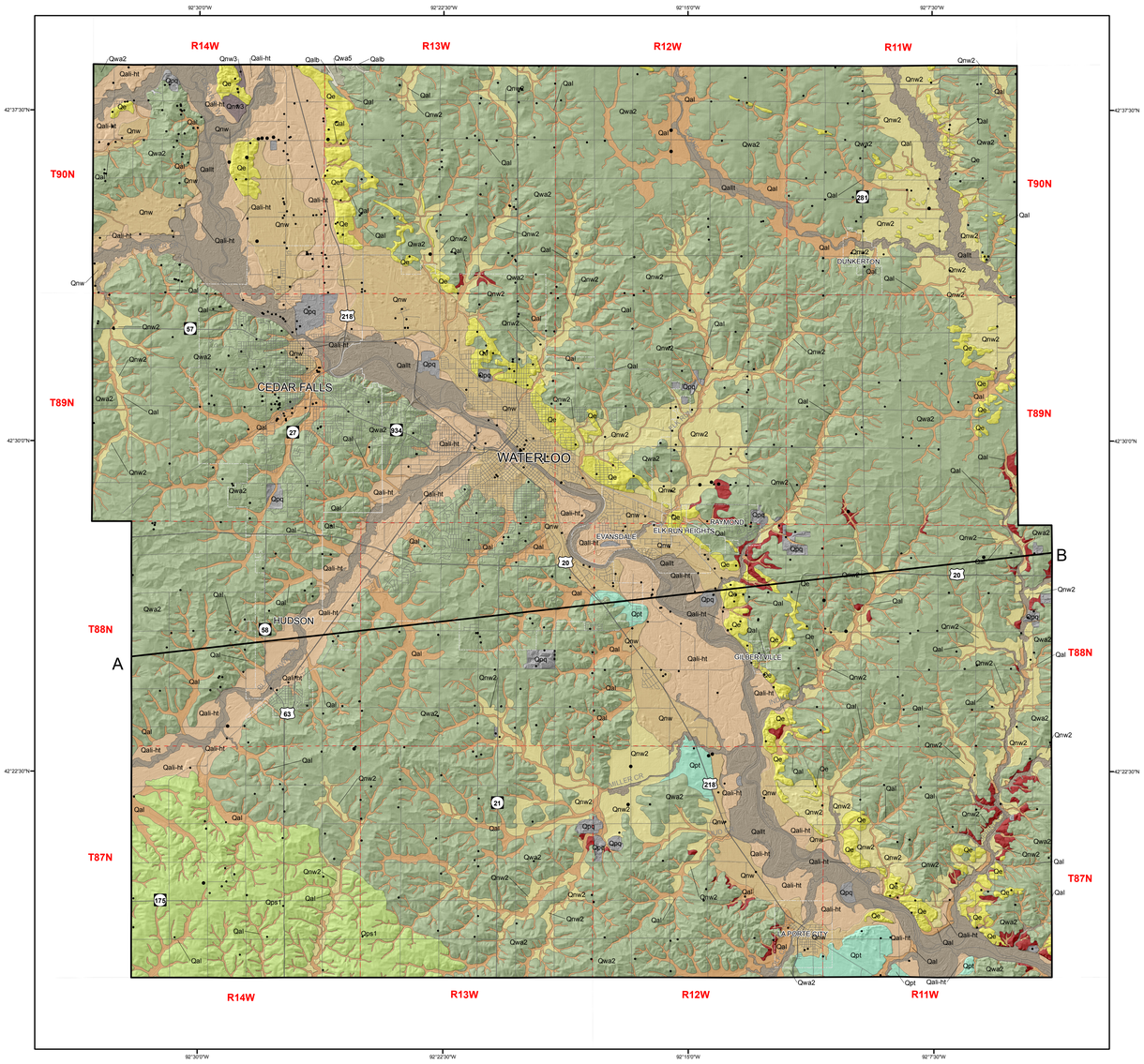
Surficial Geology of Black Hawk County, Iowa



