PRELIMINARY STORMWATER MANAGEMENT

ANALYSIS AND REPORT

FOR

REDWOOD FOX RIVER GROVE ILLINOIS ROUTE 22

FOX RIVER GROVE, ILLINOIS

JANUARY 12 , 2022

848.013

PROFESSIONAL ENGINEER'S CERTIFICATION

STATE OF ILLINOIS }
SS.
COUNTY OF DUPAGE }

I, KEVIN T. SERAFIN, A LICENSED PROFESSIONAL ENGINEER OF ILLINOIS, HEREBY CERTIFY THAT THIS TECHNICAL SUBMISSION WAS PREPARED ON BEHALF OF REDWOOD USA, LLC BY CEMCON, LTD. UNDER MY PERSONAL DIRECTION.

DATED THIS 12th **DAY OF** January **, AD, 2022**

ILLINOIS LICENSED PROFESSIONAL ENGINEER NO. 062-052118

MY LICENSE EXPIRES ON FEBRUARY 28, 2022

PROFESSIONAL DESIGN FIRM LICENSE NO. 184-002937, EXPIRATION DATE IS APRIL 30, 2023

NOTE: UNLESS THIS DOCUMENT BEARS THE ORIGINAL SIGNATURE AND IMPRESSED SEAL OF THE DESIGN PROFESSIONAL ENGINEER, IT IS NOT A VALID TECHNICAL SUBMISSION.

PREPARED FOR:

REDWOOD USA, LLC.
7007 EAST PLEASANT VALLEY ROAD
INDEPENDENCE, OH 44131

216-254-8425

PREPARED BY:

CEMCON, LTD.
2280 WHITE OAK CIRCLE
SUITE 100
AURORA, IL 60504

630-862-2100

PRELIMINARY STORMWATER MANAGEMENT

ANALYSIS AND REPORT

FOR

REDWOOD FOX RIVER GROVE ILLINOIS ROUTE 22

FOX RIVER GROVE, ILLINOIS

TABLE OF CONTENTS

PRELIMINARY STORMWATER MANAGEMENT

ANALYSIS AND REPORT

FOR

REDWOOD FOX RIVER GROVE ILLINOIS ROUTE 22

FOX RIVER GROVE, ILLINOIS

EXHIBITS

EXHIBIT A **SITE LOCATION & AERIAL MAP**

EXHIBIT B **USDA NRCS SOILS MAP**

EXHIBIT C **FEMA FLOOD INSURANCE RATE MAP NUMBER 17097C0205K (SEPTEMBER 18, 2013)**

EXHIBIT D **RELEVANT PERMITS**

EXHIBIT E **“WITHOUT PROJECT" CONDITION HYDROLOGY**

- EXISTING CONDITIONS WATERSHED EXHIBIT
- “EXIST” PONDPACK OUTPUT AND INPUT FILES
- PONDPACK SUPPORT CALCULATIONS

EXHIBIT F **"WITH PROJECT" CONDITION HYDROLOGY**

- PROPOSED CONDITIONS WATERSHED EXHIBIT
- “PROP” PONDPACK OUTPUT AND INPUT FILES
- PONDPACK SUPPORT CALCULATIONS

EXHIBIT G **WETLAND DELINEATION REPORT BY MIDWEST ECOLOGICAL, INC. (UNDER SEPARATE COVER AND WILL BE SUBMITTED WITH FINAL)**

EXHIBIT H **RUNOFF VOLUME REDUCTION (RVR) CALCULATIONS**

EXHIBIT I **ELECTRONIC COPY OF HYDROLOGIC MODELS**

PRELIMINARY STORMWATER MANAGEMENT
ANALYSIS AND REPORT
FOR
REDWOOD FOX RIVER GROVE ILLINOIS ROUTE 22
FOX RIVER GROVE, ILLINOIS

1.0 PROJECT DESCRIPTION

The Redwood Fox River Grove Illinois Route 22 subdivision proposed by Redwood USA, LLC is a 21.3± acre subdivision with 110 total rental townhome units. The 21.3± acre parcel is situated south of Illinois Route 22 and east of the Fox Glen Professional offices in the Village of Fox River Grove (see Exhibit A for a Location Map). Site infrastructure improvements (see Final Engineering Plans under separate cover) will include the construction of sanitary sewers, watermains, stormwater drainage and conveyance facilities, and a stormwater management facility, which will be vegetatively stabilized for stormwater discharge control. The purpose of this Stormwater Management Analysis and Report is to summarize the hydrologic and hydraulic analyses performed to define the Existing Conditions and to demonstrate that, when constructed in conformance with the Engineering Plans, the development will comply with Local, State and Federal laws and regulations.

