SEWAGE FACILITIES PLAN UPDATE
MIDDLE PAXTON TOWNSHIP, DAUPHIN COUNTY, PENNSYLVANIA

REWAI Project 87195

For

Middle Paxton Township
Board of Supervisors
Dauphin, PA

By

R. E. WRIGHT ASSOCIATES, INC.
3240 Schoolhouse Road
Middletown, PA 17057

July 1988

Respectfully submitted,

Andrew C. Paszkowski

Andrew C. Paszkowski, PP/AICP
Group Manager of Planning

Reviewed by:

Peter G. Robelen

Peter G. Robelen, PG
Project Director

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION AND SUMMARY

1.0 INTRODUCTION AND SUMMARY

1.1 Purpose and Scope

The Pennsylvania Sewage Facilities Act (Act 537) requires each municipality in the Commonwealth to develop and keep up-to-date plans for adequate sewage treatment and disposal facilities within their jurisdiction. The process of updating these plans is mandated by the Pennsylvania Department of Environmental Resources (DER). The Middle Paxton Township Sewage Facilities Plan was found by DER to be inadequate to meet the sewage needs of the Township because it contained outdated implementation schedules and failed to provide for adequate treatment facilities. The Middle Paxton Township Supervisors consented to an update of this plan via an order and agreement issued by DER. The DER further ordered in September 1987 additional work to define public sewerage need areas based upon previous on-lot sewage disposal system malfunctions and alleged groundwater contamination.

The intent of this update is to determine sewage facility needs and problems, and to provide alternatives to resolve these needs and problems expeditiously and prevent future sewage disposal problems from arising. The update is structured as follows:

1. Planning Objectives and Needs - Previous wastewater planning efforts and the recently adopted Comprehensive Plan are described.

2. Physical Description of Planning Area - The study area is identified and evaluated physically and demographically.

3. Evaluation of Existing Wastewater Treatment and Conveyance Systems - All the existing sewage collection, treatment, and disposal systems are evaluated to determine efficiency.

4. Evaluation of Wastewater Treatment Needs - On-lot subsurface sewage disposal systems are evaluated, malfunctions are identified and classified into those systems which can be repaired or replaced, and those areas which must be served by public sewer facilities.

5. Evaluation of Planning and Facility Alternatives - Potential solutions to facility needs and problems are identified and evaluated for cost-effectiveness and environmental impact.

6. Recommended Alternative - The selected technical and institutional strategies are described.

1.2 Recommendations and Implementation Schedule

1.2.1 On-lot System Design

Detailed designs and site inspections must be conducted by qualified personnel before a sewage permit is issued and an on-lot system is installed. Site inspections are to be conducted during and after system construction to ensure that the on-lot system has been properly installed. In deciding which type of system to use, the following must be considered:

1. Type of sewage.

2. Volume of wastewater flow.

3. Pattern of wastewater flow.

4. Soil and hydrogeological properties of the site.

Consultation with the Middle Paxton Township sewage enforcement officer is strongly suggested prior to design and a permit application.

1.2.2 Water Quality Monitoring

A water quality monitoring program should be instituted to continually assess the water quality impact from existing on-lot systems in the vicinity of Stoney Creek Manor and Delwood Acres. It would include sampling of monitoring wells, and upgradient and downgradient stream locations for nitrate-nitrogen and total coliform. In order to determine seasonal fluctuations, these wells and stream points would be sampled during drought and very wet periods. Such monitoring would be directed at areas with a concentration of chronic malfunctions and alleged water pollution.

1.2.3 Comprehensive Planning

The Middle Paxton Township Comprehensive Plan has been updated and recently adopted. It recommends amendments to the Zoning Ordinance, and Subdivision and Land Development Ordinance. Larger lot sizes (one acre or greater in land area) are proposed for residential building lots using on-lot systems without public water services and in steep sloped areas. A feasibility study of

water and sewer facilities is also required for any subdivision or land development plan for more than five building lots or dwelling units.

1.2.4 On-lot System Maintenance

An on-lot system maintenance program is proposed to include public education and pump and haul record keeping. A public education program will be established to consist of an annual property owner training session and a semiannual community newsletter. Septic tank pumping contractor certification will be developed to ensure that on-lot systems are regularly inspected and pumped by qualified personnel. An approved contractor list and an ongoing pump and haul record will be maintained by the Township.

1.2.5 Implementation Schedule

Any costs to administer the above recommendations will be absorbed in the Township budget. These recommendations either have been or will soon be implemented.

On-lot sewage system management is the preferred method for sewage treatment and disposal. Although soil conditions in Middle Paxton Township are not optimal for subsurface soil absorption systems, there are alternative systems with reliable performance under minimum supervision. They are more costly than conventional systems, but their proper operation and maintenance can be guaranteed with periodic monitoring and pumping of septic tanks.

The emerging land development pattern in Middle Paxton Township does not reflect the need for sewerage within the next 10 years. The following factors do not justify sewerage being constructed in lieu of on-lot sewage systems:

1. Presence of public water service.

2. No indication of polluted groundwater and surface water.

3. Limited extent of confirmed on-lot sewage system failures.

4. No evidence of wastewater discharges on the ground surface.

5. Existence of low development density and similar zoning restrictions.

6. Favorable economics.

The Middle Paxton Township Sewage Enforcement Officer controls on-lot sewage system installation through design review, field inspection, and certification. The identification and correction of on-lot sewage system failures are a necessary part of a complete management program. They will be accomplished by sanitary surveys, water quality monitoring, public education, and centralized record keeping.

Within the first five years of this plan, the focus of attention will be on the Delwood Acres and Stoney Creek Manor subdivisions, the area adjacent to Dauphin Borough between Stoney Creek Road and Elizabeth Avenue and between McElwee Road, Clark Creek, Hagy Road, and the commercial area along Route 22/322. The management

program will be expanded the second five years into the area bounded by Routes 225, 325, and 22/322. No sewerage facilities are planned during the next decade.

2.0 PLANNING OBJECTIVES AND NEEDS

2.0 PLANNING OBJECTIVES AND NEEDS

2.1 Previous Wastewater Planning Efforts

The original Official Sewage Facilities Plan for Middle Paxton Township was adopted in 1969. It is part of the Cumberland and Dauphin Counties Area Sewerage Plan, which recommended the upgrading of the existing Dauphin Borough Wastewater Treatment Plant to be classified as a secondary treatment plant with increased capacity. Sewers were to be extended into the vicinity of the Middle Paxton Elementary School. Subsequently, a pump station was to be constructed along Stoney Creek, and sewers installed to serve areas west of Dauphin Borough along Routes 22/322 and north of Dauphin Borough along Route 225 and Denison Road, including the Stoney Creek Manor subdivision. Development potential was determined to be greatest in the Stoney Creek valley. The 1969 plan also noted that the public water supply intake on Stoney Creek at Dauphin made protecting the stream from pollution imperative.

In 1971, DER directed Middle Paxton Township to study the feasibility of sewering those areas outlined in the 1969 plan. The Sewage Facilities Preliminary report was submitted in 1973 and became the amended Official Sewage Facilities Plan for Middle Paxton Township. This 1973 plan recommended that the Stoney Creek Manor and Fertig Farm areas be sewered as soon as grants were available. It also delineated areas throughout Middle Paxton Township where sewer service was to be implemented as sewerage facilities became necessary or desirable. It concluded that there was no concentration of population within the Township which would produce sufficient income from sewer service charges to finance a municipal sewer system without substantial state or federal financial assistance.

In 1975, Dauphin Borough authorized the Dauphin Borough Municipal Authority to apply for a United States Environmental Protection Agency (EPA) Step I Facilities Planning Grant. This application reflected both the initial and future Middle Paxton Township expansion of Dauphin Borough sewer services as shown in the Official Sewage Facilities Plan for Middle Paxton Township (1969, 1973). These plans have been incorporated into the Pennsylvania Comprehensive Water Quality Management Plan.

The DER determined that the Official Sewage Facilities Plan for Middle Paxton Township was inadequate to meet needs of the Township in respect to Chapter 71.15(a)(2) of DER rules and regulations governing the administration of the sewage facilities program. On April 30, 1986, the Middle Paxton Township Supervisors executed a consent order and agreement with DER to submit a revision to the Official Sewage Facilities Plan. Amendments to this plan were prepared on October 6, 1986, and again on June 15, 1987. Neither were found acceptable by DER.

On September 23, 1987, DER directed Middle Paxton Township to undertake additional fieldwork in order to clearly define existing sewage facility need areas based on existing on-lot sewage disposal system malfunctions and groundwater contamination. In February 1988, the Middle Paxton Township Supervisors retained R. E. Wright Associates, Inc. (REWAI) to prepare a report entitled "Groundwater and Surface Water Quality Analysis of the Middle Paxton Township Sewage Facilities Study Area," and Grove Associates to prepare a report entitled "Study of Subsurface Disposal System Repairs: Stoney Creek Manor/Delwood Acres, Middle Paxton Township." These reports were incorporated as appendices into this revision of the Official Sewage Facilities Plan for Middle Paxton Township. They both propose that the existing practice of septic tank-soil absorption systems

for sewage treatment and disposal should be continued providing that the septic tank is periodically inspected and pumped.

2.2 Adopted Comprehensive Plan

The 1979 Comprehensive Plan for Middle Paxton Township was updated and adopted on March 7, 1988. The primary purpose of this update was to examine major problems and objectives relating to land development in Middle Paxton Township over the previous nine years. It involved a review of the extent to which there had been significant changes in the assumptions, policies, and community objectives forming the basis for the Comprehensive Plan, particularly the density and distribution of population, land use, movement of people and goods, community facilities, public utilities, conservation of natural resources, and changes in applicable laws and regulations. The Comprehensive Plan (1988) determined capacity for land development in Middle Paxton Township, the ability of the Township to adequately support existing and future land development, and zoning regulations which match this capacity for development.

2.2.1 Capacity for Development

Current capacity for future land development was calculated with regard to the most restrictive factors: groundwater supply and its quality. Future land use projections were made and compared to current zoning districts. Based on the current capacity calculations, current zoning was modified to protect critical areas such as steep slopes and to direct new land development in areas with suitable natural resources or public infrastructure (roads, water, and sewer). As a result, the Middle Paxton Township Zoning Ordinance was amended to change the minimum lot size to 1 acre in the Residential Agricultural District and a

portion of the Residential Suburban District, and to 2 acres where the average slope is 15 percent or greater. This was done to provide sufficient land area to accommodate on-lot sewage disposal systems and to maintain the quality standard of the regional groundwater supply.

The adopted Comprehensive Plan recommends that the majority of new residential development utilize at least one acre of land. However, smaller tracts could be developed with the use of public water and/or sewer improvements. It is estimated that the residential districts in Middle Paxton Township could be divided into low to medium density (two to four dwelling units per acre) and very low density (one or more acres per dwelling unit) zones. Low to medium density should be permitted on 3,475 acres (or 20 percent of the residential district lands) and very low density on 13,900 acres (or the remaining 80 percent). This would be consistent with a maximum population limit of 25,000 for Middle Paxton Township, as established by the Comprehensive Plan.

Most of the developable land in Middle Paxton Township lies in the northwest corner of the Township, an area bounded by Routes 22/322, 225, and 325. This area exhibits favorable soils, gentle to moderate slopes, major roads, public water utilities, and adequate groundwater yield and quality.

2.3 Zoning and Density

The existing zoning districts are shown on Figure 2-1 along with land subdivision activity, which has occurred since 1980 in Middle Paxton Township. Most of these subdivisions are clustered in the northwest corner of the Township and along the stream valleys. As a result of zoning, only three major subdivisions were approved between the years of 1980 and 1986. Sarah's Acres

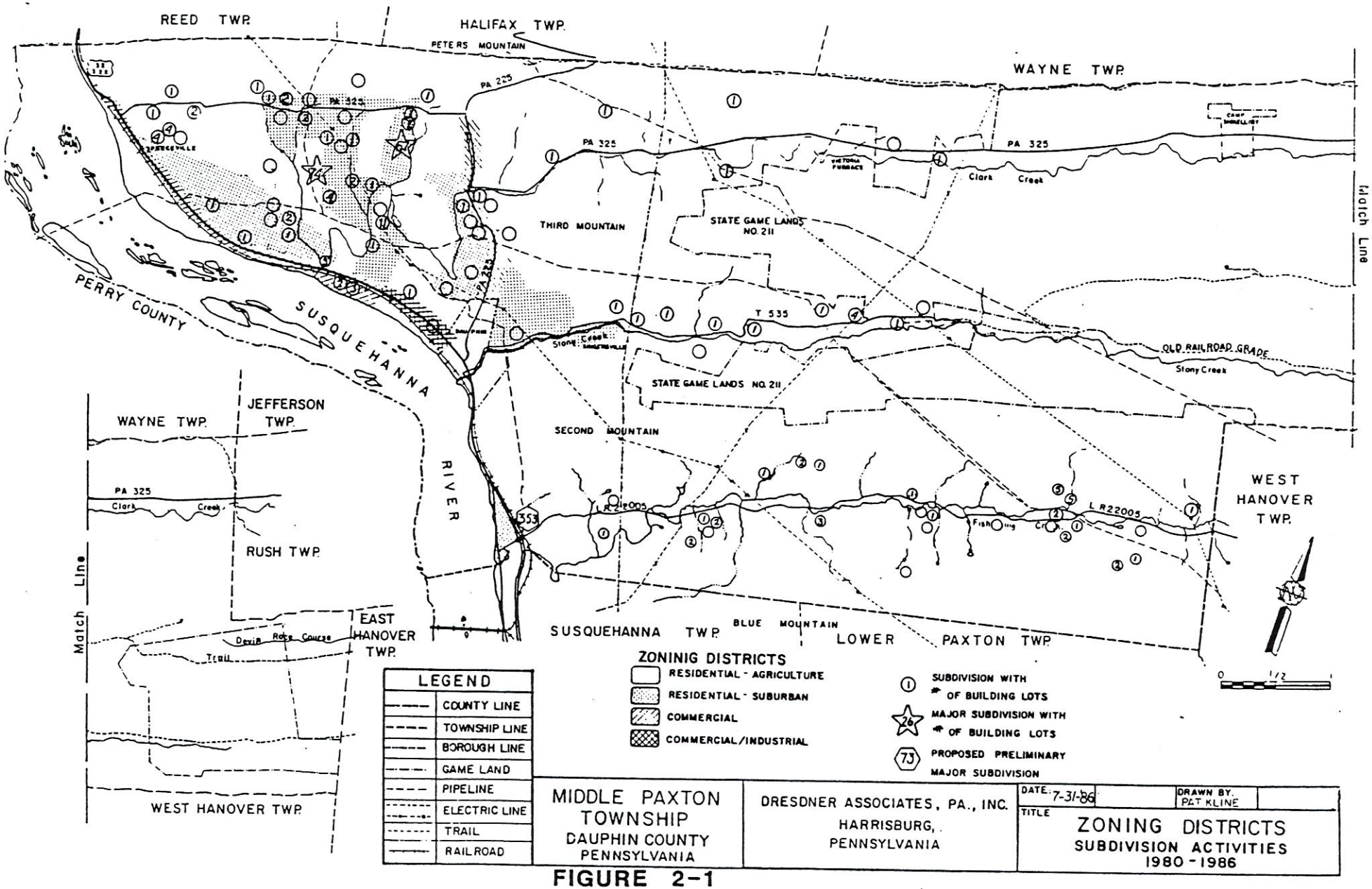

REED TWP.
HALIFAX TWP.
PETERS MOUNTAIN
WAYNE TWP.
PA 325
PA 225
Clark Creek
Match Line
THIRD MOUNTAIN
STATE GAME LANDS NO. 211
PERRY COUNTY
SUSQUEHANNA RIVER
T 535
Stony Creek
OLD RAILROAD GRADE
STATE GAME LANDS NO. 211
SECOND MOUNTAIN
JEFFERSON TWP.
WAYNE TWP.
PA 325
Clark Creek
RUSH TWP.
WEST HANOVER TWP.
353
L R22005
Fishing Cr
EAST HANOVER TWP.
Devils Race Course Trail
SUSQUEHANNA TWP.
BLUE MOUNTAIN
LOWER PAXTON TWP.
0 1/2 1
ZONINIG DISTRICTS
RESIDENTIAL - AGRICULTURE
RESIDENTIAL - SUBURBAN
COMMERCIAL
COMMERCIAL/INDUSTRIAL
SUBDIVISION WITH # OF BUILDING LOTS
MAJOR SUBDIVISION WITH # OF BUILDING LOTS
PROPOSED PRELIMINARY MAJOR SUBDIVISION
LEGEND
COUNTY LINE
TOWNSHIP LINE
BOROUGH LINE
GAME LAND
PIPELINE
ELECTRIC LINE
TRAIL
RAILROAD
MIDDLE PAXTON TOWNSHIP
DAUPHIN COUNTY
PENNSYLVANIA
DRESDNER ASSOCIATES, PA., INC.
HARRISBURG, PENNSYLVANIA
DATE: 7-31-86
DRAWN BY: PAT KLINE
TITLE
ZONING DISTRICTS
SUBDIVISION ACTIVITIES
1980 - 1986

FIGURE 2-1

and Holly Hills have sold a few lots and Ben Barra intends to construct 353 dwelling units in the southwest corner of the Township. Several subdivisions received approval since 1986. They are listed on Table 2-1.

All other subdivisions contain less than five lots. The average number of building lots created each year between 1980 and 1988 is 27. Within that same period of time, an average of 31 residential building permits and 20 new sewage system permits was issued annually (see Table 2-2).

Residential land use more than doubled in total area between the years of 1977 and 1987, followed by increases in public and commercial land uses (see Table 2-3). The transition from open space to development has been predominantly through residential land use, due to the large land area required for the on-site water supply and sewage disposal systems which accompany this type of land development.

2.4 Population Projections

The current population estimate (1988) is 5,150 persons. (Source: REWAI - based on 4,990 persons, estimated by the United States Bureau of the Census in 1986, and an additional 405 persons in 139 dwelling units occupied the past 3 years.) Population projections for the year 2000 range from 6,090 to 6,650. Therefore, approximately 545 additional dwelling units will be required by the year 2000 to accommodate the maximum increment of 1,500 persons. The present residential building trend should be able to provide close to this number of dwelling units in the next 12 years.

TABLE 2-1

Major Subdivisions
January 1986 - July 1988

Name	Number of Lots	Location
Gregory Fried	10	Fishing Creek Valley
Paul Straley	5	Clarks Valley, 5 miles east of Route 225
Robert Fried	5	Frog Hollow Road
Mid-Pax Developers	9	Between Route 22/322 and Riverview Road, 3 miles west of Dauphin
Mid-Pax Developers	10	Stoney Creek Road, 3 miles east of Dauphin
Geisel High Point	19	Potato Valley Road
Custer (preliminary conditional approval)	76	Fishing Creek Valley

Source: J. Thomas Van Wagner, Middle Paxton Township, July 1988.

TABLE 2-2

Building Activity 1980-1988

Year	Building Lots Created	Building Permits Issued	Sewage System Permits Issued	
1980	24	31R	3N	4T
1981	34	24R	23N	36T
1982	18	18R	12N	31T
1983	21	32R	22N	29T
1984	22	38R, 4C	20N	35T
1985	20	40R	27N	37T
1986	36	34R, 2C	31N	41T
1987	37	38R, 3C	27N	39T
1988 (Jan-June)	27	28R, 2C	13N	21T
Total	239	283R, 11C	178N	273T

Note: R = residential, C = commercial, N = new system installed, T = total permits issued including replacements, repairs and expansions.

Source: J. Thomas Van Wagner, Middle Paxton Township, and Anthony Prost, Grove Associates, July 1988.

TABLE 2-3

Land Use 1977-1987

Category	1977 Land Area (in acres)	1987 Land Area (in acres)	1977-1987 Percentage Change
Open Space	32,583.1	31,429.1	-3%
Residential	975.7	2,091.3	114%
Commercial	37.0	43.0	16%
Public	50.5	89.2	76%
Recreation	273.7	267.4	-2%
Totals	33,920.0	33,920.0	

Source: Dresdner Associates, 1987

2.5 Zoning Restrictions

Floodplain management is addressed through provisions in the Township Zoning Ordinance. Construction is prohibited in all floodways and protective construction is required in all flood-prone areas. Storm water management is addressed in the Township Subdivision Regulations, but is basically restricted to preventing obstructions to existing drainage patterns and enforcing positive drainage on new lots and streets.

Much of the Township is included with State Game Land Number 211. This prevents a majority of the Township land area form being heavily developed. The steep slopes of Blue, Second, Third, and Peters Mountains also prevent development on much of this area.