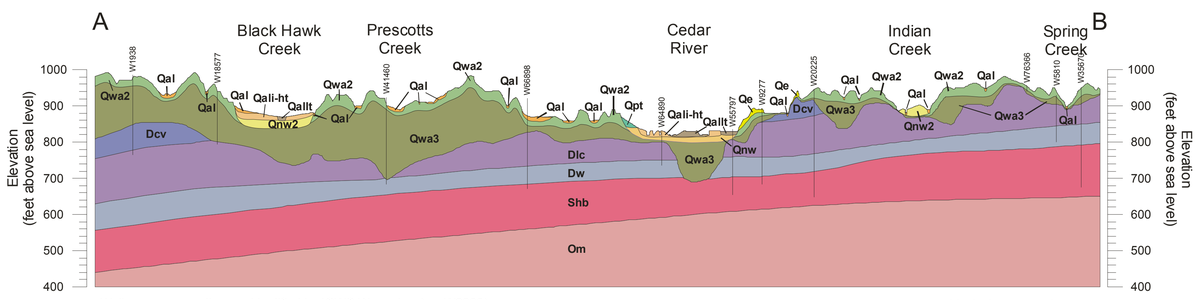
1:100,000

0 1 2 4 6 8 10 Miles

0 1 2 4 6 8 10 Kilometers

1 in
5°
WMM 2010 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

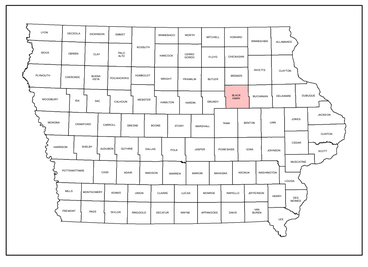
GEOLOGIC CROSS-SECTION A-B



Wells on cross-section are identified by IGWS W number (ex. W9308)
Records available at www.igsb.uiowa.edu\geosam

Vertical exaggeration 47x

Location Map



LEGEND

CENOZOIC

QUATERNARY SYSTEM

HUDSON EPISODE

Qal – **Alluvium** (DeForest Formation-Undifferentiated) Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous to calcareous, massive to stratified silty clay loam, clay loam, loam to sandy loam alluvium and colluvium in stream valleys, on hillslopes and in closed depressions. May overlie Noah Creek Formation, Wolf Creek or Albumett formations, or bedrock. Associated with low-relief modern floodplain, closed depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water table and potential for frequent flooding.

Qalb – **Alluvium Shallow to Bedrock** (DeForest Formation-Undifferentiated) Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous to calcareous, stratified silty clay loam, clay loam, loam to sandy loam alluvium and colluvium in stream valleys, on hillslopes and in closed depressions. May overlie Noah Creek Formation or Devonian carbonate bedrock. Bedrock surface is within 5 m (16 ft) of the land surface. Associated with low-relief modern floodplain, closed depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water table and potential for frequent flooding.

Qallt – **Low Terrace** (DeForest Formation-Camp Creek Mbr. and Roberts Creek Mbr.) Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous, stratified silty clay loam, loam, or clay loam. Associated with the modern channel belt of the Cedar and Wapsipinicon river valleys and their tributaries. Overlies the Noah Creek Formation. Occupies lowest position on the floodplain, ie. modern channel belts. Seasonal high water table and frequent flooding potential.

Qali-ht – **Intermediate-High Terrace** (DeForest Formation-Gunder Mbr.) Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous, silty clay loam to loam alluvium or colluvium that overlies the Noah Creek Formation. Occupies terrace and valley margin positions 1 to 2 m (3-7 ft) above the modern floodplain. May be mantled with 2 to 3 m (7-10 ft) of well sorted medium to fine sand derived from wind reworking of the alluvium. Seasonal high water table and low to moderate flooding potential.

HUDSON and WISCONSIN EPISODE

Qe – **Sand Dunes and Sand Sheets** (Peoria Formation-sand facies) Generally less than 3 m (10 ft) of yellowish brown, massive, calcareous loamy sand to fine sand. It may overlie yellowish-brown sand and gravel (Noah Creek Formation) or reworked unnamed loamy sediments associated with the Iowan Erosion Surface and/or it may overlie yellowish to grayish brown, often calcareous and fractured clay loam to loam diamicton of the Wolf Creek and Albumett formations.