2.0 SPECIAL MANAGEMENT AREAS

During the Project-Planning Phase, the subject site was evaluated for the presence of Special Management Areas defined as regulatory floodplains/floodways and wetland habitat. This evaluation consisted of a detailed review of available Topographic, Wetland and FEMA Maps, as well as a held wetland delineation completed by Midwest Ecological. Following is an account of the sources referenced and procedures employed in conducting the Special Management Area assessment for the Project.

A. Floodplain/Floodway

According to FEMA FIRM Panel 17097C0205K (September 18, 2013), the site includes Zone A floodplain located at the south side of the property. Refer to Exhibit C for a copy of the effective FIRM panel.

B. Wetlands

A Wetland Delineation Report was prepared by Midwest Ecological, Inc. for the subject site and wetlands. The wetlands were delineated and located at the south portion of the site and along the west and east property line. The proposed Project will remain outside the limits of the wetland, and concurrent to review of this Report, which will be forwarded under Separate Cover. Section 4.0 in this Report will discuss management of the wetlands in proposed conditions.

3.0 EXISTING "WITHOUT PROJECT" CONDITION

A. Description

The subject property includes a residential home and the remainder of the site is currently used for agricultural farming. The site is bordered by Illinois Route 22 to the north, forest preserve to the east and south, and Fox Glen Professional Offices parcel to the west. In general, the subject property drains to the south (refer to Exhibit E for the Existing Conditions Watershed Exhibit). The site drains into the wetland located at the south portion of the site where it continues offsite to the west. Based on a review of the Soil Survey, the existing soils are classified as type B soils (see Exhibit B).

B. Methods

CEMCON, Ltd. has performed a detailed topographic analysis and generated one-foot (1') contours on the Redwood Living site and as well as obtained a one-foot (1') Lake County Topography Map for the area adjacent to the site, supplemented by the Plans and Report. PondPack was chosen as the hydrologic model for this proposed Project for its capability to model dynamic tailwater conditions anticipated in proposed conditions. The following methodology and procedures were used in determining the hydrologic parameters.

Runoff Curve Numbers - Existing land use within the Project site is generally row crop agricultural. Based on a review of the USDS NRCS Soil Map (see Exhibit B), the hydrologic soil types for this Project are primarily soil type B. This information was used to complete Worksheet 2 from the TR-55 Hydrology Manual and calculate composite runoff curve numbers *(CN)* for each sub-basin contained in the watershed. The Existing Conditions CN documentation for the watershed is provided in Exhibit E.

Time of Concentration - The time of concentration *(T_c)* was calculated using SCS TR-55 methodology. The T_c calculations were performed for flow paths representing the travel from the hydraulically most distant point of the watershed to the point of interest. The T_c documentation for the Project site is provided in Exhibit E.

Precipitation Data/Rainfall Distribution - Updated Bulletin 75 northeast rainfall values (March 2020 revision) with Huff rainfall distributions were selected for the hydrograph method. Storage volumes were evaluated based on the 100-Year frequency 24-Hour duration event measuring 8.54 inches of precipitation and the Huff 3rd quartile rainfall distribution. As part of this analysis, a critical duration analysis was performed from the 1-Hour through the 48-Hour events to determine the peak flow rates for each storm event.

Stage vs. Storage and Stage vs. Discharge Relationships - Stage vs. storage relationships developed for storage areas were measured in AutoCAD at regular intervals corresponding to the level of potential inundation, and the volume was calculated by the method of average area times the incremental interval. Stage vs. discharge relationships were developed in PondPack for all possible combinations of headwater and tailwater. PondPack was then run dynamically to evaluate the headwater and tailwater at each time step to determine the flow through each structure. Supporting documentation for the Existing Conditions is provided in Exhibit E.

