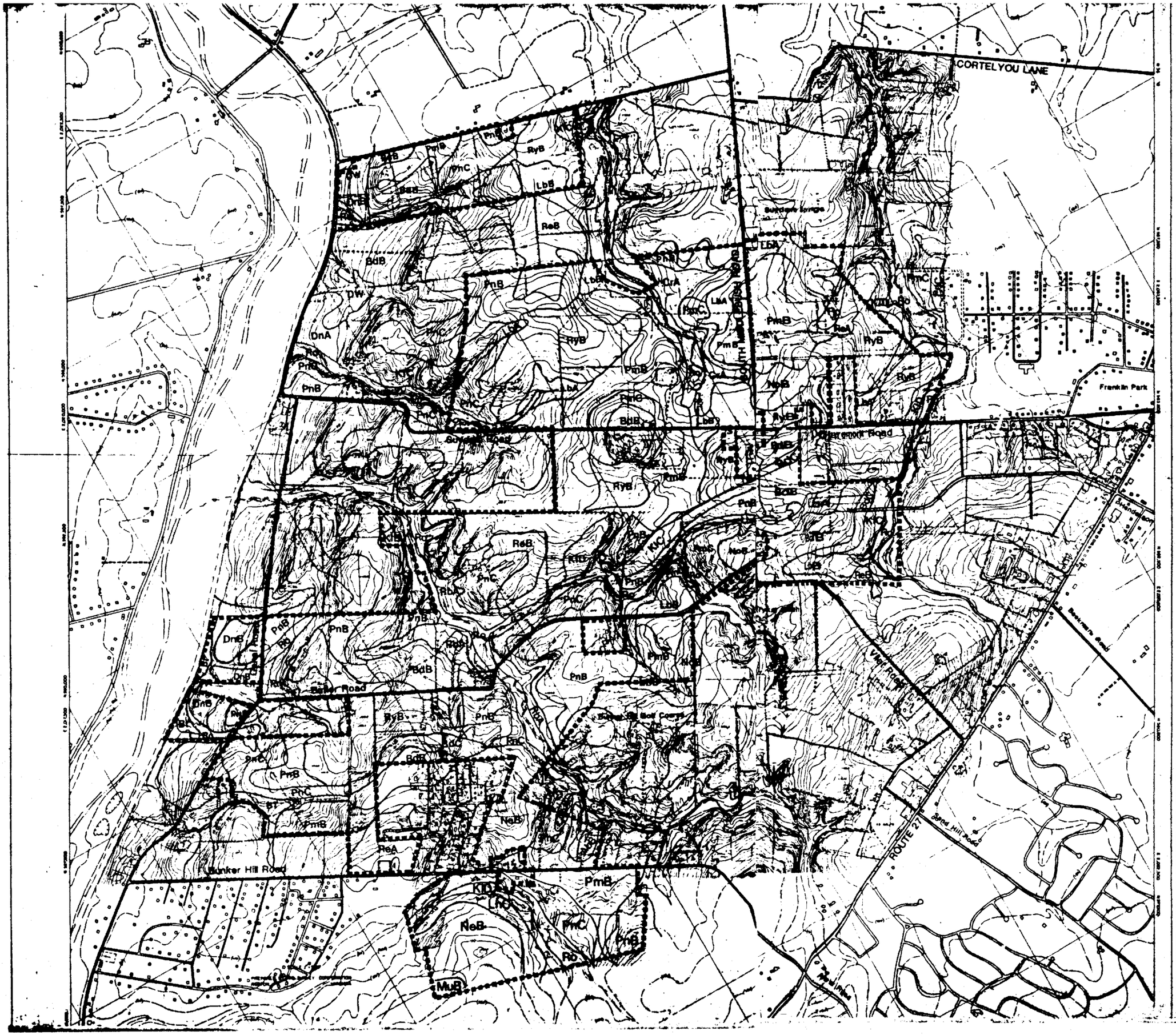
Cottontails, grey squirrels and opossum are other small mammals common the site. The cottontail is seen on the site's meadowland, swales/marshes, old fields and grasses. This mammal prefers herbaceous plants and bushy cover. It is valued

commercially, but is also rated as a nuisance. Grey squirrels frequent the site's woodlands, preferring mass nut-producing trees. Opossum are found on the woodlands and the old fields. Meadow and white-footed mice and Eastern moles are also common.

Songbirds proliferate. Grackles, crows and morning doves are common to the site's fields. Cardinals, sparrows, bluebirds are also common in the hedgerows, wood edges and suburban plantings. The sparrow hawk has been observed in both the woodland and non-forest areas. Canadian geese and mallards can be seen on the farm ponds and in the marshes.

SOILS

The soils on the site were obtained from the soils mapping prepared by the U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the N.J. Agricultural Experiment Station and the N.J. Department of Agriculture. The soil types were then arranged on several maps to delineate environmental considerations, such as erosion potential, depth to seasonal high water table, permeability, and depth to bedrock.



Soil Types

AbA	Abbottstown
AbB	Abbottstown
BuB	Bucks
BdB	Birdsboro
BdC	Birdsboro
Bt	Bowmansville
CrA	Croton
DnA	Dunellen
DnB	Dunellen
DnC	Dunellen
Dw	Dunellen variant
KlC	Klinesville
KlD	Klinesville
KlE	Klinesville
LbA	Lansdowne
LbB	Lansdowne
LhC	Lehigh
MuB	Mount Lucas
NeB	Neshaming
NoB	Norton
NoC	Norton
PmB	Penn
PmC	Penn
PnB	Penn
PnC	Penn
RbA	Raritan
ReA	Reaville
ReB	Reaville
Ro	Rowland
RyB	Royce

SOURCE: Soil Survey of Somerset County, N.J.
S.C.S., U.S.D.A. Oct 1976

FRANKLIN FIELDS

FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY

0 500 1000 2000

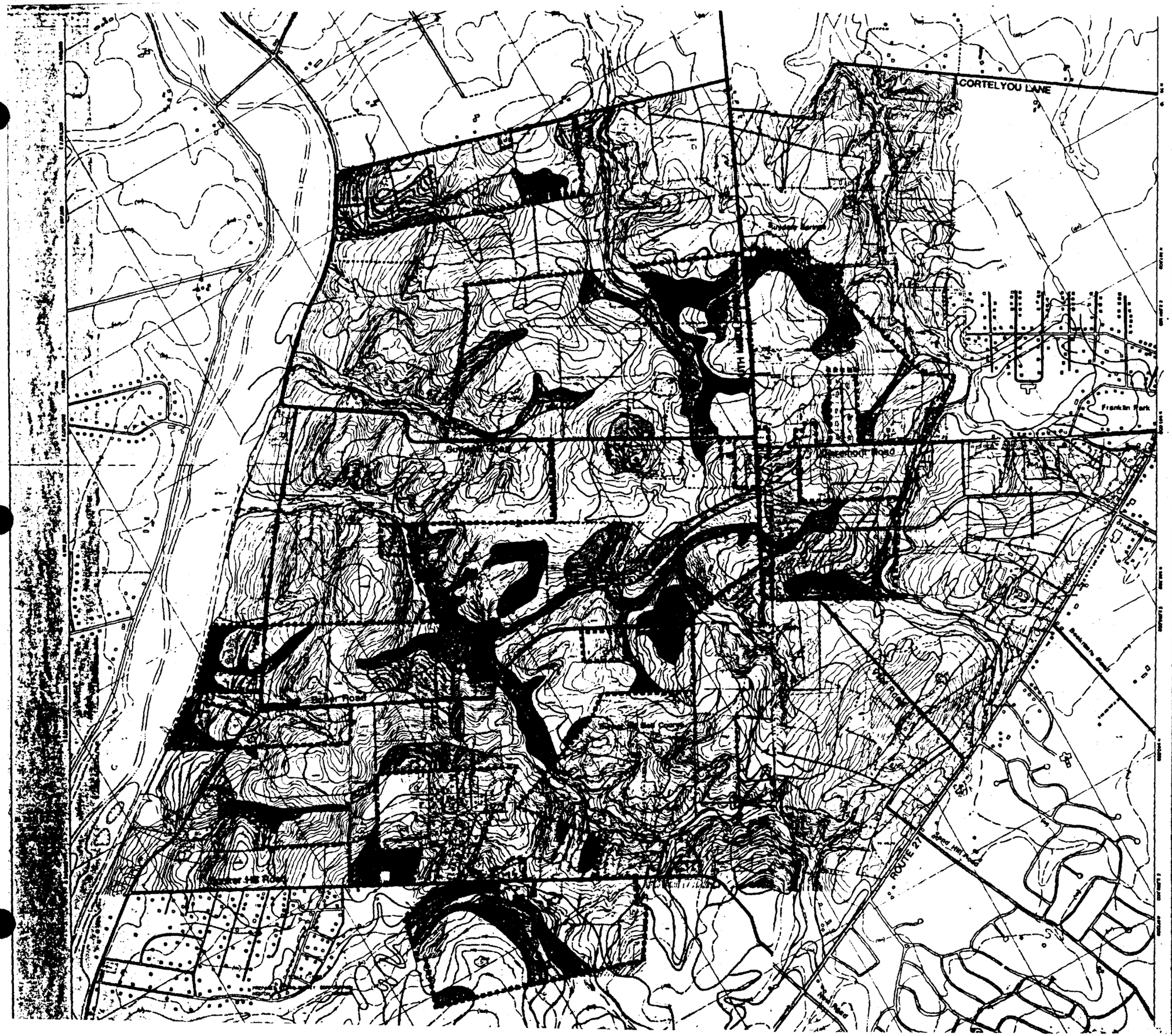
HINTZ-NELESSEN Assoc.
Princeton, New Jersey

As one can see from the attached table, Soil Types, depth to seasonal high water table is varied for the site, ranging from near (or on) the surface to five feet or greater below the surface. However, near surface areas represent only 2.63% of the site, and combined with the 1 to 3 feet areas, still account for less than one quarter of the site area. Generally, there are problems for constructing basements in soil areas with a depth to seasonal high water table of less than five feet, although slab construction and artificial drainage can help considerably to obviate these limitations.

DEPTH TO SEASONAL HIGH WATER TABLE

Feet below	Area (in acres)	Percent
0-3	48.39	2.63
1-3	371.72	20.22
4+	253.82	13.81
5+	1164.07	63.33

Permeability is the ability of surface water to move through the soil to reach underlying soil and geologic strata. Permeability for the vast majority of soil types on the site -- representing over 90 percent of its area -- is moderate. The ranges indicate there may be minor and very localized difficulties for drainage. An average for each of the soils has determined by averaging the permeability readings for each of the soil layers (generally, 0"-14", 14"-35", 35"-60').



Depth to Seasonal High Water

- 0' 3'
- 1'_ 3'
- > 4'
- > 5'

SOURCE Soil Survey of Somerset County, N.J. S.C.S., U.S.D.A., Oct 1976

FRANKLIN FIELDS

FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY

0 500 1000 2000ft

HINTZ-NELESSEN Assoc.
Princeton, New Jersey

PERMEABILITY

	Area (in acres)	Percent
Slow	12.16	0.66
Moderate	1724.8	93.84
Rapid	101.04	5.5

Depth to bedrock may present constraints to construction, when bedrock lies near the surface. For the case at hand, only very limited areas have bedrock lying less than 1.5 feet from the surface, although more extensive sections of the site have bedrock within 3.5 from the surface. Development plans will take this limitation into consideration, for it may hold cost consequences in the construction of basements, as well as the laying of sewer and water lines.

DEPTH TO BEDROCK

Feet below surface	Area (in acres)	Percent
1-1.5	71.1	3.87
1.5-3.5	767.49	41.76
3.5-6+	999.41	54.37

Erosion potential for all of the site's soils is low to moderate. Normal procedures to control sedimentation and soil loss, during and after construction, can be dealt with by proper adherence to good design practice.

Permeability

- Rapid
- Moderate
- Slow

SOURCE: Soil Survey of Somerset County, NJ. S.C.S., USDA., Oct 1976

FRANKLIN FIELDS

FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY

0 500 1000 2000 ft.

HINTZ-NELESSEN Assoc.
Princeton, New Jersey

EXPERT REPORT
FIELD

FRIZELL & POZYCKI
ATTORNEYS AT LAW
296 AMBOY AVENUE
METUCHEN, NEW JERSEY

DAVID JOSEPH FRIZELL
HARRY S. POZYCKI, JR.
MICHELE R. DONATO

MAILING ADDRESS
P.O. BOX 247
METUCHEN, N.J. 08840
(201) 494-3500

June 4, 1984

Mr. John C. Lovell, Township Manager
Franklin Township
Municipal Building
475 DeMott Lane
Somerset, New Jersey 08873

Re: The J. W. Field Company, Inc., et al.
v. Franklin Township

Dear Mr. Lovell:

Enclosed find nine copies of a report by Hintz Nelessen Associates, entitled "Franklin Village". This report outlines the current development proposals made by J. W. Field Company, Inc. for the 1,800+ acres in the Field tract which are not part of the P.U.D. and which are involved in the pending Mount Laurel litigation. I thought it would be beneficial for each member of the Council to have access to a copy of this report for future reference and to avoid any confusion in the future concerning current proposals.

It is my understanding that the Zoning Sub-committee is meeting this week, and I believe that each member of that committee should have access to a copy of this report. Mr. Cafferty and Mr. Auciello have already been provided with a copy.

Under separate cover, I am sending a copy to Mr. Pettit, Mr. Colpini and to Dr. Hamilton as Chairman of the Planning Board.

I have advised Mr. Cafferty that the total number of units and the timing or "phasing" of construction of this project, and the financial burdens to be borne, respectively, by the municipality and the developer, are all negotiable items in the context of settlement discussions of the litigation, and you should convey this message to the governing body and to the Zoning Sub-committee.

The continuing assaults by other developers against the Franklin Township zoning ordinances makes ultimate settlement of this dispute more difficult as time passes. It is my belief, however, that, notwithstanding these circumstances, a settlement which would be beneficial for all parties, including the Township, could be worked out provided considerable effort was devoted to that purpose on both sides.

The benefits to the Township from attempting a settlement resolution of these disputes include the conservation of a vast amount of taxpayers' dollars which will otherwise be spent in litigation, the acquisition of a six year judgment of repose against future Mount Laurel litigation, and the reacquisition of some degree of control over the Township's development future which is in serious danger of being lost in the context of this litigation.

Very truly yours,

FRIZELL & POZYCKI

David J. Frizell

DJF:jb

Enclosures

cc: Mr. James Pettit
Mr. Frank P. Colpini
Dr. Bruce Hamilton
(with enclosure)

Hon. Eugene D. Serpentelli, J.S.C.
Thomas J. Cafferty, Esq.
Dennis A. Auciello, Esq.
Francis P. Linnus, Esq.
Frederick C. Mezey, Esq.
Herbert J. Silver, Esq.
Guliet F. Hirsch, Esq.
Douglas K. Wolfson, Esq.
Emil H. Philibosian, Esq.
Stewart M. Hutt, Esq.
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(201) 494-3500

June 4, 1984

Honorable Eugene D. Serpentelli, J.S.C.
Superior Court of New Jersey
Ocean County Court House
C.N. 2191
Toms River, New Jersey 08753

Re: The J. W. Field Company, Inc., et als.
v. Township of Franklin, et als.
Consolidated Case
Docket No. L-006583-84 P.W.; L-007917-84;
L-014096-84 P.W.; L-21370-84;
L-022951-84 P.W.; L-25303-84;
L-019811-84

Dear Judge Serpentelli:

Enclosed find the report entitled "Franklin Village - Analysis of Fair Share Allocation, Zoning & Planning to Meet Mount Laurel II Obligations, Franklin Township, Somerset County, N.J., May 1984", which incorporates the housing allocation plan previously submitted and the land use plan which was referenced in the Complaint.

A copy of the report has been furnished to all counsel.

Respectfully yours,

FRIZELL & POZYCKI

David J. Frizell

DJF:jb

Enclosure

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Douglas K. Wolfson, Esq.
Emil H. Philibosian, Esq.
Stewart M. Hutt, Esq.

Bedrock

1 to 1½

1½ to 3½

3½ to 6

SOURCE: Soil Survey of Somerset County, N.J. S.C.S., U.S.D.A. Oct 1976

FRANKLIN FIELDS

FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY

0 500 1000 2000ft

HINTZ-NELESSEN Assoc.
Princeton, New Jersey

ERODIBILITY

	Area (in acres)	Percent
Slight	1363	74.16
Moderate	442.37	24.67
Severe	32.63	1.78

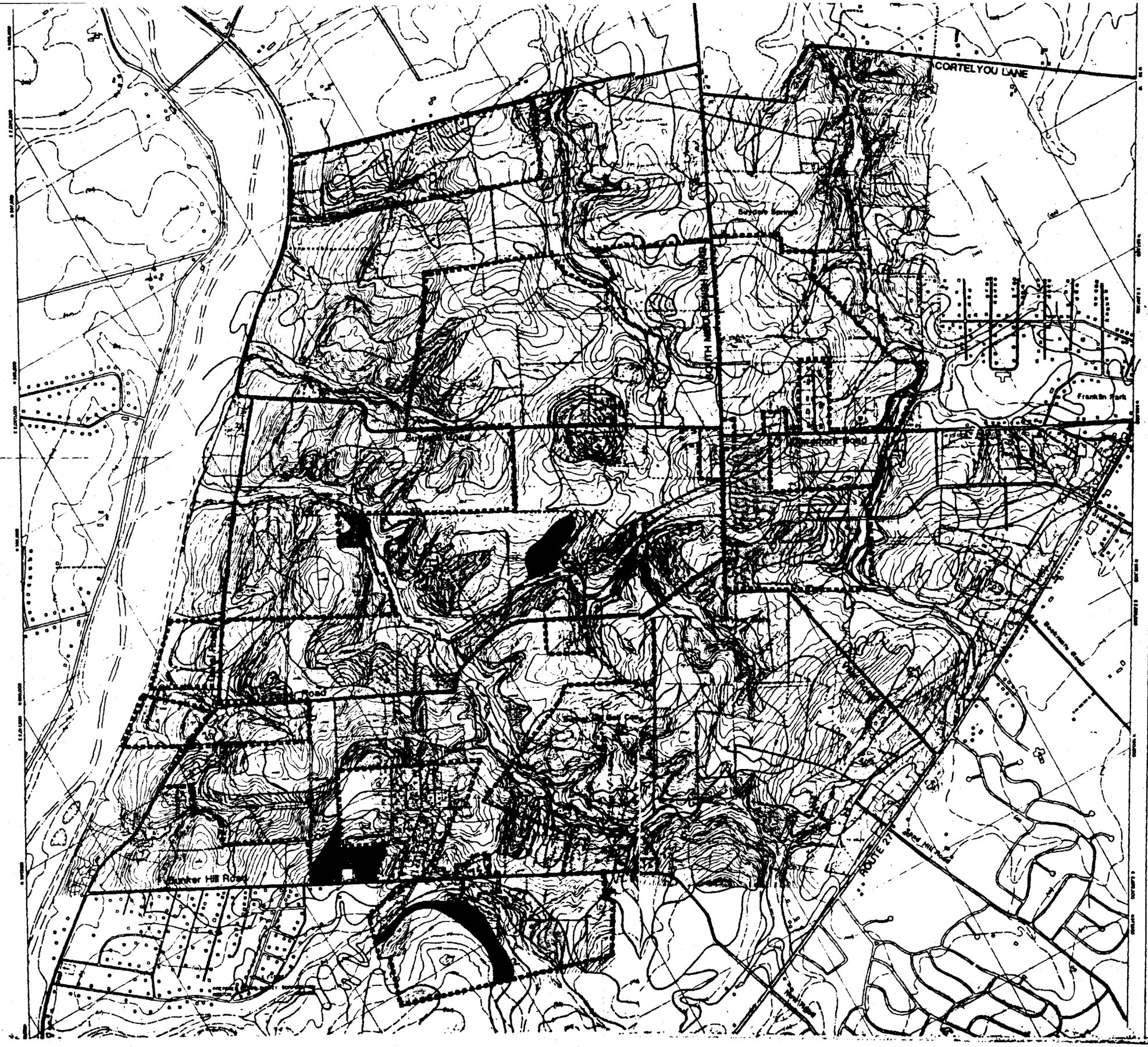
The following is a description of the various soils on the site, which factors are summarized in the table of soil types.

Abbottstown soils are deep, somewhat poorly drained gently sloping silt loams. Permeability is slow, erodibility is slight, with seasonal high water table at the surface.

Birdsboro soils are deep, well-drained somewhat sloping slit loams, located along major streams. Permeabilty is moderate, as is erodibility and depth to seasonal high water table.

Bucks soils consist of deep, well-drained , gently sloping silt loams. Erodibility is slight, depth to seasonal high water table moderate and permeability slow.

Croton soils are deep, poorly drained nearly level silt loams, with slight erosion potential, slow permeability and water near the surface.


CORTELYOU LANE
Burgess Corner
Burgess Road
Franklin Park
Old Georgetown Road
Bunker Hill Road
Bunker Hill Road
Bunker Hill Road
ROUTE 27
Bypass
Erodability
Slight
Moderate
Severe
SOURCE: Soil Survey of Somerset County, N.J. S.C.S., U.S.D.A., Oct 1976
FRANKLIN FIELDS
FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY
HINTZ-NELESSEN Assoc.
Princeton, New Jersey

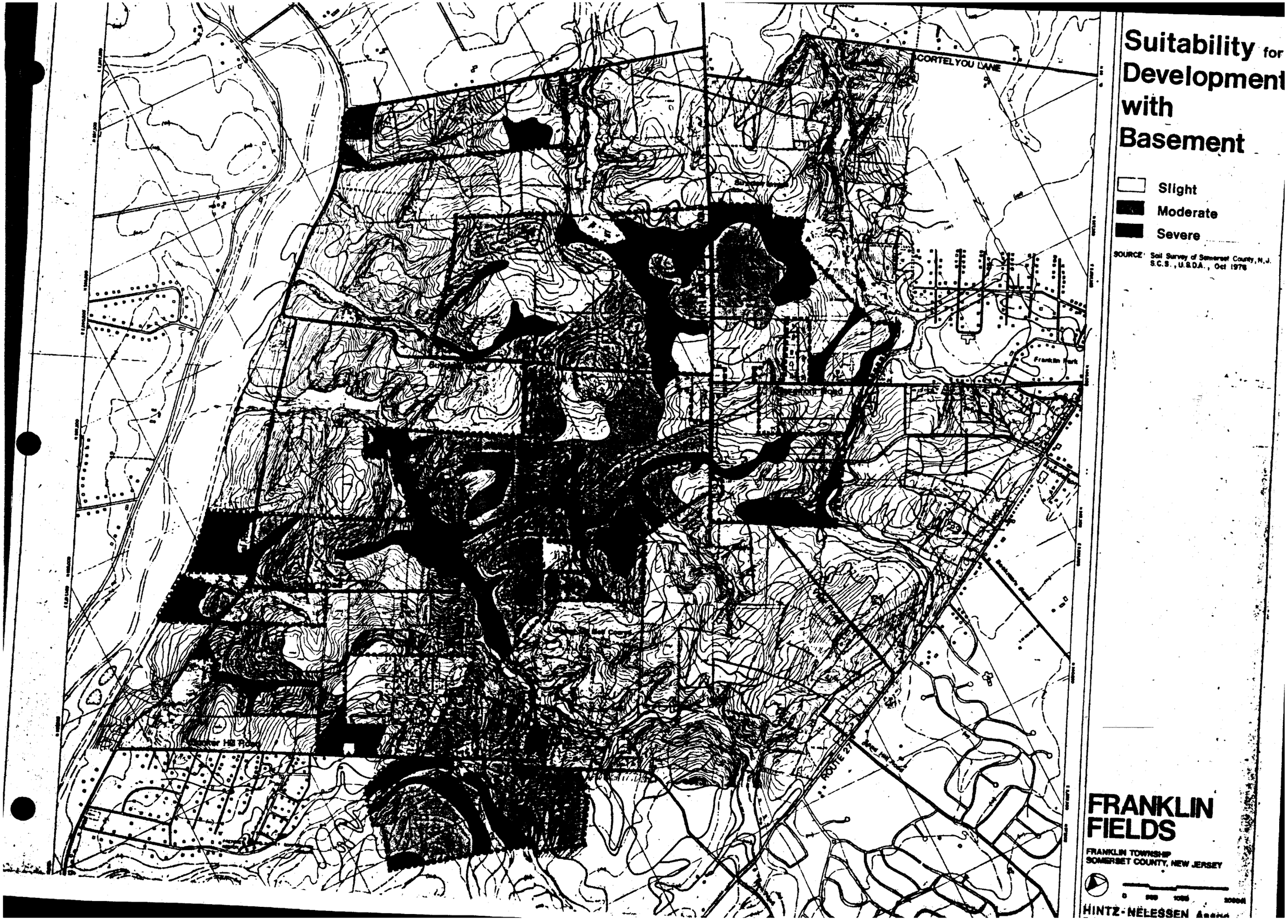
Dunellen soils consist of deep, well-drained, gently sloping sandy loams, with moderate permeability, slight erosion hazard, and moderate to severe high water constraints.

Klinesville soils are shallow, well-drained, gently to strongly sloping shaly loams, with severe hazard of erosion and high water table.

Lansdowne soils consist of deep, moderately well-drained to somewhat poorly drained, gently sloping silt loams, with moderate permeability, slight erosion potential, and high water.

Lehigh soils are deep, moderately to somewhat poorly drained, moderately sloping silt loams, with moderate permeability and hazard of erosion, and high water.

Mt. Lucas - Watchung is about 65 percent Mt. Lucas and 35 percent Watchung; it consists of deep, moderately to somewhat poorly drained, moderately sloping, very strong silt loams, with moderate erodibility and permeability, and high water.


CORTELYOU LANE
Franklin Park
Canal Road
Bunker Hill Road
ROUTE 27
Suitability for Development with Basement
Slight
Moderate
Severe
SOURCE: Soil Survey of Somerset County, N.J. S.C.S., U.S.D.A., Oct 1976
FRANKLIN FIELDS
FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY
HINTZ-NELESSEN

Neshaminy soils consist of deep, well-drained, gently sloping soils, with slight erosion and high water constraints, and moderate permeability.

Norton soils are deep, well-drained, gently to moderately sloping loams, presenting slight environmental limitations.

Penn soils consist of moderately deep, well-drained, moderately sloping shaly loams and silt loams, with slight to moderate hazard of erosion and moderate permeability and depth to high water.

Raritan soils consist of deep, moderate to somewhat poorly drained, nearly level silt loams, located along stream terraces, and with slight hazard of erosion, moderate permeability, and water table near surface.

Reaville soils are moderately deep, moderately to somewhat poorly drained, nearly level silt loams, with slight erosion potential, moderate permeability, and high water.

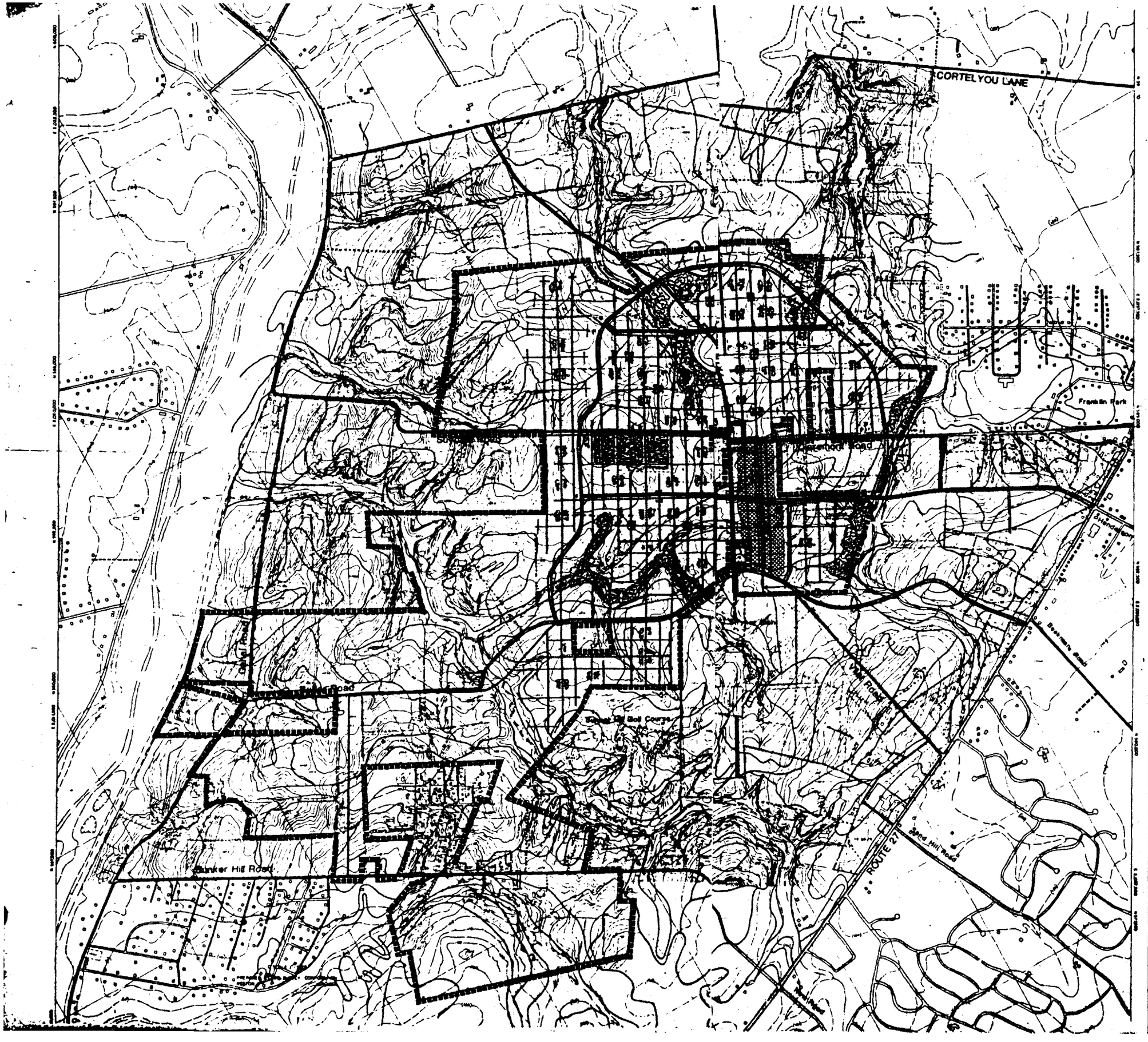
Rowland soils consist of deep, moderate to poorly drained soils, nearly level silt loams, located along flood plains, and subject to frequent overflow; erodibility is slight, permeability moderate, and high water is severe.

Royce soils are deep, well-drained, gently slooping silt loams with slight water problems, light erosion potential, and moderate permeability.

THE DEVELOPMENT PLAN

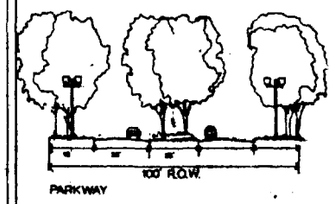
The site for Franklin Fields new community contains 1,836 acres. Development will be confined to approximately 1000 acres. The remaining eight hundred acres farmland and proposed for inclusion under the Farmland Retention Act. The entire site has a gross density of 5.41 d.u. per acre. If the farmland which is being detained is subtracted, the resulting development density is 9.7 d.u. per acre. The 9.7 d.u. per acre is the minimum required to provide for a full range of housing types with 20% of the units specifically devoted to households of moderate and low incomes.

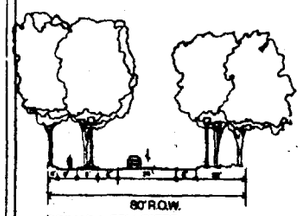
In addition to the housing, the new community will also provide the necessary community and commercial facilities, recreation and open space, parking and roads to meet the needs of the people who will live in these housing units.



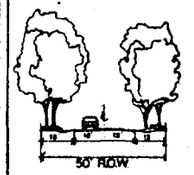
Road Network

- Boundary
- Parkway 100' R.O.W.
- Primary Collectors 80' R.O.W.
- Secondary Collectors 50' R.O.W.
- Local Streets Cul-de-Sac 43' R.O.W.
- Inter-Community Bus Route
- Inter-Community Bus Stop
- Pedestrian Path
- Intersection Control

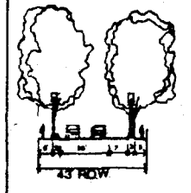




PRIMARY COLLECTOR



SECONDARY COLLECTOR



LOCAL

FRANKLIN FIELDS

FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY

0 500 1000 2000

HINTZ-NELESSEN Assoc.
Princeton, New Jersey

The plan for the new community had evolved over a ten year period through numerous legal challenges, planning board meetings, master plans, state development guide plans, Mt. Laurel II supreme court cases, sewage authority master plans, community meetings, development suitability analysis and many alternative site designs.

The original development site plan was prepared in 1976 by the New York firm of Conklin and Rossant, who were the architects for the Reston, Virginia new town village center called Lake Ann. This village center won national and international acclaim for its high qaulity urban design. The plan was designed in conjunction with the equally well known firm of Wallace, McHarg, Roberts and Todd. This firm is internationally known for environmental analysis and urban design. The environmental report is included in the appendix of this report.

The development plan has been further refined by H.N.A. over the past 5 years. The proposed development plan responds to the need to provide higher quality development in a compact pattern and preserve at least for the forseeable future some percentage of the farmland. Approximately 44% of the site has been set aside for farmland and will be used as a portion of the green belt surrounding the new community.

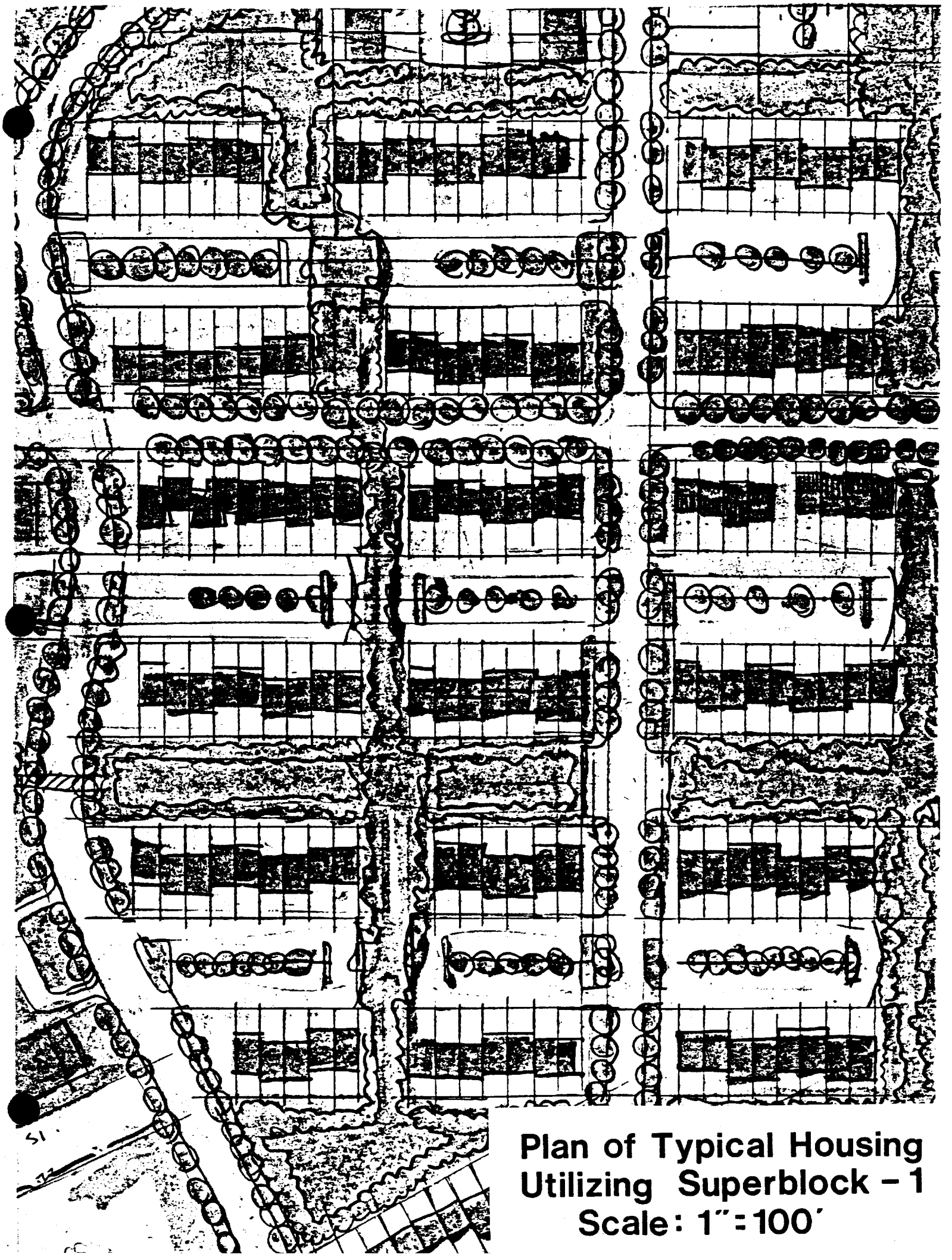
The plan is a result of significant research which generated a plan layout which would create a high quality, historically sensitive, flexible and dynamic urban setting. The concept of a compact urban settlement surrounded by green open space is a historic urban settlement pattern. This plan proposed by H.N.A. is the direct evolution of the traditional garden cities movement. The genesis of the rectangular plan reaches as far back as the Greeks which includes, the plan of Philadelphia, Savannah, Georgia, Williamsburg and countless other high quality urban areas. This plan does not try to emulate a lower density suburban tract development with its loop roads and curvelinear streets. This plan attempts to create the perfect balance of urban scale need to accommodate 9.7 d.u. per acre density for the development area. Buildings and streets will be used in a classical form to define and confine urban space to the human scale.

The basic geometric structure of the plan is a 500 x 620' center line to centerline building block. This building block contains 7.12 acres. The typology of plain configurations for residential structures within this building block are limitless and is confined only to the imagination of the architect who will be designing the units. Several of these building block layouts have been included as illsustrations. Each block has been delineated on the plan by street types and required pedestrian

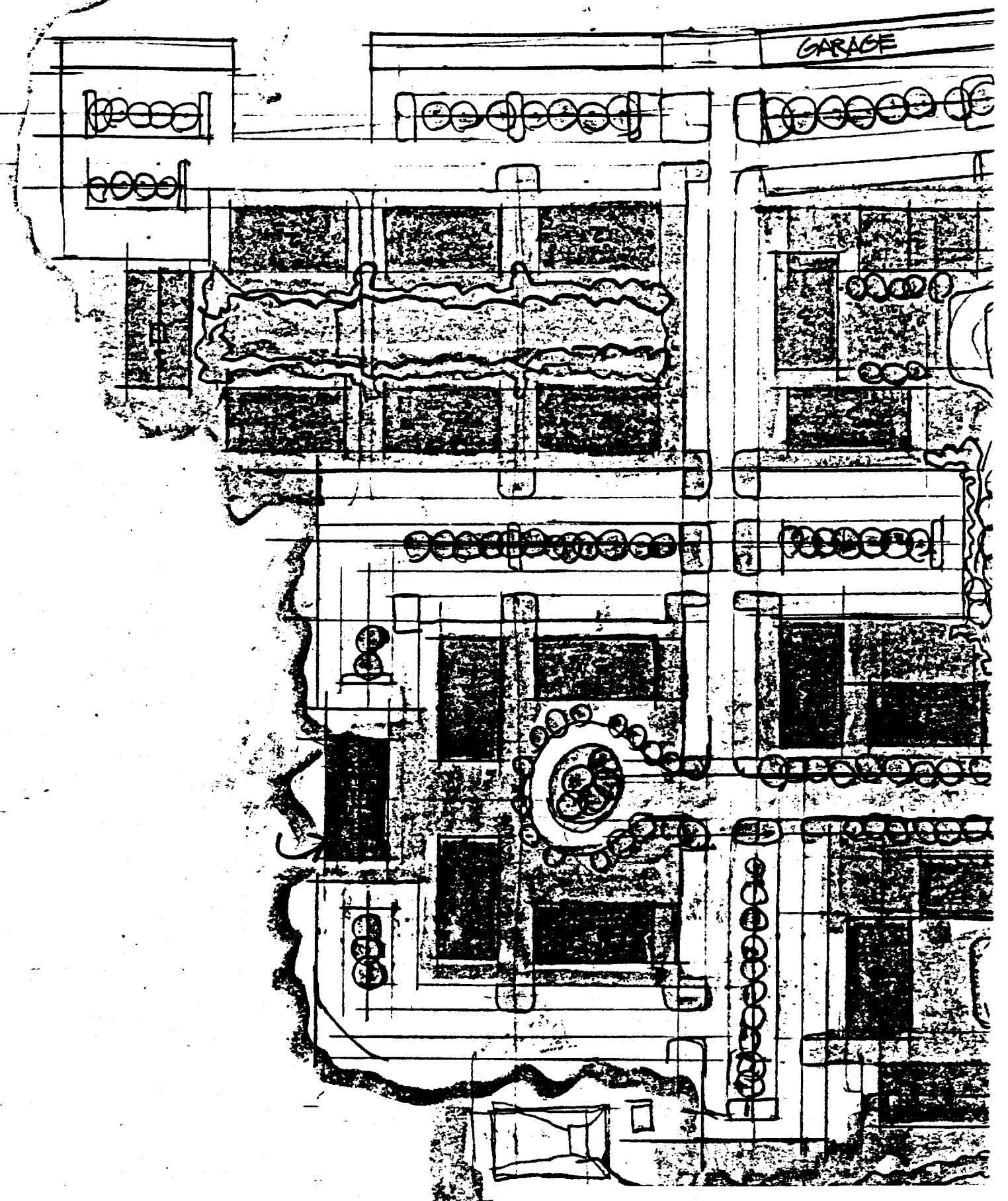
linkages. Each block will have a self contained park. A pedestrian walking on the streets will have their vista's framed and interlaced by parks on periodic landmarks. This block plan is partially modeled after Savannah, Georgia and many of the classic English squares. The road types and open space linkages which define each building block are the dominant organizing force in the plan. This plan configuration is intended to create continuity but has the possibility to accomodate a rich architectural design vocabulary. The intention is to maintain a dominant two and three story scale, using appropriately scaled street scale elements, brick sidewalks, pedestrian lighting, fixtures, fencing and landscaping. Grey trap rock walls will be used where appropriate. The streetscape will be punctured by an occassional landmark like a church or the point block midrise in the community center.

The basic block allows an organic growth. As the community expands and grows, additional blocks can be added without negatively affecting existing block. The intention is to make the community appear to be complete at each stage.

