

rangle			Qal - Alluvium (calcareous, massi	ve to stratifie
ð			depressions. May floodplain, closed Qalb - Alluvium noncalcareous to o	overlie Noal depressions, Shallow to B
92°47'30"W 92°45'0"W			depressions. May surface. Associate table and potential Qallt - Low Terra	overlie the N ed with low-re l for frequent
	− 43°0′0″N		brown, noncalcare or DeForest Form and frequent flood Qali-ht –Interme	ation. Occupi ling potential.
Qnw2			ft) of very dark gr terrace position in	the Shell Roo
250TH ST 1050- 1050- 250TH ST Qwa2 Qnw2		Qe	Qe - Sand Dunes fine sand. It occur Qkd - Loamy See brown to gray, ma outcrop may be pr	s as sand strir diments Sha ssive to weak
Qwa2		Qdsr	Qdsr - Loamy Se brown to gray, ma outcrop is extensiv	ediments Sha
Qal W ³ Cr Qalb Flood Qd/gc Qd/gc Qwa2		Qdlgc	Qdlgc - Loamy S yellowish brown bedrock surface. E Qnw2 - Sand and	to gray, mass Bedrock is ext
		Qnw2	to fine feldspathic or fine-grained all that accumulated i	quartz sand, uvium (Qal)
Qdsr 260TH ST Qal		Qnw 11	Qnw T1 - Sand a to fine feldspathic carbonate, but may that accumulated i	e quartz sand, y overlie Pre-
Qwa2 Qdsr Qdsr Onw2 Odar		Qnw 12	Qnw T2 - Sand a to fine feldspathic carbonate, but may that accumulated i	e quartz sand, y overlie Pre-l
Qal Qnw2 Qnw2 Qdlgc		Qnw3	Qnw3 - Sand and well stratified, coa with fine to mediu 5 m (16 ft) below	d Gravel Sha arse to fine fel um well-sorted
Qnw3 Qdlgc 974		Qwa2	Qwa2 - Loamy S stratified, well to Formation (silt or	ediments Sha poorly sorted
Qalb		Qwa3	Qwa3 - Glacial T Creek or Alburnet	ill (Wolf Cre tt formations.
Qwa2 Qwa2 Qal Qnw2 Qnw2 Qwa2 Qwa2 Qwa2 Qwa2 Qwa2 Qwa2 Qwa2 Qw			the cross-section.	
Qdsr	−42°57'30″N		Kd - Sandstone, I is only identified succession charac	by the soil sterized by a
Qdsr. Qnw3			cemented by iron on the cross-section	oxides. The tl
280TH ST QQS- QdGs QdGs Qdlgc Qdlgc Qdlgc Qdlgc Qdlgc Qdlgc		Dsr	Dsr - Limestone, the quadrangle. It thickness less thar	usually has a
Qa			argillaceous carbo part of the unit. Th Dlgc - Limestone quadrangle. The th	onates. Fossili his unit is only e, Dolomite, a
Qdsr Qalb Qd/gc Qnw2		2.90	shale. This unit is "Birdseye" structu section	usually chara
Qalb Qdlgc Qdsr Qdlgc Qnw2		Qpq	Qpq - Pits and Q	uarries - San
290TH ST Out Oallb			Water features - New drill holes fo IGS GEOSAM d	or this map p
Qdsr Qdlgc Qalb Qdsr Qdlgc Qalb A		W78226	Wells used for ge	ologic cross-
Qwa2 Qal Qdlgc Qnw2 Qnw2				
Qdsr Qdlgc				
CO HWY B67				CO
	− 42°55′0″N			Till
Qalb		Alluvium	Qa	1
gc log Qwa2		Eolian Colluvium		Qr
Qnw2 FLOYD LINE ST		Outwash Erosion Surface		Qnv Qv
Qal Qdlgc Qdlgc Qnw2		Glacial		Qı
A THIN I A DE TRAER ST QCIIGC 105TH ST				
Qalb Qwa2		Bedrock		
			*units only s	hown on 1
Qdlgc Qal				
ON TON BET				
Qdlgc TT UTT 2 To The Content of the		Adja	cent 7.5' Quad	angles
A Qdigc Qdsr	━42°52′30″N	ROCKFORD	ROSEVILLE	CHARLES
		AUREOLA	GREENE	NASHUA
92°47'30"₩ 92°47'30"₩				
3 4 Miles	IILS °6′	DUMONT NORTH	ALLISON	CLARKSVI
Z M	NILS			
3 4				

