A. INTRODUCTION

This chapter describes the geological, soil, and topographic conditions of the proposed Four Seasons at Hamptonburgh site and any significant adverse impacts to these resources. Information for this chapter was derived from sources including the USDA-NRCS Orange County Soil Survey, site reports prepared by Schoor DePalma Engineering, Inc., and Orange County geological maps.

B. EXISTING CONDITIONS

TOPOGRAPHY AND SLOPES

The project site is located in central Orange County adjacent to the Wallkill River within the Hudson Mohawk Lowland. This area consists of gently rolling land with several areas of almost flat glacial lake deposits. Elevation onsite varies between 346 feet at the Wallkill River to 495 feet above sea level in the center of the parcel, along Lazy Lane. Figure 3.5-1 shows onsite topography.

The subject property is predominantly gently sloping with approximately 76.5% of the parcel having slopes of 0% to 10%. The remaining portion of the site is 13.9% with slopes 10% to 15% and 9.5% with slopes over 15%. The steeper slope areas on site are generally limited to each side of the ridgeline running north-south bisecting the parcel, along Lazy Lane. Figure 3.5-2 shows onsite slopes.

GEOLOGY

The Hudson Mohawk Lowland is underlain by the Trenton group of shales dating from the Ordivician period 570 million to 500 million years ago. The two mapped bedrock types underlying the project site are:

On – Matinsburg Formation is a dark gray shale bedrock unit that underlies a large portion of central Orange County.

OeW – Wappinger Group is a dark gray to gray-black sequence of limestone and dolomite units. Judging by the mapped location of this formation, it was mined in the open pit quarry located immediately south of the project site.

Orange County was moderately affected by glaciations from the last Ice Age, beginning some 300,000 years ago and ending 12,000 years ago. These glacial advances and retreats smoothed the land and deepened valleys along the axis of its retreat. The retreat of the last glacier left a deposit of glacial till over much of Orange County, serving as the parent material for most soils found in the county. Glacial till now accounts for 86% of Orange County soils. Nine percent of the county's soils were formed from sand and gravel deposited by torrential meltwater created by the warming glaciers. Swamps and other wet areas deposited decaying organic matter into approximately three percent of the land resulting in muck soils. Recently formed alluvium soils, from recent or existing streams, account for only two percent of the land area in Orange County.

A mapped fault line separating the two bedrock mapping units is located onsite, as shown on Figures 1 and 2 of the Hydrogeologic Technical Report, Appendix G.

ON-SITE SUBSURFACE INVESTIGATION

Project engineers performed a field geotechnical investigation to obtain subsurface information on the project site. Field work for a test pit investigation was performed in December, 2003 and January, 2004. The test pit investigation involved excavating sixty two test pits along the central portion of the project site - the footprint of the primary development area - to a depth of approximately 12 feet, unless shallower refusal occurred. Soil samples were visually classified based on the Burmister and Unified Soil Classification System (USCS). The full report of the subsurface investigation can be found in Appendix F.

Based on the test pit data, the following are general descriptions of the different subsurface strata:

Stratum A – Glacial Till: This layer can be described as a yellow brown clayey silt with varying amounts of sand, gravel, and boulders. The stratum extends to depths of 1.5 to 4 feet. This stratum may be suitable for bearing loads from structures including, roads, parking areas and utilities.

Stratum B – Residual Soils: This layer was encountered beneath Stratum A, and can be described as brown-gray clayey silt with varying amounts of rock fragments. This stratum extended to depths of 2.5 to 13 feet with thicknesses varying from 0.5 to 10 feet.

Stratum C – Weathered Shale: This layer was encountered beneath Stratum B. This layer can be described as weathered shale having gradation of coarse to fine sand and some silt, with varying amounts of rock fragments. This stratum extended to the maximum depth explored, 13 feet. Weathered shale described in this report consists of residual material where during the excavation of the test pit a high degree of resistance was observed.

Free-flowing groundwater was not encountered during test pit investigations. However, water seepage was encountered at depths from 2 to 10 feet below existing grades in Test Pits TP-3 through TP-10 located west and south of Lazy Lane. (Appendix F includes the test pit location plan.)

Soil mottling was observed in most of the test pits at depths ranging from 2.5 to 3.5 feet below ground surface. Mottling is an indication of seasonal high groundwater levels. The soil material below the mottling line was found to be relatively moist with moisture content ranging from 12 to 18 percent. This may indicate that the water seepage encountered may represent perched water conditions rather than the true water table. Such a perched water table may be a result of a slight difference in permeability between the Glacial Till and the Residual Soils. The permeability of the Glacial Till is slightly higher than the Residual Soils, thereby causing the precipitation and/or snowmelt to be temporarily perched upon the contact between the two strata. These observations are generally supported by information in the Orange County Soil Survey which describes a less permeable fragipan at 16 to 60 inches below the ground surface for many of the onsite soils. Special construction procedures or design considerations may need to be taken when building over soils with tendencies to trap water.