The major road system designed to serve the community with efficient traffic flow, but it also designed to emphasize and dignify, give meaning and legibility to the community. All streets will be extensively landscaped. Most vehicular streets



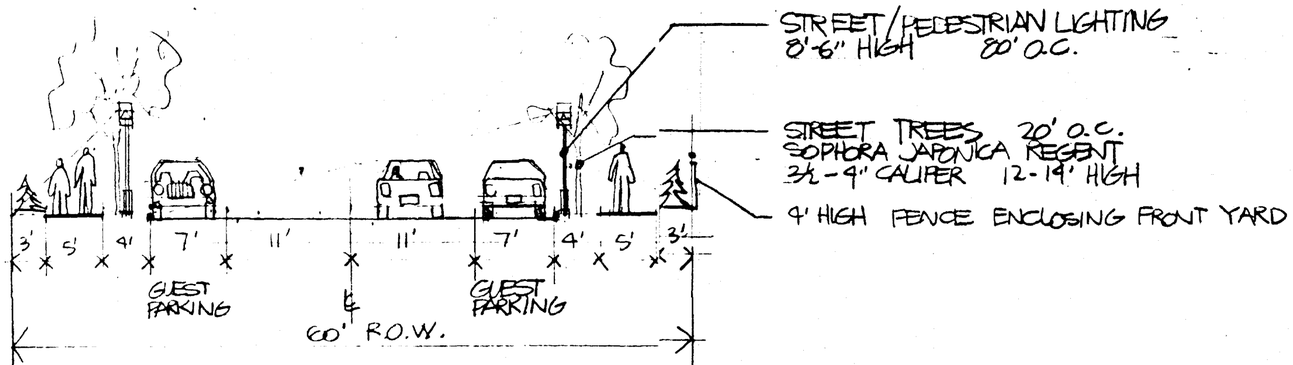
Plan of Typical Housing Utilizing Superblock – 1
Scale: 1″ = 100′



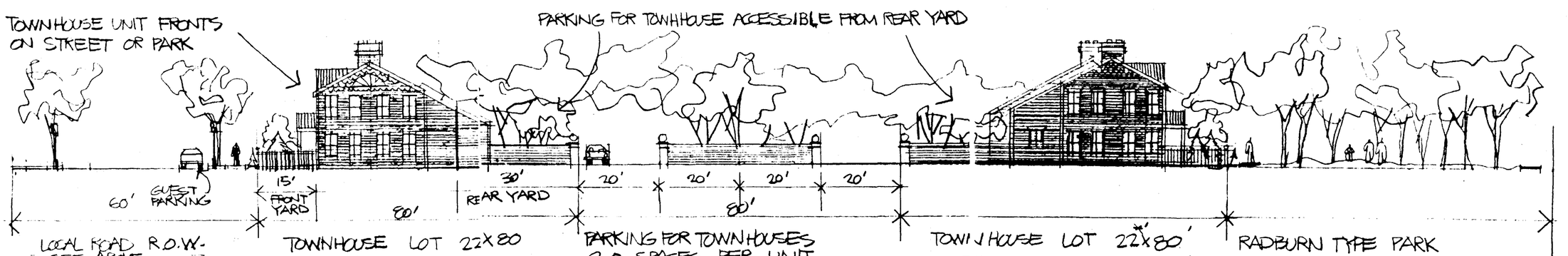
Plan of Typical Housing Utilizing Superblock – 2
Scale: 1″ = 100′

Section of Typical Superblock

URBAN DESIGN GUIDELINES



TYPICAL STREET 1" = 10'



TYPICAL SECTION THRU TOWNHOUSE BLOCK 1" = 20'

AEM
5.28
'84

will have long vistas terminated by parks or an occasional landmark. The largest scaled road serving the communtiy are the parkway/boulevards. These roadways will have a 100' r.o.w. Two boulevards serve the community from Route 27 and Route 1. The northern boulevard is an extension of Henderson Road, the southern boulevard is an extension of Beekman Road or Vliet Road. Both of these boulevards provide access to the community center. Hopefully, Suburban Transit, which presently has three buses per hour traveling between Princeton, New Brunswick, East Brunswick and New York will have a stop at the community center. The two boulevards provide an easy loop off of 27 for Suburban Transit. The two boulevards intersect with a circumferential boulevard which provides access to all local collector streets.

The plan also requires a special design treatment for South Middlebush Road. To avoid a negative traffic impact on the Six Mile Run Reservoir, the historic village of Middlebush and the municipal center an alternative alignment is recommended. To avoid the possibility of a high speed road bisecting the proposed community and cutting the center off from over half of the residents, the volume and speed on this north south major arterial needs to be slowed as it approaches and passes through the new community. As it passes through the new community the speed should be slowed by using seven stop lights. This will control speed, and allow ongrade, pedestrian crossings, the

alternative is to build grade separated pedestrian underpasses. H.N.A. recommends that the alternative alignment of South Middlebush Road considered in the Township's current Master Plan be adopted. This alternative would use primarily state owned land to construct the new higher speed road. It seems illogical in the current Master Plan to plan the future widening of a road which will be under 25 feet of water when the reservoir is built. It seems more logical to run the road down stream from the dam, or over the dam as they do in Holland. This alignment could provide the maximum positive benefit to the entire Franklin Township community while minimizing the negative impact on existing villages single family homes, and private property.

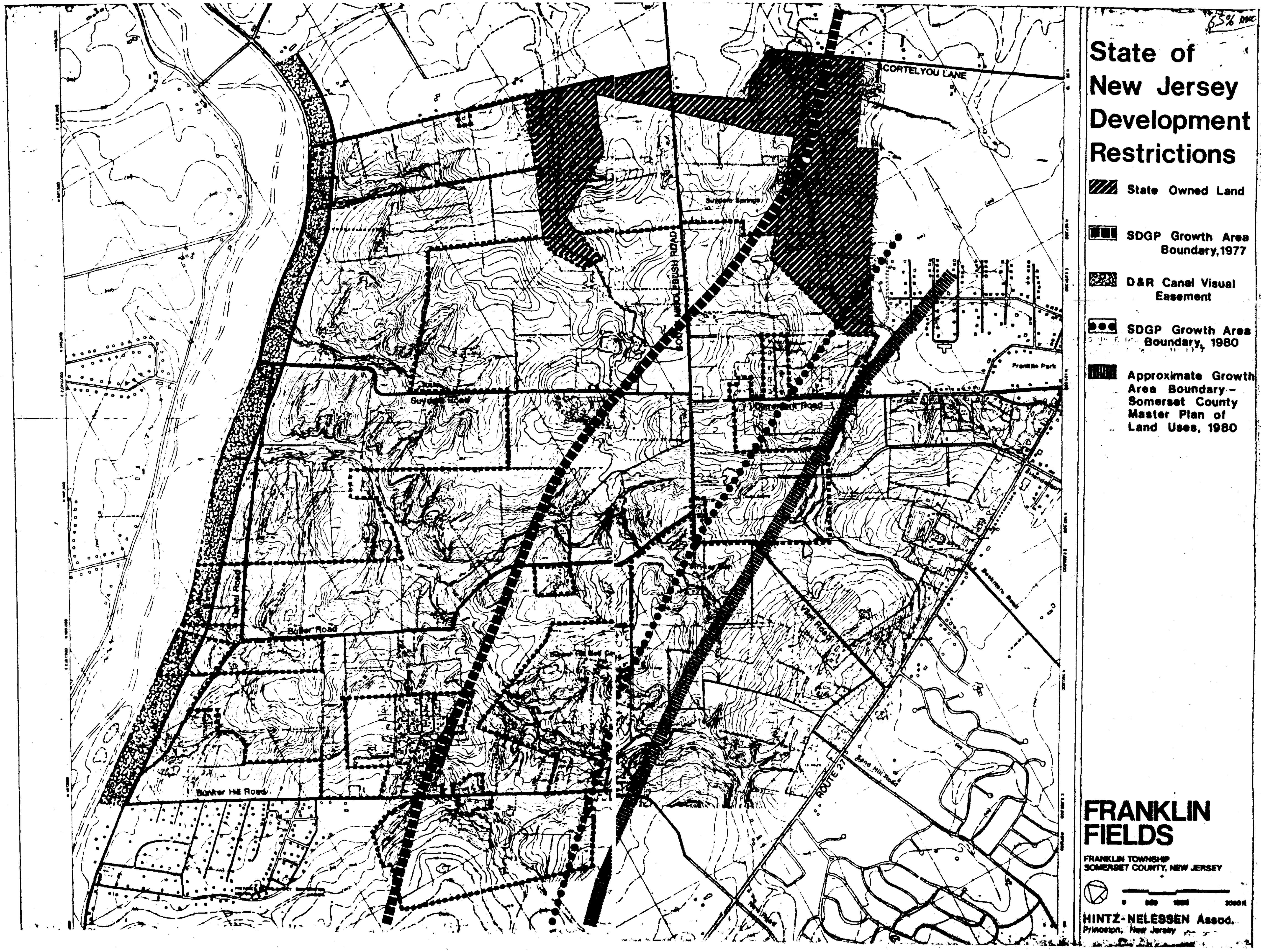
A community center is envisioned in the approximate geometric centroid of the site. The center should be part of a long-range plan after substantial residential construction, and modeled after the traditional Main Street. Major parking will be on the periphery of the pedestrian-dominated Center, in which will be a contained series of urban spaces terminated with landmark-scaled structures. A small town green will compliment the Main Street. The scale will be 3 to 4 stories. Extensive street furniture, ground textures and landscaping will provide character and excitement to the Main Street. The community center will be located in the approximate geometric centroid of the community. Assuming a walking speed of 350' per minute, one could walk to the center from the periphery in 10 minutes to 12 minutes.

The site for the Village at Franklin Field contains 1,836 acres. The property map shows the extent of land area which will be used to construct this new development. Only approximately 1,000 acres or 54.47% of the site will be developed. The remaining 800± acres will be proposed for farmland retention, consistent with the Farmland Retention Act.

This large site prvides an ideal opportunity for large scale urban design non-constrained by encroaching property lines. The large site provides the opportunity for cost effeciency and economies of scale. The most creative site plan solutions and the opportunity to integrate open space, community and commercial facilities with the residential units.

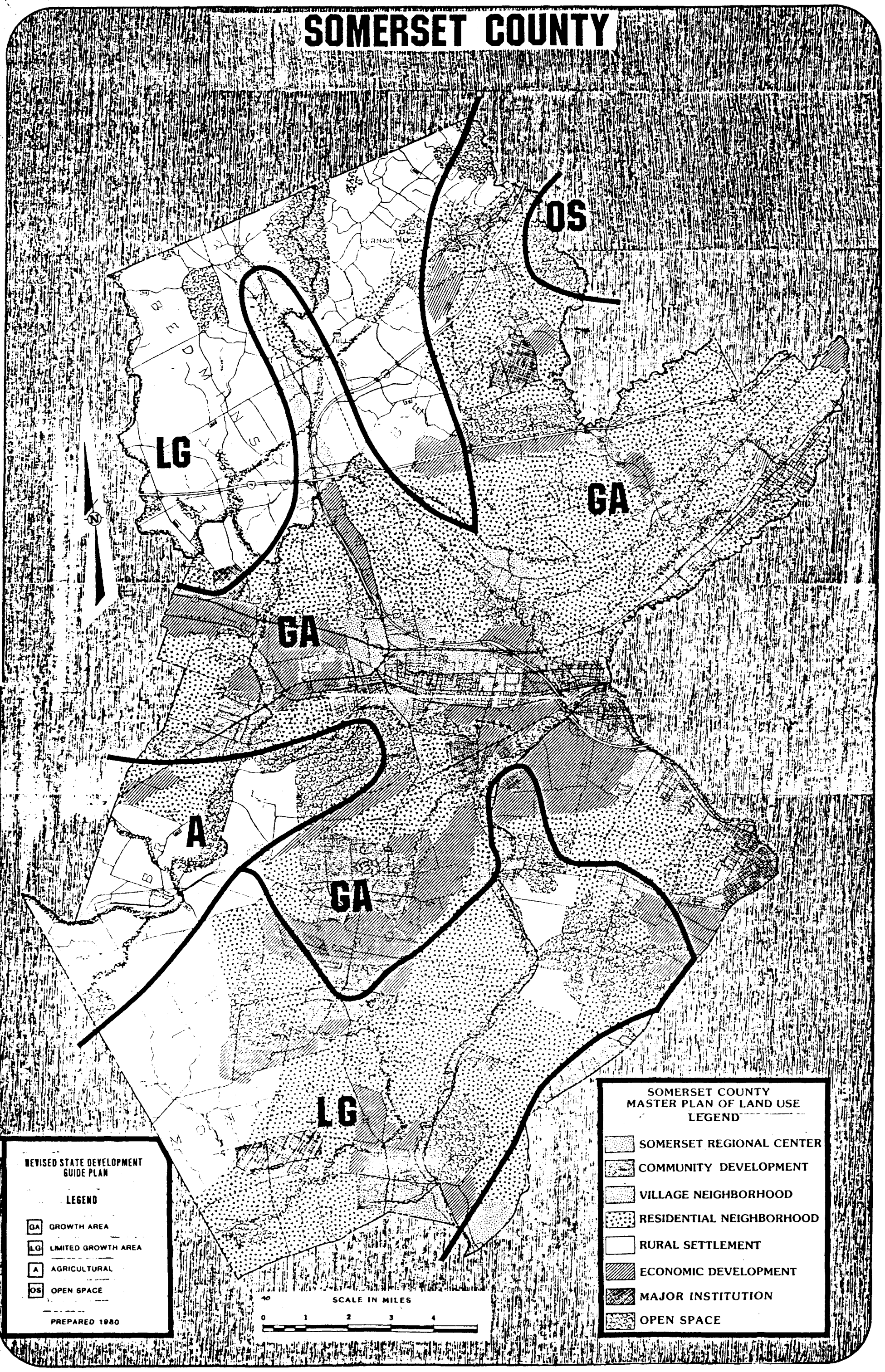
State of New Jersey Development Restrictions

HNA has mapped the various State, and county development plans for the site. The D&R Canal has a 500 foot visual restriction and very strict standards for runoff, etc. No development is proposed in this area. The State of New Jersey owns land for the proposed Six Mile Run Reservoir which forms the northern boundaries of the site. This area will be used as part of the green edge of the community and not proposed for development.

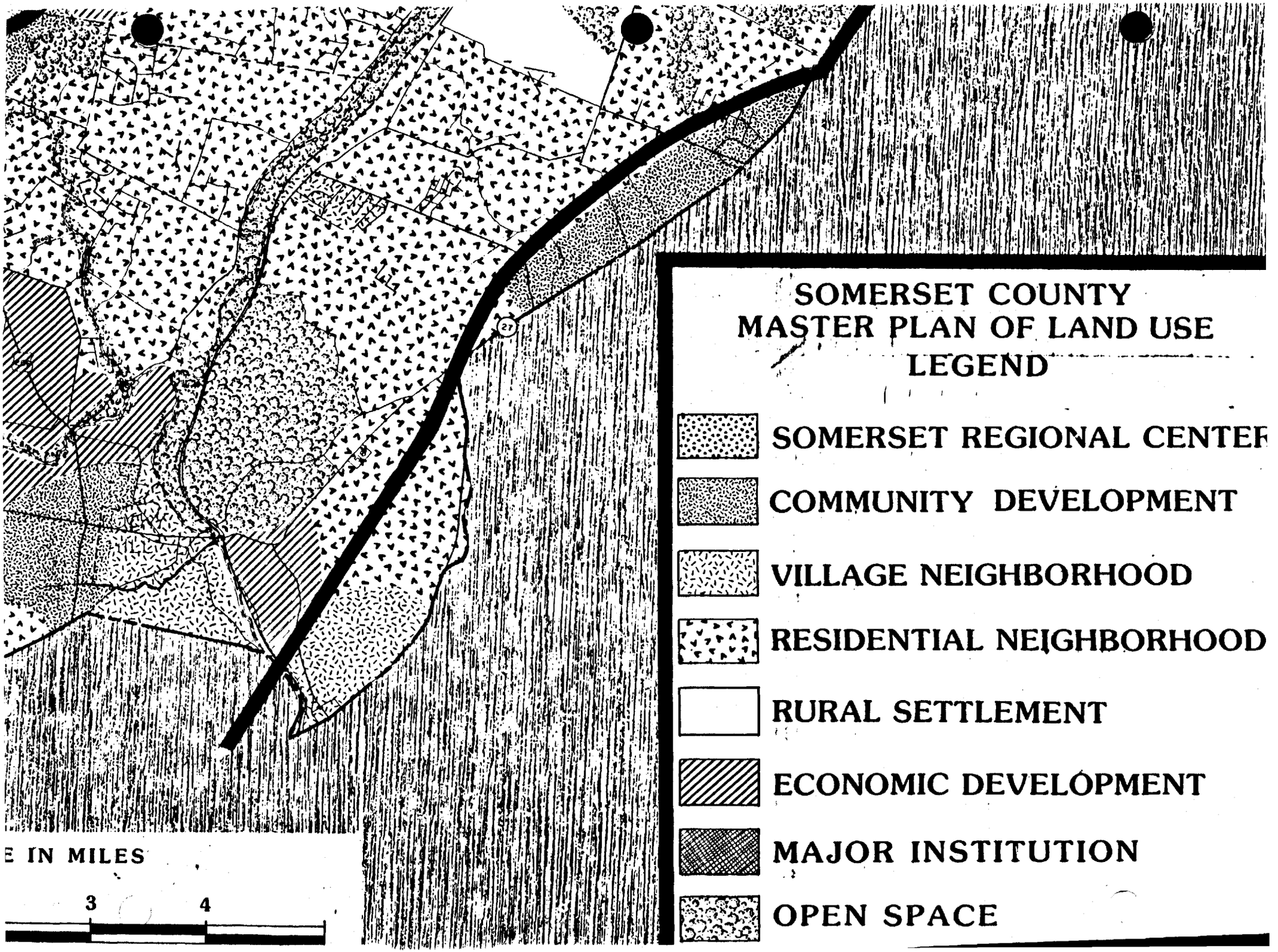


State of New Jersey Development Restrictions
State Owned Land
SDGP Growth Area Boundary, 1977
D&R Canal Visual Easement
SDGP Growth Area Boundary, 1980
Approximate Growth Area Boundary - Somerset County Master Plan of Land Uses, 1980
CORTELYOU LANE
Suydam Road
Butler Road
Bunker Hill Road
ROUTE 27
Franklin Park
Sand Hill Road
Beekman Road
FRANKLIN FIELDS
FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY
HINTZ-NELESSEN Assoc.
Princeton, New Jersey

SOMERSET COUNTY



GUIDE PLAN LINES ARE APPROXIMATE



SOMERSET COUNTY MASTER PLAN OF LAND USE

LEGEND

- SOMERSET REGIONAL CENTER
- COMMUNITY DEVELOPMENT
- VILLAGE NEIGHBORHOOD
- RESIDENTIAL NEIGHBORHOOD
- RURAL SETTLEMENT
- ECONOMIC DEVELOPMENT
- MAJOR INSTITUTION
- OPEN SPACE

HNA has delineated three lines which represent interpretations of where the S.D.G.P. designates growth and limited growth. This line has been modified over time. The heavy rectangular dashed lines shown represent the year 2000 SDGP concept map as published in September, 1977. The areas south-east of the line were designated as growth areas and the remainder of the site is limited growth. This area has not been designated as either an agricultural or preservation area on the SDGP. Clustering is recommended.

A second growth line was plotted based on the May, 1980 SDGP, which modified the earlier line. The growth guidelines suggest a concentrated linear pattern of development. It is the recommendation of HNA that this linear pattern of development is unsupportable from sound planning in that it will be auto-dependent, and assumes linear, strip commercial development (if these facilities are to be within reasonable walking distances), and places an undue burden on existing roads without provision of parallel roads to support the linear plan. It is the recommendation of HNA that this development pattern, where possible, be reconfigured into a nodal plan that put community, cultural, social and recreational facilities within walking proximity to future residents.

A third line was also plotted. This line is the "approximate" growth area boundary as plotted on the Somerset County's Master Plan of land uses. This plan, which is attached to this report, shows the entire site as residential neighborhood. This same designation is shown in the northern portion of Franklin Township overlaying areas which contain densities ranging from 2.0 to 7.0 dwelling units per acre.

The development of the site is responsive to the development restrictions and guidelines of the State of New Jersey. The proposed Six Mile Run Reservoir, the Delaware and Raritan Canal Commission/State Park and the State Development Guide Plan are important planning considerations in the development and configuration of the overall site plan for the Village of Franklin P.U.D. The proposed Six Mile Run Resevoir containing over 3,000 acres is located on the northern edge of the property. This reservoir will act as a containment to the P.U.D. and contribute to the green belt surrounding the new community. The open space network of the new community will be linked with this valuable natural resource.

On the northwest boundary of the property is the Delaware and Raritan Canal State Park and the Millstone River. This park will act as the continuation of the green belt surrounding the new

community and will provide opportunity for recreation. The Canal Commission has set stringent environmental and visual standards. A 500 foot visual easement has been recommended by the commission.

Housing Types

The new community housing program plans for 9,936 housing units to be constructed on 1,838 acres at a gross density of 5.41 d.u. per acre. The housing will be sited on only +1,000 acres of this land. The remaining 800+ acres will be retained in Farmland for the immediate future. By far, the greatest emphasis of housing types within the community will be attached housing units, including single-family townhouses, one-to-three story condo/apartments, and other innovative (mid-rise) housing types (see Table 1). Emphasis on compaction to reduce distances, smaller units to reflect decreased family size, smaller lot sizes and solar orientation is the foundation of the housing program.

TABLE 1

Housing

Unit Type	DU/Acre	% Breakdown	Number
S.F. Detached	.5-5 du/ac	5%	497
S.F. Attached	5-12 du/ac	50%	4,968
Condo/Apts./ Vertical/Duplex (1-3 stories)	12-24 du/ac	40%	3,974
Medium-High Rise (+6 stories)	40+ du/ac	5%	497
			9,936

40 percent of the total number of dwelling units, or 3,974 units, are planned as vertical duplex townhouses or flats, or three and four-story "greenhouse" condominiums. These units would comprise a density of 12-24 dwelling units an acres. The majority of the lower cost housing would be in these units. This density is appropriate; it provides opportunity for affordable housing innovation, it is well scaled and with appropriate siting can define, continuous open space linkages, it is of minimum density to provide local transportation options, directly responds to new market trends.

The second largest type of housing planned is the single-family townhouses/attached units, which would account for 50% of the total number of units, or 4,968 units.

Single-family detached units, which would be built with a density of one-half-to-five dwelling units per acre, would comprise 5% of the total number of units, or 497 units.

Income Levels

Housing for every income level would be provided in the new community (see Table 2). Of particular significance, 20% of the total number of constructed units are planned for low/moderate income families and individuals. Of the total, 1,987 units are planned for this income level. Approximately 41% or 815 units would be constructed for households above the age of 65. The majority of these households are on fixed lower incomes. The remaining units are planned for low/moderate income families.

TABLE 2

Housing Program by Income Group

Income Group	Percent	Resulting No. of D.U.'s
Low/moderate income Elderly ($11-$25,300/year)	8.2%	815 units
Low/moderate income Others	11.8%	1,172 units
Middle income Elderly ($30,000/year)	10	994 units
Middle income Others ($31-$50,000/yr.) year)	50	4,968 units
Upper income Elderly ($40,000+/year)	2%	199 units
Upper income Others ($50,000+/year)	18%	1,788 units

Existing income distribution based on current median income and will be adjusted as income and marketing trends change.

50 percent of the proposed housing, or 4,960 units, will be designed and constructed for the middle-income market, especially targeting the professional household. Homeowners who earn from $31-$50,000 per year and senior citizens who earn up to $30,000 per year are included in this group. 4,968 units are planned for the general middle-income market with an additional 994 units for the senior citizens development.

20 percent of the planned units, or 1,987 units, would be constructed for households with incomes over $40,000 per year for elderly and over $50,000 per year for all others. High-cost, quality housing for this upper income will be used to offset the costs of providing housing for the less advantaged.

Single-Family Detached Housing

The new community will include single family detached housing in clusters. 5% or 497 units, in the new community is planned for detached housing. This housing group will include one, one-and-one-half and two-story structures, which will be designed as S.F., custom-built clusters on cul-de-sacs, patio, zero-lot line houses, estates or large lot clusters.

Over half, or 250, of the proposed single family detached housing units will have three bedrooms. The remainder will be 2 and 4 bedroom units.

The majority of detached housing units will have a proposed density of either 2 to 5 units per acre. Prices will range from $100,000 - $165,000.

In the high end of the single-family detached housing market, three and four-bedroom units will be available from $135,000 to $245,000 depending upon unit density, which may be as low as one unit per four acres.

Table 3 shows a breakdown of the range of sizes of single family units.

TABLE 3

Single-Family Detached (Clustered)

7%	34	2 Bed @ 6 du/ac	1,000
25%	123	3 Bed @ 6 du/ac	1,200
3%	14	4 Bed @ 6 du/ac	1,500
15%	72	2 Bed @ 4 du/ac	1,000
20%	96	3 Bed @ 4 du/ac	1,400
5%	24	4 Bed @ 4 du/ac	1,600
3%	14	2 Bed @ 3 du/ac	1,200
9.4%	45	3 Bed @ 3 du/ac	1,500
1.5%	7	4 Bed @ 3 du/ac	1,800
1%	5	2 Bed @ 2 du/ac	1,200
5%	24	3 Bed @ 2 du/ac	1,800
2%	10	4 Bed @ 2 du/ac	2,000
1.5%	7	3 Bed @ 1 du/ac	2,000
1%	5	4 Bed @ 1 du/ac	2,500

The remainder of the single family units will be on larger lots.

The single-family attached units account for 50% of the total number of units planned. This housing-type group includes single-family units which are attached by a common fire proof and noise elimination wall to other units, townhouses, patio homes and zero-lot line units. One, two, three and four-bedroom units will be provided as seen in Table 4. A 1983 estimated market rate sales price for each unit is suggested.

Single-Family Attached

TABLE 4

Single-Family Attached/Semi-Attached Housing

%	Semi-Attached	sq.ft.	Sales $/S.F. 1983	$
3.9%	193 4 Bed @ 6-8 du/ac	1,600	$50	
15.5%	1,540 2 Bed @ 6 du/ac	1,200		$69,600
5.8%	576 3 Bed @ 6 du/ac	1,400		$81,500
	Townhouses			
14.4%	1,431 2 Bed @ 9 du/ac	1,200	$65/0	$78,000
18.4%	1,828 3 Bed @ 8 du/ac	1,400		$91,000
5.4%	536 4 Bed @ 8 du/ac	1,600		$104,000

	Townhouses			
13.8%	295 2 Bed @ 10 du/ac	1,000	$61/0	$62,000
18.4%	375 3 Bed @ 10 du/ac	1,300		$84,500
4.4	94 4 Bed @ 10 du/ace	1,500		$90,000

2,503 semi-attached units are planned with a net developable density of six to eight dwelling units per acre. For townhouses, 3,795 units are planned which have a net developable density of eight to ten units per acre. Townhouses would also be available with densities of ten to twelve units per acre. The current estimated price range (April 1983) is from 69,600 to $104,000

Apartments

As mentioned previously, 40% of the total number of proposed housing would be comprised of apartment flats or vertical duplex housing. This group includes vertically-stacked townhouses, a unit which looks like a townhouse from the outside but has one unit over another, garden apartments (flats) and mixed-use or loft-type housing (located in the town center). Housing within this group would range from $32,000 to $93,000 depending upon the number of bedrooms selected and the total square feet of the unit, which may range from 500 to 1,400 square feet (see Table 5). Efficiency, one, two, three and four bedroom units would be available.

Housing within this group would be comparatively high-density with 15 to 25 units planned per acre. Two-bedroom units would dominate this housing type with 420 units respectively planned for vertically-stacked townhouses with densities of 16 and 25 dwelling units per acre, garden apartments with 15 and 20 dwelling units per acre and mixed-use apartments. In all, 1,769 two-bedroom units are planned for walk-up apartments.

TABLE 5

Condo-Apartments

%	Vertically-Stacked Townhouses	S.F.	Sales $/S.F.	$
1.8%	72 Studio @ 16 du/ac	500*	$62/00	$31,000
3.5%	139 1 Bed @ 16 du/ac	650*		$40,300
13.2%	529 2 Bed @ 16 du/ac	1,200		$74,000
3.5%	139 3 Bed @ 16 du/ac	1,500		$93,000
1.8%	72 Studio @ 25 du/ac	500*	$60/0	$31,000
3.5%	139 1 Bed @ 25 du/ac	650*		$39,000
13.2%	529 2 Bed @ 24 du/ac	1,100*		$66,000
1.8%	72 3 Bed @ 25 du/ac	1,400		$84,000

%	Condo-Apartments	S.F.	Sales $/S.F.	$
5.3	210 1 Bed @ 15 du/ac	950*	$62/0	$58,900
13.2	525 2 Bed @ 15 du/ac	1,200		$74,400
1.8%	72 3 Bed @ 15 du/ac	1,400		$86,800
3.5%	139 Studio @ 20 du/ac	700*	$62/0	$43,400
5.3%	210 1 Bed @ 200 du/ac	950*		$58,900
13.2%	529 2 Bed @ 20 du/ac	1,100*		$68,200
1.8%	72 3 Bed @ 20 du/ac	1,300		$78,600
	Mixed-Use			
5.3%	210 Studio	900*	$64/0	$57,600
5.3%	210 1 Bed	1,100		$70,400
2.8%	111 89 2 Bed	1,300		$83,200

*Unit cost will be reduced through internal development subsidy and the utilization of modular constrution techniques.

**908 units are planned as single-bedroom units, 355 three-bedroom apartments 2,223 as two bedroom units and 492 studio units are being designed.

The 1983 estimated housing prices for apartments range from $31,000 to $93,000. The majority of these units will be rented.

Medium-Rise Housing

The unit sizes for medium-rise housing would range from 750 square feet for a studio apartment to 1,200 for a two-bedroom unit. The majority of available units would be either studio or two-bedroom units. Only 497 units are planned for medium-rise-type housing.

TABLE 6

Medium and High Rise

%		S.F.	Sales $/S.F.	$
30	149 Studio	750	$90/0	$67,500
25	124 1 Bed	950		$85,500
45	224 2 Bed	1,200		$110,000

Senior Citizen Housing

Senior citizens may elect to reside in the area of the planned development devoted to planned retirement. The planned retirement area is specifically and uniquely designed to the sociological and physical needs of the senior citizen. The village will be designed with extensive security systems (such as a gatehouse). Cultural and recreational activities, private

clubhouse, gardening center, recreation, etc. would be planned exclusively for residents within the planned retirement area. The housing units being designed for the planned retirement area would consist of efficiency or studio, one and two-bedroom detached and attached units. Housing would be provided for every income level.

"Least Cost" or Affordable Housing

The current requirement for low and moderate income housing and/or "least cost" or affordable housing is units to the year 1990 and the year 2000. This number was generated by H.N.A. using the current "consensus" formula fpr the year 1990 is 2815 units.

The Township must provide housing for income groups which have incomes less than 50% and 80% of median household income as well as affordable housing for other groups. The currently available median family income according to U.S.H.U.D. is $31,600. Therefore the moderate income households are those who have an annual income between $15,800 to $25,280. The low income households have an income between 0 and $15,800. Using the currently distribution of households based on 1980 U.S. Census the target households would have approximately 60% of mean - as a standard for moderate income, and 35% of mean as low income. This translates into an annual income of $18,960 for a moderate income household and $11,060 for a low income household.

Low and moderate income housing could be partially funded by state and/or federal subsidies but are not currently available; by using manufactured housing, by economies of scale, by building smaller units and by internal developers subsidy. This housing can be built by appropriate zoning and bonuses by the construction of housing without costly frills or extras.

Least cost housing, as determined by the Oakwood at Madison decision, is dwelling units built to the minimum standards consistent with safety and health regulations. The Madison decision also inferred that it is a municipality's obligation to overzone for this type of housing. This decision allowed for small houses to be built on small-sized lots (7,500-fee-square). The Mount Laurel decision made the same determination concerning small homes and small-sized lots.

One single-family detached unit gaining favor is the "no frills" home, also called the stripped-down or bare-bones house. A builder can slash costs by eliminating amenities such as fireplaces, patio slabs, tiled bathrooms and other features. Cost-generating requirements, such as air conditioning, are minimized. Stripped-down houses may cost approximately 20% less than a unit with the amenities. The lower cost of the dwelling unit may qualify more people for mortgage loans. The "no frills" unit has a potential for expansion. Further, some homeowners prefer to finish and customize a home themselves from which they benefit from significant labor savings.

While the no frills, small sized, small lot, single-family detached units offer savings, the largest savings are realized from attached housing units including townhouses, duplexes and ownership apartments. The housing units can be constructed at lower costs due to the fact that less land is required for each dwelling unit. Materials and construction costs are also less for attached housing units. Small-sized attached units also have lower heating, cooling and lighting requirements.

Many individuals who are locked out of the single-family detached housing market due to high costs can afford attached housing units. Many individuals actually prefer attached homes for low maintenance reasons.

Garden apartments can be built at 24 units per net acre. The U.S.H.U.D. document Minimum Property Standards has calculated area requirements for apartment rooms that meet safety and health requirements. The document said a one-bedroom apartment can be constructed with 500 to 600 square feet. Cost-generating features such as air conditioning or garages should be excluded from this type of housing.

Any of these affordable or least cost planned unit developments should be built with minimum acreage requirements and have an overall density high enough to promote high efficiency and economic development. Moreover, the planned unit development zone should be relatively free of other requirements which can increase cost and impede the goals of the housing units.

A noteworthy aspect of Franklin Township is its low taxable rate of 2.85%, which is below the statewide average of 3%. Franklin Township is slightly above the New Jersey state average in terms of its fiscal capabilities. This means that housing units built in Franklin Township will be taxed at a lower rate than other surrounding municipalities - an advantage to those on tighter housing budgets seeking "affordable housing."

OPEN SPACE PLAN

Although the community is primarily designed for people, as a high-quality residential environment, it is designed to be integrated forming an open space network with existing natural features and farmland. All of the stream corridors have been preserved in perpetuity. Hundreds of acres of the property are designated for parks and landscaping. Over 835 acres of farmland has been set aside. 62% of the Class I soils (353 acres) on the site have been retained in farmland. When the entire proposal is finished, over 60% of the land will be planted with trees, shrubs, grass and native vegetation. The community will have a green belt on three sides, which is a a classic example of good urban planning.

The first consideration in developing the open-space plan was to determine the suitability of the land by environmental analysis. Certain lands were unsuitable for development, as determined by the McHarg study and other consultants. The lands unsuitable for development or of a sensitive environmental condition will be preserved for wildlife, stream corridors, flood plains, wooded areas and other features which are important to functions of the natural processes.

Certain lands were preserved that provide aesthetic and unique values such as an unusual stand of woods.

This open land will be used for recreation and visual benefit recognizing that a community this size needs space for active and passive recreation. Open-space activities will include golf, swimming, tennis, fishing, canoeing, ball playing, gardening, stables, etc.

An overall open space/park network is planned as part of the new community. The design plans brings residences close to open space, facilitiating easy access. This network adds to the design quality and the overall living environment by enabling residents to simply walk out of their homes into an open-space network to community, recreational and educational facilities. A walkway and bicycle system is built into the open-sapce design.

The new community lies adjacent to two major state parks - the Delaware and Raritan Canal and the proposed Six Mile Run Reservoir. These areas will substantially augment the new community's open space plan and will provide additional water resource and recreational land. These two assets provide this proposed development with a unique opportunity to its future residents.

Open space is an integral element of the plan. The open-space concept is evident through the entire plan, which included three major parameters --- superblocks containing individual parks, internal linkages of path systems connecting parks to school sites, retention of stream corridors and unique tree stands, etc.

In keeping with the open-space plan, the recreation center is located within the major internal open space which contain streams and detention ponds/lakes. Major water elements will be located on two sides of the recreation center. The most intense recreational activity will be at or adjacent to this center. Also, the highest density residential housing units will be suituated within walking distance of the center. This proximity will bring residents together for leisure activities.

The following are planned recreational activities in the community:

-Boating - is planned for the Delaware and Raritan Canal for canoeing and fishing activities.

-A 10-acre lake will be built within the community/recreation center that will provide an area for row boating, small sailboats, canoeing and fishing.

Since plans are long range for the Six Mile Run Reservoir, it is uncertain how these plans will fit into the Field site plans experience.

-A pool is planned for the town center, adult village and a third proposed for possible demand.

-Play areas, soccer and tennis facilities - and other court sports will be interspersed throughout the community to serve all the neighborhoods within walking distance.

-Golfing - will be tied into Bunker Hill Golf Course. It will be located at the southerly end of the new community.

-Picnicking sites will be located in scenic locations throughout the community.

-Outdoor ampi-theater and indoor recreational center will be in the town center.

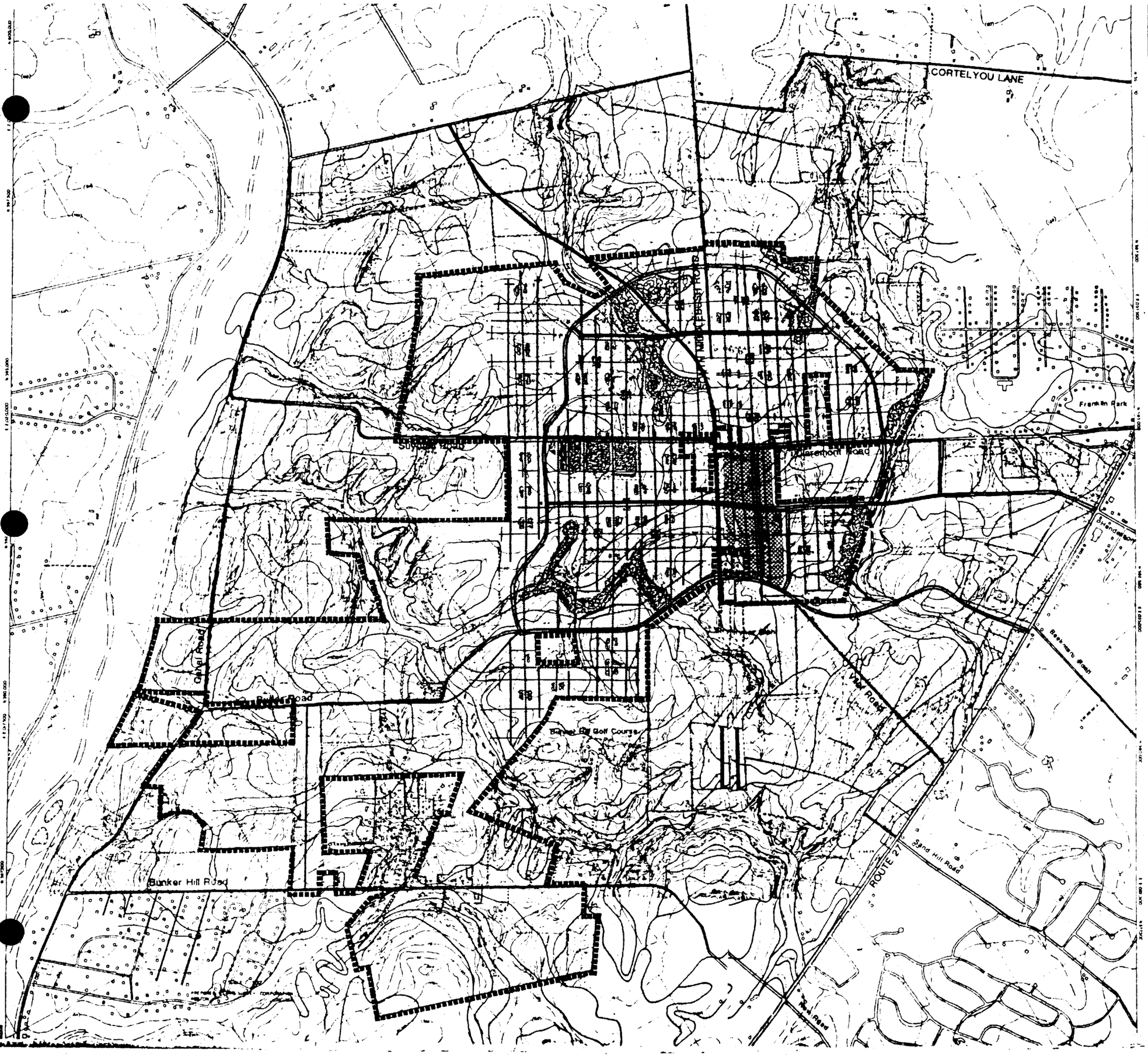
-Horseback riding, hiking and nature will occur on the perifery of the village and adjacent to the Canal.

-Major bike path systems will be coterminous with open space and local road/street system. The path will be eight feet wide and designed to meet federal standards.

Bike systems will connect with other systems outside the community such as the South Brunswick Route 27 bike path or to the Delaware & Raritan Canal bike system.

-The planned retirement area will contain its own recreational area, which will include a club house, tennis courts, putting course, swimming pool and bocce court.

All of the above planned recreational facilities compare favorably with the nationally recognized standards for community recreational facilities.



Community Facilities

- Boundary
- Community Center
- School
- Parks
- Intersection Control

FRANKLIN FIELDS

FRANKLIN TOWNSHIP
SOMERSET COUNTY, NEW JERSEY

0 500 1000 2000 ft

HINTZ-NELESSEN Assoc.
Princeton, New Jersey

COMMUNITY FACILITIES PLAN

Schools

Sites for 3 additional schools are planned for the site. Each elementary school will require five acres of land which includes school play areas and parking. If a junior high school is required eight acres including a recreation area and parking will be set aside. The State of New Jersey considers 20 acres as the ideal size aera for an elementary school in a suburban setting. The Field community will satisfy these requirements by locating the schools next to the open-space network, which will more than meet the state's criteria.

A site for either library that contains computer, video, etc. to service the new community and the surrounding area will be included in the town center. The library will require approximately 13,000 sq. ft.

Churches

Five houses of worship are planned for the site; each church will occupy 2-4 acres. A Catholic Church with school will require approximately 8 acres. At least one house of worship will be located on the fringe of the town center. The rest will be

spread throughout the community and will be located on the collector roads for easy access. Additional land will be available to houses of worship, which will allow for future growth and expansion. The community facilities and land use plan will designate possible locations for the houses of worship.

Fire Stations

Fire stations will be located to allow future areas of development with particular emphasis on life hazard and value of buildings and contents.

The table* below contains location standards for fire houses and fire flow developments, which will be followed in the design plan.

*Source: DeChiara & Koppleman, Planning Design Criteria, p. 198.

District:	Maximum travel distance from engine company	Maximum travel distance from ladder company	Required fire flow in gallons gallons/minute
High value:	3/4 - 1-1/4 mi	1-2 mi	1,000-2,500 gpm for 4-10 hrs.
Residential:	1-1/2 - 2 mi	2-3 mi	100-2,000 gpm for 2-4 hrs.

COMMERCIAL AND INDUSTRIAL DEVELOPMENT

The village center is planned as an integral component of the new community. It will be built in stages, and will grow as the new community is constructed. The village center when completed will contain shops, offices and community facilities. The town center will be constructed on + 25 acres.

The village center will provide a variety of shopping goods and services which will be comparable to a shopping district in a small city's central business district. The center will boast a supermarket plus general merchandies, apparel, home furnishing, as well as a cinema, a restaurant and a variety of other services.

Additional square footage in the proposed center is planned for office space, which will be used for medical and dental services, insurance companies, engineering firms, etc.

