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INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
LINCOLN STONE QUARRY
JOLIET 9 STATION
OCTOBER 2016

Pursuant to Code of Federal Regulations Title 40, Part 257, Subpart D (40 CFR), herein referred to as the coal combustion residual (CCR) Rule, **§**257.82(c), Geosyntec Consultants (Geosyntec) prepared this Inflow Design Flood Control System Plan for the CCR surface impoundment referred to as the Lincoln Stone Quarry (Quarry) at the Joliet 9 Station (Site) in Joliet, Illinois. The Quarry is leased and operated by Midwest Generation, LLC (Midwest Generation).

Section 257.82(c) of the CCR Rule requires that operators of every existing or new CCR surface impoundment design, construct, operate, and maintain an inflow design flood control system that adequately manages flow into the CCR unit during and following the peak discharge of the inflow design flood. The Preamble to the CCR Rule provides guidance on the documentation that should be provided for the inflow design flood control system plan.

This Inflow Design Flood Control System Plan for the Quarry meets the requirements of **§**257.82(c). The inflow design flood control system consists of an outflow pipe and maintaining minimum operating freeboard. Justification and documentation of the adequacy of the inflow design flood control systems are presented in the sections below.

The work presented in this report was performed under the direction of Ms. Jane Soule, P.E., of Geosyntec Consultants, Inc. (Geosyntec) in accordance with **§**257.82(c). Mr. Robert White reviewed this plan in accordance with Geosyntec's senior review policy.

1. Quarry Design

The Quarry is located east of the Site's former coal pile and approximately 1,000 feet south of the Des Plaines River. The Quarry is bounded on the north by Patterson Road and on the east by Brandon Road. The Quarry is considered incised in accordance with the CCR regulations (Geosyntec, 2016) and is bounded on the north, south, and east boundaries by cut slopes. The western portion of the Quarry, referred to as the West Filled Area, has been backfilled to existing adjacent grades and capped. Prior to the conversion of the Joliet 9 Station to natural gas in spring 2016, the Quarry received sluiced CCR from Joliet Units 6, 7, and 8, through a piping system that discharges into the southwest corner (Units 7 and 8) and the northwest corner (Unit 6) of the Quarry. As of April 2016, process water from plant floor drains (which does not include CCR) is discharged into the Quarry. CCR is also transported to the Quarry by truck and placed along the eastern boundary of the Quarry. Discharge of water from the Quarry is controlled through two pipes that gravity drain to a quarry located north of Patterson Road which is then discharged to the Des Plaines River. The invert elevation of these pipes is approximately 527 feet Mean Sea Level (ft MSL), above the ash accumulation level in that area of the Quarry. Gate valves on the outlet pipes are controlled manually by Midwest Generation staff to comply with the Quarry's Bureau of Land Permit No. 1994-241-LFM requirement that local groundwater gradients flow from east to west and from south to north.

2. Inflow Design Flood Control System Plan Documentation

Because of the operating procedures and incised condition of the Quarry, some of the references and drawings recommended for inclusion in the Inflow Design Flood Control System Plan by the Preamble to the CCR Rule (page 21392) are not applicable. Table 1 below provides a summary of this documentation.

Table 1: Recommended Documentation

Documentation	Assessment
Identification of the design storm event for the catchment area and CCR unit	Identification of the design storm event is provided in Section 3. A drawing of the Quarry and catchment area is presented in Figure 1.
Characterization of the rainfall abstractions, including but not limited to depression storage and infiltration in the upstream catchment area and selection of the appropriate run-off model	The selected run-off model and upstream catchment area assumptions are provided in Appendix A.
Identification and characterization of and intake or decant structures	Outflow pipes are described in Section 1. Because there is sufficient freeboard in the quarry to prevent overflow during the design event, as described in Section 6, capacity of outflow pipes is not evaluated.
Appropriate characterization and capacity of spillways	The Quarry does include a spillway.
Characterization of downstream hydraulic structures	Because there is sufficient freeboard in the quarry to prevent overflow during the design event, as described in Section 6, characterization of downstream structures is not required.

3. Design Event

As the Quarry is considered incised in accordance with the CCR regulations (Geosyntec, 2016), the inflow design flood is the 25-year flood in accordance with Section 257.82(a)(3). Flood flows are typically established by performing statistical analysis on historical stream gauge records. In instances where measured stream flow records are not available, deterministic methods such as a design storm method (ASCE, 1996) is used to establish flood flows. In the design storm method, a rainfall to runoff analysis (e.g., Runoff Curve Number Method) is used to establish the flood flows. The underlying assumptions in the design storm method are: 1) rainfall will occur uniformly across the entire contributing watershed; and 2) a specified return period storm event produces the same return period flood flow (e.g., 25-year storm event produces the 25-year flood). Since there are no measured stream flow records at the Quarry, the design storm method was used to estimate the inflows to the Quarry for the 24-hour, 25-year precipitation event.

4. Existing Quarry Water Level

Water accumulates inside the Quarry due to its incised characteristics, and water levels within the Quarry are controlled to meet the Quarry's permitting requirements (see Section 1). Midwest Generation monitors the surface water level within the Quarry daily and controls outflow from the Quarry to influence the localized groundwater gradients. Average daily water level data within the Quarry is shown in Figure 2 and indicates that the surface water level has been maintained below 550 ft MSL over the last five years. The operating level of the Quarry is assumed to be 550 ft MSL or below. Based on the site topography[1], the water level within the Quarry could rise to approximately 572 ft MSL before discharging from the Quarry.

