2.1 DESCRIPTION OF THE PLANNING AREA

Halifax Township (Township) is located in the northwest corner of Dauphin County, and has a total area of approximately twenty seven (27) square miles. The Township is bordered to the west by the Susquehanna River, Perry County and Reed Township, to the south by Middle Paxton Township, to the east by Wayne and Jackson Township, and to the north by Upper Paxton Township. The Borough of Halifax is located within the limits of Halifax Township along the western portion of the Township at the intersection of Peters Mountain Road and Armstrong Valley Road. The municipal boundaries of the Township are shown in Appendix C, and are the limits of the planning area for this Act 537 Sewage Facilities Plan.

The Town of Halifax was formed on July 18, 1794, in what was called Upper Paxton Township, organized on August 17, 1729. The Township was first called Peshtank Township (and originally comprised a portion of what is now Lebanon County), later Paxtang, then Paxton. The Township was bordered on the north by Blue or First Mountain.

Most of the roads we have today were originally Indian paths. A very popular one known as Paxtang Path went through Halifax and Halifax Township. These paths usually followed rivers such as the Susquehanna with the Paxtang Path running from Shamokin (modern Sunbury), the key Indian town located at the forks of the Susquehanna (north branch borders along Northumberland). The path came inland and passed over Peter's Mountain (named for Mr. Peter Allen who lived in a stone house at the foot of the mountain, south side) which provided a short cut for traveling to Harris Ferry (Harrisburg). Paths became roads and their financing was the responsibility of the Township; later the state and federal Governments shared the cost.

In 1803, the Dauphin County Court called upon commissioners to review the layout of parts of Middle and Upper Paxton Townships. They reported that the boundaries of the new township (Halifax) would be as follows: "Beginning on the west side of the Susquehanna River, opposite the end of Peter's Mountain (Kohtohtoning Hill, 600 ft. high); thence along the top of Peter's Mountain to the Berks and Dauphin County line; thence along said line to Wiconisco Mountain (also called Berry's Mountain); thence along the top of said mountain to the Susquehanna River, and across said river and thence to the place of the beginning." In 1804, the court confirmed this report and declared the new township to be called Halifax.

2.2 PHYSICAL CHARACTERISTICS

As shown in the Site Map of Sewage Planning Areas within Appendix C, the Township is located between Peters Mountain (south) and Berry Mountain (north) with the Susquehanna River providing the western boundary. The Township ranges in elevation from 1,338 feet on Peters Mountain to 400 along the shores of the Susquehanna River. The highpoint of Berry Mountain is 1267 feet within Halifax Township. The Township is largely rural, with the majority of land being cultivated and/or wooded. However, several pockets of concentrated housing exist throughout the Township as shown on Figure 1 (Appendix C). The individual study areas of this plan were selected based on the location of these areas. Routes 147 and 225 are the two major roads which provide access into the Township from the Harrisburg area.

2.2.1 Streams and Watersheds

The major waterway is the Susquehanna River along the western border of the Township (map shown in Appendix C), which is classified as warm water fishery (WWF) and drains south to the Chesapeake Bay. There are three (3) main drainage basins within the Township that drain from east to west between Berry and Peters Mountain to the Susquehanna River. They are Powell Creek, Armstrong Creek, and Gurdy Run. Powell Creek is located in the southern portion of the Township and is classified as a Trout Stocked Fishery (TSF). Armstrong Creek is located in the central portion of the Township and is classified as a Trout Stocked Fishery (TSF). Gurdy Run is located in the northern portion of the Township and is classified as a Warm Water Fishery (WWF). There are no known special protection streams in the Township.

2.2.3 Floodplains

Within the Township, most of the existing development is outside the limits of the floodplain. Most of the land in the floodplain along the Susquehanna River, Powell Creek, Armstrong Creek, and Gurdy Run is undeveloped. The Township is currently in compliance with the Federal Flood Insurance Program, and the State Flood Plain Management Act. The 100-year Flood Elevation hazard areas in the Township are based on the November 23 1982 Flood Insurance Rate Map (FIRM) from the Federal Emergency Management Agency, and are shown on the Hydrology Map contained in Appendix C.

2.3 SOILS

The Township is located within three (3) general soil associations, the Dekalb-Lehew, Calvin-Leck Kill-Klinesville, and BerksBedington-Weikert Associations. For general planning purposes, the characteristics of these soils associations, as defined by the Dauphin County Soil Survey are described below:

1. Dekalb-Lehew Association: Moderately deep, well drained, gently sloping to very steep soils that have channery sandy loam to channery loam subsoil; on upper mountain slopes and ridges.