Facilities are planned for public use, which will include churches, daycare facilities, municipal facilities and public meeting areas.

AGRICULTURAL PRESERVATION

When planning and designing the Field property, the importance of agricultural activity to the state and national economy, and as a local resource was recognized. However, it must be accepted that farming activity is not economically feasible on the Field site. Nevertheless, a plan has evolved for agricultural preservation, which will satisfy the goals of farmland preservation. Both the Tri-State Regional Planning Commission and the State Development Guide Plan, as well as local plans, propose limited growth on certain portions of the Field property. It is important on the other hand, to note that agricultural preservation is not recommended by the State Guide Plan for land towards the Delaware and Raritan Canal and away from Route 27 corridors. The Somerset County 1980 Master Plan recommends residential neighborhoods. The Field site simply does not have the best farmland from a soil-productivity point-of-view. In fact, the site of 1,835 acres contains only 566.14 acres on 30.8% of prime Class I soil, based on U.S.A.D. Consequently:

-The Field site contains very little soil of Class I quality - the agricultural prime soil, and 62% of the Class I land is in the proposed farm retention area. The majority of soils on the Field site are either Class II or Class III, which may drain moderately poorly and/or may be too acid. These soils limit the yield per acre at the Field site.

CORTELYOU LANE
Class A
Class B
Other Classes
Source: Soil Conservation Service U.S.D.A.
FRANKLIN FIELDS
SOMERSET COUNTY, NEW JERSEY

-Mr. Field loses money farming his land due to high land costs, interest costs and taxes.

-Existing land use regulations are confiscatory. They do not allow an adequate return on the value of the Field property.

-Capital funding. When borrowing for farm equipment/material, lenders consider the land as the asset against which to loan. Since the property, to some extent, is zoned at a low density, land value is lowered. This devalued land results in less capital for materials and equipment.

-The labor pool for farm workers is dwindling in the Franklin Township area. Finding workers for harvesting and planting is difficult.

-Farm equipment dealers are located a long distance from the site deterring rapid equipment repair.

-Farmland is inviting to vandals which run over the property with two and four-wheel vehicles and do physical damage to the property, crops and fences.

-Residents complain of herbicide and fertilizer use.

-The farmer has no legislature guaranteeing his right to farm.

Despite all these objections, over 835 acres of the proposed development will be set aside for "farmland detention." This area contains over 62% of the prime farmland on the Field site. This farmland will be used to form the open space green belt around the new development.

THE FRANKLIN PROJECT

A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

PLANNING CONSULTANT: WMRT
Wallace McHarg Roberts and Todd

MARKET CONSULTANTS:
JAMES D. LANDAUER ASSOC., INC.

GEOLOGIST/HYDROLOGIST:
APPLIED GEOTECHNICAL AND
ENVIRONMENTAL SERVICE CORP.

APRIL, 1976

CONTENTS

4.3 Soils - a detailed description of regional soil associations and site-specific soil phases by parent materials, properties, areal distribution, suitabilities for alternative land uses, potential to generate overland flow, and erodibility.

4.4 Topography - detailed breakdown of slopes by percent gradient and distribution on the site.

4.5 Landform - description and location of landforms found on the site.

4.6 Surface Hydrology - a summary of regional and site surface water features, including a description of stream discharge, water quality, and flooding history. Delineation of watersheds found on the site.

4.7a Vegetation - discussion of probable past vegetative history and current cover conditions. Detailed description of site plant associations, their tolerance to disturbance, and an assessment of vegetation value for various land uses.

4.7b Wildlife - a description of wildlife habitats determined on the basis of vegetation associations. A discussion of the wildlife known to be present on the site, preferred wildlife habitats, relative abundance of species, and wildlife value.

4.8 Visual Character - an analysis of the visual quality of the site, including a description of views from existing roads and internal views.

4.9 Climate - a summary of climate characteristics, including site temperature, precipitation, and prevailing wind conditions.

5. SYNTHESIS

5.1 Environmental Protection Standards - environmental performance standards are applied to each of seven Physical Planning Units described on the basis of similarities in geology, surface, and subsurface hydrology and topography. Two types of standards are employed, including those pertaining to runoff management and preservation of ecologically valuable land areas. Calculations indicate impervious surface limits and impoundment areas required to maintain pre-development runoff volumes, and environmental analysis reveals areas to be preserved. The site's environmental carrying capacity is determined for each individual planning unit.

5.2 Land Use Opportunities and Constraints - factors influencing the manner in which performance standards are applied are described. The structural capacity of geology and soil material, suitability for effluent disposal, requirements for preservation of agricultural land, value for structured and non-structured recreation, and ponding requirements for runoff control, are assessed for capacity to accommodate development intensity as determined by analysis under 5.1. Opportunities Maps are included for each factor excluding structural capacity.

5.3 Conclusions and Recommendations - the site's capacity to accommodate development is summarized based upon environmental performance standards and physical site characteristics. Solutions to the design of a visually acceptable development are suggested by an overlay process combining individual opportunities maps produced in 5.2.

LIST OF FIGURES

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1. INTRODUCTION

1.1 Purpose

The use of land without degradation of natural environmental conditions is a concern that Mr. Field shares with political officials, professionals, and various citizen groups in the region of Princeton and Franklin Township. Although all accept that further urbanization is necessary in the region, much disagreement exists as to how and where such growth should be accommodated to provide positive impacts to the public and private sectors.

The purpose of the "Franklin Project" Study is to determine the limit for urbanization of the natural environment, or "carrying capacity" for development of approximately 3000 acres of land in Somerset County, New Jersey. The property, located in Franklin Township, is situated between New Jersey State Route 27 and the historic Delaware and Raritan Canal. Most of the gently rolling land is currently used for agriculture, with a few natural woodlands remaining along streams, on wet soils, and steep slopes. Presently the most dense development is found along Route 27. Other built-up areas consist of well-maintained single family residences and farmhouses.

In this pastoral environment, uncontrolled development would have significant negative implications on the ecological and social environments of the Township and the region. It is important therefore to ascertain the carrying capacity within the property separately from external limitations for carrying capacity (such as capacity of access roads, zoning restrictions, building codes, provision of utilities, and socio-economic impact). These were not addressed in this Study, although their implications for development are obviously significant. This Study deals exclusively with the carrying capacity of the natural systems and the ecological dynamics of the site itself. It recommends environmental protection standards and describes upper capacity limits which could be developed without degradation of the natural environment.

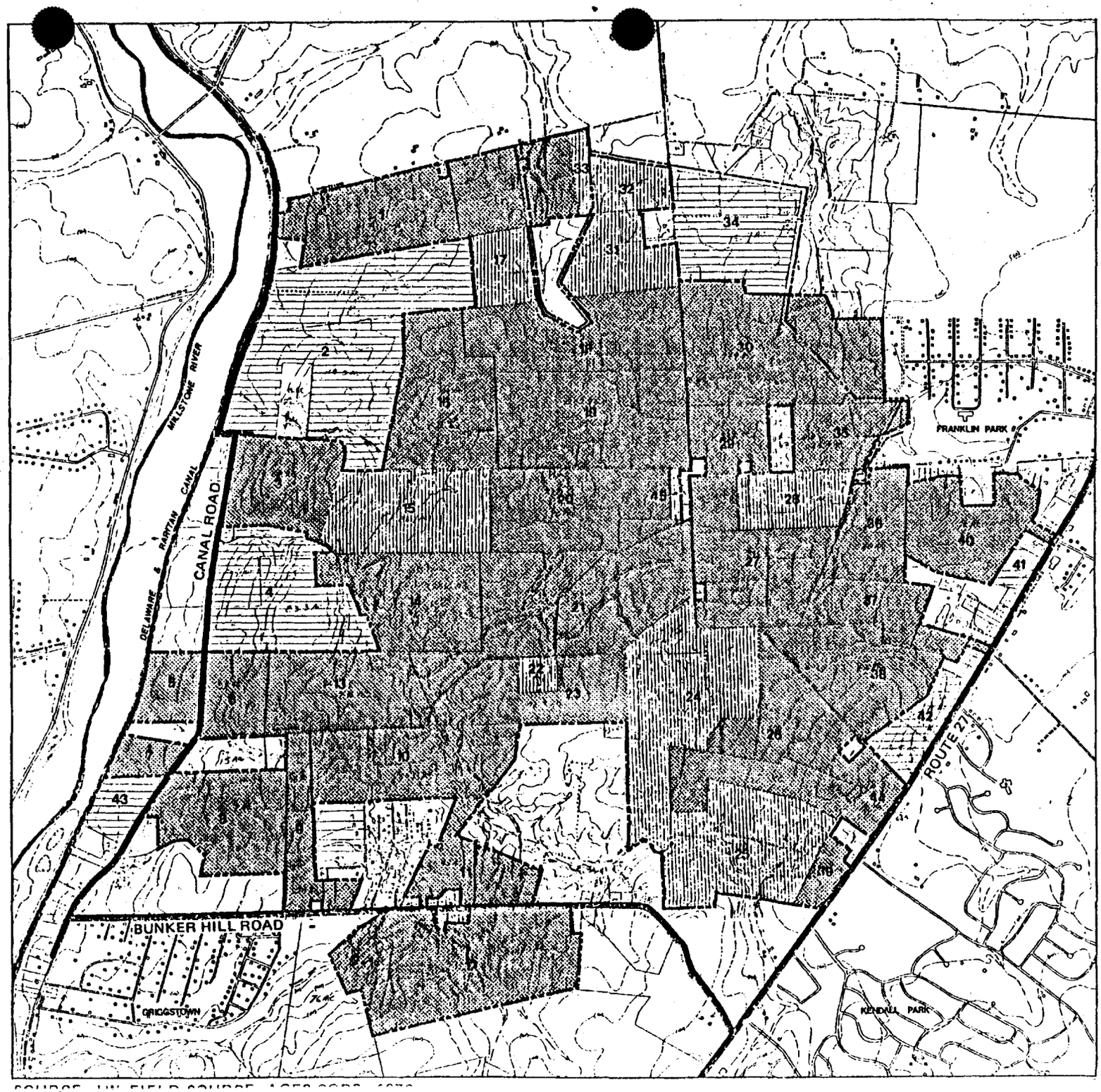
1.2 Description of the Property

The study area comprises approximately 3000 acres in Franklin Township, Somerset County, New Jersey either currently or prospectively owned by Mr. Field. The site has been divided into several classes of ownership and ownership options and includes parcels that may be acquired in the future.

The map (Figure 1) shows those parcels already owned (as of April, 1976) as part of the Franklin Project. This area comprises 2288.74 acres. Parcels most probably to be acquired total 484.7 additional acres are also identified, as are parcels for possible acquisition in the future, an additional 473.4 acres.

The area that has been considered as "the site" consists of the "owned" parcels plus the "most probable" parcels, totaling 2773.4 acres. All considerations and calculations for environmental protection standards have been based on this land area, although data over the entire study area, including the "possible" parcels, have been examined and mapped.

The full listing of parcels shown on the map includes the tax block and lot numbers and precise acreage breakdowns (Figure 2).



PROPERTIES

- OWNED
- FOR PROBABLE ACQUISITION
- FOR POSSIBLE ACQUISITION
- SITE BOUNDARY INCLUDES OWNED AND PROBABLE
- SIX MILE RUN PROPERTY LINE

THE FRANKLIN PROJECT

A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

Wallace McHarg Roberts and Todd

FIGURE 1

PROPERTY OWNERSHIP

PROPERTIES OWNED

Parcel	Block	Lot	Partial Acres	Total Acres
1	36	2	84.0	160.6
	36	4	25.2	
	36	5	51.4	
3	33	1		68.0
5				27.9
6	33	15		38.0
7				15.4
8	20	47-Q		80.9
9	20	2.02	13.0	33.0
		44.01	20.0	
10	20	3-3Q		99.13
11				45.0
12	11	6-6Q	68.4	162.6
		2	22.0	
		3	72.2	
13	33	14		82.0
14	33	12-12Q		105.0
16	36	14		100.0
18	36	11	109 -10 ac. Reservoir	99.0
19	36	12		123.95
20	33	5		91.6
21	33	11 - 110		153.0
23	20	5		70.7
26	20	9	75	124.0
	20	11	99	
27	34	1-Q	95.5	105.4
		3-Q	10.04	
29	37	40.01		33.6
30	37	44Q	149.0	149.0
35	37	30		45.0
36	34	8-Q	41.2	47.0
	34	8-QW	5.8	
37	34	9-Q 50'	48.46	48.46
38	34	59		82.0
		59-Q		
39	20	14		14.2
40	34	16	70	72.0
	34	41	2	
44	32	1	17.7 -6.7 Convalescent Home	11.0
	TOTAL			2288.74

PROBABLE ACQUISITION

Parcel	Block	Lot	Partial Acres	Total Acres
15	33	3		86.7
17				29.9
22	20	6		10.0
24	20		15.0	124.7
	20	1	109.7	
25	20	12.01		103.0
28	34		55.0	
	34	22	-5.8	49.2
31	36	10		45.0
32	36	6		24.0
33	36	6		10.0
45				2.2
	TOTAL			484.7

POSSIBLE ACQUISITION

Parcel	Block	Lot	Partial Acres	Total Acres
2	36	18	98.2	198.5
	36	16.01	100.3	
4	33	17	35.0	118.3
	33	16	83.3	
34	37	46	180.7 -90.0 Reservoir	90.7
41	34	43		10.0
42	34	57	16.0	32.5
	34	58	16.5	
43				23.4
	TOTAL			473.4

OWNED:	2288.74 Acres
PROBABLE:	484.70 Acres
SITE AREA:	2773.40 Acres
POSSIBLE:	473.40 Acres
TOTAL	3246.80 Acres

FIGURE 2

2. SUMMARY

a. General Discussion

A thorough ecological analysis is necessary in the initial land use planning stages of an area to ensure an understanding of existing ecological processes. Only with this understanding can development be planned with some assurance of the impact upon the environment both at the site and the regional levels. Elements of geology, soils, topography and landform, subsurface and surface hydrology, vegetation, and wildlife all have a specific role in ecosystem dynamics. For this reason a detailed account of the existing conditions of these elements and their interactions is given in this Report. This then reveals those areas critical to the ecosystem and necessary for preservation, and conversely those areas suitable for various types of development.

The ecological structure of the study area and major elements of environmental dynamics are summarized in the idealized transects, Figures 3 and 4. With this understanding of the area's ecosystem, it was possible to draw conclusions regarding the best use of the 2773.4 acres comprising "the site".

b. Preservation

The study of environmental systems indicates that lands critical to the site's ecology, and lands which impact regional ecosystems, should be preserved. The areas that fall into this category are the Millstone River Terraces on the western portion of the site, soils critical to maintaining the streamflow regimen, primarily in Stream Corridors and Enclosed Valleys, and woodland vegetation, mainly in Stream Corridors and on the Diabase Knoll (Figure 28). Total acres recommended to be preserved: 822.22 acres.

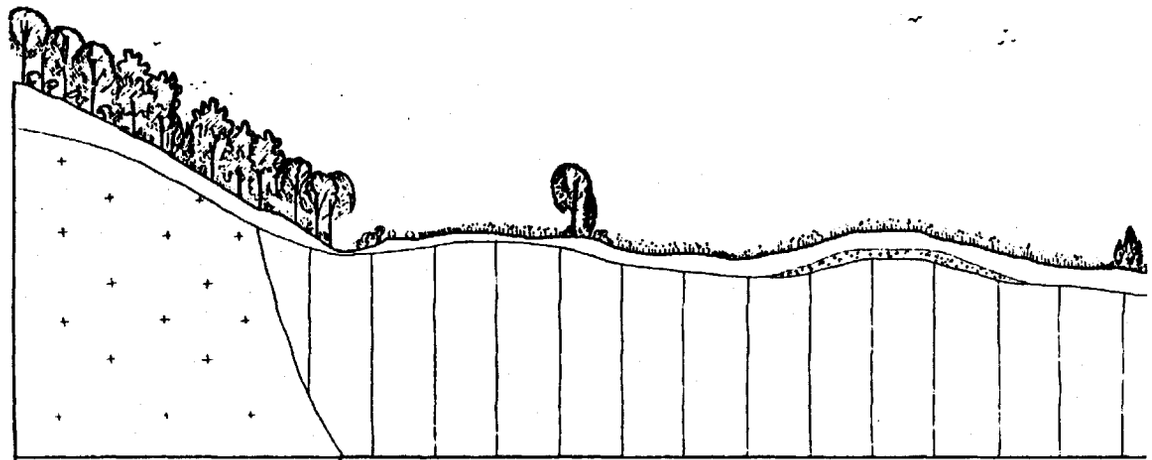
c. Environmental Protection Standards

The remaining lands total 1891.2 acres. These lands do not, however, represent the final developable land area. Because of State and local commitments to maintaining water quality, no increase in storm water runoff over that presently existing will be permitted. Of the 1891.2 acres remaining after preservation, it is estimated that 218.34 acres must be maintained for runoff control in shallow impoundments near permeable and moderately permeable soils, or as part of a recreation pond network.

The net developable land is, therefore, approximately 1589.33 acres. Geologic bearing capacity on these lands is well in excess of the maximum township zoning limits for the site (even if this area alone were totally zoned P.U.D. with a total potential of around

11,000 dwelling units). Approximately 888 acres of prime agricultural lands exist on the site, of which some 692 acres are coincident with lands suitable for effluent disposal by spray irrigation. These would provide a disposal area for approximately 9,980 dwelling units.

It must be recognized that, in fact, it is not possible to develop 11,000 dwelling units on this site because of constraints such as the capacity of local streets and public services, zoning, and other "off-site" factors. In order to determine the amount and type of development most appropriate for the site, it will be necessary to evaluate market demand for various house types, and also test site planning concepts that meet that demand. The natural environments of the site offer ample opportunity to develop intensively and in such a manner that caters to different phases and types of development. The site has excellent natural attributes which can be used to the benefit of new development and also be maintained for environmental protection.



GEOLOGY

DIABASE WITH BAKED SHALE FRINGE

DIABASE (OCCASIONALLY)

BRUNSWICK FORMATION: SHALES, SILTSTONES, SANDSTONES

PENNSAUKEN SANDS & GRAVELS OVERLYING BRUNSWICK

SOILS

SILTS AND LOAMS OF DIABASE PARENT MATERIAL (ABOVE LUCAS & MERCHANT)

SILTS AND LOAMS OF BRUNSWICK PARENT MATERIAL (PENN, KLINESVILLE)

SILTS AND LOAMS OF BRUNSWICK PARENT MATERIAL (PENN, KLINESVILLE, LANSDALE)

GRAVELLY LOAMS AND SILTS (NIXON)

HYDROLOGY

GOOD INTERNAL DRAINAGE

SURFACE RUNOFF

GOOD INTERNAL DRAINAGE

SURFACE RUNOFF

VEGETATION

WOODLAND

OPEN FIELDS, MEADOWS, CROPLANDS AND HEDGEROWS

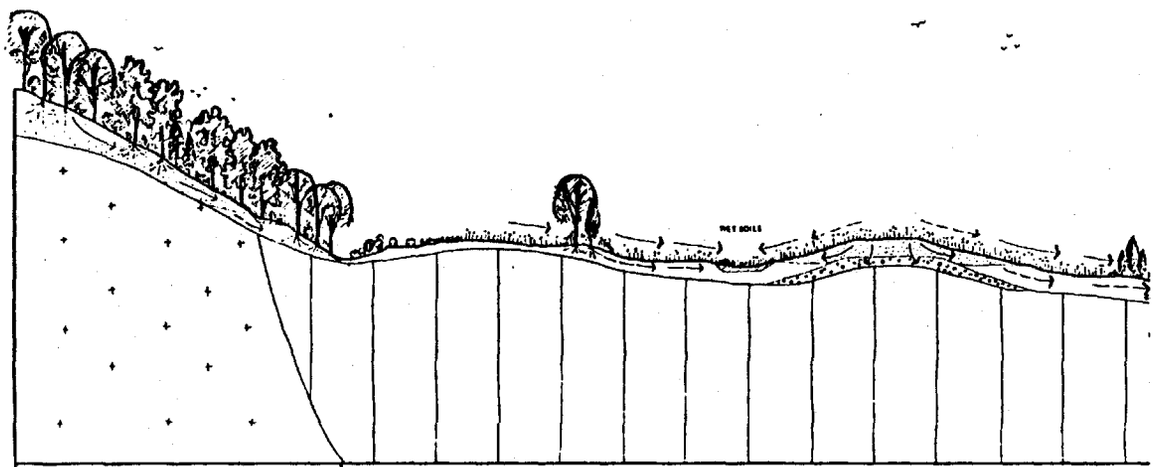
SPECIES
ASH, BLACK WALNUT, TULIP POPLAR, OAK, HICKORY, DOGWOOD, RED MAPLE, HICKORY, SPICEBUSH AT STREAMSIDE, OAK, BEECH, IRONWOOD

GRASSES, CEDAR, CHERRY, SASSAFRAS, CHERRY, MAPLE IN HEDGEROWS, PASTURE, CORN, GRAINS, AND OTHER CROPS, ORNAMENTALS, ASH, RED OAK, BLACK OAK, WHITE OAK IN WOODLOTS & HEDGEROWS, RED OSIER DOGWOOD, WET GRASSES, SEDGES, CATTAIL IN WET AREAS

WILDLIFE

DEER, RACCOON, SKUNK, MUSKRAT, OPOSSUM, RED FOX, WOOD CHUCK, GRAY SQUIRREL, EASTERN MOLE, WHITE FOOTED MOUSE, WOODPECKER, CARDINAL, WOOD THRUSH, THRASHER, SPARROW, OWL, BLUE JAY, SPARROW HAWK

SKUNK, MUSKRAT, COTTONTAIL, RED FOX, EASTERN MOLE, MEADOW MOUSE, SPARROW, BLUE JAY, CROW.



DIABASE BEDROCK WEATHERS SLOWLY, LEAVING PROMINENT — BOULDERS AND RIDGES ON THE LAND.

PERMEABLE SOILS ON THE UPLANDS ALLOW WATER TO PERCOLATE FREELY THROUGH THEM. CONTRIBUTING TO SLOPES, SHALE SOILS ARE FOUND. THEIR SLOWER PERMEABILITY RETARDS THE FLOW OF GROUND WATER, CAUSING IT TO EMERGE AT THE CONTACT OF THE TWO SOIL TYPES, OR TO RISE TO A HIGHER LEVEL IN THE GROUND. WET SOILS ARE OFTEN FOUND AT THE SURFACE IN THESE AREAS.

ROOTS OF TREES AND SHRUBS HELP PREVENT SOILS ON THESE STEEP SLOPES FROM ERODING, PARTICULARLY ON THE LOWER SLOPES WHERE SOILS ARE MORE ERODIBLE THAN ON THE UPLANDS.

ON THE UPPER, DRIER SLOPES, ASH AND BLACK WALNUT PREDOMINATE. ON THE LOWER SLOPES, IN MOIST AREAS, TULIP POPLAR IS FOUND ALONG WITH OAK, HICKORY, AND DOGWOOD. THESE WOODS ARE DEVELOPED FROM OLD FIELDS, EVIDENCED BY RED CEDARS REMAINING WITHIN THEM.

THE BRUNSWICK FORMATION BEDROCK WEATHERS QUICKLY BECAUSE OF ITS HIGHLY FRACTURED CHARACTER, ITS FREQUENT BEDDING PLANES, AND ITS NON-CRYSTAL ROCK STRUCTURE.

HIGHLY ERODIBLE SOILS DEVELOPED FROM THE BRUNSWICK ARE CARRIED OFF THE UPLANDS BY SURFACE RUNOFF. WATERS AND DEPOSITED IN LOWLAND AREAS. FOR THIS REASON, SOILS ON THE UPLANDS ARE VERY THIN. A POSSIBLE CAUSE OF THE GENERALLY SPINDLY TREES IN THE FEW REMAINING WOODLANDS.

EXCEPT FOR HEDGEROWS, LITTLE NATURAL VEGETATION REMAINS IN THESE UPLANDS SINCE THEY ARE PRIMARILY USED FOR AGRICULTURE. ABANDONED FIELDS HAVE BEGUN TO REGENERATE WITH SHRUBS AND PIONEER TREE SPECIES IN THEIR PROGRESSION TOWARDS MORE MATURE WOODLANDS.

ALTHOUGH THE UPLANDS ARE NOT USED EXTENSIVELY AS RESIDENTIAL HABITAT BY WILDLIFE, THEY PROVIDE AN IMPORTANT FOOD SOURCE FOR SMALL MAMMALS, SONGBIRDS, AND GAMEBIRDS, AND THEIR WIDE OPEN AREAS ARE IMPORTANT AS HUNTING GROUND FOR PREDATORY BIRDS.

GOOD INTERNAL DRAINAGE OCCURS WITHIN THE [illegible] PROMONTORIES WITH EXCESS WATER FLOWING TOWARD THE LOWLANDS. AT CONTACT POINTS WITH LESS PERVIOUS SOILS, RUNOFF AND GROUND WATERS SLOW DOWN, OFTEN COLLECTING AT OR NEAR THE GROUND SURFACE IN DEPRESSIONS IN THE LAND. BECAUSE OF THE PERMEABILITY OF THE SURFACE SOILS, EROSION IS LIMITED EVEN ON CROPLANDS.

IN A FEW AREAS THE [illegible] PREVENTS PERCOLA[illegible] SOILS STANDING W[illegible] THESE AREAS.

VEGETATION IS OFTEN [illegible] PASTURE TYPE SPE[illegible] HINTS ON IN USE. F[illegible] ROOTS OF PLANTS A[illegible] TROL IN THESE ARE[illegible] ERODIBLE.

THESE WET MEADOWS [illegible] WILDLIFE HABITAT[illegible] LAYERS AND FOOD[illegible]

Determination of the site's carrying capacity began w ing site ecologic conditions (Figure 5). Geology, Su graphy, Landform, Surface Hydrology, Vegetation, Wild were studied. Field observation, analysis of aerial officials in the New Jersey Department of Environment the information sources consulted. Environmental Pro from this inventory.

a. Planning Units

Because the study area has been extensively altered f tural and development practices, distinct ecologic un Thus, Physical Planning Units were derived representi topographic, and hydrologic conditions. Concurrent s tion were then delineated.

b. Storm Water Runoff Performance Standards

The resulting areas were analyzed in detail for their water runoff increases at various development intensi for maintaining stream quality, it was determined tha would be permitted to result from development. This formance standards. In this manner, it was possible velopment coverage allowable in each area and the app (i.e., water impoundment or improved vegetation cover

c. Areas for Ecological Preservation

During the protection standards synthesis, inventory the site's ecological structure and dynamics in a man to the maintenance of the ecosystem. Such areas were and were subtracted from the allowable developable la capacity applied to allowable coverage revealed the u the site.

d. Other Areas of Environmental Protection

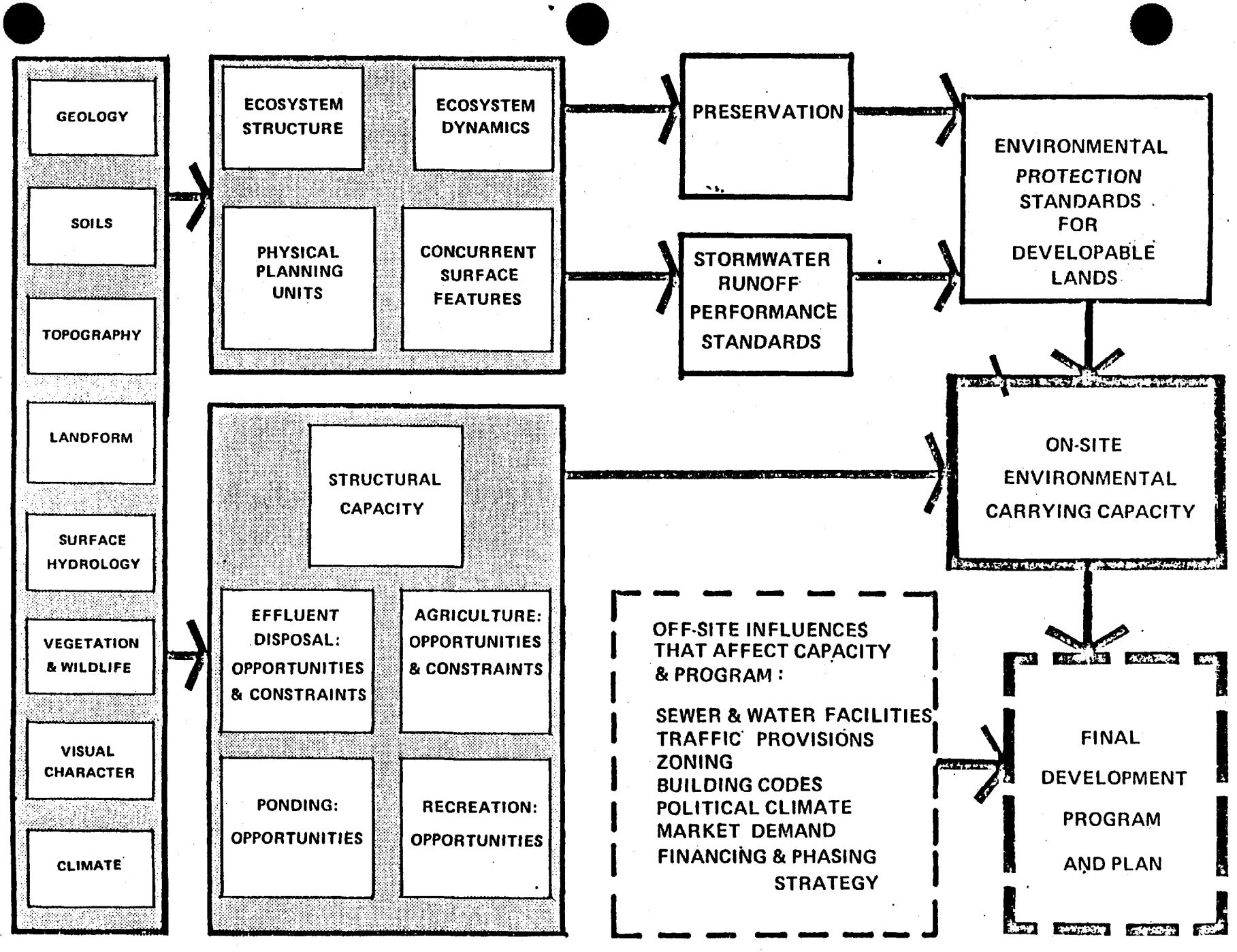
Because of the land use effects of certain expressed values, the protection of streams and the maintenance of prime agricultural soils, opportunities and constraints for ponding, on-site effluent disposal, and the suitability for agriculture were examined for their effects on site carrying capacity. In addition, opportunities for recreation were assessed in order to determine the land available for the provision of amenity associated with new community development.

e. Final Development Plans

During later planning phases, these upper limits and opportunity areas may be tested against off-site capacity limitations. Political climate, zoning, building codes, traffic, and utility capacity will all have implications for final site capacity. Marketing and program demands will then determine where various land use areas will be located, their extent and the types of tradeoffs necessary in order to accommodate them within the existing capacity limits.

f. Carrying Capacity

Areas available and suitable for development have no structural or environmental constraints which limit the actual densities that could be built. For the purposes of this study and for illustrative purposes it was decided to apply the maximum density currently allowed in the Township ordinances. This density is seven dwellings per acres and yields over 11,000 dwellings.



STUDY PROCESS
FIGURE 5

4. INVENTORY AND ANALYSIS

4.1 Geology

a. The Region

The Field Property is located in a region characterizied by a sequence of Triassic red beds and igneous intrusives similar to other sediment-filled structural basins found from Nova Scotia to North Carolina. Plant and dinosaur fossils suggest that these widespread deposits occurred at the earth's surface. The red beds overlie crystalline rock of great age, while younger beds have been largely removed by subsequent marine movements. Only a relatively sparse and discontinuous cover of Quaternary gravels and their alluvial beds in stream bottoms obscure the red bed and intrusive materials.

Stratigraphy and Structure

A cross section oriented northwest-southeast through Princeton (see Figure 6) shows a relatively uncomplicated regional structure. A crystalline core of Pre-Cambrian Baltimore Gneiss, Chickies quartzite of Cambrian age and Wissahickon formation outcrops (possibly of Paleozoic age), lie irregularly on an axis from Trenton to Princeton junction.

The red beds and diabase intrusives forming the Newark Group lie uncomformably on the northwestern-sloping crystalline rocks at dip angles ranging from 12^{o} - 15^{o}. Down faulting at the northwestern edge of this block has resulted not only in the stratigraphic thickening in this direction but repetition of strata as well. To the southeast a marine sequence of Cretaceous age sediments forms the coastal plain region. These beds outcrop as nearly parallel bands and dip to the southeast at a rate of 35-60 feet/mile, becoming progressively flatter in younger members. Unconsolidated deposits of Quarternary and recent age are horizontally bedded and cover older deposits extending from the Fall line to the south.

Geologic History

The earliest record in the geologic history of central New Jersey is found in the Baltimore Gneiss, estimated to be about 1 billion years of age. The ensuing Paleozoic era coincided with the formation of thick sedimentary deposits in linear basins parallel to the present Atlantic coast. Deformation and uplift of those deposits and widespread igneous activity mark the formation of the ancestral Appalachians. This sequence is thought to be a result of the interaction of the North American and African lithospheric plates. A depositional hiatus and erosional period of great length followed thereafter.

Subsidence during Triassic crustal movements, about 225 million years ago in the early Mesozoic era, produced linear intermontane basins. The Field Property is located within

a Triassic basin stretching southwest to northeast through central New Jersey from Pennsylvania to New York. Concurrently, sediments eroded from highlands and accumulated on adjacent down-vaulted lowlands, with great thicknesses of the Triassic deposits occurring (in places up to 16,000 feet in thickness). Erosion, accompanied by a marine transgression in the Cretaceous, removed much material, flattened the overall relief of the area, and resulted in a stratigraphic gap in the late Mezozoic era. A series of marine encroachments and recessions during the Cretaceous and Tertiary periods left the coastal plain sediments and the clays, sands, and marls (mixtures of clay and shellfish remains) found over much of southern New Jersey.

During the Quarternary, glaciers covered extensive portions of North America. It is not known whether such ice lobes actually covered the Princeton area, but their indirect effects were certainly manifest. During interglacial melt periods, a stratified mix of gravels, sands, and clays was deposited in many areas, including New Jersey. The Pennsauken gravels, in evidence on the Field Property site, mark one of these periods. During recent times, deposition of alluvial sands and gravels in stream channels and erosion and mass-wasting on valley side slopes have been the primary geologic processes in operation.

b. The Site

Lithology

Four geologic formations are found on the site: Diabase intrusions, the Triassic Brunswick Formation, the Pleistocene Pennsauken Formation, and stream channel and slope colluvial deposits of recent age along the Millstone River.

Diabase Intrusions

The Diabase dikes (number 1 on Figure 7) appear as discontinuous linear ridges at the southern portion of the study area along Bunker Hill Road. About 244 acres of diabase occur at the site. This formation is a slowly-weathering, light gray fairly coarse-grained plagioclase and augite rich igneous rock. At diabase shale contacts, the sedimentary rocks have in some cases been baked and are often more similar in weathering character to the igneous rock than to the unbaked sedimentary rock. Because the diabase is an igneous intrusion, it has no bedding planes. Major joints are often wide and are generally far apart. The material is highly resistant to weathering and results in a weathered layer of varying thickness composed generally of large rounded boulders mixed with soil.

The complexity of the boulder-soil mixture, frequently 3' to 10' from the ground surface, limits bearing capacity in this layer to 2 tons per square feet. In the unweathered zone, the diabase has great strength and the bearing capacity at depths greater than 10' may be

expected to be 20 tons per square foot. In this material, bearing capacity contines to increase with increasing depth.

Triassic Brunswick Formation

The Brunswick shale, covering 2408.7 acres of the site (number 2 on Figure 7) is comprised of red, easily weathered, soft shale occasionally interbedded with fine-grained sandstone and siltstone layers. The thickness of this unit may exceed 6000 feet. Consistent with the regional structure of the Triassic red beds, the Brunswick dips 12° - 15° to the northwest, and often contains fossils and ripplemarks. Fracture patterns intersect this formation resulting in increased secondary permeability. The characteristic blocky weathering pattern consists of frequent, uneven, and closely spaced joints. The bearing capactiy for structures in the Brunswick formation varies with the depth of the rock from the ground surface. From 3 feet to 8 feet from the surface the bearing capacity is between 2 and 8 tons per square foot, with greatest strength in the deeper zones. At depths greater than 8 feet the rock strength increases even with increasing depth because of the fractured nature of the material.

Pennsauken Formation

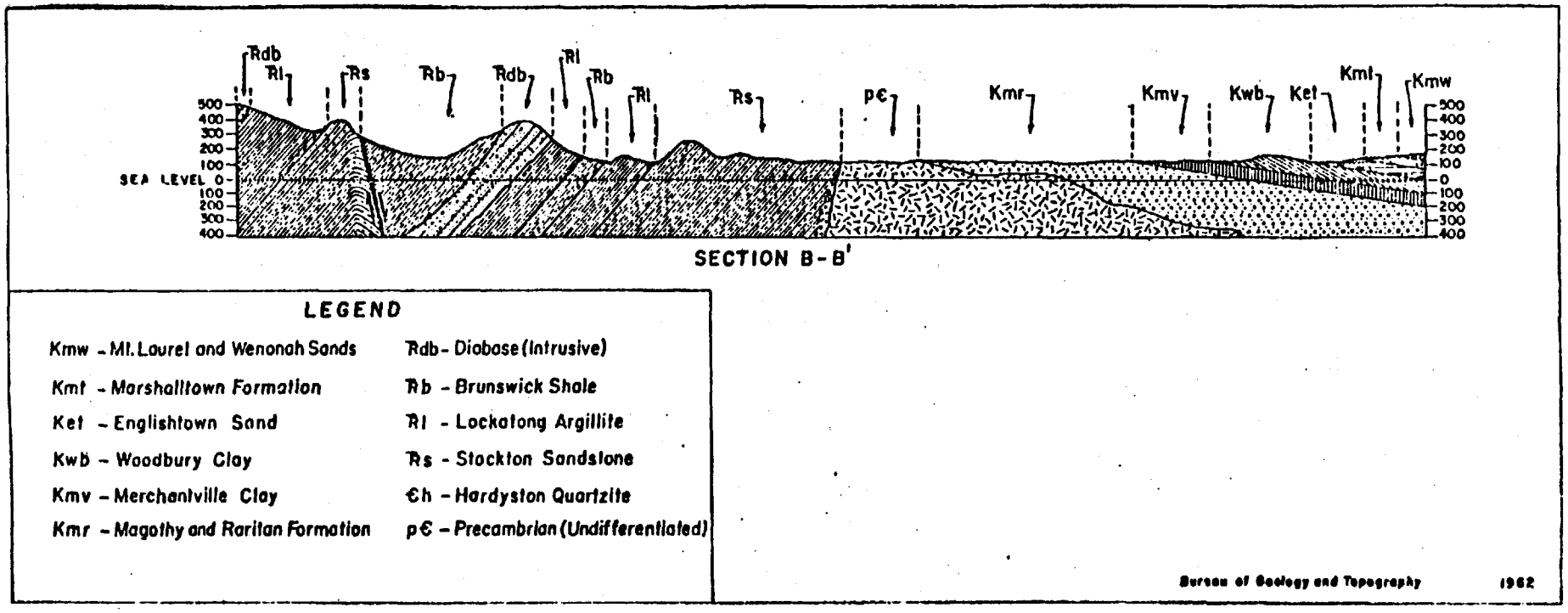
Thin remnants of the Pennsauken Formation appear sporadically over the site (number 3 on Figure 7). These deposits are comprised of unconsolidated gravels and sands with smaller amounts of silt and clays. A variety of parent materials form the sand and pebble-sized particles, including quartz, shale, sandstone, quartzite and other crystalline rocks. The thickness of the Pennsauken varies regionally from zero to ninety feet and is typically found in stream valleys as a thin (a few feet maximum) sequence of gravels through clays. The formation is found on several low promontories on the site and appears to be a few feet thick; they are generally too thin to be considered as load bearing strata.

Colluvium

Along the Millstone River on the western edge of the study area are found deposits of poorly graded sands and silty gravels overlying the Brunswick Formation to estimated depths of 10 feet or greater. The deposits may be classified as reworked glacial outwash and alluvium, however it is possible that they are, at least in part, the remnants of major flood events during the development of the Millstone River. Bearing capacities in this formation are highly variable due to the lack of stratification of the sand and gravel materials. Although it is possible that the expected bearing range is between 1/2 ton and 2 tons per square foot, on-site studies for specific buildings must be obtained before any load bearing capacity can be assigned.

Mineral Resources

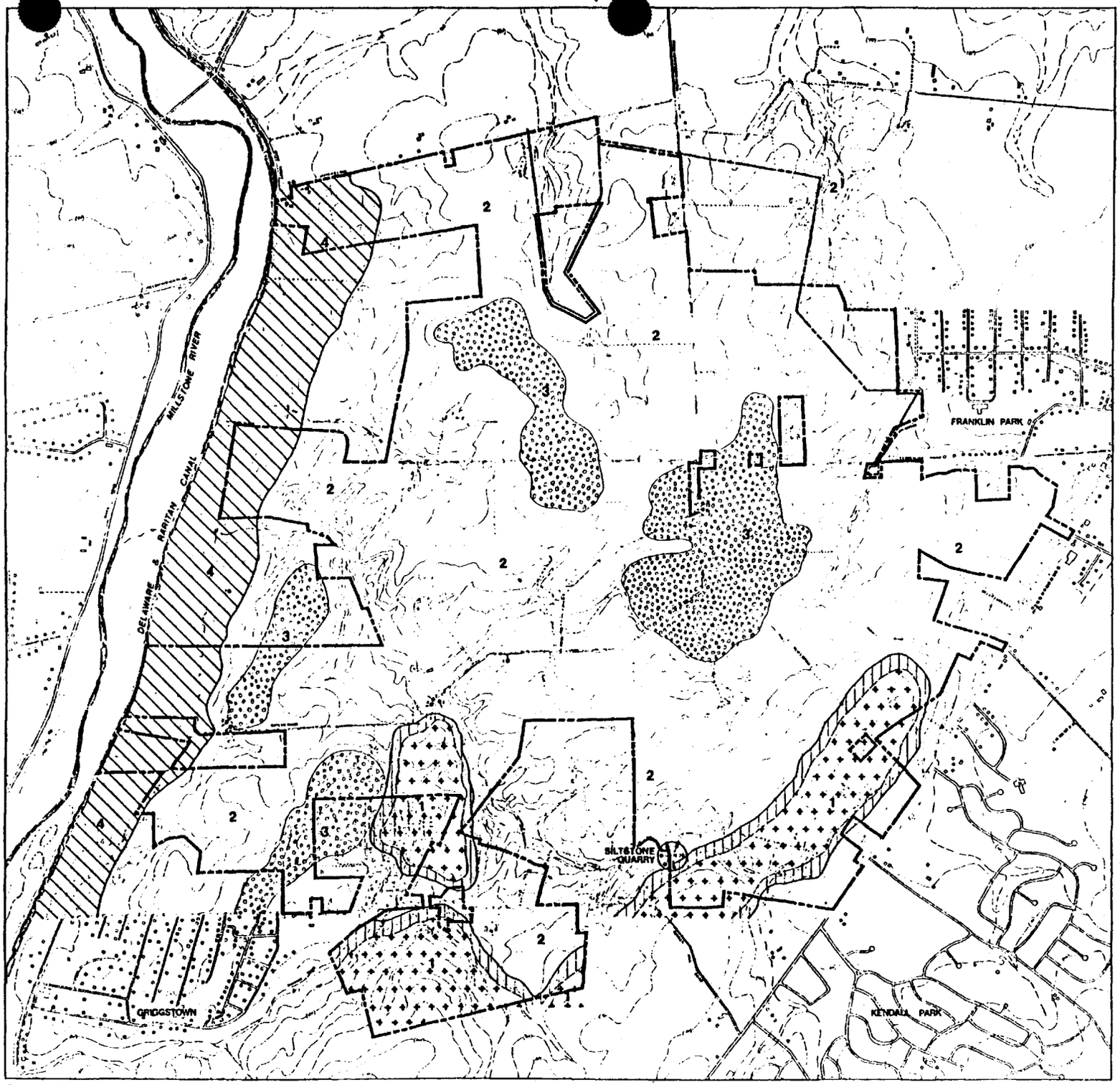
The principal earth resource in the Princeton area is represented in the Triassic diabase dikes. Large volumes of trap rock for road material and concrete aggregate are quarried at Pennington Mountain and at the Mercer County Work House. In Franklin Township, this rock is mined at a quarry near Kingston. In addition, sand and gravel may be taken from borrow pits located in Pennsauken material.