This information was used to develop an Existing Condition Hydrologic Model for the entire watershed. A detailed hydrologic analysis of the existing conditions of the site and the upstream tributary area has been prepared using the PondPack 8Vi hydrologic analysis software. The PondPack 8Vi uses the SCS Method for developing hydrographs; however, it also allows for dynamic modeling of drainage systems. See Exhibit E for the Existing Conditions PondPack model and its output. A summary of Existing Conditions peak flows to the Outfalls compared to the Proposed Conditions can be found later in the report under Section 4.0. Table 1 lists the

peak flows for the 100-Year, 24-Hour rainfall, as well as the peak flows during the 2-Year, 24-Hour rainfall.

Table 1

Existing Condition Peak Flows

PondPack ID	Area (Ac.)	100-Year, 24-Hour Peak Flow (cfs)	2-Year, 24-Hour Flow (cfs)
O-1	16.5	32.56	6.93

Refer to Exhibits H and I for the complete calculations and supporting documentation.

4.0 PROPOSED "WITH PROJECT" CONDITION

A. Description

In accordance with the Village of Fox River Grove and Lake County Stormwater Management Ordinance, any proposed site development which would affect the discharge of stormwater requires stormwater management to protect downstream properties. In general, the Stormwater Management Facilities (SWMFs) are configured to restrict site rainfall-runoff via restrictor structures to 0.04 cfs/Ac. for the 2-Year 24-Hour storm and 0.15 cfs/Ac. for the 100-Year 24-Hour storm of developed area.

The development will incorporate one SWMF located at the south east corner of the site (refer to Exhibit F for the Proposed Conditions Watershed Exhibit). SWMF 1 will provide storage for the site and will drain to the existing wetland. Furthermore, SWMF 1 will drain to the existing wetland 1 to hydrate and meet the Lake County Ordinance Wetland impact.

B. Hydrologic Analysis

The required detention was calculated in order to meet the requirements of Lake County Stormwater Ordinance. A "PROP" PondPack Model was created to simulate the Proposed Conditions of the Site modeling the 100-Year 24-Hour event and the 2-Year 24-Hour event. Using

theoretical restrictors, a high water level (HWL) was established for each basin based on an allowable release rate. The allowable release rate of 100-Year event of 0.15 cfs/Ac. and 2-Year event of 0.04 cfs/Ac. of onsite tributary area was used for the site. All onsite release rate and onsite storage required is summarized in Table 2 below. See Exhibit F for the supporting documentation and "Prop" PondPack model.

Table 2

Prop Model

Allowable Release Rate

100YR Storm:	**24**
Onsite Allowable Release Rate (cfs/Ac.):	0.15
Development Area (Ac.):	16.50
Allowable Release (cfs):	2.48
Proposed Developed Release (O-1) (cfs):	**2.44**

			STORAGE	STORAGE
		OVERFLOW	REQUIRED	PROVIDED
SWMF-01:	773.58	774.00	7.82	8.64

2YR Storm:	**24**
Onsite Allowable Release Rate (cfs/Ac.):	0.04
Development Area (Ac.):	16.50
Onsite Allowable Release (cfs):	0.66
Proposed Developed Release (O-11) (cfs):	**0.63**

The results demonstrate that 7.82 Ac.-Ft. of detention is required for Proposed Conditions. Furthermore, the proposed development will have an additional 0.82 Ac.-Ft. of storage that will provide a benefit to the downstream watershed.

The "PROP" PondPack model utilized a dynamic tailwater to accurately model real world conditions. The proposed restrictors were sized utilizing the "PROP" PondPack model. Table 3 summarizes the 2-Year and 100-Year event critical duration flows and allowable release calculations.

Table 3

Proposed Conditions Analysis

PROJECT: REDWOOD LIVING – FOX RIVER GROVE
PREPARED BY: CEMCON, Ltd.