5. Catchment Area

A description of the area surrounding the Quarry is shown in the following table.

Direction	Land Use
North	Patterson Road, two small quarries, woodland, Des Plaines River.
West	Woodland, heavy industrial site.
South	Grass and farmland, woodland, heavy industrial site.
East	South Brandon Road, low density residential area, inactive Quarry, grass and farmland, large active Quarry (southeast).

The catchment area of the Lincoln Stone Quarry was delineated using topographic maps and images. The catchment area is approximately 110 acres, see Figure 1. The catchment area is limited to the southeast by another quarry owned by Vulcan Materials Company.

[1] Topography is dated 2014 and was downloaded from Will County in February 2016 at: http://www.willcogis.org/website2014/gis/Topography.html#Topo2014

6. Analysis of Inflow Design Flow and Storage Capacity

The inflow design flow for the 25-year event was calculated based on runoff associated with the 24-hour, 25-year storm event for the upstream catchment area, which was estimated based on regional topography and the Runoff Curve Number Method. Analysis demonstrating the inflow design flow is included in Appendix A. The total inflow into the Quarry during the 24-hour 25-year storm event is estimated to be 42.5 acre-feet. Based on 2014 surface water conditions, the surface area of the impounded water within the Quarry is approximately 16 acres. The estimated potential water level increase is calculated to be 2.7 ft from the design event. Therefore, the water level in the Quarry after the design event is estimated to be at or below 553 ft MSL (operating level of 550 ft MSL plus 3 ft).

The freeboard after the design event is estimated to be a minimum of 19 ft (572 ft MSL – 553 ft MSL). As the existing freeboard is estimated to be at least 19 feet, sufficient storage capacity exists within Quarry to manage the inflow from the design flood event. The inflow design system, as designed and constructed, meets the requirements of **§**257.82.

7. Plan Amendments and Revisions

In accordance with **§**257.82(c)(2) and (4), this Inflow Design Flood Control System Plan will be amended or revised whenever there is a change in conditions that would substantially affect the plan or every five years.

8. Limitations and Certification

This inflow design flood control system plan meets the requirements of §257.82(c) of the Code of Federal Regulations Title 40, Part 257, Subpart D, and was prepared in accordance with current practices and the standard of care exercised by scientists and engineers performing similar tasks in the field of civil engineering. The contents of this report are based solely on the observations of the conditions observed by Geosyntec personnel and information provided to Geosyntec by Midwest Generation. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others, which was consistent with other information that we developed in the course of our performance of the scope of services. The information contained in this report is intended for use solely by Midwest Generation and their subconsultants.

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LICENSED
PROFESSIONAL
ENGINEER
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Illinois Professional Engineer No. 062-067766
License Expires: 11/30/17

9. References

ASCE, 1996. American Society of Civil Engineers Task Committee on Hydrology Handbook. Hydrology Handbook. ASCE Publications.

Geosyntec Consultants, 2016, Lincoln Stone Quarry Site Visit, CCR Rule Compliance Demonstrations, Midwest Generation LLC Power Stations, Illinois, dated 6 January.

<u>Attachments</u>

Figure 1:	Catchment Area
Figure 2:	Quarry Water Level
Appendix A:	Stormwater Run-on Calculations

Legend

Catchment Area

2 ft. Elevation Contours

Imagery Credit: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Topography based on 2014 topography downloaded from Will County website (downloaded February 2016), http://www.willcogis.org/website2014/gis/Topography.html#Topo2014