2. Calvin-Leck Kill-Klinesville Association: Deep to shallow, dominantly well drained, gently sloping and sloping that has a shaly silt loam subsoil; in upland areas between mountains.

3. Berks-Bedington-Weikert: Deep to shallow, nearly level to steep soils that have a shaly silt loam to shaly silty clay loam subsoil; on uplands.

2.3.1 Soil Types

Presented in Table 2-1 for On-Lot Sewage Disposal Systems, is a listing from the Dauphin County Soil Survey for each soil series located within the Township, plus a summary of important soil qualities and characteristics. Under the column heading "On-Lot Disposal of Effluent from Septic Tanks", the soils are rated as follows:

1. Slight – Soils with few or no limitations for use as drainage fields

2. Moderate – Soil has one or more properties that limit its use for drainage fields

3. Severe – Soil has one or more properties that seriously limit its use as a drainage field.

The soil limitations presented in Table 2-2 are graphically shown on the On-Lot Septic Suitability Map (Appendix C). Many of the soils identified within the Township have severe limitations for the on-lot disposal of effluent from septic tanks due to a high groundwater table, slow permeability, flooding, steep slopes or shallow depth to bedrock. Soil probe tests and percolation tests would need to be performed to determine soil suitability for any proposed disposal field site within the Township.

2.3.2 Prime Agricultural Soils

The prime agricultural soils are best suited for producing food, feed, forage and oilseed crops. This class of soil is also suitable for cropland, pastureland, rangeland and forestland. In general, prime agricultural soil has the quality, growing season and moisture supply needed to produce and sustain high yields of crops economically, when treated and managed, including water management, according to modern farming methods. The prime agricultural soil and the agricultural security areas within the Township are shown on the Prime Agricultural Soils Map (Appendix C).

2.3.3 Hydric Soils

The U.S. Department of Agriculture (USDA), Soil Conservation Service has developed a hydrologic soil grouping system for indicating the infiltration rate for most soil series found in the United States. A description of the four hydrologic soil groups is as follows:

1. Group A – Soils having high infiltration rates even when thoroughly wetted, consisting of deep, well to excessively drained sands and/or gravels. These soils have a high rate of water transmission through the soil and have a low runoff potential.

2. Group B – Soils having moderate infiltration rates when thoroughly wetted, consisting of moderately deep to deep, moderately well to well drained soils, with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission through the soil and have a moderate runoff potential.

3. Group C – Soils have a slow infiltration when thoroughly wetted, consisting of soils with a layer that impedes the downward movement of water, or soils with moderately fine to fine texture and slow infiltration rate. These soils have a slow rate of water transmission through the soil and have a high runoff potential.

4. Group D – Soils having very slow infiltration rates when thoroughly wetted, consisting of clay soils with a high swelling potential, a high permanent groundwater table, a fragipan or clay layer near the surface, and shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission through the soil and have a very high runoff potential.

It is important to note that the USDA Soil Conservation Service hydrologic soil groups were developed for soils in normal natural conditions. When using these hydrologic soil groups for planning, planners and developers should realize that other natural phenomenon and human related activities will affect the soil infiltration rates and runoff characteristics. As shown in Table 2-1, the predominant hydrologic soil groups are Soil Groups C and D, which require proper investigative procedures at each disposal site to determine the capability of the soil to treat the sewage from an on-lot disposal system.

Table 2-1 Soil Limitations for On-Lot Sewage Disposal Systems

Soil Series	Map Symbol	Hydrologic Group	Soil Limitation	Limiting Factor(s)
Albrights	AbA	C	Severe	Moderately slow permeability, seasonal high water table
	AbB2	C	Severe	Moderately slow permeability, seasonal high water table
Andover	AoB	D	Severe	High water table, slow permeability
Atkins	At	D	Severe	Flooding, high water table
Barbour	Bb	B	Severe	Flooding
Basher	Bc	B	Severe	Flooding, seasonal high water table
Berks	BhB2,	C	Severe	2 to 3.5 feet to bedrock
	BhC2,	C	Severe	2 to 3.5 feet to bedrock
	Bkd2	C	Severe	Slope condition
Brinkerton/Armaugh	BtA,	D	Severe	High water table
	BtB2	D	Severe	High water table
Buchanon	BuB,	C	Severe	Seasonal high water table, slow permeability
	BvB	C	Severe	Seasonal high water table, slow permeability
Calvin	CaD	C	Severe	2 to 3.5 feet to bedrock
Calvin-Leck Kill	CaF,	C/D	Severe	Slope condition
	ClA,	C/D	Severe	2 to 3.5 feet to bedrock
	ClB2,	C/D	Severe	2 to 3.5 feet to bedrock
	ClC2	C/D	Severe	2 to 3.5 feet to bedrock
Calvin Klinesville	CkC2,	C/D	Severe	1 to 1.5 feet to bedrock
	CkD2	C/D	Severe	1 to 1.5 feet to bedrock
Captina	CmB2	C	Severe	Seasonal high water table, slow permeability