Job No.: 848013
By: ARF
Date: 1-5-22
Rev:

Critical Duration Analysis
NORTH

100YR Storm:	1	2	3	6	12	18	24	48
Total Proposed Release (O-1) (cfs):	1.72	1.96	2.06	2.21	2.34	2.42	2.44	2.42
Total Existing Release (O-1, O-2, and O-3) (cfs):	32.56	28.56	23.58	15.69	10.57	8.35	6.78	7.63
SWMF 01:	771.47	772.10	772.40	772.85	773.35	773.52	773.58	773.50

2YR Storm:	1	2	3	6	12	18	24	48
Total Proposed Release (O-1) (cfs):	0.38	0.45	0.49	0.54	0.59	0.62	0.63	0.64
Total Existing Release (O-1, O-2, and O-3) (cfs):	6.43	6.93	6.28	4.75	3.83	3.57	2.98	2.28

As identified by Midwest Ecological in their Wetland Delineation Report, there are wetlands located in the southwest corner of the property; therefore, the proposed development should minimize any direct or indirect impacts to the wetland per Section 1006 of the Ordinance. A development is considered to have an indirect impact if the following limitations is exceeded:

- The development design shall maintain between 80% to 150% of the existing condition, 2-Year, 24-Hour storm event runoff volume from the onsite tributary drainage area to the preserved Isolated Waters of Lake County.

Table 4 below summarizes the analysis for the wetlands (PondPack ID Wetland 001 and 002). Based on the results below, it can be concluded that the proposed development runoff for the 2-Year 24-Hour storm will remain in the requisite range to the regulatory wetland. Supporting documentation can be found in Exhibit F. Furthermore, refer to Table 4 for Existing and Proposed Water Surface Elevations for Wetland 001 and 002.

Table 4: Wetland Analysis Summary

Existing Wetland

		100Yr-24Hr
Existing Wetland:	Runoff volume **(Ac.-Ft.)**	1.83
Proposed Wetland:	Runoff volume **(Ac.-Ft.)**	2.45
		134%

5.0 RUNOFF VOLUME REDUCTION

The Lake County Watershed Development Ordinance (LCWDO) includes requirements for sites to provide Water Quality Treatment and Runoff Volume Reduction (RVR) controls to help promote infiltration and minimize site stormwater runoff. The proposed development has been designed to incorporate methods of runoff reduction from the site. Listed below is the RVR hierarchy with rationale for the selection of measure.

A. Preservation and enhancement of the stormwater management benefits of the natural resource features of the development site (e.g., areas of Hydrologic Soil Groups A and B,

floodplains, Waters of the United States, Isolated Waters of Lake County, channels, drainageways, prairies, savannas, and woodlands); The site wetlands have been preserved.

B. Minimization or disconnection of impervious surfaces; N/A.

C. Enhancement of the infiltration and storage characteristics of the development site using appropriate best management practices; The site SWMF have been designed to include native plantings.

D. The use of open channels with native vegetation to convey stormwater runoff; The site SWMF have been designed to include native plantings.

E. Structural measures that provide water quality and volume reduction; N/A.

F. Structural measures that provide only volume reduction or other rainwater harvesting practices; N/A.

G. Measures that provide water quality and quantity control; Water quality requirements have been meet with the storage provided below NWL.

H. Measures that provide only quantity control; N/A.

The proposed development has been designed to utilize the existing wetlands to promote filtration and infiltration through increased travel time and passing through native plantings. The SWMF itself is designed as a wetland basin incorporating native plantings. The SWMF will be placed in a Stormwater Management Easement on a Plat of Easement.

The existing 2-Year, 24-Hour runoff amount to the wetlands is 1.8 Ac.-Ft. The proposed 2-Year, 24-Hour runoff to the wetland is 2.5 Ac.-Ft. This complies with the LCWDO requirements of maintaining 80-150% of the existing hydrology to wetlands. Also, the 1.8 Ac.-Ft. of the existing runoff has been preserved. According to Section 503.02 – B.3 of the LCWDO, the preserved 2-Year, 24-Hour runoff volume to an existing Isolated Wetland of Lake County can be utilized to comply with the RVR requirement.

Therefore, the total RVR volume is 1.8 Ac.-Ft. or 78,408 C.F. When dividing by the amount of impervious area on the site (8.45 acres), this yields an RVR quantity of 9,279 cubic feet per acre.

