

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, Sheldon Creek, Wolf Creek or Alburnett formations or fractured Devonian carbonate bedrock. Associated with lowrelief modern floodplain, closed depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water table and potential for Oalb - Alluvium Shallow to Bedrock (DeForest Formation- Undifferentiated) - Variable thickness of less than 1 to 5 m (3-16 ft) of very dark grav 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 the 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 Qallt - Low Terrace (DeForest Formation- Camp Creek and Roberts Creek members) - 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 River valley. Overlies the Noah Creek Formation. Occupies the lowest position on the floodplain i.e. modern channel belts. Seasonal high water table and frequent flooding potential. HUDSON and WISCONSIN EPISODES 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 coarse-grained sand and gravel (Noah Creek Formation), or it may overlie yellowish to gravish brown, usually calcareous, stratified loam to silt loam to sandy loam diamicton (Sheldon Creek, Wolf Creek, or Alburnett formations). Usually restricted to a narrow belt along major river valley bottoms, adjacent uplands, or may occur as sand stringers or dunes overlying unnamed erosion surface sediments. Qdlgc - Loamy Sediments Shallow to Limestone, Dolomite, and Shale (DeForest, Noah Creek, or Lithograph City formations) - 0 to 2 m (0-7 ft) of vellowish brown to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty alluvial sediments that overlie the Middle to Upper Devonian bedrock surface. Bedrock outcrop may be present in isolated areas. A detailed description of the Lithograph City Formation is provided below. Qnw2 - Sand and Gravel (Noah Creek Formation) - 2 to 12 m (7-40 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. Along many valleys, a thin mantle of loess, reworked loess, or fine-grained alluvium (Qal) 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 fine to medium 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 Ops1 - Loess and Intercalated Eolian Sand (Peoria Formation- silt facies) - 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 lower part of the eolian package. Overlies massive, fractured, loamy glacial till of the Wolf Creek, Alburnett or Sheldon Creek formations with or without the intervening Qnw - Sand and Gravel (Noah Creek Formation) - Generally 5 to 15 m (16-49 ft), but there may be significantly thinner coarse-grained deposits in smaller stream valleys. Yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse to fine feldspathic quartzsand, pebbly sand and gravel. This unit encompasses outwash deposits that accumulated in valley trains during the Wisconsin Episode. Qnw3 - Sand and Gravel Shallow to Bedrock (Noah Creek Formation) - 1 to 3 m (3-10 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 2 m (7 ft) of silty alluvial sediments. 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 5 m (16 ft) below the land surface. The unit encompasses deposits that accumulated in river and stream valleys during the late Wisconsin as well as exhumed middle Wisconsin Sheldon Creek Formation materials and/or Pre-Illinois Episode deposits of the Wolf Creek and Alburnett formation Qwa2 - Loamy and Sandy Sediment Shallow to Glacial Till (Unnamed erosion surface sediment) - 1 to 3 m (3-10 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 2 m (7 ft) of Peoria Silt (loess). Overlies massive, fractured, firm glacial till of the Wolf Creek and Alburnett formations. Seasonally high water table may occur in this Qsc2 - Loamy Sediments Shallow to Glacial Till (Unnamed erosion surface sediment) - 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 1 m (3 ft) of Peoria Formation (silt or sand facies). Formed in and often overlies massive, fractured, slightly firm glacial till of the Sheldon Creek Formation. Qsc - Glacial Till (Sheldon Creek Formation- Undifferentiated) - Generally 3 to 6 m (10-20 ft) of yellowish brown to gray, calcareous, fractured to massive clay loam; at depth this unit can be variably textured and contain significant sand and gravel bodies. The upper 3 to 7 m (10-20 ft) may be periglacially altered. This unit overlies Pre-Illinois diamicton or Devonian carbonate bedrock. PRE-ILLINOIS EPISODE Qwa3 - Glacial Till (Wolf Creek or Alburnett formations) - Generally 3 to 49 m (10-215 ft) of very dense, massive, fractured, loamy glacial till of the Wolf Creek or Alburnett formations. This mapping unit can be buried by glacial sediments (Sheldon Creek Formation), unnamed erosion surface sediments, loess, or alluvium. This unit is shown only on the cross-section. MESOZOIC

CRETACEOUS SYSTEM Kd - Sandstone, Mudstone, and Siderite Pellets (Dakota/Windrow Formation) "Mid"-Cretaceous. This map unit occurs as scattered erosional outliers and is only found occasionally in well cuttings and identified by the soil survey of Floyd County in the mapping area. This formation comprises a non-marine fluvial and pedogenic facies succession characterized by a variety of lithologies, commonly dominated by quartzose sandstones with secondary chert/quartz conglomerates, in part cemented by iron oxides. The thickness of this unit is variable, but is usually less than 6 m (20 ft). This unit is shown only on the PALEOZOIC **DEVONIAN SYSTEM**