3.0 PHYSICAL DESCRIPTION OF PLANNING AREA

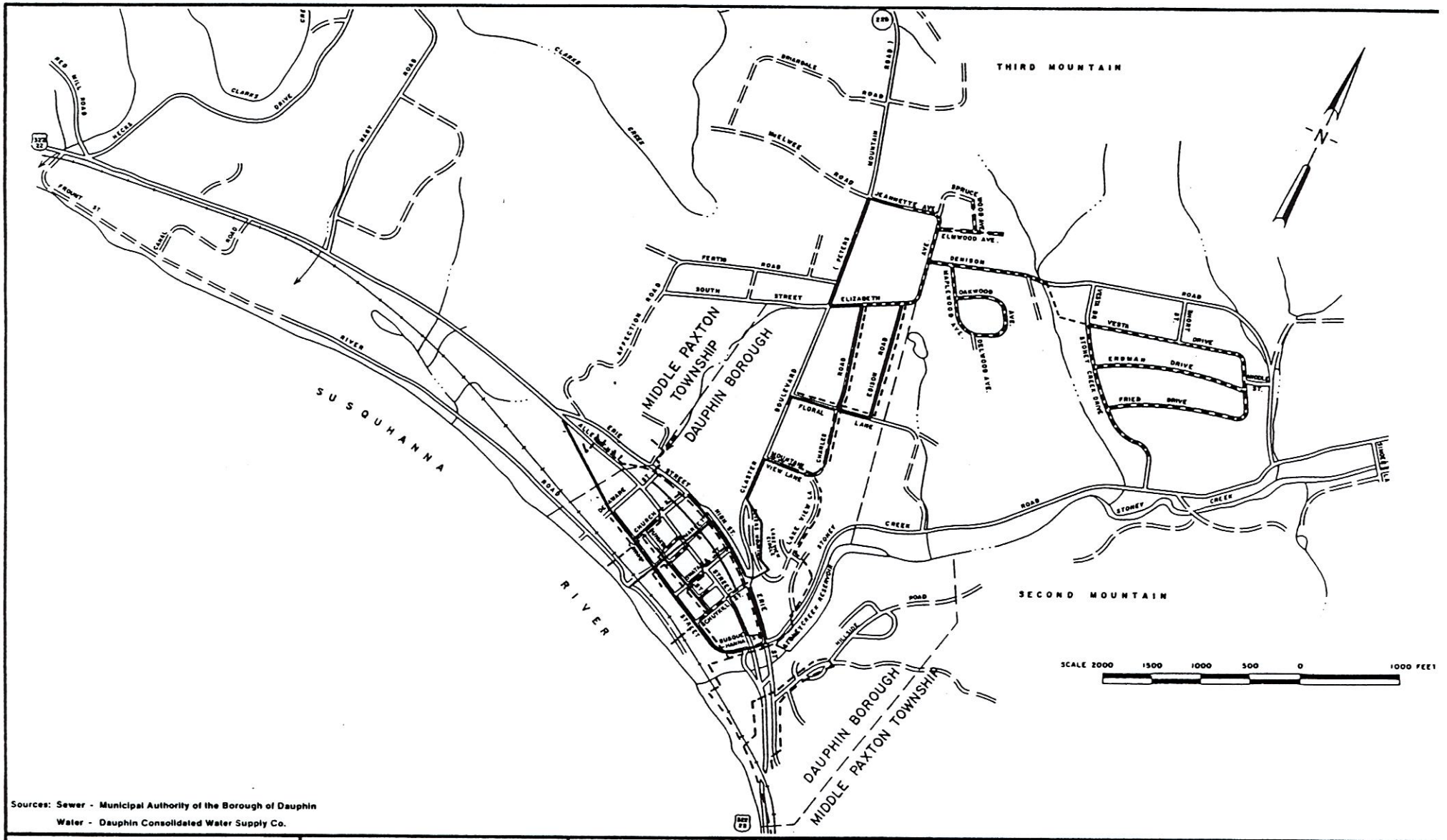
3.0 PHYSICAL DESCRIPTION OF PLANNING AREA

3.1 General Physiographical and Cultural Characteristics

By population, Middle Paxton Township is a second-class Township located in the north-central part of Dauphin County. The Township is bounded on the west by the Susquehanna River and adjoins Reed, Halifax, Wayne, Jefferson, Rush, East Hanover, West Hanover, Lower Paxton, and Susquehanna Townships, all in Dauphin County. Middle Paxton, which consists almost entirely of three mountain valleys, covers approximately 53 square miles of land which varies in topography with elevations ranging from approximately 350 to 1,660 feet above sea level.

Of the total land area in the Township, 21 square miles, or 39 percent, is state-owned game land. The bulk of the area in the Township is heavily wooded, with agricultural land in the lower portions of all three valleys. There are no dense concentrations of population in the Township; instead, residential areas are dispersed throughout the Township. A very small portion of the Township is served by the public sewer system. The vast majority of the Township relies on subsurface sewage disposal. The public water service area is much larger than the sewer service area. These current service areas are shown in Figure 3-1. Both are adjacent to the Borough of Dauphin. Public water extends into Stoney Creek Manor, Delwood Acres, and the Middle Paxton Elementary School.

One of the major highways in the state, U. S. Route 22/322 parallels the Susquehanna River along the entire western boundary of the Township. An important line of the Conrail Railroad parallels the highway. Pennsylvania Route 443 runs from Fort Hunter in an easterly direction for the entire length of Fishing Creek Valley, the southern most of the three valleys in the



Sources: Sewer - Municipal Authority of the Borough of Dauphin
Water - Dauphin Consolidated Water Supply Co.

LEGEND				
EXISTING SEWER LINE EXISTING WATER LINE	MIDDLE PAXTON TOWNSHIP DAUPHIN COUNTY PENNSYLVANIA	DRESDNER ASSOCIATES, PA, INC. HARRISBURG, PENNSYLVANIA	CURRENT SERVICE AREAS	FIGURE 3-1 JANUARY 23, 1987

Township. Pennsylvania Route 225 branches from Route 22/322 at the Borough of Dauphin and extends to the north over Peters Mountain, which forms the northern boundary of the Township. These three highways are the main traffic arteries in the Township.

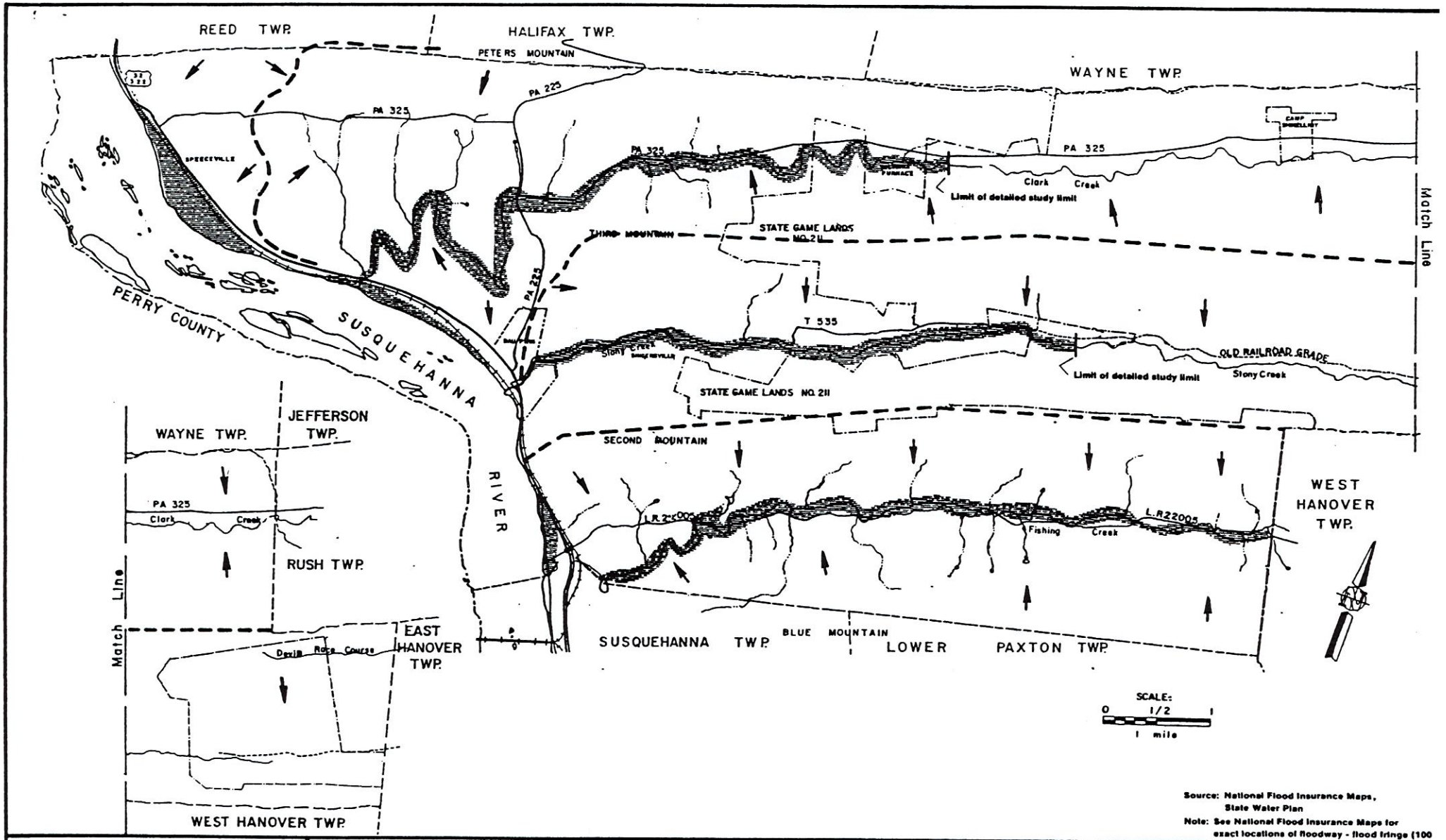
Except for the extreme northwestern portion of the Township, which drains into the Susquehanna River, all lands drain into one of the three creeks which flow through the Township from east to west. These creeks, listed from south to north, are Fishing Creek, Stoney Creek and Clark Creek. Figure 3-2 defines the drainage areas of the Township. It also shows the special flood hazard areas with the 100-year flood boundary.

3.2 Soils

There are 38 different soil types found within the Township (Table 3-1). They are found in three soil associations: DeKalb-Lehew, Calvin-Leck Kill-Klinesville, and Laidig-Buchanan-Andover (Figure 3-3). These associations have a distinct pattern of soils and exhibit similar characteristics. They are described as follows:

1. DeKalb-Lehew Association - This association occurs almost entirely on the upper slopes, ridges, and flats of the Blue, Sharp, Second, Third, and Peters Mountains. These areas are nearly all forested and the soils are stony in most places.

   The DeKalb soils have a very stony or channery surface layer and a channery, sandy loam subsoil. Sandstone bedrock occurs at a depth of two to three and one-half feet. The Lehew soils have a surface layer of very



Source: National Flood Insurance Maps, State Water Plan

Note: See National Flood Insurance Maps for exact locations of floodway - flood fringe (100

LEGEND

- DIRECTION OF FLOW
- DRAINAGE BASIN BOUNDARY
- FLOODWAY - FLOOD FRINGE (100 yr.)

MIDDLE PAXTON TOWNSHIP
DAUPHIN COUNTY
PENNSYLVANIA

DRESDNER ASSOCIATES, PA, INC.
HARRISBURG,
PENNSYLVANIA

DRAINAGE AREAS

FIGURE 3-2

JANUARY 23, 1987

TABLE 3-1

Soils of Middle Paxton Township

Map Symbol	Soil Name	Capability Units
AbA	Albrights silt loam	II w-2
AbB2	Albrights silt loam	II e-5
AnB	Andover gravelly loam	IV w-1
AoB	Andover very stony loam	VII s-2
At	Atkins silt loam	III w-1
Bc	Basher silt loam	II w-1
BtA	Brinkerton & Armagh silt loams	IV w-1
BtB2	Brinkerton & Armagh silt loams	IV w-1
BuB	Buchanan gravelly loam	II e-5
BvB	Buchanan very stony loam	VI s-1
CaD	Calvin very stony silt loam	VII s-1
CaF	Calvin very stony silt loam	VII s-1
CkC2	Calvin-Klinesville shaly silt loams	IV e-1
CkD2	Calvin-Klinesville shaly silt loams	IV e-1
C1A	Calvin-Leck Kill shaly slit loams	II e-4
C1B2	Calvin-Leck Kill shaly slit loams	II e-4
C1C2	Calvin-Leck Kill shaly silt loams	III e-3
DcC2	DeKalb channery sandy loam	III e-5
D1B	DeKalb & Lehew very stony sandy loams	VI s-1
D1D	DeKalb & Lehew very stony sandy loams	VI s-1
D1F	DeKalb & Lehew very stony sandy loams	VII s-1
DuB2	Duffield silt loam	II e-1
KaC2	Klinesville shaly silt loam	IV e-2
KaD2	Klinesville shaly silt loam	VI e-1
KaE2	Klinesville shaly silt loam	VII e-1
LaB2	Laidig gravelly loam	II e-3
LaC2	Laidig gravelly loam	III e-2
LdB	Laidig very stony loam	VI s-1
LdD	Laidig very stony loam	VI s-1
LrB2	Lewisberry gravelly sand loam	II s-2
Lt	Lindside silt loam	II w-1
Ph	Philo silt loam	II w-1
Rv	Riverwash	VII w-2
Ta	Tioga fine sandy loam	II s-1
Ua	Urban land	-
VsC	Very stony land	VIII s-1
VsF	Very stony land	VIII s-1

Source: Dauphin County Soil Survey, 1972

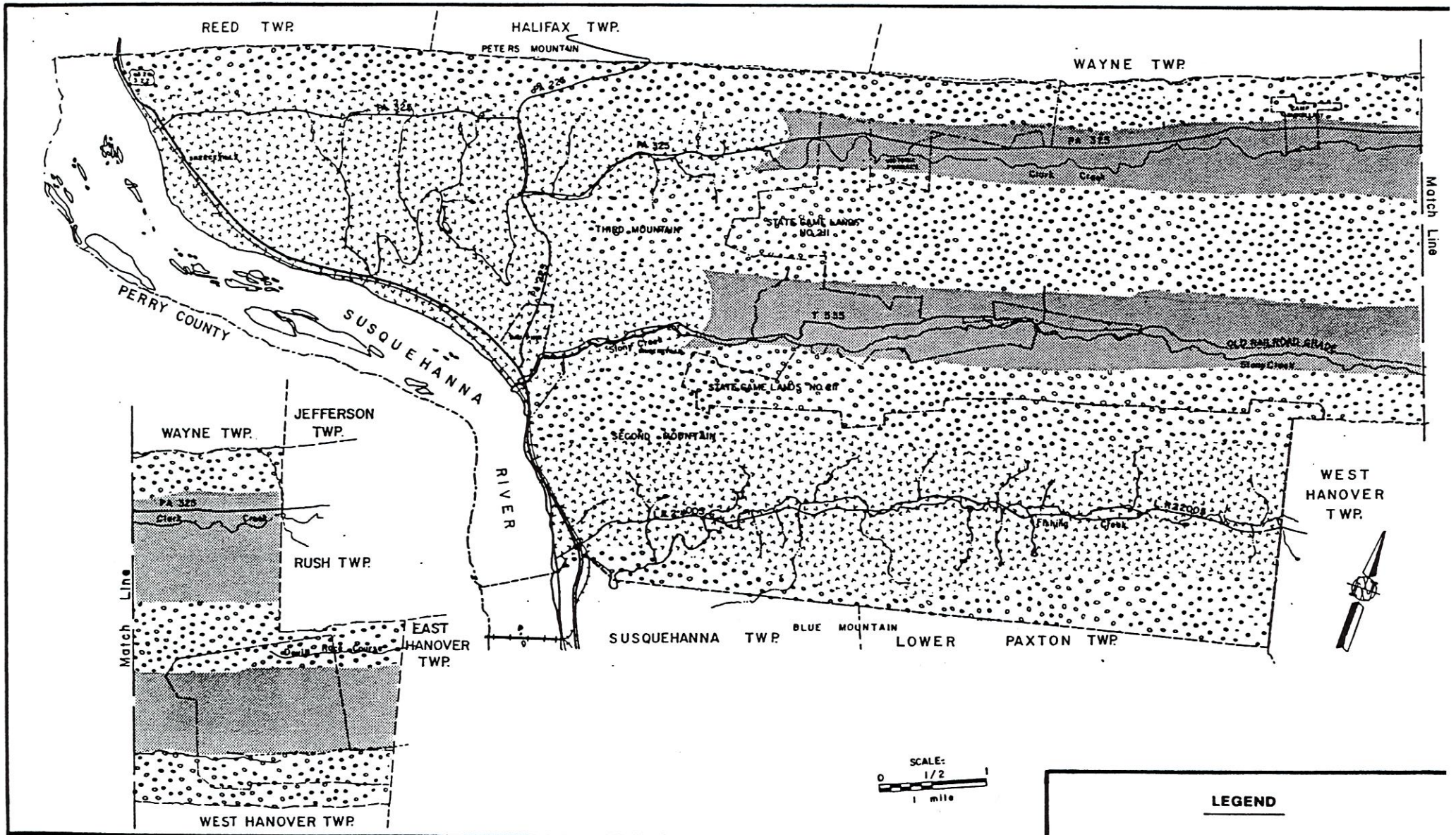


FIGURE 3-3	MIDDLE PAXTON TOWNSHIP DAUPHIN COUNTY PENNSYLVANIA	DRESDNER ASSOCIATES, PA., INC. HARRISBURG, PENNSYLVANIA	SOIL ASSOCIATIONS
JANUARY 23, 1987			

Source: U.S. Dept. of Agriculture, Soil Conservation Servic

stony, sandy loam. The subsoil is channery, sandy loam, and channery loam, and it is underlain by very gravelly loam. Sandstone bedrock occurs at a depth of two to three and one-half feet.

Because of the low available moisture capacity, stoniness, and relatively steep slopes, this association is poorly suited for development and agriculture. It is well-suited for woodland.

2. Calvin-Leck Kill-Klinesville Association - This association is deep to shallow in depth, dominantly well-drained, gently to moderately sloping. It consists of soils with a shaly, silt loam subsoil, and is found in upland areas between the mountains. The large streams, which drain the valleys, originate at the base of the mountains. The soils developed in material weathered from red shale and sandstone. They are predominantly located adjacent to Route 325 and in the Borough of Dauphin along Fishing Creek Valley, and in the area between Route 225 and the Susquehanna River.

The Calvin soils are moderately deep and well-drained, and have moderate to low available moisture capacity. They have little clay in the subsoil. The Leck Kill soils are deep and well-drained, and have moderate available moisture capacity. The Klinesville soils are shallow, well-drained, and droughty. They generally have the steepest slopes in the association.

The bulk of existing land development in Middle Paxton Township is found on Calvin-Leck Kill soils.

Klinesville soils are usually used for pasture or woodland.

3. Laidig-Buchanan-Andover Association - This association occurs along the Stoney Creek and Clark Creek Valleys on the lower mountain slopes where colluvium has accumulated. It consists of soils which are deep, well to poorly drained, gently sloping and sloping, and having a fragipan.

The Laidig and Buchanan soils are sloping to gently sloping. They occupy about the same position on the slopes, though in many places the Buchanan soils are just below the Laidig. The Andover soils are nearly level or gently sloping. They are at or near the base of mountains, just below the Buchanan soils. Because Andover soils receive seepage from higher areas throughout the year, they are saturated most of the time.

The Laidig soils are deep and well-drained, and have a mostly reddish-yellow subsoil. Clay has accumulated in the layers below the surface layer and available moisture capacity is moderate. The Buchanan soils are deep and moderately well-drained. A compact layer in the lower part of the subsoil restricts internal drainage. The Andover soils are deep, poorly drained, and have a slowly permeable fragipan at a depth of 14 to 30 inches.

In about 85 percent of this association, the soils are very stony and forested. They are used for agriculture and may be developed with caution.

All the soils in Middle Paxton Township have been designated by the U. S. Soil Conservation Service as having severe limitations for on-site disposal of sewage effluent from septic systems. Soil types are broken down into soil capability units, a convenient grouping of soils which will require similar management. This does not necessarily mean that every place in the municipality is unsuitable for an on-lot sewage disposal system. It indicates, however, that extreme care should be exercised in the testing, location, and design of any such system. Soils have been mapped according to degree of slope and type of limitation, and are depicted in Figures 3-4 and 3-5, respectively.

3.3 Geology and Groundwater Resources

Middle Paxton Township is located in the Appalachian Mountain section of the Valley and Ridge Province. This section consists of alternating narrow ridges and valleys. The ridges are composed of highly resistant sandstones, sandstone conglomerates and siltstones, and include the Tuscarora, Catskill, and Pocono Formations, and the Pottsville group.

The Fishing Creek Valley is underlain by the Catskill Formation; and the Mauch Chunk Formation underlies the other two valleys between Second and Peters Mountains. These valleys are comprised of less resistant sandstones and siltstones, and have eroded faster than the adjacent ridges. All the geologic formations found in Middle Paxton Township are shown on Figure 3-6.

The ridge-forming rocks are low yielding and relatively unimportant as aquifers. The Tuscarora Formation has average yields of less than three gallons per minute (gpm). Pocono and Pottsville Formations constitute high topography, and are

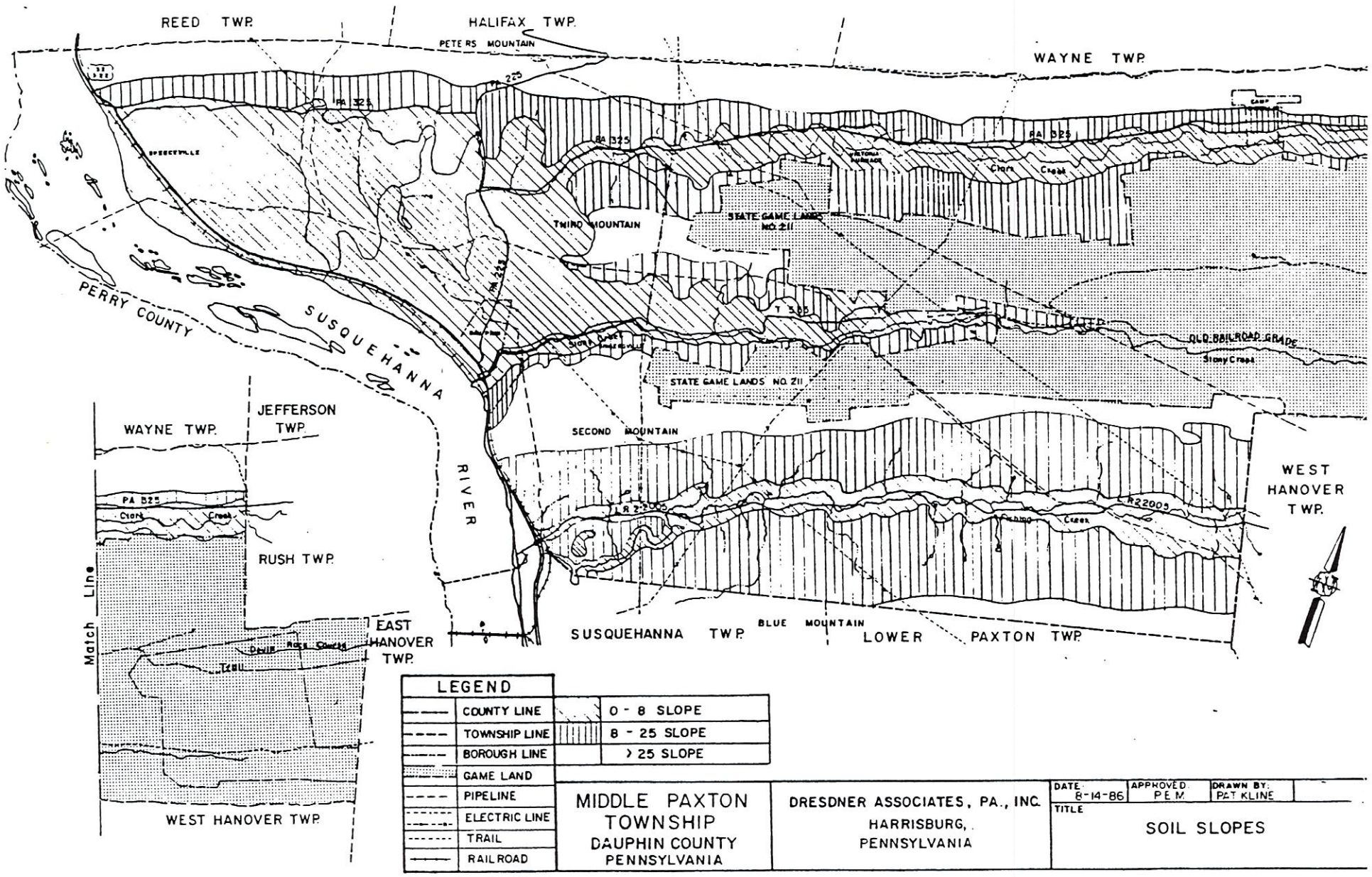


FIGURE 3-4

r.e. wright associates, inc.