Soil Series	Map Symbol	Hydrologic Group	Soil Limitation	Limiting Factor(s)
Chavies	CnA,	B	Slight	Ground water contamination hazard
	CnB2,	B	Slight	Ground water contamination hazard
Comly	CoB2	C	Severe	Moderately slow permeability
Dekalb-Lehew	DcB2,	B	Severe	2 to 3.5 feet to bedrock
	DcC2,	B	Severe	2 to 3.5 feet to bedrock
	DlF	B	Severe	Slope condition
Duncannon	DvA,	B	Slight	
	DvB2	B	Slight	
Klinesville	KaB2,	C	Moderate	Flooding, ground water contamination hazard
	KaC2,	C	Severe	1 to 1.5 feet to bedrock
	KaD2,	C	Severe	Slope condition, 1 to 1.5 feet to bedrock
	KaE2	C	Severe	Slope Condition
Laidig	LaB2,	C	Severe	Moderately slow permeability
	LaC2,	C	Severe	Moderately slow permeability, slope condition
	LdB,	C	Severe	Moderately slow permeability
	LdD	C	Severe	Moderately slow permeability, slope condition
Lawerence	LeB2	C	Severe	Moderately slow permeability, seasonal high water table
Lindside	Lt,	C	Severe	Flooding
	Lw	C	Severe	Flooding
Philo	Ph	B	Severe	Flooding, seasonal high water table
Riverwash	Rv	A	Severe	Flooding
Tioga	Ta,	B	Severe	Flooding
	Tg	B	Severe	Flooding
Urban Land	Us	N/A	N/A	N/A
Very Stony Land	VsF	A	Severe	Stoniness, slope condition
Weikert	WeD2,	C	Severe	Slope condition, 1 to 1.5 feet to bedrock
	WeE2	C	Severe	Slope condition

2.3.4 Soil Suitability for On-Lot Sewage Disposal

Criteria and limitations for suitability for OLDS are presented in Chapter 73 of Title 25 of the Pennsylvania Code and summarized in Table 2-2.

Table 2-2 Suitability Criteria for On-Lot Sewage Disposal Systems

System	Hydric Soils	Depth To Bedrock	Depth to Seasonal High Water Table	Slope
Unsuitable for Any System	Yes	< 16 Inches	< 10 Inches	> 25%
Suitable for Elevated Sand Mound	No	20 Inches or Greater	20 Inches or Greater	<12%
Suitable for Conventional In-Ground System	No	60 Inches or Greater	60 Inches or Greater	<25% for Standard Trenches <8% for Seepage Beds

Note: In addition to limitations relating to soils, subsurface conditions, and slopes, absorption areas shall not be located within 100-year floodways.

2.3.5 Soil Rating Criteria for Conventional Subsurface Systems

The following ratings for subsurface systems apply only to deep soils with limiting zones greater than sixty inches (60"). In such areas, the following criteria were used to determine slight limitations, marginal limitations, and generally unsuitable conditions:

1. Soils with limiting zones (groundwater or bedrock) at a depth less than sixty inches (60") are rated unsuitable for subsurface systems.

2. Soils that exhibit slopes between eight percent (8%) and twenty-five percent (25%) are rated marginal for subsurface systems.

3. Soils that exhibit slopes greater than twenty-five percent (25%) are rated unsuitable for subsurface systems.

4. Soils with major hydric components are unsuitable for subsurface systems. Soils with inclusions of hydric components are rated at a grade lower than determined using the above criteria.

2.3.6 Soil Rating Criteria for Elevated Sand Mounds

Soils with a depth of limiting zone between twenty inches (20") and sixty inches (60") typically require elevated sand mounds. In such areas, the following criteria were used to determine marginal or generally unsuitable conditions:

1. Soils with limiting zones (groundwater or bedrock) at a depth less than twenty inches (20") are rated unsuitable for elevated sand mounds.