Qnw2 – **Sand and Gravel** (Noah Creek Formation) Generally 2 to 8 m (6-26 ft) of yellowish brown to gray, poorly to well-sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel with few intervening layers of silty clay. A thin mantle of loess, reworked loess or fine-grained alluvium may be present. This unit includes silty colluvial deposits derived from the adjacent map units. In places this unit is mantled with 1 to 3 m (3-10 ft) of well sorted medium to fine sand derived from wind reworking of the alluvium. This unit encompasses deposits that accumulated in low-relief stream valleys during the Wisconsin and Hudson episodes. Seasonal high water table and some potential for flooding.

WISCONSIN EPISODE

Qpt – **Loess Mantled Terrace** (Peoria Formation –silt and/or sand facies) 2 to 8 m (7-26 ft) of yellowish brown to gray, massive, jointed, calcareous or noncalcareous, silt loam and intercalated fine to medium, well sorted, sand. May grade downwa nd to poorly to moderately well sorted, moderately to well stratified, coarse to fine feldspathic quartz sand, loam, or silt loam alluvium (Late Phase High Terrace) or may overlie a Farmdale Geosol developed in Pisgah Silt which in turn overlies a well-expressed Sangamon Geosol developed in poorly to moderately well sorted, moderately to well stratified, coarse to fine sand, loam, or silt loam alluvium (Early Phase High Terrace).

Qps1 – **Loess and Intercalated Eolian Sand** (Peoria Formation-silt facies) Generally 2 to 5 m (7-16 ft) of yellowish brown to gray, massive, fractured, noncalcareous grading downward to calcareous, silt loam and intercalated fine to medium, well sorted, sand. Sand is most abundant in the lower part of the eolian package. Overlies massive, fractured, loamy glacial till of the Wolf Creek or Albumett formations with or without intervening clayey Farmdale/Sangamon Geosol.

Qnw – **Sand and Gravel** (Noah Creek Formation) 3 m (10 ft) to more than 20 m (66 ft) of yellowish brown to gray, poorly to well-sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. In places mantled with 1 to 3 m (3-10 ft) of fine to medium, well sorted sand derived from wind reworking of the alluvium. This unit encompasses deposits that accumulated in stream valleys during the Wisconsin Episode.

Qnw3 – **Sand and Gravel Shallow to Bedrock** (Noah Creek Formation) 1 to 6 m (3-20 ft) of yellowish brown to gray, poorly to well-sorted, massive to well stratified, coarse to fine feldspathic quartz sand, pebbly sand and gravel. May be overlain by up to 3 m (10 ft) of silty alluvial material. In places mantled with fine to medium well-sorted feldspathic quartz sand derived from wind reworking of the alluvium. Fractured carbonate bedrock is less than 6 m (20 ft) below the land surface. The unit encompasses deposits that accumulated in river and stream valleys during the late Wisconsin as well as exhumed Pre-Illinois Episode deposits of the Wolf Creek and Albumett formations. Deposits may be slightly thicker along the Cedar River.

Qwa2 – **Loamy and Sandy Sediment Shallow to Glacial Till** (Unnamed erosion surface sediment) Generally 2 to 8 m (6-26 ft) of yellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty Iowan Erosion Surface sediment. Map unit includes some areas mantled with less than 2 m (7 ft) of Peoria Formation materials (loess and eolian sand). Overlies massive, fractured, firm, glacial till of the Wolf Creek and Albumett formations. Seasonally high water table may occur in this map unit.

Qwa5 – **Loamy and Sandy Sediment Shallow to Rock** (Unnamed erosion surface sediment) Generally 1 to 6 m (3-20 ft) of yellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty erosion surface sediment. Map unit includes some areas mantled with less than 3 m (10 ft) of Peoria Formation sand facies (eolian sand). Eolian sand may lie directly on top of bedrock in isolated areas. Overlies fractured Devonian carbonate rocks. Seasonal high water table may occur in this map unit.