Cross section showing regional stratigraphy (thin mantle of Quarternary sands and gravels not shown)

Source: "Geology of Mercer County in Brief", State of New Jersey Geological Survey, 1963.

FIGURE 6



GEOLOGY

DIABASE: IGNEOUS DIKE WITH BAKED SHALE FRINGE

BRUNSWICK: SEDIMENTARY SANDSTONES, SILTSTONES & SHALES

PENNSAUCKEN: THIN INTERGLACIAL SANDS & GRAVELS

MILLSTONE TERRACES: REMNANTS OF INTERGLACIAL & RECENT ALLUVIUM POSSIBLY IMPORTANT IN MILLSTONE RIVER BANK STORAGE

MATERIAL	WEATHERED ZONE		UNWEATHERED ZONE	
	[illegible]	[illegible]	[illegible]	[illegible]
1 DIABASE	3' - 10'	2	10'	20
2 BRUNSWICK	3' - 8'	2 - 8	8'	10 - 15
3 PENNSAUCKEN	DEPOSIT TOO THIN FOR CONSIDERATION			
4 MILLSTONE TERRACES	NOT RECOMMENDED FOR STRUCTURES WITHOUT SPECIFIC ON SITE TESTING			

SILTSTONE QUARRY

PHOTOGRAPH LOCATION

THE FRANKLIN PROJECT

A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

Wallace McHarg Roberts and Todd

SOURCE: AGES CORP., 1976

FIGURE 7

References

Applied Geotechnical and Environmental Service Corp., A.A. Fungarolli, Ph.D., P.E. "An Evaluation of Subsurface Soil and Rock Conditions, Field Property, Franklin Township, New Jersey" Project 41176, February 23, 1975.

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Registered Engineering Geologist, State of California, No. EG391
Member, American Institute of Engineering Geologists
Member, Association of Engineering Geologists
Fellow, Geological Society of America.

4.2 Subsurface Hydrology

1. The Region

Regional ground water is a resource from two reasons. First, it is used directly from wells for human and industrial consumption. Second, ground water maintains the base flow of streams and is therefore an important part of surface water resources as well. The occurrence and behavior of ground water in the Princeton area changes in accordance with the wide variations in geologic materials. In Triassic deposits fracture systems provide the only storage and ground water conveyance medium in such rocks. Consequently, their ground water value is relatively low. Pleistocene surficial deposits, on the other hand, are comprised of highly permeable sands and gravels -- thus their storage and transport capacities are much higher. Such deposits, however, are of limited and discontinuous extent at the site.

The Brunswick shale supplies small to moderate quantities of ground water and in Mercer County is a moderately important gound water source. The bulk of water in this formation resides in fractured portions of the weathered residium in semi-artesian and water table conditions. This may extend up to depths of 600 feet. Yield results of wells in Mercer County show a range of 8-644 gpm, with an average of 148 gpm, for large diameter wells[1] and 1/2 to 60 gpm with an average of 15 gpm for domestic wells (Figure 8). Ground water from the Brunswick is of generally good quality, notwithstanding exhibited hardness and local concentrations of sulfate, iron, and manganese. A summary of ground water quality data for the Brunswick is indicated in Figure 9, which shows data for selected wells in Mercer County.

Unlike the Brunswick shale, Triassic diabase dikes function poorly as aquifers. This materials's resistance inhibits development of solution channels, hence yields and storage capacity rank quite low. Yields of ten operable wells in Mercer County range from 2 to 21 gpm, with an average of 9 gpm. Most wells, however, have not been successful. Furthermore, poor water quality due to hardness and substantial concentrations of iron and sulfate reduces the potability of even these limited quantities.

The Pleistocene sands and gravels of the Pennsauken infrequently develop thick exposures. Therefore, these deposits yield only small supplies to shallow wells. Where greater thicknesses are realized, however, (e.g., 90 feet in some areas) even irrigation demands may be fulfilled with ground water supplies from this formation. Concentrations of nitrates, iron, manganese, and hardness diminish water quality at some locations. Such permeable materials may act as recharge portals, as well as recent stream channel deposits.

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[1] Industrial wells: 6" - 12" in diameter.

Several wells within the study area are known to be good producers. Preliminary study, however, suggests that these wells may be located in major crack intersections in the Brunswick which are fed from aquifer recharge areas at higher topographic regions outside the site boundaries. Very little opportunity for aquifer recharge occurs at the site due to the sparseness of the Pleistocene deposits and the paucity of deep, permeable soils. In addition, the joint pattern of the Brunswick Formation seems to indicate that water would flow toward the Millstone River, rather than be trapped in cracks.

Along the western portion of the study area, permeable soils overly the terraces of the Millstone, allowing water to percolate freely through these layers and, eventually, to feed the Millstone River and the Delaware and Raritan Canal. It is probable that, during periods of high precipition, when the water level in the River and Canal are high, pressure from these waters causes water in the terraces to be stored. When drought occurs and the water levels in the River and Canal are lowered, the pressure on the terraces is released, allowing water to flow from them into the River and Canal.[2] Although the exact quantities of water involved are unknown, the geology and soils of the terraces may be important in the dynamics of flow in the River and Canal during low precipitation periods, and should therefore be preserved to ensure protection of these waterbodies.

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[2]N. J. Dept. of Enviromental Protection, Division of Water Resoures, Conversation with Ian Walker, Feb. 20, 1976.

BRUNSWICK SHALE

DOMESTIC WELLS

Township	*No. of Wells*	*YIELD IN GALLONS PER MINUTE*			
		Maximum	*Minimum*	*Average*	*Median*
Hopewell	176	60	½	15	10
Princeton	8	30	5	11	8
Lawrence	2	7	5		
All Shale (Mercer Co.)	186	60	½	15	
Montgomery	43	40	3	13	11
Bridgewater					
a. Washington Valley	95	25	8	12	10
b. South of 1st Watchungs	144	35	2	13	12

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INDUSTRIAL WELLS

Township	*No. of Wells*	*YIELD IN GALLONS PER MINUTE*			
		Maximum	*Minimum*	*Average*	*Median*
Hopewell	24	412	8	76	50
Princeton	5	470	88	271	197
Lawrence	..	..	..	..	..
All Shale (Mercer Co.)	29	470	8	110	50
Montgomery	15	296	22	100	106
Bridgewater					
a. Washington Valley	4	(50, 50, 30, 20)			
b. South of 1st Watchungs	46	664	32	183	137

NOTE: Montgomery and Bridgewater Townships are in Somerset County.

Source: Widmer, Kemble "Geology and Ground Water Resources of Mercer County", N.J. Geologic Survey, 1965 pp. 28-29.

FIGURE 8

—Chemical analyses of water from the principal water-bearing formations and major streams in Mercer County, N. J.
(Results, except for pH and specific conductance, in parts per million. Analyzed by the U. S. Geological Survey.)

Well	Date Collected	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue at 180°C)	Hardness as $CaCO_3$: Calcium, magnesium	Hardness as $CaCO_3$: Noncarbonate	Specific conductance (micromhos at 25°C)	pH
PLEISTOCENE DEPOSITS																		
180	10/ 8/58	7.1	0.10	—	38	21	11	64	44	126	22	0.0	123	482	182	146	643	6.5
(a)	9/26/49	7.7	.12	....	2.8	5.9	2.4	3.1	3	2.5	5.0	.0	33	64	31	—	98	5.2
(a)	4/14/58	9.4	.01	0.18	3.2	6.8	9.2	3.3	3	2.9	27	.0	19	121	36	34	155	5.2
211	10/ 8/58	17	.50	.09	14	5.6	8.8	5.0	16	5.0	20	.0	45	165	58	45	202	6.2
ENGLISHTOWN FORMATION																		
204	4/14/58	10	10	0.27	4.0	1.5	2.3	1.7	4	13	4.0	0.3	0.4	42	16	13	66	5.6
RARITAN AND MAGOTHY FORMATIONS																		
144	4/15/58	14	0.03	0.08	19	12	16	3.4	14	47	23	0.0	54	231	97	86	305	6.7
239	9/26/49	7.7	.06	—	1.6	.8	2.7	.9	0	11	2.5	.0	.1	27	7	—	53	4.5
239	4/14/58	8.6	.61	.04	1.2	.2	2.3	.9	0	10	2.8	.0	.2	43	8	8	50	4.3
161	4/14/58	7.9	.07	.10	2.0	.5	2.3	.9	3	.8	3.2	.0	7.4	42	7	5	37	5.5
179	8/20/58	8.4	1.1	.07	5.2	6.8	8.5	3.3	4	.0	21	.0	35	97	41	38	152	5.4
197	9/26/49	9.3	4.1	—	2.2	1.2	2.3	1.0	8	6.2	2.4	.1	.1	27	10	—	38	5.6
198	4/14/58	10	3.5	.08	2.4	.7	2.0	.9	6	6.1	2.6	.1	.4	42	9	4	41	6.9
220	4/14/58	15	6.9	.21	12	3.6	2.3	2.6	54	6.6	3.2	.1	.2	80	45	1	110	6.9
BRUNSWICK SHALE																		
4	4/24/58	23	0.81	0.03	40	20	9.2	1.1	170	29	10	0.1	20	240	182	43	380	7.2
38	9/22/49	24	.20	—	35	17	15	1.4	168	24	11	.2	4.1	209	157	—	357	7.6
42	5/ 1/58	26	.13	.05	38	16	9.2	1.2	162	39	7.6	.1	3.8	215	161	28	344	7.8
30	8/ 7/58	21	.04	.04	56	14	12	1.8	196	38	8.8	.0	11	267	197	37	421	7.4
59	5/ 1/58	20	.04	.07	31	12	20	2.8	164	25	6.0	.1	9.3	215	127	0	332	7.3

Source: Vecchioli, J. and Palmer, M. "Groundwater Resources of Mercer County, N.J.", N.J. Dept. of Conservation and Economic Development Special Report No. 19, 1962.

FIGURE 9

References

1. "Ground Water Management Study of Middlesex County, New Jersey", Middlesex County Planning Board, 1974.

2. Widmer, Kemble "Geology and Ground Water Resources of Mercer County", N. J. Bureau of Geology and Topography, 1965.

3. Widmer, Kemble "The Geology of Mercer County in Brief", N. J. Bureau of Geology and Topography, 1965.

4. Vecchioli, John, and Palmer, Mark M. "Ground Water Resources of Mercer County, N.J.", 1962.

4.3 Soils

a. The Region

The soils in the tri-county area are widely varied in accordance with variations in regional bedrock geology. Soils in ghe Coastal Plain derive from the underlying sands, gravels, and clays of their bedrock. Those soils weathered from the sands and gravels are sandy, coarse-textured, and very well drained. The soils derived from clays are more fine-textured and poorly drained.

In the Piedmont, in which Franklin Township is located, soils are underlain primarily by Triassic shale and diabase, with smaller formations of argillite (baked shale), sandstone, and interglacial sand and gravel deposits.

Triassic Shale Soils

Red shale and siltstone of the Triassic era weather mainly into the Bucks-Penn-Readington soil association. Ranging from moderately deep to shallow, these moderately well-drained soils are found on gently sloping, rolling shale hills. Some Lehigh soils are also found with this assocation. Derived from argillite (baked shale) formations, they exhibit the moderate permeability and poor drainage of some of the shale soils. They are often found in the gently sloping transition zones between the Bucks-Penn-Readington soils and soils of diabase derivation.

Bucks-Penn-Readington soils have generally been used for croplands; steeper slopes, such as those overlying argillite, have remained in pasture. Limitations for development arise primarily from the shallowness of many of the soils to bedrock, causing severe hazard of pollution of ground water contained in rock fractures and faults in the shale to occur if septic tanks are used. Areas of high water table cause an additional limitation to use of septic tanks and also to construction of roads and foundations. In addition, the shale bedrock is often too weak to support some sewerage facility construction.[1] In general, adaptive strategies must be sought in response to these conditions in order for development to occur.

Argillite and Sandstone Soils

Interbedded with the shales and forming a transition between them and the diabase areas are formations of sandstone and argillite (baked shale). Quakertown-Chalfont-Doylestown soils are found overlying this bedrock. These soils are moderately deep to deep and vary in drainage and steepness. In poorly-drained areas they have been left as woodlands or used for hay or pasture. Where better drained, they have been cultivated for crops.

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[1]Franklin Environmental Commission Report, 1975.

Limitations for development on these soils arise primarily from wetness. Poor percolation and varying seasonal high water table cause severe hazards for septic tank utilization and require special construction adaptation for roads and foundations.

Diabase Soils

The Neshaminy-Mount Lucas-Lehigh is the primary soil assocation found overlying diabase bedrock. These soils are generally deep and range from well-drained to poorly drained. They are found on the steeply-sloping diabase ridges and are generally silty and stony in texture with scattered outcrops of the bedrock material. Most of these soils have been retained as woodland because their steep slopes, stoniness and wetness have made development on them costly. In addition, these conditions cause severe limitations for septic tank utilization. Foundation and road construction would also require special adaptive techniques.

Gravel and Sand Soils

Along stream terraces and in open, rolling hill areas are gravel deposits of interglacial or alluvial origin. These formations which overlie the shales, develop the Birdsboro-Tioga soil association. These soils are deep, well-drained, loose-textured loams and sandy loams. They have rapid percolation rates and have traditionally been used as croplands and for well locations. Road and foundation construction is simple in these soils, however, their rapid transmission of water into underlying bedrock can be a severe limitation to use of septic tanks because of ground water and stream pollution hazards. In addition, these soils overlie aquifer recharge areas of gravels and sands and should therefore be sparingly utilized for development purposes. Figure 10 is a diagrammatic cross-section through the region, showing the relationship between geology, soils, and land use, (figure not included, associated table is included).

b. The Site

The study area is covered primarily by soils of the Bucks-Penn-Readington association, derived from rock of the Brunswick Formation. The dominant soils are the Penn silts and shaly silts (5 x 10 B, C-12, 5 x 14 B, C-15) found on most of the rolling uplands of the study area. These soils are moderately erodible, generally less than 3 feet thick from ground surface to bedrock, and have a seasonal high water table of approximately 4 feet (or slightly greater) from ground surface. Because these soils are thin, any development would need to rely on the underlying geology for structural support. Keyport silt (6C20 A 2), Nixon Gravelly Loam (6811, 6818 B, C-12), Norton (5310 B, C-12) and Royce Silt (5910 B, C-12) are deeper shale soils. Nixon, Norton, and Royce have lower seasonal high water table than Keyport and are the most suitable soils for building in the study area. About 1245 acres of these soils occur on the site.

Reaville Silt (5 x 20) and Croton Silt (5 x 30) are found in close association with the Penn soils, but are formed from alluvial materials and generally appear on intermediate elevations between the stream valleys and the uplands. They are deeper than the Penn soils with a depth to bedrock of 3-1/2 to 5 feet, or greater. The Croton Silts are one of only two soils in the study area with an impermeable claypan within 25" of the ground surface, making standing water above them a frequent occurrence. Although in some situations, puncturing of this brittle clay layer permits water to percolate through to more permeable layers, the deeper Croton layers are also slowly permeable, so little percolation would occur even with perforation of the clay layer. Thus, these soils are ideal locations for construction of water-retaining ponds. A band of this soil type stretches along the east side of the western tributary to Six Mile Run, with another area at the headwaters of one tributary to Ten Mile Run. Abbotstown Silt (5020 A, B-12) is the other soil with such a claypan.

Bowmansville Silt (0330 A-12) and Rowland Silt (0320 A-12) are stream alluvial soils found along continuous and intermittent streams. In these areas, depth to bedrock of the silty, moderately permeable soils is generally greater than 4 feet. Water flowing overland towards the streams flows into and is held in these soils during high precipitation periods and emerges from numerous springs and seeps to feed the streams during periods of low rainfall. With much the same dynamics as the terraces along the Millstone River, these soils seem vital to trapping excess runoff during high rainfall periods and in maintaining flow levels in the streams during drought.

Along the terraces of the River, Dunellen Silts (B413, B-12 and B423, A-12) and Birdsboro silt are the permeable soils that allow water to percolate into the underlying sand and gravel geology (Section 4.2). The Dunellen Soils are the deepest in the study area, with depths greater than 10 feet. Seasonal high water table and erodibility are both low. Although these soils would provide few limitations for development, their role in the stream regimen may be critical enough that they should be preserved.

Mount Lucas Silt (T020, B-12), Mount Lucas Very Stony Silt (T0C2, B, C-12), and Neshaminy Silt (T010 B-12) are the three soils found overlying diabase bedrock. All have depth to bedrock of 3 to 5 feet. The former two have depth to seasonal high water table of less than 3 feet, while the Neshaminy Silt has about 4 feet to this ground water level. All these soils are moderately permeable and bouldery, with their silty particles being moderately erodible.

Figure 12 shows a more detailed description of the above mentioned soils, as wells as soils occurring on minor portions of the Field Property.

Agricultural Suitability

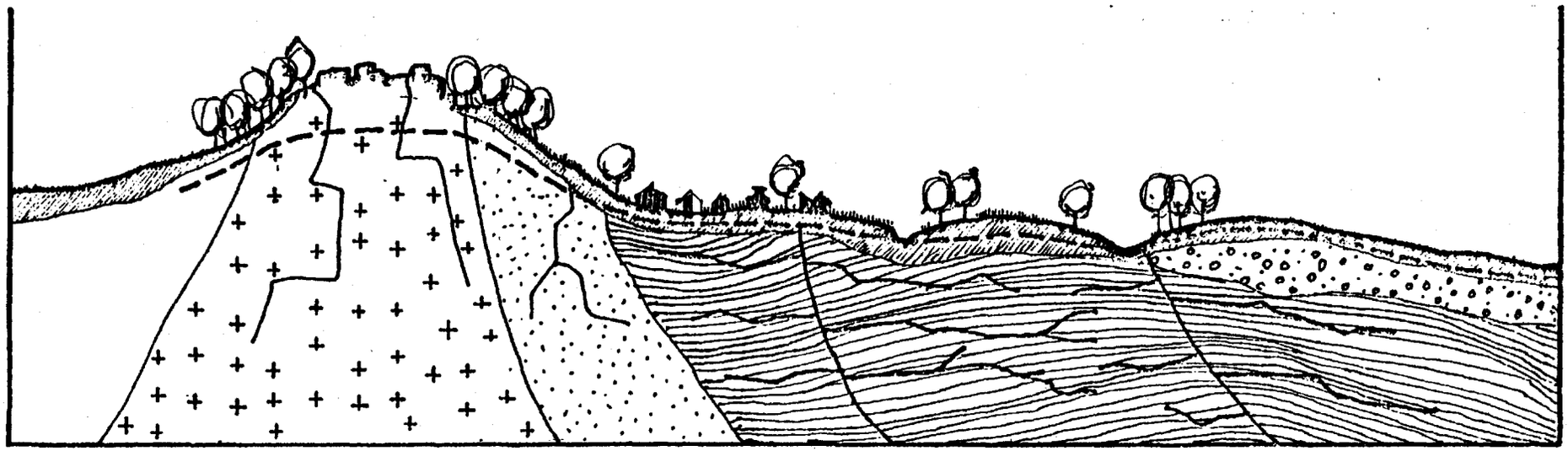
According to the U.S.D.A. Soil Conservation Service, most of these soils fall into agricultural tax assessment categories B and C, (Penn, Reaville, Dundlen) with large areas of A soils (Nixon, Birdsboro, Neshaminy silt) and smaller areas of C and D soils (Rowland silt, Lehigh silt). These letter ratings have been developed by the S.C.S. in accordance with the Farmland Assessment Act of 1964. They reflect combinations of soil fertility, erodibility, and moisture characteristics considered most suitable for agricultural uses.

Development Potential

The map (Figure 12) graphically indicates conditions of depth to bedrock by horizontal lines. The closest lines indicate the shallowest rock. The depth to seasonal high water table is shown by vertical lines, the closest showing the shallowest water table. The lightest areas on the map, therefore, show areas with fewest soils constraints for development, with the darkest areas possessing the highest soil constraints for development, both shallow depth to bedrock and shallow high water table at the same location. The prevalence of either shallow bedrock or shallow seasonal high water table over the majority of the land area makes the consideration of septic tanks at the site impossible, and indicates the need either for a private collection and disposal system or connection into regional off-site disposal facilities.[1] Construction implications of seasonal high water table are discussed further in Section 5.2 a, Structural Capacity.

[1] WMRT, In-house papers to J. W. Field, November 28, 1975.

RELATIONSHIP BETWEEN GEOLOGY, SOILS AND LAND USE



Bedrock Geology	**Diabase Ridge:** Hard, slow weathering; few fractures.	**Argillite (Baked Shale)** side slopes; weathers slowly, few fractures.	**Brunswick Shale:** Soft, weathers easily; weak, many fractures; rolling valleys.	**Sands & Gravels:** Stream terrace and open hills; unconsolidated, many spaces between stones.
Soil Association	**Neshaminy-Mt. Lucas-Lehigh**	**Quakertown-Chalfonte-Doylestown**	**Bucks-Penn-Readington**	**Birdsboro-Tioga**
Soil Characteristics	Silty to loamy texture; often very rocky. Slow percolation. Depth to bedrock may be deep but often with rock outcrops; moderately erodible; steep.	Silty-loamy; sometimes rocky; slopes vary; depth to high water table varies. Bedrock is deep to mod. deep.	Silt-silt loam texture; occasionally rocky; moderate percolation, shallow depth to bedrock; depth to seasonal high water table generally shallow especially in floodplain areas. Moderate erodibility.	Loamy to sandy texture. Very rapid percolation. Soils generally deep; depth to high water table varies; streamside soils floodprone.
Drainage	Slow through soils because of silt. Rapid through fractures.	Slow through silty soil. Rapid through fractures.	Moderate through silty soils. Slow where water table is high.	Extremely rapid percolation. Well-drained sandy soils except in floodplain.
Ground Water	Very little contained in few fractures.	Very little in few fractures.	Moderate quantity contained in fractures and faults.	High quantity of water in many pores between particles.
Existing Land Use	Generally remains in woodland—some development.	Pasture, hayfields, woodland.	Generally used for croplands, now being developed in many areas; floodplain often wooded.	Used almost entirely for cropland and aquifer resource.
Development Implications	High cost because of steep slopes, hard bedrock. No septic tanks because of steep slopes, poor drainage.	High cost results from construction on slopes. Hard bedrock, poor drainage in soils limits septic tanks.	Moderate to high costs; weak shales may not support large sewer systems. Shallow bedrock prohibits septic tanks that could let water into rock fissures resulting in ground water pollution. High water table requires road and foundation adaptation. Ponds easy to construct and fill.	Severe hazard of ground water pollution from septic tanks. No other development hazards but these areas should be preserved for ground water recharge—leave undeveloped.

FIGURE 10

Detailed Description and Soils Occurring on Site

Soil Name	Code	Geologic Parent (Bedrock)	Slope	Erodibility	Hydrologic Group	Depth to Bedrock	Depth to High Water Table	Shrink-Swell Potential	Frost Heave Potential	Clay Pan Present	Pan Depth from Surface	Farm Assessment Group	Foundation Suitability	Septic Suitability	Road Const. Suitability	Drainage	Permeability within 3 feet of Surface
Abbottstown Silt	5020 A-12,B-12	Shale, siltstone, or fine s.s.	0-2% 2-6%	.43	C	3½-5'	½-1½'	Low	High	Yes	15-30'	B	Poor	Poor	Poor	Poor	.2-2.0"/hr. except in claypan
Birdsboro Silt	B-12 or BNID	Stratified sands & gravels	2-6%	.28	B	5'+	3'	Low	Mod.-High	No	–	A	Good (fh)	Mod. (ph)	Mod. (f,fh)	Good	.6-2.0"/hr.
Bowmansville Silt	0330,A-12	Formed from stream alluvium	0-2%	–	D	4'+	0-1'	Low	High	No	–	D	Poor	Poor	Poor	Poor	.2-2.0"/hr.
Croton Silt	5X30,A-12	Shale & s.s. (Argillite)	0-2%	.43	D	3½-5'	0-½'	Low-Mod.	High	Yes	15-25"	C	Poor	Poor	Poor	Poor	.2-0.6"/hr. except in claypan
Dunellen Silt	B413,B-12 B423,A-12	Red shale or sandstone on stream terraces & outwash plains	2-6%	.24	B	10'+	4'+	Low	Mod.	No	–	A	Good	Fair(ph)	Mod. (f)	Good	.6-6.0"/hr.
Keyport Silt	6C20,A-12	Shales & Argillite	0-2%	.43	D	10'+	1½-2½'	Low	High	No	–	B	Fair-Mod.	Poor	Poor	Mod.	<.2"/hr.
Klinesville Shaly Loam	5X14,DE15 D-15	Red shale	12-25% 12-18%	.20	C	1-1½'	3-5+'	Low	High	No	–	D-E D	Poor-Fair	Poor	Poor	Good	2-6.3"/hr.
Lansdowne Silt	5920,A-12 B-12	Shale, s.s., & siltstone	0-2% 2-6%	.43	C	3½-5'+	1-2½'	Low-Mod.	High	No	–	C	Poor	Poor	Poor-Fair	Fair	<.2"/hr.
Lehigh Silt	5720,B-12 C-12	Dark shale & sandstone	2-6% 6-12%	.43 (-.37)	C	3½-5'+	½-2'	Low-Mod.	High	No	–	C	Poor	Poor	Poor	Poor	.2-2.0' /hr.
Mount Lucas-Watchung, Very Stony Silt	TOCZ, B-C12	Diabase	2-6% 6-12%	.32	C	3-5'+ boulders	½-2½'	Low-Mod.	High	No	–	D	Poor-Fair	Poor	Poor	Fair-Mod.	.2-2.0"/hr
Mount Lucas Silt	T020,A-12 B-12 C-12	Diabase	0-2% 2-6% 6-12%	.32	C	3-5'	½-2½'	Low-Mod.	High	No	–	B	Poor-Fair	Poor-Fair	Poor-Fair	Fair-Mod.	2-2.0 '/hr.
Neshaminy Silt	T010,B-12 T017	Diabase	2-6%	.32	B	3½-4½'	4'	Low-Mod.	Low	No	–	A		Mod.	Mod.	Mod.	.6-2.0"/hr.
Nixon Gravelly	6811,B-12 C-12(1) 6818,B-12 C-12	Red siltstone or shale	2-6% 6-12% 2-6% 6-12%	.28	B	6'+	4'+	Low-Mod.	Mod.	No	–	A B A B	Mod-Good	Fair-Poor	Mod.	Good	.6-6.0"/hr.
Norton	5310,BC-12		2-6% 6-12%	.32	C	4-10'	5'+	Low-Mod.	High	No		A,B	Mod.	Poor	Mod.	Mod.-Good	.2-2.0 '/hr.
Penn Shaly Silt	5X14,B-15 C-15	Shale or Sandstone	2-6% 6-12%	.32	C	1½-3'	4'+	Low	Mod.	No	–	B	Fair-Poor	Poor	Fair	Good	.6-6.0"/hr.

Continued

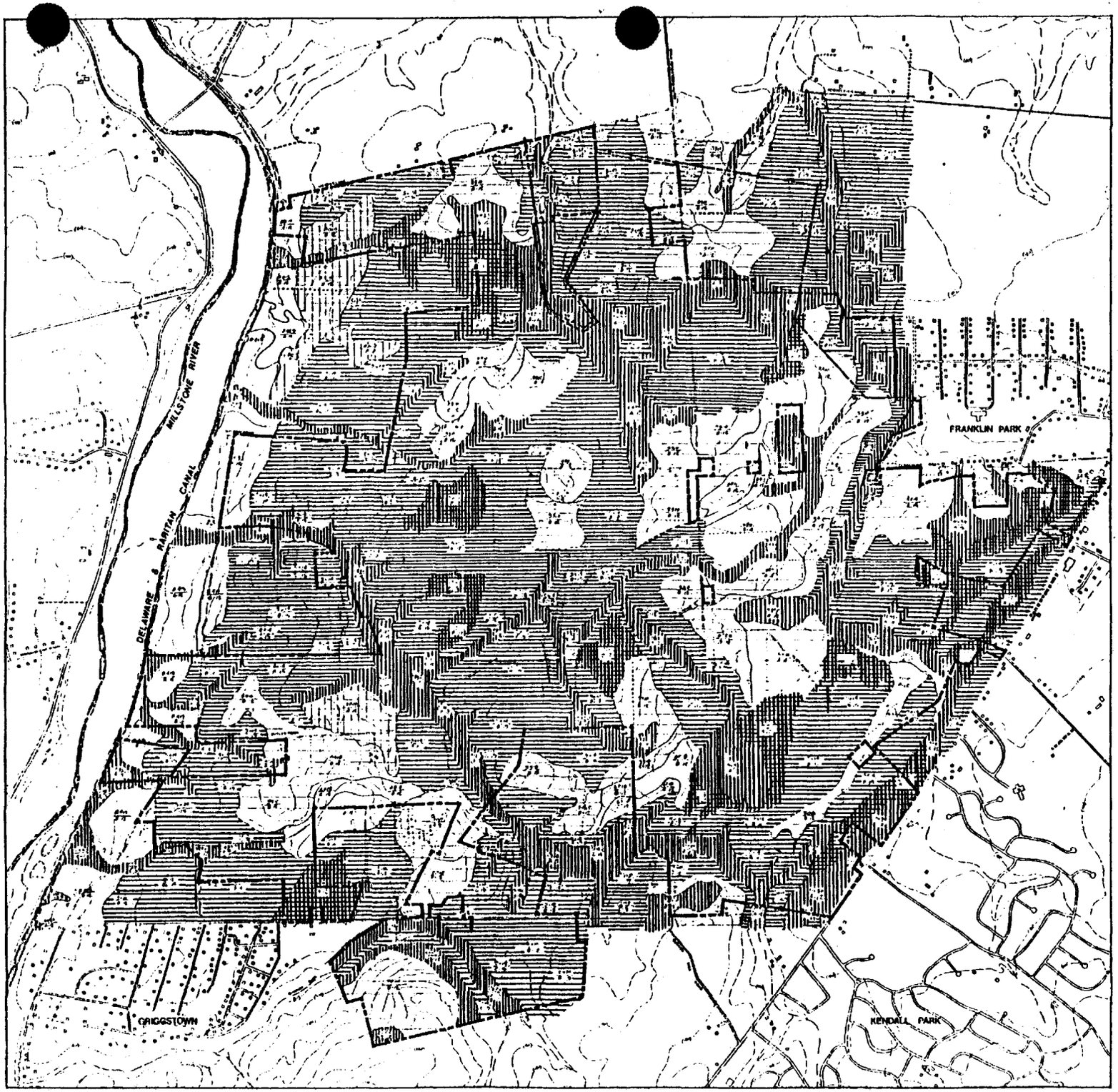
FIGURE 11

Detailed Description and Soils Occurring on Site (continued)

Soil Name	Code	Geologic Parent (Bedrock)	Slope	Erodibility	Hydrologic Group	Depth to Bedrock	Depth to High Water Table	Shrink-Swell Potential	Frost Heave Potential	Clay Pan Present	Pan Depth from Surface	Farm Assessment Group	Foundation Suitability	Septic Suitability	Road Const. Suitability	Drainage	Permeability within 3 feet of Surface
Penn Silt	5X10,A-12 B-12 C-12(3)	Shale or sandstone	0-2% 2-6% 6-12%	.32	C	1½-3'	4'+	Low	Mod.	No	—	B	Fair-Poor (db)	Poor (ph in rock fissures)	Fair	Good	.6-6.0"/hr.
Raritan Silt stream terraces	B120,A-12 D-12		0-2% 12-18%	.43	C	5'+	1-2'	Low-Mod.	High	Yes	20-30"	B	Fair-Poor	Poor (dhw)	Poor (f,dhw)	Fair	.2-6.0"/hr.
Reaville Silt	5X20,A-12 B-12	Shale and siltstone	0-2% 2-6%	.43	C	1½-3½'	1-2'	Low	High	No	—	C	Fair-Poor	Poor (db,dhw)	Poor (f)	Fair	.2-2.0"/hr.
Rowland Silt	0320,A-12	Red and gray shale alluvium on floodplains	0-2%	.43	C	4'	1½-2½'	Low-Mod.	High	No	—	D	Poor (fh)	Poor (fh)	Poor	Poor	.2-2.0 '/hr.
Royce Silt	5910,B-12 C-12 5911,B-12	Red shale	2-6% 6-12% 2-6%	.32	B	3½-5'+	6'+	Low	High	No	—	A B A	Mod.-Good	Varies (db,perc)	Mod. (f)	Good	.6-2.0 '/hr.

"K" Erodibility categories—sheet erosion from bare soil
.17 .20 .24 .28 .32 .37 .43 .49
least ⟶ most

s.s. — sandstone



SOURCE: U.S.D.A. CONSERVATION SERVICE, SOMERSET COUNTY, N.J. 1956

MAP EXISTS AT A SCALE OF 1" = 500'

SOILS

	DEPTH TO SEASONAL HIGH WATER TABLE			DEPTH TO BEDROCK		
	0-2'	2'-4'	4'+	0-3'	3'-5'	5'+
6811			●			●
6818						
8413			●			●
8423						
6C21			●			●
5310			●		●	
5910			●		●	
5911						
5x14D E			●	●		
5x14B C			●	●		
5x10			●	●		
8010		●			●	
BN10						
5020	●				●	
0320	●				●	
0330	●				●	
5x30	●				●	
5920	●				●	
5720	●				●	
T020	●				●	
T010			●		●	
T017						
8120	●				●	
5x20	●			●		
TCCZ B,C	●				●	

THE FRANKLIN PROJECT

A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

Wallace McHarg Roberts and Todd

FIGURE 12

References

U.S.D.A. Soil Conservation Service, "Soil Survey of Mercer County, New Jersey", 1972.

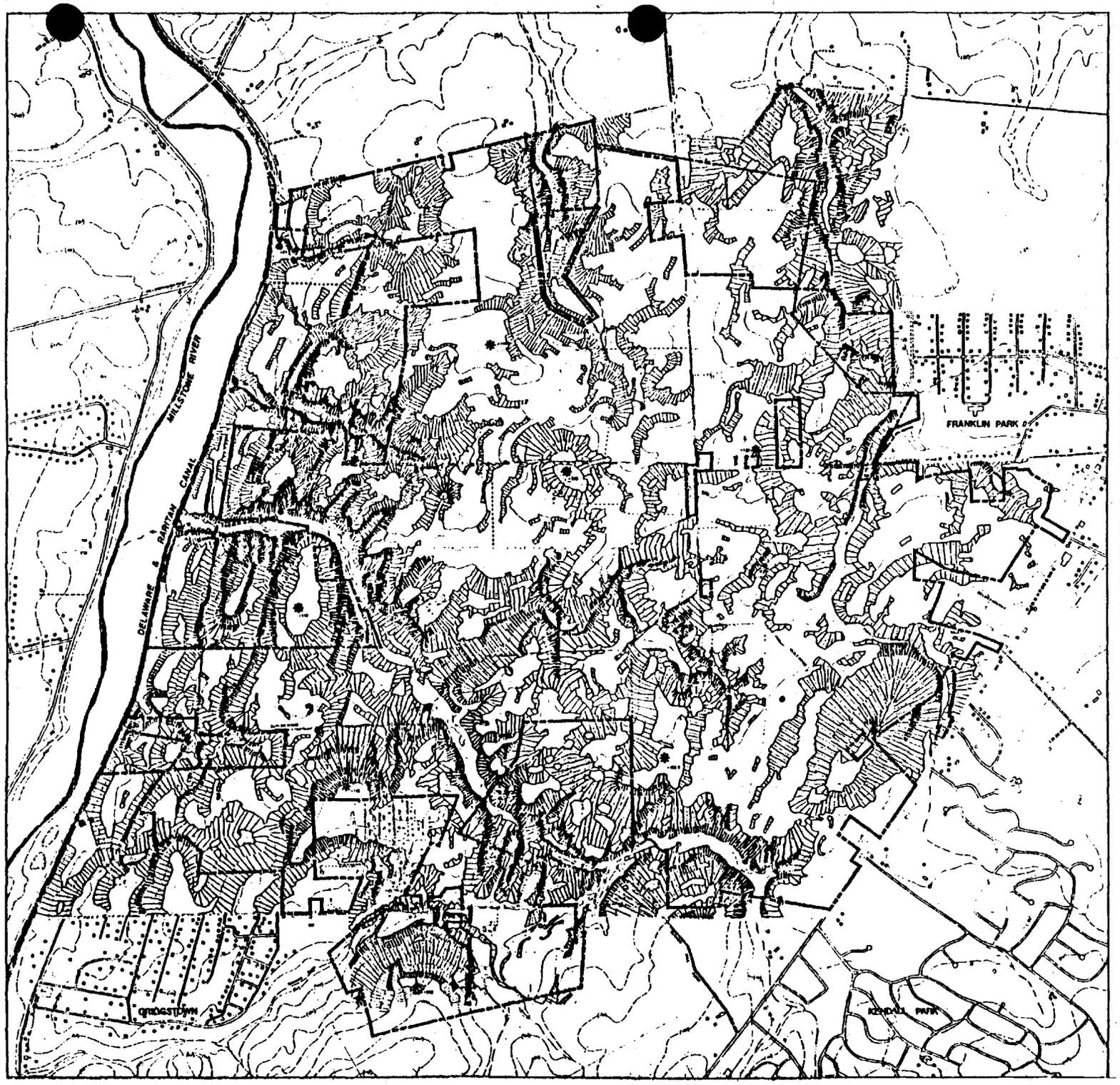
U.S.D.A. Soil Conservation Service, "Soil Resource Map Booklet", advance copy, subject to change, no date given.

4.4 Topography

The study area consists mainly of gently rolling hills ranging from a low elevation of 34 feet to a high elevation of about 220 feet. The highest point is the top of the steeply sloping ridge which dominates the landscape south of Bunker Hill Road. Side slopes of this ridge range from 8% to 15% in grade, with smaller areas of slopes as high as 25%. The major portion of the study area is made up of rolling lands about 100 feet to 180 feet above sea level. Slopes over much of this area are 3% to 8%, with flat areas, less than 3% in slope, occurring as small mounds or promontories scattered over the site.

Steep slopes, about 8% to 15% or greater, form side walls along most of the streams in the area with flat valley floors, less than 3% in slope, between them. The lowest elevation, about 34 feet above sea level, is found at the mouth of Ten Mile Run as it crosses under the Delaware and Raritan Canal to enter the Millstone River.

The topography map (Figure 9) shows steepest slopes in the darkest areas and least slopes in the lightest areas. A black dot indicates low points, while the star indicates high points.



TOPOGRAPHY

SLOPES

- 0-3%
- 3-8%
- 8-15%
- › 15%

ELEVATION

- LOW POINT
- HIGH POINT

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SOURCE: WMRT, 1976

MAP EXISTS AT A SCALE OF 1" = 500'

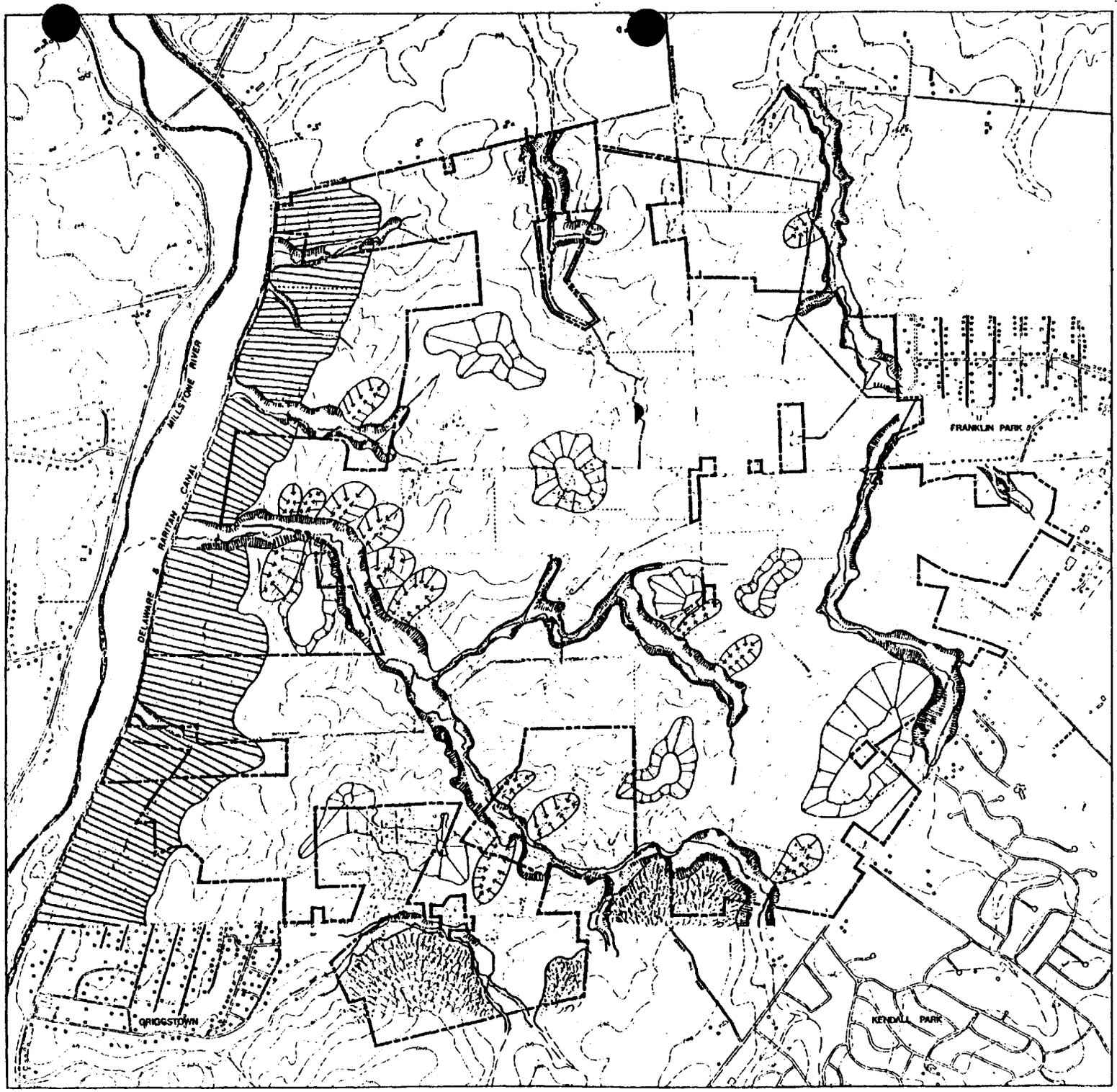
FIGURE 13

4.5 Landform

In order to establish a readily understandable organization of various portions of the study area, landforms easily perceivable in their grossest sense were delineated. Six landforms revealed themselves after initial scrutiny of the topography map and a preliminary site visit. The Knoll, rising up at the southern part of the site is a distinct, rounded, hill with side slopes of 8% to 15% or greater. The Gently Rolling Uplands consist of rolling lands, generally of 0 - 8% in slope (with a few areas sloping as much as 15%) and are occasionally accented by Low Promontories, the tops of which have 0 - 3% slope, and the sides, all sloping away from the top, have generally about 3 - 8% slope. These low knobs can easily be identified on the topography map, although on the land they appear only subtly.