SOILS

The U.S. Department of Agriculture (USDA) identifies major classifications of soils that have similar characteristics, such as texture and drainage, into a series. Within each series, soils can differ in slope and other characteristics that affect their use. On the basis of these differences, soil series are further divided into phases. Different soil phases exhibit variable water storage, erosion potential, and other characteristics significant from a development perspective. According to the Orange County Soil Survey, dated 1981 and prepared by the USDA Soil Conservation Service, the dominant soils on the project site are:

- **Mardin:** Dominantly gently sloping and sloping, deep, moderately well drained and somewhat poorly drained, medium textured soils; on uplands. These soils are predominantly located in the northeast portion of the project site and in the central ridge bisecting the project site.
- **Hoosic, Madalin, Erie and Canandaigua:** Dominantly gently sloping, deep, somewhat excessively drained to very poorly drained, moderately coarse textured and medium textured soils; on lowland plains and in valleys. These soils are generally located on lower slopes or within the wetland and floodplain regions in the southwest, southeast and northeast portions of the project site.

Additional soil types are also found on the project site, as listed in Table 3.5-1 and described in more detail below in the "Soil Unit Descriptions" section that follows. Surficial mapping of soil types on the project site is shown in Figure 3.5-3.

Several terms used in this chapter to describe onsite soil properties are defined below:

- **Permeability** is the ability of a soil to transmit water when saturated. It is considered in the design of soil drainage systems and construction of buildings. Permeability is generally moderate at the surface and slow or very slow in the subsoil of the predominant soil types onsite (Mardin/Erie).
- A soil’s **hydrologic group** is an indicator used to estimate surface runoff from long periods of precipitation. Generally speaking, Group A soils have a high infiltration rate, allowing the soil to absorb more precipitation before surface runoff begins. Whereas Group D soils are the least able to absorb precipitation and therefore produce the greatest amount of runoff in the shortest period of time. Most of the onsite soils have a hydrologic group of "C" indicating that they have a slow infiltration rate when thoroughly wet. Group "D" soils are also common onsite, and are generally confined to wetland areas. Group "A" soils occur west of Route 416.
- **Depth to seasonal high water table** is the depth below the surface at which the water table occurs at its seasonal high point. The water table in some soils may rise to the ground surface of the soil, as in the Alden, Canandaigua, Madalin, and Halsey soils found onsite, in which case ponding occurs. Except for the areas west of NYS 416 closer to the Wallkill River, which are generally well drained, the majority of the site has a seasonal water table of less than 6 feet perched above a less permeable fragipan located 16-60 inches below the ground surface. Seasonal flooding and perched water tables occur in certain portions of the project site during the spring or during extremely wet periods.
- The **erodibility factor** is defined by the erosion factor K. This is one of several variables used in the Universal Soil Loss Equation (USLE) for the calculation of average annual soil loss from sheet and rill erosion. Erosion Factor K indicates the susceptibility of a soil to

erode by water, and is represented by tons of soil per acre per year. Values ranges from 0.05 to 0.69, with higher values representing soil that is more susceptible to erosion by water. A value of zero is considered to be very low, 0.4 medium, and 0.8 very high. The erosion hazard of the soils on the project site is moderate, ranging between 0.17-0.49.

- **Construction limitations** indicate the limitations for construction of shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. As characterized by the USDA NRCS, soil limitations range from "slight" to "severe." The limitations are considered "slight" if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; "moderate" if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitation; and "severe" if soil properties or site features are so unfavorable that special design, significant increases in construction costs, and possibly increased maintenance are required. Construction limitations for onsite soils are generally listed as "moderate" to "severe" due to wetness, indicating that some extra cost may be incurred and special design considerations considered for development.

Table 3.5-1
Summary of On-Site Soil Characteristics

Map Unit(s)	Name	Construction Limitations	Depth to Seasonal High Water Table	USDA Hydrologic Soil Group/Drainage Class
Ab	Alden silt loam, 0 to 3 percent slopes	Severe due to frost action	Water table at or near surface (0-0.5 ft)	D/Very Poorly Drained
AdA	Allard silt loam, 0 to 3 percent slopes	Severe due to frost action K = 0.49	6 feet or more throughout year (> 6 ft)	B/Well drained
BnB, BnC,	Bath/Nassau shaly silt loams, BnB – 3 to 8 percent slopes, BnC – 8 to 15 percent slopes	Severe due to frost action K = 0.2-0.28	Perched above fragipan (2.0-4.0 ft)	C/ Well drained
Ca	Canandaigua silt loam, slopes less than 2 percent	Severe due to wetness and frost action K = 0.17-0.49	Water table at or near surface for prolonged period of time (0-0.5 ft)	D/Poorly-very poorly drained
ErA, ErB	Erie gravelly silt loams, 3 to 8 percent slopes	Severe due to wetness and frost action K = 0.24-0.28	Perched above fragipan (0.5-1.5 ft)	C/Somewhat poorly drained