2. Soils considered marginal for elevated sand mounds exhibit slopes greater than eight percent (8%) and less than fifteen percent (15%).

3. Soils that exhibit slopes greater than fifteen percent (15%) are rated unsuitable for elevated sand mounds.

4. Soils with major hydric components are unsuitable for elevated sand mounds. Soils with inclusions of hydric components are rated at a grade lower than determined using the above criteria.

2.3.7 Soil Rating Criteria for IRSIS

In June of 1996 the DEP created another on-lot disposal alternative for areas deemed unsuitable for subsurface systems or elevated sand mounds. This system, known as Individual Residential Spray Irrigation System (IRSIS), utilizes spray irrigation for ultimate disposal of treated domestic wastewater.

In areas that are unsuitable for standard systems, the following criteria were used to determine marginal limitations and unsuitable conditions:

1. Soils revealing a limiting zone of less than 10 inches (seasonal high water table) or 16 inches (coarse fragments/bedrock) are unsuitable.

2. Soils that exhibit greater than 4% slope on agricultural land are unsuitable.

3. Soils that exhibit greater than 12% slope on grass are unsuitable.

4. Soils that exhibit greater than 25% slope on woodlands are unsuitable.

5. Soils with major hydric components are unsuitable for IRSIS. Soils with inclusions of hydric components are rated at a grade lower than determined using the above criteria.

2.4 GEOLOGIC FEATURES

The surface soil drainage patterns, slope, excavation and erosion characteristics are all dependent on the underlying geology. Thus understanding the underlying geology, and integrating its factors with other components of the environment, is important in providing for proper and safe disposal and treatment of sewage for the protection of the groundwater as a drinking water source. It is not the purpose of this section to provide a detailed study of rock types, but to provide a general inventory of engineering characteristics of the Township's rock formations and geology. The Township is underlain by the following seven (7) geologic rock formations:

1. Spechty Kopf Formation

2. Duncannon Member of the Catskill Formation

3. Clark's Ferry Member of the Catskill Formation

4. Shermans Creek Member of the Catskill Formation

5. Irish Valley Member of the Catskill Formation

6. Trimmers Rock Formation

7. Hamilton Group

The geologic descriptions and characteristics of these formations for sewage planning and general development decisions are presented in Geologic Descriptions (below) and the location and extent of these formations within the Township are shown on the Geologic Map presented in Appendix C. The areas containing nitrate-nitrogen levels that are in excess of 5 mg/L are represented on the Map contained in Appendix D.

2.4.1 Geologic Descriptions

The Environmental Geology Report #1, developed by the Pennsylvania Department of Environmental Resources Office of Resource Management, Bureau of Topographic and Geologic Survey, describes characteristics for all geologic formations in the State. Figure 6 graphically delineates the various geologic formations of the Township.

1. **Spechty Kopf Formation (Mdsk)**
   The Spechty Kopf Formation is a narrow band of rock located along the top of Peters Mountain and on the western top of Berry Mountain.

   Description: The Spechty Kopf Formation is a light to olive-gray, fine to medium sandstone containing interbeds of olive-gray to dark-gray shale and siltstone; locally has grayish-red shale near top and conglomerate at base and in the middle; contains minor thin coal and coalified plant fragments; the formation has a depth of up to 575 feet.

   Bedding: This formation is well bedded. It contains planar bedding and some crossbedding. These beds are usually 2 inches to 5 feet thick.

   Fracturing: Highly developed joints; irregular spacing, generally 2 inches to 3 feet thick, open 10 to 50 millimeters.

   Weathering: The formation is highly resistant to weathering; slightly weathered to a shallow to moderate depth; fragments are blocky to tabular, 1 inch to 10 feet in diameter; overlying mantle is thin to moderately thick in boulder colluvium on some slopes.

   Topography: This formation forms mountains of high relief; topographic expression is approximately 800 to 900 feet; natural slopes are moderate to steep and stable.

   Drainage: Good surface drainage.

   Porosity and Permeability: The formation's joint, fault, and bedding-plane openings provide a moderate to low secondary porosity and moderate permeability.

   Groundwater: Generally unproductive on ridge crests but favorable for development below ridge crests; median yield is 25 gal/min. from wells between 40 and 350 feet deep; generally good quality; occasional high iron content; salt water may be found in deeper wells.