Stream corridors dissect these uplands, their side walls mostly formed by 15% slopes and the valley floors usually less than 3%. A few major swales and intermittent tributaries to the streams are surrounded by discrete bowls or enclosed valleys, having side walls that generally range from 8 - 15% in slope. Visual privacy is virtually total within these enclosed valleys and their location can be easily identified both from within the landscape and on the map (Figure 10).

Finally, the terraces of the Millstone River stream corridor may also be easily discriminated. The landform is severed by a narrow band of 8 to 15% slopes that forms the top of the terraces and blocks the view past them from Canal Road. The Millstone Terraces are oriented almost completely toward the Canal and the Millstone River. (A more detailed diagram of these landforms is found in Figure 11.)



LANDFORM

- MILLSTONE RIVER TERRACES
- STREAM CORRIDOR
- ENCLOSED VALLEY
- LOW PROMONTORY
- GENTLY ROLLING UPLANDS
- KNOLL

THE FRANKLIN PROJECT

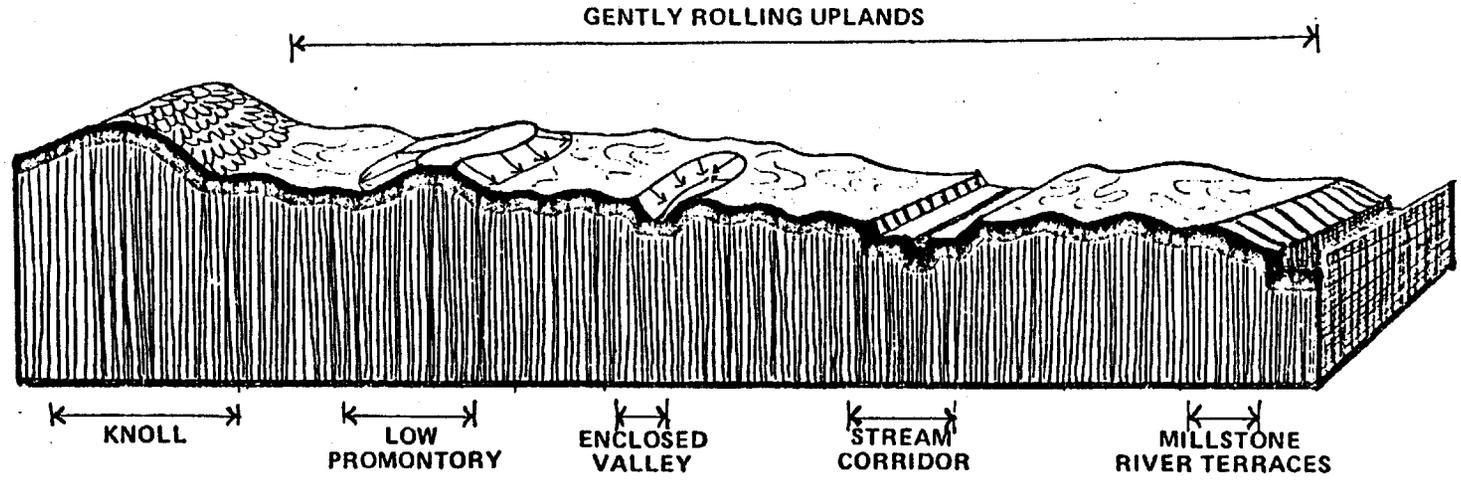
A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

Wallace McHarg Roberts and Todd

SOURCE: IMMRT, 1976

MAP EXISTS AT A SCALE OF 1" = 500'

FIGURE 14



LANDFORM: IDEALIZED SECTION
Not to Scale

FIGURE 15

4.6 Surface Hydrology

a. The Region

The Raritan River Basin is the regional watershed within which the site is located. The basin drains an area 1,100 square miles in size, most of which is in Somerset and Middlesex Counties with some portions in Mercer, Monmouth, Hunterdon, and Morris Counties. The surface waters within the Basin provide for the domestic and industrial needs of much of Central New Jersey's population.

The Raritan River flows northwest to southeast through New Jersey. It is fed primarily by the South River, the Millstone River, the Stony Brook, and the Neshanic River from the south, and by the Green Brook and the North and South Branches of the Raritan River from the north.

Reservoirs

Within the South Branch Raritan River Basin, in Hunterdon County, are located the Round Valley and Spruce Run Reservoirs. These reservoirs provide some water for consumption, although their primary function is to "stockpile" unused flood waters which may then be used to augment stream flow in the northern sector of the Raritan River Basin during low-flow periods. The Round Valley Reservoir covers 2,350 acres. Since its drainage areas only covers 5.7 square miles, water for storage must be pumped to the facility from the South Branch Raritan River at Hamden. The reservoir's capacity of 55 billion gallons will have an annual yield of 70 mgd. Although Spruce Run Reservoir is out of the study area, it is mentioned because of its importance in maintaining stream-flow at downstream locations. Spruce Run Reservoir has a capacity of 11 billion gallons and an annual yield of 20 mgd. The watershed of this reservoir is 41 square miles and the resultant water body covers 1,290 acres.

Several other reservoir sites have been proposed by the state to provide water for consumption. A decision on most of the sites is pending reassessment of water needs by several counties. Meyers Road, along the Passaic River, would provide flood control and would have 38 mgd for low-flow augmentation. This facility, along with Ravine Lake Reservoir, (also planned for low-flow augmentation), would be located in the northern portion of Somerset County. Confluence Reservoir, to be used for purposes of storage of winter water excesses to be pumped to Round Valley for later release, would be located in the western part of Somerset County. Six Mile Run, just north of the Field Property Site, would also be used to supplement streamflow during low-flow periods. The proposed Crab Island Reservoir, in Middlesex County at the confluence of the South River and the Raritan River, would transform the lower Raritan (of which 14 miles above the river mouth is tidal) into a fresh water pool, making 98 mgd

available for industrial and domestic use in the lower Raritan Basin. (The status of Crab Island is indefinite pending two water management studies in Middlesex County.)

Flooding in the Region

Historically, flooding has occurred in the Raritan Basin during all times of the year, with major floods having occurred during late summer to early fall and during early spring. Figures 16 and 17 show maximum known discharges for Raritan River Basin streams from 1903 to 1971.

The State of New Jersey has delineated Floodway and Flood Hazard areas throughout the Basin. The Flood Hazard area is composed of the Floodway and the Flood Fringe. The Floodway is a high energy zone, carrying the greatest depths and velocities of water during inundation. The Flood Fringe is inundated to a lesser degree and is a lower energy zone. With development of floodplain areas, the waterway is reduced, flow is often obstructed, and runoff speeds increase with increased paved area. The result is that flood potential is increased as are quantity and velocity of flood waters. Use of Floodway areas is therefore regulated by the state under NJSA 58:1-26 and 27. According to the state, the Flood Fringe areas are regulated by each individual municipality "by adoption of rules and regulations which at least conform with minimum standards promulgated by the Department of Environmental Protection".[1] These laws contain permitted land uses within the floodplain. In addition, state laws also encompass stream encroachment guidelines. (See Addendum: New Jersey Floodplain Regulations.)

2. Franklin Township

The Millstone River and the Delaware and Raritan Canal are the major water bodies within the boundaries of Franklin Township. The Millstone River, the longest tributary of the Raritan, forms the Township's western border as it flows from Ely, New Jersey, northward, joining the Raritan River at Manville. From this junction, the Raritan forms the northern border of the Township. Over two-thirds of Franklin lies within the 285.2 square mile watershed of the Millstone River, with the remainder within a subwatershed of the Raritan. Simonson Brook, Ten Mile Run, and Six Mile Run are the major streams in the Township. Other smaller waterways occur, draining east to west into the Millstone and south to north into the Raritan. The watersheds of all these streams fall within Township boundaries, except for small portions of the Six Mill Run and Ten Mile Run drainage areas.

Six major floods have been measured at U.S.G.S. gaging stations at Blackwells Mills and at Kingston: in July 1938, September 1938, June 1946, December 1948, March 1967, and August 1971. Hurricane Doria was the cause of the 1971 floods, with water levels 3.4 feet higher than the previous flood of record (September 1936).

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[1] State of New Jersey D.E.P., Division of Water Resources, Resolution re: "Delineation of the Floodway and Flood Hazard Areas Along the Millstone River and Rocky Brook...", Adopted by the Water Policy and Supply Council, June 18, 1973.

Because of extremely high flood damages sustained in the Raritan watershed, several townships, among them Franklin, have become participants in the National Flood Insurance Emergency Program. It should be noted that Federal Insurance Administration Preliminary Flood Hazard and Boundary Maps are not always in accordance with the State's Delineation of Flood Hazard Areas. The U.S.G.S. is now doing a detailed flood hazard study of Franklin Township which will override the existing H.U.D. map of Flood Hazard Areas, however this information will not be ready before March 1976.[1] The State says the existing H.U.D. maps are too general to be used in land planning. In member townships, however, although regulation of Floodway and Flood Fringe areas are strong land use control tools, the H.U.D. program is also a strong determinant of land use. Within the Federal Insurance Administration Flood Hazard Boundaries no construction of any sort will receive any Federal Aid (including mortgages) unless flood insurance is purchased.[2]

The design flood profile adopted by the Division of Water Resources for the Millstone River "Flood Hazard Area" is that of the August 1971 record flood. In addition, the Division adopted a level of one foot below this profile as the design "Floodway" profile. At the Millstone River junction with the Raritan, this Floodway has an elevation of 39.0 feet above mean sea level, or about 14' above the normal water level at 25' above mean sea level. At the junction with Six Mile Run the normal water level elevation of 29' above sea level is increased by 16' to elevation 45' for the design Floodway and by 17' to about elevation 46' for the design Flood Hazard Area. Under these circumstances, the Delaware and Raritan Canal is always inundated within the Flood Hazard Area.

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[1]U.S.G.S. Franklin Township Flood Hazard Study, Bob Schopp by telephone conversation, October 23, 1975.

[2]New Jersey Department of Environmental Protection, Division of Water Resources; Clark Gillman by telephone conversation, October 16, 1975.

	Normal Water Elevation	Design Floodway Elevation	Design Flood Hazard Elevation	Flood Hazard Increases
Millstone/Raritan Junction	+25'	39'	41'	16'
Millstone/Six Mile Run Junction	+29'	45'	46'	17'
Millstone/Ten Mile Run Junction	+31'	46'	47'	16'
Millstone/Beden Brook Junction	+34'	49'	51'	17'

b. The Site

Several streams drain the site including Simonson Brook, Ten Mile Run, and tributaries to Six Mile Run. These flow to the northwest, passing under the Delaware and Raritan Canal forming the western site boundary, and discharging into the Millstone River.

A small portion of Simonson Brook passes through the site at the foot of the diabase knoll south of Bunker Hill Road. Much of Ten Mile Run and one of its main tributaries flow through the study area in a northwestern direction. Two tributaries of Six Mile Run, proposed by the State of New Jersey as part of the Six Mile Run Reservoir, flow due north and also are within the study area, although the main channel of Six Mile Run is not. Several intermittent tributaries of these continuous streams are also present on the site. A few small ponds, generally about one acre in size, are also found. These are man-made waterbodies, usually adjacent to the streams or in areas of high water table.

The property's streams are among its aesthetic assets, the stream corridors naturally forming wooded separations between unvegetated upland areas. In addition, they provide ecological and visual variety with their rich vegetation, populations of songbirds and waterfowl, and calmly flowing waters. Because the streams meander through much of the site, they could effectively be used as structuring elements for a recreation system against which other land uses could be set in developing the property.

The condition of the area's streams is, in several cases, degraded, both visually and ecologically. In wooded areas, dense vines and brambles encrust the trees, the evidence of flood episodes made more severe by urbanization upstream and debris in the channels themselves. Such conditions were noticed along Simonson Brook and a few locations along Ten Mile Run. Where vegetation is less dense, the channels show signs of severe bank scouring with tree roots being undercut at many locations, particularly along Ten Mile Run. In areas where vegetation has been cleared by man to provide open views of the streams, bank slumping, erosion, and increased sedimentation into the streams occurs. Such a situation may be seen looking south from Jacques Lane along Six Mile Run. Disturbance of streamside soils in such a manner may further add to stream degradation by increasing runoff during high precipitation, and thus reducing possible percolation for bank storage of water to be released into the streams during drier periods. (Refer to Section 4.2 for more detail regarding this system.) Turbidity of the streams resulting from agriculture and urban runoff is also high, with sediment loads so high during even 10 year frequency storms that fish kills have been experienced in some of the streams.

After one such storm, the sediment load in Six Mile Run alone was over 15 tons.[1] In the Millstone River similar conditions prevail. In addition, dissolved oxygen levels and nutrient levels are inadequate to meet New Jersey's water quality standards for these streams. All the streams in the study area are classed SW2, potable water. Since they fall below SW_2 standards, any development or other land use action will need to include demonstration of improving or meeting the existing water quality levels of the stream. For this reason, the State is unwilling to issue permits for dumping of package plant sewage effluent into any of these streams until their existing quality is improved.[2,3] Recent specific information on the existing quality of the Millstone River was not available at the time of this study, however, partial records were available (Figure 18).[4] Because of the State's policy and local interest in improving stream quality, every possible precaution should be taken in any future urban development to ensure that these objectives will be met.

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[1]Tom Tuffey, Rutgers University, U.S.D.I. Office of Water Resources Technology - Urbanization and Runoff Control in the Six Mile Run Watershed; Telephone conversation, March 12, 1976.

[2]WMRT: In-house reports to J.W. Field, November 28, 1975.

[3]Telephone conversation with Russ Nerlich, N.J. Dept. of Environmental Protection, Division of Water Resources, March 11, 1976.

[4]Water Resources Data for N.J., part 2. Water Quality Records, U.S.D.I., Geologic Survey, 1972, p. 107.

Careful management during and after development could make the streams on the site as attractive and ecologically healthy as possible. Standards for environmental protection should be established during development planning phases and should include stream protection. Techniques to control surface runoff and sedimentation, such as small check dams, sedimentation basins, strategically placed vegetation buffers, and protection of eroded streambanks with rip-rap are among those which should be employed. Reduction of flood levels, particularly after urbanization, reduction of stream turbidity, and control of bank erosion could then be accomplished. Thus the beauty and health of the streams would be enhanced, and the waterbodies would serve as a great amenity to the site.

The study area encompasses parts of the watersheds of Simonson Brook, Ten Mile Run, and Six Mile Run. The divides of these watersheds fall on the low promontories, identified earlier (Section 4.4 and 4.5) as high points of the site and are shown as heavy lines on the map (Figure 19). Watersheds of tributaries and subdrainage basins of intermittent streams are also shown. In all, 118 distinct watersheds have been defined (Figure 20) in order to determine existing and potential runoff characteristics in the study area.

Although none of the Field Property occurs within the Floodway or Flood Hazard Area of the Millstone River, large portions fall within the Federal Insurance Administration's Flood Hazard Boundaries.

Very little data is available regarding flood patterns of the Millstone River tributaries. Along the Millstone itself, however, refined flood data indicates that the flood hazard increase is about 16' at Ten Mile Run and 17' at Six Mile Run.[1] Although flood levels have been recorded for these junctions, no specific flood levels will be available for the upper reaches of these streams until completion of the U.S.G.S., H.U.D. study.[2]

Deposits of alluvial soils such as the Abbotstown and Bowmansville Silts and the Rowland Silts (Section 4.2) provide a clear indication of the most likely flood prone areas, and are therefore indicated as possible floodplain locations on the map (Figure 19). Because of their importance in maintaining stream flow patterns, the Millstone River Terraces have also been delineated on the above mentioned map.

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[1]State of New Jersey D.E.P., Division of Water Resources, "Flood Hazard Report No. 12: The Millstone River and Rocky Brook, 1973.

[2]Bob Schopp, New Jersey U.S.G.S., by telephone on October 23, 1975.

Six Mile Run Reservoir is a water storage facility to be created by damming of Six Mile Run at Canal Road in Franklin Township. Approximately 16.5 square miles of land, including all but a small portion of the Field Property, make up the watershed of this stream.

RECORDED MAXIMUM KNOWN DISCHARGES FOR REGULAR GAGING STATIONS IN RARITAN RIVER BASIN

Station Name	Station Number	Period of Record	Date of Maximum Discharge	D.A. sq.mi.	Maximum Known Discharge c.f.s.
South Branch Raritan River near High Bridge, N.J.	01396500	1918-	March 15, 1940	65.30	5,160
Spruce Run at Clinton, N.J.	01396800	1959-	April 2, 1970	41.30	6,410
South Branch Raritan River at Stanton, N.J.	01397000	1903-1906 1919-	Aug. 19, 1955	147.00	18,000
Walnut Brook near Flemington, N.J.	01397500	1936-1961	July 18, 1945	2.24	645
Neshanic River at Reaville, N.J.	01398000	1930-	Aug. 28, 1971	25.70	16,000*
North Branch Raritan River near Far Hills, N.J.	01398500	1921-	Aug. 28, 1971	26.20	6,390(a)
Lamington (Black) River near Pottersville, N.J.	01399500	1921-	Aug. 28, 1971	32.80	2,700*
North Branch Raritan near Raritan (at Milltown), N.J.	01400000	1923-	Aug. 28, 1971	190.00	24,900*
Raritan River at Manville (Finderne), N.J.	01400500	1903-1907(b) 1908-1915(c) 1921-	Sept. 22, 1933	490.00	36,100
Millstone River at Plainsboro, N.J.	01400730	1964-	Aug. 28, 1971	65.80	3,780*
Baldwin Creek at Baldwin Lake, near Pennington, N.J.	01400932	1962-1970	March 7, 1967	2.52	336*
Honey Branch near Pennington, N.J.	01400953	1967-	Sept. 3, 1969	0.70	721
Stony Brook at Princeton, N.J.	01401000	1953-	Aug. 28, 1971	44.50	9,000*
Lake Carnegie at Princeton, N.J.	01401300	1924-	Aug. 28, 1971	159.00	13,000(c)(e)
Millstone River near Kingston, N.J.	01401500	1933-1949	Sept. 21, 1938	171.00	9,820
Millstone River at Blackwells Mills (Millstone), N.J.	01402000	1903-1904(c) 1921-	Aug. 29, 1971	258.00	22,200*
Royce Brook tributary at Frankfort, N.J.	01402590	1968-	July 20, 1970	0.29	122
Royce Brook tributary near Bell Meade, N.J.	01402600	1966-	Aug. 28, 1971	1.20	1,450
Raritan River at Bound Brook, N.J.	01403000	1903-1909 1944-1966	Oct. 10, 1903 Sept. 21, 1938	800.00 779.00	32,100 18,300
Raritan River below Calco Dam at Bound Brook, N.J.	01403060	1966- (d)	Aug. 28, 1971	785.00	46,100*
Green Brook at Plainfield, N.J.	01403500	1938-	July 23, 1938	9.75	2,890
Lawrence Brook at Patricks Corner, N.J.	01404500	1922-1926	April 7, 1924	29.00	1,370
Lawrence Brook at Farrington Dam, N.J.	01405000	1927-	Aug. 28, 1971	34.40	2,980*
Matchaponix Brook at Spotswood, N.J.	01405300	1957-1967	Sept. 13, 1960	43.90	2,050
Manalapan Brook at Spotswood, N.J.	01405400	1957-	May 30, 1963	40.70	1,650
South River at Old Bridge, N.J.	01405500	1939-	Aug. 28, 1971	94.60	4,880
Deep Run near Browntown, N.J.	01406000	1932-1940	Sept. 21, 1938	8.07	1,240
Tennent Brook near Browntown, N.J.	01406500	1932-1941	Sept. 21, 1938	5.25	177

* Provisional U.S.G.S. data subject to revision
(a) Discharge of about 7,000 c.f.s. from Flood Mark occurred July 23, 1919
(b) Published as "at Finderne"
(c) Gage heights only
(d) Prior to October 1966 published as Raritan River at Bound Brook (see 01403000)
(e) No historical summary available, discharge computed only for "Doria"

FIGURE 16

RECORDED MAXIMUM KNOWN DISCHARGES FOR CREST STAGE PARTIAL RECORD STATIONS IN RARITAN RIVER BASIN

Station Name	Station Number	Period of Record	Date Maximum Discharge	D.A. sq.mi.	Maximum Known Discharge c.f.s.
Walnut Brook near Flemington, N.J.	01397500	1963-	Aug. 28, 1971	2.24	1,570
Woodsville Brook at Woodsville, N.J.	01400850	1957-1958 1964-	Aug. 28, 1971	1.78	1,560*
Stony Brook at Glenmoore, N.J.	01400900	1957-	Aug. 28, 1971	17.00	**
Baldwin Creek at Pennington, N.J.	01400930	1957; 1960-	Aug. 28, 1971	1.99	1,220*
Stony Brook at Pennington, N.J.	01400947	1965-	Aug. 28, 1971	26.50	**
Hart Brook near Pennington, N.J.	01400950	1968-1970	Dec. 11, 1969	0.80	**
Honey Branch near Pennington, N.J.	01400953	1966	Feb. 13, 1966	0.70	**
Honey Branch near Mount Rose, N.J.	01400960	1968-	Aug. 28, 1971	1.50	**
Honey Branch near Rosedale, N.J.	01400970	1967-	Aug. 28, 1971	3.83	**
Duck Pond Run at Clarksville, N.J.	01401200	1965-	Aug. 28, 1971	5.21	402
Beden Brook near Hopewell, N.J.	01401520	1967-	Aug. 28, 1971	6.07	7,240
Rock Brook near Blawenburg, N.J.	01401595	1967-	Aug. 28, 1971	9.03	3,960
Beden Brook near Rocky Hill, N.J.	01401600	1967-	Aug. 28, 1971	27.60	12,100
Six Mile Run near Middlebush, N.J.	01401870	1966-	Aug. 28, 1971	10.70	**

FIGURE 17

WATER QUALITY IN THE MILLSTONE RIVER

01402000 - MILLSTONE RIVER AT BLACKWELLS MILLS, N. J. (LAT 40 28 30 LONG 074 34 34)

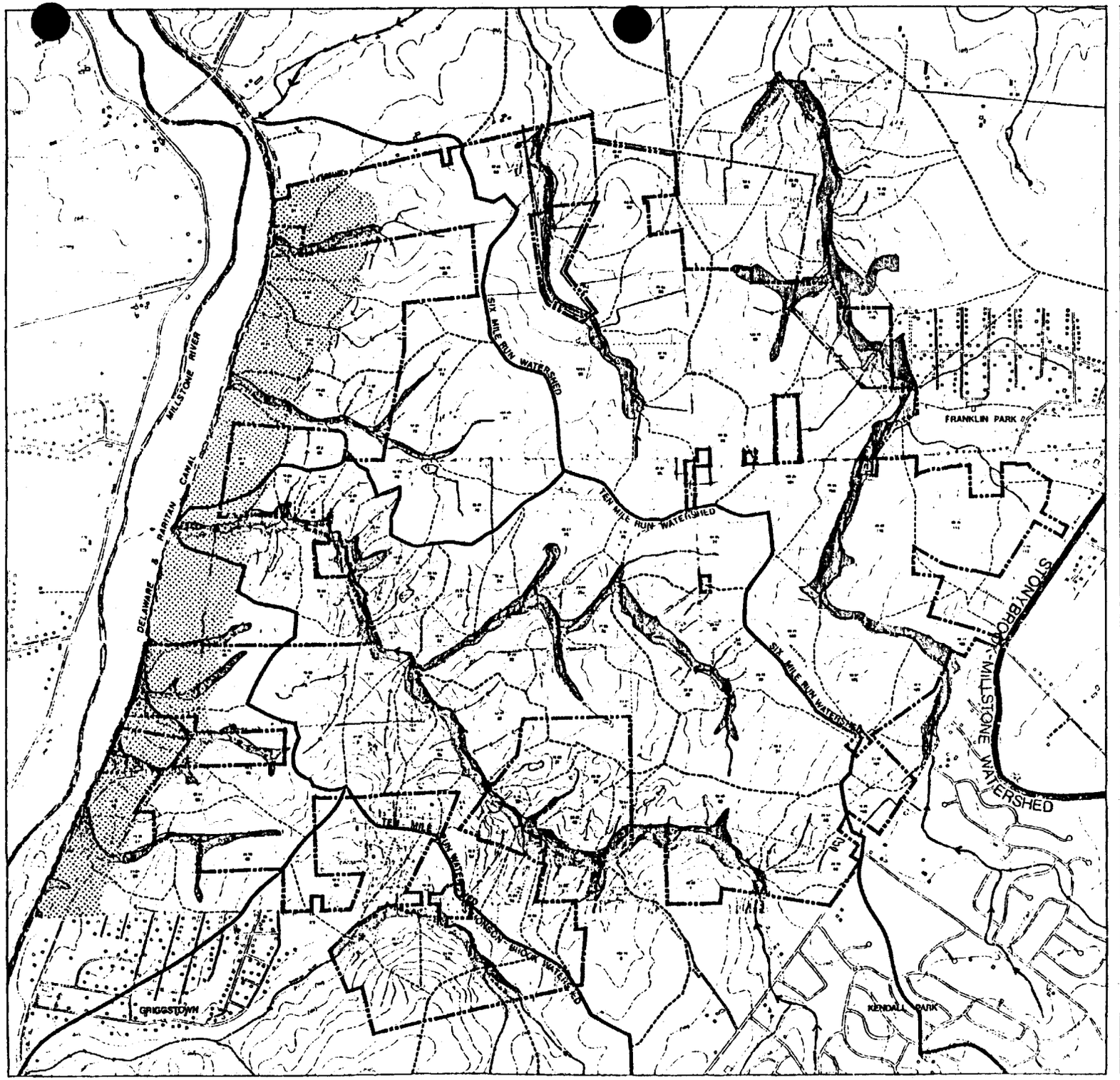
OCT 13, 1970	1210	48	14	1.8	APR 7.....	1400	2020	197	1070
NOV 2.....	0905	66	12	2.1	MAY 13.....	1215	219	79	47
JAN 5, 1971	1115	1640	83	368	MAY 13.....	1510	530	116	166
FEB 8.....	1555	2600	96	674	JUL 30.....	0845	121	91	30
FEB 9.....	1310	2950	128	1020	JUL 30.....	1415	778	944	1980
FEB 23.....	0830	2100	181	1030	AUG 27.....	0955	345	63	59
FEB 23.....	1420	2220	82	492	AUG 27.....	1450	2500	927	6260
FEB 23.....	1605	2230	64	385					

INSTANTANEOUS SUSPENDED SEDIMENT AND PARTICLE SIZE, WATER YEAR OCTOBER 1970 TO SEPTEMBER 1971
(METHODS OF ANALYSIS: B, BOTTOM WITHDRAWAL TUBE; C, CHEMICALLY DISPERSED; N, IN NATIVE WATER; P, PIPET; S, SIEVE; V, VISUAL ACCUMULATION TUBE; W, IN DISTILLED WATER)

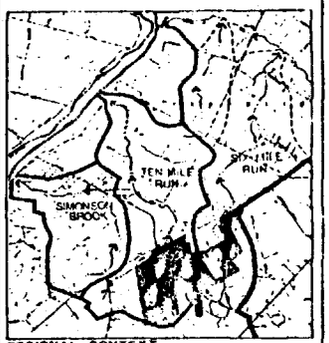
DATE	TIME	WATER TEMPERATURE (C)	DISCHARGE (CFS)	CONCENTRATION (MG/L)	SUSPENDED SEDIMENT DISCHARGE (TONS/DAY)	PARTICLE SIZE PERCENT FINER THAN THE SIZE (IN MILLIMETERS) INDICATED .002	.004	.008	.016	.031	.062	.125	.250	.500	1.00	2.00	METHOD OF ANALYSIS

"Water Resources Data for New Jersey, Part 2, Water Quality Records." U.S.D.I., Geologic Survey, 1972.

FIGURE 18



SURFACE HYDROLOGY



REGIONAL CONTEXT

- CONTINUOUS STREAMS TEN MILE RUN, SIMONSON BROOK, DAREY'S BROOK & TANB, SIX MILE RUN & TRIBUTARIES
- INTERMITTENT STREAMS
- SWALES
- STONYBROOK & MILLSTONE RIVER DIVIDE
- SIX MILE RUN, TEN MILE RUN & SIMONSON BROOK DIVIDES
- STREAM TRIBUTARY DIVIDES
- INTERMITTENT STREAM & SUBDRAINAGE BASIN DIVIDES
- ALLUVIAL SOILS: PROBABLE FLOODPLAIN LOCATION
- MILLSTONE RIVER TERRACES: PROBABLE AREAS OF BANK STORAGE DURING HIGH RAINFALL PERIODS

THE FRANKLIN PROJECT

A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

Wallace McHarg Roberts and Todd

SOURCES: WMRT, SOMERSET COUNTY S.C.S., N.J. DEPARTMENT OF ENVIRONMENTAL PROTECTION

MAP EXISTS AT A SCALE OF 1" = 500'

FIGURE 19

WATERSHEDS WITHIN THE STUDY AREA

Water-shed No.	Total Acres	Acres On-Site	Water-shed No.	Total Acres	Acres On-Site	Water-shed No.	Total Acres	Acres On-Site
1	122.0	28.5	36	30.26	30.26	77	27.23	–
2	100.14	10.0	37	18.82	2.28	77a	14.02	–
3	21.03	7.41	38	8.18	–	78	117.5	10.0
4	22.9	10.26	39	26.40	–	79	22.84	–
5	118.13	10.26	40	23.22	–	80	135.19	105.6
5a	–	13.68	41	12.51	2.8	81	60.29	17.1
5b	–	14.0	42	66.49	66.49	82	135.40	–
5c	–	13.0	43	29.57	29.57	83	32.01	22.8
5d	–	21.66	44	22.09	22.09	84	123.5	111.0
5e	–	25.03	45	119.77	5.0	85	39.61	37.0
6	47.67	39.0	46	3.52	–	86	59.35	57.65
7	13.44	12.5	47	52.17	10.0	87	30.14	30.14
8	76.65	65.2	48	13.25	–	88	68.96	48.5
9	39.02	6.0	49	17.04	–	89	31.2	17.1
10	24.18	–	50	50.89	26.0	90	53.05	31.4
11	17.17	–	51	127.46	–	91	60.49	17.1
12	20.68	8.55	52	21.7	21.7	92	70.62	–
13	19.98	19.98	53	21.96	21.96	93	35.72	–
14	8.07	8.07	54	48.37	24.5	94	42.95	–
15	6.4	6.4	55	68.0	19.9	95	54.40	–
16	16.82	16.82	56	138.45	–	96	82.5	–
17	14.7	14.7	57	35.25	–	97	60.4	–
18	12.80	12.8	58	135.89	–	98	7.37	–
19	7.01	7.01	59	23.84	–	99	134.12	77.0
20	20.7	20.7	60	74.78	31.35	100	23.49	5.7
21	12.39	12.0	61	13.38	4.0	101	100.25	79.0
22	12.51	12.51	62	16.36	5.0	102	5.08	–
23	27.57	27.57	63	39.61	31.5	103	65.55	57.0
24	18.82	18.32	64	5.5	–	104	50.71	50.7
25	60.47	60.47	65	86.6	46.0	105	53.87	53.87
25a	23.84	23.84	66	120.34	49.0	106	32.0	14.25
26	8.30	8.30	67	51.9	19.95	107	21.96	13.25
27	64.96	64.96	68	22.9	13.1	108	18.29	11.4
28	46.07	46.07	69	40.43	40.43	109	48.77	20.0
29	6.5	6.5	70	33.07	33.0	110	89.62	75.1
30	23.72	23.79	71	101.65	101.65	111	80.15	45.6
31	95.2	95.2	72	12.27	11.3	112	71.74	21.7
32	30.26	30.26	73	28.3	25.0	113	79.84	–
33	93.24	64.1	74	4.46	–	114	123.73	–
34	21.85	21.85	75	11.68	–	115	44.36	.8
35	39.26	39.26	76	24.66	–	116	26.76	15.0
						117	121.16	1.0
						118	15.42	–

FIGURE 20

ADDENDA: 1. STATE FLOOD CONTROL REGULATIONS
2. DELAWARE AND RARITAN CANAL COMMISSION JURISDICTION

Please note that Flood Fringe Areas fall within municipal jurisdiction.

1. State Flood Control Regulations within Delineated Floodways

Under N.J.S.A. 58, the New Jersey floodplain and flood control law, rules governing land use in delineated floodways were enacted in June, 1975. The following sections are included from New Jersey Administrative Code, Chapter 18 "Water Supply and Floodplain Management", mandated by NJSA 58 16A-50 et seq.

A. Prohibited uses (7:18 - 1.4)
B. Non-regulated uses (7:18 - 1.5)
C. Regulated uses (7:18 - 1.6)
(See NJSA 58 1-26)

7:18-1.4 Prohibited uses

(a) This Section shall apply within the delineated floodways set forth in Section 11 of this Subchapter;

(b) No person shall engage in or cause other persons to engage in any of the following prohibited uses:

1. Placing, depositing, or dumping any solid waste;

2. The erection of structures for occupancy at any time by humans or livestock, and the erection of kennels for the boarding of domestic pets;

3. The discharge (except as authorized under other provisions of law), processing, storage or disposal of pesticides, domestic or industrial wastes, radioactive materials, petroleum products or other hazardous materials;

4. The storage of materials or equipment;

5. The construction of individual septic systems for residential, commercial or industrial buildings.

(c) Exceptions to subsection (b) of this Section are as follows:

1. Lawful pre-existing prohibited uses may be maintained or repaired but not expanded or enlarged.

2. Lawful pre-existing prohibited structures damaged by any means may be restored provided the extent of destruction is 50 per cent or less.

   i. In those cases where the above results in an exceptional and undue hardship, the applicant may appear in writing to the Division for a hearing before the Council;

   ii. Following the hearing the Council shall render a decision which will be subject to the approval of the Commissioner;

   iii. No relief may be granted from the terms of Paragraph 2 Subsection (c) of this Section unless the applicant adequately demonstrates that no substantial detriment to the public would result, and that no substantial impairment to the intent and purpose of the Act and these regulations would result.

3. Lawful pre-existing sanitary landfills may be expanded vertically provided that:

   i. No horizontal expansion is made;

   ii. The side slopes of the landfill be not steeper than two horizontal to one vertical;

   iii. Adequate soil erosion and sediment control measures are taken to the satisfaction of the Division of Water Resources;

   iv. The flood hazard potential is not increased;

   v. The other applicable provisions of law are complied with.

4. Sturctures which are lawfully under construction on the effective date may be completed.

(d) Stream encroachment permits under the provision of N.J.S.A. 58:1-26 et seq. shall not be issued for prohibited uses.

7:18-1.5 Non-regulated uses

(a) For purposes of this Section, non-regulated uses are uses which:

1. Do not require fill borrowed from outside the immediate floodway; and

2. Do not require erection of structures; and

3. Do not require channel modification or relocation; and

4. Do not obstruct flood flows; and

5. Do not affect the water carrying capacity of any delineated floodway or channel; and

6. Are undertaken with full onsite flood damage risks accepted by the owner; and

7. Do not increase offsite flood damage potential; and

8. Are not prohibited under Section 4 of this Subchapter.

(b) Non-regulated uses must satisfy the conditions of N.J.A.C. 7:18-1.4(a) and shall include:

1. Residential: Lawns, gardens and play areas;

2. Private and Public Recreation: Playing fields, picnic grounds, swimming areas, parks, wildlife and nature preserves, game farms, hunting and fishing areas, shooting preserves, and hiking and horseback riding trails;

3. Agriculture: General cultivation, pasture, grazing, outdoor plant nurseries, horticulture, viticulture, truck farming, forestry, sod farming, and wild crop harvesting. Additionally specific soil conservation practices as terracing, construction of diversions, subsurface tile drainage and the construction of grassed waterways and dug ponds will be considered non-regulated uses but only when designed and constructed under the immediate supervision of the appropriate County Soil Conservation District Office and the local U.S.D.A. Soil Conservation Service office. Single strand fences associated with these agricultural uses are non-regulated.

7:18-1.6 Regulated Uses

The provisions of the Stream Encroachment Law, N.J.S.A. 58:1-26 et seq., shall apply to uses other than those covered by Sections 4 and 5 of this Subchapter.

7:18-1.7 Penalties

(a) Any person who violates a provision of this Act or a rule or regulation adopted pursuant to this Act shall be subject to a penalty of not more than $2,500 for each offense, to be collected by the Department in a summary proceeding under the penalty Enforcement Law (N.J.S.A. 2:58-1 et seq.), and in any court of competent jurisdiction wherein injunctive relief has been requested. The Superior Court, county court and county district court shall have jurisdiction to enforce said Penalty Enforcement Law. If the violation is of a continuing nature each day which it continues shall constitute an additional, separate and distinct offense.

(b) If any person violates any rule or regulation, the Department may institute an action in a court of competent jurisdiction for injunctive relief to prohibit and prevent such violation or violations and the said court may proceed in the action in a summary manner.

According to NJSA 58 16A-57 the effected townships must adopt Flood Hazard Area regulations for areas not regulated under the above administrative code. These would be the Flood Fringe Areas. These regulations must be adopted by June, 1976.

2. Delaware and Raritan Canal Commission Jurisdiction

The Delaware and Raritant Canal Commission will have power, under NJSA 58, to delineate a development review zone along the Canal. After the zone is set, all plans for development within it will be subject to review by the Commission. The exact zone will be determined after a master plan of land use is done for the Canal area. The plan will include the Commission's recommendations for further state acquisition of lands along the Canal. At the present time, since no master plan has been done and no review zone exists, the privately owned lands along the Canal fall within the state floodplain regulations (see Addendum) and township regulatory policies. The Commission does not anticipate having the review zones established for another 9 months to 1 year from now.

Source: Telephone conversation with James Amon, Executive Director, Delaware and Raritan Canal Commission, November 3, 1975.

References:

1. New Jersey D.E.P. "Delineation of Flood Hazard Areas, Raritan River Basin", "Millstone River, Rocky Brook", Flood Hazard Report #2, February 1973.

2. Somerset County Planning Board "Water Supply and Distribution in Somerset County".

3. Metcalf and Eddy, Engineers, Boston, Mass., "Middlesex County Comprehensive Water Plan, Phases Two and Three", 1975.

4. Cross, E. Eugene & Associates, "Delaware and Raritan Canal - Flood Hazard Areas and Six Mile Run Protection Program and Policy Recommendations", Franklin Township Planning Board, February 18, 1974.

4.7a Vegetation

Introduction

Wooded stream corridors, hedgerows, old field thickets and occasional woodlots are all that remain of the once uninterrupted oak-chestnut, red maple-hickory forest characteristic of the moist New Jersey uplands. These areas exhibit a wide variety of successional stages and a surprising number of species, despite the limited size of the natural areas.

The patterns, the species and the condition of the vegetation on this property reflect two centuries of agrarian usage dictated within its own special environmental context. As early as 1725, Dutch settlers were removing the trees, tilling the land, raising crops and livestock along Six Mile Run. These settlers established a stable farming community which remained in equilibrium until the mid 1900's. Land continued to be owned and worked by descendants of the original settlers, leaders of the Dutch Reformed Church and Community. Although the soil was only moderately productive, other factors compensated. Good water was readily available and produce could be exported efficiently to New York because of the proximity of the Canal. These farms averaged 50 to 150 acres, and appeared much as they do today. For about 40 years, from the late 1880's to 1920, apple and peach orchards covered about 20% of the arable land, especially benefitting from the convenience of canal transport. Small grains such as wheat, barley, oats and soy beans were grown on sizeable portions of the tract, in much the same amount and distribution as seen today. Corn grown for feed has always been a major crop; in addition soybeans, barley, wheat, and hay are grown. In the past, flax and buckwheat were both raised in small amounts on the property.

From the description of long time residents, it seems clear that both appearance and practice has changed but slightly here. Property lines have remained fairly constant with ownership largely staying in the same family. Despite the social stability which existed here, agricultural practices do not reflect the careful husbandry that would be expected. Some areas have experienced erosion and gullying and even today contour ploughing is rarely used.

Each agricultural use has its own characteristic pattern in the landscape. Of all the possible agricultural uses, those associated with livestock have left the most distinctive imprint on the land. Grazing fields are seldom as regular as those used for crops, since machinery is rarely needed for tilling or harvest. Nevertheless they assume their own distinctive though sometimes irregular patterns, enclosed by thorny hedgerows to contain the animals. Often a tree, achieving specimen dimensions, will be left

for shade in each field. Frequently, woody vegetation is removed along the stream, allowing the grazers ready access to the water. Cattails and algae growth often accompany removal of streamside vegetation as nutrients from animal wastes find their way to the stream.

While man's use of the land clearly impacts the vegetation patterns and types it is only one determinant of vegetation. Climate, microclimate, geology, soils and water availability make up the components of a system which dictates the success of species, structure of woody vegetation and role of growth and succession. On the subject property these natural components can best be described as moderate; the weather is temperate, with damaging storms occurring infrequently. The growing season is moderately long and blessed with summer precipitation. The soils which have developed on acid red shale and diabase are moderately shallow but have good water holding abilities. Plant growth is steady, sometimes luxurious and fairly predictable.

Agricultural practices have left large areas of open land that could be developed without clearing of woodlands. Preservation of more valuable vegetation can then provide an enhancing backdrop for urbanization while maintaining the ecological balance of the site. Floodplain vegetation, which protects streambanks and provides wildlife habitat, woods such as oak and beech, with their visual appeal and easy penetrability, are of great benefit to man and to the ecosystem and are among those communities that should be preserved. (Vegetation value is further detailed in Figures 16 and 17.)