Table 3.5-1
Summary of On-Site Soil Characteristics

Map Unit(s)	Name	Construction Limitations	Depth to Seasonal High Water Table	USDA Hydrologic Soil Group/Drainage Class
FaC	Farmington silt loams, 8 to 15 percent slopes	Severe due to depth to bedrock and slope K = 0.28-0.32	No seasonal highs due to the fractured bedrock near ground surface (> 6 ft)	C/Somewhat poorly drained
Ha	Halsey silt loam	Severe due to wetness and frost action K = 0.2-0.32	Water table at or near surface for prolonged periods (0-0.5 ft)	D/Very Poorly Drained
HoA, HoB, HoC, HoD	Hoosic gravelly silt loam, HoA – 0 to 3 percent slopes HoB - 3 to 8 percent slopes HoC – 8 to 15 percent slopes HoD –15to25 percent slopes	Slight to severe depending on the slope of the terrain K = 0.17	Greater than 6 feet for all subclasses (> 6 ft)	A/Very well drained
Ma	Madalin silt loam, nearly level slope	Moderate to severe due to slope and wetness K = 0.28-0.49	Water table at or near surface for prolonged periods of time (0-0.5 ft)	D/Poorly to Very Poorly Drained
MdB, MdC, MdD	Mardin gravelly silt loam, MdB – 3 to 8 percent slopes MdC – 8 to 15 percent slopes MdD – 15 to 25 percent slopes	Moderate to severe due to slope and wetness K = 0.24-0.28	Water table at or perched above fragipan (1.5-2.0 ft)	C/Moderately well drained
NaD	Nassau shaly silt loam	Severe due to slope and depth to bedrock K = 0.2	No seasonal highs due to the fractured bedrock near ground surface (> 6 ft)	B/Moderately drained

Notes: K = Erosion Factor K
Source: United States Dept. of Agriculture Soil Survey, Orange County, New York

SOIL MAP UNIT DESCRIPTIONS:

Alden Silt Loam

The Alden Silty Loam (Ab) is a deep, nearly level, and very poorly drained soil. It is found in broad drainage-ways or depressional areas of dissected till plains and in depressional areas of bedrock-controlled uplands. The slope ranges from 0 to 3 percent, and areas are mostly round and 5 to 10 acres in size. The water table is at or near the surface for prolonged periods, therefore many areas are ponded for brief periods in spring. Permeability is moderately slow in the subsoil and available water capacity is high, and runoff is very slow. Natural organic matter content is high, and the surface layer is slightly acid or neutral. Most areas support only grasses, shrubs, and trees that tolerate wetness, and are not suited to most crops unless drained. The United States Department of Agriculture (USDA) Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on these soil types as “severe” due to wetness and frost action. The Alden loams are located in the low depression running parallel and east of Route 416. This area contains some forested wetland and hedgerow/drainageway habitat. Alden soils are also located in meadow habitat at the southern property boundary and adjacent to the primary pond in the eastern portion of the project site.

Allard silt loam

The Allard silt loam (AdA) is a deep, nearly level and well drained soil formed in silty deposits over sandy or gravelly glacial outwash. This soil is located on terraces and benches along valley floors, in oblong areas that are commonly 5 to 10 acres in size. Depth to the water table is 6 feet or more throughout the year. Permeability is moderate in the surface layer and subsoil and is rapid to very rapid in the substratum. Available water capacity is high, and runoff is slow. Root growth is generally not restricted. Natural organic mater content is low, and the soil is well suited to cultivated crops, small grain, hay vegetable crops and nursery stock. This nearly gravel –free soil is well suited to irrigation, particularly for vegetable crops, however pollution of the water table by onsite septic systems is listed as a hazard by the USDA Soil Survey. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on these soil types as “severe” due frost action. This soil type is found in a very small area adjacent to Route 416, and is the least predominant soil onsite.

Bath-Nassau shaly silt loam

The Bath-Nassau shaly silt loam (BnB, BnC) is a shallow to deep, gently sloping and well to excessively well-drained soils. This soil type is located on hilltops and ridges in uplands. This complex is about 50 percent Bath soil, and 30 percent Nassau soil, and 20 percent other soils. Areas of Bath and Nassau soils occur in such an intricate pattern that they were not mapped separately. The subclasses of the Bath-Nassau shaly silt loams are determined by degree of slope with BnB present on slopes of 3 to 8 percent, and the BnC located on slopes of 8 to 15 percent. Because of the underlying folded and tilted bedrock the topography is often irregular and sloping in many directions. Areas are mostly long and oval and occupy 5 to 30 acres. In the Bath soil a perched water table is above the fragipan for very brief periods early in spring. In the Nassau soil there is no seasonal high water table above the bedrock. Permeability in the Bath soil is moderate in the subsoil above the fragipan and is slow or very slow in the fragipan. In the Nassau soil permeability is moderate throughout. Runoff is slow to medium in both soils. This soil complex is suited to pasture, and row crops. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on these soil types as “moderate” to “severe” due to frost action, depth to bedrock, wetness, and slope. This soil type is located on the eastern slope of the project site within wet meadow and forested wetland areas adjacent to the central pond.

Canandaigua silt loam

The Canandaigua silt loam (Ca) is deep, nearly level, and poorly to very poorly-drained. It is located in small depressions in uplands and broad flat lowland plains. Slopes are mostly less than 2 percent with some spots at 3 percent. Areas are usually oval and occupy 5 to 50 acres. The water table is at or near the surface for prolonged periods of time, and some areas are ponded for brief periods in the spring. Permeability is moderate or moderately slow in the surface layer and subsoil and moderately rapid in the substratum. Runoff is very slow, and available water capacity is high. Natural organic matter content is high. Most areas are idle and support only the trees and shrubs that tolerate wetness. Unless drained, this soil is too wet for cultivated crops. This soil is generally not suited to urban uses because of prolonged wetness. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on these soil types as “severe” due to wetness, and frost action. These constraints generally require special design, maintenance, and higher construction costs to facilitate building site development. This soil type is located in the northern portion of the project site and is occupied by NYS Wetland MB-1 and farm fields.

