Chapter 4: Geology, Soils, and Topography

A. INTRODUCTION

This chapter describes the existing geology, soils, and topography within the Project Site and addresses potential impacts to these resources. Bedrock geology, surface soils, and steep slopes are described based on site-specific topographic surveys and data published by the Natural Resources Conservation Service (NRCS) and the New York State Museum. Potential impacts to these resources are based on the potential for the project to cause soil erosion, bedrock blasting/removal, or to result in the loss of valuable soil resources. Baseline conditions regarding the underlying soils, groundwater, bedrock, as well as site topography are provided to understand how construction of project elements will impact or be impacted by these conditions (i.e., erosion, sedimentation, etc.).

PRINCIPAL CONCLUSIONS

The Proposed Project is not expected to adversely affect the overall topography, geology, or soil characteristics of the Project Site. There are no proposed structures or construction in areas of the site containing slopes greater than 15 percent, which have the potential to increase erosion. Because the depth to bedrock is greater than 60 inches for all onsite soil types (NRCS Soil Survey) upon which new structures would be built for the Proposed Project, no impact to the City's artesian springs, including the onsite Big Red Spring, are expected to occur with development of the proposed project. Soil limitations for building foundations are limited to the wetland soils on the eastern portion of the Project Site and within the central portion of the Backstretch parcel where the Oklahoma Track is located. These areas are not affected by proposed construction activities in the Proposed Project. Temporary exposure of soils during construction will be mitigated by implementation and maintenance of erosion and sediment controls (E&SC's) to be reviewed and approved by the City and State when construction plans are finalized for each project component in the future. Chapter 242 of the City of Saratoga Springs will require such standard erosion control measures for all land disturbance actions greater than 0.1 acres required for the future, incremental build-out of the Proposed Project. Due to the depth of groundwater and bedrock, it is not expected that any soil dewatering or special engineering measures would be required for the construction of building foundations or for the installation of stormwater management practices.

B. EXISTING CONDITIONS

TOPOGRAPHY AND SLOPES

The Project Site's topography is generally level throughout the developed portion of the property, sloping gradually downwards towards the east. Elevation ranges from 310 to 260 feet above sea level (**Figure 4-1**). The vast majority of the site is uniformly level, varying little from the base elevation of 310 feet.

As presented in **Table 4-1**, nearly the entire Project Site contains slopes less than 10%. Steep slopes (>15%) are minimal and located solely in the easternmost portion of the Backstretch parcel where the site slopes downwards towards Interstate 87 and the Saratoga Lake region. **Figure 4-2** shows the onsite slope categories. The City of Saratoga Springs does not have a Steep Slopes Ordinance.

Table 4-1
Slope Categories on the Project Site

Slope Category	Percent of Site
0 – 10%	> 95%
10-15%	< 4%
>15%	1%
Source: USGS National Elevation Dataset	

GEOLOGY

Bedrock and surficial geology maps indicate that the Project Site is underlain by Canajoharie Shale (Oc) bedrock of Ordovician age.[1] Unconsolidated deposits of glacial origin cover the bedrock and are mapped as Lacustrine sand (Lc), consisting of well sorted and stratified deposits comprised generally of quartz sand with variable thickness over bedrock of 2-20 meters.[2] The Project Site lies within the Hudson-Mohawk Lowlands physiographic province. The underlying soils of the Saratoga region have been substantially influenced by glacial events that resulted in the deposition of a substrate of sandy material.

At the close of the Pleistocene Epoch, with the retreat of the Wisconsin Glacier between 15,000 and 12,000 years ago, substantial amounts of meltwater created temporary lakes in the lowland areas. The lakes served as receiving basins for large quantities of sediment transported by glacial meltwater streams. The largest temporary lake in the Saratoga County region was glacial Lake Albany, reaching a length of nearly 140 miles and a width of 8-12 miles in the mid and upper Hudson Valley and including the region now occupied by the City of Saratoga Springs. Surficial deposits in the eastern portion of Saratoga County reflect material deposited in and near this glacial lake. Stratified deposits of fine to coarse sand occupy a substantial portion of the county including the Saratoga Springs region. These sands are the most productive source of groundwater in the county and are usually underlain by glacial till but in some areas may lie directly on bedrock. The sands have also contributed to the formation of pine barren habitats, such as the Albany Pine Bush, which have locally rare plants and animals.[3]

