Appendix G1

Detailed Geology, Soils, and Prime Farmlands Supplemental Information

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Acronyms and Abbreviations

AASHTO .... American Association of State Highway and Transportation Officials
BRT .... Bus Rapid Transit
CFR .... Code of Federal Regulations
CgB .... Cazenova silt loam
Cv .... Cosad loamy fine sand
CY .... Cubic Yards
Draft EIS .... Draft Environmental Impact Statement
FPPA .... Farmland Protection Policy Act
LRT .... Light Rail Transit
Metro .... Niagara Frontier Transit Metro System, Inc.
Metro Rail .... Metro Light Rail Transit System
NRCS .... Natural Resources Conservation Service
NYSDOT .... New York State Department of Transportation
Project .... Buffalo-Amherst-Tonawanda Corridor Transit Expansion
SPDES .... New York State Discharge Elimination System
SMMP .... Soil and Materials Management Plan
UB .... University at Buffalo
Ud .... Urban Land
Uh .... Urban land-Churchville Complex
Ut .... Urban land-Odessa Complex
Uu .... Urban land-Schoharie Complex
USGS .... United States Geological Survey

This appendix describes existing geology and soils in the study area, farmland prevalence within the study area, and potential environmental effects of the LRT Build Alternative and BRT Build Alternative on these resources. Geology considers both bedrock (*e.g.*, sandstone, shale, gneiss), unconsolidated surficial deposits (*e.g.*, sand, gravel, clay), and geologic hazards. The section on soils considers the uppermost layer of the ground, which has been exposed to climatic and erosive forces. Impacts on geology and soils are primarily associated with temporary construction activities, which are discussed in more detail in Section 4.17, "Construction Effects." Table G.1-1 summarizes the geology, soils, and farmland impact findings related to the Project.

Table G.1-1. Geology, Soils, and Farmlands - Impacts Summary

Resource	Geology		Soils and Farmlands	
	Permanent Effect	Mitigation	Permanent Effect	Mitigation
No Build Alternative	No impacts	No mitigation warranted	No impacts	No mitigation required

Resource	Geology		Soils and Farmlands	
	Permanent Effect	Mitigation	Permanent Effect	Mitigation
LRT Build Alternative	Impacts resulting from construction of the tunnels on UB South Campus and the underground segment at Maple Road and Sweet Home Road	Direct Contractor to execute sequential excavation method protocols for tunnel excavation and controlled blasting as defined by the final construction plans, including development of a monitoring program/mitigation plan. Direct Contractor to properly treat, manage, and dewater groundwater encountered during deep excavation activities in accordance to state and federal regulations. Direct Contractor to execute safety protocols associated with the potential to encounter hydrogen sulfide gas encountered during excavation.	Impacts would not be adverse	Direct Contractor to properly treat and manage contaminated soils in accordance with state and federal regulations. Require the Contractor to develop and implement a Dust Control Plan that includes pro-active measures to prevent discharge of dust into the atmosphere. In areas not subject to traffic, apply products and materials including vegetative cover, mulch, and spray adhesives on soil surfaces to prevent airborne migration of soil particles. In areas subject to traffic, apply products and materials including water sprinkling, polymer additives, barriers, windbreaks, and wheel washing. Require sediment and erosion controls and stormwater maintenance facilities to be implemented in accordance with the 2010 Western New York Stormwater Coalition Stormwater Management Plan as well as all applicable state and federal permit requirements.

Resource	Geology		Soils and Farmlands	
	Permanent Effect	Mitigation	Permanent Effect	Mitigation
BRT Build Alternative	Impacts would not be adverse	No mitigation warranted	Impacts would not be adverse	Direct Contractor to properly treat and manage contaminated soils in accordance with state and federal regulations. Require the Contractor to develop and implement a Dust Control Plan that includes pro-active measures to prevent discharge of dust into the atmosphere. In areas not subject to traffic, apply products and materials including vegetative cover, mulch, and spray adhesives on soil surfaces to prevent airborne migration of soil particles. In areas subject to traffic, apply products and materials including water sprinkling, polymer additives, barriers, windbreaks, and wheel washing. Require sediment and erosion controls and stormwater maintenance facilities to be implemented in accordance with the 2010 Western New York Stormwater Coalition Stormwater Management Plan as well as all applicable state and federal permit requirements.

G.1 REGULATORY CONTEXT AND METHODOLOGY

G.1.1 Geology

Geology considers both bedrock (*e.g.*, sandstone, shale, gneiss), unconsolidated surficial deposits (*e.g.*, sand, gravel, clay), and geologic hazards. The section on soils considers the uppermost layer of the ground, which has been exposed to climatic and erosive forces. Metro reviewed existing data on geology to understand the general geologic setting and identify the locations of geologic hazards that could result in substantial damage to structures or infrastructure or could expose people to substantial risk of injury and to determine potential impacts of the Build Alternatives. Geologic data are provided by the Natural Resources Conservation Service

(NRCS), the U.S. Geological Survey (USGS), and the New York State Geological Survey. Additional references include published bedrock maps for the Western New York region and information obtained from the March 2025 Geotechnical Data Report generated to support preliminary tunnel designs, provided as Appendix G3 of this Draft EIS.