1,100 550 0 1,100 Feet

CATCHMENT AREA
LINCOLN STONE QUARRY
JOLIET 9 STATION

JOLIET ILLINOIS

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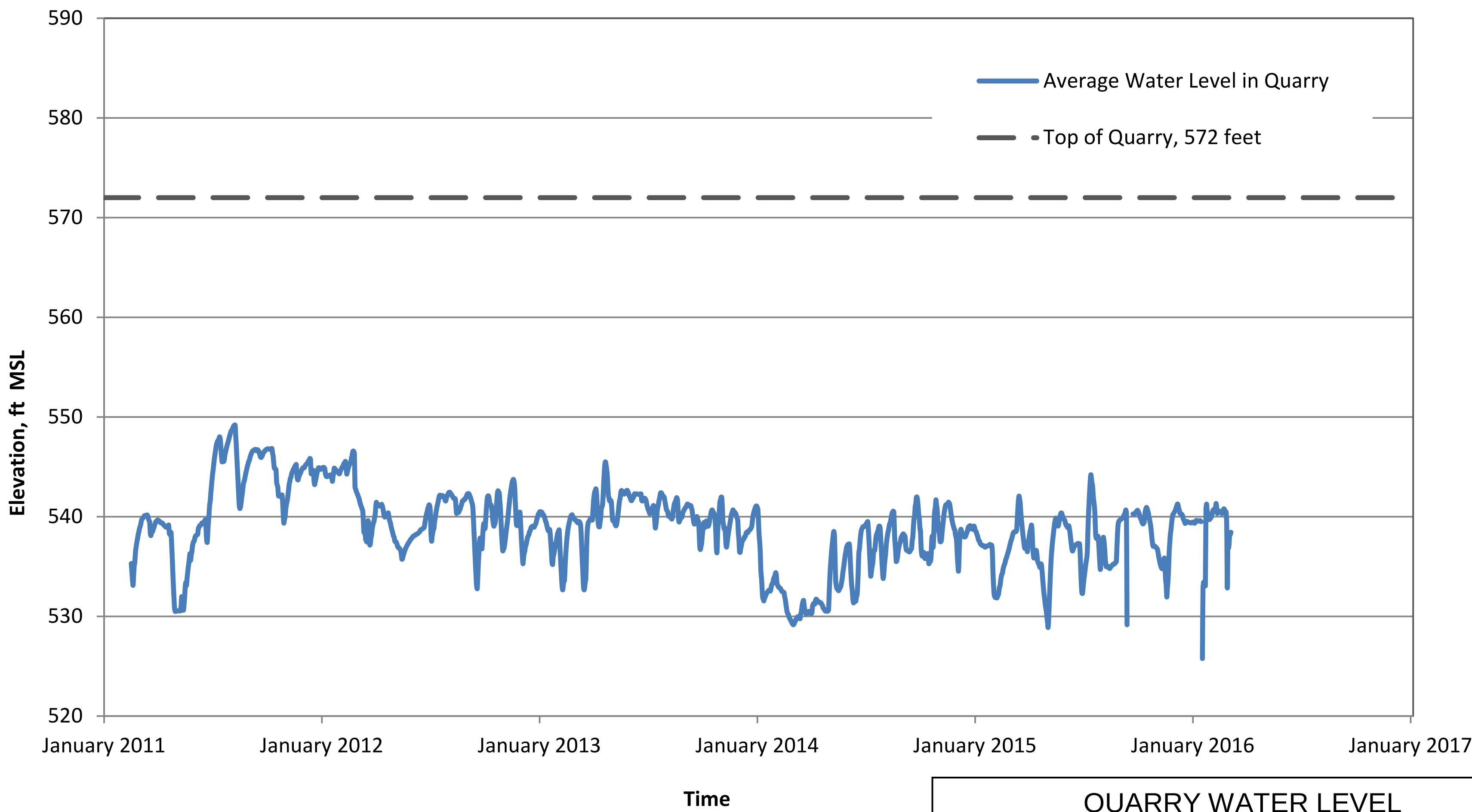
PROJECT NO: SW0251

October 2016

Figure 1



QUARRY WATER LEVEL
LINCOLN STONE QUARRY
JOLIET 9 STATION
JOLIET, ILLINOIS

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Figure 2

PROJECT NO: SW0251

October 2016

Note: Daily Quarry water levels recorded by KPRG Associates.

internal info: path, date revised, author

Appendix A

Stormwater Run-on Calculations

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COMPUTATION COVER SHEET

Client: **Midwest Generation** Project: **Joliet 9 Station** Project No. **SW0251**

Title of Computations **STORMWATER RUN-ON CALCULATIONS, LINCOLN STONE QUARRY**

Computations by:	Signature	[signature]	7 October 2016
	Printed Name	Max Dugan	Date
	Title	Senior Staff Engineer	
Assumptions and Procedures Checked by: (peer reviewer)	Signature	[signature]	7 October 2016
	Printed Name	Venkat Gummadi	Date
	Title	Senior Engineer	
Computations Checked by:	Signature	[signature]	7 October 2016
	Printed Name	Venkat Gummadi	Date
	Title	Senior Engineer	
Computations backchecked by: (originator)	Signature	[signature]	7 October 2016
	Printed Name	Max Dugan	Date
	Title	Senior Staff Engineer	
Approved by: (pm or designate)	Signature	[signature]	7 October 2016
	Printed Name	Jane Soule, P.E.	Date
	Title	Senior Engineer	

Approval notes:

Written by:	M. Dugan	Date:	7/16/16	Reviewed by:	V. Gummadi	Date:	9/16/16
Client:	Midwest Generation	Project:	Joliet 9	Project No.:	SW0251	Phase No.:	6

STORMWATER RUN-ON CALCULATIONS
LINCOLN STONE QUARRY
JOLIET 9 STATION

INTRODUCTION

Pursuant to Code of Federal Regulations Title 40, Part 257, Subpart D, (40 CFR) Section 257.82(c), Geosyntec Consultants (Geosyntec) prepared this calculation package to support development of the Inflow Design Flood Control System Plan for the Lincoln Stone Quarry (Quarry) at the Joliet 9 Station (Site) in Joliet, Illinois. 40 CFR Section 257.82(c) requires that operators of every existing or new CCR (Coal Combustion Residuals) surface impoundment design, construct, operate, and maintain an inflow design flood control system that adequately manages flow into the CCR unit during and following the peak discharge of the inflow design flood. This calculation evaluates the inflow design flood and evaluates the capacity of the Quarry to handle inflow from this event.