Before horse racing began in Saratoga, the area's natural mineral springs attracted summertime visitors for many decades. The springs occur along the line of the north-south Saratoga Springs-McGregor fault zone, which allows water trapped in subsurface shale layers to reach the surface. One of the City's designated springs is located on the Saratoga Race Course property: the Big Red Spring, located near the paddock at the back of the picnic area. The Big Red Spring is named after Secretariat and Man O'War, the two famed thoroughbred champions. Both horses were chestnut colored and racing fans referred to them as "Big Red."

[1] Geologic Map of New York, Hudson-Mohawk Sheet, New York State Museum, Fisher et al, 1970.

[2] Surficial Geologic Map of New York, Hudson-Mohawk Sheet, New York State Museum, D. Cadwell, R. Dineen, 1987.

[3] Soil Survey of Saratoga County New York, NRCS, 1993.

SOILS

The Natural Resource Conservation Service (NRCS) is a division of the USDA tasked with classifying and mapping soils, among other natural resource conservation goals. The NRCS identifies major classifications of soils that have similar characteristics (such as texture and drainage) into a series. Within each series, soils differ in slope and other characteristics that affect their use. On the basis of these differences, soil series are further divided into phases (soil map units). Different soil phases exhibit variable water storage, erosion potential, and other characteristics that are important from a development perspective. The NRCS also protects and regulates soils designated as prime farmland per the Farmland Protection Policy Act (7 USC 4201; 7 CFR 658). The following soil types occur on the Project Site, as shown in **Figure 4-3** and listed in **Table 4-2**.

WINDSOR LOAMY SAND

Three phases of this soil type occur on the Project Site and constitute the majority of soils on the Project Site. These are WnA: Windsor loamy sand, nearly level; WnB: Windsor loamy sand, undulating; and WnC: Windsor loamy sand, rolling. These are very deep, excessively drained soils formed in water-sorted sand, found on glacial outwash plains, kames, and terraces. Slopes range from 0-3 percent for WnA, 3 to 8 percent for WnB, and 8 to 15 percent for WnC. Depth to seasonal high water is more than 6 feet and depth to bedrock is greater than 60 inches for all three phases of this soil type. The hydrologic soil group for these soils is listed as "A", indicating the soil has a high infiltration rate and low runoff potential. These three soil types are listed as "not limited" for dwellings with basements according to the Saratoga County Soil Survey.

DEERFIELD LOAMY FINE SAND

Two phases of this soil type occur on the Project Site. These are DeA: Deerfield loamy fine sand, nearly level; and DeB: Deerfield loamy fine sand, undulating. These are very deep, moderately well drained soils formed in water-sorted sand found on glacial outwash plains and terraces. Slope ranges from 0 to 3 percent for DeA and 3 to 8 percent for DeB. The hydrologic soil group for both soil types is "A", indicating the soil has a high infiltration rate and low runoff potential. Depth to seasonal high water table is listed as 1.5 to 3 feet between December through April and depth to bedrock is greater than 60 inches. Use limitations are described as "very limited" for dwellings with basements due to wetness or depth to saturated zone. This soil type occurs beneath the Oklahoma Track within the Backstretch portion of the Project Site.

PALMS MUCK

Palms muck (Pm) soils are very deep, nearly level, very poorly drained soil formed in deposits of organic materials 16 to 51 inches thick over mineral soil material. It is found in broad, depressional or basin like swamps and bogs in glaciated uplands, lake plains or outwash plains. Depth to water table ranges from 1 foot above to 1 foot below the surface between November and May. Depth to bedrock is greater than 60 inches. This soil type is "limited" for dwellings with basements because of wetness, ponding, and subsidence. Hydrologic soil group is D indicating it has a very slow infiltration rate and high runoff potential.