The regulatory implications of geology are generally established through building codes or other engineering criteria that dictate design requirements for project elements. Examples include design codes for earthquake resistance and bearing capacity of foundations. For example, the American Association of State Highway and Transportation Officials (AASHTO) and the New York State Department of Transportation (NYSDOT) in its *Bridge Safety Assurance and Blue Pages* manual prescribe seismic design requirements for transportation facilities, such as roadway and bridge structures. Such codes and criteria are typically accounted for during detailed design of Project-related structures. Excavations related to tunnel construction are regulated at the local level through the City of Buffalo and Town of Amherst zoning codes.

The New York State Pollutant Discharge Elimination System (SPDES) controls wastewater discharge. Activities requiring a SPDES permit include point source discharges of wastewater into groundwater of the state, including the discharge of water for operating a disposal system (*e.g.*, groundwater pumping).

Unless otherwise specified, the study area for this section is defined as 0.25-miles on either side of the alignment of the Build Alternatives and a 0.5-mile radius around each proposed station. Most of the geologic data are provided by the Natural Resources Conservation Service (NRCS), the U.S. Geological Survey (USGS), and the New York State Geological Survey. Additional references are cited below. Bedrock and surficial geologic conditions are based on published maps for the Western New York region and information obtained from the September 2023 Geotechnical Data Report generated to support preliminary designs (McMahon & Mann 2023). See Appendix G3, "Geotechnical Data Report" of this Draft EIS.

G.1.1.1 Soils and Farmland

The NRCS of the U.S. Department of Agriculture protects and regulates prime farmland soils under the Farmland Protection Policy Act (FPPA) (7 CFR Part 658), which was passed in 1981 as a measure to minimize the effects of Federal programs on the unnecessary and irreversible conversion of farmland to nonagricultural use. In addition, the Town of Amherst Soils and Residential Foundation Study, which included a literature review, home inspections, soil sampling, field inspections, and phone surveys, was referenced.[1] The Town of Amherst also has an adopted an Agricultural Plan.[2]

1 U.S. Army Corps of Engineers and the Town of Amherst. 2005. Town of Amherst Soils and Residential Foundation Study. *http://www.amherst.ny.us/pdf/building/soilsstudy/TOA_Soils_Foundation_Study.pdf/*

2 Town of Amherst Agricultural Plan. *https://www.amherst.ny.us/pdf/planning/farmland/211006_approved_plan.pdf*

G.1.1.2 Project Impacts

For this Draft EIS, Metro analyzed the potential for certain geologic conditions to be encountered as a result of construction of the Project. A summary of potential construction impacts that may dictate implementation of specific construction methods, includes the following:

- Damage to structures or infrastructure
- Tunneling through unstable bedrock
- Dewatering and its effect on settling of soils
- Risk of encountering hydrogen sulfide (H2S) gas
- Generation of vibrations from tunnel construction
- Soil erosion and degradation
- Disturbance of contaminated soils
- Conversion of farmland to nonagricultural use

G.2 AFFECTED ENVIRONMENT

This section characterizes existing geologic and soils conditions in the study area. Existing conditions are largely based on available mapping and surveys of the study area, data collected as part of the Geotechnical Data Report, and the Town of Amherst Soils and Residential Foundation Study. More extensive geotechnical investigations would occur during the final design of the selected Build Alternative.

G.2.1 Geology

G.2.1.1 Bedrock Geology

The study area is located in the Erie-Ontario Lowlands Physiographic Province and is underlain by shale, limestone, dolostone, salt, and gypsum.[3] The portion of the study area in Tonawanda and Amherst is underlain by the Akron Dolostone and the Salina group, which consists of the Camillus, Syracuse, and Vernon Formations.[4] Depth to bedrock in the area is approximately 40 feet. These formations begin in the vicinity of Kenmore Avenue and continue north through the remainder of the study area. Onondaga and Bois Blanc limestone underlie the portion of the study area south of Kenmore Avenue. Dissolution of rock, due to the limestone ladened base rock, has been known to cause sinking foundations in the northeast section of the study area, north of Maple Road.

Bedrock is encountered at very shallow depths in the area south of Kenmore Avenue where observations of thin layers of the Onondaga Limestone and Akron Dolostone underlain by a thicker layer of the Bertie Formation will likely only be encountered in this portion of the study

[3] New York State Education Department GIS Clearinghouse. *http://www.nysm.nysed.gov/common/nysm/files/NYS_Physiographic_0.jpg*

[4] New York State Education Department GIS Clearinghouse. *http://www.nysm.nysed.gov/common/nysm/files/niagara_bedrock_sheet.jpg*

area. The Camillus Formation is more prevalent throughout the study area but will likely be observed south of Kenmore Avenue, between I-290 and Maple Road, and in the vicinity of Bizer Creek (McMahon & Mann 2023). See Appendix G3, "Geotechnical Data Report." of this Draft EIS.

G.2.1.2 Surficial Geology

Unconsolidated deposits of mostly glacial and glacial lacustrine origin define the native surficial geology in the study area. The glacial deposits consist of till, sand and gravel, and lake deposit sediments with a typical thickness of 40 feet (but generally ranging from 1 to 70 feet). The unconsolidated deposits become thicker starting just north of Kenmore Avenue consisting mainly of glacial till overlain by topsoil/fill material extending northward until it thins out around Bizer Creek near the Audubon Parkway. Thickness of the deposits resumes further into the north-northeast along the study area with more lake sediment deposition as the primary material. As stated in Section G.1, the study area is located entirely in an urbanized area; therefore, the upper five to ten feet of the subsurface would likely contain infrastructure or urban fill (brick, road base, coal ash, etc.). According to the Geotechnical Data Report in Appendix G3 of this Draft EIS, the surficial geology of most segments of the Project corridor (with exceptions of Segments 5 and 7) generally consists of fine-grained fill material overlain by thinner strata of topsoil, asphalt or coarse-grained road base. Segments 5 and 7 specifically observed significant coarse-grained fill material to depths as deep as 32 feet. Table G.2-1 summarizes surficial topsoil and fill depths observed based on borehole data reported in the Geotechnical Data Report.