Ease of Excavation: Excavation in the formation is difficult to moderately difficult in shale. Drilling rates in this area are slow to moderate.

Cut_Slope Stability: Generally good; poor where cut slope parallels strike and dip of bedding; rockfall occurs in steep cuts, notably where sandstone overhangs easily eroded shale beds.

Foundation Stability: Excellent after removal of unconsolidated mantle.

Construction Material: Quarried for crushed stone and aggregate for road construction; good source of riprap, rock protection, and rock fill.

2. Duncannon Member of Catskill Formation (Dcd)

This geologic formation is a narrow band that runs along the southern face of Berry Mountain and the northern face of Peters Mountain.

Description: The formation is interbedded red and gray sandstone, red siltstone, and red mudstone. The sandstone is generally fine and very fine grained, silty, poorly sorted, micaceous, and locally congolmeratic. The formation's thickness is from 560 to 3,000 feet.

Bedding: Well bedded; medium to massive; crossbedded; mudstone is thick to massive bed.

Fracturing: Joints are well developed in blocky and tabular pattern; generally closely spaced (2 inches to 2 feet), except widely spaced in mudstone; open, narrow and steeply inclined to bedding.

Weathering: Slightly weathered to shallow depth; weathered surface is hackly, except on mudstone, where it is smooth; fragments are blocky, 2 inches to 4 feet in diameter. The overlaying mantle is moderately thick, often made up of boulder colluvium from the Pottsville Formation above.

Topography: The formation forms hills and ridges of moderate to high relief and lower slopes of mountains capped by the Pocono Formation; moderate to very steep natural slopes on which overlying mantle can be subject to land slides.

Drainage: Good surface drainage.

Porosity and Permeability: The joint and bedding plane openings provide a secondary porosity; low in massive mudstone; moderate permeability except in mudstone, which has low permeability.

Groundwater: Moderate to good aquifer potential; best yields are expected from sandstone; reported yields are 7 to 40 gal/min. in wells averaging 150 feet deep; quality is generally good except for occasional high sulfur content.

Ease of Excavation: Moderately difficult; moderate drilling rate, except in conglomerate zones, which have slower drilling rate.

Cut_Slope Stability: Fair to good; mantle and weathered bedrock are subject to landslides; unweathered rock stands well in near vertical cuts; some rockfall.

Foundation Stability: Excellent after excavation of overlying mantle..

Construction Material: Good for rock fill and riprap.

3. Clark's Ferry Member, Catskill Formation (Dccf)

This geologic formation is a narrow band that runs along portions of the southern face of Berry Mountain and the northern face of Peters Mountain.

Description: The Clark's Ferry Member of the Catskill Formation is grayish-purple and lightly gray to olive-gray, medium-to-course-grained, micaceous, conglomeratic sandstone and conglomeratic with thin interbeds of dark-gray shaly claystone. Its thickness is from 140 to 225 feet.

Bedding: This formation is characterized as being well bedded and cross bedded. The bedding ranges from 6 inches to 4 feet deep.

Fracturing: Joints of this formation have a blocky pattern. They are highly developed, having irregular spacing, less than 2 inches to 3 feet. Joints are open in surface exposure and steeply dipping.

Weathering: The Clark's Ferry Member is moderately weathered to a shallow depth, except in shaly claystone, which is more deeply weathered. Weathered surface is rough, yielding blocky and tabular fragments; chippy fragments weather from shaly claystone. The overlying mantle is thin to moderately thick.

Topography: This formation underlies a distinct ridge of moderate relief or forms a bench along the flanks of higher ridges. The formation show no expression along some hillsides.

Drainage: In general, the Clark's Ferry Member is characterized as having good surface drainage.

Porosity and Permeability: The formation is characterized by a moderate secondary porosity in joint- and bedding-plane openings, except in shaly claystone, which has low secondary porosity. The permeability of this formation is moderate.

Groundwater: Low to moderate aquifer potential; low yields are expected where formation has topographic expression as ridges and hillside benches. Moderate yields are expected where the formation has no topographic expression along ridge flanks. Ground water yields may reach 20 gal/min. in wells approximately 200 feet deep. The iron content may be high.

Ease of Excavation: The ease of excavating this rock formation is generally characterized as moderately difficult. Excavating is easier in shaly claystone interbeds. The formation has a moderate drilling rate which is faster in shaly claystone.