CALCULATION OF INFLOW DESIGN FLOW

The City of Joliet's "Consolidated Stormwater Management, Soil Erosion and Sediment Control and Floodplain Management Regulations" specifies that the Soil Conservation Service (SCS) Runoff Curve Number Method be used to calculate design runoff volumes. The SCS method and its current application are documented in Technical Release 55 (TR-55) published by Natural Resources Conservation Service (NRCS). The SCS runoff equation is:

$$Q = \frac{(P-I_a)^2}{(P-I_a)+S}$$

Where:

Q = runoff (in)

P = rainfall (in)

S = potential maximum retention after runoff begins (in) and

I_a = initial abstraction (in)

The initial abstraction (I_a) accounts for all losses prior to the beginning of runoff including water retained in surface depressions, intercepted by vegetation, evaporation, and infiltration. I_a is typically correlated with soil cover parameters and is approximated by the equation:

$$I_a = 0.2S$$

S is a function of the soil type and cover and is related to the runoff curve number (CN) by the equation:

$$S = \frac{1000}{CN} - 10$$

Where:

CN = Runoff Curve Number

CN is determined by the Hydrologic Soils Group (HSG) and cover type, treatment, hydrologic condition, and antecedent moisture condition. In cases where multiple land uses occur in the same drainage area, a composite CN is determined by the area weighted method.

After calculating runoff (Q) for a design storm event, the total volume of runoff is then calculated by multiplying the runoff by the drainage area (A).

DRAINAGE AREA (A)

The area of the drainage basin of the Lincoln Stone Quarry was delineated using topographic maps[1] and aerial images[2]. The catchment area has an estimated area of 109.9 acres (refer to Figure 1), and was subdivided into five areas based on land use (cover) and soil type (HSG) for determination of CN.

Most of the catchment area outside of the Quarry footprint is located to the southeast. The drainage basin area is limited to the southeast by another quarry owned by Vulcan Materials Company.

[1] Topography is dated 2014, downloaded from Will County in February 2016 at: http://www.willcogis.org/website2014/gis/Topography.html#Topo2014

[2] ESRI ArcGIS online images accessed in July 2016. Imagery credit: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Written by: M. Dugan Date: 7/16/16 Reviewed by: V. Gummadi Date: 9/16/16

Client: Midwest Generation Project: Joliet 9 Project No.: SW0251 Phase No.: 6

RUNOFF CURVE NUMBER (CN)

The value of the runoff curve number (CN) has been extensively studied in the literature. Its value depends on the land use and type of soil (HSG). In general, the value of CN is higher for developed, impervious surfaces, and Type D soils. Correspondingly, CN has lower values for undeveloped, pervious surfaces, and Type A soils.

Land use in the drainage basin within the Quarry is mostly rock or standing water. Land use in the drainage basin outside of the Quarry is mostly pasture, grass and farmland. Industrial sites to the south and east of the Quarry are located outside the drainage basin.

HSG for use in CN selection was determined by importing the watershed boundary into the Natural Resources Conservation Service Web Soil Survey (Attachment A). Approximately 43% of the site consists of vegetated Type C soils, 18% vegetated Type D soils, 35% water, and 3% paved/impervious surfaces. Based on the HSG and land use analysis a composite CN of 87.8 was determined for the drainage area. The following table summarized the analysis of the runoff curve number.

Description	Area (acres)	HSG	Cover Type	CN	Weighted
Pond	38.3	W	Water	100	34.9
Impervious	3.5	NA	Paved	98	3.1
Vegetated	0.38	B	Open Space-Fair	69	0.2
Vegetated	47.5	C	Open Space-Fair	79	34.2
Vegetated	20.2	D	Open Space-Fair	84	15.4
Total	109.9 acres		Composite		87.8

RAINFALL DEPTH (P)

In accordance with 40 CFR Section 257.82(a)(3)(iv), the inflow design flood for an incised CCR surface impoundment, such as the Quarry, is the 25-year flood.

The City of Joliet, Will County, and the Illinois Department of Transportation (DOT) require the use of the Illinois State Water Survey Bulletin 70, Northeast Sectional rainfall statistics (Huff and Angel, 1989) in runoff volume calculations. Based on this publication, the 25-year, 24-hour rainfall depth is 6.04 inches for the Quarry (see Attachment B).

Written by:	M. Dugan	Date:	7/16/16	Reviewed by:	V. Gummadi	Date:	9/16/16
Client:	Midwest Generation	Project:	Joliet 9	Project No.:	SW0251	Phase No.:	6

INFLOW DESIGN FLOW

The following table summarizes the inflow design flow calculations.

Parameter	25-Year, 24-Hour Precipitation Event
CN	87.8
S	1.4
P	6.0
I_a	0.3
Q (in)	4.6
Area (Ac)	109.9
Volume (ac-ft)	42.5

The potential increase in Quarry water surface elevation was estimated by dividing the total inflow (42.5 acre-ft for the design event) by the Quarry wet area (estimated to be 15.9 acres based on 2014 aerial images). The increase in water depth in the Quarry for the design event is approximately 2.7 ft.

WATER LEVEL AND FREEBOARD

Water accumulates inside the Quarry due to its incised characteristics, and water levels within the Quarry are controlled to meet the Quarry's Bureau of Land Permit No. 1994-241-LFM requirement that local groundwater gradients flow from east to west and from south to north. Midwest Generation monitors the surface water level within the Quarry daily and implements engineering controls to influence the localized groundwater gradients. Average daily water level data within the Quarry indicates that the surface water level has been maintained below 550 ft MSL over the last five years (Figure 2). The water surface elevation for the design event, assuming the water level is at 550 ft prior to the start of the design event, is 553 ft.