Table G.2-1. Surficial Geology Summary – Depth Below Ground Surface

Project Study Area	Topsoil and Fill	Groundwater
UB South Campus to Niagara Falls Boulevard and Princeton Avenue	Includes topsoil, asphalt, or concrete overlying fill to depths as great as 14 feet. The fill is generally fine-grained, other than the coarse road base material.	Nearly 50-feet in depth on UB South Campus. North of Kenmore Avenue depth reduces to about 3-feet.
Along Niagara Falls Boulevard Between Princeton Avenue and Treadwell Road	Encountered asphalt over and up to nearly 8 feet of coarse-grained fill. Underlying the coarse-grained fill was as much as 6.5 feet of fine-grained, mostly silty-clay fill.	Approximately 6 feet below the ground surface.
Niagara Falls Boulevard from Treadwell Road to Hillcrest Drive and Maple Road	Encountered asphalt over up to 5 feet of coarse road base fill. A fine-grained silty-clay fill was observed below the coarse-grained fill.	Approximately 20 feet below the ground surface.
Hillcrest Drive and Maple Road to I-290 Overpass at Sweet Home Road	Includes topsoil fill or asphalt and concrete over coarse- or fine-grained fill. Fill depths vary between about 2 and 3 feet.	Approximately 20 feet below the ground surface.
Sweet Home Road between I-290 Overpass and Bizer Creek	Includes mostly a coarse-grained gravelly silty-sand approximately 32-feet deep. The upper 6 to 10 feet of the fill is medium dense to dense and below that, it is loose to medium dense.	Approximately 30 feet below the ground surface.

Project Study Area	Topsoil and Fill	Groundwater
Sweet Home Road at Bizer Creek to Lee Road (UB North Campus)	Includes asphalt overlies fill to depths between 2 and 17 feet. The fill is predominately medium stiff to stiff, fine-grained silt and clay, although thin layers (typically less than 3 feet, but up to 6 feet) of dense coarse-grained fill was encountered in some locations.	Varies from approximately 18 feet to 30 feet or deeper below ground surface.
Lee Road (UB North Campus) to Ellicott Creek at John James Audubon Parkway	Topsoil fill overlies between about 9 feet and 29 feet of fill. The fill generally consists of dense coarse-grained fill, and medium stiff to stiff fine-grained fill.	Varies from approximately 10 feet to 25 feet or deeper below ground surface.
Ellicott Creek at John James Audubon Parkway to north I-990	Asphalt, gravel, or topsoil fill overlies fill to depths up to 6 feet, which includes both dense coarse-grained fill and medium stiff to stiff fine-grained fill.	Varies from approximately 5 feet or deeper below ground surface.

G.2.2 Geologic Hazards

The following sections describe potential geologic hazards in the region. Hazards include seismic activity and faults, liquefaction, landslides, and karsts.

G.2.2.1 Seismic Activity and Faults

The potential for seismic hazards was assessed for Erie and Niagara Counties using the USGS Unified Hazard Tool in order to determine the likelihood of a damaging earthquake occurring in or near the study area. There are no significant faults located within the study area, especially none that could contribute to a seismic event that would cause structural damage.[5]

According to the USGS, the largest magnitude earthquake recorded in Erie or Niagara Counties was a magnitude 3.0 event in 1995 that was centered near the Tonawanda/Amherst border (located on the western edge of the study area). Although some residents felt minor shaking, there were no reports of structural damage. An earthquake of this magnitude would have no effect on the study area and would pose no hazard to people or infrastructure. The most recent earthquake in the Buffalo-Niagara region occurred in February 2023 and was a magnitude 3.8. The epicenter was located approximately ten miles southeast of the study area. There is a two percent chance of an earthquake of magnitude 3.0 or greater in either Niagara or Erie Counties in the next 50 years.[6] Therefore, risk of an earthquake damaging the infrastructure or harming people in the study area is very low.

5 New York State Education Department GIS Clearinghouse. *http://www.nysm.nysed.gov/common/nysm/files/brittle_structures.jpg*

6 USGS Unified Hazard Tool. https://earthquake.usgs.gov/hazards/interactive/

G.2.2.2 Liquefaction

Liquefaction occurs when loose, saturated, fine-grained soil behaves similarly to a fluid in response to a seismic event. When fine-grained soil with a shallow water table is not densely packed and is subjected to shaking from an earthquake, it can continue to shake and flow even after the seismic waves have passed, causing structural damage to buildings. Liquefaction is unlikely in the study area due to the composition of soil of glacial or lacustrine origin typically unconsolidated and denser than similar sized sediments deposited via fluvial processes. Also, liquefaction typically occurs in regions where the depth to the water table is shallow, considered less than ten feet below ground surface (bgs). Strength of soil due to compaction is another factor [7]. Based on geotechnical borehole data collected within the study area, the depth to the water table is generally observed between 12 to 28 feet bgs throughout the project area. Combining these factors with the decreased likelihood of a significant seismic event, liquefaction probability is low.