PRE-ILLINOIS EPISODE

Qwa3 – **Till** (Wolf Creek or Albumett formations) Generally 3 to 73 m (10-240 ft) of very dense, massive, fractured, loamy glacial till of the Wolf Creek or Albumett formations with or without a thin loess mantle (Peoria Formation—less than 2 m) or thin loamy sediment mantle. An intervening clayey Farmdale/Sangamon Geosol may separate these units. This mapping unit is shown only in the cross-section and may be buried by unnamed erosion surface sediments, loess or alluvium.

Other Mapping Units

Qpq – **Pits and Quarries** Sand and gravel pits and rock quarries. Extent mapped as shown in county soil surveys and as identified on aerial imagery.

Bedrock – All areas of bedrock outcrop regardless of the unit are shown in red on the map, without any labels. Bedrock units are shown on the cross-section with the following descriptions:

PALEOZOIC

DEVONIAN SYSTEM

Dlgc – **Dolomite, Limestone, and Shale** (Lithograph City Formation) Middle to Upper Devonian. The total thickness of this map unit is up to 30 m (97 ft), consisting of interbeds of laminated lithographic and sublithographic limestone and dolomitic limestone with scattered to abundant brachiopods, corals and/or stromatoporoids. This unit occurs on some bedrock highs in the western one third of the county.

Dcv – **Limestone and Dolomite** (Coralville Formation) Middle Devonian. The thickness of this map unit varies between 0 and 31 m (0-100 ft) within the county. The lower Gizzard Creek Member is a fossiliferous carbonate with an abundant marine fauna and is dominated by dolomite and dolomitic limestone, becoming slightly argillaceous in part, with common calcite filled vugs; the low diversity fauna are characterized by crinoid debris and brachiopods and rare gastropods and bryozoans. The upper Iowa City Member is carbonate dominated, with laminated, brecciated, or evaporitic textures and some restricted marine faunas; the restricted marine fauna is dominated by favositid corals and/or branching and domal stromatoporoids. Stromatoporoid rich biostromal intervals occur within and around the map area.

Dlc – **Dolomite and Limestone** (Little Cedar Formation) Middle Devonian. The thickness of this map unit ranges from 0 to 40 m (0-130 ft) within the county. The map unit is dominated by slightly argillaceous to argillaceous dolomite and dolomitic limestone, usually vuggy and partially laminated and/or cherty. This unit is commonly fossiliferous and brachiopods are especially abundant in the lower portion. The upper portion (Hinkle Member) is a dense unfossiliferous lithographic or sublithographic limestone or dolomitic limestone, with laminated, pelleted, intraclastic, and bindseye fabrics.

Dw – **Dolomite, Limestone, Shale, and minor Sandstone** (Wapsipinicon Group) Middle Devonian. This map unit contains only the Pinicon Ridge Formation of the group, with a total thickness that varies from 0 to 24 m (0-80 ft) in the mapping area. It is dominated by laminated or brecciated, unfossiliferous limestone and dolomite that is sometimes sandy and cherty at its base. This unit occurs in some deeper bedrock valleys within the map area.

SILURIAN SYSTEM

Sl – **Limestone, Dolomitic Limestone and Dolomite** (LaPorte City Formation) upper Llandovery-lower Wenlock Lower Silurian. This unit is a limestone facies that correlates with the upper Hopkinton-lower Scotch Grove formations. These rocks are unconformably overlain by the Wapsipinicon Group. The total thickness of the map unit is up to 43 m (140 ft.). The formation is dominated by dense, fossiliferous limestone that is cherty to very cherty. Secondary lithologies include dolomitic limestone and dolomite. Minor lithologies include argillaceous to shaly chert residuum at the top of the interval (may be basal Wapsipinicon Group) and green-gray shale. This unit occurs in a bedrock valley within the southeastern part of the county.