GEOLOGIC CROSS-SECTION A-A'

W31255 Qnw2 Qal Qal Qwa2 Qal Qal Qwa2 Qal Qal Qwa2 Qnw2 Qal Qal Qwa2 Qnw T2 Qallt Qal Qwa2 Qnw T2 Qallt Qal Qwa2 Qnw T1 Qal Qal Qwa2 Qnw T1 Qal Qal Qwa2 Qnw T1 Qal Qal Qwa2 Qnw T1 Qal Qal Qwa2 Qnw T1			Shell Rock	River			_{Kd} Qwa3 Kd	
Qal Qal Qwa2 Qal Qal Quw2 Qal Qal Quw2 Qal Qal Dsr Dlgc	W3 ⁻		W85875	W78571	W75446	\bigcirc	Kd Qwa3 Kd	C
	va3	Qal Qal Qwa2	Qal	Qallt Qal		Qdigc		



DeForest Formation- Undifferentiated) - Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, noncalcareous to sive to stratified silty clay loam, clay loam, loam to sandy loam alluvium and colluvium in stream valleys, on hillslopes and in closed voverlie Noah Creek, Wolf Creek or Alburnett formations or fractured Devonian carbonate bedrock. Associated with low-relief modern I depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water table and potential for frequent flooding. Shallow to Bedrock (DeForest Formation- Undifferentiated) - Variable thickness of less than 1 to 5 m (3-16 ft) of very dark gray to brown, calcareous, stratified silty clay loam, clay loam, loam to sandy loam alluvium and colluvium in stream valleys, on hillslopes and in closed overlie the Noah Creek Formation, Devonian carbonate bedrock, or Cretaceous bedrock. Bedrock surface is within 5 m (16 ft) of the land ed with low-relief modern floodplain, closed depressions, modern drainageways or toeslope positions on the landscape. Seasonal high water l for frequent flooding. race (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 reous, stratified silty clay loam, loam, or clay loam. Associated with the modern channel belt of the Shell Rock River. Overlies the Noah Creek nation. Occupies the lowest position on the floodplain, i.e. modern channel belts in the Shell Rock River Valley. Seasonal high water table ediate Terrace (DeForest Formation- Camp Creek, Roberts Creek, and Gunder members) - Variable thickness of less than 1 m to 5 m (3-16 gray to brown, noncalcareous, stratified silty clay loam to loam that overlies the Noah Creek Formation. Occupies the intermediate to high n the Shell Rock River Valley. Seasonal high water table and frequent flooding potential. HUDSON and WISCONSIN EPISODE s and Sand Sheets (Peoria Formation- sand facies) - Generally less than 3 m (10 ft) of yellowish brown, massive, calcareous loamy sand to rs as sand stringers or dunes overlying Wisconsin aged outwash, unnamed erosion surface loamy sediments, or bedrock. ediments Shallow to Sandstone and Mudstone (DeForest, Noah Creek, or Dakota/Windrow formations) - 0 to 2 m (0-7 ft) of yellowish assive to weakly stratified, well to poorly sorted loamy, sandy and silty sediment that overlies the "Mid"-Cretaceous bedrock surface. Bedrock resent in isolated areas. A detailed description of the Dakota/Windrow Formation is provided below.

diments Shallow to Limestone, Dolomite, and Shale (DeForest, Noah Creek, or Shell Rock formations) - 0 to 2 m (0-7 ft) of yellowish assive to weakly stratified, well to poorly sorted loamy, sandy and silty sediment that overlies the Upper Devonian bedrock surface. Bedrock ive in areas. A detailed description of the Shell Rock Formation is provided below. Sediments Shallow to Limestone, Dolomite, and Shale (DeForest, Noah Creek, or Lithograph City formations) - 0 to 2 m (0-7 ft) of to gray, massive to weakly stratified, well to poorly sorted loamy, sandy and silty sediment that overlie the Middle to Upper Devonian Bedrock is extensive in the mapping area. A detailed description of the Lithograph City Formation is provided below. 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 e quartz sand, pebbly sand and gravel with few intervening layers of silty clay. Along many valleys, a thin mantle of loess, reworked loess, luvium (Qal) may be present. This unit includes silty colluvial deposits derived from the adjacent map units. This unit encompasses deposits in low-relief stream valleys during the Wisconsin and Hudson episodes. WISCONSIN EPISODE and Gravel (Noah Creek Formation) - Up to 17 m (56 ft) of yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse quartz sand, pebbly sand and gravel. This unit represents the older, higher terrace. In the map area this unit usually overlies Devonian v overlie Pre-Illinois Episode diamicton of the Wolf Creek or Alburnett formations in isolated areas. This unit encompasses outwash deposits