The map of vegetation and this report are the result of a combination of field work, aerial photo interpretation, discussion with local residents and comparison with prior vegetation studies done for similar areas. The purpose of such a map is to indicate groupings of vegetation by type and to highlight ecological relationships between groups and environments.

Plant Associations

The study area occurs in the mixed oak upland region of northern New Jersey as described by Robichaud and Buell.[1] Although the woody vegetation is limited in area, an amazing array of successive stages can be seen within this property. The woody vegetation is quite diverse; attributable no doubt to frequent disturbance over the last 100 years or so. There are some indications that the non-woody flora may be restricted to early successional areas and mature upland woods, while somewhat fewer spring flowers and ferns are likely to appear along the streams.

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[1]The vegetation of New Jersey.

There are 14 distinct vegetation groupings within the boundaries of the site (Figure 15). Although some may be more subtle than others, they all show some basic discernible differences. Three are lowland. These include vegetation on wet meadow, canal edge and floodplain. Three are typically on terraces and slopes. Seven are characteristic of the upland, dependent on the good drainage it provides. Pasture is not closely identified with a particular moisture level; it occurs on both lowland and upland.

The wettest areas have generally not been disturbed. Where wet meadows occur on the property there is an interesting diversity of shrubs, grasses, sedges, forbs and vines. Red osier dogwood is the most prevalent shrub, forming large red-twigged mounds on some part of every wet meadow. Black cherry, not exceeding shrub height, is a common invader of the wet meadow; small willows and hawthorns appear occasionally while sumac is moderately successful on dry edges. Multiflora rose is both the most ubiquitous and forbidding of the meadow's inhabitants. An escapee from fences and hedgerows, it has had remarkable success in low wet areas and along the canal, making them fairly impenetrable. Sedges, wet grasses, cattails, reeds and ferns take up what remains of the saturated land. These wet areas are vital to the site's hydrologic balance as they serve as a sponge during wet periods and are biologically important. Vegetative competition is reduced because of the hydrous environment. While typical marsh plants thrive, so can a number of colorful and unusual flowering forbs. Such are also favorable for wildlife because human land uses rarely intervene on this soggy, difficult terrain thereby allowing wild creatures a safe and diverse habitat.

The strip of land between the road and the canal is vegetated by highly tolerant woody species. Here, where water is ponded much of the winter, boxelder, willow, alder, birch virburnum, multiflora rose and honeysuckle are numerous. This grouping is neither remarkable nor attractive; boxelder, the major tree, is a coarse, highly competitive species which sprouts readily and spreads rapidly at the expense of more attractive species. High water level and frequent immersion dictates the presence of such weedy species. Seasonally ponded water is not unnatural here, however this extreme condition may be accentuated by a debris-clogged canal which overtops its banks with every heavy rain with the road acting as a dam. Additional species should be established here to improve the vegetation. Sycamore is an attractive species that would do especially well along the canal edge. Only two specimens were seen within the property boundaries, but as these were healthy and thriving in very wet areas they should do well along the canal.

Red-maple-spice bush is the typical streamside association. Sometimes joined by bitternut and white ash, this association probably represents the highest successional stage

that can be attained where water disturbance is frequent. Red-maple, through development of a tap root can adapt to drier conditions.[1] It appears infrequently on upland sites here, being mainly restricted to the narrow strip on either side of the stream. Where cherry, honeysuckle and multiflora rose join red maple on the floodplain it is likely that this land was pastured within the past seventy years.

All three of these lowland associations have great value ecologically and aesthetically. Where they appear unkempt they should be upgraded and where the stream is unprotected, woody vegetation should be encouraged.

Moist Slopes and Terraces

White ash is the most ubiquitous tree on the site. Although a few populate the low floodplain and some can be found at higher elevations, their best growth occurs on the moist low terrace, slightly elevated above the stream. Ash is a successional species which follows red cedar and is replaced by red maple, hickory and sugar maple on moist soils. Although it is so very common here this tree indicates rather narrow pH requirements (between 5 and 7), high nitrogen levels and fairly high calcium levels.[2]

Black walnut is frequently associated with white ash,[3] but here it occurs infrequently. Some specimens were seen in woods along Butler Road as well as a few on Bunker Hill Road. A full growth of blackhaw indicates slightly acid and rich soils.[4] This shrub does grow densely anywhere on the site, but its fullest development occurs in conjunction with white ash, as corroborating evidence that some of these soils are fertile. Ash appears in all sizes and shapes. Most ash growing slightly above the stream is young, thin-trunked and in a dense stand. The largest, most imposing specimen tree in the study area is an ash. This huge-trunked tree can be seen on Jacques Lane near the stream.

Neither oak/beech/dogwood nor tulip poplar/oak/hickory/dogwood appear often on the site. However, they represent a later successional level which gives additional information about the land, while adding interest and beauty to the landscape. Tulip poplar is positively correlated here with the diabase slopes.[5] It is able to stand only a few days of flooding annually and has high nutrient demands.[5] Although it does grow on flat,

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[1]Silvics.
[2]Ibid.
[3]Vegetation of New Jersey
[4]Soiler, 1972.
[5]Ibid.

wide floodplains it grows best on better drained slopes away from the force of water. Examples of this association can be seen along Bunker Hill Road. Oak/beech dogwood is another relatively scarce association within the property boundaries. In northern New Jersey the presence of beech trees indicates the culmination of successional progression, most especially on mesic terraces and slopes.[1] Buell has found that it also replaces oak hickory on dry uplands. Beech is found on wet side slopes near the golf course, and in the oak woods on South Middlebush Lane. Individual species also occur in a few other well developed woodlands on the property. Understory is very important in these associations. Spice bush is closely associated with areas of high moisture; in Revolutionary times this shrub was a positive indicator of good agricultural soil. This fragrant shrub is dominant where beech grows on moist slopes near the golf club. Dogwood, blackhaw and hazelnut occur along with tulip poplar/oak/hickory. This is a moist but well drained area and an ideal environment for a mixed shrub understory. The tall, straight trunks of the tulip poplar allow some light penetration which encourages a somewhat thicker undergrowth. In the moderately dry upland oak woods the understory appears less dense with dogwood and honeysuckle the major species.

Agriculture

Much of the site is presently used for farming, which in some respects has given only moderate care to the natural environment, limiting the variety of vegetation and causing erosion and siltation of soil into the streams. Most fields are bound by hedgerows which not only give a neat appearance but reduce erosion and include diverse vegetation valuable as wildlife habitat. Improvements could include contour farming and alternating cover crops in every field and preserving floodplain vegetation as a wide band along the streams.

Ornamentals

This association includes all landscaping around residences and businesses. Often these are native species, frequently oaks, a few hickories, several ash and dogwood. The best formed, largest oak trees which are the principal specimen trees on the site, are found in this association. Some especially handsome pine and red oaks can be seen along Canal Road, while several outstanding ashes and hickories grow on Jacques Lane. Lawn grasses and a mixture of shrubs are an important part of this association.

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[1]Horn, 1971.

Old Field

This is perhaps the most spectacular appearing vegetation association within the property boundary. The contrast between the deep green of the pyramid-shaped red cedars and the reddish brown, uniform cover of beardgrass is quite startling. Beardgrass is a typical old field successional grass which stifles competitors. Red cedar does penetrate its dense mat, although it is one of the few species which can, and does so infrequently and at random. Beardgrass once established can remain stable for decades. Because of its stark yet handsome appearance and the contrast it lends to the landscape it might well be incorporated into a development plan. Unfortunately, due to its dry, persistent culms which are responsible for its unusual color it is readily inflammatory. With proper management and kept at distances far enough from residences it could be utilized safely and attractively in the landscape.

Although beardgrass and cedar are the characteristic old field community on the site, there are occasional variations on this theme. The earliest successional fields are almost non-existent; only a few small areas near Franklin Park which are covered with annual grasses and forbs, can be categorized as such. Apparently the extent of farming has been stable and consistent over the years. With agricultural lands remaining static and herbicides widely used such attractive but common annuals such as daisy, thistle, Queen Anne's Lace, viper's bugloss and dandelion are largely absent. Later successional forbs, such as asters and goldenrod have gotten a roothold in small areas which add a touch of color and zest to the late summer landscape.

Red cedar is the tree of abandoned farmlands in New Jersey. It is an enormously successful pioneering species; its form well adapted to high solar light utilization, while the smallness of its needles reduces loss of water. It can tolerate high moisture or drought and is found in swamps as well as on steep slopes. It is intolerant of shade and, although spindly cedars are sometimes found in the woods, they do not reproduce under a dense canopy.

Hedgerows

The hedgerows are an important part of the vegetation on the property. They are of two types: remnants of late successional or mature woodland trees such as ash, red, black, white oak, hickory and sugar maple or earlier successional trees which have been allowed to grow up along fences. These are typically sassafras, cherry, black locust or red cedar. Almost every field is surrounded by one such strip or the other. They define

properties, outline crops and give a geometric pattern to the land. Sometimes unexpected species appear along the fence rows. Birds drop seeds of ornamental shrubs or trees and such things as a non-native hawthorn, a crabapple or rose may appear.

Moist Upland Woods

Examples of the typical dry upland oak woods do not appear on this site. However, red oak which is the major oak species is associated here with smaller amounts of black oak, only occasional white oak individuals, and very infrequent chestnut oaks. Sugar maple and beech are found in conjunction with these oaks, both species indicating a high moisture gradient. The understory is commonly dogwood and maple-leaf viburnum. Although ironwood often is a component of such an understory it is absent here; only occasional sassafras and cherry remain as small relics of an earlier successional stage.

Conclusion

The plant associations here run the gamut of rural land uses from careful management through to benign neglect. Nowhere has irretrievable damage been done to this landscape although gullying and erosion are apparent in some places. Where these occur, contouring and cover crops should be used as corrective measures. The most extensive change that has taken place can be seen at the site of the quarry, where siltstone was dug to line the Canal banks, but even here the damage is relatively mild and gradually being corrected with the passage of time.

There are a number of positive steps which could be taken to help balance the hydrologic regime and at the same time enhance the quality of the vegetation. All streamsides and seeps should be left vegetated or revegetated with trees and shrubs where none occur. Low wet areas should be allowed to generate their natural cover, forming a mat of sedges, wet grasses and low shrubs. Tulip poplar, which is relatively rare on the property should be given a certain amount of protection. They may be limited to diabase here, but as they are so common elsewhere, it seems unlikely. With adequate preparation of a substrate and proper management it is quite possible that they could grow elsewhere on the site.

Black walnuts and tight and shag bark hickories are very desirable vegetation and should be encouraged. Walnuts develop best in open areas; although prey to fungus diseases they are an immensely valuable commercial and aesthetic species.

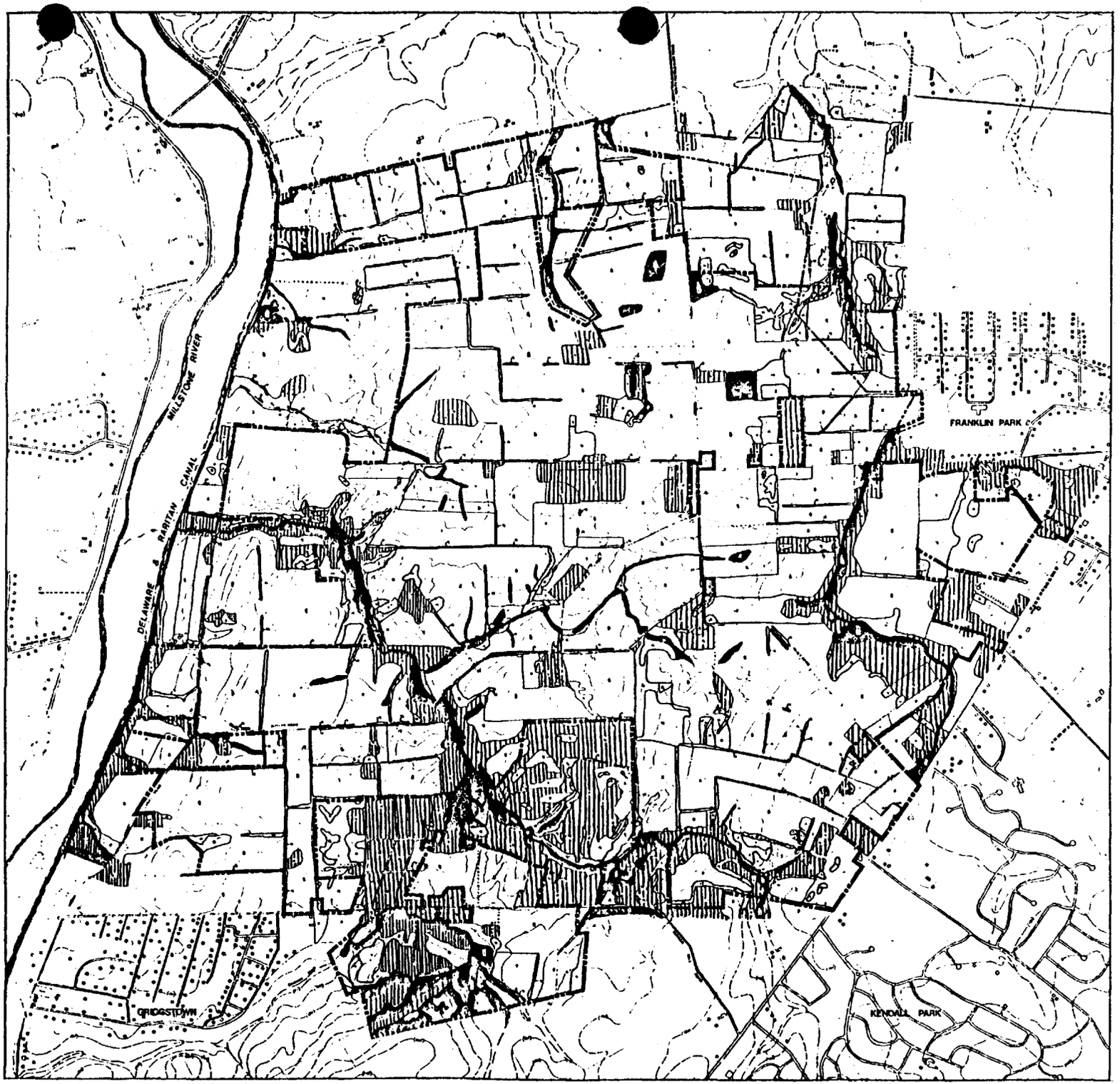
Dogwood does particularly well here as demonstrated by the many specimens in different environments. Other flowering understory trees could either be introduced or their numbers increased. Shadbush appears as an occasional individual; this beautiful small tree is interesting for its fruit and flowers, its form and its trunk. It has sinewy bark, and attractive leaves, buds and form, although inconspicuous flowers. Native azaleas or laurels would also flourish on parts of the site adding spring color.

It is important that debris in the floodplain be removed. It appears to hinder water flow and to increase the chance of flooding, as well as being unsightly. Although the multiflora rose has reached pestiferous proportions, it should be contained rather than entirely removed, which probably could not be done anyway.

Vegetation along the canal should be given highest priority. Boxelder should be contained, and other tree and shrub species introduced. Those with particularly high water absorbing capacities (i.e., sweet pepper bush, should be introduced).

The matrix (Figure 16) summarizes the value of vegetation to man and the ecosystem, and is illustrated by the map (Figure 17) entitled "Vegetation Value".

Each association and community should be allowed to flourish as it gives immeasurable variety to the landscape. Early successional annuals might be encouraged for summer color; later, successional perennials could be allowed to proliferate for late summer and early fall color. With such simple techniques this handsome property could reflect the best of the seasons.



VEGETATION

	WET	MOIST	MODERATELY DRY
LOWLAND	1		
	2		
	3		7
		4	8
		5	9
		6	10
			11
			12
			13
UPLAND			14

TOLERANCE TO DISTURBANCE

- HIGH 7,8,11,12,13,14
- MODERATE 4,9,10
- LOW 1,2,3,5,6,

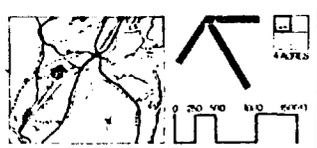
SPECIES:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]
5. [illegible]
6. [illegible]
7. [illegible]
8. [illegible]
9. [illegible]
10. [illegible]
11. [illegible]
12. [illegible]
13. [illegible]
14. [illegible]

NOTE: [illegible]

THE FRANKLIN PROJECT

A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N.J.



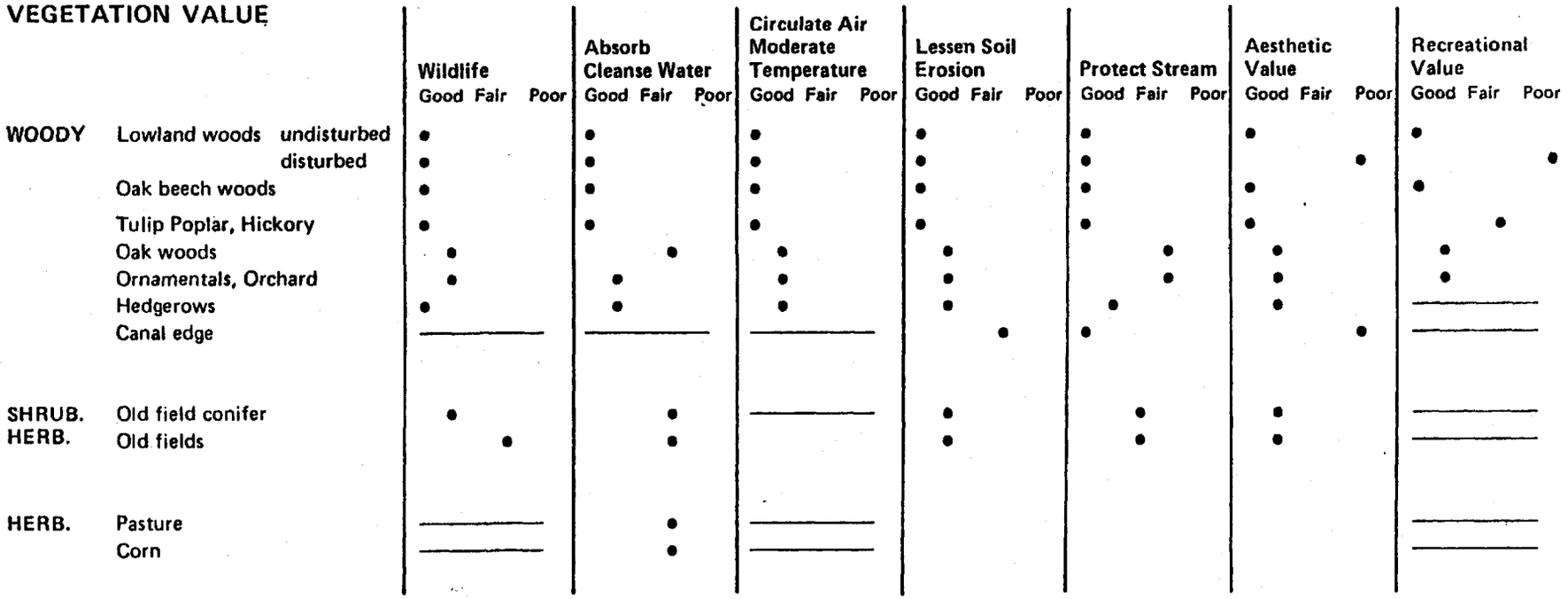
Wallace McHarg Roberts and Todd
Architects
Landscape Architects
Urban and
Ecological Planners
1127 Chestnut Street
Philadelphia, Pennsylvania 19107
215-923-2611

SOURCE: WMRT, 1976

MAP EXISTS AT A SCALE OF 1" = 500'

FIGURE 21

VEGETATION VALUE



High Value:

2 Wet Meadow
3 Lowland Woods & Disturbed Lowland Woods
5 Oak-Beech
6 Tulip Poplar-Oak

Moderate Value:

4 Ash
9 Ornamental & Nursery-Orchard
12 Old Field-Conifers

Limited Value:

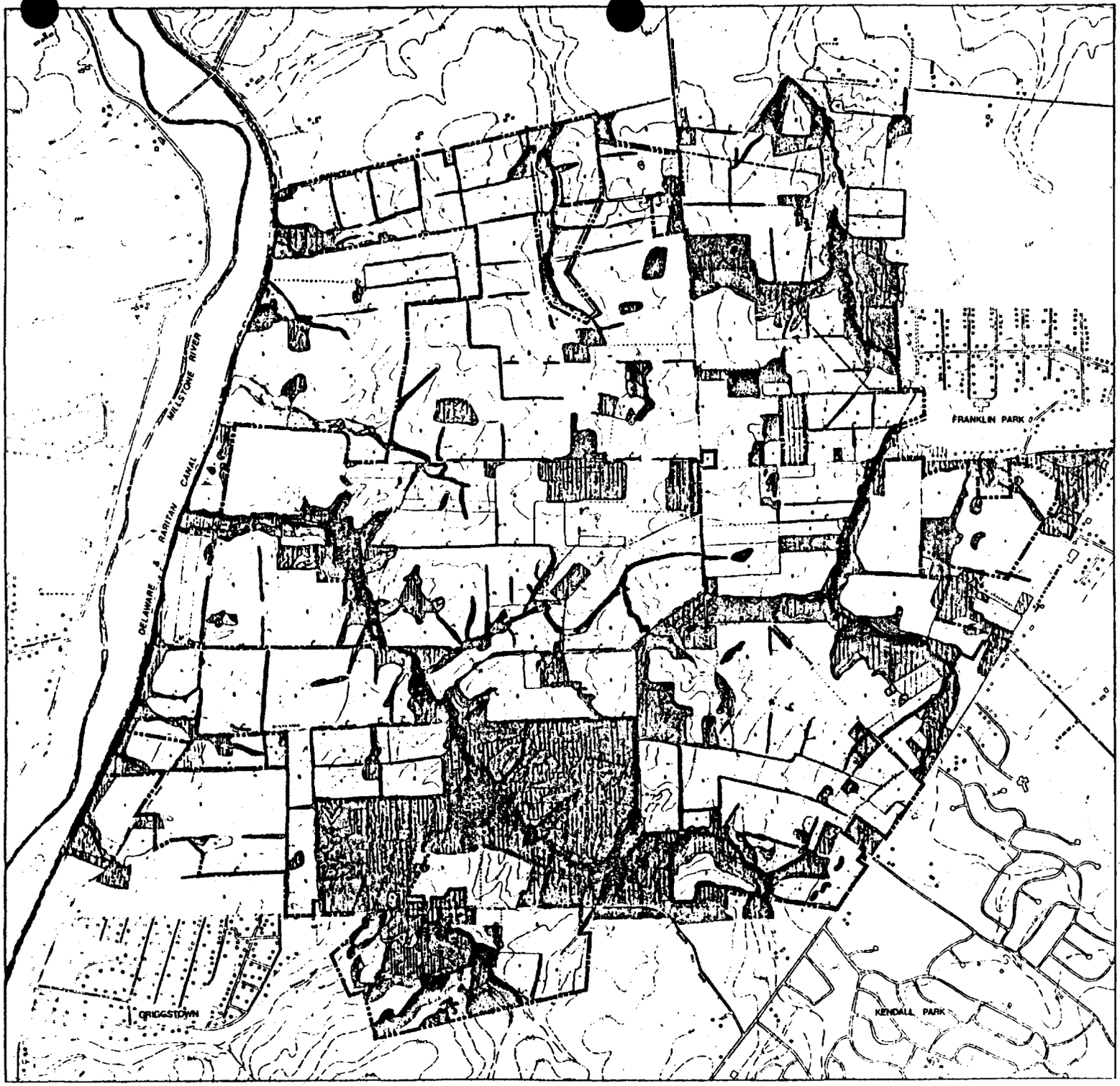
11 Old Fields, Grass

Low Value:

1 Canal Edge
7 Pasture
8 Corn

SOURCE: WMRT, 1976

FIGURE 22



VEGETATION VALUE

HIGH:
- 2 WET MEADOW
- 3 LOWLAND WOODS & DISTURBED LOWLAND WOODS
- 5 OAK BEECH
- 6 TULIP POPLAR/OAK

MODERATE:
- 4 ASH
- 9 ORNAMENTAL & NURSERY-ORCHARD
- 12 OLD-FIELD, CONIFERS

LOW:
- 11 OLD-FIELDS, GRASS
- 1 CANAL EDGE
- 7 PASTURE
- 8 CORN

THE FRANKLIN PROJECT

A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

Wallace McHarg Roberts and Todd

SOURCE: IMART, 1970

MAP EXISTS AT A SCALE OF 1" = 500'

FIGURE 23

WOODY PLANTS		OCCURRENCE
Fraxinus Americana	white ash	very common
Carya ovata	shagbark hickory	along roads, moist woods
C. cordiformis	bitternut	lowland woods
Betula populifolia	gray birch	edge of old field
Alnus incara	speckled alder	along canal - in oak woods
Fagus grandifolia	American beech	very few in swale
Quercus alba	white oak	upland woods
Q. mulhenbergii	chestnut oak	upland woods
Q. rubra	red oak	commonest oak - moist uplands
Q. palusris	pin oak	driveways - ornamental - lowland woods
Q. velutina	black oak	lowland wood edges - uplands
Ulmus Americana	white elm	eradicated by Dutch elm dis.
Liriodendron tulipifera	tulip poplar	limited to diabase - upland woods
Sassafras albidum	sassafras	fence rows
Platanus occidentalis	sycamore	lowland
Malus	apple	orchard, ornamental
Prunus serotina	black cherry	
P. Pennsylvanica	fire cherry	
Rhus typhina	staghorn sumac	
Acer rubrum	red maple	floodplain
Acer negundo	boxelder	along road
Cornus stolonifera	redstemmed dogwood	
Cornus florida	Florida dogwood	
Juglans nigra	black walnut	
Acer platanoides	Norway maple	ornamental
Juniperus virginiana	red cedar	
Pinus strobus	white pine	
Corylus americana	hazelnut	
Gleditzia triacanthos	honey locust	old field rare
Robinia pseudo-acacia	black locust	hedgerow

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4.7b Wildlife

Introduction

The recurring pattern of cropland and hedgerow in the study area has a mixed effect on wildlife; it is inviting to smaller creatures yet inhospitable to the larger ones. On one hand, narrow bands of woody vegetation alternating with grassy pastures or seasonal crops provide certain creatures with an almost ideal habitat. Edible fruits and sites for nesting and refuge make the hedgerow a favored place while open fields give birds of prey a definite advantage. On the other hand, the very narrowness of these vegetated bands and the expanse of open fields discourage the larger or more secretive creatures which depend upon extensive woodlands. Small mammals, especially rodents which scurry through fields and nest in stubble, medium sized plant-eating mammals which burrow and hide, fruit and seed eating songbirds and winged predators such as vultures and hawks find that such an agricultural area fits most of their needs.

Due to the absence of a four season study of the wildlife on the property which would determine actual species and quantities present, habitats have been determined on the basis of vegetation associations, assuming certain species will be found although they have never actually been sighted. Mr. Vliet, whose intimate knowledge of the property spans many decades, has enumerated the species and given an approximation of the frequency and numbers which he has noticed over the years. Care was taken to note species and any indication of activity, such as nests or tracks while on field visits.

Discussion

White-tailed deer crosses over as well as uses this land. A herd of about 30 are known to live and raise their young in the vicinity. Perhaps the commonest medium sized mammals which occur are red fox and woodchuck. During the building of the golf course a large number of fox were trapped and it is believed that since they have no natural predator they are on the increase.[1] Woodchucks occur frequently. These plant-eaters are the enemy of the dairyman, as their open holed burrows cause cattle to fall and break their legs. Observing and counting burrows added to Mr. Vliet's verbal descriptions have determined the presence of woodchucks on the site. Raccoons are also numerous but are more often associated with the urbanized aspect of the land rather than the agricultural. These creatures seem to benefit from disturbance.

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[1]Verbal communication, Mr. Vliet, local landowner and resident.

They have multiplied around dwellings, supplementing their natural food sources with man's refuse.

Cottontails and squirrels are small mammals both obvious and common to the property. Squirrels are attracted to the large number of acorns and enough suitable trees for nesting. Cottontails have the open agricultural fields from which they can procure foods, and sufficient shrubby cover in which to nest and hide, making this land their virtual haven. Opossums are also common although infrequently noticed here. Muskrats and skunks are relatively rare, although known. Mice and moles, largely unobtrusive are nevertheless common.

Songbirds are the most numerous, colorful and interesting creatures which either visit or reside on the property. Although it does not seem necessary to list all of the species which would be expected here, it is important to mention those which are very common or otherwise significant.

Grackles, crows and mourning doves are typically associated with cultivated fields. Here, grackles travel and feed in huge flocks. The farmers must compete with them in harvesting grain, as well as try to protect newly planted seed. Crows are not present in such numbers and rarely become a nuisance. Despite their raucous behavior, they are more often an asset to the farmer, eating small insects, grasshoppers, and caterpillars during the summer, carrion year round, and relying on agricultural remnants chiefly after the harvest. Another typical species here is the mourning dove. Recognized by its doleful call, it is usually welcomed for its gentle, unobtrusive ways. Meadow larks, another open field and crop devotee are both attractive and have a melodious song. Here they occur in such small numbers that they do not cause major crop damage, as they do when they feed in flocks.

Cardinals, mockingbirds, sparrows, titmice, robins, nuthatches, and chickadees seem equally at home in hedgerows, wood edges or suburban plantings. All these are found on the property and might even increase in numbers if development were to occur. Ornamental planting and frequently replenished bird feeders attract large numbers of birds, even some species which would not be expected otherwise. Evening grosbeaks, purple finches, bluebirds and martins are a few that respond to an additional provision of food or dwelling place.

Ducks and Canada geese have found the farm ponds congenial areas. The geese are especially attractive. Elsewhere they have adapted readily in an absence of predators, and

they are overbreeding in many places. If the geese become a nuisance, they may be controlled by keeping the areas around the ponds in a natural state, as they prefer lawns for grazing. Supplementary fall feeding should be withheld to encourage them to migrate.[1]

Recommendations and Conclusions

A change over from the rural to suburban pattern does not necessarily imply a loss of wildlife habitat, nor the introduction of nuisance species. Utilizing available knowledge of preferred plant foods as well as what type and amount of habitat is necessary to support certain wildlife species, it is possible to design for a maximum amount of aesthetic and beneficial species. The best habitats here are brushy meadowlands, hedgerows and lowland woods. (Figures 16, 17). However, wild creatures use different areas at different times. Birds which would forage open brushy fields during winter and spring often rely on the cool shade of woodlands for summer nesting. Although bottomland woods, which are often more dense and diverse, are known to support more wildlife than their equivalent in the uplands,[2] the acorns, beech nuts, hickories and tulip poplar fruits of the terrace and upland trees provide valuable and indispensable year round sustenance for many creatures.

Carefully manicured areas discourage most truly wild creatures. Weedy annuals produce prodigious amounts of seed for birds and mammals. Not only are colorful summer flowers attractive along the roadsides and at wood's edges but they provide a supplementary diet for many creatures. Vines and thorny shrubs furnish a refuge from predators and they often produce edible fruits. Blackberries and poison ivy are considered lowly, often noxious weeds, but they are both indispensible sources of later summer and winter foods. Therefore in order to maintain, even enhance the wildlife habitat here some of each plant association should be preserved. Emphasis should be placed on the maintenance of the most natural and diverse open areas which provide a connected system of open space to allow for uninterrupted wildlife passage throughout the area. Buildings can be designed which discourage nuisance species from nesting while ponds can be built which will not become seasonal breeding grounds for mosquitos. It is possible to design for man and at the same time allow for and encourage the smaller, attractive and desirable species of mammal and many colorful beneficial and interesting birds.

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[1]Wildlife, Toronto Central Waterfront Canada Geese Population.

[2]Studies-U.S. Fish and Wildlife Service in Where Birds Live.

REPRESENTATIVE WILDLIFE

	WOODLANDS			NON-FOREST					
	Low-land	Up-land	Value	Crop-land	Mead-ow	Swales/ Marshes	Old Fields	Grasses	Preference
Deer	X	X	B	F	F	F	X	F	Browse, plants
Raccoon	X	X	C,B	F	F	X	F	F	Dense trees, rock outcrops
Skunks	X	X	B,R	F	X		X	X	Forest edge, brushland
Muskrats			C,B	F	X	X	X	X	Water courses
Opossums	X	X	B	F	F	F	X	F	Bottomland, rocky areas
Cottontail	F	F	N,C	F	X	X	X	X	Herbaceous plants, brushy cover
Red fox	X	X	N,C	F	X	X	X	X	Open fields + woods
Woodchuck	X	X	N	X	X	X	X	X	Herbaceous plants
Gray squirrel	X	X	B	F			F		Mast producing trees
Eastern mole	X	X	N	X	X	X	X	X	Deep soils
White-footed mouse	X	X	B	F	F	F	X	X	Open woods
Meadow mouse			B	F	X	X	X	X	Sedge-grass areas
*Woodpeckers	X	X	B						Dead trees
*Cardinals	X	X	B		F		F	F	Tulip poplar trees, hedgerows
Wood thrush	X	X	B		F	F		F	Deciduous woods, hedges
Thrashers	X	X	B	F	F		F	F	Thickets and shrubs
*Sparrows	X	X	B	X	X	X	X	X	Widely varied from urban to woodlands
*Owls	X	X	B				X		Open woods, marsh
*Blue jays	X	X	N/B	X	X		F	F	Ubiquitous
*Crows			N	X	X	X	X	X	Ubiquitous
*Grackles			N	X	X	X	X	X	Ubiquitous
*Bluebirds	X	F	R	F	F	F	F	F	Semi-open woods
*Mourning doves			B	X	X	X	X	X	Open croplands
*Meadowlarks			B	X	X	X	X	X	
Bob-white			B	X	X	X	X	X	Brushy cover
*Mallards			B			X			Open water
*Canadian geese			B			X			Open water
*Sparrow hawk	X	X	B	F	X	X	X	X	Tree cavities

Legend:

R: Rare
B: Beneficial
C: Commercial
N: Nuisance

*: Sighted on property
V: Normal habitat
F: Frequents as transient

FIGURE 24

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4.8 Visual Character

Man's utilization of the study area for agriculture has changed what would have once been hills of dense forests to open vistas of farmland, bounded by hedgerows and limited woodlands remaining on steep slopes and within drainageways. From the bustling suburban strip of commercial development along Route 27 to the calm and tranquility along Canal Road, the study area offers several quite distinctive visual experiences to one travelling around and through it.

Views from Existing Roads

One's first perceptions are from the existing roads which surround and penetrate it. Route 27, the main access road, is intermittently developed in commercial, service and institutional uses; between this development one catches glimpses of the hedgerows, old fields, and croplands beyond. Not much of the site is revealed, since the view is curtailed by the crest of the low promontory and rolling hills about 1500 feet from the road. From this low promontory, along Vliet Road, the southeastern view is of residential development to the west of Route 27. Driving north, as one approaches Franklin Park, the spire of the Franklin Park Church becomes an orientation point signaling the intersection of South Middlebush Road and Claremont Road, one of the entry points into the site. This road becomes Suydam Road as one drives toward the west. From this intersection, the northwesterly view affords one of the most distant vistas on the site. Past the fields and woods, the Watchung Ridge rises to form the horizon line. Looking southwest, the view is past old fields and over the top of the woods along Ten Mile Run, as far as the wooded diabase knoll which forms the southernmost portion of the site. Because of Suydam Road's location along higher topography, the land along the road, and for quite a distance from it, is highly visible. In this area, any development would need considerable screening with earth mounds and vegetation in order to maintain the unbroken long views. Along South Middlebush Road, similar views may be had. However South Middlebush is more urbanized in character, with residences and farms well maintained. Most of the other internal roads afford views of similar character, although not as distant as those from Suydam Road.

Turning into Canal Road from any internal access, the entire character of the scenery changes. Looking west, the tranquil Delaware and Raritan Canal may be glimpsed through dense stands of boxelder, alder and rank viny undergrowth. Occasionally, the vegetation is low and open, and the Canal, with its stone bank, may be seen for some length. Looking east, the Millstone River Terraces rise gently from the road. The tops of these terraces form a visual barrier from the road, and their elevated topography accented by hedgerows protects the internal parts of the site from visual intrusion. Except for the

North Brunswick Water Company Treatment Plant at Suydam Road, a visually prominent incongruity in the pleasant surroundings, well kept single family residences, typical of rural America, are the only structures. The southernmost road, Bunker Hill Road, encompasses a different scene. Bounded on the south by the steep knoll, the view is short and dark into the woods. Past this area a few modest but neatly kept homes precede the Bunker Hill Golf Course. Past the manicured hills of the golf course are single family homes and scattered fields. At the end of Bunker Hill Road, Kendall Park, with its row after row of single family homes, is the antithesis of the pastoral quality of the Franklin Project Site.

Internal Views

From the interior of the site, another type of view is added. Views from the Knoll are short and wooded, with distant views only glimpsed through the trees on the steep slope. Broad vistas may be had from the Low Promontories and Gently Rolling Uplands. Old fields are among the most beautiful scenes, and may be best appreciated from the interior of the site. Their dark green cedars are accented by the golden-orange beardgrass that is ubiquitous in this plant community, and they are a striking low foreground for woodlands and ridges in the far distance.

In the Enclosed Valleys, a different scale is perceived. The space is more confined, limited by the top edge of the hills forming these small bowls in the land. Privacy and protection are sensed in these areas, whose character is quite distinct from other locations. Within the Stream Corridors, privacy and calm are also remarkable, although the view along the meanders of the stream reduces the sense of confinement. Steep side slopes form the visual barrier here, with the tops of the trees further defining the space in wooded portions.

Thus, the site affords a subtle variety of visual experience, from long range panoramas, to quiet streamside views all of which can serve to provide valuable aesthetic amenity to future inhabitants of the site and to the region.

By preserving the low promontories and high points of the land, a sense of openness may be maintained after development. Visual preservation areas could include those parts of the site visible from the public roads. Because of the rolling terrain and the pattern of woods and fields, the site planning and design considerations for the development of this site could incorporate these attributes to great advantage.

4.9 Climate

In initial planning, climatic influences are primarily related to broad scale sheltering of development areas by providing topographic or vegetative buffers from prevailing winds, locating major effluent disposal fields downwind from proposed development areas, and choosing development sites with maximum southerly aspect for most efficient internal home temperature control. At a more refined scale, it is recommended that climatic determinants guide the selection of building orientation, form, and materials, and specific placement of new vegetation.

The study area falls in a region of New Jersey with a temperate climate whose main characteristics include adequate rainfall for farming, moderately wide variation in average monthly temperatures and prevailing winds from a northwesterly direction.

The annual temperature ranges between a low of 30° F in January with the lowest recorded temperatures below 0° F, and 74° in July with highs of over 90° F occurring frequently.

Precipitation in the area is about 43" per year. Peak rainfall of 4.2 inches to 4.3 inches occurs generally in July and August, with a secondary peak of about 3.8 inches in February and March. Drier periods, with less than 3.2 inches generally occur during April and May. November is usually the driest month with only 3.0 inches of precipitation. During January and February, the 7 to 10 inches per month of snow makes up the major portion of precipitation. Snowfall usually occurs between November and March, with some minor snows occasionally as late as April.

Prevailing winds are from the northwest during most of the year. From October through April, all recorded winds are from the northwest. In May and June, breezes from the south and southwest are common. During July, August, and part of September, prevailing breezes are from the southwest and south.

In summary the site enjoys a temperate and pleasant climate that poses no special problems to its future development. Some parts of the site such as the tops of the knolls or bottoms of stream valleys will have microclimates which may have variations of 5° - 10° difference from other areas. These are considerations that can be intelligently used in site planning and building design.

Sources: American Institute for Architects "Regional Climate Analysis and Design Data. The House Beautiful Climate Control Project, Section II, Metropolitan New York and New Jersey", 1949.

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5.1 Environmental Protection Standards

a. Determinants for Standards

The degraded condition of the Millstone River and its tributaries passing through the study area is of great concern to both the New Jersey Department of Environmental Protection (D.E.P.) and to Franklin Township. State regulations governing construction in floodplain areas are an important step toward rectifying the problem of increased stream pollution and flood damage caused by urbanization.[1,2] The Franklin Environmental Commission has also expressed its concern for this situation.[3]

Little is known about the precise effects of urban runoff on stream quality. With the increase in impervious surface that comes with development, less water is able to percolate through soil layers to filter slowly toward streams and to replenish deep ground water. More water therefore flows overland during rains and flooding increases. With the removal of natural vegetation to accommodate development, exposed soils erode and sediment loads in the streams increase. Federal interest in these problems has been recently demonstrated in the study area. At Rutgers University, the United States Department of the Interior has funded a study, currently in progress, of the effects of urbanization in the Six Mile Run Reservoir Watershed.[4] On completion, the results of this study will be of great use to legislators, planners, and developers in the formulation of policies and plans that will accommodate urban growth and protect surface water resources. Because the results are as yet incomplete, it was determined that the environmental protection standards for development of the Franklin Project would result in no increase over existing runoff into any stream.

Several methods for runoff control are possible. Traditionally, storm sewers carry storm waters directly into streams, causing the flooding and pollution problem mentioned

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[1] WMRT, In-house papers to J.W. Field, Nov. 28, 1975.

[2] N.J. Dept. of Environmental Protection, Division of Water Resources, "Flood Hazard Report #12: Millstone River and Rocky Brook", February, 1973.

[3] Franklin News Record, Jan. 16, 1975.

[4] Tom Tuffey, Rutgers University, U.S.D.I., Office of Water Resources Technology - Urbanization and Runoff Control in the Six Mile Run Watershed; Telephone conversation, March 12, 1976.

earlier. A storm sewer system could work effectively, without causing these hazards, by channeling water into large impoundment basins for storage. This type of system over the extent of a large site, however, involves extensive earthwork and would be extremely costly; it also reduces water availability to plants.

A less structured solution, involves overland flow through natural, vegetated drainageways or swales and thereafter retention of small quantities of water in areas of permeable soils. Vegetation may thus utilize the water, filter it of pollutants before it enters the stream, and act as a retardant to water velocity, further reducing erosion and sedimentation into the streams. Shallow impoundments may be created by road location and special grading to achieve these effects. (The ideal locations for impoundments for infiltration would be over permeable soils and should be studied in detail during future study of guidelines for site planning.) Ponds, serving as amenities during most of the year, could be designed to accommodate portions of this runoff as well. Such a solution would be far less costly, avoiding much of the need for piping and minimizing earthwork.

The least costly solution in terms of construction, although one that requires maintaining the greatest amount of undeveloped land, is the regeneration of dense, natural vegetation cover to compensate for the increases in runoff after development. For every acre of development, a certain quantity of land would need to be given over to woodland or meadow, thus substituting an area of reduced runoff for an area of increased runoff. Wildlife habitat and aesthetic benefits may also be expanded through this manner of runoff control.

Because of their increased benefits and decreased construction costs, the two latter methods, 1) overland flow with shallow retention areas and 2) vegetation cover improvement, were studied. The upper limits of the recommended permitted area for development were based on the impoundment method, since it requires less land area and therefore sets the maximum level of development. Calculations to determine vegetation requirements were also made in order to fully describe this alternative. It is recommended that, during site planning and design studies these two methods should be combined to derive an optimum plan for allowing development while providing runoff control and an increased diversity of vegetation. It this were done it is highly probable that storm water runoff, soil erosion, and degradation of streams will be less under developed conditions than under present conditions.

