3.0 Affected Environment and Environmental Consequences

This section of the report describes the characteristics of the project site and summarizes the preliminary findings of environmental studies completed through Steps 5 and 6 of the PDP. This section also provides a preliminary assessment of the impacts of the project by impact category based upon the available data.

For the majority of the project length, only one Feasible Alternative was recommended for advancement from earliert studies. However, two options were carried forward for the I-74/I-75 interchange area – with and without local access ramps. The environmental impacts of the two options are virtually identical, as no differences in impacts are anticipated for the topics discussed in this chapter. The primary differences are in utility impacts, operational performance, engineering feasibility and cost, discussed in Chapter 2 and summarized in Chapter 5. Therefore, both options are anticipated to have the environmental impacts discussed in this chapter. Additional environmental studies, agency coordination, and public input will be used to refine the impact assessment prior to completion of the environmental document in Step 7.

3.1 Geology

Methodology. The field review consisted of making observations of the I-75 Mill Creek Expressway study area on January 8, 2005 and also on January 10, 2005. The field reconnaissance was limited primarily to the existing IR 75 right-of-way except for observations made along IR 74 and Spring Grove Avenue west of the Mill Creek. The information from this review is presented in the Geotechnical Red Flag Summary provided by CTL Engineering. The Red Flag Summary mapping is included in Appendix B – Environmental Data.

The existing IR 75 mainline structures and corresponding embankments and/or cut slopes were observed for signs of geotechnical concerns. In addition the existing mechanically stabilized earth retaining (MSE) and cantilever walls along with the grass median, where present, were also observed for geotechnical concerns. From the IR 75 roadway, no obvious signs of instability were noted on the slopes above or below IR 75 or within the retaining walls observed except for isolated signs of continuing seepage from the MSE wall along east side of IR 75.

Project Impacts. The I-75 Mill Creek Expressway study area lies within the Outer Bluegrass Region (Physiographic Regions of Ohio, *Ohio Department of Natural Resources, 1998*) that is characterized by the Mill Creek valley. Portions of IR 75 lie within filled areas on floodplains and also within cut/fill benches in and along the eastern Mill Creek valley wall. These benches lie within sedimentary rock, the overlying residual clay soils and also glacial deposits. The geology of the study area is characterized by soils formed from the underlying sedimentary rock (Kope and Point Pleasant Formations) along the hillside slopes and glacial deposits as a result of glacial episodes (Kansas and Illinoan). The residual clay soils formed from the weathered interbedded shale and limestone rock are typically thin and have low shear strength. Soils located within lower elevations along the Mill Creek valley terraces and floodplains consist primarily of glacial deposits (till, silts and lake-bed clays) that were eroded and re-deposited with the most recent glacial episode.

The mapping of the soils (Surficial Glacial Geology of the Ohio Portion of Cincinnati and Falmouth 30 x 60 Quadrangles, *Ohio Department of Natural Resources, 1998*) within and immediately adjacent to the existing IR 75, consists of a Wisconsin-age silt stratum less than 20 feet thick, with localized clay, sand, and gravel layers. In addition, lacustrine (lake-bed) deposits are found in low level slackwater terraces. These glacial soils are underlain by buried glacial valley fills consisting of interlayered medium-fine to fine-grained materials with fine sand predominating along with clay, silt and gravel interbeds on the order of 150 feet thick. To the west of IR 75, within the Mill Creek floodplain, the alluvial deposits range from silt to gravel and cobbles. To the east of IR 75, the surficial soils consist of Illinoan-age clay and glacial till that is capped by loess (silt) layer ranging from 3 to 5 feet in thickness.

The soil overburden is underlain by Ordovician-age sedimentary rock consisting of interbedded shale and limestone (Bedrock Geology of the Cincinnati West and Cincinnati East Quadrangles, *Ohio Department of Natural Resource, 1996*). The rock formations mapped along the project corridor along with their relative composition of interbedded shale and limestone consist of the following as mapped from south to north of the project limits:

- Point Pleasant Formation (60% limestone, 40% shale)
- Kope Formation (75% shale, 25% limestone)

In general, the rock encountered in this formation is similar and is typically distinguished by some or all of the following features; ratio of shale and limestone within the formation, thickness of shale or limestone beds, the type of bedding observed. The shale is generally described as being gray to bluish gray, weathers to light gray and/or yellowish gray, planar and/or lenticular, bedding that is thin to medium or thin to thick.

The depth of the glacial soils varies with location and is as deep as 100 to 200 feet below ground surface. Near the northern end of the project at the Norwood Lateral (SR 562) and IR 75 interchange the depth is on the order of 150 feet. Mapping of the bedrock topography (Bedrock Topography of the Cincinnati West and Cincinnati East, *Ohio Department of Natural Resources, 1996*) indicates the elevation of the rock surface ranges from about 425 feet at the southern limit of the project corridor and is relatively level till IR 75 crosses the Mitchell Avenue interchange where the rock surface falls in elevation to about 350 feet at the Norwood Lateral. Notably, the referenced mapping utilizes 50-foot contours, which are interpolated from topographic surface features, and widely spaced data points where water wells encountered rock.

According to the Ground Water Resources of Hamilton County (Ohio Department of Natural Resources, 1986), the majority of the project corridor yields ground water from wells in the underlying sand and gravel deposits. The description indicates the volume of water is typically on the order of less than 100 to 500 gallons per minute (gpm).

Original Construction Plan Observations. The following table summarizes the information reviewed by CTL.