Erie gravelly silt loams

The Erie gravelly loams (ErA,ErB) are deep, nearly level, somewhat poorly drained, and have a fragipan. The Erie soils are located on broad nearly flat hilltops and foot slopes of the uplands. Slopes are between 3 to 8 percent, and areas are mainly round or oval and occupy 5 to 10 acres. The seasonal high water table in this Erie soil is perched above the fragipan in spring and other wet periods. Permeability is moderate in the surface layer and upper part of the subsoil and is slow or very slow in the fragipan and the substratum. Runoff is slow, and available water capacity is moderate to low. Natural organic mater content is medium. Most areas are either idle or pastured. This soil can be used for cultivated crops but is generally better suited to hay or pasture. Unless the soil is drained, wetness delays planting in spring and often interferes with harvesting in fall. The soil is somewhat difficult to drain because of slow water movement through the fragipan. Seasonal wetness and slow or very slow permeability in the fragipan are serious limitations for most urban and recreation uses. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on these soil types as “severe” due to wetness, and frost action. This soil type is located in the eastern areas of the project site along the lower portions of hay fields and within forested wetland habitat.

Farmington silt loam

The Farmington silt loams (FaC) are shallow, well drained, sloping and gently sloping soils formed in glacial till deposits, derived form limestone, shale, slate and siltstone. The slope ranges from 1 to 15 percent but is dominantly 8 to 15 percent. Areas are mainly oval and 10 to 20 acres in size. There is usually no perched water table above the jointed and fractured bedrock. Permeability is moderate, and available water capacity is low or very low. Runoff is medium to rapid, and the bedrock is shallow, usually occurring at a depth of 10 to 20 inches below the ground surface. Natural organic matter content is low. This soil can be used for cultivated crops but is better suited to hay or pasture. Suitability for urban uses is limited by shallowness over bedrock. Excavation is very difficult because of the hardness of the rock. Because of solution cavities in the bedrock, pollution of the underground water supply by septic effluent is listed as a very serious hazard by the USDA Soil Survey. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on these soil types as “severe” due to depth to bedrock and slope. A very small portion of the project site contains this soil type at its southern boundary closest to the offsite, former mining operations.

Halsey silt loam

The Halsey silt loams (Ha) are deep, nearly level, and very poorly drained. The Halsey silt loam is located in depressions and concave areas on low terraces along valley floors on nearly flat plains in lowland areas. Slopes are less than 3 percent. The deposits occupy mostly round areas between 5 to 10 acres in size. The water table is at or near the surface for prolonged periods, and many areas are ponded for brief periods in spring. Permeability is moderate in the surface layer, moderate or moderately slow in the subsoil, and moderately rapid to rapid in the substratum. Runoff is very slow. Available water capacity is moderate to high. Natural organic matter content is high. This soil is poorly suited to most crops because of prolonged wetness, and is poorly suited to most urban and recreation uses because of wetness. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on these soil types as “severe” due to wetness, and frost action. This soil type is located in the northwest portion of the project site within the Wallkill River floodplain. It currently contains pasture land and hedgerows/stream corridors leading to the river.

Hoosic gravely sandy loam

The subclasses of the Hoosic gravely sandy loams (HoA, HoB, HoC, HoD) are determined by degree of slope. The HoA subclass, which lies on slopes between 0 to 3 percent, is a deep nearly level and somewhat excessively drained soil. It is located on terraces and broad flat areas along valley floors and on lowland plains. This soil is suited to many urban and recreation uses. The HoB subclass, which exists on 3 to 8 percent slopes, is a deep, gently sloping, and somewhat excessively drained soil. This soil type is suited to pasture, but lack of moisture in midsummer often results in poor growth. HoC soils located on slopes between 8 to 15 percent, is a deep sloping and somewhat excessively drained soil. It is located on low rounded hills, on ridges, and along the fronts of terraces in valleys and on lowland plains. This soil can be used for many urban and recreation purposes, but slope is a limitation for some uses. The HoD subclass is located on slopes of 15 to 25 percent, and is a deep, moderately steep, and somewhat excessively drained soil. It is located on the sides of terraces and on low rounded hills and ridges in valleys and on lowland plains. This soil is poorly suited to most urban and recreation uses because of slope. Runoff is slow to rapid depending on the slope, with the HoA having the slowest runoff rate and the HoD having the fastest runoff rate.

Permeability is similar for all subclasses and is moderately rapid in the surface layer, moderately rapid or rapid in the subsoil, and very rapid in the substratum. Available water capacity is also low for all subclasses of the Hoosic soil. The depth to the water table is usually more than 6 feet for all of the subclasses. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on these soil types as “slight” to “severe” depending on the slope of the terrain. The HoA has the least limitations and the HoD has the most limitations due to the extreme sloping of the soil of this subclass. Hoosic soil is located adjacent to the Wallkill River on level ground currently used for pasture.