Dlgc - Dolomite, Limestone, and Shale (Lithograph City Formation) Middle to Upper Devonian. This map unit dominates the bedrock surface except the large bedrock valley in the north and the areas with Cretaceous deposits in the southwest portion of the quadrangle, with a maximum thickness up to 30 m (100 ft). It consists of limestone, dolomitic limestone, and dolomite. This unit is usually characterized by interbeds of laminated lithographic and sublithographic limestone and dolomitic limestone, in part argillaceous or with some green to greyish shale. "Birdseye" structures, vugs and calcite vug-fills are common. Some intervals are fossiliferous and stromatoporoid-rich. This unit is shown only on the cross-section and not on the map. Dcv - Limestone and Dolomite (Coralville Formation) Middle Devonian. This map unit occurs on the bedrock surface along the bedrock valleys in the north portion of the quadrangle. The thickness of this map unit mostly varies between 12 and 21 m (40-70 ft) in the mapping area. It is dominated by limestone, dolomitic limestone, and dolomite, in part laminated, argillaceous, or shaly. Brachiopods, echinoderm debris and corals usually occur in the Dlc - Dolomite, Limestone and Shale (Little Cedar Formation) Middle Devonian. This map unit only occurs on the bedrock surface within the bedrock valley in the east-central part of the quadrangle. The thickness of this formation ranges from 26 to 40 m (85-130 ft) in the mapping area. This unit is lominated by slightly argillaceous to argillaceous dolomite and dolomitic limestone, usually vuggy and partially laminated and/or cherty. A shaly layer with a thickness around 3 to 6 m (10-20 ft) commonly occurs in the upper part of the formation. This unit is commonly fossiliferous, and brachiopods are especially abundant in the lower portion. This unit is shown only on the cross-section and not on the map. Dpr - Dolomite and Dolomitic Limestone (Pinicon Ridge Formation) Middle Devonian. This formation consists of dolomite and dolomitic limestone with varying textures (shaly, laminated, brecciated, sandy, and/or cherty). The thickness of this unit usually ranges from 5 to 14 m (15-5 ft). Compared to other Devonian strata in the mapping area, this formation is usually unfossiliferous. This unit is shown only on the cross-section and not on the map.

onglomeratic with reworked Ordovician chert clasts. This unit is shown only on the cross-section and not on the map. OTHER FEATURES **Qpq - Pits and Quarries -** Sand and gravel pits and rock quarries. Extent mapped as shown on the county soil survey and as identified on aerial imagery. Water features - Rivers, lakes and small ponds. Extent mapped as shown in the county soil survey and as identified on aerial imagery.

CORRELATION OF MAP UNITS Iowan Surface heldon Creek Till Plain Pre-Illinoian Till Plain Shallow Rock Qallt Qal Qallt Qalb Hudson Qe ludson and Qnw2 Qps1 Qnw3 Qnw Qsc2 Qsc* Qwa2 Pre-Illinois Qwa3* Kd* Cretaceous Dlgc* Qdlgc Dcv* Dlc* Devonian Dsp*

Adjacent 7.5' Quadrangles FLOYD COLWELI ORCHARD ROSEVILLE CHARLES BASSETT GREENE NASHUA NW NASHUA

Location Map



Introduction to the Surficial Geologic Map of the Charles City 7.5' Quadrangle, Floyd County, Iowa

The Charles City 7.5' Quadrangle of Floyd County is located within the Wisconsin-age Iowan Surface landform region of north-central Iowa which is defined by large scale erosion (Prior and Kohrt, 2006). The current post-settlement landscape, which is heavily tilled, is being re-shaped by frequent precipitation and gradual overland water and sediment movement and dissected by less frequent large rainfall events (Cruse, et al., 2006). Quaternary deposits in this quadrangle generally vary in thickness from 9 to 27 m (30-90 ft), but may reach a maximum thickness of 71 m (235 ft) in bedrock valleys occurring in the east-central and northeast parts of the mapping area.. The map area is dominated by loamy sediments (unnamed erosion surface sediment) of variable thickness overlying Pre-Illinoian glacial sediments, but may also be overlying Wisconsin-age Sheldon Creek Formation glacial sediments or shallow rock. These deposits are regionally extensive as shown on the Des Moines 4° x 6° Quadrangle at a scale of 1:1,000,000 (Hallberg et al., 1991). Areas of bedrock outcrop or areas with less than 4.5 m (15 ft) of loamy material over rock are present, especially along the Cedar River. Statewide bedrock geologic maps by Hershev (1969), and most recently by Witzke and others (2010). illustrated the improved understanding of the complex distribution of geologic units at the bedrock surface across north-central Iowa, including Floyd County. Previous surficial geologic mapping completed as part of the STATEMAP program near the project area includes Surficial Geology of Worth County, Iowa (Quade et al., 2012), Surficial Geology of the Osage Quadrangle (Tassier-Surine et al., 2014a), Surficial Geology of the St. Ansgar Quadrangle (Tassier-Surine et al., 2014b). Surficial Geology of the New Haven Quadrangle (Kerr et al., 2015), and Surficial Geology of Cerro Gordo County, Iowa (Tassier-Surine et al., 2015). Iowa has a rich and complex geologic history punctuated by at least seven periods of glaciation between 2.6 million to 500,000 years before present (Boellstorff, 1978a, b; Hallberg, 1980, 1986). In this map area, Pre-Illinois Episode glacial deposits and associated buried soils may be overlain by much