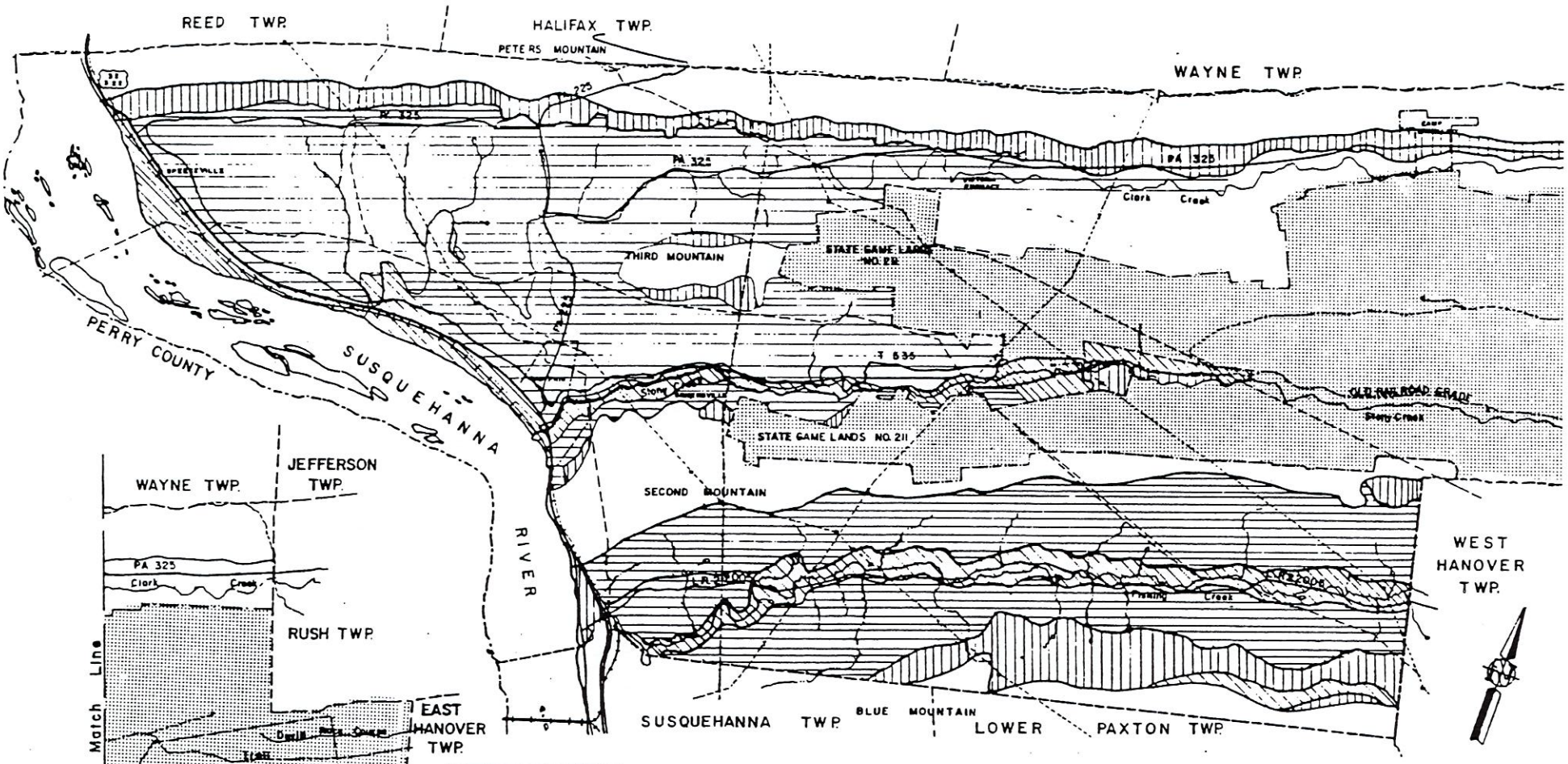


FIGURE 3-5

r.e. wright associates, inc.

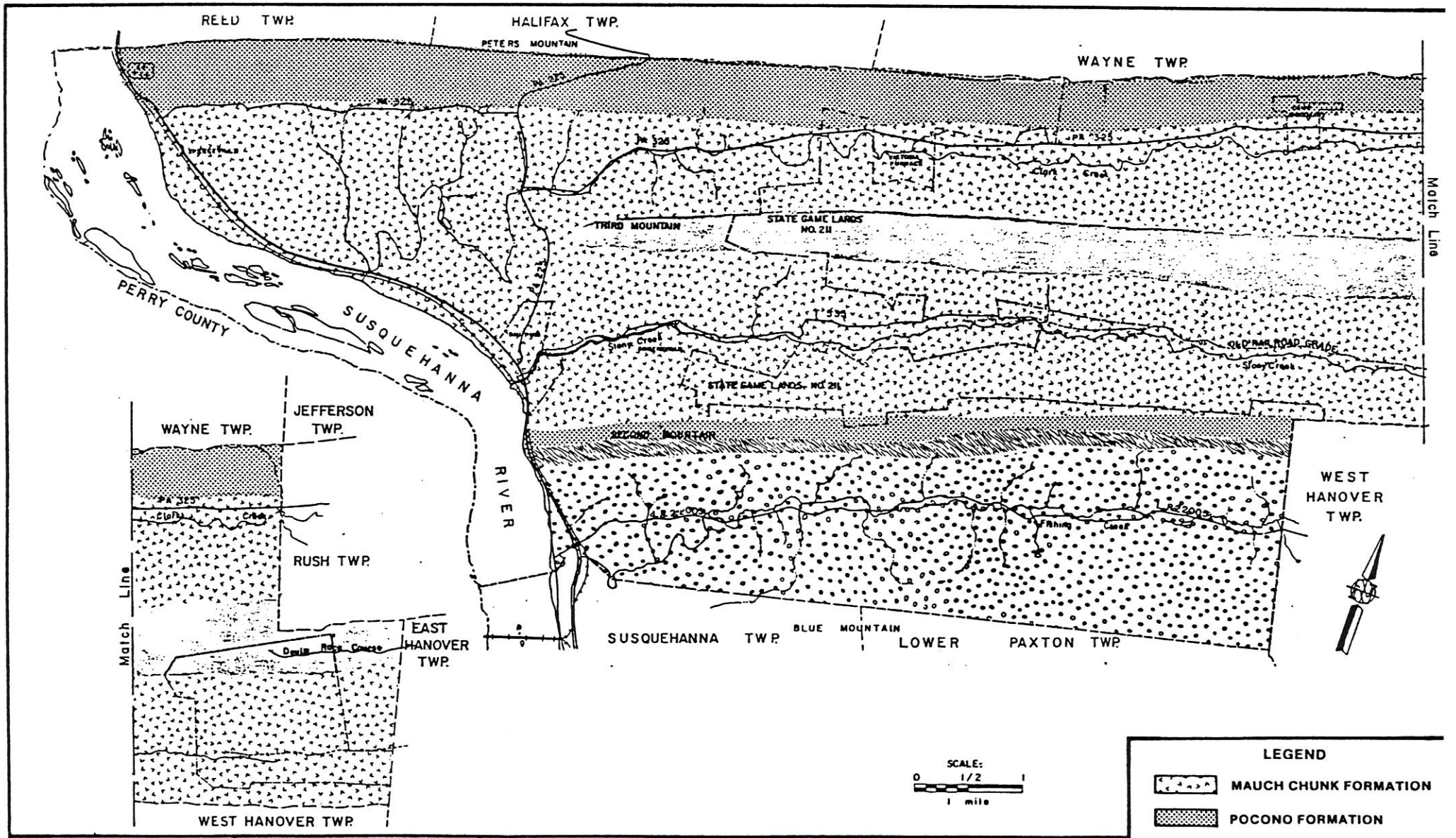


FIGURE 3-6	MIDDLE PAXTON TOWNSHIP DAUPHIN COUNTY PENNSYLVANIA	DRESDNER ASSOCIATES, PA., INC. HARRISBURG, PENNSYLVANIA	GEOLOGIC FORMATIONS
JANUARY 23, 1987			

relatively inaccessible. Therefore, they are also of little value as a source of domestic supply. The Catskill Formation, which underlies Fishing Creek Valley, has domestic yields of 1 to 95 gpm, with median values of 12 to 16 gpm. The majority of the developed area in the Township is supported by the Mauch Chunk Formation, with yields ranging from 2 to 60 gpm, and a median value of about 10 gpm. These yields are considered adequate for most purposes.

Available published information does not indicate any existing nitrate-nitrogen pollution (NO_3-N) in Middle Paxton Township, a crucial factor to consider when planning development. Values of NO_3-N are less than 2.5 milligrams per liter (mg/l) in the Mauch Chunk Formation, well below the 10 mg/l EPA limit. High concentrations are most often the direct result of the overapplication of manure and fertilizer. However, malfunctioning on-lot sewage disposal systems can also contribute to the problem.

The Mauch Chunk Formation will, in general, yield sufficient water of acceptable quality for most land uses. This formation accounts for over 29 square miles or 54 percent of the Township land area.

3.4 Surface Water Resources

The Susquehanna River is the major waterway in Middle Paxton Township. It accounts for approximately five square miles of the Township. Fishing Creek, Stoney Creek, and Clark Creek flow into the river, and constitute the water basin for the Township.

Average annual runoff in this basin ranges from 14 inches in the south and west to 24 inches in the east. Runoff is primarily influenced by the distribution of precipitation. However, other factors such as land use, vegetative cover, geology, soils, and topography influence the variability of flows from individual watersheds. Runoff has a distinct seasonal variation, with the period of highest runoff occurring in late winter or early spring, and the period of lowest runoff occurring in late summer and early fall.

The topography of the area determines the drainage patterns and surface flow characteristics. Steeper slopes cause increased runoff and erosion, and discourage infiltration to the water table. Land use patterns and development decisions can exert a considerable impact on the quantity, quality, and utilization of surface and groundwater. Also hydrologic processes and water resources management profoundly influence existing and future land use patterns in the basin.

The majority of the Township's water withdrawal is self-supplied from groundwater. According to the State Water Plan: Subbasin 7, Lower Susquehanna River, (1980), public water supply is abundant and reliable for the current service area in Middle Paxton Township. Dauphin Consolidated Water Supply Company supplies water to about 90 acres of the Township. As of December 1987, there were 296 metered connections broken down as follows:

TABLE 3-2

Water Metered Connections
December 1987

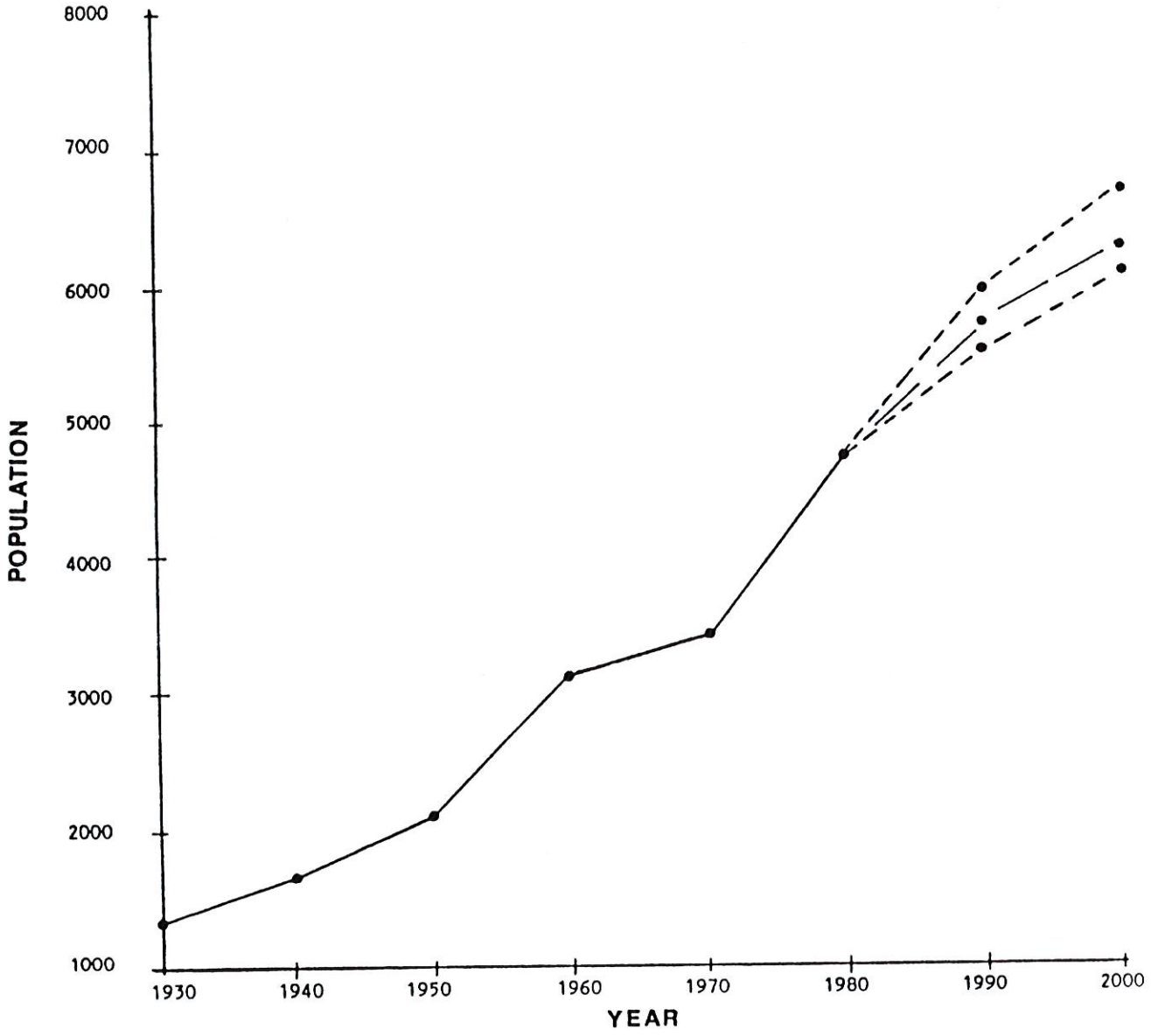
Type	Number
Residential	285
Commercial	10
Public	1
Total	296

Source: Dennis Beitzel, Dauphin Consolidated Water Supply Company, July 1988

Water quality reports were available from DER for each stream in Middle Paxton Township. Water quality in Stoney Creek was reported as very good. Water quality in Clark Creek is good and water in Dehart Reservoir, located on this stream, continues to be used as a major water supply source for the City of Harrisburg. No sources of pollution have been identified in Fishing Creek.

3.5 Population and Sewage Facility Needs

Population in Middle Paxton Township has been increasing modestly since 1930. Over the past 50 years, the average annual growth rate has been 5 percent. Figure 3-7 shows the historical growth trend and future projected population for the Township. The



NOTE: SOURCE FROM DRESNER ASSOCIATES, 1986.

FIGURE 3-7

GROWTH TRENDS AND PROJECTIONS

current limitations on sewage permits will have a small dampening effect on growth.

Land development has followed over time the three stream valleys and the highway corridor along Route 22/322. The majority of existing development has concentrated in the northwestern sector of the Township (Figure 3-8). Based on current capacity calculations in the Comprehensive Plan, current zoning should be modified to recognize critical resource areas, such as steep slopes and floodplains, and to direct new development into areas with adequate natural or infrastructure capability. Land development suitability has been determined in Figure 3-9. Both positive and negative features were mapped and reviewed with existing land use and potential development areas in the Comprehensive Plan. The most suitable development area of the Township is bounded by Routes 22/322, 225, and 325 north and west of Dauphin Borough.

The uncertainty of the U. S. Route 22/322 bypass between Dauphin and Speeceville will impact existing planning and zoning, and, thus, also the basis for population projections. There have been preliminary discussions concerning relocation of U. S. Route 22/322 to an alignment east of its present location. Such an alignment would have a significant impact within the Township. A design location and environmental study has been recently authorized by the Pennsylvania Department of Transportation (Penn DOT). The time frame for implementing the resultant highway improvements is beyond 10 years.

As of 1985, only 4 percent of the total dwelling units (71 out of 1,715) in the Township had public sewer service. The balance of the Township utilizes on-site sewage disposal. Total residential sewage flows in the Township, including all on-site

LEGEND

- STATE GAME LANDS
- OPEN (AGRICULTURE & WOODS)
- RESIDENTIAL
- COMMERCIAL
- PUBLIC & QUASI-PUBLIC
- RECREATION

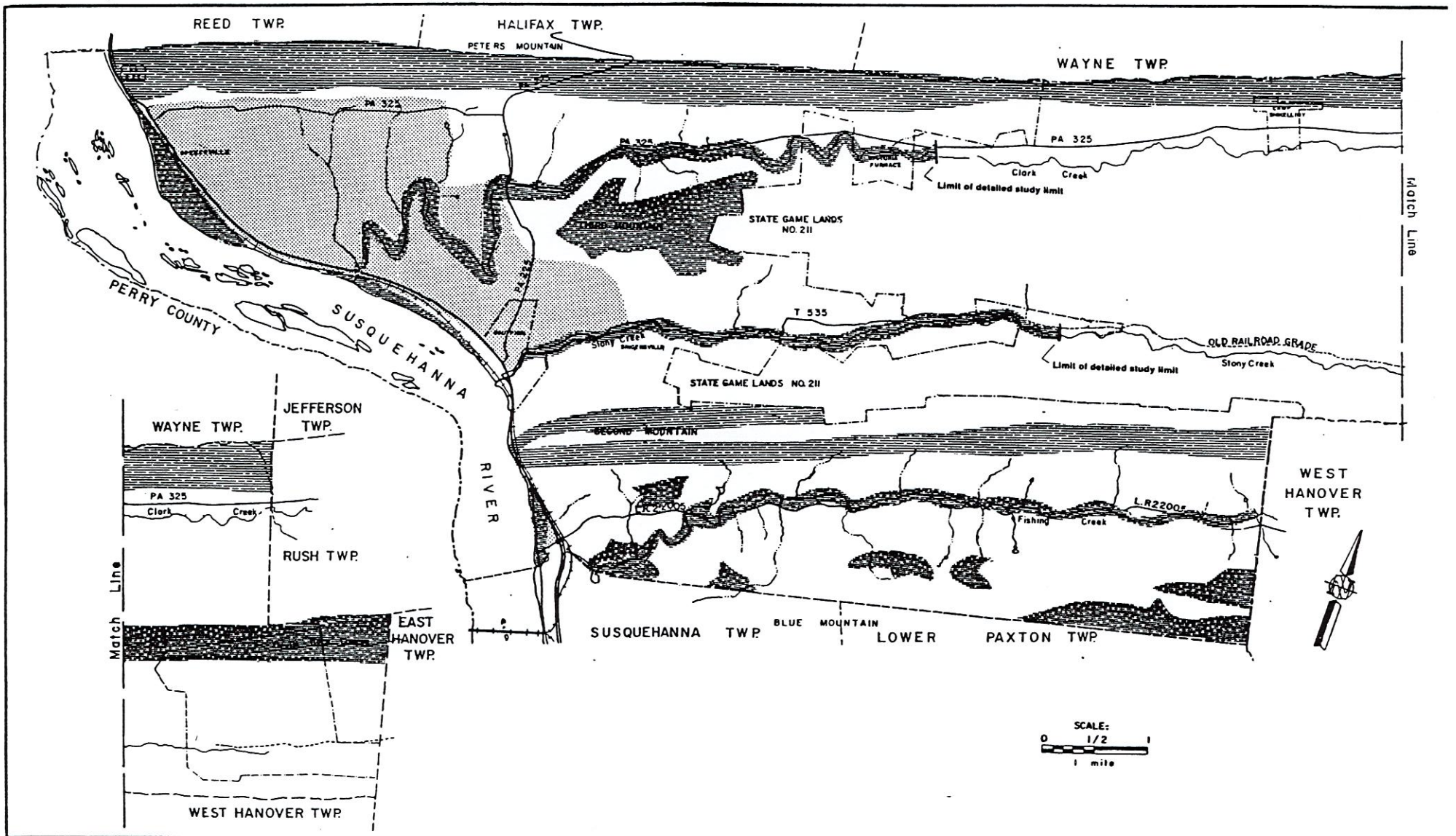
MIDDLE PAXTON TOWNSHIP
DAUPHIN COUNTY
PENNSYLVANIA

DRESDNER ASSOCIATES, PA, INC.
HARRISBURG,
PENNSYLVANIA

EXISTING LAND USE

JANUARY 23, 1987

FIGURE 3-8



LEGEND				
MOST SUITABLE FEATURES LEAST SUITABLE FEATURES	MIDDLE PAXTON TOWNSHIP DAUPHIN COUNTY PENNSYLVANIA	DRESDNER ASSOCIATES, PA., INC. HARRISBURG, PENNSYLVANIA	LAND DEVELOPMENT SUITABILITY	FIGURE 3-9 JANUARY 23, 1987

systems are estimated to be 750,400 gallons per day (gpd). The component utilizing public sewer service was estimated by using 230 gpd per dwelling unit (Dauphin Borough, 1985). The on-site sewage flows were estimated by using Chapter 73, Standards for Sewage Disposal Facilities: 400 gpd for housing units with 3 or fewer bedrooms, 500 gpd for 4-bedroom units, and 600 gpd for each unit with 5 or more bedrooms. Commercial and other categorical sewage flows were estimated as a percentage of the land uses in the Township which generate sewage. This is estimated as 4 percent of total flow or an additional 30,000 gpd. The total sewage estimated to be generated in the Township is 780,400 gpd.