Madalin silt loam

The Madalin silt loam (Ma) is deep, nearly level, poorly and very poorly drained. It is located on flats and in depressions on lowland lake plains and in small basins in uplands. Areas are typically 5 to 15 acres in size and round or concave in shape. The water table is at or near the surface for prolonged periods during the year. Some areas are ponded for brief periods in spring. Permeability is moderately slow in the surface layer, slow in the subsoil, and slow or very slow in the substratum. Available water capacity is high, and runoff is very slow. The natural organic matter content is high. This soil is poorly suited to most urban and recreational uses because of prolonged wetness and slow or very slow permeability. Low strength is a problem in constructing roads and buildings. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on this soil type as moderate to “severe” due to slope and wetness. This soil type is located primarily in forested wetlands at the southeastern boundary of the project site.

Mardin gravelly silt loams

The subclasses of the Mardin gravelly silt loams (MdB, MdC) are determined by degree of slope. The MdB subclass which lies on slopes between 0 to 3 percent, is a deep, moderately well drained, and gently sloping soil formed in glacial till deposits. It is located on broad divides, hilltops, and ridges in uplands. This soil is suited to pasture. The MdC subclass is a deep, moderately well drained, moderately steep soil, formed in glacial till deposits. This soil is located on hillsides and valley sides in uplands and slopes between 8 to 15 percent. The soil is moderately suited to cultivated crops, small grain and hay. This soil is suited to pasture.

The water table is perched above the fragipan early in spring and in other excessively wet periods for both subclasses (MdB, MdC). Permeability is moderate in the surface layer and upper part of the subsoil and is slow or very slow in the fragipan and substratum. Available water capacity is moderate to low and runoff is slow to medium. Areas are mostly long and narrow and 5 to 30 acres in size. Seasonal wetness and slow or very slow permeability in the fragipan are limitations for many urban uses. Carefully designed and installed drains around foundations are needed to overcome the risk of damage from wetness in spring. Erosion is listed as a hazard by the USDA Soil Survey, particularly on long slopes, or in areas bare of plant cover. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on this soil type as “moderate” to “severe” due to slope and wetness. These soils are the most predominant on the project site, located on either side of the central ridge running along Lazy Lane. Mardin soils lie east and west of this central ridge and are primarily in hay field or pastureland at present, with some forested cover at the foot of the cleared slopes.

Nassau shaly silt loam

The Nassau shaly silt loam (NaD) is a shallow, moderately steep, somewhat excessively drained soil formed in glacial till deposits. It is located on hillsides and valley sides in uplands. Areas are generally long and narrow and 5 to 15 acres in size, and slope between 15 to 25 percent. There is no seasonal high water table above the bedrock. Permeability is moderate and available water capacity is very low or low, and runoff is restricted by bedrock. This soil can be used for pasture, but growth is poor in midsummer because of drought. Natural organic content is low. Most areas are either idle or forested and some are pastured. This soil is poorly suited to most urban uses because of slope and shallowness over bedrock, an excavation is difficult because of the hard bedrock. It is located on hillsides and valley sides on uplands. The USDA Soil Survey characterizes development limitations for constructing dwellings, commercial buildings or roadways on this soil type as “severe” due to slope and depth to bedrock. On the project site, this soil type is found at the top of the central ridge running along Lazy Lane, with a smaller area downslope to the east.

AGRICULTURAL SOIL

In New York State, agricultural soils have been classified according to their value for agriculture on a scale from 1 to 7. Group 1 soils are the most productive, with the soil productivity decreasing as group number increases. Classification groups 1 through 4 are the most productive, and are suited to arable cropping. Groups 5 through 7 are suitable for improved grassland and rough grazing. Soils not classified at all are generally unsuitable for agriculture. A soil’s texture, lime content, crop yields, and supply are all factors considered in the categorizing of agricultural soils. The conversion of certain soils from agriculture use is not prohibited by state law. However, it may require permitting and may result in a penalty by the state for the loss of the available resources. On the project site, five soil types fall within those soils best suited for arable cropping. These are the Allard Silt Loam (AdA) classified as a Group 1 agricultural soil; Hoosic 0-3% Slopes and 3-8% Slopes (HoA and HoB) classified as Group 3 and 4 respectively; Bath-Nassau 3-8% Slopes (BnB) classified as Group 4; and Mardin 3-8% Slopes (MdB) classified as Group 4. These make up a minority of the soils on the overall project site. Other onsite agricultural soils best suited for grassland/grazing include the Bath-Nassau 8-15% Slope (BnC), Erie (ErA and ErB), Hoosic (HoB, HoC), Marden 8-15% Slopes (MdC), Canandaigua (Ca) and Madalin (Ma) soils, which have agricultural soil classifications ranging from Group 5 to Group 7. The remaining soils found onsite (Alden, Farmington, Halsey, Hoosic 15-25% Slopes, and Nassau) are not listed as agricultural soils under the NYS Land Classification System [1 NYCRR 370].

Chapter 3.16, “Agricultural Resources,” of this DEIS contains additional information on the current agricultural uses of the land on the project site.