Table 3-1: Historical Work within Study Area and related Geotechnical Issues

Roadway	Project	Type of Work	Date	Notes
IR 75 (US 25)	HAM-25-1.63	Structural Foundation Investigation	1977	Soil test borings for Abutment, Bridge No. HAM-25-0252 under US 52
IR 75 (US 25)	HAM-25-2.99	Soil Profile Drawings	1959 (?)	Soil profile for Original Construction of IR 75 (US 25) from north of Harrison Avenue to south of Central Pkwy
IR 75 (US 25)	Millcreek Expressway under Bates Avenue	Structural Foundation Investigation	1959	Soil test borings for Bates Avenue overpass
IR 75 (US 25)	Millcreek Expressway over Marshall Avenue	Structural Foundation Investigation	1959	Soil test borings for Millcreek Expressway over Marshall Avenue
IR 75 (US 25)	Millcreek Expressway under Hopple Street	Structural Foundation Investigation	1959	Soil test borings for Hopple Street over Millcreek Expressway. A buried canal (Miami & Erie) was encountered in the test borings. No problems encountered.
IR 75 (US 25)	HAM-25-2.96	Structural Foundation Investigation	1959	Soil test borings for carrying Ramp "U" over the Millcreek Expressway at Hopple Street Interchange. Soils conditions good however N-values less than 15 were noted for 40 to 70 feet.
IR 75 (US 25)	HAM-25-2.96	Structural Foundation Investigation	1959	Soil test borings for carrying Ramp "W" over the Millcreek Expressway at Hopple Street Interchange. Soils conditions observed in test boring were good.
IR 74	IR 74-1(10)16	Structural Foundation Investigation	1966	Soil test borings for carrying Ramp "N" over the relocated Ramp "N"
IR 75 (US 25)	Bridge No. HA-25-34 over Clifton Avenue	Structural Foundation Investigation	1953	Bridge site plan and pile driving logs
IR 74	HAM-74-1926L HAM-74-1926R	Structural Foundation Investigation	1966	Logs of Borings; Elmore to Millcreek Expressway
IR 74	HAM-74-1902	Structural Foundation Investigation	1966	Logs of Borings; Elmore to Millcreek Expressway
IR 75 (US 25)	Bridge No. HAM-75-0440 over Ramp "G"	Structural Foundation Investigation	1977	Logs of Borings
USR 127	Bridge No. HAM-27-0560L	Structural Foundation Investigation	1970	Logs of Borings US 27 southbound over US 127 (HAM-75-5.47)
USR 127	Bridge No. HAM-127-0521	Structural Foundation Investigation	1970	Logs of Borings
USR 27	Bridge No. HAM-27-0562	Structural Foundation Investigation	1969	Logs of Borings
IR 74	HAM-74-19.00	Structural Foundation Investigation	1968	Logs of Borings
IR 74	HAM-74-19.00	Structural Foundation Investigation	1966	Logs of Borings
IR 74	HAM-74-18.92	Structural Foundation Investigation		Logs of Borings, Ramp "P"
IR 75 (US 25)		Structural Foundation Investigation		Logs of Borings, relocating Spring Grove Ave. Bridge over Millcreek Expressway
IR 75 (US 25)	HAM-75-(5.42) (5.53) (5.97) (9.00)	Landslide Investigation	1976	Summary of slide limits and recommended corrective repairs, cross sections, test boring logs, and soil laboratory test results.
IR 75	Norfolk & Southern RR Third Mainline	Landslide Investigation (FMSM Engineers)	1995	Subsurface Investigation Report and recommended corrective repairs for slide below IR 75 north of Ludlow Avenue Overpass
IR 75	Norfolk & Southern RR Third Mainline	Landslide Investigation (HC Nutting)	1995	Slope movement above retaining wall no. 2 for third mail line and below IR 75 south of FMSM slide area. Conclusion was reactivation of old slide planes induced in 1986 during construction of the toe of slope for improvements and widening of the Mill Creek channel.

Summary. The most considerable geologic hazard within project study area is the occurrence of landslides. In general, landslides occur within the soil overburden. Due to the frequency, resulting damage and extensive cost of repairs, the area was studied and as a result a landslide susceptibility map developed for the City of Cincinnati. The types of landslides vary from relatively slow downward movement of soil (creep) to rapidly moving (mudslides). The occurrence of the landslides is attributed to several factors including geology, topography, ground water and most importantly the influence of construction.

Previous studies show that landslides within the study area primarily occur within the cut/fill slopes overlying the glacial deposits. The most notable areas where previous landslides have occurred are at the IR 75-Mitchell Avenue interchange, along eastern hillside slopes above IR 75 between IR 74 interchange at the base of Cincinnati State Community College, and the hillside above the Hopple Street interchange. Repairs were made in these areas and no obvious signs of continuing instability were observed in the field. The City of Cincinnati Department of Transportation and Engineering uses instrumentation along the IR 75 corridor that consists of inclinometers and/or piezometers that measure slope movements and ground water levels over time.

Repairs of previous landslides and retaining walls for grade changes consisted of soldier pile tie-back walls, rock fill buttresses, drilled pier with lagging retaining walls and conventional cantilever retaining walls. The depths to the underlying rock and groundwater levels are typically the most critical design factors. Mapping of the geology (type and depth of materials) along with the identification of previous landslide activity provide critical information that may influence the alignment alternatives in critical design areas. Refer to geotechnical Red Flag Mapping in Appendix B – Environmental Data.

Additional geotechnical information was collected as a part of the design process for Step 6. The locations of borings taken as a part of the project are plotted on the Plan/Profile Sheets within the Recommended Alternative Exhibits. The full text of the geotechnical report is available in the project file and in the *Value Engineering Review Submission.* Relevant factors are described in the engineering issues components of this document.