Of particular focus for liquification are significant Project related underground construction activities. The water table (groundwater level) is approximately 50 feet in depth at the location of the proposed excavated tunnels for the LRT Build Alternative on UB South Campus. The water table (groundwater level) is approximately 20 feet in depth at the location of the proposed and underground segment of the LRT Build Alternative at Maple Road and Sweet Home Road. Combining these factors with the decreased likelihood of a significant seismic event, liquefaction probability is low.

G.2.2.3 Landslides

Landslides, rockfalls, and debris flows can occur in a variety of environments and slopes. They typically occur in areas of weak or clay bedrock or where geologic features such as bedding planes, jointing, or fracture planes dip or downslope, especially at higher angles. Landslides can be triggered by ground shaking in an earthquake, tunnel blasting, overweighting, or excavation. The grade of bedrock and soil in the study area is generally very low (0 to 3 percent) and the dense overburden provides a cohesiveness to the soil that would make the risk of landslides in the area very low.[8]

G.2.2.4 Karsts

A karst topography is formed through the dissolution of soluble rocks such as limestone, dolostone, and gypsum. A karst terrain consists of a combination of some of, but not limited to, the following features: abundance of closed topographic contours, presence of shallow carbonate

7 Budhu, M., Vijayakumar, V., Giese, R. F., & Baumgras, L. (n.d.). (rep.). Liquefaction Potential for New York State: A Preliminary Report on Sites in Manhattan and Buffalo. Retrieved August 2022, from *https://nehrpsearch.nist.gov/static/files/NSF/PB88163704.pdf*.

8 USGS U.S. Landslide Inventory. *https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=ae120962f459434b8c904b456c82669d*

bedrock, and presence of soluble mineral mines.[9] The presence of human-made cavities, such as mines, is the greatest contributor to karst topography.[10]

The study area is underlain by the Salina group, which has been mined for gypsum in Clarence, New York (located approximately 15 miles east of the study area) but has not been mined in the area surrounding the study area.[11] Structural damage from a sinkhole collapse impacted one building in Clarence in the 1980s and was attributed to the previous mining operations. The last report of a collapse in karst topography in New York State was in the late 1980s in Eastern New York.[9]

Furthermore, the study area does not contain closed contours indicative of a karst topography, and Erie and Niagara Counties as a whole have fewer closed contours compared to surrounding counties at risk for karst action.[8] Due to lack of human-made caverns as well as poor evidence for naturally occurring sinkholes in the study area, the potential for damage due to karst movement or collapse is low.

G.2.2.5 Soils and Farmlands

The NRCS identifies major classifications of soils into series with similar characteristics (such as texture and drainage). Within each series, soils differ in slope and other characteristics that impact their use. Based on 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 construction perspective. Clay, loam, silt loam, urban land, sand, and sandy loam define the soil texture in the study area. These soils are made up of fine particles that impact the region's drainage, permeability, infiltration, rooting depth, and moisture-holding capacity.

A variety of soil types exist within the study area (Figure G.2-1). From University Station to Maple Road, Urban land (Ud) and Urban land–Odessa complex (Ut) dominate the soil type but Urban land–Churchville complex (Uh) and Urban land-Schoharie complex (Uu) are also common. Throughout the UB North Campus, the soil types are a mix of Odessa silt loam (Od), Churchville silt loam (CoA), and Cazenovia silt loam (CgB). North of UB North Campus, the soil type is primarily Cosad loamy fine sand (Cv).

As defined by the NRCS, hydric soils are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic (*i.e.*, without oxygen)

9 Kappel, W.M., Reddy, J.E., and Root, J.C., 2020, Statewide assessment of karst aquifers in New York with an inventory of closed-depression and focused-recharge features: U.S. Geological Survey Scientific Investigations Report 2020–5030, 74 p. Retrieved September 2022 from *https://doi.org/10.3133/sir20205030*