SEPTIC SYSTEM SUITABILITY

As part of the project, a back-up subsurface disposal system was investigated adjacent to the wastewater treatment plant. The USDA Orange County Soil Survey rates each soil type according to its limitations for septic tank absorption fields. Subsurface absorption fields are areas in which effluent is distributed into the soil through subsurface perforated pipe. The limitations are considered “slight” if soil properties are generally favorable for the indicated use, “moderate” if the soil properties are not favorable for the indicated use, and “severe” if the soil properties are so unfavorable that specific construction design is needed to overcome the limitations. The septic system suitability for each soil type on the project site is summarized in Table 3.5-2 below. As described in Chapter 3.8, “Infrastructure and Utilities,” the proposed project would provide for surface discharge of treated effluent to the Wallkill River. Subsurface discharge of treated effluent is not proposed. However, investigations reveal that the soil in the area of the proposed wastewater treatment plant could accommodate subsurficial discharge.

Table 3.5-2
Septic System Suitability

Map Unit(s)	Septic System Suitability

Ab	*Slight*
BnB, BnC,	BnB, BnC - *Severe* due to slow percolation and shallow depth to bedrock.
Ca	*Severe* due to wetness
Era, Erb	Era, Erb – *Severe* due to wetness, and slow percolation
FaC	*Severe* due to depth to bedrock
Fd	*Severe* due to wetness
Ha	*Severe* due to wetness
HoA, HoB, HoC, HoD	HoA, HoB – *slight* HoC – *moderate* due to slope HoD – *severe* due to slope
Ma	*Severe* due to slow percolation
MdB, MdC, MdD	MdB, MdC – *severe* due to wetness and slow percolation MdD – *severe* due to slope slow percolation and wetness.
NaD	*Severe* due to depth to bedrock
Sources: United States Dept. of Agriculture Soil Survey, Orange County, New York	

B. THE FUTURE WITHOUT THE PROPOSED PROJECT

No changes in site soils, topography, or bedrock geology are anticipated in the future without the proposed project. No blasting or soil movement is expected, nor is there an increased potential for soil erosion in the future without the project. The current agricultural and forested conditions can be expected to continue in the future without the project. Therefore, soil use and related potential environmental impacts of current activities onsite would remain unchanged.

C. PROBABLE IMPACTS OF THE PROPOSED PROJECT

Development of the proposed project would result in the alteration of approximately 115 acres of land. Of this amount, approximately 83 acres would be re-vegetated with landscaping and 32 acres would be covered by buildings, roads, and other impervious surfaces. Construction of the proposed project would require re-grading and may require rock removal. By adhering to specific design guidelines, including sediment and erosion control measures (discussed below), the proposed project would not have any significant adverse impacts on bedrock geology, soils, or topography.

TOPOGRAPHY AND SLOPES

The majority of the proposed development would be located along the central ridge running roughly north-south from Eager Road to the southern property boundary. As shown in Figure 3.5-4, the majority of the proposed development would occupy the highest topographic elevation now used primarily for pasture. This development plan avoids most of the lower elevation areas east and west occupied by a mix of forest, field and wetland areas. In order to avoid impacts to more sensitive resources at lower elevations, by necessity the proposed project would disturb some steep slopes (greater than 15%) along Lazy Lane. However, total steep slope disturbance is relatively minor at approximately 10.0 acres due to the generally level topography onsite. Table 3.5-3 shows the acreage of disturbance according to slope.

Table 3.5-3

Slope Disturbance

Slope Category	Acreage of Disturbance
0-10%	73.27 acres
10-15%	24.95 acres
15% or greater	9.94 acres

Table 3.5-4 shows the estimated excavation for each aspect of the proposed project based on conceptual grading. This includes rock as well as earth removals. Cut and fill amounts will roughly balance for the project as a whole, requiring importation of only 5,490 cubic yards of material to finalize project grading. The large scale plans contained in this DEIS show the proposed grading for the project.

Table 3.5-4
Earthwork Summary - cubic yards

Phase (Area)	Excavation (Cut)	Fill	Balance
Quadrangle 1	19,304	44,272	(24,968)
Quadrangle 2	33,866	40,866	(7,000)
Quadrangle 3	198,093	101,627	96,466
Quadrangle 4	105,553	138,029	(32,476)
Quadrangle 5	266	1,329	(1,063)
Topsoil Volume	24,798	31,109	--
Road Volume	7,966	11,492	--
Total (including rock)	340,250	345,740	(5,490)
Notes: (number) indicates excess amount			

Excavation depths for building foundations vary from units with walk out basements or tuck-under garages. However, all foundations will be excavated to a depth of 3-6 feet from proposed finished grade at the building line.

The extent of regrading is minimal for most of the project site due to the limited amount of steep slopes present. Most finished grades closely match existing grades, as shown on the large scale grading plans accompanying this DEIS.

GEOLOGY

Shallow bedrock can increase the cost of building site development by requiring blasting and/or heavy equipment to perform excavation and grading. According to the Orange County Soil Survey, the depth to bedrock is more than 60 inches for almost all of the soils found on the project site, with the exception of Nassau Shaly Silt Loam (NaD) which has shallow depth to bedrock (10-20 inches). The grading plan for the proposed project shows that existing topography is not substantially altered throughout the site. Some rock removal may be required in isolated areas for basements and building foundations, and generally within the central portion of the project site overlying NaD soils.