Based on the site topography[3], the water level within the Quarry could rise to approximately 572 ft MSL before discharging from the Quarry. The freeboard after the design event is estimated to be at least 19 ft (572 ft MSL – 553 ft MSL). As the existing freeboard is estimated to be 19 feet (minimum), sufficient storage capacity

[3] Topography is dated 2014 downloaded from Will County in February 2016 at: http://www.willcogis.org/website2014/gis/Topography.html#Topo2014

Written by:	M. Dugan	Date:	7/16/16	Reviewed by:	V. Gummadi	Date:	9/16/16
Client:	**Midwest Generation**	Project:	**Joliet 9**	Project No.:	**SW0251**	Phase No.:	**6**

exists within Quarry to manage the design flood event without discharge from the Quarry.

REFERENCES

City of Joliet, 2003, Consolidated Storm Water Management, Soil Erosion and Sediment Control and Floodplain Management Regulations.

Huff, F.A., and J.R., Angel, 1989. Rainfall Distributions and Hydroclimatic Characteristics of Heavy Rainstorms in Illinois (Bulletin 70, Illinois State Water Survey.

Technical Release 55 (TR-55), Natural Resources Conservation Service USDA, 2016, Soil Map, Will County, Illinois, Web Soil Survey, National Cooperative Soil Survey. USDA Natural Resources Conservation Service.

Water Resource Ordinance for Unincorporated Will County.

ATTACHMENTS

Attachment A: Soil Map from USDA – Natural Resources Conservation Service
Attachment B: Figure 21 and Appendix A from Illinois State Water Survey Bulletin 70

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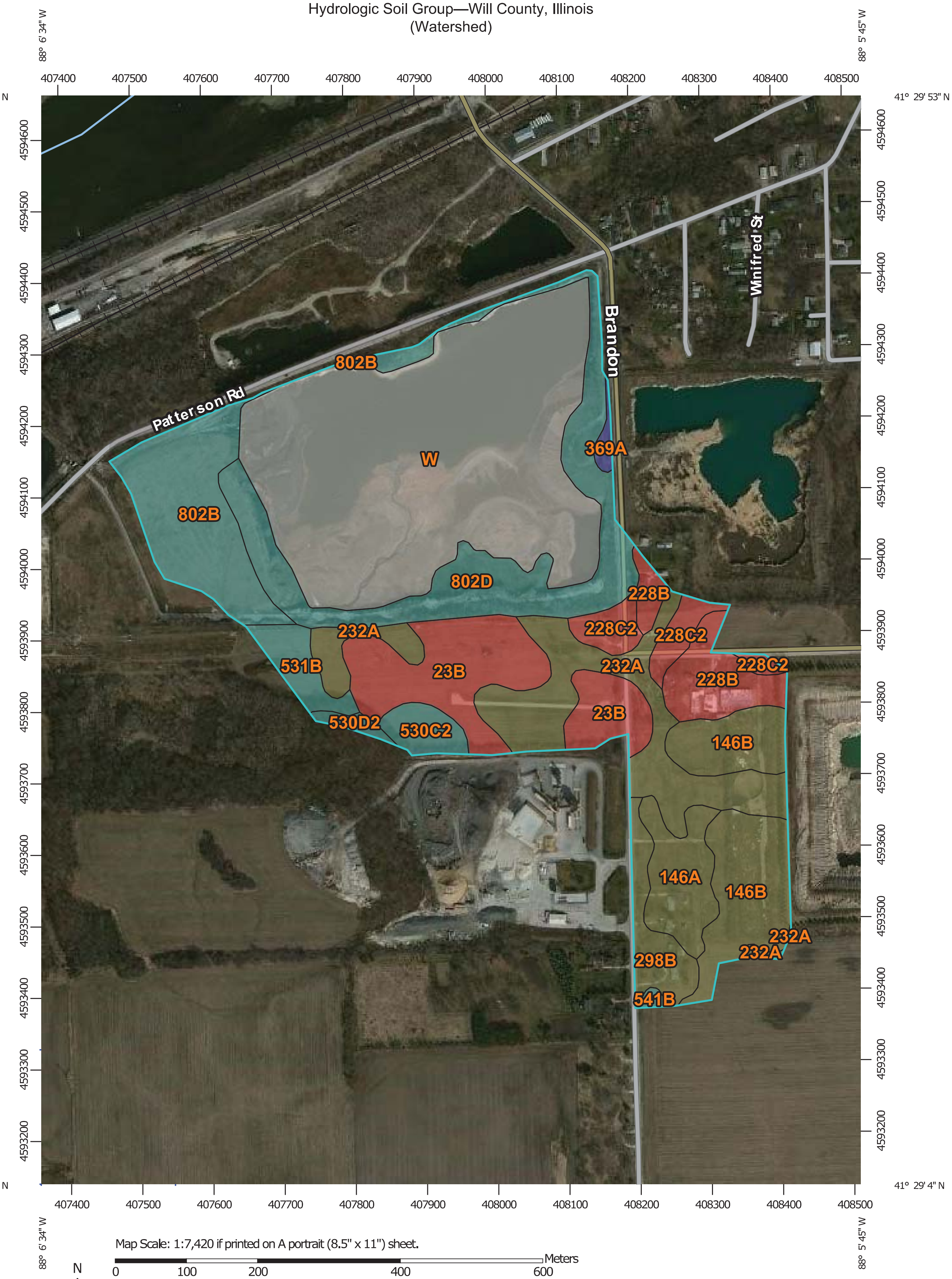
Attachment A