For the purpose of estimating sewage flow, Middle Paxton Township was divided into four planning areas (see Figure 3-10). These areas are consistent with the watershed limits of Fishing Creek, Stoney Creek, and Clark Creek. The Clark Creek watershed is further divided by Pennsylvania Route 225 into two subareas. Total flows for each area are shown in Table 3-3 and are based on the total number of dwelling units within each planning area. Dwelling unit flows were adjusted to equivalent dwelling units to account for commercial activities within each planning area.

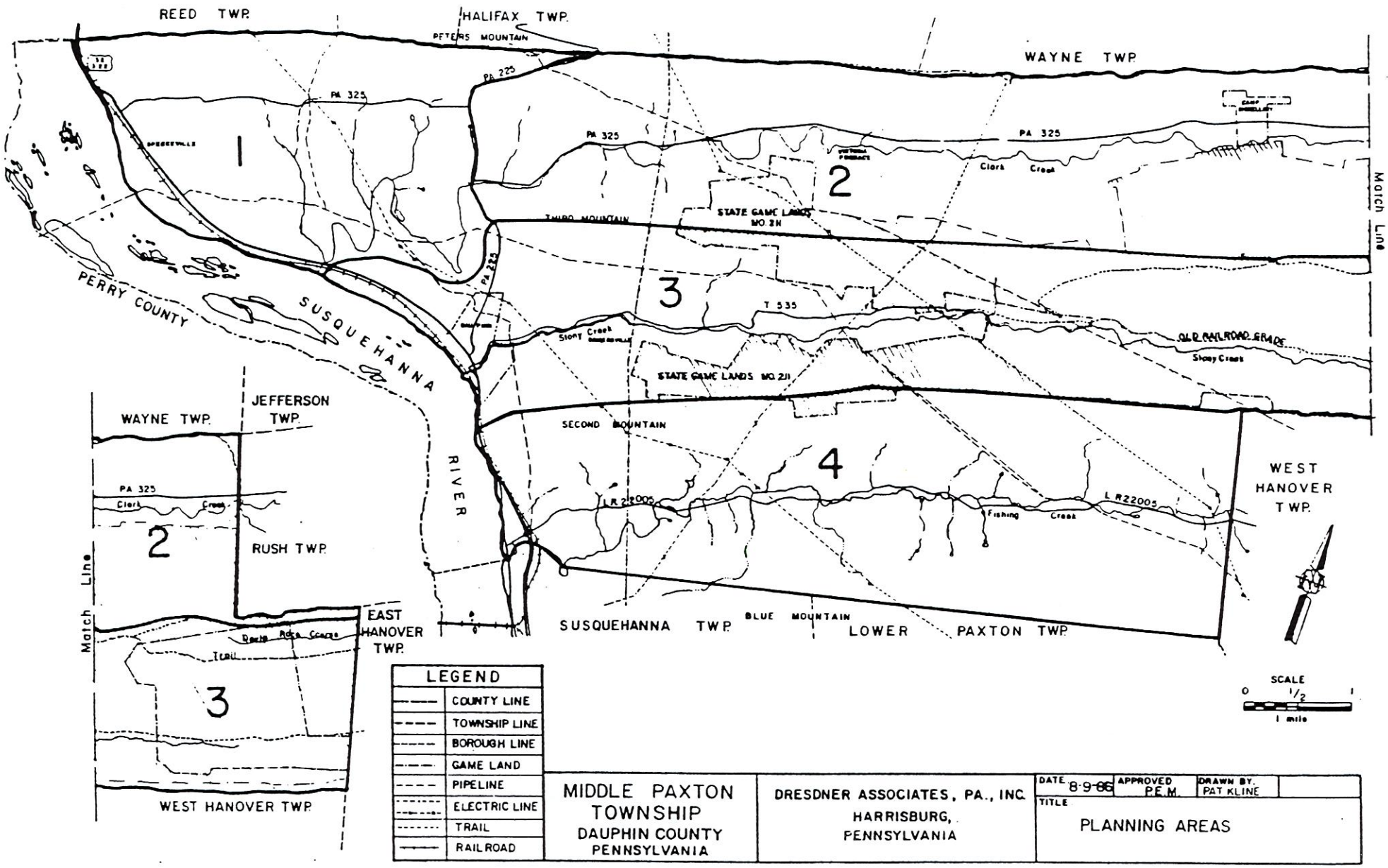


FIGURE 3-10

r.e. wright associates, inc.

TABLE 3-3

Sewage Flows by Planning Area

	EDU	Flow
Fishing Creek (4)	311	124,400 gpd
Stoney Creek (3)	659	263,600 gpd
Clark Creek East (2)	135	54,000 gpd
Clark Creek West (1)	846	338,400 gpd
Total	1,951	780,400 gpd

Source: Dresdner Associates, 1987

4.0 EVALUATION OF EXISTING WASTEWATER TREATMENT AND CONVEYANCE SYSTEMS

4.0 EVALUATION OF EXISTING WASTEWATER TREATMENT AND CONVEYANCE SYSTEMS

4.1 Public Sewerage

The only public sewerage facilities in the Township are owned and operated by the Municipal Authority of Dauphin Borough. These facilities serve portions of the Township adjacent to Dauphin Borough and to the developed areas of Dauphin Borough, except for Hillside Road and River Road. Sewer service is available to the west along U. S. Route 22/322, as far as Hardee's Family Restaurant, and to the north along Pennsylvania Route 225, as far as the Middle Paxton Elementary School. Sewage is conveyed to a primary wastewater treatment plant on Delaware Street. The effluent is discharged via a 10-inch outfall sewer into the Susquehanna River. The Borough treatment facilities are designed for 156,000 gpd of sewage flow and provide the following components:

1. Screening and comminution.

2. Primary clarification in two rectangular, endless belt-type clarifiers.

3. Disinfection in one chlorination contact tank.

4. Sludge stabilization in one unheated anaerobic digester.

5. Sludge dewatering on drying beds.

Borough records indicate that sewage flows average about 90,000 gpd, with a 3-month maximum average of 105,000 gpd. Average flow per dwelling unit has been estimated at 230 gpd.

Table 4-1 shows wastewater effluent discharge limits which are exceeded by current sewage flows, indicating the necessity to upgrade the Borough facilities to a secondary sewage treatment plant.

4.2 On-lot Subsurface Sewage Disposal

Outside the Dauphin Borough sewer service area, the balance of the Township provides wastewater treatment and disposal by means of on-lot systems. Sewer lines were installed in the Delwood Acres subdivision along Oakwood and Maplewood Avenues. However, these lines are not yet functional and the homes in this subdivision are currently served by individual on-lot systems. Except for Camp Shikellimy, there are no community on-lot systems in the Township. All other land use areas rely on individual on-lot systems.

Where site conditions are suitable, subsurface soil absorption is usually the best method of wastewater treatment for single dwellings or their equivalent. Under the proper conditions, soil is an excellent treatment medium and the wastewater needs little pretreatment. Wastewater is discharged below the ground surface, where it is absorbed and treated by the soil as it percolates to the groundwater. Continuous application of wastewater causes a clogging mat to form which retards the movement of water into the soil. This is beneficial in that it helps to maintain an unsaturated soil condition below the clogging mat. Two to four feet of unsaturated soil is usually a sufficient thickness to rejuvenate the wastewater before it reaches the groundwater. If a subsurface soil absorption system is to have a long life, the design must be based on the infiltration rate through the clogging mat which ultimately forms.

TABLE 4-1

Wastewater Effluent Discharge Limits

Parameter	Monthly Average	Weekly Average	Maximum
BOD_5	30 mg/1	45 mg/1	60 mg/1
Suspended Solids	30 mg/1	45 mg/1	60 mg/1
Total Phosphorus	2 mg/1	3 mg/1	4 mg/1
Dissolved Oxygen	Minimum of 5 mg/1		
pH	Within limits of 6.0 to 9.0 at all times		
Fecal Coliforms	200/100 ml		

Source: Dauphin Municipal Compliance Plan, CET, 1985

Conventional subsurface disposal techniques include the following: septic tank with standard trench absorption field and septic tank with soil absorption field/soil absorption bed. Alternate subsurface systems include subsurface sand filters, oversized absorption areas, shallow placement absorption areas, and elevated sand mounds. Rather than dictating any single acceptable plan consisting of design, construction materials, and location specifications, variations to on-lot system design and installation are permitted on the basis of site characteristics and performance standards promulgated by DER.

5.0 EVALUATION OF WASTEWATER TREATMENT NEEDS

5.0 EVALUATION OF WASTEWATER TREATMENT NEEDS

5.1 Malfunctioning On-lot Systems

Since 1982, there have been reported malfunctions in existing on-lot subsurface sewage disposal systems in Middle Paxton Township. They are noted in Figure 5-1 and attributed in order of frequency to the following factors:

1. Undersized absorption area.
2. Small lot size.
3. Poor permeability.
4. Excessive slope.
5. High water table.
6. Shallow depth to bedrock.
7. Marginal soils.

The area that appears to have had the greatest concentration of malfunctions is the Stoney Creek Manor subdivision, consisting of Stoney Creek, Fried, Erdman and Vesta Drives. Other areas showing minimal concentration of malfunctions are Red Hill Road and Mountain Road (Pennsylvania Route 325). These previously reported cases of malfunctioning on-lot systems have been corrected, and are now operating well.

System repairs within the Stoney Creek Manor subdivision were supervised over the past seven years by the Middle Paxton Township Sewage Enforcement Officer (Grove Associates). In

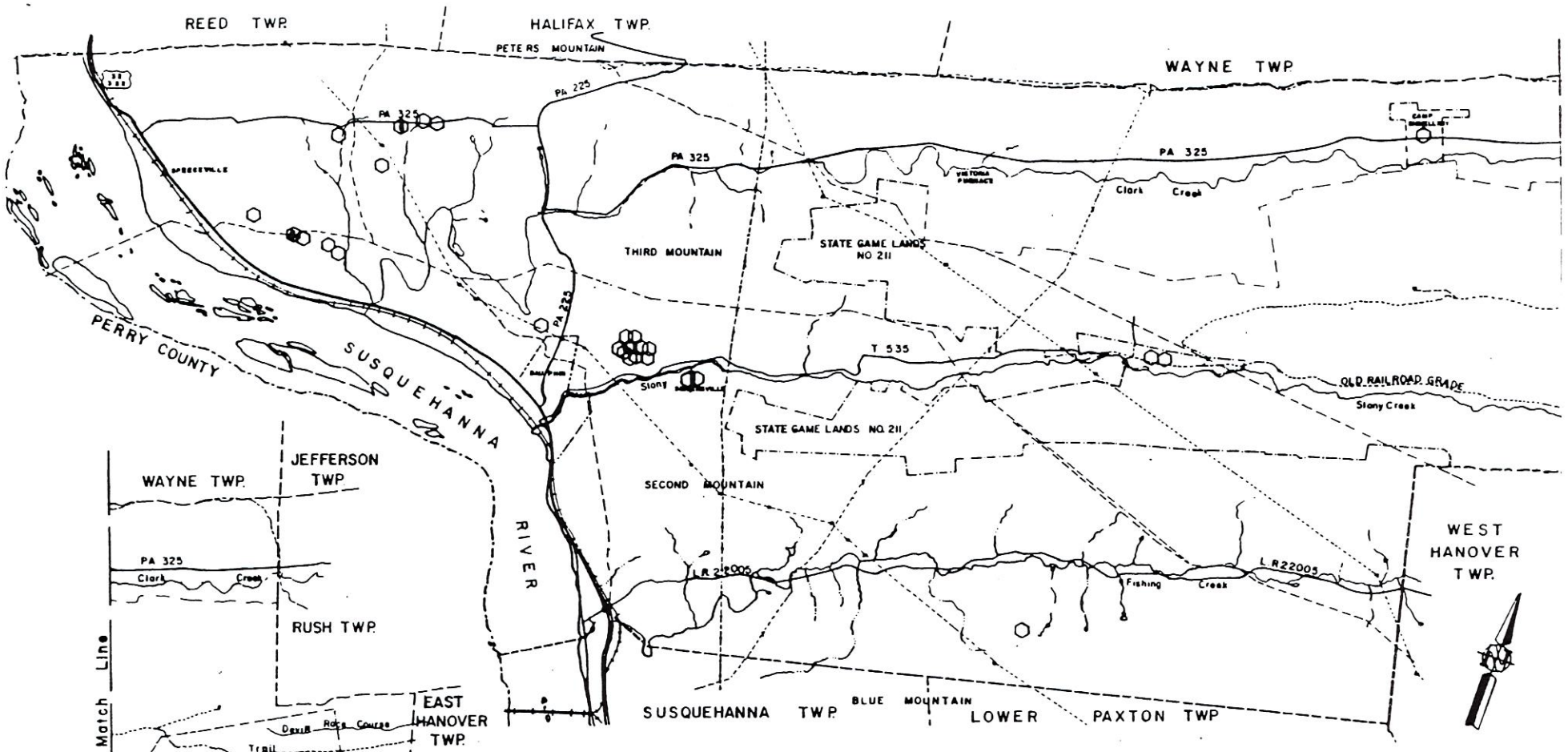


FIGURE 5-1

r.e. wright associates, inc.

March 1988, Grove Associates conducted a study to determine the current condition and status of the repaired on-lot systems, and to forecast the potential performance of future on-lot systems in the vicinity of the Stoney Creek Manor subdivision. The study report generally indicates that repairs have been successful. Even though a majority of lots in the Stoney Creek Manor public water subdivision are less than one acre in lot size, there is sufficient space for a system repair. The investigation of the original malfunctions and the inspection of the repaired systems have revealed a common problem among these malfunctions as the use of poor materials and poor methods of construction. There is no evidence that the repair systems are not functioning properly, and no surface malfunction has occurred on these sites which have undergone repair. The Grove Associates report is included as Appendix A of this plan.

5.2 Groundwater Pollution

Three areas have been reported and tested for reported groundwater contamination: Red Hill Road, Hicks Drive (between Miller Road and Mountain Road), and Mountain View Boulevard (off Riverview Road). Sources of contamination could not be identified from extensive investigation. While this contamination was not proven to be due to sewage disposal, the problem was resolved in each area. For example, the Red Hill Road area implemented use of disinfection and activated carbon filters in its water well systems.

DER has asserted that there is groundwater contamination in the area of Middle Paxton Township adjacent to Dauphin Borough which is due to existing on-lot septic systems. This contention is based on the age of the existing on-lot systems, relatively small

lot sizes, and the mapped presence of marginally acceptable soils.

A special study was recently conducted by REWAI (see Appendix B) to analyze the groundwater and surface water quality of the area of the Township next to Dauphin Borough, including Stoney Creek Road, Denison Drive, Elizabeth Avenue, Jeannette Avenue, McElwee Road, South Street, Affection Road, and U. S. Route 22/322. Based on the results of this study, the water quality in the study area is generally good. Nitrate-nitrogen concentrations in streams and wells are consistent with drinking water standards.

Bacteriological sampling of surface water and groundwater has revealed no areas of gross contamination. Rather, the sampling indicated two isolated wells with probable contamination from on-lot sewage disposal systems, and some areas of low-level coliform bacteria to the west of Pennsylvania Route 225. Even the two monitoring wells downgradient from the densest areas of on-lot sewage disposal systems (Stoney Creek, Manor, and Delwood Acres) have no bacteria present and reveal moderately 4.5 mg/l and 5.1 mg/l, respectively, of nitrate-nitrogen. These results do not indicate the presence of widespread water pollution generally associated with existing on-lot systems, especially in the vicinity of the two aforementioned subdivisions.

6.0 EVALUATION OF PLANNING AND FACILITY ALTERNATIVES

6.0 EVALUATION OF PLANNING AND FACILITY ALTERNATIVES

6.1 Introduction

Much of the findings and evaluations provided in earlier drafts and proposals of this chapter of the Middle Paxton Township Sewage Facilities Plan Update erroneously relied upon information presented by the DER suggesting a compelling need for community sewage collection and treatment for the area of the Township surrounding Dauphin Borough. However, after the Township undertook the investigation and testing of the area suggested by the DER, it became evident that this area is not in a condition warranting public sewerage and wastewater treatment. There is no significant site-specific evidence of malfunctioning on-lot sewage disposal systems or pollution of the land surface, or the groundwater or streams in the affected area.

Nevertheless, Chapter 6 will address the various alternatives available to the Township for sewage treatment, which may be desirable in principle to consider Township objectives and common approaches for purposes of recognizing the range of choices of sewage treatment recognized by present technology.

Only by investigating the merits of every possible alternative may there be confidence of not having overlooked the preferred alternative. Chapter 7 will address the obvious and only realistic choice available to the Township in view of the compelling findings that no present danger of groundwater or surface water pollution exists in the Township.

6.2 Use of an Existing Wastewater Treatment Plant

Two alternatives were reviewed: participation with Dauphin Borough and participation with Susquehanna Township. A sewer

service area was outlined to include Stoney Creek Manor, Delwood Acres, Mid Penn Properties, and various properties along a west-southwesterly route from Denison Drive to U. S. Route 22/322, approximately 1,100 feet west of the boundary line between Middle Paxton Township and Dauphin Borough. Capital costs range from $1.8 to $2 million, and annual costs from $706 to $788 per dwelling unit.

While negotiations with Dauphin Borough are presently at an impasse, this alternative would assume cooperation between Middle Paxton Township and Dauphin Borough as follows:

1. The Township would be permitted to use the Borough's northwest interceptor located between Claster Boulevard and the Borough's wastewater treatment plant.

2. The Township and the Borough would agree on a method of estimating the amount of Township sewage flow entering the Borough sewer system.

3. The Township would be permitted to pump sewage flows into an expanded Borough or a proposed new wastewater treatment plant.

4. The Township and the Borough would agree to share costs of operation and maintenance.

5. The Township and the Borough would agree to form a joint sewer authority.

6. The Township and the Borough would agree to apply for financial assistance.

7. The Township and the Borough would agree to adopt and implement a similar sewage facilities plan committed to either combined or separate wastewater treatment plants.

The second alternative is a tie-in with the Susquehanna Township sewer lines for conveyance to the Harrisburg City Wastewater Treatment Plant. This alternative has several potential problems. It relies on the construction of sewer lines along the railroad tracks, adjacent to the Dauphin Narrows, and hooking onto a pumping station of the Ben-Barra Planned Residential Development. It also provides the least potential for future expansion.

6.3 Construction of a New Wastewater Treatment Plant

Middle Paxton Township could construct sewer lines, pumping stations and treatment facilities totally within the Township. It is assumed that the initial capacity of such a wastewater treatment plant would be 150,000 gpd for approximately 430 equivalent dwelling units. This is based on estimated demand plus a small reserve of future connections. Construction of a new wastewater treatment plant, to be located between U. S. Route 22/322 and the railroad and west of Dauphin Borough, could be projected to start within ten years. Sewer lines would be run north of the Borough along Affection Road and South Street, and across Elizabeth Avenue and Denison Drive to Stoney Creek Manor and Delwood Acres. These sewer lines would serve areas of immediate concern and offer access to areas of potential future development. Capital costs would exceed two million dollars, and financing would depend upon grant-in-aid and developer contributions. Presently, no developers have come forward to offer contributions.

In addition, it is assumed that the DER would permit a separate wastewater treatment plant in Middle Paxton Township, and both Township and Borough would provide single secondary treatment process units to satisfy the dual facilities requirement. The new wastewater treatment plant would be owned and operated by the Township.

Construction of sewer lines would take place in areas where there are no foreseeable problems. This alternative features local control, but capital costs would be much higher and the chance of obtaining grant-in-aid to offset these costs is unlikely. In addition, annual operating costs would be higher.

6.4 Continued Use of On-lot Sewage Disposal Systems

The treatment of wastewater on the property where the sewage is generated is referred to as an on-lot system. It occurs in two stages: primary and secondary treatment. Primary treatment occurs in either a septic tank or an aerobic tank. Sewage flows to this underground chamber where initial decomposition of raw sewage is begun through the separation of solids from liquids. Secondary treatment takes place after the liquids are discharged from the tank. Soil absorption or some other means may be used as secondary treatment. When the effluent is distributed over the soil, organisms and chemical processes react to remove impurities, and the wastewater is renovated by the soil to an acceptable level of water quality before it reaches the water table.

The suitability of installing additional on-lot systems in Middle Paxton Township is questionable because of required optimum soil conditions and annual pumping. Where space is limited, a conventional soil absorption bed or trench may be inappropriate.

Neither increases the effectiveness of the decomposition process. An aerobic tank can be used, and allows the majority of solids to break down into liquids by circulating air through the sewage. Since an aerobic tank contains a mechanical aerator, it must be inspected and serviced periodically. Final decomposition is still dependent on the soil's ability to renovate the wastewater.

Soils in Middle Paxton Township all have some constraints with respect to suitability for on-lot sewage disposal. However, most of the existing dwellings and other land use areas rely upon on-lot sewage disposal, and the potential for providing public sewerage is highly limited. Therefore, the vast majority of the Township will continue to be served by on-lot subsurface sewage disposal systems.

Alternate systems have been used in Middle Paxton Township, and approved by DER. Several approved methods of on-lot sewage disposal are adaptable to the specific site conditions found in the Township. The methods currently authorized for alternate systems include the following:

1. Subsurface Sand Filters - The absorption area is excavated and replaced with sandy fill material below the natural surface. This sandy fill material provides a medium through which effluent may pass at a more appropriate infiltration rate.

2. Oversized Absorption Areas - This alternative is used only where soils are deep, where the percolation rate is between 60 and 90 minutes per inch, and where the limiting zone can accommodate a filtration area four feet in depth below the gravel placed in the bed or

trench. Aerobic tanks are required instead of septic tanks.