Results of the onsite subsurface investigation generally support the information in the NRCS Orange County Soil Survey regarding depth to bedrock. Weathered shale was encountered between 4 and 13 feet below grade. Therefore, most of the project would not encounter rock because excavations for foundations are expected to range from approximately 3 to 13 feet. This weathered shale material is easily excavated with a backhoe and should not need special equipment. The shallowest test pit refusal occurred in the southern and southeastern portions of the project site. In the southeastern portion of the project site, refusal was encountered at 4 feet below grade in TP-41, and 2.5 feet below grade in TP-39. (See Appendix G for test pit location plan.) In the southwest portion of the project site shallow refusal was encountered in TP-20, 21, and 22, at 5-6 feet below grade. Both of these areas are designated for development, therefore it may be necessary to perform limited rock blasting to install building foundations and/or utilities at or below the current bedrock elevation. Based on the current grading plan it is estimated that only approximately 45,000 cubic yards of rock would be removed. Excavated rock will be crushed onsite and used for structural fill and sub-base material.

Removal of rock with a ripping blade mounted on a bulldozer or a hydraulic hammer mounted on an excavator produces vibrations and noise that could create a temporary disturbance to adjacent homeowners. However, homes in the vicinity of the most likely areas of rock removal (along Lazy Lane and adjacent to the southern development areas) are buffered by distance, and therefore, noise impacts to these homes related to blasting would not be significant. Additional information on project-related noise impacts can be found in Chapter 3.10, “Noise.” Similarly, potential impacts to offsite groundwater wells would be avoided by the very shallow blasting depths that may be required, the minimal amount of blasting expected and the significant distance to offsite residences.

BLASTING GUIDELINES

Should blasting be required, it would be carried out in conformance with all local, state, and federal regulations. Schedules for blasting and rock ripping (day, hour, and duration) would be provided to the Town and limited to Monday through Saturday during normal working hours. In conjunction with final construction plans, an appropriate blasting program would be finalized.

Under proper supervision and control, rock blasting would be accomplished safely with no significant adverse impact on the public and nearby properties. Blasting vibrations could potentially affect structures within 200 feet of the blasting zone. The closest point of potential rock removal for foundation placement to a neighboring property is approximately 150 feet from the property line, in the southernmost part of the proposed development, as shown in red on the left (southern) side of Figure 4-6. The nearest structure on an adjacent property is approximately 225 feet from the property line. As a result of the distance between potential blasting areas and the adjacent structures, it is expected that blasting energy would not result in any adverse impacts to surrounding properties. In the event that off-site blasting results in any damage to neighboring properties, the applicant will compensate any affected property owners and ensure that damage properties are reconstructed. In addition, as noted below, blasting contractors will be licensed and will carry adequate insurance to cover any off-site property damage.

As discussed below, additional precautions will be taken to prepare precondition surveys on all structures that may be found to occur within 200 feet of a location where blasting may occur.

- Blasting shall be done with such quantities and strengths of explosives, and in such a manner that will break the rock approximately to the intended lines and grades, and yet will leave the rock not to be excavated in an unshattered condition.

- Care shall be taken to avoid excessive cracking of the rock, upon or against which, any structure will be built, and to prevent damage to existing pipes or other structures and property above or below ground.
- All operations involving explosives shall be conducted by experienced personnel, only with all possible care to avoid injury to persons and damage to property. In addition, the licensed blaster(s) shall at all times have his(their) license(s) on the work site and shall permit examination thereof by the official having jurisdiction. Adequate insurance to cover any off-site property damage that may occur as a result of blasting will be required of all licensed blasters.
- Sufficient warning shall be given to all persons in the vicinity of the work before a charge is exploded. Flagmen shall be employed to stop or direct traffic as required.
- To limit potential for blasting damage to nearby structures, blasting vibrations will be limited to a maximum peak particle velocity of 2 inches per second (2 ips). A precondition survey will be performed of all structures within 200 feet of any location where blasting will occur.
- All blasting effects shall be monitored in the field by a professional engineer or geologist who shall be selected and paid by the contractor. This monitoring will utilize seismographic type equipment. Records of all blasting will be submitted to the project engineer.
- Before any blasting is carried out, the contractor shall submit to the engineer a report prepared by the professional engineer licensed to practice in the State of New York containing specific recommendations for blasting. This will include sketches showing blasting locations and adjacent buildings or utilities, and shall cover the amount of charge, firing times, ground velocities, energy ratios, accelerations, displacements, and effects on adjacent structures.
- If rock is excavated beyond the limits indicated in project plans, the excess excavation, whether resulting from overbreakage or other causes, shall be backfilled by and at the expense of the contractor, with the specified backfill that is applicable for that section of the project.
- Domestic groundwater wells on adjacent properties will be monitored as part of the blasting plan. Observation wells and piezometers installed during the groundwater investigation will be monitored during blasting for changes in surface water and wetland water levels.

Whenever blasting is necessary, charges would be limited. The most common complaints with blasting are ground vibrations and noise. (It should be noted that noise complaints are often due to the air horns which are used to signal a pre-blast warning and a post-blast all clear sign rather than the noise of the actual blast). However, careful blast design and careful monitoring of the blast effects can minimize potential complaints.