Soil Map from USDA – Natural Resources Conservation Service

Hydrologic Soil Group—Will County, Illinois
(Watershed)



Map Scale: 1:7,420 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 100, 200, 400, 600

Feet: 0, 350, 700, 1400, 2100

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Will County, Illinois
Survey Area Data: Version 10, Sep 25, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 13, 2012—Mar 28, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Will County, Illinois (IL197)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
23B	Blount silt loam, 2 to 4 percent slopes	D	10.3	9.4%
146A	Elliott silt loam, 0 to 2 percent slopes	C/D	4.0	3.7%
146B	Elliott silt loam, 2 to 4 percent slopes	C/D	9.1	8.3%
228B	Nappanee silt loam, 2 to 4 percent slopes	D	4.4	4.0%
228C2	Nappanee silty clay loam, 4 to 6 percent slopes, eroded	D	2.9	2.6%
232A	Ashkum silty clay loam, 0 to 2 percent slopes	C/D	11.2	10.2%
298B	Beecher silt loam, 2 to 4 percent slopes	C/D	2.8	2.5%
369A	Waupecan silt loam, 0 to 2 percent slopes	B	0.4	0.4%
530C2	Ozaukee silt loam, 4 to 6 percent slopes, eroded	C	1.7	1.5%
530D2	Ozaukee silt loam, 6 to 12 percent slopes, eroded	C	0.5	0.5%
531B	Markham silt loam, 2 to 4 percent slopes	C	2.0	1.8%
541B	Graymont silt loam, 2 to 5 percent slopes	C	0.2	0.2%
802B	Orthents, loamy, undulating	C	9.1	8.3%
802D	Orthents, loamy, rolling	C	13.0	11.8%
W	Water		38.3	34.9%
Totals for Area of Interest			**109.8**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

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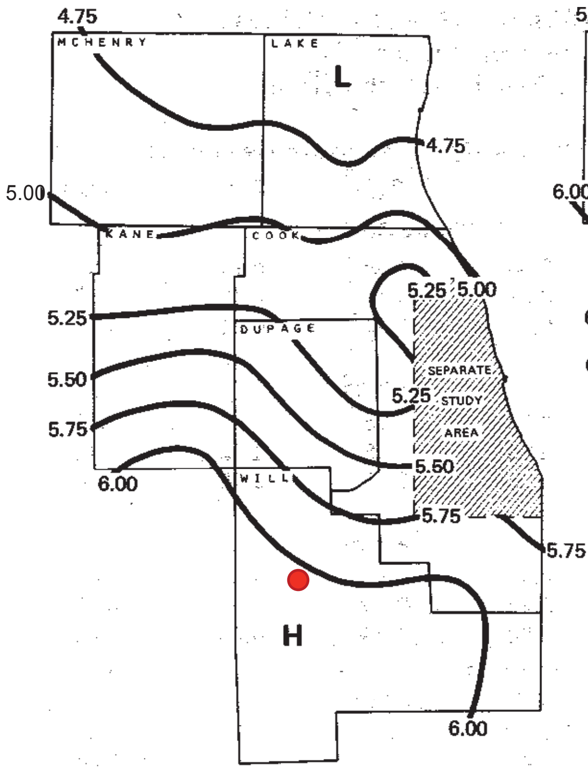
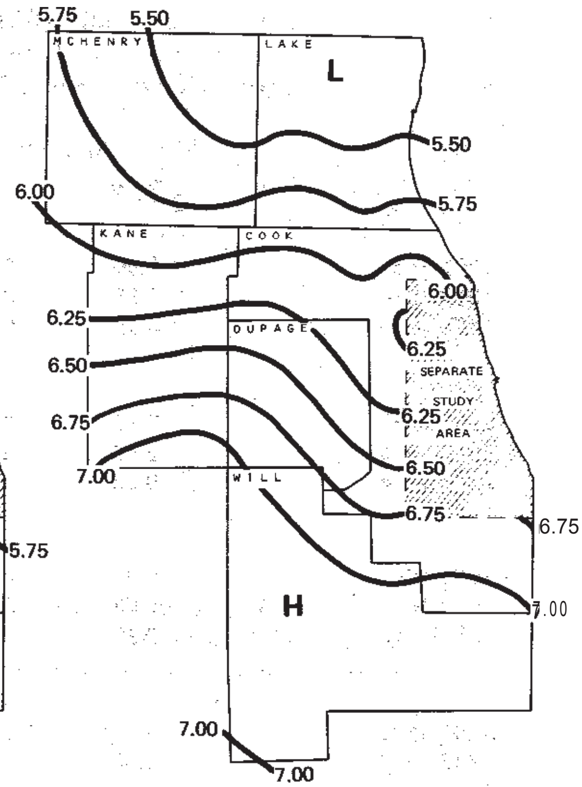
Attachment B