3. Shallow-placement Absorption Areas - This alternative is used only where the depth of permeable soil for filtration is shallow. A minimum cover of 12 inches of suitable soil must be placed over the aggregate of the system above ground level.

4. Elevated Sand Mounds - This alternative may be used if the soil is at least moderately well-drained and the limiting zone occurs more than 20 inches below ground level. A sandy fill filtering system is constructed. Wastewater flows from the tank to the sand mound, where it is dispersed through pipes. The cost of constructing a sand mound is relatively high for the average home owner, ranging from $4,500 to $6,000, depending upon site conditions. Dosing is required to regulate the flow of effluent to the absorption field. This is accomplished mechanically by a pump or a siphon. Lapses in wastewater flows are used to prevent an organic mat from forming around the drainage pipes.

6.5 Malfunctioning On-lot Systems

Repair, replacement or upgrading of malfunctioning on-lot systems as the need arises is imperative to maintain clean water and public sanitation. In the un-sewered areas of the Township, these alterations would be the responsibility of the individual property owner.

Occasionally, soil absorption systems fail. The causes of failure can be complex, resulting from poor siting, poor design, poor construction, poor maintenance, hydraulic overloading, or a combination of these factors. To determine the most appropriate method of rehabilitation, the cause of the failure must be determined. The failure frequency should also be determined, whether it is occasional or continuous.

6.5.1 Causes and Corrective Measures

6.5.1.1 Occasional Failures - Occasional failure is easier to determine, and rehabilitation may be simpler than detection of continuous failure. This type of failure manifests itself with occasional seepage on the ground surface, sluggish drains, or plumbing backups. Since the system functions between periods of failure, sizing and construction can usually be eliminated as causes of failure. In these instances, failures may be the result of poor siting, poor maintenance, or hydraulic overloading. The site of the soil absorption area should be investigated. Occasional failure can result from poor drainage, seasonally high water table conditions, or poor surface drainage because of grading or landscape position. Lack of maintenance of the pre-treatment unit may also cause occasional failures.

6.5.1.2 Continuous Failures - Continuous failure causes are more difficult to determine. If the age of the system and the date when failure first occurred can be determined, then the causes can be more readily identified. If failure occurs in the first year of operation, then the cause is probably due to poor siting, design, or construction. If the system is older, hydraulic overloading or poor maintenance is probably the cause.

6.5.1.3 Failures Due to Poor Maintenance - Lack of proper maintenance of the septic tank may have resulted in excessive clogging due to poor solids removal. This can be determined by checking the maintenance record and the condition of the tank. If this appears to be the problem, the tanks should be pumped and repaired, or replaced if necessary. The infiltrative surface of the absorption field should also be checked. If siting, design, or maintenance do not appear to be the cause of failure, excessive clogging is probably the problem. In such cases, the infiltration surface can sometimes be rejuvenated by oxidizing the clogging mat. This can be done by allowing the system to rest for several months. To permit resting, a new system must be constructed with a means provided for switching back and forth. Alternatively, the septic tank could be operated as a holding tank until the clogging mat has been oxidized. However, this involves frequent pumping, which may be costly.

Other methods for system rejuvenation include many chemical treatments. Caution must be used because these chemicals are many times more of a pollution risk to groundwater supplies than an effective cure for malfunctioning on-lot system. The best of these chemical methodologies seems to be treatment with hydrogen peroxide. This is an inexpensive oxidant which rapidly converts sulfide precipitates (which are causing the problem) to sulfate at neutral or slightly alkaline pH without creating noxious by-products.

6.5.1.4 The Impact of Wastewater Characteristics - The characteristics of wastewater can have significant impact on on-site treatment and disposal systems. Systems serving commercial buildings may fail because of the wastewater characteristics. High solids concentration or large amounts of fats, oils, and greases can cause failure. These failures may be

corrected by segregating the wastewaters, or by improving pre-treatment. Modification of the characteristics of wastewater can be used to enhance conventional system strategy or encourage new ones. There are three interrelated strategies for wastewater modification:

1. Water Conservation and Flow Reduction - An extensive array of techniques and devices are available to reduce average water use and wastewater flows generated by individual water-using activities and, consequently, total effluent from residences or establishments. These methods can be divided into three categories: elimination of nonfunctional water use; water saving devices, appliances, and fixtures; and wastewater recycling/reuse systems.

2. Pollutant Mass Reduction - Another strategy is directed toward decreasing the mass of potential pollutants at the source. This may involve the complete elimination of the pollutant mass contributed by a given activity or the isolation of the pollutant mass in a concentrated wastewater stream.

3. On-site Containment for Off-site Disposal - The last strategy utilizes holding tanks for on-site containment, and then transportation off-site for subsequent treatment and disposal. A holding tank is a water tight receptacle where sewage is stored, with little or no treatment, on-site. Ultimately the sewage is removed to be treated elsewhere. In many respects, the design, installation, and operation of a holding tank is similar to that of a septic tank, with several additional considerations. The size should have a holding capacity

of more than seven days of waste flow generation, with a minimum capacity of 1,000 gallons. There should be no discharge. A high water alarm should be positioned to allow three additional days storage after activation. Tanks should be readily accessible to a pumping vehicle because of frequent pumping. Frequent pumping and effluent disposal contribute to high operating costs.

6.6 Use of Cluster or Community Treatment Systems

An alternative for certain areas of Middle Paxton Township is the installation of an innovative collection system to carry septic tank effluent to a centralized point for treatment. Two systems have been evaluated--small-diameter gravity sewers and pressure sewers:

1. Small-diameter Gravity Sewers - This type of collection system uses small sewer lines (four inches or more in diameter) to transport septic tank effluent. Since the septic tank retains most solids, scum and grease, these lines can be much smaller than conventional raw wastewater sewers.

   In cases where the terrain permits, septic tanks can be connected to the main collection system using gravity connections. In instances where slopes interfere or septic tanks are lower than collection lines, individual sewage pumps can be used to lift the effluent to the proper level to allow gravity flow.

Some advantages of small-diameter gravity sewers are as follows:

a. Lower construction costs

b. Lower material costs

c. Lower equipment needs

2. Pressure Sewers - This type of collection system uses on-lot pumps to force wastewater through small-diameter sewers to a point where treatment takes place. There are two types of pressure sewer systems: grinder pumps and Septic Tank Effluent Pumps (STEP). Grinder pumps are used to grind and pump raw wastewater from each home into the main pressure sewer line. STEP systems pump septic tank effluent into the main pressure sewer line. STEP systems appear to be more cost-effective and require less maintenance than grinder pumps because treated wastewater, rather than raw sewage, is being pumped.

Some advantages of pressure sewers are follows:

a. Allow greater flexibility in hilly terrain.

b. Prevent any infiltration of surface water and groundwater.

c. Allow the use of small diameter plastic pipe which is more cost-effective.

d. Pipes are self-cleaning due to high liquid velocities.

A disadvantage to the pressure sewer system is its high operation and maintenance costs. Although construction can be less expensive than conventional gravity systems, maintenance of pumps and valves often offsets these savings.

It is estimated that Stoney Creek Manor and Delwood Acres could be sewered with small-diameter gravity and pressure sewers for $785,000. This figure is based on pumping to a point on Denison Drive and Elizabeth Avenue. Treatment could then be handled by a community on-site system or a package treatment plant.

A community on-site soil absorption system could be built north of Stoney Creek Manor. Costs for this system are estimated at $92,000 and would be limited to handling flows from a maximum of 50 dwelling units. Viability of this alternative depends on location and acquisition of an appropriate site with suitable soils. A community on-site system is viewed as a temporary treatment facility.

Another alternative is a package treatment plant serving at least the 195 dwelling units in Stoney Creek Manor and Delwood Acres. Costs for this system, delivered and installed on-site, are estimated at $546,000, and would depend on the adherence to effluent discharge limitations, which require a certain level of treatment. Package plants are usually small transportable units that are prefabricated at a manufacturing plant. Most of these units feature specific biological treatment processes with physical or chemical equipment available to provide improved treatment results. If a package plant is properly operated and maintained, it can provide a high level of wastewater treatment.

However a package treatment plant does not appear cost-effective for Middle Paxton Township, especially in light of the DER criteria for effluent discharged into a tributary of the Susquehanna River. Possible discharge sites include Stoney Creek and Clark Creek. Stoney Creek is a water supply source for Dauphin Consolidated Water Supply Company, and the reservoir is at the headwaters in Dauphin Borough. Clark Creek is another possibility, but transportation of effluent this distance would add significantly to the cost of the system.

6.7 Sewage System Management

A sewage system management program transfers the responsibility of maintaining individual on-lot systems from property owners to a public agency. This program could require better site evaluation, the use of improved system designs, and additional inspections during construction and operation. All these factors combined would greatly increase the life expectancy of on-lot systems. The agency would be responsible for maintenance. This would involve an annual inspection of the on-lot system, septic tank pumping, when necessary and repairs to the system when needed. The public management agency would require an easement to enter private property for inspections. The annual charge to the property owner would depend on the level of service provided.

A Sewage Management District has been considered both for the entire Township and for problem areas only. Individual on-lot systems are the predominant type of sewage treatment facility presently available in the Township. Once these systems are sited and installed, each individual property owner is responsible for the system's operation and maintenance. Because of this, it makes sense to implement a Sewage Management District, with regulations governing system inspection,

operation, maintenance, rehabilitation and replacement, where necessary. An ordinance is required to create an on-lot sewage disposal system management district. The cost of one alternative is estimated to be about $20 per year per property owner for an inspection program alone; however, the individual property owner would pay for pumping and repairs. Another alternative would include the public management agency paying all costs of system maintenance, including repairs. The cost of this program might be $100 or more per year per property owner. For a smaller area like Stoney Creek Manor and Delwood Acres, the cost estimate increases to approximately $200 per year for each property owner.

6.8 Comprehensive Plan Update

The Middle Paxton Township Comprehensive Plan was recently revised to propose certain use and density restrictions in residential areas. Minimum lot size was proposed at one acre per dwelling unit in the Residential Agricultural District; one acre per dwelling unit in the Residential Suburban 1 District; two dwelling units per acre in the Residential Suburban 2 District when public water is available and three dwelling units per acre when public water and public sewer are available. The Residential Suburban 2 District was established in the Zoning Ordinance, and comprises an area bounded by Hagy Road, Clark Creek, McElwee Road, Peters Mountain Road, the existing Residential Suburban District located immediately surrounding Dauphin Borough, and U. S. Route 22/322. The remainder of the existing Residential Suburban District would become Residential Suburban 1 District.

Severe slope areas were identified throughout the Township where the inclination of the land surface from the horizontal plane is 15 percent or greater; or in other words, where there is an

average change in topography of 15 or more feet in elevation for a distance of 100 feet. The minimum lot size for areas having average slopes of 15 percent or greater is two acres.

Other density considerations have been incorporated into an amendment to the Zoning Ordinance, as follows:

1. Areas of floodplain and severe slope are deemed critical resource areas and shall not be included as a part of the gross area upon which density is computed.

2. Existing easements and rights-of-way through a property shall not be included as a part of the gross area for density computation purposes. Likewise proposed road right-of-way shall not be included as a part of the gross area for density computation purposes. Other proposed easements may be included in the gross area calculations.

3. Required stormwater basins shall not be included in the gross area calculations. Other open space requirements may be included in the gross area calculations in determining density.

In addition, a feasibility study of water and sewer facilities was recommended to be required for more than five lots or dwelling units in the Subdivision and Land Development Ordinance. This study would consist of an examination of a possible connection to an existing public system, including an assessment of its capacity and distance from a proposed development.

Subsurface sewage disposal systems will be approved only when the DER certifies the suitability of the land for on-lot sewage disposal, and the feasibility study indicates the following:

1. The project necessitates consideration of this method.

2. The soil absorption is satisfactory for this type of system.

3. Such a system will not endanger groundwater supplies below the level of the soil absorption area.

4. The system will not be installed in creviced rocks or limestone formations.

Individual on-lot water supply systems will be approved only when the Middle Paxton Township Engineer certifies the suitability of the available resources for groundwater withdrawal, and the feasibility study indicates the following:

1. The project necessitates consideration of this method.

2. The water supply yield is adequate for the type of development proposed.

3. The installation of such systems will not endanger or decrease groundwater supplies of properties adjacent to the proposed development.

Based on the feasibility study, any proposed development will be provided with appropriate sewage disposal and water supply facilities, as follows:

1. Where there is an existing public sewer system on or within 1,000 feet of the proposed development, a complete sewage collection system must be installed and connected to the existing public sewer system, or

   a. Where there is no existing public sewer system, but a public sewer system is to be installed on or near the development within four years, a complete sewage collection system must be installed and connected to a temporary package treatment plant, or capped and on-lot subsurface sewage disposal systems provided until such time as connection to a public sewer system can be made, or

   b. Where there is no existing public sewer system and the Feasibility Study Report indicates that a public sewer system and treatment plant are not feasible, the adequate provision of on-lot subsurface sewage disposal systems must be investigated.

   c. If on-lot subsurface sewage disposal systems or connection to a public sewer system or installation of a public sewer system are not found feasible, the proposed development would not be approved.

2. Where there is an existing public water system on or within 1,000 feet of the proposed development, a complete water main system connected to the existing public water system must be provided, or

   a. Where plans approved by the Dauphin Consolidated Water Supply Company provide for the installation of such public water facilities within four years, the

proposed development shall be provided a complete water main system ready to be connected to the proposed water system, or

b. Where there is no existing public water supply and the Feasibility Study Report indicates that connection to a public water system is not feasible, each lot in the development must be provided with an individual water supply system in accordance with minimum standards approved by the DER.

7.0 RECOMMENDED ALTERNATIVES

7.0 RECOMMENDED ALTERNATIVES

7.1 Technical Strategy

An on-lot system maintenance program is proposed for existing and new subsurface sewage disposal systems in Middle Paxton Township through inspection, periodic cleaning, pumping and hauling. Repairs and replacement would be undertaken if chronic malfunctions occur.

It has been recommended that a monitoring program be instituted to continually assess the water quality impact of existing on-lot systems. This program should be directed toward areas with a concentration of prior malfunctions; with old or existing un-permitted systems; and with newly permitted systems with marginal soils and satisfactory designs. For example, the subdivision of Stoney Creek Manor, and Delwood Acres would require quarterly monitoring of wells and annual monitoring of streams for nitrate-nitrogen and total coliform. Also seasonal fluctuations could be determined by sampling after certain climatic changes, such as at the end of a drought period and at the peak of prolonged precipitation.

Proper siting, density control, and appropriate design and construction of on-lot systems can prevent most water contamination problems. The use of an innovative or alternative sewage disposal system in conjunction with on-lot systems may be necessary in areas of marginal soil and hydrogeological conditions. These systems include pressure dosing, multiple drain-fields, mound systems, package aerobic treatment, denitrification and waterless toilets. Recent advances in on-lot system technology provide viable alternatives for environments where conventional systems are inappropriate.

Soil and hydrogeologic evaluations are highly encouraged. Through these, a site's strengths and weaknesses with respect to on-lot systems can be identified. Site-specific field measurements can be made to determine the best system design and installation configuration for an individual site.

Because land use control is a municipal responsibility, it is of utmost importance that the sewage facility element of a site development plan be coordinated with the Township and regional sewage enforcement agencies. At least one acre of land should be required for an individual on-lot subsurface sewage disposal system and a well to serve a single dwelling. This would provide additional land area for replacement of an on-lot system and proper isolation distance from the well. The presence of public water could reduce the minimum lot size, while steep slopes would require a much larger lot. Therefore, a limited growth policy for the Township is recommended.

A feasibility study of water and sewer facilities will be required of any major subdivision and land development plan. This will determine the most appropriate technology for sewage collection, wastewater treatment, and effluent discharge.

7.2 Institutional Strategy

The Middle Paxton Township Board of Supervisors is proposed as the agency which will provide the necessary authority for the fiscal, regulatory, technical and administrative functions of managing the on-lot system maintenance program. There should be provisions requiring that periodic maintenance and pumping records be kept by on-lot system owners, and requiring a system inspection by the Township when a certain level of documented evidence of system malfunction is obtained.

The Township should also institute a public education program to encourage property owners and contractors to actively participate in efforts to improve sewage management. These efforts range from distributing printed materials to conducting training programs. In addition, water conservation and waste reduction practices could be promoted to extend on-lot system life and improve its performance by reducing daily loading. The public should be made aware of the various contaminants which appear in on-lot system discharges, and their potential impacts on groundwater and surface water quality. For example, the use of septic tank cleaning solvents should be discouraged because they can damage on-lot systems and contaminate groundwater with toxic chemicals.

The Township should establish a capital reserve fund. Even though future sewerage is being deferred for more than 10 years, it is prudent to provide a contingency for the life expectancy of existing on-lot systems. This fund will accumulate, and be dedicated toward monitoring the on-lot system maintenance program. It could also serve as seed money for financing interim or new public wastewater treatment facilities.

SELECTED REFERENCES

E. H. Bourquard Associates, Inc., 1975, Plan of Study for U. S. EPA Grant Application: Prepared for the Municipal Authority of Dauphin Borough.

E. H. Bourquard Associates, Inc., 1975, Step 1 Facilities Plan of Dauphin Borough and Part of Middle Paxton Township: Prepared for the Municipal Authority of Dauphin Borough.

Dresdner Associates Pennsylvania, Inc., 1987, Comprehensive Plan Update, Middle Paxton Township, Dauphin County, Pennsylvania.

Dresdner Associates Pennsylvania, Inc., 1986, Sewage Facilities Plan Update, Middle Paxton Township, Dauphin County, Pennsylvania.

Dresdner Associates Pennsylvania, Inc., 1987, Sewage Facilities Plan Update, Middle Paxton Township, Dauphin County, Pennsylvania.

Glace & Glace, Inc., 1973, Preliminary Report: Sewerage Facilities, Middle Paxton Township, Dauphin County, Pennsylvania.

Grove Associates, 1988, Study of Subsurface Sewage Disposal System Repairs, Stoney Creek Manor/Delwood Acres, Middle Paxton Township, Dauphin County, Pennsylvania.

Middle Paxton Township, 1983, Subdivision and Land Development Ordinance.

Middle Paxton Township, 1983, Zoning Ordinance.

Middle Paxton Township, 1988, Ordinance No. 28 Amending the Revised Zoning Ordinance.

Pennsylvania Department of Environmental Resources, 1980, State Water Plan.

Clifton E. Rodgers and Associates, 1979, Middle Paxton Township Comprehensive Plan.

Tri-County Regional Planning Commission, 1969, Cumberland and Dauphin Counties Area Sewerage Plan.

APPENDIX A

Study of Subsurface Sewage Disposal System Repairs

STUDY OF
SUBSURFACE SEWAGE DISPOSAL SYSTEM REPAIRS
STONEY CREEK MANOR/DELWOOD ACRES
MIDDLE PAXTON TOWNSHIP
DAUPHIN COUNTY

STUDY OF

SUBSURFACE SEWAGE DISPOSAL SYSTEM REPAIRS

STONEY CREEK MANOR/DELWOOD ACRES

MIDDLE PAXTON TOWNSHIP

DAUPHIN COUNTY

FOR

Middle Paxton Township Board of Supervisors

P.O. Box 277

Dauphin, Pa. 17018

BY

Grove Associates

Engineers & Surveyors

P.O. Box 136

Dauphin, Pa. 17018

March, 1988

The Middle Paxton Township Board of Supervisors has requested Grove Associates to conduct a study of the septic systems repaired during the past seven years in the areas of Middle Paxton Township known as Stoney Creek Manor and Delwood Acres. The intent of the study was twofold; to determine the current condition and status of these repair septic systems and to propose an estimate of the functionability of future repair septic systems in this area based upon the performance of the existing repair septic systems.

The seven year time frame was chosen due to the fact that Gerald C. Grove was appointed as the SEO for Middle Paxton Township in August of 1981. Since that date, nineteen (19) permits for the repair of a septic system have been issued to eighteen (18) different sites in the areas of interest (Site M-3 was issued two permits, an initial permit for replacement of the pipe leading from the septic tank to the drain field and a subsequent permit for repair to the drain field itself). All eighteen sites are located in Stoney Creek Manor. No repair permits have been issued within this time frame for Delwood Acres. These nineteen permits can be grouped as follows:

Minor Repairs - Four (4)
(Sites M-3, M-6, M-10, and M-15)

In-ground Gravity Bed/Trench - Seven (7)
(Sites M-1, M-3, M-9, M-12, M-13, M-14, and M-17)

Pressurized In-Ground Bed/Trench - Five (5)
(Sites M-2, M-7, M-8, M-16, and M-18)

Subsurface Sand Filters or equivalent - Three (3)
(Sites M-4, M-5, and M-11)

The following is a general discussion of each type of repair and the reasons such repairs were chosen.

Minor repair permits were issued for replacement of system components of the septic system other than the drain field. In each case within the study area, these permits were issued for the replacement of a cast iron pipe initially installed between the residence and the septic tank or the septic tank and the distribution box. In all cases the cast iron pipe had corroded and become blocked with debris causing the system to "back-up". The repair simply amounted to the cast iron pipe being replaced with a PVC pipe. We would expect more repairs of this type to be needed in the future as most of the systems in the area seem to have been installed with the cast iron pipes.

In-ground Gravity systems were permitted during the first few years of the study period prior to the recognition of the benefits of pressure dosing. Of the seven permits of this type permitted, one utilized serial distribution, two utilized entirely new seepage beds, one utilized a new bed to be used in addition to an existing system, one utilized an entirely

new trench system, and two utilized new trenches to be used in addition to an existing system. Most of these systems were installed on lots with substandard soil tests and selection of the type of repair system depended upon soil test results, the type of malfunction, site limitations, and the SEO's interpretation of best technical guidance. In general, the slope of the particular site determined whether a bed or trench system was utilized. Also in general, if a surface malfunction was detected, an entirely new absorbtion field was permitted. If the original system was backing-up, the original absorbtion field was used in conjunction with the new absorbtion area. In most cases the size of the repair system was restricted by site limitations such as existing buildings or areas of severe slope. We would not expect many more of this type of system to be permitted as in most of these cases, pressure dosing would have resulted in a more even distribution of effluent presumably lengthening the life of the repair system.