The large size of the study area and the limited time available for this study dictated the need for dividing the site into as few as possible discrete units with similar surface and subsurface characteristics. Because of man's utilization of the study area for agriculture, few remaining portions could be classified as "ecological units", or concurrences of geology, soils, hydrology, vegetation, and wildlife. For this reason, a synthesis of site information was developed to describe basic structural characteristics, called Physical Planning Units and subsequently for Concurrent Surface Features. In this way the underlying system and the surface environments could be compared for areas of congruence and dissimilarity. Standards for one area could then confidently be applied to other similar areas for planning purposes. It should be noted that specific design might involve refinements of calculations, however, these will always be within the established limits of the environmental protection standards.

b. Physical Planning Units

The Physical Planning Units map (Figure 25) shows the seven distinct Physical Units that were found in the study area. Similarities in geology, surface and subsurface hydrology, and topography were aggregated into divisions as follows:

Diabase Uplands - Moderately Dry

Geology: Diabase

Hydrology: Seasonal high water table 4'-6' or greater from ground surface. No stream present.

Topography: Slopes of 0-8% with some areas up to 15%.

Diabase Uplands - Wet

Geology: Diabase

Hydrology: Seasonal high water table less than 4' from ground surface. No stream present.

Topography: Slopes of 0-8% with some areas up to 15%.

Brunswick Uplands - Moderately Dry

Geology: Brunswick or Brunswick with Pennsaucken Remnants.

Hydrology: Seasonal high water table 4'-6' or greater from ground surface. No stream present.

Topography: Slopes of 0-8%.

Brunswick Uplands - Wet

Geology: Brunswick or Brunswick with Pennsaucken Remnants.

Hydrology: Seasonal high water table less than 4' from the ground surface. No stream present.

Topography: Slopes of 0-8%.

Enclosed Valley

Geology: Brunswick

Hydrology: Intermittent stream or major swale present. Seasonal high water table less than 4' from ground surface.

Topography: Side slopes 8-15%.

Stream Corridor

Geology: Brunswick or Diabase.

Hydrology: Continuous stream present. Seasonal high water table less than 4' from surface.

Topography: Flat plain, slopes 0-3%, bounded by side slopes of 8-15%.

Millstone Terraces

Geology: Remnants of interglacial and stream alluvium.

Hydrology: Internal drainage. Seasonal high water table greater than 6' from ground. No stream present.

Topography: All slopes drain towards Millstone River. Slopes generally 0-8% with a band of 8-15% slopes separating this unit from the remainder of the study area.

c. Concurrent Surface Features and Runoff Calculations

Concurrent Surface Features were delineated (Figure 26). Based on soils hydrologic groups and percolation rates in the A and B soil horizons, areas of permeable soils (hydrologic group B), moderately permeable soils (hydrologic group C) and impermeable soils (hydrologic group D) were aggregated with four types of vegetative cover: Woods, Old Field, Pasture (or lawn) and Crops.

Since the soils hydrologic groups are based on the quantity of runoff generated by a specific soil (least runoff from groups A and B, most runoff from group D), this map provided the basic information for calculating runoff according to the Soil Cover Complex Method[1,2,3] for the 50 year frequency storm.[4]

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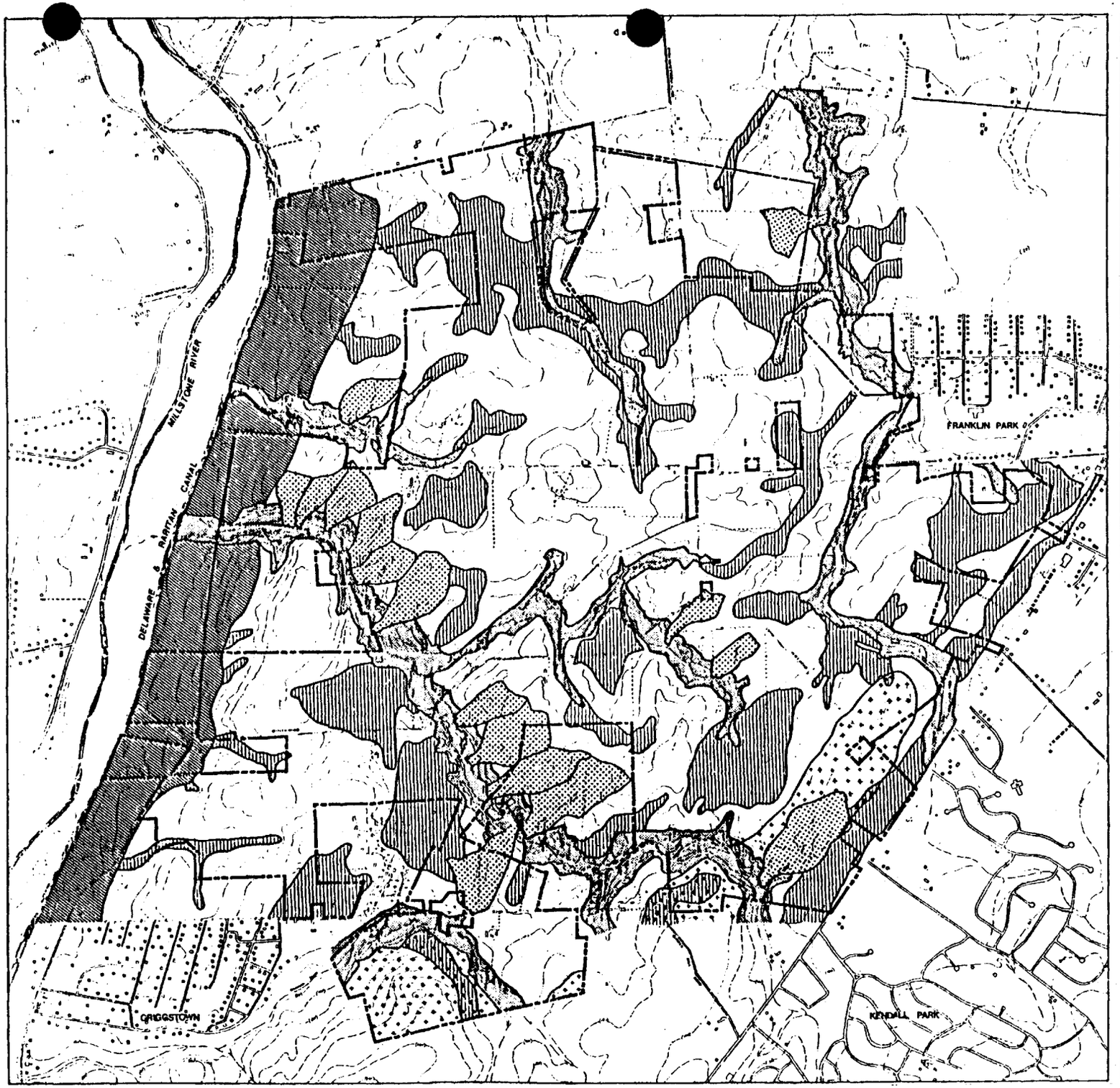
[1]Engineering Division, Soil Conservation Service, U.S.D.A. technical release #55, "Urban Hydrology for Small Watersheds", January, 1975.

[2]Chester County Conservation District, Chester County, Pa., "Runoff Calculation Handbook".

[3]Soil Conservation Service, "Engineering Field Manual, Chapter 2: Estimating Runoff".

[4]7" with a 24 hour rainfall, U.S. Weather Bureau.

Following calculations for the existing runoff generated by each watershed in the study area, estimates were made of the increased runoff assuming 90%, 75%, 50%, and 25% of impervious surface added to the watershed. The areas of shallow impoundments needed to retain this increase (two feet deep) were then calculated. Thus, it was possible to determine the relation between the amount of land paved and the required impoundment area. For instance, 90% paving required an amount of impoundment exceeding 10% of the available land area. Thus, this situation could not meet the performance standard of zero "off-site" runoff increase.



PHYSICAL PLANNING UNITS

- DIABASE UPLANDS
  MODERATELY DRY
- DIABASE UPLANDS
  WET
- BRUNSWICK UPLANDS
  MODERATELY DRY
- BRUNSWICK UPLANDS
  WET
- ENCLOSED VALLEY
  INTERMITTENT STREAM OR DISTRICT SWALE SOILS GENERALLY CRITICAL TO STREAMFLOW LIMIT FLOWS SUBMERGED OF STREAM SIDE SLOPES 8-15%
- STREAM CORRIDOR
  CONTINUOUS STREAM PRESENT SOILS CRITICAL TO STREAMFLOW REGIMEN WATER TABLE LESS THAN 4' FROM SURFACE SIDE SLOPES 8-15%
- MILLSTONE TERRACES
  GEOLOGY & SOILS CRITICAL TO STREAMFLOW SEPARATED BY BAND OF 8-15% SLOPES DRAINING TOWARDS MILLSTONE RIVER

THE FRANKLIN PROJECT

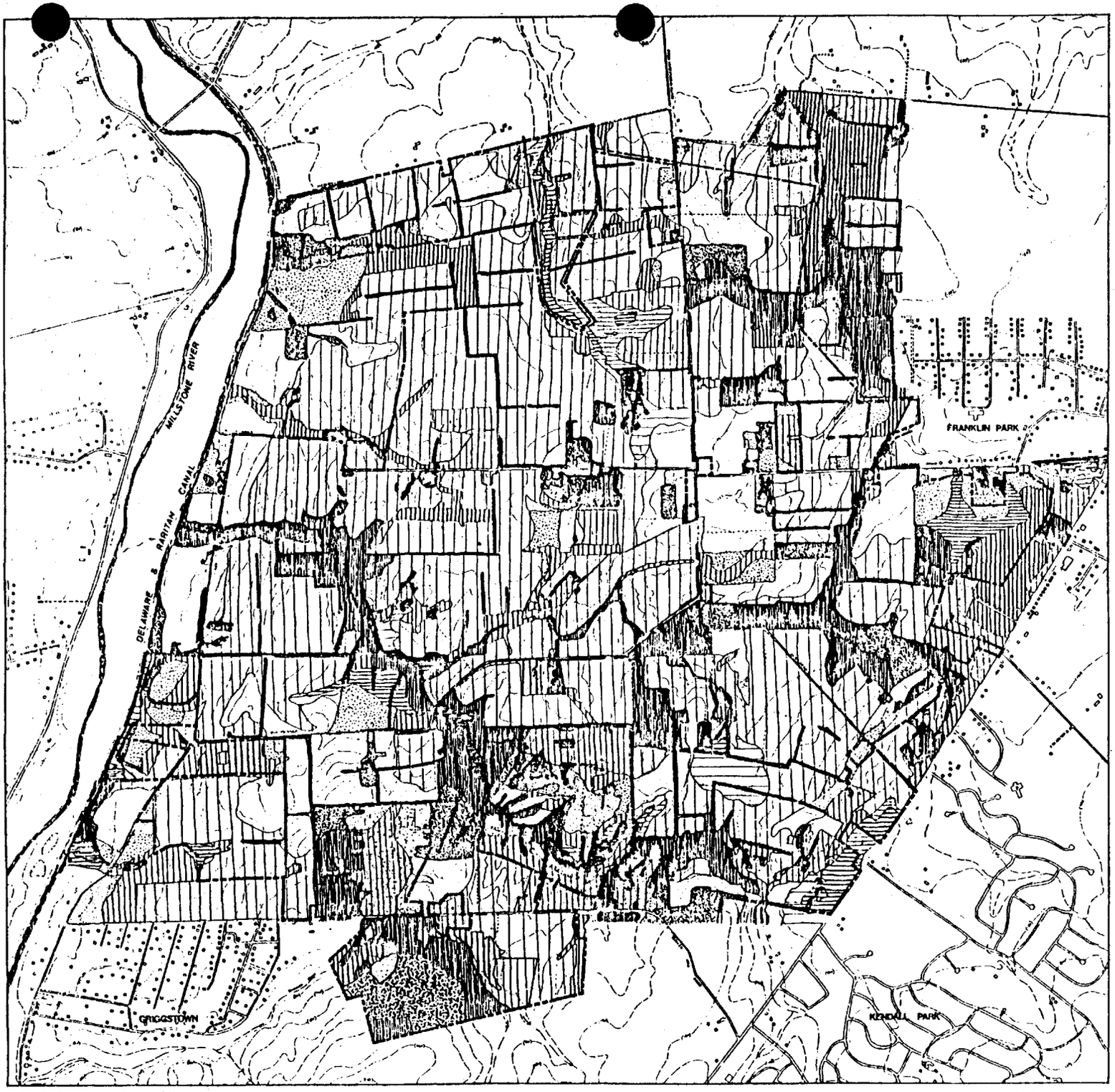
A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

Wallace McHarg Roberts and Todd

SOURCE: WMRT, 1976

MAP EXISTS AT A SCALE OF 1" = 500'

FIGURE 25



CONCURRENT SURFACE FEATURES

WOODS OLD FIELD LAWN CROPS

PERMEABLE SOILS

MODERATELY PERMEABLE SOILS

IMPERMEABLE SOILS

PERMEABLE SOILS:
HYDROLOGIC GROUP B

MODERATELY PERMEABLE SOILS:
HYDROLOGIC GROUP C

IMPERMEABLE SOILS:
HYDROLOGIC GROUP D

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SOURCE: WMRT, 1976

MAP EXISTS AT A SCALE OF 1" = 500'

FIGURE 26

d. Impervious Surface Limits

The Physical Units were then each assigned an area number (from 1 to 84) and runoff from the appropriate watersheds was applied to these Physical Unit areas. It was found, as expected, that the percentages of runoff generated at various paving levels were within a consistent range from one similar Physical Unit Area to another, despite the fact that the acreage varied. For instance, the limit for paving within the Enclosed Valleys Physical Unit was between 60% and 75% while the limit for the Uplands Unit was between 80% and 90%.[1]

In addition, it was found that the percentage of impoundment area required also varied consistently. For example, the Diabase Uplands required between 9% and 10% impoundment area for runoff generated while the Enclosed Valleys required between 30% and 40%. As a result of these calculations the following averages were established as the basis for the permitted impervious surface standards for each area.

Physical Unit	Permitted % of Impervious Surface	Required % of Area for Impoundment
Diabase Uplands - moderately dry	85%	9.5%
Diabase Uplands - Wet	85%	10.5%
Brunswick Uplands - Moderately dry	85%	10.5%
Brunswick Uplands - Wet	85%	11.5%
Enclosed Valley	65%	32.0%
Stream Corridor	85%	9.0%

[1]Due to the limited time of the Study, only a representative sample of the Physical Planning Unit Areas was calculated specifically.

e. Preservation

The second determination of performance standards was made in the following manner. The site was analyzed in order to determine those areas critical to the maintenance of the ecosystem that would need to be preserved.

The Millstone River Terraces, whose soils and geology indicate an important role in maintaining the streamflow regimen, were the first areas to be designated for preservation. Soils critical to the streamflow pattern in the interior of the site were also so designated. In addition these soils (the Bowmansville Silts and the Rowland Silt) represent the only present indication of known floodplain along the stream corridors on the site.

Vegetation was the second preservation determinant. Because of the scarcity of undisturbed woodlands in the area, both the most highly valued vegetation and moderately valuable vegetation were designated for preservation. Development could therefore take place up to the woodland edges, but none of the woods themselves could be disturbed. Streamside associations, such as red-maple/spice bush, upland beech/oak woods, and tulip poplar/oak would be spared. In addition, ash/black walnut and mature old fields, with their dark cedars, small trees, and brilliant orange beardgrass, would be retained. With proper management during and after development, new woodland growth could be encouraged around and between developed areas. An additional area, the Sun Oil Company right-of-way in the eastern portion of the site, was also removed from the available site area for preservation. Within this 40 foot right-of-way a 14 inch pipeline is buried at about 3 feet depth. To avoid its disruption by development at a later date, this area is assumed to be preserved; it could well serve as a pathway connection within a recreation system, as well as an open movement corridor for wildlife in the area.

The total acreage of land to be preserved is 882.22 acres or 31.8 percent of the site. This includes all of the above mentioned areas (Figure 28). This acreage was subtracted from the total land area prior to the establishment of carrying capacity for Physical Planning Units.

f. Environmental Protection Standards

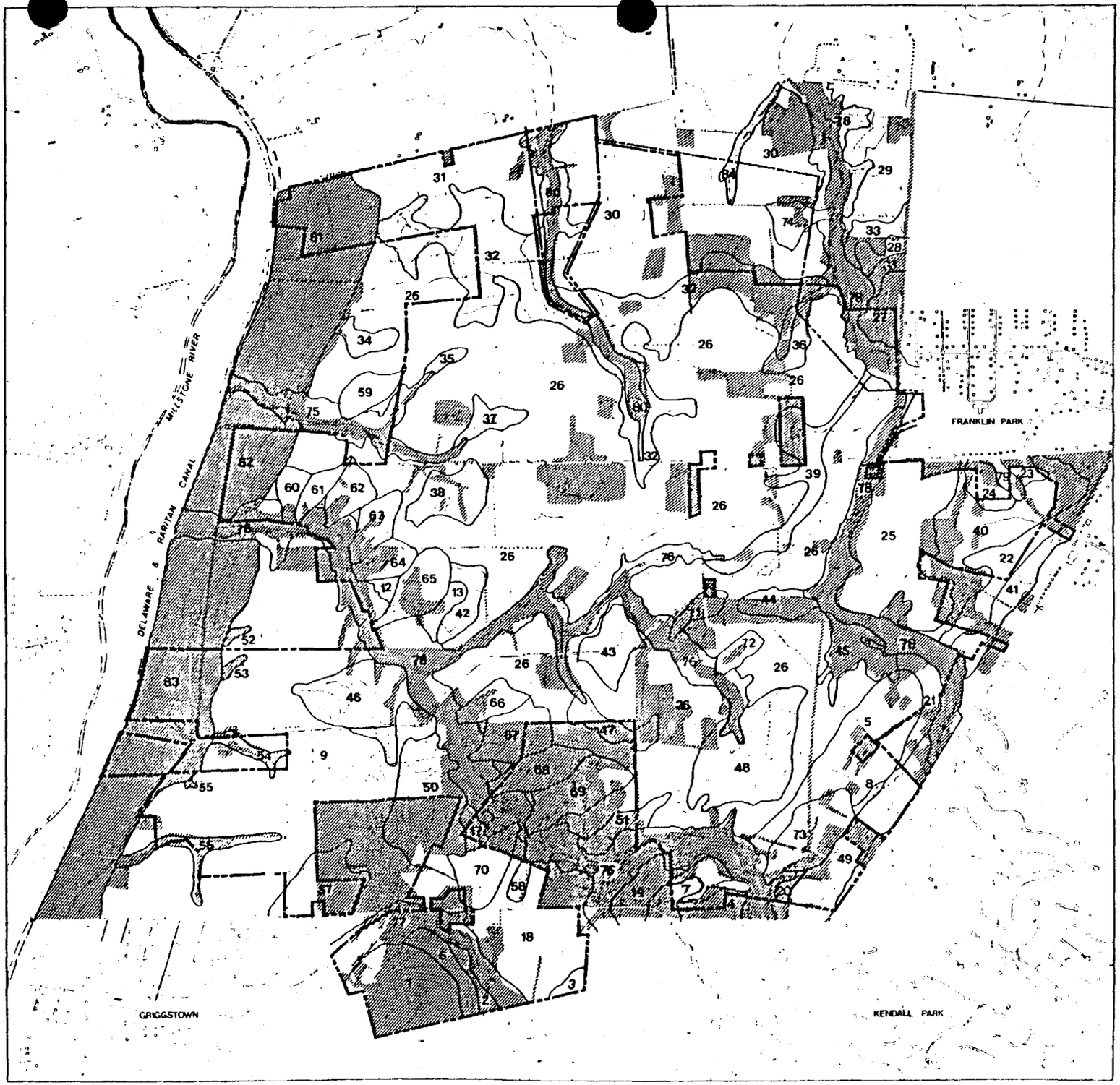
The final determination of Performance Standards was made in the following manner. The appropriate area of preservation was subtracted from each Physical Unit Area, with the remaining lands totalling 1891.2 acres. The maximum percentage of impervious surface and the required area for impoundment were then applied to this remaining area to reveal, for each Physical Planning Unit Area, the resultant developable land area available. This land totals 1589.33 acres and represents 51.31 percent of the site (Figure 27).

SUMMARY OF ENVIRONMENTAL PROTECTION STANDARDS

PHYSICAL PLANNING UNIT	EXISTING CONDITIONS					DEVELOPMENT STANDARDS	
	Acres	Preserve %	Acres	Remain %	Acres	Impervious Surface Permitted: Acres	Impoundment Area Required: Acres
DIABASE UPLANDS–MODERATELY DRY	110.6	51%	56.9	49%	1891.2	45.7	5.12
DIABASE UPLANDS–WET	19.3	76%	14.75	24%	4.55	3.9	.48
BRUNSWICK UPLANDS–MODERATELY DRY	1487.3	13%	194.5	87%	1293.0	1099.87	132.77
BRUNSWICK UPLANDS–WET	532.3	28%	146.4	72%	385.9	328.11	44.40
ENCLOSED VALLEY	164.3	42%	69.57	58%	94.73	61.48	30.25
STREAM CORRIDOR	338.9	83%	279.4	17%	59.5	50.27	5.32
MILLSTONE RIVER TERRACES	120.7	100%	120.7	–	–	–	–
TOTAL	2773.4	31.8%	882.22	68.2%	1891.2	1589.33	218.34

Develop	57.31%	1589.33 Acres
Required Preservation & Impoundments	39.68%	1100.56 Acres
Residual Lands	3.01%	83.51 Acres
	100.0%	2773.40 Acres

FIGURE 2



ENVIRONMENTAL PROTECTION STANDARDS

PRESERVE: 882.2 ac.

GROSS AREA: 1891.2 ac.

DEVELOP ACCORDING TO STANDARDS EXPECT HIGHER COSTS DUE TO WET SOILS & VEGETATION REMOVAL

DEVELOP ACCORDING TO STANDARDS

TOTAL AREA: 2773.4 ac.

64 PHYSICAL PLANNING UNIT AREA

THE FRANKLIN PROJECT

A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

Wallace McHarg Roberts and Todd

It should be noted that this is a functional upper limit of carrying capacity and does not yet include either density considerations or the aesthetic and design implications of development over the area. The map (Figure 28) shows the preservation area, and the physical unit areas numbered in the table of Environmental Protection Standards by Physical Planning Unit Areas (Figure 29). This table details the available land for each Physical Planning Unit Area. The summary table (in section 5.1d) shows that the highest development capacity potential occurs in the Physical Planning Unit Area of the Diabase Uplands: Moderately Dry - where the percent of impervious surface can be high (85%) and the percent of impoundment area required is low (9.5%). The lowest development capacity potential is in the Physical Planning Unit of Enclosed Valleys where 65% of the impervious area is permitted and the percent of impoundment area required is 32%.

The right hand column in Figure 29 entitled "Permitted Impervious Surface: Vegetation Cover Impoundment" gives the permitted useable area with storm water runoff management accomplished by improvement of vegetative cover. Much less land area is available for development under this method, however the advantages of erosion control, additional wildlife habitat, and aesthetic benefits from this method are far greater than runoff control by impoundments only. Some areas of the site where low intensity development is anticipated could well use this method of storm water control. In addition, since the areas were calculated on the basis of allowing croplands to develop to old fields, the runoff control would increase over time if the old fields were allowed to continue to mature into woodlands, since the runoff from woodlands is significantly lower than that from old fields.[1] The table (Figure 30) of required cover improvements to compensate for (one acre of) impervious surface shows the specific exchange used in these caluclations. If this method were used over the entire site the total developable land area would be 906.47 acres or 32.7% of the site. The area required for runoff control would be 901.43 acres, or 33% of the site.

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[1]S.C.S. Engineering Field Manual, op. cit.

	PHYSICAL PLANNING UNIT Area	Acres	EXISTING CONDITIONS: Preserve % of Total	Preserve Acres	Remaining % of Total	Remaining Acres	DEVELOPMENT STANDARDS: Maximum Development: Impoundment — Impervious Surface % of Remaining	Impervious Surface Acres	Impoundment Surface % of Remaining	Impoundment Surface Acres	Maximum Development: Improved Vegetative Cover — Impervious Surface % of Remaining	Impervious Surface Acres	Improved Cover % of Remaining	Improved Cover Acres
DIABASE UPLANDS-MODERATELY DRY	1	45.7	85%	38.8	15%	6.9	75%	5.87	9.5%	.66	25%	1.73	48%	3.3
	2	5.9	100%	5.9	–	–	–	–	–	–	–	–	–	–
	3	3.2	–	–	100%	3.2	75%	2.7	9.5%	.31	25%	.08	48%	1.5
	4	10.9	50%	5.45	50%	5.45	85%	4.6	9.5%	.52	25%	1.36	48%	2.6
	5	44.9	15%	6.7	85%	38.2	85%	32.5	9.5%	3.63	25%	9.55	48%	18.2
	TOTAL	110.6		56.9		53.7		45.7		5.12		12.72		25.6
DIABASE UP - LANDS - WET	6	11.8	100%	11.8	–	–	–	–	–	–	–	–	–	–
	7	5.9	50%	2.95	50%	2.95	85%	2.5	10.5%	.31	25%	.74	51%	1.5
	8	1.6	–	–	100%	1.6	85%	1.4	10.5%	.17	25%	.40	51%	.82
	TOTAL	19.3		14.75		4.55		3.9		.48		1.14		2.32

FIGURE 20

PHYSICAL PLANNING UNIT	Area	Acres	EXISTING CONDITIONS: Preserve % of Total	Preserve Acres	Remaining % of Total	Remaining Acres	DEVELOPMENT STANDARDS: Maximum Development: Impoundment — Impervious Surface % of Remaining	Impervious Surface Acres	Impoundment Surface % of Remaining	Impoundment Surface Acres	Maximum Development: Improved Vegetative Cover — Impervious Surface % of Remaining	Impervious Surface Acres	Improved Cover % of Remaining	Improved Cover Acres
BRUNSWICK UPLANDS–MODERATELY DRY	9	200	2%	4	98%	196	85%	166.6	10.5%	20.6	50%	98	47%	92.1
	10	1	–	–	100%	1		.85		.11		.5		.47
	11	1	–	–	100%	1		.85		.11		.5		.47
	12	2	–	–	100%	2		1.7		.22		1.0		.94
	13	8.2	25%	2	75%	6		5.1		.63		3.0		2.82
	14	1.5	100%	1.5	–	–								
	15	1.5	100%	1.5	–	–								
	16	.8	100%	.8	–	–								
	17	3.0	100%	3.6	–	–								
	18	61.1	20%	12.2	80%	48.9		41.6		5.13		24.5		22.98
	19	.5	80%	.4	20%	.1		.9		.01		.005		.05
	20	2.3	40%	.9	60%	1.4		1.9		.15		.7		.66
	21	5.9	38%	2.2	62%	3.7		3.15		.39		1.85		1.7
	22	12.3	–	–	100%	12.3		10.5		1.29		6.15		5.8
	23	1.8	15%	.29	85%	1.7		1.5		.18		.85		.8
	24	5.9	1.5%	.84	85%	5.01		4.23		.53		2.51		2.4
	25	94.6	18%	17.3	82%	77.3		65.7		8.1		38.7		36.3
	26	897.9	14%	125.7	86%	772.2		656.4		81.1		386.1		362.9
	27	11.5	100%	11.5	–	–								
	28	NA	–	–	–	–								
	29	NA	–	–	–	–								
	30	99.6	8%	8.0	92%	91.6		77.9		9.62		45.8		43.1
	31	74.9	3%	2.3	97%	72.6		61.7		7.6		36.3		34.1
	TOTAL	1487.3		146.4		385.9		1099.87		135.77		646.5		607.6

PHYSICAL PLANNING UNIT	Area	Acres	EXISTING CONDITIONS				DEVELOPMENT STANDARDS							
							Maximum Development: Impoundment				Maximum Development: Improved Vegetative Cover			
			Preserve		Remaining		Impervious Surface		Impoundment Surface		Impervious Surface		Improved Cover	
			% of Total	Acres	% of Total	Acres	% of Remaining	Acres	% of Remaining	Acres	% of Remaining	Acres	% of Remaining	Acres
BRUNSWICK UPLANDS–WET	32	124.8	19%	23.7	81%	101.1	85%	85.94	11.5%	11.63	50%	50.55	50%	50.55
	33	NA	–	–		–	–	–	–	–				
	34	NA	–	–	–	–	–	–	–	–				
	35	4.7	–	–	100%	4.7		3.99	11.5%	.59		2.35		2.35
	36	12.0	45%	5.4	55%	6.6		5.6		.76		3.3		3.3
	37	9.9	–	–	100%	9.9		8.4		1.14		4.95		4.95
	38	20.4	15%	3.1	85%	17.3		14.7		1.99		8.65		8.65
	39	29.4	8%	2.4	92%	27.0		23.0		3.11		13.5		13.5
	40	55.1	38%	20.9	62%	34.2		29.1		3.93		17.1		17.1
	41	5.0	16%	.8	84%	4.2		3.6		.48		2.1		2.1
	42	14.8	2%	.3	98%	14.5		12.33		1.67		7.25		7.25
	43	18.2	–	–	100%	18.2		15.47		2.1		9.1		9.1
	44	11.8	100%	11.8	–	–		–		–		–		–
	45	18.2	90%	16.4	10%	1.8		1.53		.21		.9		.9
	46	44.4	15%	6.7	85%	37.7		32.05		4.34		18.85		18.85
	47	8.5	50%	4.28	50%	4.25		3.6		.49		2.13		2.13
	48	55.2	4%	2.2	96%	53.0		45.1		6.1		26.5		26.5
	49	31.2	25%	7.8	75%	23.4		19.9		2.7		11.7		11.7
	50	28.2	60%	16.9	40%	11.3		9.6		1.3		5.65		5.65
	51	3.8	20%	.76	80%	3.04		2.6		.35		1.52		1.52
	52	1.5	100%	1.5	–	–								
	53	1.3	100%	1.3	–	–								
	54	.9	100%	.9	–	–								
	55	.5	100%	.5	–	–								
	56	9.5	100%	9.5	–	–								
	57	18.5	50%	9.25	50%	9.25		7.9		1.06		4.63		4.63
	58	4.3	–	–	100%	4.3		3.7		.5		2.15		2.15
	TOTAL	532.3		146.4		385.9		328.11		44.4		192.88		192.88

	PHYSICAL PLANNING UNIT Area	Acres	EXISTING CONDITIONS: Preserve % of Total	Preserve Acres	Remaining % of Total	Remaining Acres	DEVELOPMENT STANDARDS. Maximum Development: Impoundment — Impervious Surface % of Remaining	Impervious Surface Acres	Impoundment Surface % of Remaining	Impoundment Surface Acres	Maximum Development: Improved Vegetative Cover — Impervious Surface % of Remaining	Impervious Surface Acres	Improved Cover % of Remaining	Improved Cover Acres
ENCLOSED VALLEY	59	NA	–	–	–	–	–	–	–	–				
	60	9.5	30%	2.9	60%	6.6	65%	4.3	32%	2.11	25%	1.65	48%	3.14
	61	9.5	10%	.95	90%	8.55		5.56		2.74		2.14		4.10
	62	12.3	30%	3.7	70%	8.6		5.59		2.75		2.15		4.13
	63	14.7	45%	6.6	55%	8.1		5.27		2.59		2.03		3.89
	64	12.8	50%	6.4	50%	6.4		4.16		2.05		1.6		3.07
	65	20.7	35%	7.2	65%	13.5		8.78		4.32		3.4		6.48
	66	10.8	40%	4.32	60%	6.48		4.21		2.07		1.62		3.1
	67	14.8	75%	11.1	25%	3.7		2.41		1.18		.93		1.78
	68	1.7	100%	1.7	–	–	–	–	–	–				
	69	NA	–	–	–	–	–	–	–	–				
	70	14.9	–	–	100%	14.9		9.69		4.77		3.73		7.15
	71	6.9	100%	6.9	–	–		–	–	–		–		–
	72	5.9	–	–	100%	5.9		3.84		1.89		1.48		2.8
	73	29.6	60%	17.8	40%	11.8		7.67		3.78		2.95		5.7
	74	NA	–	–	–	–	–	–	–	–				
	TOTAL	**164.3**		**69.57**		**94.73**		**61.48**		**30.25**		**23.68**		**45.26**
STREAM CORRIDOR	75	10.6	72%	7.6	28%	3.0	85%	2.55	9%	.27	50%	1.5	47%	1.4
	76	177.7	82%	145.7	18%	32.0		2.72		2.88		16.0		15.04
	77	36.4	70%	25.5	30%	10.9		9.3		.98		5.45		5.12
	78	78.3	90%	70.5	10%	7.8		6.63		.70		3.9		3.67
	79	.6	60%	.4	40%	.2		.17		.02		.1		.09
	80	34.9	85%	29.7	15%	5.2		4.42		.47		2.6		2.45
	TOTAL	**338.9**		**279.4**		**59.5**		**50.27**		**5.32**		**29.55**		**27.77**

NOTE: Areas 81, 82, 83 are the Millstone River Terraces: 120.7 acres occur on the site and are entirely preserved.
Area 84 is off-site and therefore has not been included.

REQUIRED COVER IMPROVEMENTS TO COMPENSATE FOR ONE ACRE OF IMPERVIOUS SURFACE

Development Area	Acres of Cropland or Cleared Land Improved to Old Field Conditions
Diabase Uplands	
Moderately Dry[1]	1.94
Wet[2]	2.00
Brunswick Uplands	
Moderately Dry[3]	.94
Wet[4]	1.00
Enclosed Valley[1]	1.94
Stream Corridor[3]	.94

1. Based on S.C.S. curve for "Meadow", hydrologic group C.
2. Based on S.C.S. curve for "Meadow", hydrologic group D.
3. Based on S.C.S. curve for "Crops", hydrologic group C.
4. Based on S.C.S. curve for "Crops", hydrologic group D.

FIGURE 30

5.2 Land Use Opportunities and Constraints

a. General Discussion

Environmental Protection Standards recommend the extent of area which could be converted from existing conditions to impervious surface under future developed conditions. Specific decisions of land use, however, will determine the ultimate capacity of the site as well as the organization of the site plan. Several factors will influence the manner in which the Protection Standards are applied. Bedrock conditions determine the limitations of structural types and thus become a carrying capacity determinant. Off-site influences of public planning, market demand, and infrastructure are also important determinants that determine the ultimate capacity of the site. If politics require that prime agricultural soils are to be retained, carrying capacity for development is decreased. If on-site sewage treatment is required, areas available for land disposal of effluent will greatly influence carrying capacity. Because of need for recreation areas, those lands with high recreation potential, including water-related recreation may be removed from development.

These considerations, however are highly variable and their effect on carrying capacity is dependent on factors not considered in this Study.

b. Structural Capacity

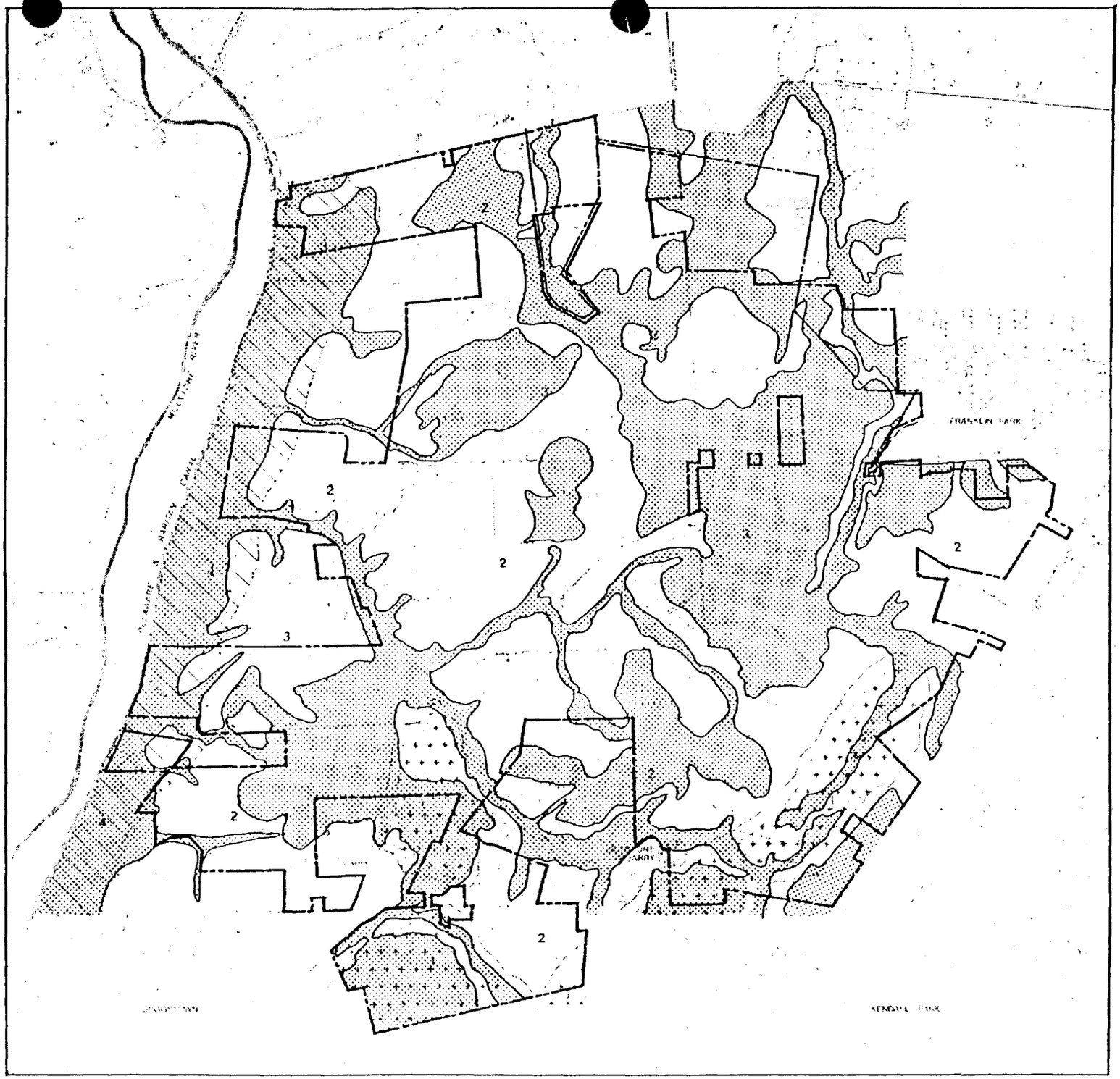
The capacity of the site for structures is primarily dependent on conditions of bedrock geology. Although many factors, including the slope of land, and design of the structures, the type of foundations, etc. influence structural capacity; bearing capacity is the most important determinant.

Three layers of structural bearing strata are identified on the maps (Figures 31 to 33). Layer 1 (Figure 31) is the soil mantle from 3'-6' or greater in depth. Three feet is the minimum depth for foundations due to the depth of frost from the ground surface. About 1,245 acres of this condition (Layer 1) occur. Under conditions of ideal drainage the bearing capacity of such materials is about 1 ton per square foot. At the study area, however, the depth to seasonal high water table is not more than 4' from the ground in many areas and not more than 6' over the balance of the site. For this reason, expected bearing capacity in the soil is not more than 1/2 ton per square foot. The maximum structure that can be built under these circumstances is a single family house of up to 2 stories. In addition, it is advisable that, should any basements be constructed, thorough water proofing should be an important factor of construction.

Layer 2 (Figure 32) consists of the upper layers of rock that have begun the process of weathering into soil. This layer is stronger than the soil layer (Layer 1) and it is found deeper from the surface. Of the four geologic formations at the site, the Diabase and the Brunswick formations are the rocks best suited for structural loadbearing. The Pennsaucken deposits are likely to be too thin and randomly stratified for bearing purposes. The Millstone Terraces would require extensive on-site testing to determine their bearing capacity; they have not been discussed since they are to be preserved for their function in the study area's ecosystem. (Refer to Chapter 4.1, 4.2 and Chapter 5.1f.) About 244 acres of the Diabase formation occurs on the site. In the weathered zone, 3'-10' from the surface, about 2 tons per square foot bearing capacity may be expected. Single family attached structures, or small office buildings (up to 3 stories) may be built in these areas. In the Brunswick formation, about 2408.7 acres of which are found on site, weathered rock is between 3 feet and 8 feet from the surface and has an expected bearing capacity of 2-8 tons per square foot. The maximum structure permitted on this formation would be office or family residences of 3 stories in height.

In the third layer, the unweathered rock zone (Figure 33), the bearing capacity further increases. In the Diabase formation the hard crystalline rock can support 20 tons per square foot at depths greater than 10 feet from the surface. Structures as large as 10-15 story buildings can be supported by this deep, strong rock. In the Brunswick formation, where the unweathered rock may be found below 8' from the surface, the bearing capacity is about 10-15 tons per square foot with a permitted structure of from 6-9 stories (for office or multi-family use).