Table 4-2
Onsite Soils Mapped by NRCS

Symbol	Depth to Bedrock	Soil Series (Taxonomic Name)	Drainage Characteristics
DeA	More than 60 inches	Deerfield loamy fine sand, 0 to 3 percent slopes	Very deep, moderately well-drained soil, formed in water-sorted sand, found in glacial outwash plains and terraces. Typical surface layer (0-10 inches) is very dark grayish brown loamy fine sand. Subsoil (10-26 inches bgs) is mottled, dark yellowish brown loamy fine sand. Erosion hazard slight, surface run-off rapid, water capacity low.
DeB	More than 60 inches	Deerfield loamy fine sand, 3 to 8 percent slopes	Very deep, moderately well-drained soil, formed in water-sorted sand, found in glacial outwash plains and terraces. Typical surface layer (0-10 inches) is very dark grayish brown loamy fine sand. Subsoil (10-26 inches bgs) is mottled, dark yellowish brown loamy fine sand. Erosion hazard slight, surface run-off slow, water capacity low.
WnA	More than 60 inches	Windsor loamy sand, 0 to 3 percent slopes	Very deep, excessively drained soil, formed in water-sorted sand, found in glacial outwash plains, kames, and terraces. Typical surface layer (0-2 inches) consists of moderately decomposed pine needles. Beneath that (2- 11 inches) is very dark grayish brown loamy sand. Subsoil consists of two layers: the first (11-21 inches) a yellowish brown loamy sand, and the second (21-25 inches) is a yellowish brown sand. Erosion hazard slight, surface run-off very slow, water capacity low or moderate.
WnB	More than 60 inches	Windsor loamy sand, 3 to 8 percent slopes	Very deep, excessively drained soil, formed in water-sorted sand, found in glacial outwash plains, kames, and terraces. Typical surface layer (0-2 inches) consists of moderately decomposed pine needles. Beneath that (2- 11 inches) is very dark grayish brown loamy sand. Subsoil consists of two layers: the first (11-21 inches) a yellowish brown loamy sand, and the second (21-25 inches) is a yellowish brown sand. Erosion hazard slight, surface run-off slow, water capacity low or moderate.
WnC	More than 60 inches	Windsor loamy sand, 8 to 15 percent slopes	Very deep, excessively drained soil, formed in water-sorted sand, found in glacial outwash plains, kames, and terraces. Typical surface layer (0-2 inches) consists of moderately decomposed pine needles. Beneath that (2- 11 inches) is very dark grayish brown loamy sand. Subsoil consists of two layers: the first (11-21 inches) a yellowish brown loamy sand, and the second (21-25 inches) is a yellowish brown sand. Erosion hazard moderate, surface run-off medium, water capacity low or moderate.
Sa	More than 60 inches	Scarboro mucky loamy sand, 0 to 3 percent slopes	Very deep, poorly drained soil, formed in water-sorted sand, found in depressions in glacial outwash and lake plains. Typical surface layer is (0-3 inches) black mucky peat, followed by (3-10 inches) black mucky loamy sand. Substrata consist of various gray and olive sands. Erosion hazard slight, surface run-off very slow or ponded, water capacity moderate.
Pm	More than 60 inches	Palms muck	Very deep, nearly level, poorly drained soil, formed in deposits of organic materials over mineral soil material. It is found in swamps and bogs in glaciated uplands, lake plains or outwash plains. Typical surface layer (0-11 inches) consists of black muck. Subsurface layer (11-28 inches) is very dark gray muck. Erosion hazard none, surface run-off very slow or ponded, water capacity very high.

Source: Saratoga County Soil Survey, New York, U.S.D.A. Soil Conservation Service

SCARBORO MUCKY LOAMY SAND

Sa: Scarboro mucky loamy sand. These are very deep, nearly level, very poorly drained soil formed in water sorted sand, found in depressions on glacial outwash and lake plains. Slopes range from 0 to 3 percent. Depth to water table is 1 foot above to 1 foot below the surface throughout the year. Depth to bedrock is greater than 60 inches. This soil is described as "very limited" for dwellings with basements because of wetness and ponding. Hydrologic soil group is D, indicating it has a very slow infiltration rate and high runoff potential.