Pressurized In-ground Systems were permittted during the most recent part of the study period. Of the five (5) permits issued for this type of system, one utilized an entirely new seepage bed, two utilized an entirely new trench absorbtion area, one utilized an entirely new sand lined inground bed system, and one utilized a new sand filled bed system in addition to an existing system. The factors contributing to the selection of the type of system for these repairs are similar to those reported for the In-ground systems with the exception that soil tests were performed more regularly with these repairs due to increased emphasis on the use of soil tests to determine design. Sand was used in these repairs where the percolation rate at a 20 inch depth was particuarly slow and where the soil profile indicated that the drainage would improve once an impermeable soil layer was bypassed.

Subsurface sand filters or systems bearing resemblance to the same have been permitted only where the soil tests results have shown this to be the appropriate system for the site and through the use of the best technical guidance concept. There is a vein of sandy soil running through the Stoney Creek Manor development which is ideal for the placement of subsurface sand filters. Three such systems have been installed over the study period and all three showed similar soil profiles.

Analysis of the repair permit data submitted with this report shows that of the nineteen permits issued in the study area, five of these sites were unsuitable per the DER regulations and policies at the time of issuance, some sites for more than one reason. The reasons for unsuitability can be classed as follows:

Slope too great for type of system	- 1
Percolation rate greater than 120 min./inch	- 2
Limiting Zone of less than 20 inches	- 1
System type installed different than new system with same soil test results	- 4

** Note: The repair system permits issued which are of a different type than a new system with the same soil test results were issued using best technical guidance and, at the time of permit issuance, were thought to be the best repair alternative for the site.

The repair systems installed at the remaining fourteen sites were all designed and installed in accordance with the DER regulations at the time of issuance/construction. It should be noted here that although the majority of the lots within the study area are less than one acre in size, there is sufficient room for a repair septic system on the vast majority of lots due to the fact the the entire area is served by a public water supply (Dauphin Consolidated) and the designer does not need to meet any well isolation distances.

The investigation of the original malfunctions and the inspection of the repair systems as they were installed has revealed one factor which is common to all of the malfunctions within the study area. The use of poor materials and poor methods of construction have been the major causes of the malfunctions of the original systems in the study area. One may reasonably assume, therefore, that in the future more systems within the study area will malfunction. We would expect the vast majority of these systems to be the original systems. The new repair systems which have used the higher material and construction standards and which require inspection by the SEO prior to approval, appear to be functioning well.

The question therefore arises, is the use of subsurface on-lot sewage disposal systems a reasonable long term alternative for future septic system malfunctions. The study conducted shows no evidence that the repair systems installed within the last eight years are not functioning properly. There was no evidence of a surface malfunction at any of the eighteen sites. The residents of sixteen of these sites were contacted and questioned about the performance of their repair systems. Residents were questioned individualy about 1) surface malfunctions, 2) odor problems, and 3) system "backup". All residents contacted reported no problems of any sort since the repair of their systems.

The final type of septic system malfunction, the pollution of the ground water table, has not been covered in this study. However, analysis of the data supplied in this report in conjuction with the Groundwater and Surface Water Quality Analysis report prepared by R.E. Wright Associates, Inc. in February of 1988, would indicate that use of subsurface on-lot sewage disposal systems is a plausible and reasonable solution to the long term sewage disposal needs within the study area.

Site	M1 - Reference Map for approximate location
Owner	Ron Blydon
Address	828 Stoney Creek Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	1:41 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Inground Bed
Repair Permit #	A51144
Date Permit Issued	May 9, 1982
Date of Final Inspection	May 11, 1982

Soil Test Results

Limiting Zone	26 inches
Limiting Factor	Shale
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. Ground on top of system is firm and dry. Slight odor from cleanouts. There is a steeply sloped area 10 feet west of the new septic system. There is no evidence of seepage through the soil to this steeply sloped area.

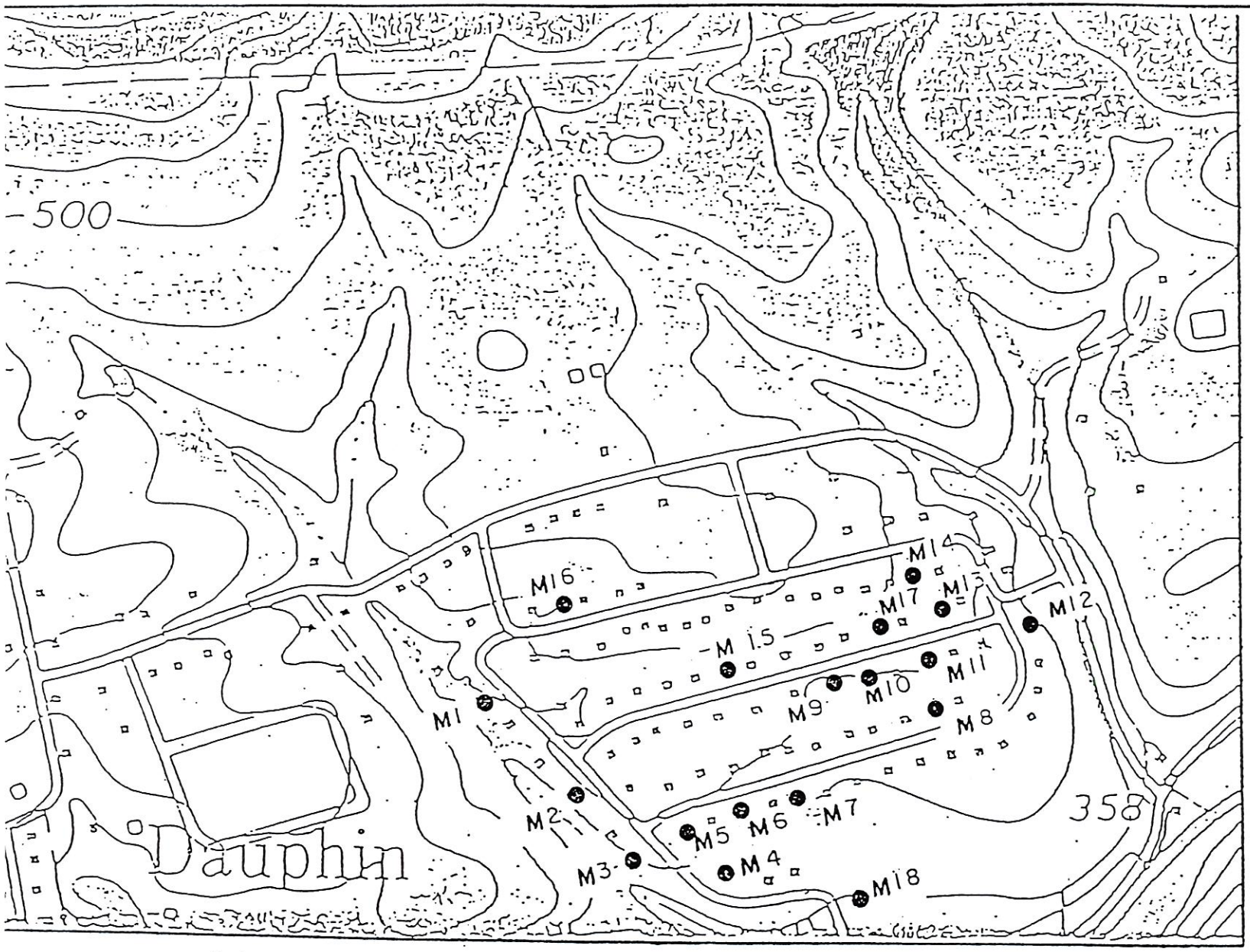
Site	M2 - Reference Map for approximate location
Owner	Olga Fried
Address	716 Stoney Creek Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	12:54 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Pressurized Inground Bed
Repair Permit #	E16297
Date Permit Issued	Sept. 17, 1986
Date of Final Inspection	July 16, 1987

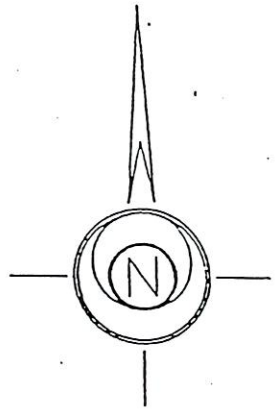
Soil Test Results

Limiting Zone	15 inches
Limiting Factor	Shale
Percolation Rate	220 min./inch

Visual Inspection Comments

No visual evidence of malfunction. Ground on top of system is firm and dry. There is a steeply sloped area 10 feet west of the new septic system. There is no evidence of seepage through the soil to this steeply sloped area. No odor.





LEGEND

● — MALFUNCTION SITE.

BASE MAP: FROM HALIFAX, PA 7 1/2 MINUTE USGS TOPOGRAPHIC QUADRANGLES.

SUBSURFACE SEWAGE DISPOSAL SYSTEM REPAIRS

MIDDLE PAXTON TOWNSHIP- Stoney Creek Manor/ Delwood Acres	SCALE NTS	DRAWN BY JR
		REVISED

GROVE ASSOCIATES
ENGINEERS & SURVEYORS — DAUPHIN, PA

DATE	APPROVED BY	DRAWING NUMBER
5-25-88		25-B

Site	M3 - Reference Map for approximate location
Owner	Larry Olenycheck
Address	640 Stoney Creek Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	12:40 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Inground Trench
Repair Permit #	A51721
Date Permit Issued	Oct. 20, 1983
Date of Final Inspection	Aug. 14, 1984

Soil Test Results

Limiting Zone	75+ inches
Limiting Factor	None
Percolation Rate	60.17 min./inch

Visual Inspection Comments

No visual evidence of malfunction. There is a steeply sloped area 10 feet west of the new septic system. There is no evidence of seepage through the soil to this steeply sloped area. There is a slight odor from the cleanouts.

Site	M4 - Reference Map for approximate location
Owner	Albert J. Beard
Address	621 Stoney Creek Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	1:15 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Subsurface Sand Filter
Repair Permit #	A51131
Date Permit Issued	Nov. 10, 1981
Date of Final Inspection	Nov. 10, 1981

Soil Test Results

Limiting Zone	36 inches @ 60" - 112" sandy loam material present
Limiting Factor	Mottling at upper limiting zone
Percolation Rate	23 min./inch at lower 60"-112" horizon

Visual Inspection Comments

No visual evidence of malfunction. Site is located in a topographic low spot and gathers runoff. The entire yard area was somewhat soft but there was no evidence that this was due to a septic system malfunction.

Site	M5 - Reference Map for approximate location
Owner	T.L. Guistwhite III
Address	651 Stoney Creek Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	1:28 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Ingorund Bed
Repair System Type	Subsurface Sand Filter + Existing
Repair Permit #	16833
Date Permit Issued	June 24, 1981
Date of Final Inspection	July 22, 1981

Soil Test Results

Limiting Zone	Not Available
Limiting Factor	Not Available
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. Ground on top of system is firm and dry. No odor. Small bank located 10 feet east of the new system. No evidence of seepage out of this bank.

Site	M6 - Reference Map for approximate location
Owner	F.R. Costello
Address	309 Fried Dr. Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	1:51 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground
Repair System Type	Original
Repair Permit #	A51268
Date Permit Issued	Dec. 17, 1982
Date of Final Inspection	Dec. 21, 1982

Soil Test Results

Limiting Zone	Not Available
Limiting Factor	Not Available
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. Ground on top of system is firm and dry. No odor.

Site	M7 - Reference Map for approximate location
Owner	Thomas Andros
Address	317 Fried Dr. Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	2:03 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Pressurized Inground Bed
Repair Permit #	D32783
Date Permit Issued	Nov. 12, 1985
Date of Final Inspection	May 7, 1986

Soil Test Results

Limiting Zone	70 inches
Limiting Factor	Water
Percolation Rate	201 min./inch

Visual Inspection Comments

No visual evidence of malfunction. No odor.

Site	M8 - Reference Map for approximate location
Owner	James Miceli
Address	412 Fried Dr. Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	2:21 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Pressurized Inground Bed
Repair Permit #	D32732
Date Permit Issued	April 30, 1985
Date of Final Inspection	Aug. 1, 1985

Soil Test Results

Limiting Zone	Not Available
Limiting Factor	Not Available
Percolation Rate	75 min./inch

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system is firm and dry.

Site	M9 - Reference Map for approximate location
Owner	Andrew Wenrich
Address	405 Erdman Dr. Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	3:48 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Gravity Inground Bed + Existing
Repair Permit #	A51143
Date Permit Issued	July 15, 1982
Date of Final Inspection	July 15, 1982

Soil Test Results

Limiting Zone	38 inches
Limiting Factor	Sandstone Bedrock
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. Slight odor form cleanout. Ground on top of new system firm and dry.

Site	M10 - Reference Map for approximate location
Owner	John Sardelis
Address	409 Erdman Dr. Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	4:12 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground
Repair System Type	Inground
Repair Permit #	G34981
Date Permit Issued	Sept. 22, 1987
Date of Final Inspection	Dec. 9, 1987

Soil Test Results

Limiting Zone	Not Available
Limiting Factor	Not Available
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system firm and dry.

Site	M11 - Reference Map for approximate location
Owner	Ray Barth
Address	421 Erdman Dr. Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	4:01 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Subsurface Sand Filter
Repair Permit #	E16257
Date Permit Issued	Dec. 5, 1986
Date of Final Inspection	Dec. 31, 1986

Soil Test Results

Limiting Zone	66+ inches
Limiting Factor	None
Percolation Rate	86 min./inch

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system firm and dry.

Site	M12 - Reference Map for approximate location
Owner	Henderson Sigler
Address	441 Fried Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	2:46 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground
Repair System Type	Inground - Serial Distribution
Repair Permit #	A51139
Date Permit Issued	April 22, 1982
Date of Final Inspection	April 22, 1982

Soil Test Results

Limiting Zone	Not Available
Limiting Factor	Not Available
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system firm and dry.

Site	M13 - Reference Map for approximate location
Owner	George Gift
Address	416 Erdman Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	3:33 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Inground Trench + Existing
Repair Permit #	B21067
Date Permit Issued	Dec. 18, 1984
Date of Final Inspection	Dec. 20, 1984

Soil Test Results

Limiting Zone	Not Available
Limiting Factor	Not Available
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system firm and dry.

Site	M14 - Reference Map for approximate location
Owner	Steven Trythall
Address	425 Vesta Dr. Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	3:06 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Inground Trench
Repair Permit #	A51433
Date Permit Issued	May 13, 1983
Date of Final Inspection	May 18, 1983

Soil Test Results

Limiting Zone	85+ inches
Limiting Factor	None Observed
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system firm and dry.

Site	M15 - Reference Map for approximate location
Owner	George Weisner
Address	316 Erdman Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	4:39 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground
Repair System Type	Inground
Repair Permit #	16829
Date Permit Issued	June 19, 1981
Date of Final Inspection	June 19, 1981

Soil Test Results

Limiting Zone	Not Available
Limiting Factor	Not Available
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system firm and dry.

Site	M16 - Reference Map for approximate location
Owner	Joe DeSantis
Address	304 Vesta Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	2:33 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Pressurized Inground Trench
Repair Permit #	A51441
Date Permit Issued	May 15, 1984
Date of Final Inspection	July 13, 1984

Soil Test Results

Limiting Zone	52 inches
Limiting Factor	Shale
Percolation Rate	99.5 min./inch

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system firm and dry.

Site	M17 - Reference Map for approximate location
Owner	Thomas Palmer
Address	408 Erdman Drive Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	4:26 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Inground Bed
Repair Permit #	A51723
Date Permit Issued	Nov 8., 1983
Date of Final Inspection	Jan. 6, 1984

Soil Test Results

Limiting Zone	Not Available
Limiting Factor	Not Available
Percolation Rate	Not Available

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system firm and dry.

Site	M18 - Reference Map for approximate location
Owner	St. Matthew's (Rectory) Father Kelly
Address	420 Stoney Creek Road Dauphin, Pa. 17018
Date of Inspection	March 23, 1988
Time	2:57 p.m.
Weather Conditions	Sunny & Mild
Original System Type	Inground Bed
Repair System Type	Pressurized Inground Trench
Repair Permit #	D33809
Date Permit Issued	Oct. 18, 1985
Date of Final Inspection	May 2, 1986

Soil Test Results

Limiting Zone	84 inches
Limiting Factor	Shale
Percolation Rate	71.33 min./inch

Visual Inspection Comments

No visual evidence of malfunction. No odor. Ground on top of new system firm and dry.

APPENDIX B

Groundwater and Surface Water Quality Analysis of the Middle Paxton Township Sewage Facilities Study Area

GROUNDWATER AND SURFACE WATER QUALITY ANALYSIS OF THE MIDDLE PAXTON TOWNSHIP SEWAGE FACILITIES STUDY AREA, DAUPHIN COUNTY, PA

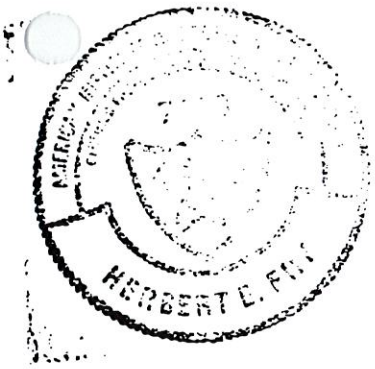
REWAI Project 87195

For

Middle Paxton Township Board of Supervisors
Dauphin, PA

By

R. E. WRIGHT ASSOCIATES, INC.
3240 Schoolhouse Road
Middletown, PA 17057



June 1988

Respectively submitted,

Herbert E. Fry

Herbert E. Fry, CPG
Project Manager/Hydrogeologist

Reviewed by:

Bruce P. Willman

Bruce P. Willman, CPSS
Project Manager/Soil Scientist

Andrew C. Paszkowski

Andrew C. Paszkowski, PP/AICP
Group Manager of Planning

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICIES

1.0 INTRODUCTION

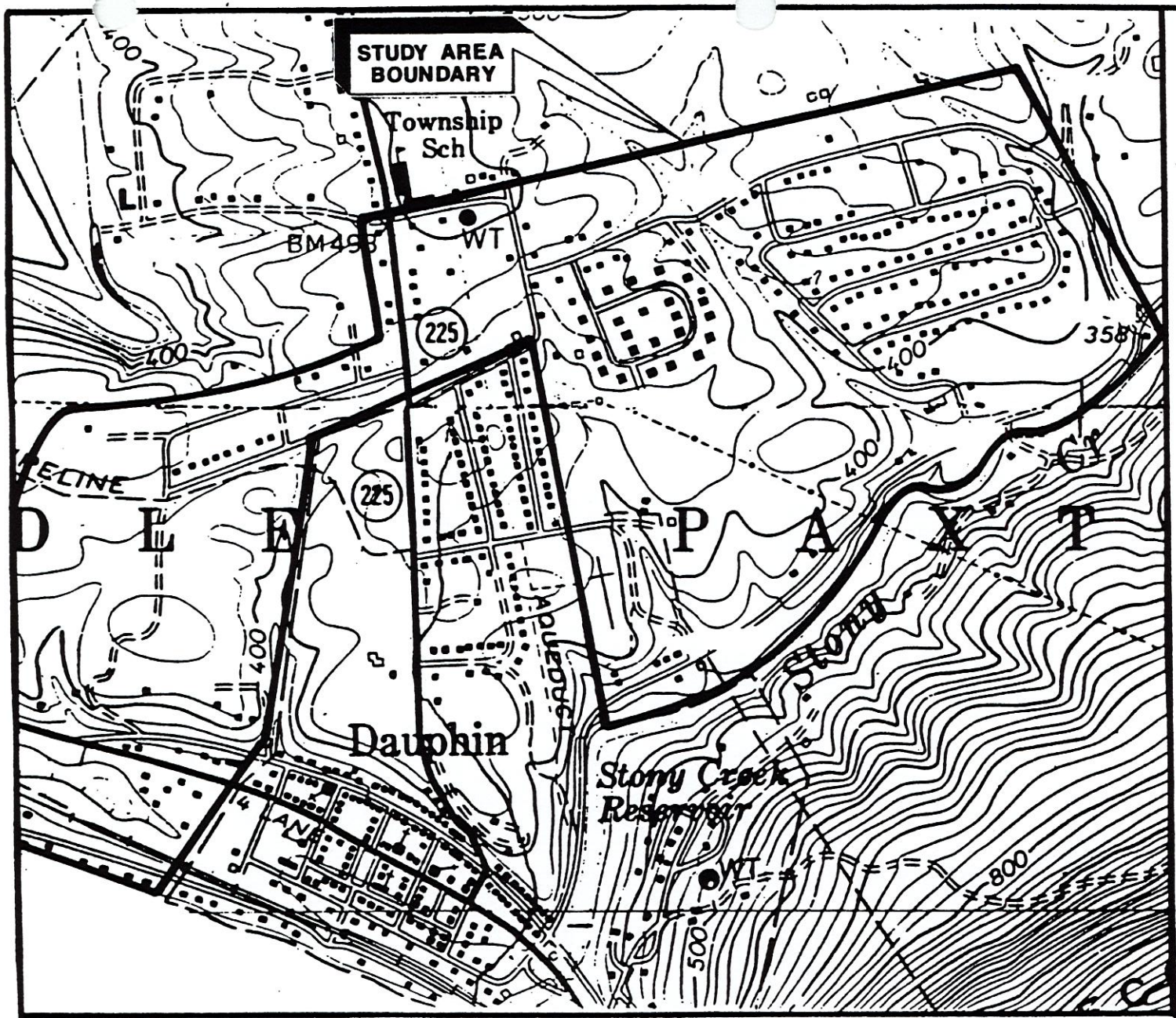
The area of Middle Paxton Township, Dauphin County, Pennsylvania adjacent to Dauphin Borough (See Figure 1) has been designated by the Pennsylvania Department of Environmental Resources (PADER) for changeover from on-lot septic systems to public sewerage. PADER has assumed that there are a large amount of malfunctioning septic systems contaminating the groundwater and surface water of the area based on the age of the existing systems, small lot sizes, and the mapped presence of marginally acceptable soils.

R. E. Wright Associates, Inc. (REWAI) was contracted in January 1988 to determine the groundwater and surface water quality impact from the existing septic systems. The study has been designed to provide real data to determine the need for public sewerage by concentrating primarily on sampling of small tributaries and existing domestic wells, as well as from monitoring wells downgradient from the densest areas of on-lot septic systems.