Cut_Slope Stability: This characteristic is rated good in the Clark's Ferry Member. There may be some blocky rock fall and accumulation of shaly rubble at toe of slopes. Weathered shale in this formation leaves some overhanging sandstone beds above, which contribute to rockfall.

Foundation Stability: Excellent support after removal of loose overhanging mantle, while areas of steep slope require special design.

Construction Material: Good source of random rock and rock fill and rock protection; sandstone has been used for decorative building stone.

4. Sherman's Creek Member of the Catskill Formation (Dcsc)

This formation is the largest geologic formation in the Township. One large band of rocks is situated near the base of Berry Mountain. The other large areas comprise most of the Armstrong and Powell Creek watersheds.

Description: This formation generally consists of interbedded grayish-red silty mudstone, sandy silt stone, and reddish-gray to light-olive-gray, very fine to medium grained silty, micaceous sandstone. The formation is crossbedded with a thickness of about 1,200 feet.

Bedding: The mudstone of this formation is thick bedded to massive, siltstone is medium to thick bedded and sandstone is thin to very thick bedded. The formation is extensively cross bedded. This formation is characterized as being well bedded and crossbedded in most places.

Fracturing: Joints of this formation are well developed, unevenly spaced, highly abundant, steeply dipping and open.

Weathering: The Sherman's Creek Member is moderately resistant to weathering. It is moderately weathered to a moderate depth. Fragmentation of this formation is tabular with fragments having rough hackly surfaces. The overlying mantle is thick in most places.

Topography: This formation underlies a rolling topography characterized by moderate to moderately steep slopes. Natural slopes within this area are stable.

Drainage: In general, the Sherman's Creek Member is characterized as having good surface drainage.

Porosity and Permeability: The formation is characterized by a moderate secondary porosity in joint- and bedding-plane openings. The permeability of this formation is moderate.

Groundwater: Well yields are generally good to excellent. Water quality is generally good, but water may be high in iron.

Ease of Excavation: The ease of excavating this rock formation is generally characterized as difficult. Excavating highly fractured rock is moderately easy. The drilling rate within the formation is fast.

Cut_Slope Stability: This characteristic is rated poor to good. Where rocks are highly weathered and fractured, cut-slope stability is only poor.

Foundation Stability: Foundation stability is generally good. Foundations should be excavated to sound bedrock.

Construction Material: Good source of road material and random fill.

5. Irish Valley Member of the Catskill Formation (Dciv)

This formation is the second largest geologic area in the Township. In two sections, this formation is located parallel to Berry Mountain and folds back toward the Borough of Halifax. A second band of rock is located at the southwestern corner of the Township under Powell Creek and south of Million Dollar Road.

Description: This formation generally consists of alternating beds of olive-gray sandstone, siltstone and shale with red siltstone, mudstone and shale. The olive-gray sandstone of this

formation commonly contains fossils. The formation has an approximate maximum thickness of 250 feet.

Bedding: The siltstone of this formation is thin to very thin bedded, while shale is very thin to medium bedded and the mudstone and sandstones are medium to very thick bedded. The formation is extensively cross bedded. This formation is characterized as being well bedded and crossbedded in most places.

Fracturing: Joints of this formation are well developed, unevenly spaced, highly abundant, steeply dipping, and open.

Weathering: The Irish Valley Member is slightly to moderately resistant to weathering. It is deeply weathered. Fragments of this formation are blocky to pencil shaped, rough surfaced. The overlying mantle is moderate to thick in most places.

Topography: This formation forms hills and ridges of moderate relief. Slopes are generally fairly steep to steep. Natural slopes within this area are generally stable.

Drainage: In general this member has good surface drainage.

Porosity and Permeability: The formation is characterized by a low secondary porosity in joint- and bedding-plane openings. The permeability of this formation is also low.

Groundwater: Well yields are reported to range from 2 to 380 gal/min, with a median of 35 gal/min. Water quality problems include salty water and hydrogen sulfide.

Ease of Excavation: The ease of excavating this rock formation is generally characterized as moderately easy. Excavating deeply weathered shale and siltstone is generally easy. Sandstone and mudstone are generally broken by fractures.

Cut_Slope Stability: This characteristic is rated poor to fair due to the rapid disintegration of shale and siltstone and fractured sandstone and mudstone.

Foundation Stability: Foundation stability is generally good. Foundations should be excavated to sound bedrock.

Construction Material: Good source of road material and random fill.