It became obvious from rough calculations utilizing these figures that the structural capacities applied to the available developable area of 1589.33 acres, would result in a total carrying capacity well beyond the maximum allowable zoning and would meet virtually any program required. Thus, within the limits of the type of structures permitted, as outlined above, the development of the site will not be hindered by structural capacity of surface and subsurface conditions. The following maximum residential net densities for various building types were used to arrive at this conclusion:



STRUCTURAL CAPACITY: 1

LAYER 1: SOIL MANTLE

SOILS: 3 - 6' DEEP
BEARING CAPACITY:
1/2 TON PER SQ FT
MAXIMUM STRUCTURE
2 STORY DETACHED
SINGLE FAMILY RESIDENCE
OCCURRENCE: 1245 ACRES

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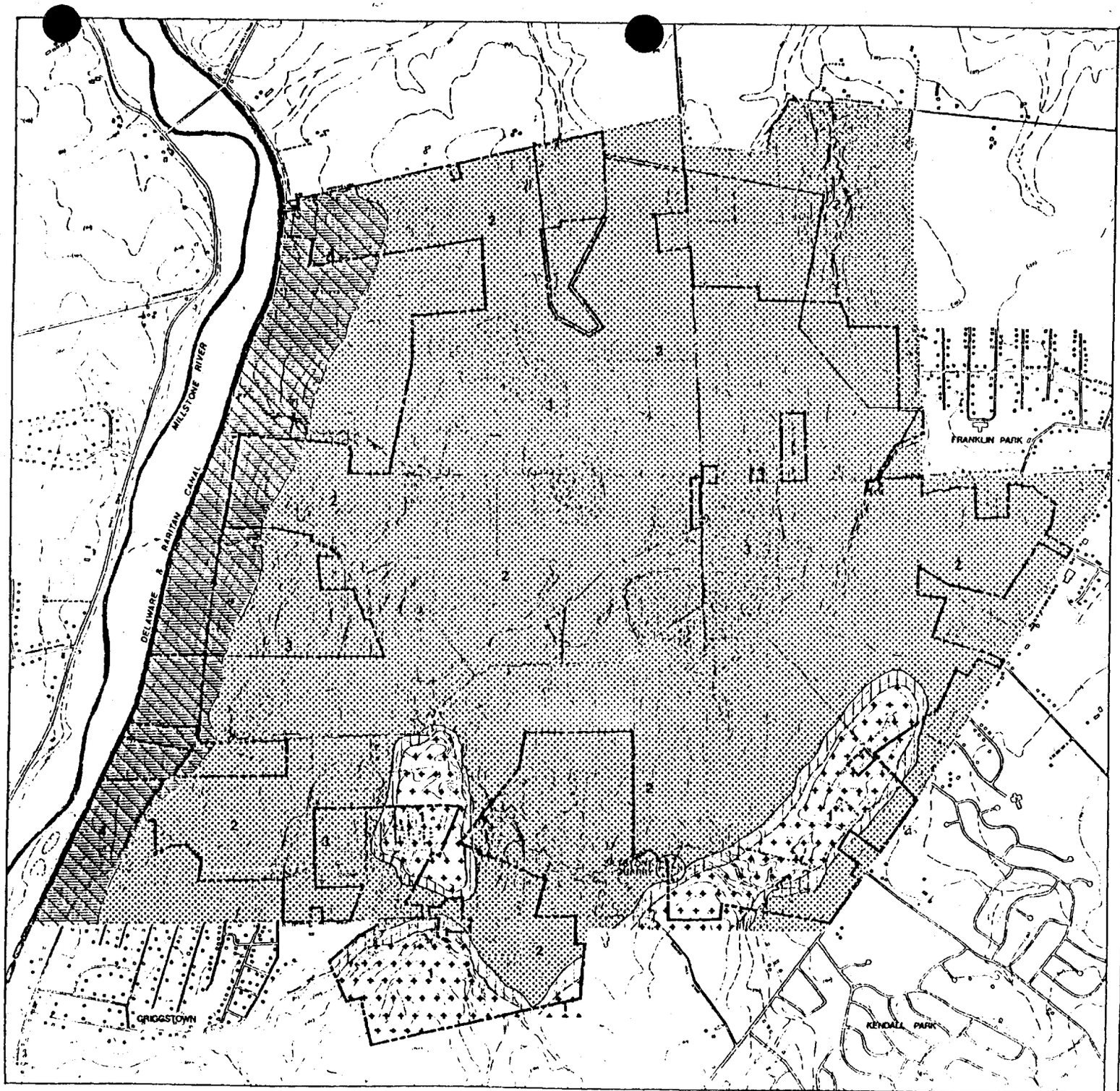

STRUCTURAL CAPACITY: 2

LAYER 2: WEATHERED ROCK

DIABASE: 3-10' FROM SURFACE
BEARING CAPACITY:
2 TONS PER SQ. FT.
MAXIMUM STRUCTURE: OFFICE OR SINGLE FAMILY ATTACHED, UP TO 3 STORIES
OCCURRENCE: 244 ACRES

BRUNSWICK: 3-8' FROM SURFACE
BEARING CAPACITY:
2-8 TONS PER SQ. FT.
MAXIMUM STRUCTURE: OFFICE OR MULTI-FAMILY RESIDENCE, UP TO 3 STORIES
OCCURRENCE: 24087 ACRES

MILLSTONE TERRACES:
ON SITE TESTING REQUIRED

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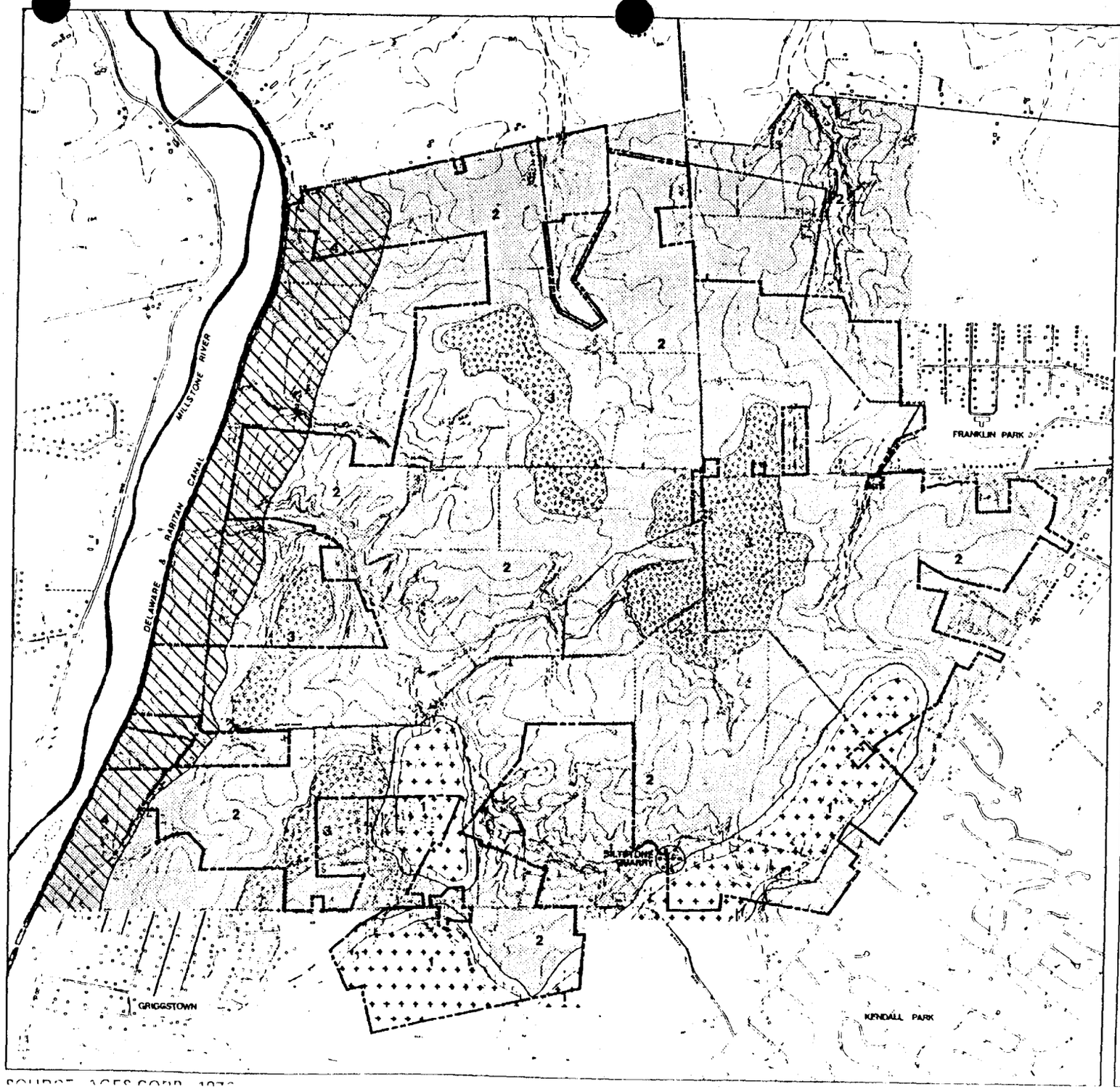
SOURCE: AGES CORP. 1976

MAP EXISTS AT A SCALE OF 1" = 500'

FIGURE 32



STRUCTURAL CAPACITY: 3

LAYER 3: UNWEATHERED ROCK

DIABASE:) 10' FROM SURFACE
BEARING CAPACITY:
20 TONS PER SQ FT
MAXIMUM STRUCTURE: OFFICE OR MULTI-FAMILY RESIDENCE, 10-15 STORIES
OCCURRENCE: 244 ACRES

BRUNSWICK:) 8' FROM SURFACE
BEARING CAPACITY:
10-15 TONS PER SQ FT.
MAXIMUM STRUCTURE: OFFICE OR MULTI-FAMILY RESIDENCE, 6-9 STORIES
OCCURRENCE: 2408.7 ACRES

MILLSTONE TERRACES
ON SITE TESTING REQUIRED
OCCURRENCE: 120.7 ACRES

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Building Type	Units Per Acre
Single family detached	8
Single family attached - 3 story maximum	29
Multi-family - 3 story maximum	54
Multi-family - 6-9 stories	63
Multi-family - 10-15 stories	211

c. Effluent Disposal

Communication with the Department of Environmental Protection has indicated that is current policy is to strictly enforce permitting regulations pertaining to the construction of private package treatment plants. The State has consistently refused to permit construction of such facilities due to the poor water quality of most streams into which they would discharge and the consistent history of poor effluent quality and operational failures in such systems. As a result, permits have been granted for individual package disposal and land application facilities only where the quality of discharges, stream quality, and proposed operation and maintenance will clearly provide for compliance with all State regulations.

Because of the precedented difficulty in obtaining permits for package treatment plants, alternative disposal systems were considered for site use. This analysis indicated that land application systems represent the most acceptable alternative.

The potential for land disposal of sewage effluent at the site was based on criteria recommended by the D.E.P.[1] and Rutgers University.[2] The best conditions are deep loamy soils on gentle slopes with great depth to seasonal high water table. Slopes should ideally be no greater than 8%, although a maximum of 15% is permitted. Therefore, since slopes over most of the study area are less than 15%, slope is not considered a constraint. Although ideal conditions for spraying do not occur on the site, about 692 acres of suitable soils may be found. This acreage includes a recommended 100 foot buffer zone from most areas with a 200 foot buffer from streams and ponds.

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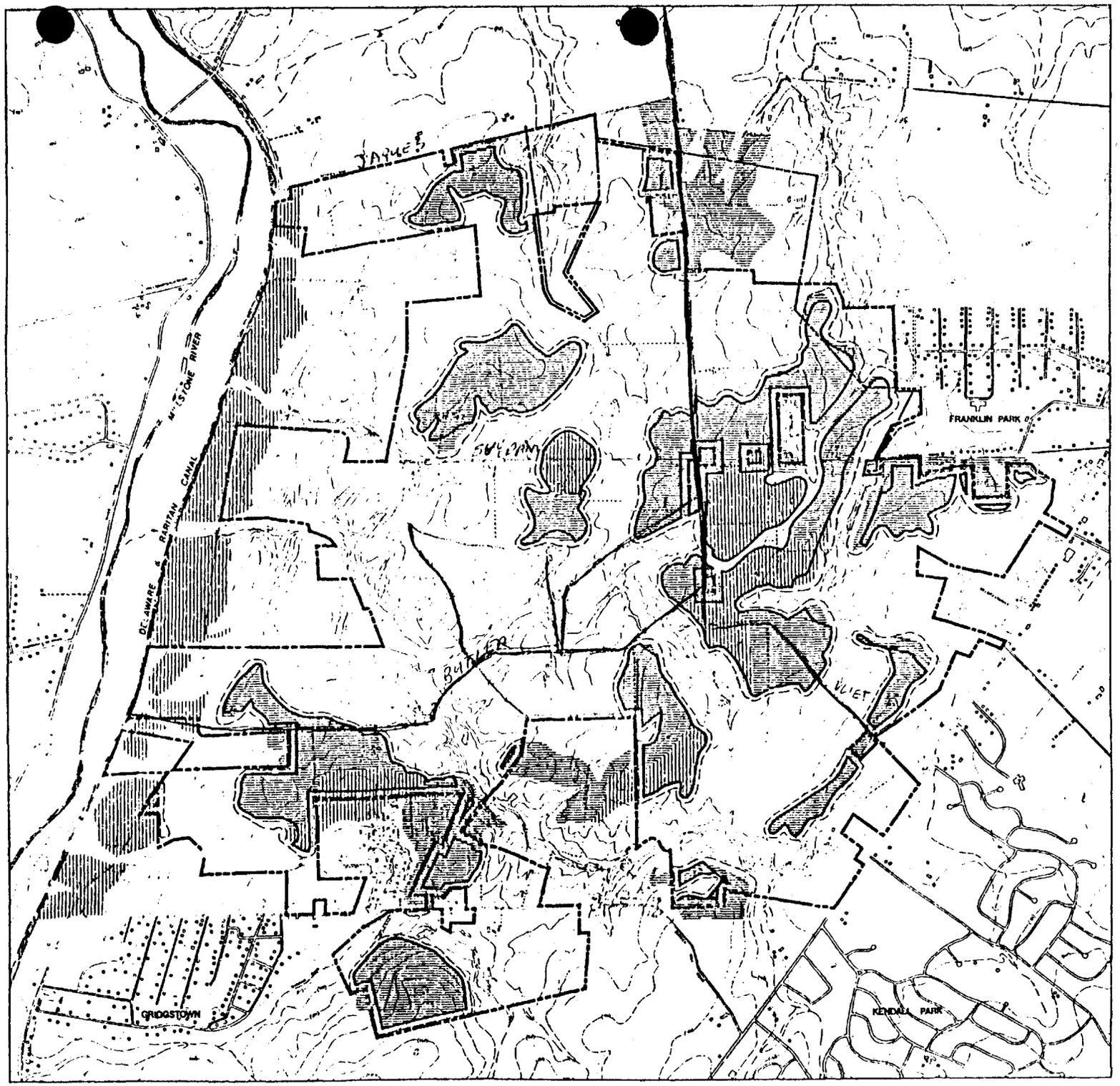
[1]Telephone conversation with Haig Kasaback, D.E.P. Division of Water Resources.

[2]Telephone conversation with Robert Hanna, Rutgers University.



LAND DISPOSAL OF EFFLUENT

OPPORTUNITIES & CONSTRAINTS

ACCEPTABLE SOILS: DUNELLEN SILT, PENN GRAVELLY LOAM, NIXON LOAM
SPRAY RATE = 2 PER ACRE PER WEEK
AVAILABLE SPRAY AREA: 147.23 ACRES

CONDITIONALLY ACCEPTABLE SOILS: READINGTON SILT, HOWELL SILT
SPRAY RATE = 1 PER ACRE PER WEEK
AVAILABLE SPRAY AREA: 544.52 ACRES

LIMIT OF RECOMMENDED BUFFER ZONE

LIMIT OF AVAILABLE SPRAY

AREA REQUIRED: ACCEPTABLE SOILS
1000 D.U.
42 ACRES

AREA REQUIRED: CONDITIONALLY ACCEPTABLE SOILS
1000 D.U.
84 ACRES

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Wallace McHarg Roberts and Todd
Architects
Landscape Architects
Urban and
Ecological Planners

SOURCES: NEW JERSEY DEPT. OF ENVIRONMENTAL PROTECTION, S.C.S., SOMERSET COUNTY, N.J.

MAP EXISTS AT A SCALE OF 1" = 500'

FIGURE 34

The map (Figure 34) indicates these areas. Soils are shown that were found to be acceptable for effluent spraying: the Dunellen and Nixon soils with depths of 6 feet or greater to bedrock and 4 feet to 6 feet or greater to seasonal high water table. These soils were considered to be acceptable for spraying with treated sewage effluent at a rate of 2 inches per acre per week. At this rate, about 50,000-55,000 gallons per week of effluent could be accommodated. Thus, the potential capacity of these areas would serve 71.5 persons per acre or about 23.8 dwelling units per acre.[1] Approximately 147 acres of these soils occur, with a potential total carrying capacity of 3,499 dwelling units.

Other soils are shown that were considered to be Conditionally Acceptable. These are soils with a depth to bedrock of 3 feet to 6 feet from the surface and 4 feet to 6 feet from the seasonal high water table. Soils with shallow depth to seasonal high water table 2 feet to 4 feet, but at least 6 feet to bedrock were also considered in this category.[2] A spray rate of only 1 inch per week could be permitted in these areas. About 544.5 acres of these soils occur. Thus, at the permitted spray rate, this area could handle the effluent to serve about 35.8 persons, or 11.9 dwelling units per acre. The potential carrying capacity of the Conditionally Acceptable soils is therefore 6480 dwelling units. Under existing conditions, then, the upper limit of available land for effluent spraying can support approximately 9979 dwelling units. The actual quantity of this land to be used would depend on considerations of program and marketing requirements, to achieve a balance between developed lands and land utilized for effluent disposal. Such spray areas could be combined with land held for agricultural production of crops, since they are largely coincident with areas best suited for agriculture.

It should be noted that the above capacities are estimates and that specific on-site testing is required for permits to be granted. In addition, a monitoring system for protection against ground and surface water pollution must be part of any spray irrigation program.

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[1]Based on 100 gallons per person per day for 7 days.

[2]Based on telephone conversations with Robert Hanna, Rutgers University, March 1976.

d. Agriculture

Opportunities for agriculture were mapped in accordance with Soil Conservation Service tax assessment classifications.[1] Five levels of soil productivity exist within this system:

"A" Best Soils: These are permanently cultivatable and produce the highest yields for most crops.

"B" Good Soils: These are permanently cultivatable, but produce somewhat lower yields.

"C" Fair Soils: These are permanently cultivatable, but often shallow, excessively dry, or excessively wet, and produce lower yields for most crops than "A" or "B" soils.

"D" Poor Soils: These are excessively wet, stony, or droughty and produce low yields for most crops.

"E" Unsuitable Soils: These are more wet, stony, shallow, or droughty, include extremely steep slopes, and are not suited for agriculture.

On the site about 888 acres of soils are classified under category "A", best suited for agriculture. The remainder consist of soils in the B, C, and D categories. The map (Figure 35) shows the "A" class soils, the "B" and "C" classes combined, and the "D" class soils. None of class "E" soils is found at the site.

If preservation of agricultural soils is to become a development goal, the "A" soils are those most desired to be preserved. The "D" soils are those least desired to be preserved and most likely to be developed first (except where they occur in other preservation areas).

If all the "A" soils are to be preserved, the implications for carrying capacity will be significant since these soils occur primarily within the designated developable land areas. Thus, during site planning, tradeoffs will have to be made between agricultural preservation and the carrying capacity limits of the site. In addition, the "A" soils are almost totally concurrent with the soils suited for spray disposal of sewage effluent. This situation again implies specific area tradeoffs to be made during site planning and design if this method of effluent disposal is to be employed.

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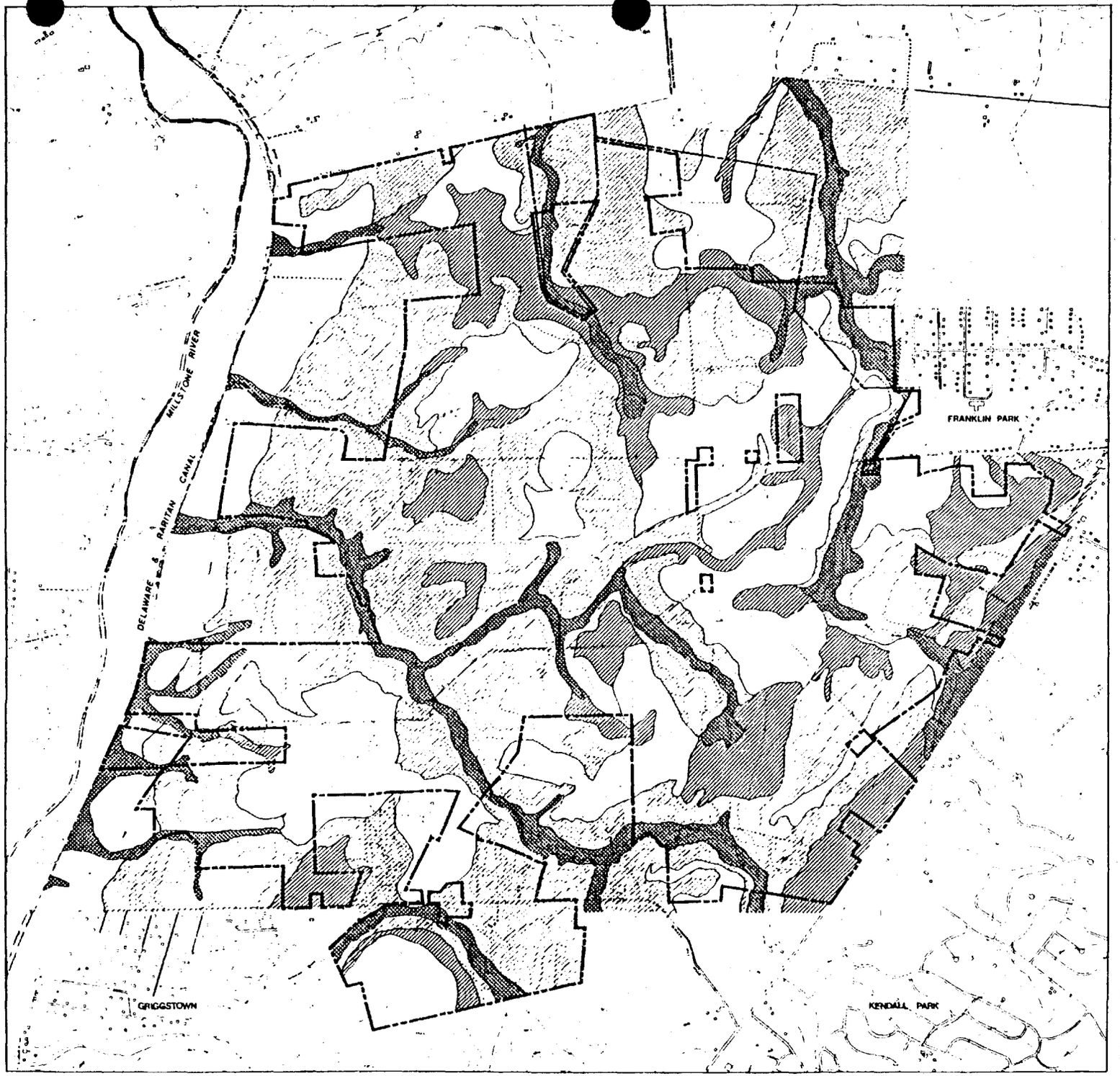
[1]Somerset County Soil Conservation Service.



AGRICULTURE:
OPPORTUNITIES & CONSTRAINTS

- FARM ASSESSMENT *A
- FARM ASSESSMENT B
- FARM ASSESSMENT C
- FARM ASSESSMENT D

*AS ASSESSED FOR AGRICULTURAL PRODUCTIVITY BY S.C.S., SOMERSET COUNTY, N.J.

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Wallace McHarg Roberts and Todd
Architects
Landscape Architects
Urban and
Ecological Planners
1737 Chestnut Street
Philadelphia, Pennsylvania 19103
215 561 0520

SOURCE: SOMERSET COUNTY SOIL CONSERVATION SERVICE, 1972

FIGURE 27

e. Recreation

Structured (Active) Recreation

Structured recreation includes activities such as softball, baseball, football, soccer, tennis, volleyball, and handball. These activities, required in an urbanized area of the size contemplated on the site, usually require flat, open and well drained areas.

Three criteria were used for evaluating structured recreational opportunities: 1) flat slopes (0-3%), 2) non-wooded areas (primarily consisting of crop and pasture vegetative cover) and 3) permeable soils. Permeable soils were selected by use of the Soil Conservation Service hydrologic group classification containing four groups: A-B-C-D, "A" being the most permeable and "D" being the least permeable. Only group B soils were considered appropriate as the best locations of recreation facilities. As shown on the map (Figure 36) two categories of suitability for structured recreation have been defined. The best opportunities represent the synthesis of all three criteria. The second best opportunities represent the synthesis of flat slopes, 0-3%, and non-wooded, vegetative cover. Also illustrated are unique points of recreational significance. They include the Bunker Hill Golf Course, an eighteen hole public facility; and the Six Mile Run Reservoir area, a potential site for future recreation activities either water-related (if the reservoir is constructed) or forest-related, if the area becomes a hunting preserve.[1]

Non-Structured (Passive) Recreation

Non-structured recreation includes activities such as picnicking, walking (nature trails), bicycling, horse riding, and wildlife observation. These activities usually occur in flat to moderate sloped areas where walking is easy, close to water, and in those wooded areas in which pedestrian access is unimpeded.

The criteria used to evaluate non-structured recreational activities were: 1) slopes (of 0-3%), 2) wooded areas (illustrated on the map vegetation as groups 4, 5, 6, and 14, consisting of tulip poplar, ash, black walnut, oak, beech, dogwood and red oak) and 3) areas within the defined physical planning unit "stream corridor" (as shown on the Physical Planning Unit Map). Also included was any area within easy viewing distance of

[1]WMRT, In-house papers, J.W. Field, November 28, 1975.

surface waters (within 300' or the nearest ridge line of the water body).

As shown on the map (Figure 36) two categories of non-structured recreation are defined. The best opportunities represent the synthesis of the three criteria. The second best opportunity consists of the synthesis of slopes (0-8%) and vegetative group covers (4,5,6, and 14).

Also illustrated are points of unique recreational significance. They include: 1) a quarry, (probably used for the stone in the Delaware and Raritan Canal, and a potential site for study of the area's geology), 2) an underground pipeline (the right of way which could be used in establishing an on-site trail system), and 3) the Delaware and Raritan Canal. The John Honeyman house, near the site at Bunker Hill and Canal Roads, belonged to one of George Washington's intelligence agents and, although it is not open to the public, is a historically significant feature.

The specific acreages of areas suitable for recreation were not calculated, since they comprise most of the developable as well as preservation lands on the site. It is obvious, however, that the quantity of these lands ultimately used for recreation amenity in an overall program will have an important effect on the remaining quantity of land available for development.

f. Ponding

Suitability for ponding was studied as part of the assessment of runoff control capacity and the establishment of areas suited for recreation, since ponds can be a major addition to recreation programs. Areas best suited for ponding occur within most of the site's watersheds and would provide opportunities for ultilizing both constantly filled ponds and shallow impoundments in an overall runoff control scheme.

As with recreation lands, the acreage of areas suitable for ponding was not calculated, since the quantity of these areas and their effect on carrying capacity will reflect program and marketing decisions.

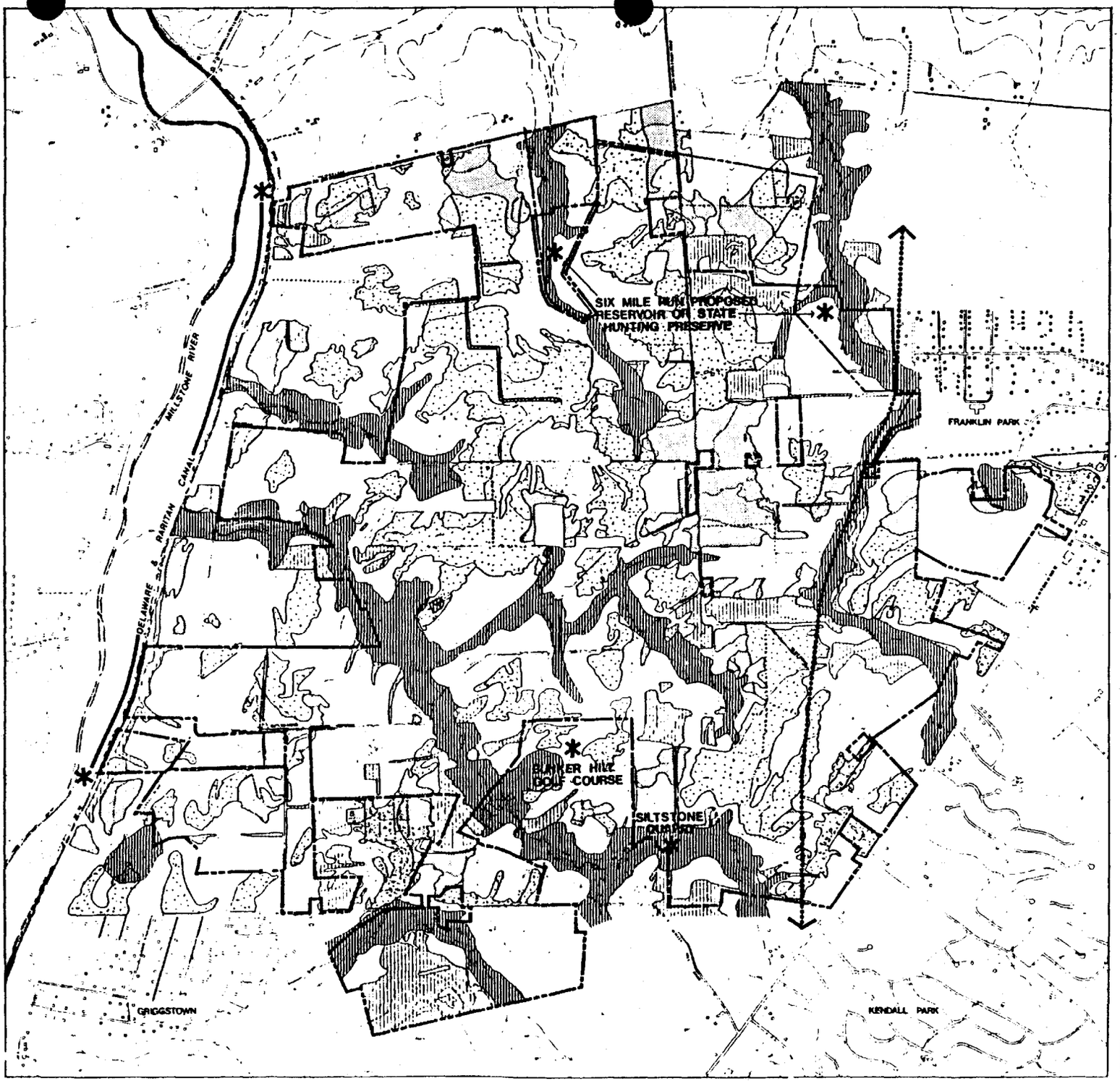
The areas considered suitable for ponding are illustrated on the map (Figure 37). Three criteria were used for evaluating ponding opportunities. They are: 1) soil hydrologic group classification determined by the Soil Conservation Service (Grouping is A.B.C.D., A being the most permeable and group D being the least permeable); 2) depth to water table, and 3) runoff volume intensity. Runoff volume intensity is the runoff calculated for each watershed by the Soil Cover Complex Method divided by the number of areas

within the watershed, thus giving an equal basis of comparison for runoff quantities.

Three levels of suitability are illustrated. The most suitable areas are those where the soil hydrologic group is D, the depth to water table from the surface is 0-3 feet and the runoff intensity is .8 to 6.6 cubic feet per second per acre for a 50 year, 7 inch, 24 hour rainfall.[1] The second most suitable areas are those in soil hydrologic group D, or with depth to water table 0-3' from the surface and a runoff intensity of 2.27 to 6.6 cfs/acre, again for a 7 inch, 50 year, 24 hour rainfall.

The third most suitable areas are those within soil hydrologic group D or with a water table depth of 0-3' from the surface and a runoff intensity of .82 to 3.7 cfs/acre for a 7 inch, 50 year, 24 hour rainfall.

[1]Soil Conservation Service S.C.S.



RECREATION:
OPPORTUNITIES

STRUCTURED (ACTIVE)

- HIGH: FLAT, NON-WOODED, PERMEABLE SOILS
- MODERATE: FLAT, NON-WOODED

NON-STRUCTURED (PASSIVE)

- HIGH: MODERATELY FLAT, WOODED, NEAR WATER BODY
- MODERATE: MODERATELY FLAT, WOODED
- LOW TO MODERATE: OPPORTUNITY FOR STRUCTURED & NON-STRUCTURED RECREATION
- POINT OF INTEREST
- SUN OIL PIPELINE R.O.W.

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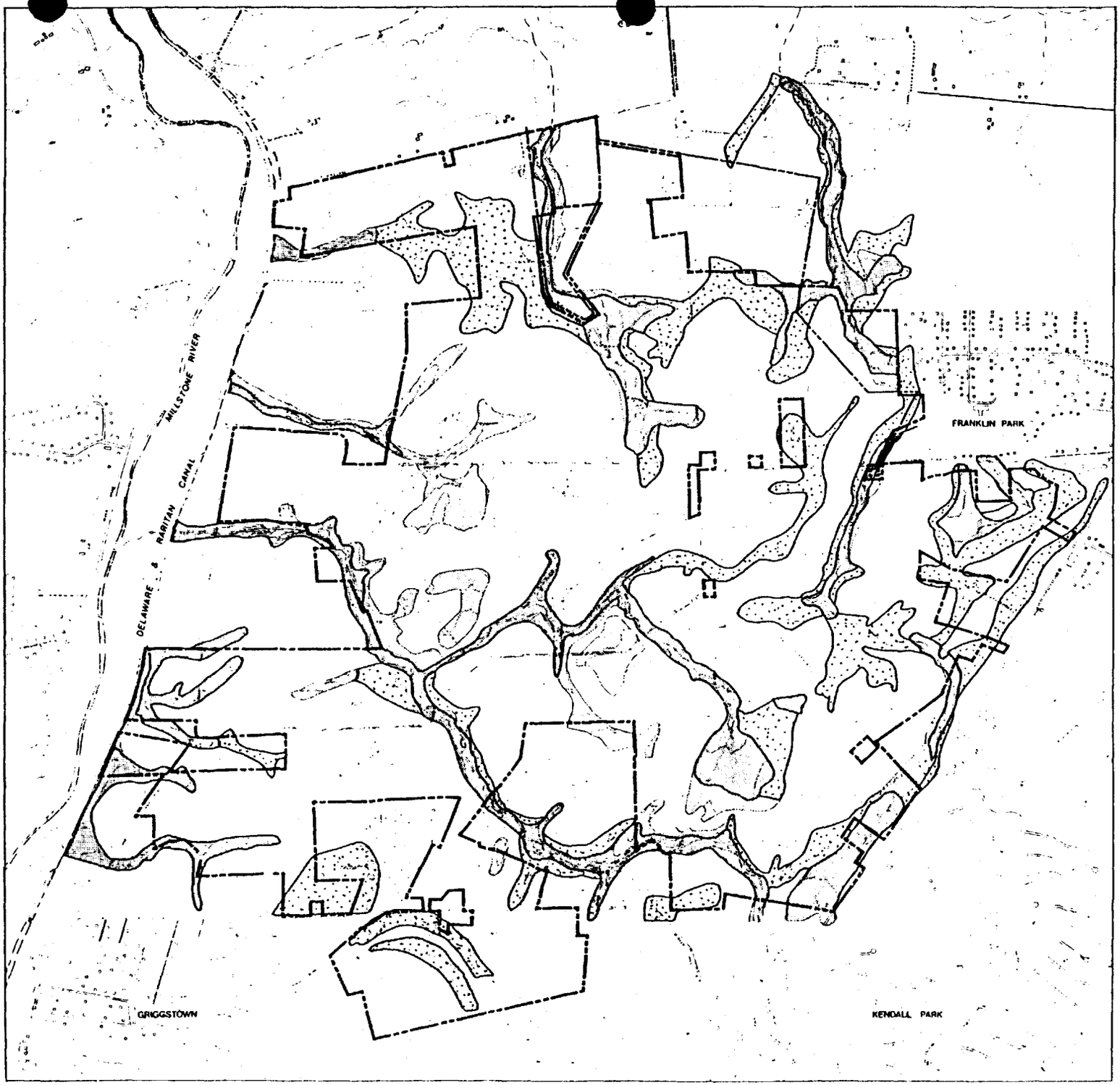
Wallace McHarg Roberts and Todd



PONDING:
OPPORTUNITIES

HIGHEST

1. HYDROLOGIC GROUP D
2. WATER TABLE 0-3 ft.
3. .8 to 6.6 C.F.S. AC. OF WATERSHED

HIGH

1. HYDROLOGIC GROUP D OR WATER TABLE 0-3 ft.
2. 2.27 to 6.6 C.F.S. AC. OF WATERSHED

MODERATE

1. HYDROLOGIC GROUP D OR WATER TABLE 0-3 ft.
2. .82 to 3.7 C.F.S. AC. OF WATERSHED

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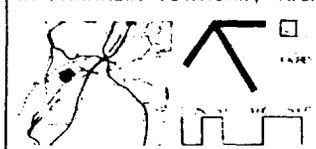

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5.3 Conclusions and Recommendations

a. Carrying Capacity

Based on the findings of this Study, it is concluded that, in terms of environmental factors, the carrying capacity on the site is very high. Scarcity of valuable native vegetation, shallow slopes, narrow stream corridors, and adequate bearing strength result in a site with few physical capacity limitations (assuming a sewerage treatment system is permissable).

With the required preservation of ecologically important areas, and provisions of adequate runoff control measures to ensure zero runoff increase, approximately 1590 acres remain for development purposes to include buildings, roads, parking areas, parks, playgrounds and any areas given to effluent disposal.

With construction allocated only to areas of weathered rock layer of the developable lands, more capacity exists than would be allowed by the highest allowable P.U.D. zoning in Franklin Township. If the P.U.D. categories H-D and R-40 (1) were allocated to the above acreage and given the maximum gross density of 7 dwelling units per acre, 11,125 dwelling units could be built on the site. Even this intensity of development does not represent the upper limit of the site's physical capacity because much higher densities can be accommodated.

It is, of course, important to realize there are several implications of building at high development intensity that also affect the social and economic viability of a project. This Study represents the carrying capacity of environments within the site boundaries only without accounting for considerations of aesthetics or other program determinants. If Franklin Township were to permit a P.U.D. density of 7 dwelling units per acre on the net land area after deducting all the soils best suited for effluent disposal (approximately 147 acres) plus three-quarters of the soils conditionally suited for effluent disposal (544.5 x 3/4, or approximately 408.4 acres), the net developable area would be approximately 1142 acres which would yield 7993.3 dwelling units (Figure 38). Considerations of visual and social environment may not suggest a uniform P.U.D. density across all developable land, but that higher densities be allowed at the central and eastern portions where public services are most accessible. Other local and regional planning considerations will be taken into account to determine the full capacity and types of uses for the site. Some of these can be measured by marketing and planning studies whereas others are entirely within the province of values and policies of the Franklin Township Community and Somerset County.

b. Design Implications

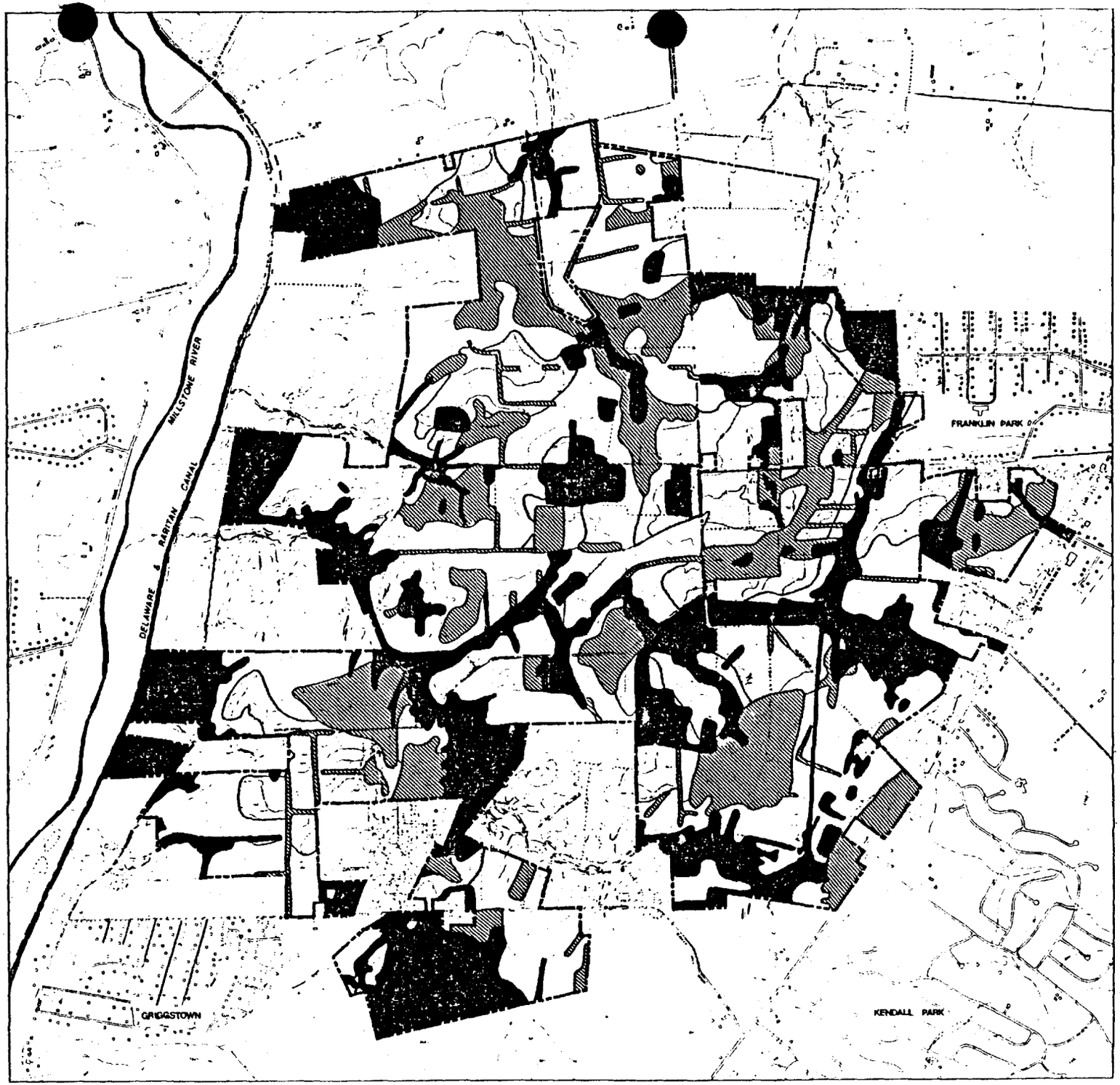
On comparative analysis of the maps of Environmental Protection Standards (Figure 28), Opportunities for Effluent Disposal (Figure 34), Opportunities for Agriculture (Figure 35), Opportunities for Recreation (Figure 36), and Opportunities for Ponding (Figure 37) patterns of possible development begin to be observable.

On the uplands, development could be interspersed with shallow runoff control, impoundments over permeable and moderately permeable soils. Downslope, effluent treatment lagoons could catch both filtered runoff waters and sewage for treatment and subsequent spraying onto areas of suitable soils.

Preservation corridors for passive recreation could easily be linked to the Delaware and Raritan Canal and to lowland ponds over impermeable soils. These corridors of open space and other improvements such as ponds and the storm water runoff control system along with additional dense vegetative buffers could all be connected into a network of recreation areas and open space systems.

It is possible to plan and design a mixed use community that caters to a wide range of housing and land use requirements along with preservation and rehabilitation of the natural environment. Some aspects of the natural environment will inevitably be modified but the essential components and dynamics of the system will be preserved and in some cases enriched by careful husbandry and introduction of new species.

A visually satisfying development applying the foregoing standards is finally dependent on building form and aesthetics. It is recommended that as far as possible, landscaping plant materials native to the area be used in order to establish identity with the woods and hedges on site and that buildings use assorted browns and greys as much as possible in their color schemes.



LAND USE SUITABILITY FOR DEVELOPMENT

LAND RECOMMENDED FOR BUILDING 1140 ACRES

MOST SUITABLE

LAND RECOMMENDED FOR OTHER USES 1635 ACRES

EFFLUENT DISPOSAL

RUNOFF CONTROL

PRESERVATION

TOTAL 2775 ACRES

THE FRANKLIN PROJECT

A CARRYING CAPACITY STUDY IN FRANKLIN TOWNSHIP, N. J.

Wallace McHarg Roberts and Todd

FIGURE 38