in valley trains during the Wisconsin Episode. and Gravel (Noah Creek Formation) - Up to 10m (33 ft) of yellowish brown to gray, poorly to well sorted, massive to well stratified, coarse c quartz sand, pebbly sand and gravel. This unit represents the younger, lower terrace. In the map area this unit usually overlies Devonian voverlie Pre-Illinois Episode diamicton of the Wolf Creek or Alburnett formations in isolated areas. This unit encompasses outwash deposits in valley trains during the Wisconsin Episode. I 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 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 dium well-sorted feldspathic quartz sand derived from wind reworking of the alluvium. Fractured carbonate or sandstone bedrock is less than the land surface. ediments Shallow to Glacial Till (Unnamed erosion surface sediment) - 1 to 6 m (3-20 ft) of yellowish brown to gray, massive to weakly poorly sorted loamy, sandy and silty erosion surface sediment. Map unit includes some areas mantled with less than 1 m (3 ft) of Peoria sand facies). Overlies massive, fractured, slightly firm glacial till of the Wolf Creek or Alburnett formations.

PRE-ILLINOIS EPISODE Till (Wolf Creek or Alburnett formations) - Generally 3 to 15 m (10-50 ft) of very dense, massive, fractured, clay loam glacial till of the Wolf tt formations. This mapping unit can be overlain by unnamed erosion surface sediments, outwash, or alluvium. This unit is shown only on MESOZOIC

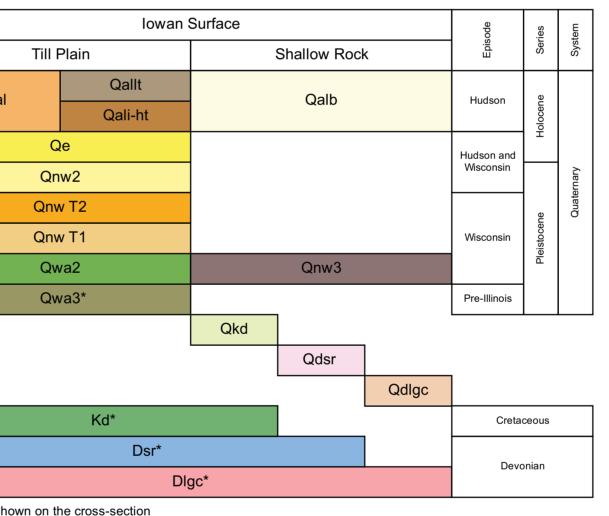
CRETACEOUS SYSTEM Mudstone, and Siderite Pellets (Dakota/Windrow formations) "Mid"-Cretaceous. This map unit occurs as scattered erosional outliers and d by the soil surveys in the northwestern part of the mapping area. This formation comprises a non-marine fluvial and pedogenic facies cterized by a variety of lithologies, commonly dominated by quartzose sandstones with secondary chert/quartz conglomerates, in part n oxides. The thickness of this unit is variable, but is usually less than 6 m (20 ft) when present in the mapping area. This unit is only shown PALEOZOIC DEVONIAN SYSTEM Dolomite, and Shale (Shell Rock Formation) Upper Devonian. This map unit occurs on the bedrock surface mainly in the northern part of usually has a thickness of 9 to 20 m (30-65 ft), but an outcrop of this unit just beyond the northern border of the quadrangle shows a total 1.3 m (10 ft). This formation is characterized by limestone, dolomitic limestone and dolomite, with minor gray to light green shale and/or

nates. Fossiliferous layers, especially characterized by abundant bryozoans, brachiopods and stromatoporoids, commonly occur in the lower his unit is only shown on the cross-section. , Dolomite, and Shale (Lithograph City Formation) Middle to Upper Devonian. This map unit forms most of the bedrock surface of the hickness of this unit is usually 21 to 30 m (70-100 ft) in the mapping area. It consists of limestone, dolomitic limestone, dolomite, and minor s usually characterized by interbeds of laminated lithographic and sub-lithographic limestone and dolomitic limestone, in part argillaceous. ures, vugs and calcite vug-fills are common. Some intervals are fossiliferous and stromatoporoid-rich. This unit is only shown on the cross-**OTHER FEATURES** Quarries - Sand and gravel pits and rock quarries. Extent mapped as shown on the county soil surveys and as identified on aerial imagery.