PRIME FARMLAND

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. None of the soil types mapped for the Project Site are listed as "prime farmland" by the NRCS. The Saratoga Project site is not within any Agricultural Districts mapped/designated by New York State Department of Agriculture and Markets or County.

C. THE FUTURE WITHOUT THE PROPOSED PROJECT

Without the proposed project, the Project Site is expected to remain in its current condition with no disturbance to geology, soils and topography. No offsite projects in the vicinity of the Project Site are expected to have an effect on the geologic and soil resources of the Project Site. Slopes on the Project Site will not be disturbed by other approved projects.

D. PROBABLE IMPACTS OF THE PROPOSED PROJECT

TOPOGRAPHY AND SLOPES

The Proposed Project proposes no new structures in areas of the site containing slopes greater than 15 percent. Topographic changes to the site would not occur because excess excavated material removed for new building foundations would either be exported offsite or deposited in the Lowlands area of the Backstretch. If excess material is disposed of in the Lowlands area, a wetland delineation would be prepared to ensure that no fill material impacts wetlands. In addition, all areas of temporary and permanent soil storage would be shown on project grading and sediment/erosion control plans and would be subject to review by applicable regulatory agencies. Chapter 7, "Stormwater," provides details on the measures that would be taken to avoid impacts from erosion and sedimentation.

GEOLOGY

Due to the depth of bedrock onsite, excavation for any new building foundations would not require bedrock removal. Removal of unconsolidated material for foundation excavation would be exported offsite or disposed onsite in upland areas. Because the depth to bedrock is greater than 60 inches for all onsite soil types (NRCS Soil Survey) upon which new structures would be built for the Proposed Project, no impact to the City's artesian springs, including the onsite Big Red Spring, are expected to occur with development of the proposed project. Therefore the project would have no impact on bedrock or surficial geological resources.

SOILS

Soil limitations for building foundations are limited to the wetland soils on the eastern portion of the Project Site and within the central portion of the Backstretch parcel where the Oklahoma Track is located. These areas would be avoided by the Proposed Project. Therefore, it is not expected that any soil dewatering or specific engineering measures would be required for the construction of building foundations or for the installation of stormwater management practices. The vast majority of the Project Site is mapped as Windsor Loamy Sand soil (WnA, WnB, WnC), which has a depth to water table of greater than 6 feet. Therefore, it is not expected that groundwater within the unconfined aquifer (surficial aquifer) would be affected by the excavation of foundations for new structures. For the area of mapped Deerfield Loamy Fine Sand soil (DeA, DeB) seasonal groundwater reaches 1.5 to 3 feet below the surface. This soil type is mapped beneath the existing Oklahoma Track where no new buildings or work is proposed. Therefore, the seasonal shallow depth to high groundwater in the Deerfield Loam Fine Sand Soil is not expected to be an impediment to construction.

Should unexpected subsurface conditions present constraints in the future during sequential build-out of the proposed master plan, site-specific erosion control and/or dewatering practices will be implemented in accordance with the NYS Standards and Specifications for Erosion and Sediment Control.

As discussed in the Chapter 7: Stormwater Management, each phase of the proposed project would be required to prepare and submit erosion and sedimentation control plans in accordance with City and State regulations. These apply at the City-level to land disturbance activities of 0.1 acres or more (City of Saratoga Springs Code §242-7), and would be fully adhered to by NYRA.

E. MITIGATION

Through the implementation of a New York State and City of Saratoga Springs-approved SWPPP, the Project would avoid any adverse impacts to soils and topographic resources. Principally through use of sedimentation and erosion control measures, discussed in Chapter 7, “Stormwater Management,” the movement of soil downslope or downstream would be avoided. This would prevent detrimental impacts to receiving waters and wetlands. These measures would be installed prior to construction, and would be monitored and maintained during construction.

With the implementation of the measures noted above, the potential cumulative impacts on the geology, soils and/or topography on or in the vicinity of the Project Site resulting from the development of the proposed project in conjunction with those associated with other approved projects in the area are not expected to be significant. ✷