Shb – **Dolomite with Chert** (Hopkinton and Blanding formations) Lower Silurian. The total thickness of this map unit is up to 49 m (160 ft.). The unit is fossil-moldic to vuggy dolomite and cherty to very cherty with nodular to bedded chert in the upper part of the Blanding Formation. Fossils include corals, brachiopods, and stromatoporoids. The Hopkinton rocks are generally more fossiliferous and less cherty than the underlying Blanding rocks. This unit occurs in some of the deeper portions of the bedrock valleys within the map area.

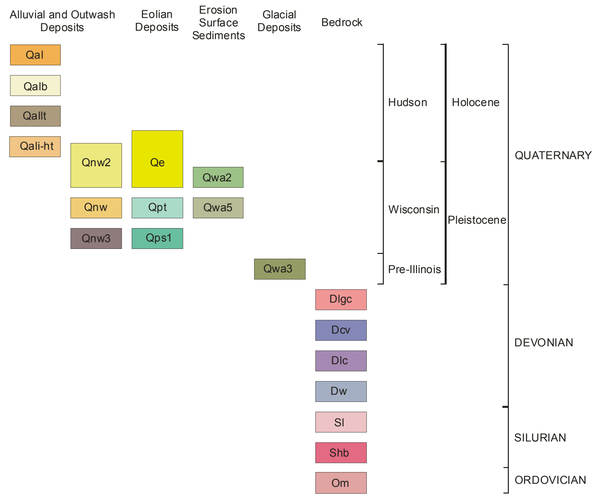
ORDOVICIAN SYSTEM

Om – **Shale and Dolomite** (Maquoketa Formation) Upper Ordovician. The total thickness of this map unit is up to 91 m (300 ft). The unit is comprised of interbedded green to gray dolomitic shale and shaly dolomite with minor limestone, variably cherty and variably fossiliferous with brachiopods and graptolites; thin brown to brown-gray dolomitic shale layers occur in the lower 10 m (33 ft). This unit occurs in the deepest portions of the bedrock valleys in the northeast part of the map area.

Drill Holes

Wells

CORRELATION CHART



SURFICIAL GEOLOGY OF BLACK HAWK COUNTY, IOWA

Iowa Geological and Water Survey
Open File Map OFM-13-4
September 2013

prepared by

Stephanie Tassier-Surine, Deb Quade, Robert Rowden, Robert McKay, Huaibao Liu, and James Giglierano

Iowa Geological and Water Survey, Iowa City, Iowa

Iowa Department of Natural Resources, Chuck Gipp, Director
Iowa Geological and Water Survey, Robert D. Libra, State Geologist

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Introduction to the Surficial Geology of Black Hawk County

Black Hawk County lies within the Iowan Erosion Surface (IES) Landform Region (Prior and Kohrt, 2006) in northeast Iowa. This area has been subjected to multiple periods of Quaternary glaciations and subaerial erosion. Generally speaking, the map area consists of unnamed loamy sediments (IES materials) of variable thickness overlying Pre-Illinoian glacial sediments. The Cedar and Wapsipinicon river valleys are filled with Wisconsin Episode Noah Creek Formation sand and gravel and mantled with younger Holocene terrace materials. These deposits are regionally extensive.

Previous surficial geologic mapping completed as part of the STATEMAP program includes the Gilbertville (Tassier-Surine et al., 2011) and Cedar Falls (Tassier-Surine et al., 2012) quadrangles in Black Hawk County and mapping to the north in adjacent Bremer County (Tassier-Surine et al., 2007, 2009, 2010). The only other regional surficial map of the area consists of the Des Moines 4 ° x 6 ° Quadrangle at a scale of 1:1,000,000 (Hallberg et al., 1991).