6. Trimmers Rock Formation (Dtr)

This formation is located with the "V" shaped fold of the Irish Valley Member north of the Borough of Halifax.

Description: This Formation generally consists of light-gray to olive, fine-grained sandstone and siltstone with olive to gray shale interbeds. The formation has an approximate maximum thickness of 3,000 feet.

Bedding: The bedding of this formation is well developed and massive to flaggy.

Fracturing: Joints of this formation are well developed. They are moderately to closely spaced and steeply dipping. The also have a blocky and platy pattern and are regularly spaced.

Weathering: The Trimmers Rock Formation is slightly to moderately resistant to weathering. It is moderately weathered at a moderate depth. Medium to small blocks result from the disintegration of sandstone beds. Small, flat, plate-like fragments accumulate at the base of

shale units. The overlying mantle is moderate to thick in most places and is composed of glacial till in northeastern Pennsylvania.

Topography: This formation forms rolling ridges of medium relief. Slopes are generally fairly steep to steep. Natural slopes within this area are generally steep and stable.

Drainage: In general this member has good surface drainage.

Porosity and Permeability: The formation is characterized by a moderate secondary porosity in joint- and bedding-plane openings. The permeability of this formation is also moderate to low.

Groundwater: Median well yields are reported as 30 gal/min. Water may be high in total dissolved solids and may contain hydrogen sulfide. Water from. This area is generally characterized as soft.

Ease of Excavation: The ease of excavating this rock formation is generally characterized as moderately difficult. A moderate drilling rate can be expected in this formation.

Cut_Slope Stability: This characteristic is rated fair in siltstone and shale, and good in sandstone.

Foundation Stability: Foundation stability is generally good. Foundations should be excavated to sound material.

Construction Material: Good source of road material and random fill.

7. Hamilton Group (Dh)

The Hamilton Group is a small formation located within the Trimmers Rock formation and is situated almost entirely in the Susquehanna River. A small portion of this formation stretches across Route 147.

Description: This formation generally consists of olive-gray to medium-olive gray, fossiliferous siltstone and shale inter-bedded with fine-grained, medium-dark-gray sandstone. The formation has an approximate maximum thickness of 2,200 feet.

Bedding: The bedding of this formation is well developed. Shale in this formation is thin to fissile, while sandstone is thin flaggy and medium bedded.

Fracturing: Joints of this formation are well developed, closely spaced, mostly open, and steeply dipping. Joints produce smooth, even-faced, sharp-edged rectangular blocks in sandstone.

Weathering: This formation is moderately to poorly resistant to weathering. Fissile shale weathers to light gray and disintegrates relatively easy into this plates. Sandstone withers to light olive-gray and yellowish brown and is moderately to highly resistant. The overlying mantle is thin.

Topography: Sandstone of this formation form conspicuous ridges, while shale underlies hills of medium height having stable slopes.

Drainage: In general this formation has good surface drainage.

Porosity and Permeability: The formation is characterized by a low to moderate secondary porosity in joint- and bedding-plane openings. The permeability of this formation is also moderate.

Groundwater: Median well yields are reported as 30 gal/min. Water may be high in iron and sulfur. Hydrogen sulfide gas is also common.

Ease of Excavation: The ease of excavating this rock formation is generally characterized as moderately easy to difficult. A fast to moderate drilling rate can be expected in this formation.

Cut_Slope Stability: This characteristic is rated fair in shale, and good in sandstone.

Foundation Stability: Foundation stability is generally good. Foundations should be excavated to fresh bedrock. There may be a need for underdrainage.

Construction Material: Good source of road material, rip rap, building stone, and fill. Shale may be good source of light weight aggregrate.

2.5 TOPOGRAPHY

The existing topography within the Township is shown on the Slopes Map (Appendix C). The areas with 25% and greater slope are mainly located along Berry and Peters Mountain with several other small isolated pockets occurring throughout the Township, and are unsuitable for currently available on-site disposal system. The areas with 15% to less than 25% slopes are also located along Berry and Peters Mountain with several other small isolated pockets occurring throughout the Township. These areas are restricted to on-lot spray irrigation systems on wooded lots, and steep slope in-ground systems, due to the slope and limited useable soil depth.

The areas with 8% to less than 15% slopes are also located along Berry and Peters Mountain and other isolated areas within the Township. These areas are restricted to elevated systems, steep slope in-ground systems, and spray irrigation systems, due to the slope and limited useable soil depth.