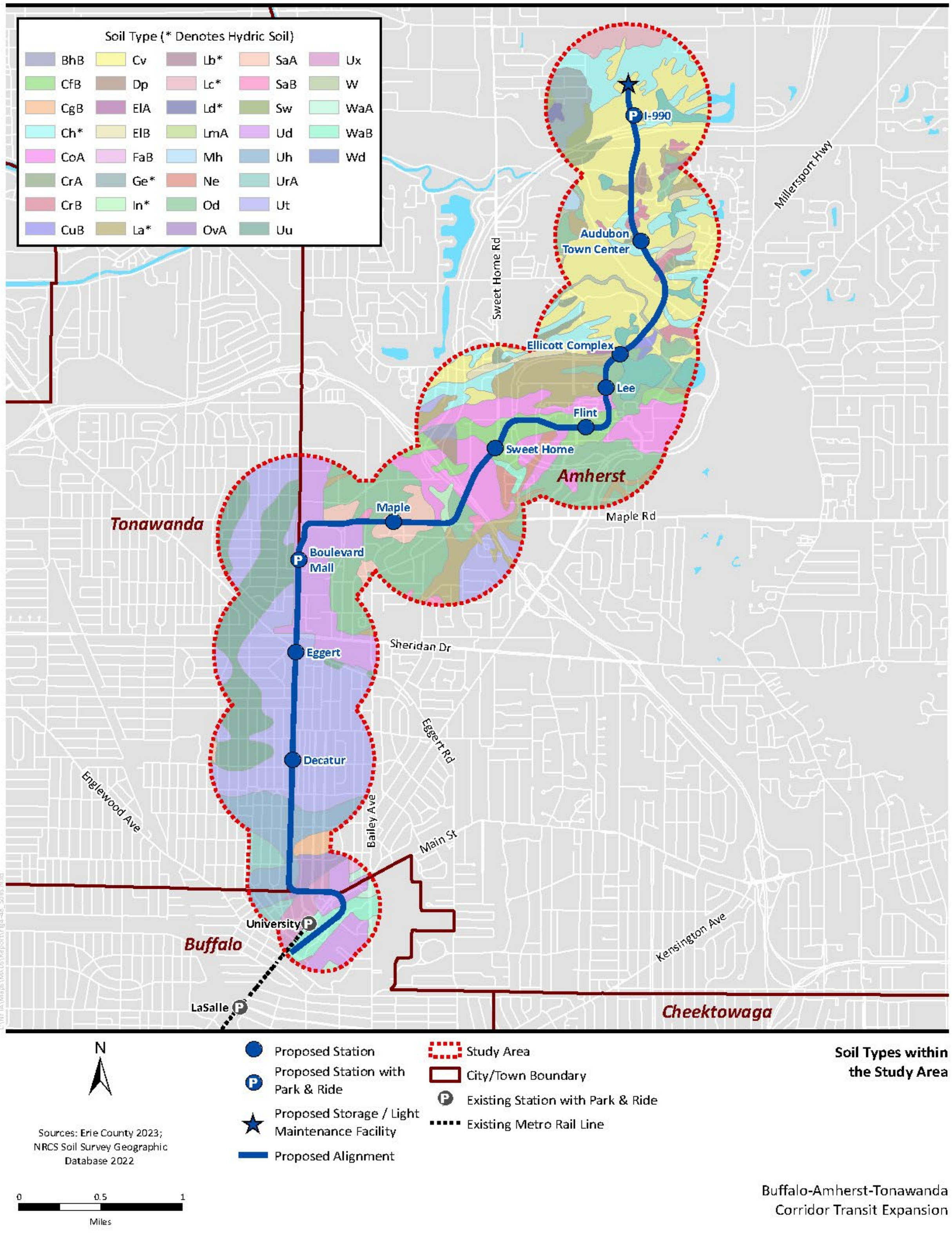
10 AES Corporation "Appendix 10-3 Karst Mitigation Plan" 2021, Retrieved September 2022 from *https://www.aes.com/sites/default/files/2021-10/Appendix%2010-3.%20Karst%20Mitigation%20Plan.pdf*

11 Clemency, C.V. "The Gypsum Deposits of the Salina Group of Western New York" SUNY Buffalo, 1966, Retrieved September 2022 from *https://www.nysga-online.org/wp-content/uploads/2019/06/NYSGA-1966-Gypsum-Deposits-of-the-Salina-Group-of-Western-NY.pdf*

conditions in the upper part. Hydric soils in the study area occur primarily along streams and creeks (see Section 4.11, "Water Resources"). Table G.2-2 details the hydric soils within the study area.

Soils meeting Federal requirements for prime farmland, unique farmland (prime farmland if drained), and farmland of statewide importance are present throughout the study areas as presented in Table G.2-2. However, these areas are largely developed with urban and suburban uses, classified as "urbanized area," within existing transportation rights-of-way, without active farming, or presence of forested land.

Figure G.2-1. Soil Types within the Study Area



Source: NRCS Soil Survey Geographic Database 2022 See Table G.2-2 for soil definitions.