SOILS

On site soils are generally classified as moderate to severe for site development due to wetness and frost action, depth to bedrock, and slope. The Mardin soil series cover approximately fifty percent of the project site, 181 acres, and would be the soil type most affected by the proposed project. This soil type is generally well drained but does have a water table perched above the fragipan at 18-60 inches below the ground surface in spring and following wet periods. Erosion is listed as a serious hazard on Mardin soils in areas left bare of soil. Phasing of development, whereby the amount of acreage cleared of vegetation and subject to construction activity is staggered, would also avoid any adverse impacts related to erosion and sedimentation. The Erie soil series occupies approximately 25 percent of the project site or 87 acres. This soil type is located in lowlands further from the proposed development areas but would be built upon to a lesser degree than the Mardin soils. The poor drainage characteristics of the Erie soil series require the implementation of specific engineering designs to overcome the intrusion of groundwater during construction activities, as described below. Other soils affected to a lesser degree by the proposed project include the Nassau (NaD), Bath-Nassau (BnB) and Hoosic (HoA) soils. These soils exhibit a range of management limitations, generally less challenging than the Mardin and Erie soils. Nevertheless, the prevalence of onsite streams and wetlands will require that careful adherence to an erosion control plan is carried out to avoid impacts to these resources.

Techniques for overcoming soil development limitations for the proposed project will include the use of foundation drains if necessary and strict compliance with an approved erosion and sediment control plan as discussed below. All topsoil in the disturbed area would be stripped and stockpiled for future use. Where groundwater is observed to be trapped by confining soil layers, curtain drains or French drains will be specified to redirect flow of groundwater around the substructures of the buildings and roadways.

Temporary and permanent soil erosion and sediment control measures will be implemented to minimize impacts to surrounding land and water body areas during construction activities. A sediment and erosion control plan has been prepared for the project site as shown in Chapter 4, “Construction Impacts”, Figure 4-4. This plan, also included in large scale project plans, will become part of the overall Stormwater Pollution Prevention Plan (SPPP) prepared for the project in accordance with SPDES General Permit # GP-02-01 and the “New York Standards and Specifications for Erosion and Sediment Control.”

Erosion and sedimentation would be controlled by a number of measures. These would include the use of mulching, temporary seeding, silt fencing, anti-tracking pads, sedimentation basins and hay bale check dams. In addition, construction work would be staged in order to avoid disturbing large areas. Temporary seeding and mulching will be implemented, if construction operations cease for more than 14 days. Gravel sub-base bedding will be placed on internal roads and parking areas as soon as practicable. Sedimentation will be avoided during construction through the use of temporary silt fence barriers installed along the contour of exposed areas and around soil stockpiles. Hay bale check dams and other design elements of the stormwater management system for the project will ensure that sediment does not enter onsite or offsite wetlands and water bodies. Sedimentation pond outlets would have temporary rise units to ensure silt entrapment. Accumulated sediment would be removed on a regular basis during construction and after completion of the project. Access roads would be covered with crushed stone to facilitate site access in adverse weather conditions. All graded areas not utilized in the long-term for buildings or pavement would be permanently seeded and landscaped as soon as final grades are established. Considering the shallow depth to perched groundwater found on some of the onsite soils, during construction any water accumulating in open excavation areas would be removed within 24 hours and discharged to onsite sedimentation basins in conformance with New York State dewatering specifications.

Regarding the use of onsite soils for construction purposes, the subsurface investigation reveals that the high silt content of on-site soils would require careful site preparation due to the potential for soil water retention. The retention of water by this type of soil causes shrinking and swelling which results in a loss of stability unless properly compacted and drained before construction. Careful field control of moisture content and pneumatic tired rollers are normally required for proper compaction of silt-rich soil. Nevertheless, reuse of existing native soils for structural fill application is considered feasible as long as soils are free of organic matter and moisture content is adjusted to achieve proper compaction levels. The stabilization of moisture content by mixing with dry granular materials, such as lime, may be necessary if construction starts in a wet season. Based on the preliminary geotechnical analysis, spread footings are feasible to support the new buildings, which may be supported on suitable natural soils and/or on new compacted structural fill following removal of soft, unsuitable material from beneath the footing bottoms. Roadways and parking area construction would require proper underdrain systems due to the high silt content of onsite soils. Topsoil stockpiled during construction would be used for grass surface restoration and landscaping areas.

Detailed structural stability calculations and recommendations for construction design are located in the Schoor DePalma Preliminary Geotechnical Engineering Report (1/6/04) located in Appendix G.

AGRICULTURAL SOILS

The project would result in the loss of a small quantity of available agricultural soils. This would be an unavoidable impact. Of the soils best suited for agriculture, those in NYS Land Classification classes 1 through 4, the Hoosic (HoA) soil (Group 3) would be affected by construction of the sewage treatment facility west of Route 416; and the Mardin (MdB) and Bath-Nassau (BnB) soils (Group 4) would be disturbed for construction of the two relatively small development "pods" east of the onsite pond, specifically the "Grove" and "Meadow Green" development areas. The total loss of agriculture soils would be 40.1 acres. Loss of these soils would not constitute a significant adverse impact because the HoA soils are currently used for pasture - a land use abundant in the area that will also be retained elsewhere on the project site. In addition, much of the MdB and ErA soils onsite are not used for agriculture and exist in a forested condition. Therefore, impacts to local or regional agricultural resources is expected to be negligible.

D. MITIGATION

The proposed project incorporates design elements to reduce the footprint of the proposed project on sensitive soils and geologic formations. Therefore, the proposed project would not have a significant adverse impact on local geology, soils and topography.