2.0 SOILS AND HYDROGEOLOGY

2.1 Soils

The study area is covered by soils of the Calvin-Leck Kill - Klinesville association, which are residual soils developed from the underlying bedrock and are typically deep to shallow, well drained, shaly silt loams. More than half of the study area and virtually all places where homes have been built are comprised of the Calvin-Leck Kill shaly silt loam, 3 to 8% slopes. The depth to the limiting zone in this Calvin-Leck Kill soil, which is bedrock, ranges from 25 to 40+ inches. Therefore, these soils under the present Pennsylvania Sewage Facilities Regulations are



BASE MAP: FROM HARRISBURG WEST AND HALIFAX, PA 7 1/2 MINUTE USGS TOPOGRAPHIC QUADRANGLES.

1000' 0 1000'

SCALE IN FEET

FIGURE 1

MIDDLE PAXTON TOWNSHIP

STUDY AREA

drawn JST II	approved ACF	drawing no.	
checked HCF	date 2/29/88	87195-010-AA	

r. e. wright associates, inc
earth resources consultants
middletown pennsylvania

normally suitable for only sand mound septic systems and not standard in-ground systems.

2.2 Geology

The study area is underlain by bedrock of the Mauch Chunk Formation, which consists of brownish-gray to grayish-red shale, siltstone, and sandstone. Bedding planes within the rock are oriented northeast-southwest and dip steeply to the northwest, as this area is on the southeast limb of a regional syncline. Although joints and fractures are present within the bedrock, the dominant planar discontinuities are bedding planes, which produce an anisotropic permeability condition of higher permeabilities along the bedding plane orientations.

2.3 Groundwater Flow System

The depth to the water table in the study area ranges from 0 feet at streams to approximately 40 feet at the hilltops. Therefore, the zone of saturation and groundwater flow is contained almost completely within the bedrock. The shape of the water table mimics the regional configuration of surface topography. The directions of groundwater flow are roughly perpendicular to the regional topographic contours, similar to surface runoff, but may be skewed somewhat to the northeast and southwest by the preferential permeability along bedding planes.

Water recharges to the groundwater flow system as infiltrating precipitation on hilltops and side slopes, and surfaces as groundwater discharge to small tributaries, Stony Creek, and the Susquehanna River. Discharges from the existing septic systems would infiltrate the underlying soil and rock to the water table. These discharges would then mix with the groundwater and flow in

the same direction, eventually discharging into the surface water courses. Because of the proximity of the existing septic systems to the numerous local groundwater discharge zones (surface water courses), septic system effluent probably does not disperse to depths, greater than 100 to 200 feet below the water table and possibly much shallower.

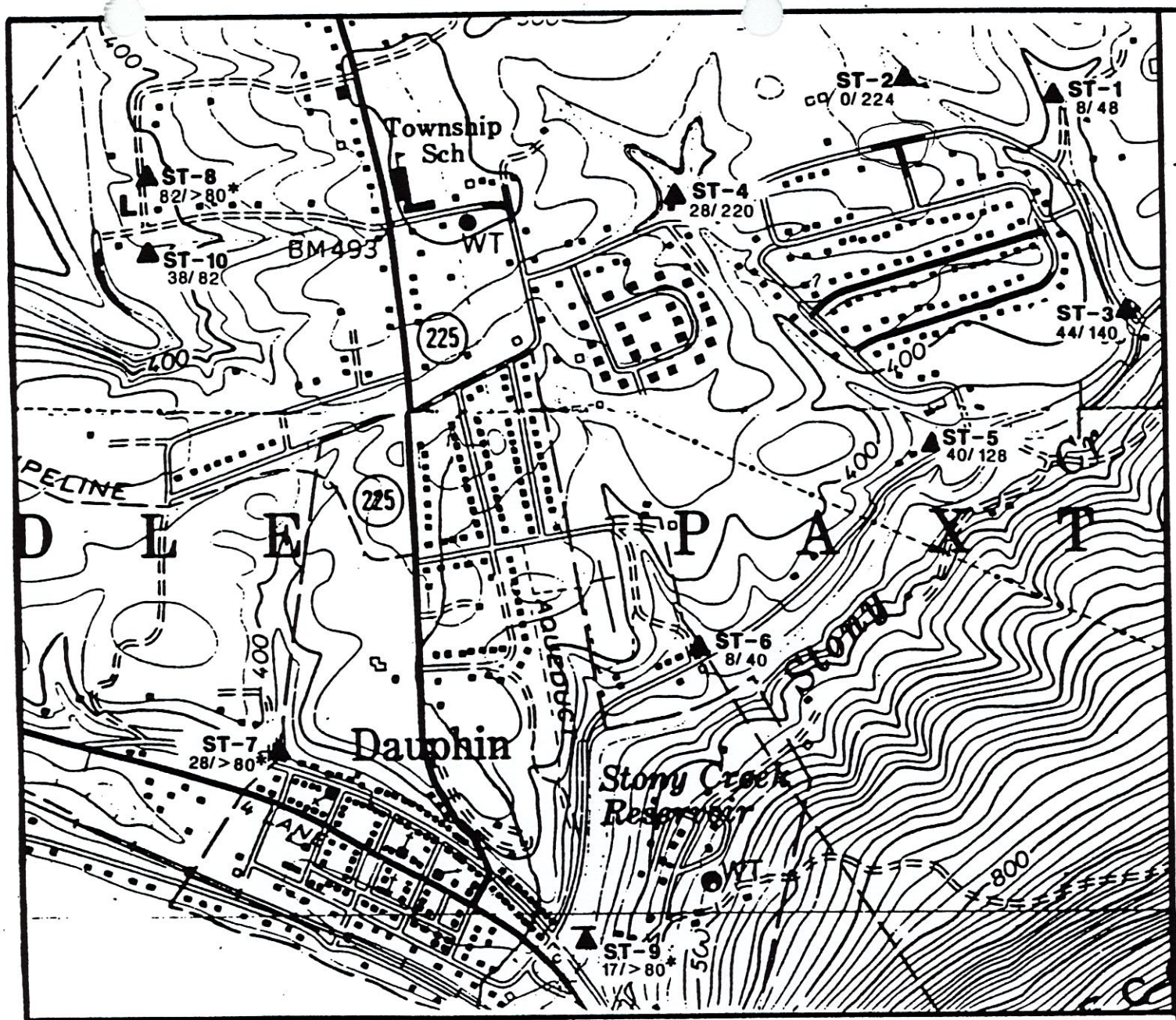
3.0 EXISTING WATER QUALITY

3.1 Surface Water

In order to assess the impact of existing septic systems on surface water quality, REWAI devised a sampling program of local tributaries that would be most directly affected by these septic systems. Details of the sampling program are discussed in Appendix A, and results are included in Appendix B.

The nitrate-nitrogen concentrations in the small tributaries range from 2.6 to 4.4 mg/l, which indicate that some man-induced impacts are occurring, such as farming and septic systems, but not producing values above the 10 mg/l USEPA drinking water standard. The value for Stony Creek of 0.48 mg/l near the dam reflects natural background values of nitrate-nitrogen, since most of the drainage basin to the creek has not been developed, but remains forested.

The fecal coliform and fecal streptococci results, which are plotted on Figure 2, show the presence of low levels of these bacteria, ranging from 0 to 224 colonies/100 ml. Human wastes typically have fecal coliform/fecal streptococci ratios of greater than 4, while animal wastes are less than 1. All the ratios are less than 0.5, possibly indicating animal wastes as the source; however, due to the length of time needed for



BASE MAP: FROM HARRISBURG WEST AND HALIFAX, PA 7 1/2 MINUTE USGS TOPOGRAPHIC QUADRANGLES.

LEGEND

▲ SURFACE SAMPLING POINT

100/50 FECAL COLIFORM COUNT / FECAL STREPTOCOCCI COUNT (IN COLONIES/100 ml) ON FEBRUARY 3, 1988

* DATA FROM JANUARY 21, 1988

1000' 0 1000'

SCALE IN FEET

FIGURE 2

MIDDLE PAXTON TOWNSHIP

BACTERIOLOGICAL SURFACE WATER QUALITY

drawn JST II	approved ACP	drawing no.
checked MEF	date 2/26/88	87195-005-AA

r. e. wright associates, inc.
earth resources consultants
middletown pennsylvania

groundwater flow from septic systems to the streams, these ratios could have changed from selective die-off of bacteria.

Review of upstream and downsteam samples from the area of densest housing development (ST-1 through ST-5) can determine if any impact from septic systems is occurring. Although some increases in fecal coliform and decreases in fecal streptococci do occur downstream, these changes are so minor that with only one sampling event, they cannot be considered statistically different. In any event, with the quantity of sewage disposal from these two subdivisions, much larger increases in bacteria counts would likely be present downstream if widespread septic system malfunctions existed. Therefore, these results do not conclusively indicate the presence of any widespread contamination from septic system malfunctions.

3.2 Groundwater

In order to assess the impact of existing septic systems on groundwater quality, REWAI devised a sampling program of existing domestic wells up and downgradient from areas of septic systems. In addition, two shallow monitoring wells (75 feet deep) were completed downgradient from the two densest areas of on-lot septic systems at positions in the groundwater flow system most likely affected by these systems. Details of the sampling program are discussed in Appendix A, results are included in Appendix B, and well construction records and logs are included in Appendix C.

Nitrate-nitrogen results range from 2.1 to 8.4 mg/l, which indicate that some man-induced impact has occurred to raise the values above the approximate 0.5 natural background concentration. Since all but one of the values are below 6.1 mg/l, and

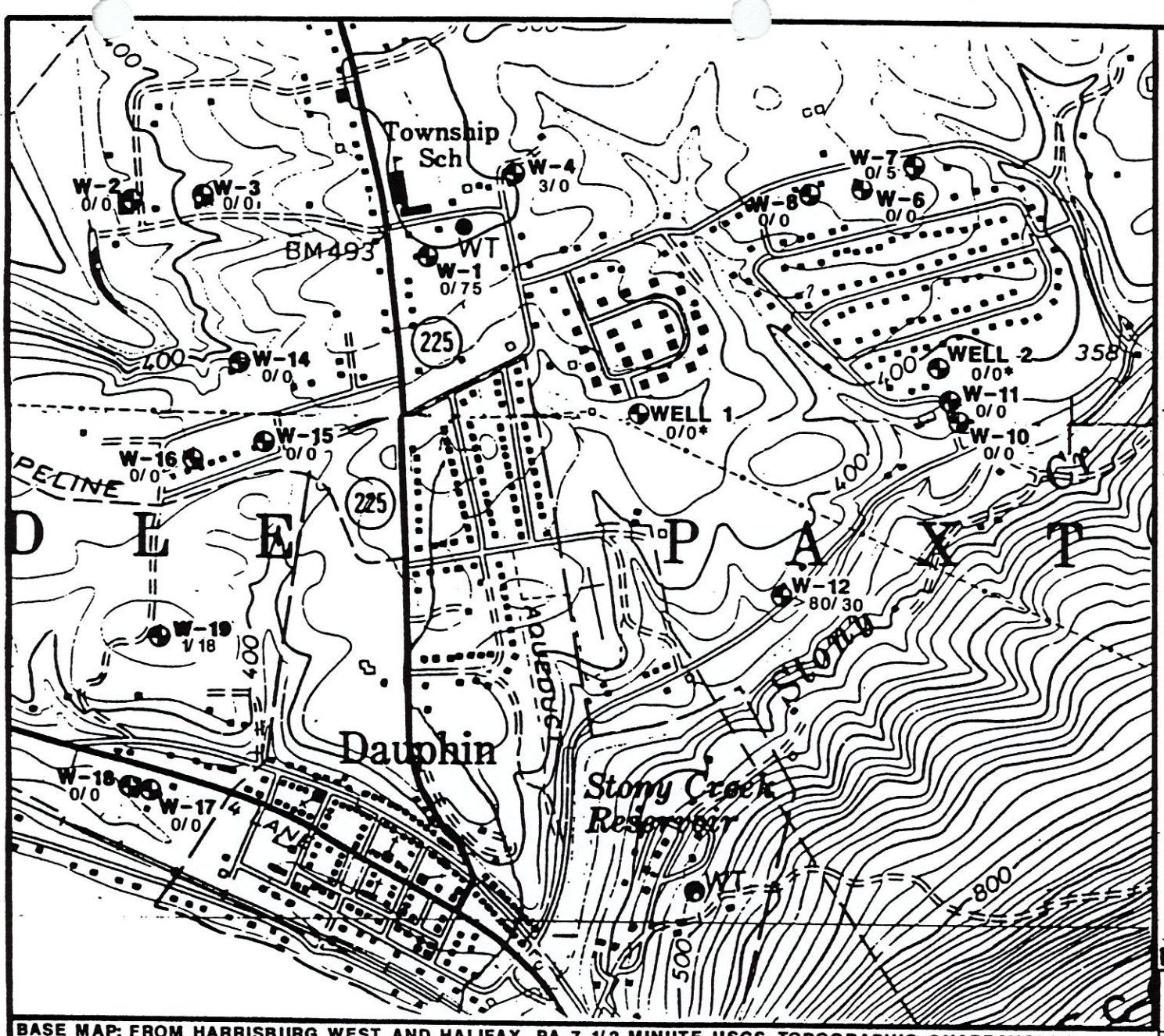
since they are all below the 10 mg/l USEPA drinking water standard, any impacts to nitrate-nitrogen water quality from the existing septic systems are not significant. Even the two monitoring wells only have nitrate-nitrogen concentrations of 4.5 and 5.1 mg/l.

The fecal coliform and fecal streptococci results, which are plotted on Figure 3, and the total coliform results, which are plotted on Figure 4, show the presence of some low levels of bacteria west of Route 225 and the notable absence of bacteria near the two subdivisions in the eastern portion of the study area. Two samples east of Route 225, WS-11 and WS-12, had high bacteria counts and high fecal coliform/fecal streptococci ratios, indicating contamination by human waste, most likely on-site septic systems located 15 to 50 feet upgradient from the wells. Sample WS-1 also exhibits moderately high total coliform and fecal streptococci counts. WS-1 is in a sewered area and not downgradient from any known septic systems.

In general, the results of the groundwater sampling show that no nitrate-nitrogen problems exist and that no bacterial problems are evident from the two larger subdivisions in the eastern portion of the study. Some local bacteriological problems are present at two homes (WS-4 and WS-12), and some areas of low level total coliform are present west of Route 225.

4.0 CONCLUSIONS/RECOMMENDATIONS

Based on the results of this study, the water quality in the Middle Paxton Township Study Area is generally good. Nitrate-nitrogen concentrations in streams and groundwater are well within the USEPA drinking water standard. Bacteriological sampling of surface water and groundwater has found no areas of



BASE MAP: FROM HARRISBURG WEST AND HALIFAX, PA 7 1/2 MINUTE USGS TOPOGRAPHIC QUADRANGLES.

LEGEND

- SAMPLED WELL LOCATION
- 100/ 50 — FECAL COLIFORM COUNT/ FECAL STREPTOCOCCI COUNT (IN COLONIES / 100 ml) ON JANUARY 21, 1988
- *DATA FROM APRIL 20, 1988

1000' 0 1000'
SCALE IN FEET

FIGURE 3

MIDDLE PAXTON TOWNSHIP

FECAL COLIFORM / FECAL STREPTOCOCCI GROUNDWATER QUALITY

REVISIONS			
NO	DESCRIPTION	DATE	BY
	Added wells 1 and 2	5-88	HEF

drawn JST II | approved ACP | checked HEF | date 2/29/88 | drawing no. 87195-006-AA

r. e. wright associates, inc.
earth resources consultants
middletown pennsylvania

LEGEND

- SAMPLED WELL LOCATION
- 10 TOTAL COLIFORM COUNT (IN COLONIES / 100 ml) ON JANUARY 21, 1988

*DATA FROM APRIL 20, 1988

1000' 0 1000'

SCALE IN FEET

BASE MAP: FROM HARRISBURG WEST AND HALIFAX, PA 7 1/2 MINUTE USGS TOPOGRAPHIC QUADRANGLES.

FIGURE 4

MIDDLE PAXTON TOWNSHIP

TOTAL COLIFORM GROUNDWATER QUALITY

REVISIONS			
NO.	DESCRIPTION	DATE	BY
	Added wells 1 and 2	5-88	HEF

drawn JST II | approved ACP | checked HEF | date 2/21/88 | drawing no. 87195-007-AA

r. e. wright associates, inc
earth resources consultants
middletown pennsylvania

gross contamination. Rather, the sampling has found two isolated wells (WS-4 and WS-12) with likely contamination from on-site septic system malfunctions, and some areas of low level coliform bacteria (less than 11 colonies/100 ml) to the west of Route 225. Even the two monitoring wells downgradient from the two densest areas of on-lot septic systems have no bacteria present and moderately low levels of nitrate-nitrogen (4.5 to 5.1 mg/l).

These results do not indicate the presence of widespread contamination associated with existing septic systems, especially in the vicinity of the two subdivisions in the eastern portion of the study area. Hence, there is no immediate need to sewer the area.

Instead, REWAI recommends that a monitoring program be instituted to continually assess the water quality impact from existing septic systems. This monitoring program should be directed toward the two subdivisions in the eastern portion of the study area. It should include quarterly monitoring of Wells 1 and 2 for nitrate-nitrogen and total coliform and annual monitoring of up and downgradient stream locations (ST-1 through ST-6) for nitrate-nitrogen and total coliform. In order to determine seasonal fluctuations in nitrate-nitrogen and total coliform, these well and stream points should be sampled at other times during the first year to include the end of a long dry period and the height of the wettest season.

If water quality results begin to indicate a groundwater or surface water quality problem from the septic systems, then public sewerage should be considered.

APPENDIX A

Sampling Procedures

APPENDIX A
SAMPLING PROCEDURES

Three sampling events were conducted for this study. The first event sampled various wells and streams in the study area for total coliform, fecal coliform, fecal streptococcus, and nitrate-nitrogen. These parameters were selected as indicators of discharge from septic systems. The well and stream locations were selected to have water quality coverage over the entire study area and to provide a measurement of up and downgradient surface water and groundwater quality from the areas of densest development. Few wells were available at proper locations for sampling because most of the homes in the area are served by public water.

The second sampling event focused on the stream quality near the two major subdivisions, with locations strategically placed up and downgradient of the subdivisions in order to detect any increase in fecal coliform or fecal streptococcus that could be attributed to septic system failure.

The third sampling event involved sampling two recently constructed groundwater monitoring wells adjacent and downgradient from the two major subdivisions. These wells are relatively shallow (75 feet) and are completed in the groundwater zone most likely impacted by the septic systems. The wells were sampled for nitrate-nitrogen, chloride, total coliform, fecal coliform, and fecal streptococcus.

Well sampling procedures consisted of first purging the plumbing system by running the water from a tap (usually the kitchen faucet) for a minimum of five minutes. This procedure initiated pumping in the well, thus providing a fresh well sample. The monitoring wells were purged by either removing all water from the well bore or by removing five well volumes with a submersible

pump. Samples were then collected after purging from the submersible pump discharge line.

Total coliform, fecal coliform, and fecal streptococcus samples used sterile Nasco Whirlpak collection bags with 10 mg of sodium thiosulphate. Nitratenitrogen and chloride samples used sterile, tinted 100 ml bottles. The resident was also questioned about various aspects of their property, including well construction and design, water use, septic system location, and general water quality. Information on well construction and well logs has been included in Appendix C.

Stream samples were collected by grab sampling using the same bottles and Whirlpak bags as mentioned earlier. The samples were taken on days when streamflow should have been 100% groundwater discharge (i.e. no snow melt or rainfall).

All laboratory analyses were performed by Wright Lab Services, Inc. of Middletown, PA.