The remaining areas with slopes of less than 8% are able to employ the use of all conventional systems, depending on testing results. Please note that on-site soil investigation must be performed by the Township SEO to determine the type and location of the appropriate system for each lot.

2.6 POTABLE WATER SUPPLIES

Public Water from the Halifax Area Water Authority extends south from Halifax Borough to Matamoras along S.R. 225 as shown on the Public Water Service Area mapping provided in Appendix C. This water main services Township residents/businesses in the areas of Matamoras, Clover Hills, Hickory Hills, Triangle Manor, Lenker Estates, and other properties along S.R. 225. Private on-lot wells and springs supply the remaining properties with potable water in the Township. The topography and physical features of the land determine the drainage patterns and the characteristics of surface water flow. The ground water flow is influenced in part by the topography, but is most heavily influenced by the soils and underlying geological formations. The geologic characteristics of the underlying geological formations, such as bedrock type, intergranular spacing, rock strata inclination, faults and joints, folds and bedding planes, and solution channels, affect groundwater movement, storage and availability.

The groundwater quality is a result of its initial quality as it percolates into the ground and the interaction between the groundwater and the bedrock it contacts. If the bedrock types are more soluble, more compounds may become dissolved in the groundwater. An example of this bedrock influence is groundwater in highly soluble limestone aquifers, which will have increased hardness due to the dissolved minerals from the limestone. As the groundwater percolates out of the ground into surface streams, the surface water quality is then also influenced by the underlying geological formations.

The Township is underlain by seven geologic rock formations. The water bearing quantity and water quality of these geologic formations within the Township was obtained from the Environmental Geology Report 1, prepared by the Pennsylvania Department of Environmental Resources (now the DEP), Bureau of Topographic and Geologic Survey, Office of Resource Management, as follows: Spechty Kopf Formation – Generally unproductive on ridge crests but favorable for development below ridge crests; median yield is 25 gal/min. from wells between 40 and 350 feet deep; generally good quality; occasional high iron content; salt water may be found in deeper wells.

Duncannon Member of the Catskill Formation - Moderate to good aquifer potential; best yields are expected from sandstone; reported yields are 7 to 40 gal/min. in wells averaging 150 feet deep; quality is generally good except for occasional high sulfur content. Clark's Ferry Member of the Catskill Formation - Low to moderate aquifer potential; low yields are expected where formation has topographic expression as ridges and hillside benches. Moderate yields are expected where the formation has no topographic expression along ridge flanks. Ground water yields may reach 20 gal/min. in wells approximately 200 feet deep. The iron content may be high. Shermans Creek Member of the Catskill Formation - Well yields are generally good to excellent. Water quality is generally good, but water may be high in iron. Irish Valley Member of the Catskill Formation - Well yields are reported to range from 2 to 380 gal/min, with a median of 35 gal/min. Water quality problems include salty water and hydrogen sulfide.

Trimmers Rock Formation - Median well yields are reported as 30 gal/min. Water may be high in total dissolved solids and may contain hydrogen sulfide. Water from. This area is generally characterized as soft.

Hamilton Group - Median well yields are reported as 30 gal/min. Water may be high in iron and sulfur. Hydrogen sulfide gas is also common.

2.7 WETLANDS

In addition to surface water and groundwater resources, another important hydrologic component in the Township is wetlands. The wetlands are important since they provide habitats for some threatened and endangered species, and provide food for game fish, animals and nesting birds. In addition, the wetlands reduce flooding by absorbing excess water, slowing the water flow to neighboring creeks and streams, and to provide a buffer to protect creeks and streams from excessive soil erosion and sedimentation. The wetlands are characterized as having minimal depth to groundwater, hydric soils and certain types of vegetation. The three types of wetlands are as follows:

1. Emergent – These wetlands are characterized by non-woody vegetation of less than 20 feet tall.

2. Scrub-Shrub – These wetlands are characterized by smaller ground plants.

3. Forested – These wetlands are characterized as dominated by trees, 20 feet or more in height.

The known wetlands within the Township, based on the National Wetlands Inventory Map, are shown on the Hydrology Map provided in Appendix C.

The hydric soils are associated with the Albright, Andover, Atkins, Barbour, Brinkerton, Buchanon, Comly, Klinesville, Lindside, Philo, Riverwash, and Weikert Soil Series, and are shown in Figure 9 – Hydric Soils Map. As previously noted, these soils are severely limited and may not be suitable for currently available on-lot disposal systems.