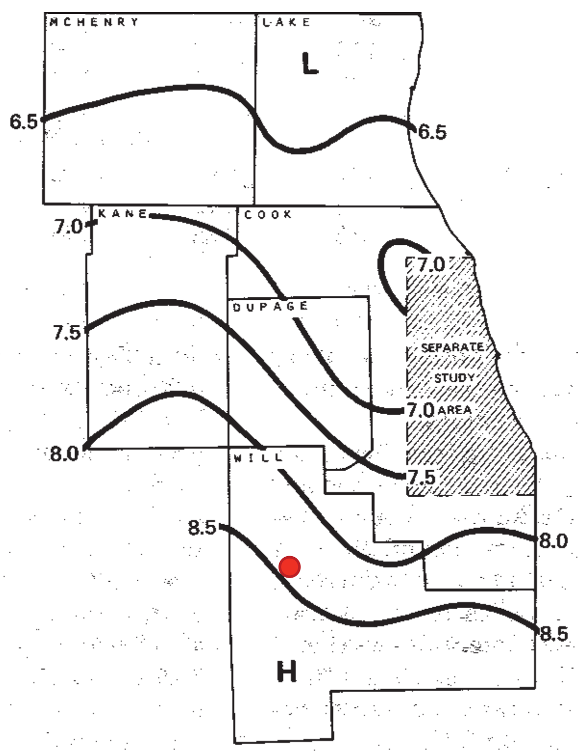
Figure 21 and Appendix A from Illinois State Water Survey Bulletin 70