Table G.2-2. Soils Located Within the Study Area

Class	Name	Slope	Acres within the Study Area	Percentage of Study Area	Hydric Soil Rating	Farmland Classification	Depth to Water Table Rating (Feet)	Drainage Class
BhB	Benson-Rock outcrop complex	3% to 8%	10.16	0.3%	No	Not prime farmland	>6.6	Somewhat excessively drained
CfB	Cayuga silt loam	3% to 8%	131.28	3.3%	No	All areas are prime farmland	2.3	Moderately well drained
CgB	Cazenovia silt loam	3% to 8%	17.02	0.4%	No	All areas are prime farmland	3.0	Well drained
Ch	Cheektowaga fine sandy loam	0% to 3%	239.75	6.0%	Yes	Farmland of statewide importance	0.2	Very poorly drained
CoA	Churchville silt loam	0% to 3%	282.64	7.1%	No	Prime farmland if drained	1.0	Somewhat poorly drained
CrA	Claverack loamy fine sand	0% to 3%	21.14	0.5%	No	All areas are prime farmland	1.8	Moderately well drained
CrB	Claverack loamy fine sand	3% to 8%	31.25	0.8%	No	All areas are prime farmland	1.8	Moderately well drained
CuB	Colonie loamy fine sand	3% to 8%	6.57	0.2%	No	All areas are prime farmland	>6.6	Well drained
Cv	Cosad loamy fine sand	0% to 3%	621.00	15.5%	No	Prime farmland if drained	1.0	Somewhat poorly drained
Dp	Dumps	N/A	14.60	0.4%	N/A	Not prime farmland	>6.6	N/A
EIA	Elnora loamy fine sand	0% to 3%	4.16	0.1%	No	All areas are prime farmland	1.8	Moderately well drained
EIA	Elnora loamy fine sand	3% to 8%	28.29	0.7%	No	All areas are prime farmland	1.8	Moderately well drained
FaB	Farmington channery loam	3% to 8%	3.18	0.1%	No	All areas are prime farmland	>6.6	Moderately well drained
Ge	Getzville silt loam	0% to 3%	53.09	1.3%	Yes	Farmland of statewide importance	0.3	Poorly drained
In	Ilion silt loam	0% to 3%	10.41	0.3%	Yes	Farmland of statewide importance	0.5	Poorly drained
La	Lakemont silt loam	0% to 3%	221.63	5.5%	Yes	Farmland of statewide importance	0.0	Poorly drained
Lb	Lakemont mucky silt loam	0% to 3%	5.95	0.1%	Yes	Farmland of statewide importance	0.2	Very poorly drained
Lc	Lamson very fine sandy loam	0% to 3%	41.57	1.0%	Yes	Not prime farmland	0.2	Very poorly drained
Ld	Lamson mucky very fine sandy loam	0% to 3%	5.97	0.1%	Yes	Not prime farmland	0.2	Very poorly drained
LmA	Lima loam	0% to 3%	0.19	0.0%	No	All areas are prime farmland	1.8	Moderately well drained
Mh	Minoa very fine sandy loam	0% to 3%	6.19	0.2%	No	Prime farmland if drained	1.0	Somewhat poorly drained
Ne	Newstead loam	0% to 3%	24.22	0.6%	No	Prime farmland if drained	0.8	Somewhat poorly drained

Class	Name	Slope	Acres within the Study Area	Percentage of Study Area	Hydric Soil Rating	Farmland Classification	Depth to Water Table Rating (Feet)	Drainage Class
Od	Odessa silt loam	0% to 3%	482.78	12.0%	No	Prime farmland if drained	0.7	Somewhat poorly drained
OvA	Ovid silt loam	0% to 3%	30.07	0.7%	No	Prime farmland if drained	1.2	Somewhat poorly drained
SaA	Schoharie silt loam	0% to 3%	68.06	1.7%	No	All areas are prime farmland	2.5	Moderately well drained
SaB	Schoharie silt loam	3% to 8%	12.35	0.3%	No	All areas are prime farmland	2.5	Moderately well drained
Sw	Swormville clay loam	0% to 3%	31.04	0.8%	No	Prime farmland if drained	1.0	Somewhat poorly drained
Ud	Urban land	N/A	296.31	7.4%	N/A	Not prime farmland	>6.6	N/A
Uh	Urban land- Churchville complex	0% to 3%	145.99	3.6%	No	Not prime farmland	>6.6	Somewhat poorly drained
UrA	Urban land-Lima complex	1% to 6%	35.32	0.9%	No	Not prime farmland	>6.6	Moderately well drained
Ut	Urban land–Odessa complex	0% to 3%	641.79	16.0%	No	Not prime farmland	>6.6	Somewhat poorly drained
Uu	Urban land- Schoharie complex	0% to 3%	262.31	6.5%	No	Not prime farmland	>6.6	Moderately well drained
Ux	Urban land-Wassaic complex	0% to 3%	39.29	1.0%	No	Not prime farmland	>6.6	Well drained
W	Water	N/A	103.63	2.6%	N/A	Not prime farmland	>6.6	N/A
WaA	Wassaic silt loam	0% to 3%	16.06	0.4%	No	All areas are prime farmland	2.3	Well drained
WaB	Wassaic silt loam	3% to 8%	61.06	1.5%	No	All areas are prime farmland	2.3	Well drained
Wd	Wayland soils complex	0% to 3%	2.64	0.1%	Yes	Not prime farmland	0.0	Poorly drained

Source: NRCS Web Soil Survey, Erie County, New York, Version 21, August 29, 2021. *https://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx*

G.3 ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

This section summarizes the potential impacts to geology, soils, and farmlands as a result of each alternative.

G.3.1 No Build Alternative

No geology or soil impacts would occur as part of the No Build Alternative.

G.3.2 Build Alternatives

G.3.2.1 Geology

The construction of both the LRT Build Alternative and BRT Build Alternative would require excavation of earth material. Surface construction of at-grade portions of both Build Alternatives would displace excavated soil deposits up to five feet (detailed further in Section 4.17 “Construction Effects”). A geological investigation conducted in 2022 and 2023 (see Appendix G3 of this Draft EIS) did not identify any fills within their samples that qualifies as contaminated fill. However, given the urban nature of the Project corridor, there is the potential for contaminated infill material. The excavated material from tunneling would be managed in accordance with a site-specific soil and materials management plan (SMMP).

From University Station, the LRT Build Alternative would extend underground for 0.8 miles under Kenmore Avenue and Niagara Falls Boulevard to the portal location. Construction of the underground portion of the LRT Build Alternative, running from the existing University Station, under Main Street and Kenmore Avenue would involve construction of two 16-foot-wide tunnels using the sequential excavation method (SEM) process. The SEM would utilize a combination of hard rock drill-and-blast methods to connect the tunneling section between Main Street and the existing end of the Metro Rail line, along with segments of cut-and-cover under Kenmore Avenue and Niagara Falls Boulevard. Drill-and-blast tunneling involves a systematic process of boring and explosive demolition that enables the efficient creation of tunnels. Specifically, the method involves drilling, where holes are meticulously drilled into the rock using advanced machinery tailored to the specific rock's hardness and composition, followed by blasting, where the holes are filled with explosives and detonated in a controlled manner. Cut and cover is the oldest method of tunnelling and involves the digging of a trench, construction of a tunnel, and then returning the surface to its original state. Approximately 193,000 cubic yards (CY) of material would be excavated to construct the tunnels for the LRT Build Alternative. All excavated material from tunneling would be managed in accordance with SMMP.