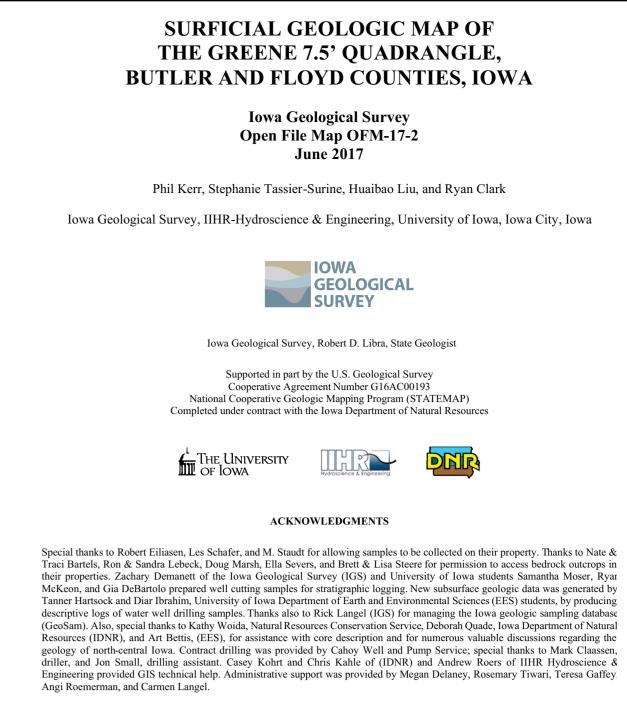
Rivers, lakes and small ponds. Extent mapped as shown in the county soil surveys and as identified on aerial imagery. or this map project

lata points - records available at www.iowageologicalsurvey.org eologic cross-section

CORRELATION OF MAP UNITS



Location Map HARLES CIT NASHUA NW LARKSVILL



Introduction to the Surficial Geologic Map of the Greene 7.5' Quadrangle, **Butler and Floyd Counties, Iowa**

The Greene 7.5' Quadrangle is located in north-central Iowa on the Wisconsinan-age Iowan Surface (IS) landform region (Prior and Kohrt, 2006). It lies within Butler and Floyd counties. The map area is dominated by unnamed loamy sediments (IS materials) of variable thickness overlying Pre-Illinoian Wolf Creek or Alburnett formation glacial sediments and large areas of shallow Devonian carbonate bedrock and Cretaceous sandstone. Extensive areas of bedrock outcrop or areas with less than 5 m (16 ft) of loamy material over rock are present, especially in upland positions and in the Flood Creek Valley. The thickness of Quaternary deposits in the Greene Quadrangle is generally less than 6 m (20 ft), though deposits reach a maximum thickness of 36 m (118 ft) in a bedrock valley found in the south

western part of the mapping area. Iowa has a rich and complex Quaternary geologic history punctuated by at least seven periods of glaciation between 2.6 million to 500,000 years ago (Boellstorff, 1978a,b; Hallberg, 1980, 1986). In the map area, Pre-Illinois Episode glacial deposits and associated buried soils have been subaerially exposed since deposition. The most recent glacial advance of the Des Moines Lobe did not extend into Butler and Floyd counties, but its influence is evident in the development of river valleys and periglacial alteration of the landforms. Statewide bedrock geologic maps by Hershey (1969), and most recently by Witzke and others (2010), illustrate the improved understanding of the complex distribution of geologic units at the bedrock surface across north-central Iowa, including the study area. Previous surficial geologic mapping completed as part of the STATEMAP program in the area include The Surficial Geology of Cerro Gordo County (Tassier-Surine et al., 2015), The Surficial Geology of Mitchell County (Tassier-Surine et al.,