At least seven episodes of Pre-Illinoian glaciations occurred in this region between approximately 2.2 and 0.5 million years ago (Boellstorff, 1978a,b; Hallberg, 1980, 1986). Episodic erosion during the last 500,000 years has led to the destruction of pre-existing glacial landforms associated with Pre-Illinoian glaciations. A period of intense cold occurred during the Wisconsin full glacial episode from 21,000 to 16,500 years ago (Bettis, 1989). This cold episode and ensuing upland erosion led to the development of the distinctive landform recognized as the IES (Prior, 1976). A periglacial environment prevailed during this period with intensive freeze-thaw action, solifluction, strong winds, and a host of other periglacial processes (Walters, 1996). Surface soils were removed from the IES and the Pre-Illinoian till surface was significantly eroded; resulting in the development of a region-wide colluvial lag deposit referred to as a "stone line." Another common feature of this region are paha, isolated and uneroded topographic highs of loess-mantled Pre-Illinoian till with a directional orientation from northwest to southeast that exist as erosional outliers of the once higher and older landscape. Thick packages of stratified loamy and sandy sediments located low in the upland landscape and adjacent to streams are remnants of solifluction lobes associated with the formation of the IES. These materials can commonly be found along tributaries of the Cedar River.

Black Hawk County is covered by various Quaternary deposits with a maximum thickness of up to 73 m (240 ft) occurring in bedrock valleys. Surficial deposits of the map area are composed of five formations: DeForest, Noah Creek, Peoria, Wolf Creek, and Albumett formations as well as unnamed erosion surface sediments. Hudson age deposits associated with fine-grained alluvial and colluvial sediments are composed of the DeForest Formation which is subdivided into the Camp Creek, Roberts Creek, Gunder, and Corrington members. The Noah Creek Formation includes coarse sand and gravel associated with outwash from the Des Moines Lobe, as well as coarse to finer grained fluvial deposits associated with local stream and river valleys. Unnamed erosion surface sediments consist of reworked till and slopewash deposits associated with peri-glacial activity during the Wisconsin ice advance and may be up to 8 m (26 ft) thick. Peoria Formation eolian materials consist of fine sand and silt. A relatively thin (up to 3 m, 10 ft) loess mantle is present in the southwest portion of the county. Thick deposits of eolian sand are only present adjacent to the Cedar and Wapsipinicon river valleys. Additional eolian materials may be intermittently present mantling most other mapping units and are more abundant near stream valleys and on terraces. Pre-Illinoian glacial deposits in northeast Iowa consist of two formations: the younger Wolf Creek Formation and the Albumett Formation. The Wolf Creek Formation is divided into the Winthrop, Aurora, and Hickory Hills members (oldest to youngest). The Albumett Formation consists of several "undifferentiated" members. Pre-Illinoian till is not exposed in the map area but is mantled throughout Black Hawk County by IES materials, eolian sand, or alluvial sediments.

The Quaternary materials are underlain by Devonian and Silurian carbonate bedrock. Eleven bedrock outcrops (five quarries, five road cuts and one excavation for a lift station) were found in the map area during the field investigation. In the mapping area, Middle Devonian rocks form the major bedrock surface, and water wells are developed in both Devonian and Silurian rocks. Ordovician Maquoketa Formation rocks occur in the deepest portions of the bedrock valleys in the northeast part of the map area and directly underlie the Silurian rocks. The stratigraphy of the regional area has been intensively studied by Iowa Geological Survey staff (e.g., Belanski, 1927; Koch, 1970) and re-studied and correlated by Witzke and Bunker (1984), Witzke and others (1988, 2010), Anderson and Bunker (1998), Groves and others (2008), etc. Other studies in the area include Anderson and Garvin (1984) and Day and others (2006). The stratigraphic nomenclature and correlation in this map follow the stratigraphic framework proposed by Witzke and others (1988). The bedrock surface of two quadrangles within Black Hawk County was recently mapped by Rowden and others (2011 and 2012).

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Base map from Black Hawk County GIS data derived from IDOT Transportation Basemap files from 2009.

Iowa Geological and Water Survey digital cartographic file BlackHawkCo_SurficialGeology_final.mxd , version 9/17/13 (ArcGIS 10.1).
Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15, datum NAD83.

Map and cross-sections are based on interpretations of the best available information at the time of mapping.
Map interpretations are not a substitute for detailed site specific studies.