The vertical alignment of the SEM tunnels was selected to minimize placement of the tunnels in the unpredictable fractured Camillus, utilize the preferential ground properties of the Bertie formation, and minimize disturbance due to tunnelling including groundwater inflow and stability. Minimal grouting is anticipated and will be further assessed during preliminary and final design. Dewatering requirements and mitigation, during both construction and operation of the tunnels, has not been assessed at this time but will be included in the 30% design. In addition, potential settlement impacts and development of settlement mitigation plans will be further assessed during preliminary and final design.

Controlling groundwater is a significant consideration during the construction of cut and cover tunnels. The implementation of proper techniques can minimize the impact of potential settlement and the effect of ground water drawdown on the adjoining structures and facilities. These measures are assessed during the design phase and are implemented during construction and could include dewatering, watertight support of excavation system, permeation, jet grouting, and ground freezing.

Tunnel grouting and lining are also important methods in tunnel construction to ensure safety and stability. In general, grouting is used to prevent groundwater leakage and increase rock mass strength. It involves injecting a chemical agent or cement mass into the tunnel to fill cavities and achieve intimate contact between the geology and the tunnel liner. Lining refers to the tunnel structure that encloses the excavated area. It can be a single or double shell, and its design affects water tightness and ground pressure transfer. Grouting can be used to mitigate excessive deformation of tunnel linings in soft soils.

Due to the optimization of the alignment, systematic grouting is not anticipated; however, localized grouting may be required to support the tunnels and to reduce water ingress. Water ingress for the SEM tunnels will be addressed in the preliminary and final design with localized pumping, as required. The need for tunnel grouting and lining will be assessed further during the preliminary and final design of the tunnels.

Tunnel-wide dewatering for the SEM tunnels or construction of the cut and cover structure has not been assessed at this time but will be included in the 30% design. Localized dewatering will likely be required during construction to account for shallow groundwater table and weather conditions. There would be some groundwater inflow as a result of the cut and cover structure excavation; however, this will be mitigated with sumps for localized groundwater inflow. Impacts due to groundwater inflows, such as recharge rate or anticipated inflow volume, will be addressed during preliminary and final design. Tunnel lining will be designed to control water inflow.

The presence of sulfide gas will be investigated during preliminary and final design. If the investigation confirms the existence of sulfide gas, appropriate excavation methods and techniques will be implemented. Spoils from the excavation will be managed through the SMMP, and gas within the excavation's water laden with analytes that include sulfates, sulfides, and chlorides, will be treated as required by the local municipal sewer agency. Additionally, a ventilation and monitoring system will be designed in accordance with OSHA standards and all applicable state and federal requirements to ensure worker and public safety.

Cut and cover construction would also take place for the grade-separated portion of the LRT Build Alternative alignment through the intersection of Maple Road and Sweet Home Road (underlain by well-drained soils and Salina group shale, dolostone, salt, and gypsum), where the alignment would traverse under the intersection. Design of this portion of the LRT Build Alternative will include the same identification and assessment of geologic issues as presented for the tunnel portion from the existing University Station, under Main Street and Kenmore Avenue.

Operation of both the LRT Build Alternative and BRT Build Alternative would be primarily on or within the existing transportation right-of-way and use industry standard construction practices and follow required safety measures. As a result, neither Build Alternative would result in permanent adverse impacts on soil resources; however, the LRT Alternative does involve geologic impacts resulting from construction of the tunnels on UB South Campus and the underground segment at Maple Road and Sweet Home Road. At this time, impacts associated with tunnel construction and operation (i.e., settlement, dewatering, and hydrogen sulfide) have not been assessed but will be included in the preliminary and final design. Specifically, Project design will incorporate features that would minimize ground settlement, groundwater impacts, and the potential to damage structures or infrastructure or expose people to risk of injury. Project impacts are detailed further in Section 4.17, "Construction Effects."

G.3.2.2 Soils and Farmlands

The LRT Build Alternative and BRT Build Alternative would be located primarily on or within existing transportation use areas. Soil types present within the Project's area of disturbance are presented in Table 4.8-2, along with their farmland classification. The Project area of disturbance is defined as the areas where the Project alignment would be located, and the area immediately adjacent required for construction of the Project. The Project would expand beyond the current transportation right-of-way in some locations where there are soils mapped as prime farmland and farmland of statewide importance. However, the Project study area is classified as urbanized area and therefore, the FPPA does not apply.

None of the properties that would be acquired under the LRT Build Alternative and BRT Build Alternative are currently used for farming, and the Build Alternatives would not result in any effects on active farmland. Therefore, Article 25-AA of New York State's Agricultural and Markets Law does not apply.