APPENDIX B

Water Quality Results

TABLE B-1

RESULTS OF GROUNDWATER SAMPLING OF WELLS

ON JANUARY 21, 1988

Well Sample No.	Total Coliform (Colonies/100 ml)	Fecal Coliform (Colonies/100 ml)	Fecal Streptococci (Colonies/100/ ml)	Nitrate-Nitrogen (mg/l)	Chloride (mg/l)
WS-1	20	0	75	6.0	--
WS-2	1	0	0	4.4	--
WS-3	0	0	0	2.7	--
WS-4	70	3	0	5.7	--
WS-6	0	0	0	4.0	--
WS-7	0	0	5	2.1	--
WS-8	0	0	0	6.1	--
WS	0	0	0	3.4	--
WS-11	0	0	0	3.0	--
WS-12	>80	>80	30	8.4	--
WS-14	3	0	0	4.4	--
WS-15	6	0	0	5.4	--
WS-16	9	0	0	3.7	--
WS-17	0	0	0	4.5	--
WS-18	0	0	0	2.1	--
WS-19	11	1	18	6.1	--
Well 1*	0	0	0	4.5	8
Well 2*	0	0	0	5.1	18

mpled on April 20, 1988
-- t Analyzed

TABLE B-2

RESULTS OF SURFACE WATER SAMPLING OF STREAMS

ON JANUARY 21, 1988

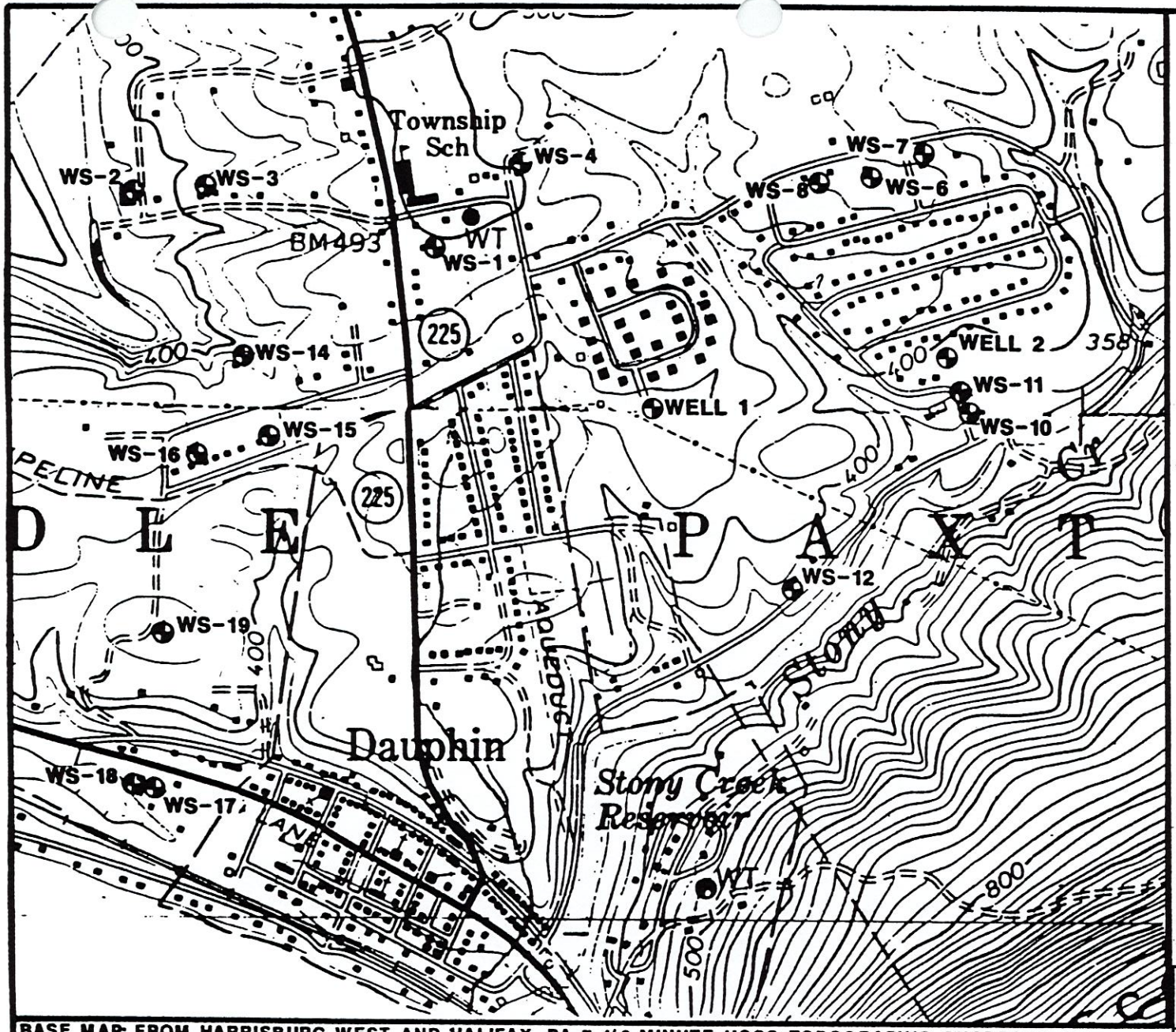
Stream Location No.	Total Coliform (Colonies/100 ml)	Fecal Coliform (Colonies/100 ml)	Fecal Streptococci (Colonies/100 ml)	Nitrate-Nitrogen (mg/l)
ST-3	>80	0	>80	3.9
ST-5	>80	>80	>80	4.4
ST-6	>80	122	>80	2.6
ST-7	>80	28	>80	3.5
ST-8	>80	82	>80	3.8
ST-9 (Stony Creek)	>80	17	>80	0.48

TABLE B-3

RESULTS OF SURFACE WATER SAMPLING OF STREAMS

ON FEBRUARY 3, 1988

Stream Location No.	Fecal Coliform (Colonies/100 ml)	Fecal Streptococci (Colonies/100 ml)
ST-1	8	48
ST-2	0	224
ST-3	44	140
ST-4	28	220
ST-5	40	128
ST-6	8	40
ST-10	38	82



BASE MAP: FROM HARRISBURG WEST AND HALIFAX, PA 7 1/2 MINUTE USGS TOPOGRAPHIC QUADRANGLES.

REVISIONS			
NO	DESCRIPTION	DATE	BY
	Added wells 1 and 2	5-88	HEF

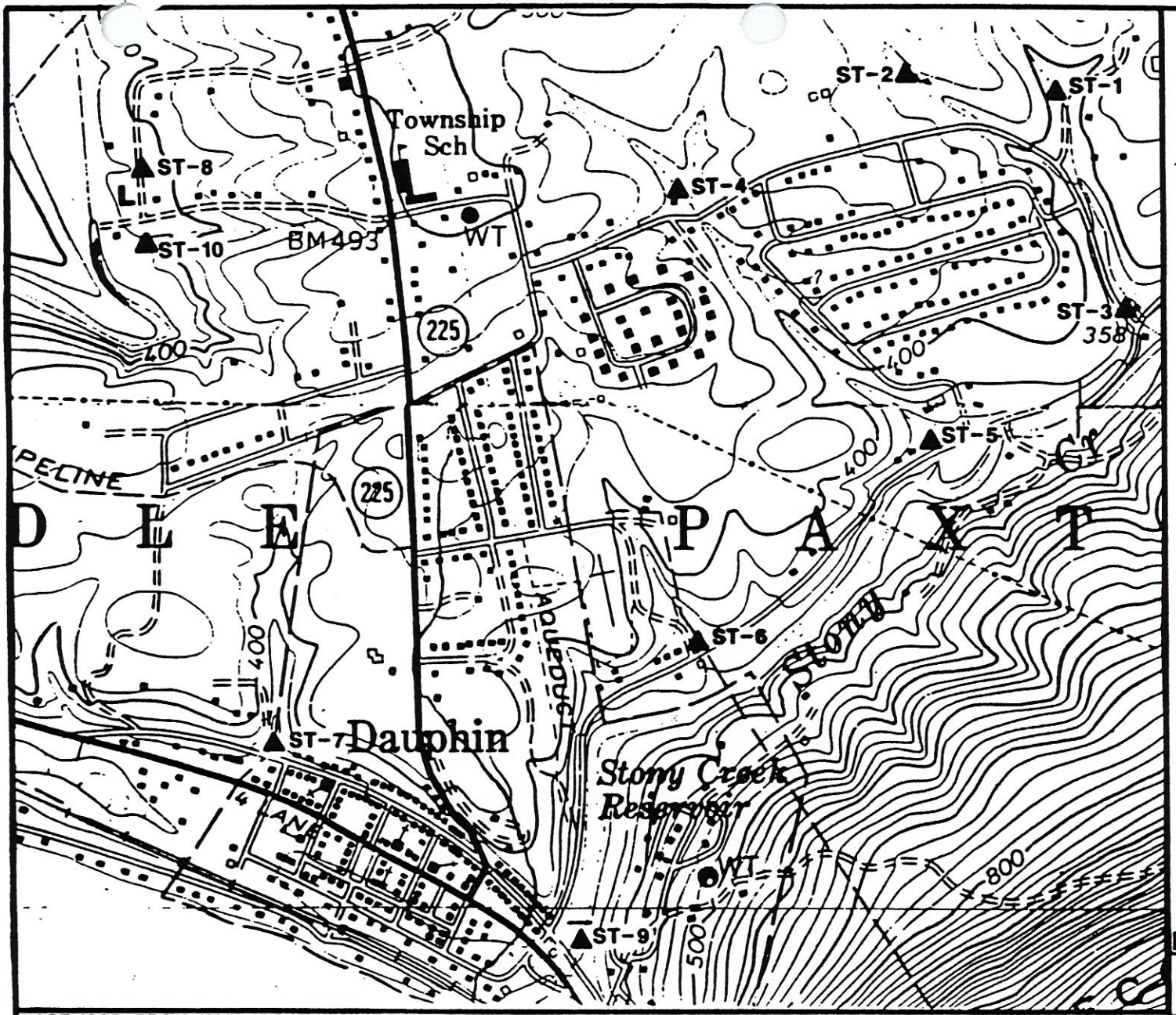
FIGURE B-1

MIDDLE PAXTON TOWNSHIP

GROUNDWATER SAMPLING LOCATIONS

drawn JST II	approved ACP	drawing no. 87195-009-AA
checked HEF	date 2/29/88	

r. e. wright associates, inc.
earth resources consultants
middletown pennsylvania



BASE MAP: FROM HARRISBURG WEST AND HALIFAX, PA 7 1/2 MINUTE USGS TOPOGRAPHIC QUADRANGLES.

FIGURE B-2

MIDDLE PAXTON TOWNSHIP

SURFACE WATER SAMPLING LOCATIONS

drawn JST II	approved ACP	drawing no.
checked HEF	date 2/29/88	87195-008-AA

r. e. wright associates, inc.
earth resources consultants
middletown pennsylvania

APPENDIX C

Well Construction Records And Logs

7195T

SUMMARY OF WELL CONSTRUCTION RECORDS
FOR WELLS SAMPLED IN MIDDLE PAXTON TOWNSHIP, DAUPHIN CO., PA

Well No.	Address	Depth (ft)	Casing Length (ft)	Diameter (inches)	Year Drilled	Yield (gpm)	Water Bearing Zone Depth(ft)	Comments
WS-1	851 Peters Mtn. Road	N.A.	N.A.	6	N.A.	N.A.	N.A.	--
WS-2	10 Creek Road	50	N.A.	6	1945	N.A.	N.A.	--
WS-3	61 McElwee	125	N.A.	6	1974	>5	60	--
WS-4	Box 131, Dauphin	123	11	6	1952	6.5	80	--
WS-6	Box 351, Dauphin	N.A.	N.A.	6	1955	N.A.	N.A.	--
WS-7	825 Short Street	150	N.A.	6	N.A.	N.A.	N.A.	--
WS-8	321 Dennison Drive	120	N.A.	6	1962	N.A.	N.A.	--
WS-10	605 Stony Creek Drive	N.A.	N.A.	6	N.A.	N.A.	N.A.	--
WS-11	609 Stony Creek Drive	N.A.	N.A.	6	N.A.	N.A.	N.A.	--
WS-12	260 Stony Creek Drive	N.A.	N.A.	6	N.A.	N.A.	N.A.	--
WS-14	71 Ferth Road	100	80	6	1973	16	80	--
WS-15	18 South Road	92	70	6	1958	12	N.A.	Pump set at 75'
WS-16	28 South Road	90	N.A.	6	1959	9	N.A.	Static water level 30' below surface
WS-17	Rt. 22 Professional Bldg.	165	N.A.	6	N.A.	8	N.A.	Static water level 9.5' below surfac
WS-18	Rt. 22 Hardee's	400	81	6	N.A.	N.A.	N.A.	Static water level 13.3' below surfa
WS-19	111 Fertig Lane	240	50	6	1976	50	105/160/210	Static water level 45' below surface

N.A. - Not available

GEOLOGIC DRILLING LOG

WELL NO. 1

CLIENT: Middle Paxton Township

SURFACE ELEV. T.O.C. ELEV.

PROJECT NAME: PROJECT NO. 87195

LOCATION End of Delwood PAGE 1 OF 2

LITHOLOGIC DESCRIPTION (Trace-0 to 10%, Little-10 to 20%, Some-20 to 35%, And-35 to 50%)	GRAPHIC LOG	WELL CONSTRUCTION DETAILS
		Locking well cap 2.10' stickup
0 *Ground Surface*		
Sandy silty clay, dark reddish-brown, and silty shale fragments. Moist (GC)		Concrete surface seal to 4'.
		Bentonite/cuttings backfill 4' - 14.75'
10 Silty shale dark reddish-brown, trace subrounded quartz pebbles to 2-1/2 cm.		10" diameter hole 0-18'.
Quartz pebble conglomerate, subrounded pebbles to 2-1/2 cm in dark reddish brown silty shaley sandstone.		Bentonite pellets 14.75 - 17.75'.
20		6" diameter steel casing to 18'.
Siltstone, dark redish-brown, trace fine sand		6" diameter open hole 18-75'.
40		
50		
60		

DRILLER: Tim Shiffer

LOGGED BY: E. Johnson

DRILLING STARTED: 4/7/88

DRILLING COMPLETED: 4/7/88

WELL CONSTRUCTION steel casing /open hole

DRILLING METHOD air rotary

STATIC WATER LEVEL 22.6'

WATER BEARING ZONES None Observed

NOTES:

Yield 0.4 gpm

r. e. wright associates, inc.

GEOLOGIC DRILLING LOG

WELL NO. 1

CLIENT: Middle Paxton Township

SURFACE ELEV.

T.O.C. ELEV.

PROJECT NAME:

PROJECT NO. 87195

LOCATION End of Delwood

PAGE 2 OF 2

Depth	LITHOLOGIC DESCRIPTION (Trace-0 to 10%, Little-10 to 20%, Some-20 to 35%, and-35 to 50%)	GRAPHIC LOG	WELL CONSTRUCTION DETAILS
60	Sandstone, as above.		
	Sandstone, pale brown, medium grain, angular, little silt.		
70			Total depth 75'.

r. e. wright associates, inc.

GEOLOGIC DRILLING LOG

WELL NO. 2

CLIENT: Middle Paxton Township

SURFACE ELEV. T.O.C. ELEV.

PROJECT NAME: PROJECT NO. 87195

LOCATION S. of Freid Dr.

Feet	LITHOLOGIC DESCRIPTION (Trace-0 to 10%, Little-10 to 20%, Some-20 to 35%, And-35 to 50%)	GRAPHIC LOG	WELL CONSTRUCTION DETAILS
			Locking well cap 1.75' stickup
0	*Ground Surface*		
	Sandy silty clay, moderate brown, moist, cohesive (CL)		Concrete surface seal to 2'.
	Sandstone, pale yellow-orange, fine to medium grain, angular, trace silt, weathered		Bentonite/cuttings backfill 2 - 7-1/2'.
	Silty sandy shale, dark red-brown, hard.		10" diameter hole 0-10'.
10			Bentonite pellets 7-1/2'-10'
	Silty sandstone, pale brown, medium grain, angular.		6" diameter steel casing to 10'.
20			
	Quartz pebble conglomerate, rounded pebbles to 2 cm in pale brown siltstone.		6" diameter open hole 10-75'.
	Sandstone, pale brown, medium grain, angular, some silt.		
30			
40			
50			
	Sandstone as above only medium to coarse grain, trace quartz pebbles.		
60			

DRILLER: Tim Shiffer

LOGGED BY: E. Johnson

DRILLING STARTED: 4/13/88

DRILLING COMPLETED: 4/13/88

WELL CONSTRUCTION steel casing /open hole

DRILLING METHOD air rotary

STATIC WATER LEVEL 7.7'

WATER BEARING ZONES Observed at 57' only.

NOTES:

Yield 2 gpm

r. e. wright associates, inc.

GEOLOGIC DRILLING LOG

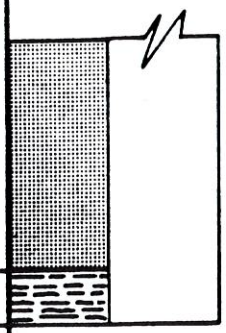
CLIENT: Middle Paxton Township

PROJECT NAME: PROJECT NO. 87195

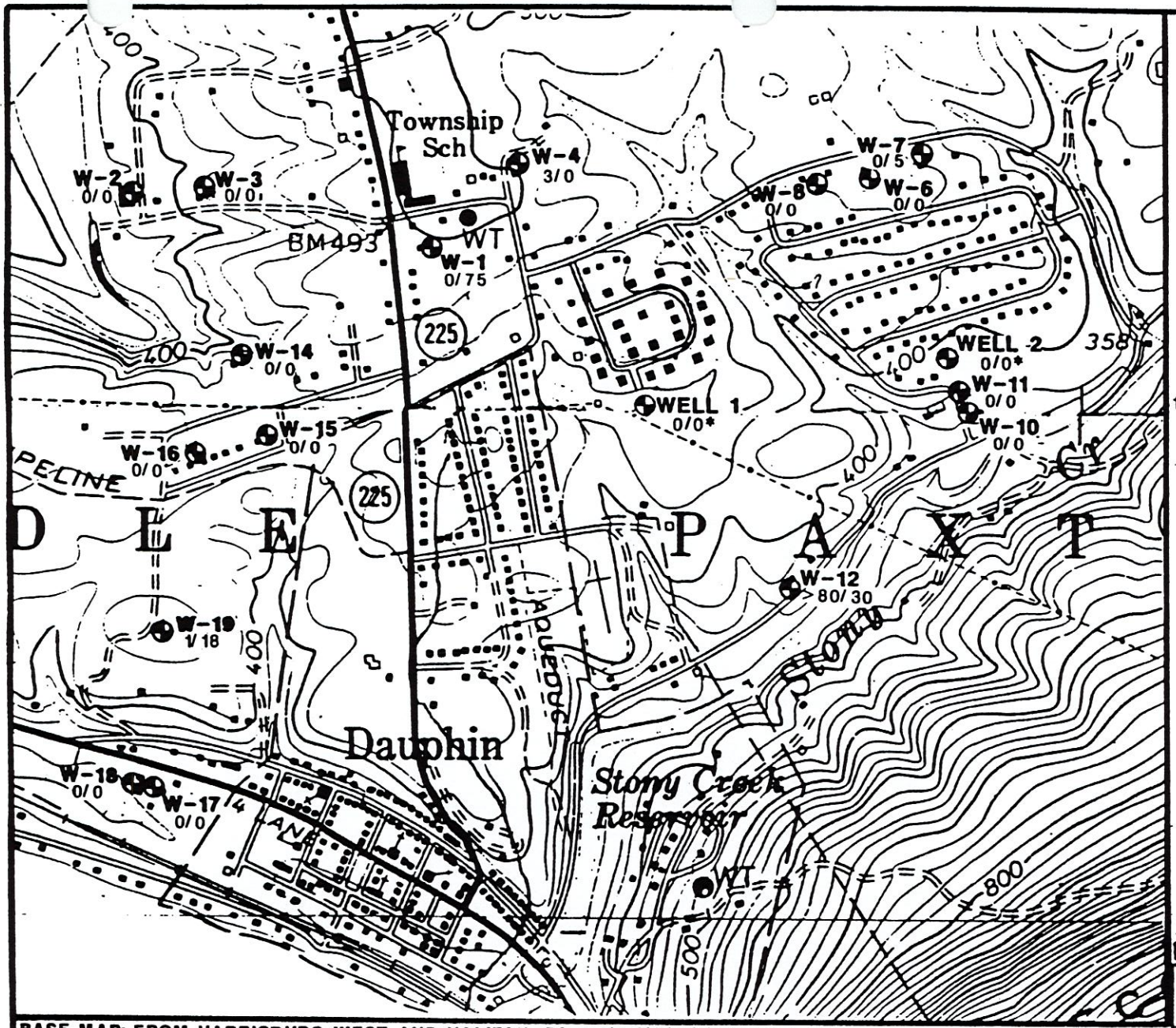
WELL NO. 2

SURFACE ELEV. T.O.C. ELEV.

LOCATION S. of Fried Dr. PAGE 2 OF 2

LITHOLOGIC DESCRIPTION (Trace-0 to 10%, Little-10 to 20%, Some-20 to 35%, and-35 to 50%)	GRAPHIC LOG	WELL CONSTRUCTION DETAILS
60 Sandstone, as above.		
70 Siltstone, moderate brown, trace fine sand.		Total depth 75'.

r. e. wright associates, inc.



LEGEND

- SAMPLED WELL LOCATION
- 100/50 FECAL COLIFORM COUNT/ FECAL STREPTOCOCCI COUNT (IN COLONIES / 100 ml) ON JANUARY 21, 1988

*DATA FROM APRIL 20, 1988

1000' 0 1000'

SCALE IN FEET

BASE MAP: FROM HARRISBURG WEST AND HALIFAX, PA 7 1/2 MINUTE USGS TOPOGRAPHIC QUADRANGLES.

FIGURE 3

MIDDLE PAXTON TOWNSHIP

FECAL COLIFORM / FECAL STREPTOCOCCI GROUNDWATER QUALITY

REVISIONS			
NO	DESCRIPTION	DATE	BY
	Added wells 1 and 2	5-88	HEF

drawn JST II approved ACP
checked HEF date 2/29/88
drawing no. 87195-006-AA

r. e. wright associates, inc.
earth resources consultants
middletown pennsylvania

GEOLOGIC DRILLING LOG

WELL NO. 2

CLIENT: Middle Paxton Township

SURFACE ELEV. T.O.C. ELEV.

PROJECT NAME: PROJECT NO. 87195

LOCATION S. of Freid Dr. PAGE 1 OF 2

Feet	LITHOLOGIC DESCRIPTION (Trace-0 to 10%, Little-10 to 20%, Some-20 to 35%, And-35 to 50%)	GRAPHIC LOG	WELL CONSTRUCTION DETAILS
			Locking well cap 1.75' stickup
0	*Ground Surface*		
	Sandy silty clay, moderate brown, moist, cohesive (CL)		Concrete surface seal to 2'.
	Sandstone, pale yellow-orange, fine to medium grain, angular, trace silt, weathered		Bentonite/cuttings backfill 2 - 7-1/2'.
	Silty sandy shale, dark red-brown, hard.		10" diameter hole 0-10'.
10			Bentonite pellets 7-1/2'-10'
	Silty sandstone, pale brown, medium grain, angular.		6" diameter steel casing to 10'.
20			
	Quartz pebble conglomerate, rounded pebbles to 2 cm in pale brown siltstone.		6" diameter open hole 10-75'.
	Sandstone, pale brown, medium grain, angular, some silt.		
30			
40			
50			
	Sandstone as above only medium to coarse grain, trace quartz pebbles.		
60			

DRILLER: Tim Shiffer

LOGGED BY: E. Johnson

DRILLING STARTED: 4/13/88

DRILLING COMPLETED: 4/13/88

WELL CONSTRUCTION steel casing /open hole

DRILLING METHOD air rotary

STATIC WATER LEVEL 7.7'

WATER BEARING ZONES Observed at 57' only.

NOTES:

Yield 2 gpm

r. e. wright associates, inc.

GEOLOGIC DRILLING LOG

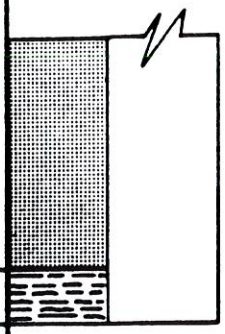
WELL NO. 2

CLIENT: Middle Paxton Township

SURFACE ELEV. T.O.C. ELEV.

PROJECT NAME: PROJECT NO. 87195

LOCATION S. of Fried Dr. PAGE 2 OF 2

DEPTH	LITHOLOGIC DESCRIPTION (Trace-0 to 10%, Little-10 to 20%, Some-20 to 35%, and-35 to 50%)	GRAPHIC LOG	WELL CONSTRUCTION DETAILS
60	Sandstone, as above.		
70	Siltstone, moderate brown, trace fine sand.		Total depth 75'.

r. e. wright associates, inc.