younger Wisconsin-age glacial deposits. During the earlier and middle Wisconsin, ice advances dating from approximately 40,000 to 26,000 years before present deposited glacial materials throughout the map area. In Iowa, this glacial deposit is formally recognized as the Sheldon Creek Formation (Bettis et al., 1996, Bettis, 1997) and in earlier literature is referred to as the "Tazewell till" (Ruhe, 1950). Results from this mapping program and others in Worth and Cerro Gordo counties indicate that the Sheldon Creek glacial materials extend much farther east than was previously thought. A period of intense cold occurred during the Wisconsin full glacial episode from 21,000 to 16,500 years before present (Bettis, 1989). This cold episode and ensuing upland erosion led to the development of the distinctive landform recognized as the Iowan Surface (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). As a result, soils were stripped from the Iowan Surface, and the Sheldon Creek and Pre-Illinois till surfaces were significantly eroded, resulting in the development of a region-wide colluvial lag deposit referred to as a "stone line." 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 Iowan Surface.

Surficial deposits within the map area are composed of six formations: DeForest, Noah Creek, Peoria, Sheldon Creek, Wolf Creek, and Alburnett formations, as well as unnamed erosion surface sediments. Hudson-age DeForest Formation deposits include fine-grained alluvial, organic, and colluvial sediments that are subdivided into the Camp Creek, Roberts Creek, Gunder, Corrington, Flack, and Woden members. The Noah Creek Formation includes coarse sand and gravel 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 periglacial activity during the Wisconsin ice advance. Areas of Peoria Formation eolian materials are intermittently present mantling most other mapping units, and are more abundant near stream valleys. Sheldon Creek Formation glacial deposits are undifferentiated and occur in northwest and north-central Iowa. The maximum extent of these deposits is still not fully understood. However, these deposits were not found in the southern portion of the mapping area based on current data. Pre-Illinoian glacial deposits in Iowa consist of two formations: the younger Wolf Creek Formation and the Alburnett Formation. The Wolf Creek Formation is divided into the Winthrop, Aurora, and Hickory Hills members (oldest to youngest). The Alburnett Formation consists of several "undifferentiated" members. Four bedrock mapping units (the Cretaceous Dakota/Windrow Formation, and the Devonian Lithograph City, Coralville, and Little Cedar formations of the Cedar Valley Group) are present at the bedrock surface in the quadrangle. The Lithograph City Formation occurs at the bedrock surface over

most of the mapping area while the Coralville and Little Cedar formations occur within bedrock valleys. A total of 17 bedrock outcrops including a few abandoned quarries, which are mostly along the Cedar River and its tributaries, have been accessed and studied in the map area. The Devonian rocks are dominated by carbonates varying between limestone and dolomite, accompanied with minor shale. The Cretaceous Dakota/Windrow Formation is characterized as a reddish, shaly sandstone with siderite pellets. References Bettis, E.A., III, 1989, Late Quaternary history of the Iowa River Valley in the Coralville Lake area in Plocher, O.W.,

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> Base map from USGS Charles City 7.5' Digital Raster Graphic (IGS GIS file DRGC34.tif) which was scanned from the Charles City 7.5' Topographic Quadrangle map, published by US Geological Survey in 2013 Land elevation contours (10' interval). Iowa Geological Survey digital cartographic file CharlesCity_SurficialGeology.mxd, version 6/30/16 (ArcGIS 10.3) Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15, datum NAD83. The map and cross-section 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. Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G15AC00242. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or

implied, of the U.S. Government.

Tassier-Surine, S., Quade, D., Streeter, M., Kerr, P., Rowden, R., McKay, R., Liu, H., Clark, R., and Galer, R., 2014b, Surficial Geology of the St. Ansgar Quadrangle, Mitchell County, Iowa: Iowa Geological Survey, Open File Map OFM-