In order to minimize and mitigate impacts to soils during construction, a Dust Control Plan that includes pro-active measures to prevent discharge of dust into the atmosphere will be developed. In areas not subject to traffic, products and materials including vegetative cover, mulch, and spray adhesives will be applied on soil surfaces to prevent airborne migration of soil particles. In areas subject to traffic, products and materials including water sprinkling, polymer additives, barriers, windbreaks, and wheel washing will be implemented. In addition, sediment and erosion controls and stormwater maintenance facilities will be developed in accordance with the 2010 Western New York Stormwater Coalition Stormwater Management Plan as well as all applicable state and federal permit requirements.

The construction of the LRT Build Alternative and BRT Build Alternative and related construction activities are anticipated to have temporary impacts to soil. Section 4.17 "Construction Effects," defines these temporary construction-related impacts and required mitigation measures.

Table G.3-1. Soils Located Within the Project Area of Disturbance

Class	Soil Name	Acres within the Area of Disturbance (LRT Build Alternative)	Acres within the Area of Disturbance (BRT Build Alternative)	Farmland Classification
CfB	Cayuga silt loam	6.47	6.47	All areas are prime farmland
CgB	Cazenovia silt loam	0	0	All areas are prime farmland
Ch	Cheektowaga fine sandy loam	0.71	0.71	Farmland of statewide importance
CoA	Churchville silt loam	3.29	3.32	Prime farmland if drained
CrA	Claverack loamy fine sand	0.16	0.16	All areas are prime farmland
CrB	Claverack loamy fine sand	0.99	0.99	All areas are prime farmland
CuB	Colonie loamy fine sand	0.60	0.60	All areas are prime farmland
Cv	Cosad loamy fine sand	11.21	11.21	Prime farmland if drained
ElA	Elnora loamy fine sand	0	0	All areas are prime farmland
ElB	Elnora loamy fine sand	0	0	All areas are prime farmland
FaB	Farmington channery loam	0	0	All areas are prime farmland
Ge	Getzville silt loam	0	0	Farmland of statewide importance
In	Ilion silt loam	0.53	0.54	Farmland of statewide importance
La	Lakemont silt loam	1.90	1.61	Farmland of statewide importance
Lb	Lakemont mucky silt loam	0	0	Farmland of statewide importance
LmA	Lima loam	0	0	All areas are prime farmland
Mh	Minoa very fine sandy loam	0	0	Prime farmland if drained
Ne	Newstead loam	0	0	Prime farmland if drained
Od	Odessa silt loam	5.27	5.77	Prime farmland if drained
OvA	Ovid silt loam	0	0	Prime farmland if drained
SaA	Schoharie silt loam	4.30	4.36	All areas are prime farmland
SaB	Schoharie silt loam	0.47	0.47	All areas are prime farmland
Sw	Swormville clay loam	0	0	Prime farmland if drained
Ud	Urban land	7.98	7.98	Not prime farmland
Uh	Urban land- Churchville complex	1.90	1.90	Not prime farmland
Ut	Urban land–Odessa complex	6.56	6.56	Not prime farmland
Uu	Urban land-Schoharie complex	0.23	0.23	Not prime farmland
Ux	Urban land-Wassaic complex	0	0	Not prime farmland
W	Water	0.28	0.28	Not prime farmland
WaA	Wassaic silt loam	0	0	All areas are prime farmland
WaB	Wassaic silt loam	0	0	All areas are prime farmland

Source: NRCS Web Soil Survey, Erie County, New York, Version 21, August 29, 2021. *https://websoilsurvey.sc.egov.usda.gov/app/WebSoilSurvey.aspx*

G.4 POTENTIAL MITIGATION STRATEGIES

The LRT Build Alternative will include incorporating a number of design measures into the final design, to avoid, minimize, or mitigate impacts to and from geologic or soil conditions, which Metro will implement during construction.

- Excavated material from tunneling would be managed in accordance with SMMP and any contaminated soils encountered during construction will be properly treated and managed in accordance to state and federal regulations.
- Localized dewatering will be required during construction to account for weather and localized conditions. Groundwater inflow resulting from tunnel construction will be mitigated with sumps for localized groundwater inflow. In addition, tunnel lining will be designed to control water inflow. Impacts due to groundwater inflows, such as recharge rate or anticipated inflow volume, will be addressed during preliminary and final design.

  Dewatering requirements and mitigation for both construction and operation of the tunnels has not been fully assessed at this time but will be included in the preliminary and final designs. In addition, potential settlement impacts and development of settlement mitigation plans as well as the need for tunnel grouting and/or lining will be further assessed during preliminary and final design.
- The presence of sulfide gas will be investigated during the preliminary and final design. If the investigation confirms the existence of sulfide gas, appropriate excavation methods and techniques will be implemented to mitigate potential impacts.
- To mitigate vibration impacts generated during excavation or other construction activities, Metro will implement a vibration monitoring program.
- Metro will implement soil erosion control measures where there is earth disturbance or pavement would be removed during construction to prevent adverse impacts to erodible soils. Construction will be performed in accordance with standards and specifications for selection, design, and implementation of erosion and sediment control practices contained in the latest version of New York State Guidelines for Urban Erosion and Sediment Control.

The BRT Build Alternative would not result in adverse impacts to geologic conditions. To minimize impacts to soil conditions, Metro will implement erosion control measures where pavement would be removed during construction to prevent adverse impacts to erodible soils. Construction will be performed in accordance with standards and specifications for selection, design, and implementation of erosion and sediment control practices contained in the latest version of New York State Guidelines for Urban Erosion and Sediment Control.