25-year, 24-hour



50-year, 24-hour



100-year, 24-hour

Figure 21. Concluded

Annual rainfall (inches) for given recurrence interval

Storm code	Zone code	Station	2-month	3-month	4-month	6-month	9-month	1-year	2-year	5-year	10-year	25-year	50-year	100-year
5	1	Aledo	1.40	1.63	1.79	2.06	2.35	2.55	3.11	3.95	4.68	5.69	6.58	7.56
5	1	Dixon	1.41	1.64	1.82	2.11	2.39	2.60	3.14	4.02	4.68	5.63	6.74	7.70
5	1	Freeport	1.42	1.65	1.81	2.09	2.37	2.58	3.14	3.95	4.67	5.87	7.07	8.40
5	1	Galva	1.41	1.64	1.80	2.08	2.36	2.57	3.09	3.89	4.57	5.63	6.52	7.56
5	1	Moline	1.38	1.61	1.78	2.06	2.34	2.54	3.11	3.95	4.68	5.69	6.58	7.32
5	1	Morrison	1.40	1.63	1.78	2.06	2.34	2.54	3.09	3.84	4.52	5.46	6.35	7.32
5	1	Mt Carroll	1.40	1.63	1.78	2.06	2.34	2.54	3.11	4.07	4.73	5.51	6.23	6.96
5	1	Rockford	1.42	1.65	1.81	2.09	2.37	2.58	3.07	3.95	4.61	5.51	6.30	6.96
5	1	Walnut	1.42	1.66	1.82	2.12	2.42	2.63	3.11	3.89	4.57	5.45	6.23	7.00
5	2	Aurora	1.37	1.60	1.78	2.06	2.34	2.54	3.12	3.93	4.74	6.04	7.22	8.40
5	2	Chicago	1.33	1.55	1.72	1.98	2.25	2.45	3.00	3.81	4.49	5.56	6.47	7.50
5	2	DeKalb	1.39	1.62	1.80	2.08	2.36	2.57	3.02	3.82	4.54	5.45	6.35	7.38
5	2	Joliet	1.44	1.68	1.86	2.15	2.45	2.66	3.20	4.08	4.85	6.04	7.17	8.47
5	2	Kankakee	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	2	Marengo	1.31	1.52	1.70	1.97	2.24	2.44	2.95	3.48	3.87	4.70	5.40	6.50
5	2	Ottawa	1.38	1.60	1.75	2.03	2.30	2.50	3.00	3.81	4.49	5.45	6.35	7.25
5	2	Waukegan	1.29	1.50	1.64	1.90	2.15	2.34	2.80	3.38	3.85	4.60	5.45	6.40
5	3	La Harpe	1.54	1.80	2.00	2.32	2.63	2.86	3.50	4.29	5.03	6.29	7.48	8.90
5	3	Monmouth	1.47	1.71	1.89	2.19	2.48	2.70	3.30	4.15	4.88	5.93	6.94	8.09
5	3	Quincy	1.55	1.80	1.97	2.28	2.59	2.82	3.53	4.40	4.94	5.99	6.70	7.62
5	4	Bloomington	1.41	1.64	1.79	2.07	2.36	2.56	3.11	3.98	4.63	5.45	6.22	7.05
5	4	Decatur	1.47	1.71	1.87	2.16	2.46	2.67	3.26	4.06	4.63	5.40	6.05	6.80
5	4	Havana	1.35	1.57	1.72	1.98	2.25	2.45	2.90	3.62	4.18	5.17	5.94	6.90
5	4	Lincoln	1.33	1.55	1.72	1.98	2.25	2.45	2.98	3.79	4.51	5.59	6.22	6.90
5	4	Minonk	1.32	1.54	1.68	1.94	2.21	2.40	2.91	3.63	4.29	5.15	6.00	6.90
5	4	Peoria	1.38	1.60	1.75	2.03	2.30	2.50	2.99	3.78	4.60	5.65	6.42	7.40
5	4	Rushville	1.42	1.64	1.81	2.10	2.38	2.59	3.00	3.63	4.20	5.00	5.70	6.50
5	5	Danville	1.40	1.63	1.78	2.06	2.34	2.54	3.09	4.01	4.61	5.40	5.95	6.75
5	5	Hoopeston	1.38	1.61	1.76	2.03	2.31	2.51	2.97	3.52	3.94	4.69	5.25	6.00
5	5	Pontiac	1.32	1.54	1.68	1.94	2.21	2.40	3.03	3.80	4.40	5.48	6.40	7.02
5	5	Roberts	1.28	1.49	1.63	1.89	2.14	2.33	2.84	3.52	4.22	5.07	6.12	7.13
5	5	Urbana	1.41	1.64	1.80	2.08	2.36	2.57	3.10	3.70	4.20	4.85	5.45	6.10
5	6	Carlinville	1.42	1.65	1.83	2.11	2.40	2.61	3.15	3.94	4.71	5.77	6.81	8.02
5	6	Griggsville	1.39	1.62	1.79	2.07	2.36	2.56	3.09	3.88	4.54	5.57	6.47	7.55
5	6	Hillsboro	1.54	1.79	1.96	2.27	2.58	2.80	3.25	4.10	4.71	5.56	6.47	7.55
5	6	Jacksonville	1.42	1.66	1.81	2.10	2.38	2.59	3.15	3.99	4.60	5.59	6.46	7.20
5	6	Morrisonville	1.39	1.62	1.77	2.05	2.33	2.53	3.06	4.06	4.77	5.70	6.50	7.20
5	6	Pana	1.38	1.60	1.75	2.03	2.30	2.50	3.10	3.80	4.47	5.37	6.20	7.20
5	6	Springfield	1.39	1.62	1.77	2.05	2.33	2.53	3.06	3.94	4.72	5.76	6.49	7.40
5	6	White Hall	1.40	1.64	1.81	2.10	2.38	2.59	3.12	3.90	4.70	5.51	6.34	7.32
5	7	Charleston	1.40	1.63	1.78	2.07	2.35	2.55	3.00	3.75	4.38	5.38	6.32	7.28
5	7	Effingham	1.34	1.56	1.71	1.98	2.24	2.44	2.92	3.69	4.42	5.49	6.43	7.70
5	7	Palestine	1.40	1.63	1.78	2.07	2.35	2.55	3.02	3.86	4.40	5.25	6.16	7.50
5	7	Paris	1.41	1.64	1.80	2.08	2.36	2.57	3.06	3.80	4.47	5.37	6.16	6.94
5	7	Windsor	1.44	1.68	1.86	2.15	2.45	2.66	3.14	3.88	4.48	5.37	6.24	7.54
5	8	Belleville	1.43	1.67	1.86	2.15	2.45	2.66	3.31	4.30	5.08	6.54	7.74	9.20
5	8	DuQuoin	1.51	1.75	1.92	2.22	2.52	2.74	3.32	4.12	4.72	5.76	6.64	7.55
5	8	Greenville	1.50	1.75	1.91	2.21	2.51	2.73	3.26	3.99	4.62	5.76	6.81	7.90
5	8	Sparta	1.46	1.70	1.87	2.15	2.45	2.66	3.22	4.01	4.70	5.70	6.64	7.55
5	8	St Louis	1.48	1.73	1.92	2.23	2.53	2.75	3.29	4.23	4.99	6.34	7.52	8.85
5	9	Fairfield	1.46	1.70	1.86	2.15	2.44	2.65	3.21	4.02	4.70	5.82	6.71	7.84
5	9	Flora	1.41	1.64	1.79	2.07	2.36	2.56	3.15	4.05	4.75	6.09	7.25	7.90
5	9	McLeansboro	1.45	1.70	1.88	2.17	2.47	2.68	3.25	4.08	4.80	5.93	6.81	8.06
5	9	Mt Carmel	1.45	1.68	1.84	2.13	2.42	2.63	3.17	3.97	4.60	5.76	6.71	7.80
5	9	Mt Vernon	1.45	1.68	1.84	2.13	2.42	2.63	3.14	3.97	4.48	5.43	6.16	6.95
5	9	Olney	1.42	1.65	1.81	2.09	2.37	2.58	3.12	3.91	4.60	5.70	6.60	7.80
5	10	Anna	1.69	1.97	2.16	2.49	2.83	3.08	3.75	4.66	5.32	6.40	7.10	7.80
5	10	Cairo	1.66	1.93	2.11	2.44	2.77	3.05	3.75	4.80	5.43	6.31	7.20	8.20
5	10	Carbondale	1.61	1.87	2.04	2.37	2.69	2.92	3.57	4.37	5.10	5.98	6.84	7.77
5	10	Harrisburg	1.56	1.82	1.99	2.30	2.61	2.84	3.45	4.32	5.10	6.38	7.42	8.75
5	10	New Burnside	1.66	1.93	2.11	2.45	2.78	3.02	3.58	4.40	5.10	6.10	7.00	8.36