2016), The Surficial Geology of The Charles City Quadrangle (Streeter et al., 2016), and The Surficial Geology of the Orchard Quadrangle (Kerr et al., 2016). Results from previous mapping projects in Worth, Cerro Gordo, and Mitchell counties indicate that the Sheldon Creek glacial materials extend much farther east than were previously mapped. However, there is no evidence for this advance in this mapping area. Samples collected and analyzed during this project indicated glacial diamiction from Pre-Illinoian deposition. 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 IS (Prior, 1976). A periglacial environment prevailed during this period with intensive freeze-thaw action, solifluction, strong winds, and a host of other periglacial processes (Betts, 1997; Walters, 1996). As a result, surface soils were removed from the IS and the Pre-Illinoian till surface was significantly eroded. 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 IS. These materials can be found along Flood Creek, Coldwater Creek, and

smaller drainages. As the Des Moines Lobe melted, large pulses of water carried outwash away from the ice margin and deposited sand and gravel bodies along river valleys that drained melt water. The Shell Rock River has terraces formed from this Wisconsin aged outwash. The soil surveys of Floyd and Butler counties (Buckner, 1974; Voy, 1975;) provided information regarding shallow rock areas, helped to guide valley mapping units, and defined slope areas where glacial till is exposed. Subsurface information was mostly derived from the analysis of water well cutting samples reposited by the IGS. Lithologic and stratigraphic information from these samples are stored in the online GeoSam database of the IGS. Additionally, IGS drilled 12 cores in the quadrangle to characterize the Quaternary sediments and establish unit thickness. Surficial deposits in the map area are composed of 3 formations: DeForest, Peoria, and Noah

Creek, as well as unnamed erosion surface sediments. These are underlain by the Wolf Creek and Alburnett formations, Devonian aged carbonates, and Cretaceous sandstone. Hudson-age deposits associated with fine-grained alluvial, organic, and colluvial sediments include the DeForest Formation which is subdivided into the Camp Creek, Roberts Creek, Gunder, and Corrington members. The Noah Creek Formation consist of thick packages of sand and gravel delivered from glacial meltwater during the end of the last glacial cycle. These deposits are high terraces on the landscape and occupy a position 4.5 to 7.5 m (15 to 25 ft) above the modern channel. This formation also includes coarse sand and gravel forming from periglacial erosion and deposition during the last glacial period, as well as coarse to finer grained fluvial deposits associated with local low-relief stream valleys. Unnamed erosion surface sediments consist of reworked till and slopewash deposits associated with periglacial activity during the late Wisconsin ice advance. Areas of Peoria Formation eolian materials are present on the valley train outwash of the Shell Rock River and mantle the unnamed erosion surface sediment and Devonian bedrock on the downwind side of the river valley. 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 (Cretaceous Dakota or Windrow formations, and Devonian Lime Creek, Shell Rock, and Lithograph City formations) comprise the bedrock surface in the Greene Quadrangle, with the Lithograph City Formation representing most of the bedrock outcrops in the map area. Bedrock is exposed extensively in the mapping area. 18 rock outcrops including quarries were investigated in the field. The Devonian rocks are dominated by carbonates and accompanied by minor shale while the Cretaceous rocks are characterized by sandstone and iron oxides.

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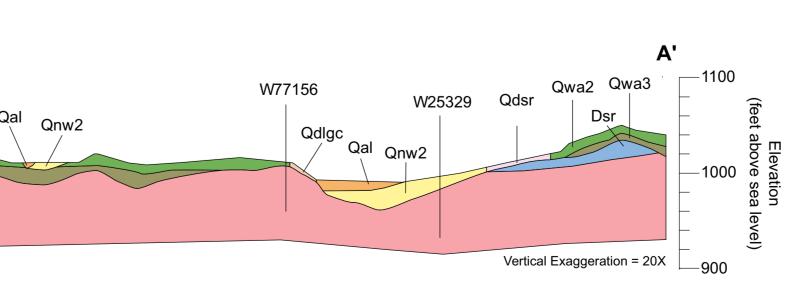
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mapping. Map interpretations are not a substitute for detailed site specific studies. Research supported by the U.S. Geological Survey, National Cooperative Geologic Mapping Program, under USGS award number G16AC00193. The views and conclusions contained 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.

Land elevation contours (10' interval).

Base map from USGS Greene 7.5' Digital Raster Graphic (IGS GIS file IA Greene USGS topo.tif) which was scanned from the Greene 7.5' Topographic Quadrangle map, published by the US Geological Survey in 2015 lowa Geological Survey digital cartographic file Greene_SurficialGeology.mxd, version 6/30/17 (ArcGIS 10.3) Map projection and coordinate system based on Universal Transverse Mercator (UTM) Zone 15N, datum NAD83. The map and cross-section are based on interpretations of the best available information at the time of