According to the RVR Chart included within the LCWDO, this results in a Runoff Volume Reduction for 95% of Rainfall Events (see Exhibit I).

6.0 WATER QUALITY TREATMENT

In addition to the Runoff Volume Reduction discussed in Section 7.0 above, the LCWDO also requires a development to provide a certain amount of Water Quality Treatment Volume. According to Section 504.02 of the LCWDO, a Water Quality Treatment Volume equivalent to 0.01 inch of runoff for every 1% impervious area on the site should be detained. The proposed development has 10.1 acres of impervious area on the 21.3 acre site, resulting in a site that is 47.4% impervious. The required water quality volume is calculated as follows:

0.01 inches / % * 47.4% = 0.47 inches of runoff

(0.47 inches / 12) * 10.1 acres of impervious area = 0.40 acre-feet

The site SWMFs have been designed to provide storage volume below NWL. A volume of 5.0 Ac.-Ft. has been provided below the NWL of the proposed SWMF. Therefore, the total Water Quality Treatment volume provided is 5.0 Ac.-Ft., which surpasses the required volume calculated above (0.40 Ac.-Ft.).

7.0 STORMWATER SYSTEMS MAINTENANCE PLAN

The Applicant shall be responsible for the periodic monitoring and maintenance of all Stormwater Management and Stormwater Conveyance Facilities until such time of final acceptance of the improvements by the Village of Fox River Grove systems include, but are not limited to, (a) storm sewers, storm drains, inlets, manholes, catch basins and appurtenances, (b) swales and overland drainageways, (c) all containment berms and all stormwater storage facilities, (d) all landscaping and vegetative cover around and within stormwater conveyance and stormwater storage facilities, and (e) all permanent erosion and sedimentation control devices. The Applicant/Village of Fox River Grove shall undertake appropriate measures to monitor and maintain such facilities in accordance with the policies and procedures established under the Ordinance as amended from

time-to-time, and/or the programs and procedures set forth by the owner as part of the routine maintenance program. The programs for monitoring and maintaining the Stormwater Management and/or Water Conveyance Facilities/Systems imposed under this Plan shall include the following components and procedures:

a. Storm sewers, storm drains and other drainage appurtenances, including manholes and inlets, shall be kept clear of sediment and debris, retained at the elevations, lines and grades intended, and maintained in an operable condition capable of conveying storm water runoff.

b. Swales and overland drainage ways shall be maintained to the line and grade established on the Site Development Plan documents to convey stormwater runoff in a free and unobstructed manner. Landscape planting, earthen fill, or other obstructions that impede the flow of stormwater shall be removed, the area regraded, and a vegetative cover shall be reestablished to deter erosion.

c. The proper function of the stormwater management system is dependent upon maintaining both the structural integrity and the minimum elevation of the containment berms, and it is also essential that the volume of potential storage available within the stormwater management facility be preserved. Substantial regrading, placement of earthen fill, or other earthwork operations that would change the elevation, impair the structural integrity, or diminish the volume contained within the basin shall be prohibited. Containment berms shall be maintained at the minimum elevations noted on the Site Development Plan documents and in good structural condition.

d. A vegetative cover around and within the SWMF is essential for the prevention of soil erosion and the deposition of sediments within the basin. The periodic replanting and replacement of vegetation shall be required, when necessary, to maintain the vegetative cover.

e. Temporary sediment traps, siltation fences, or ditch checks, as well as those permanent facilities including catch basins and inlets shall be periodically cleaned of sediment and debris and/or replaced and restored to operable conditions.

8.0 SUMMARY

Redwood USA, LLC proposes to develop Redwood Fox River Grove Illinois Route 22 in a manner that is consistent with the Lake County Stormwater Ordinance and all applicable Fox River Grove Ordinances. A detailed hydrologic analysis was performed utilizing PondPack software to verify compliance with the County and Village Ordinance, and to demonstrate that the proposed Project will provide a benefit to the receiving drainage systems.

H:\848013\REPORTS\2022-1-12 PRELIM SWMF REPORT.docx

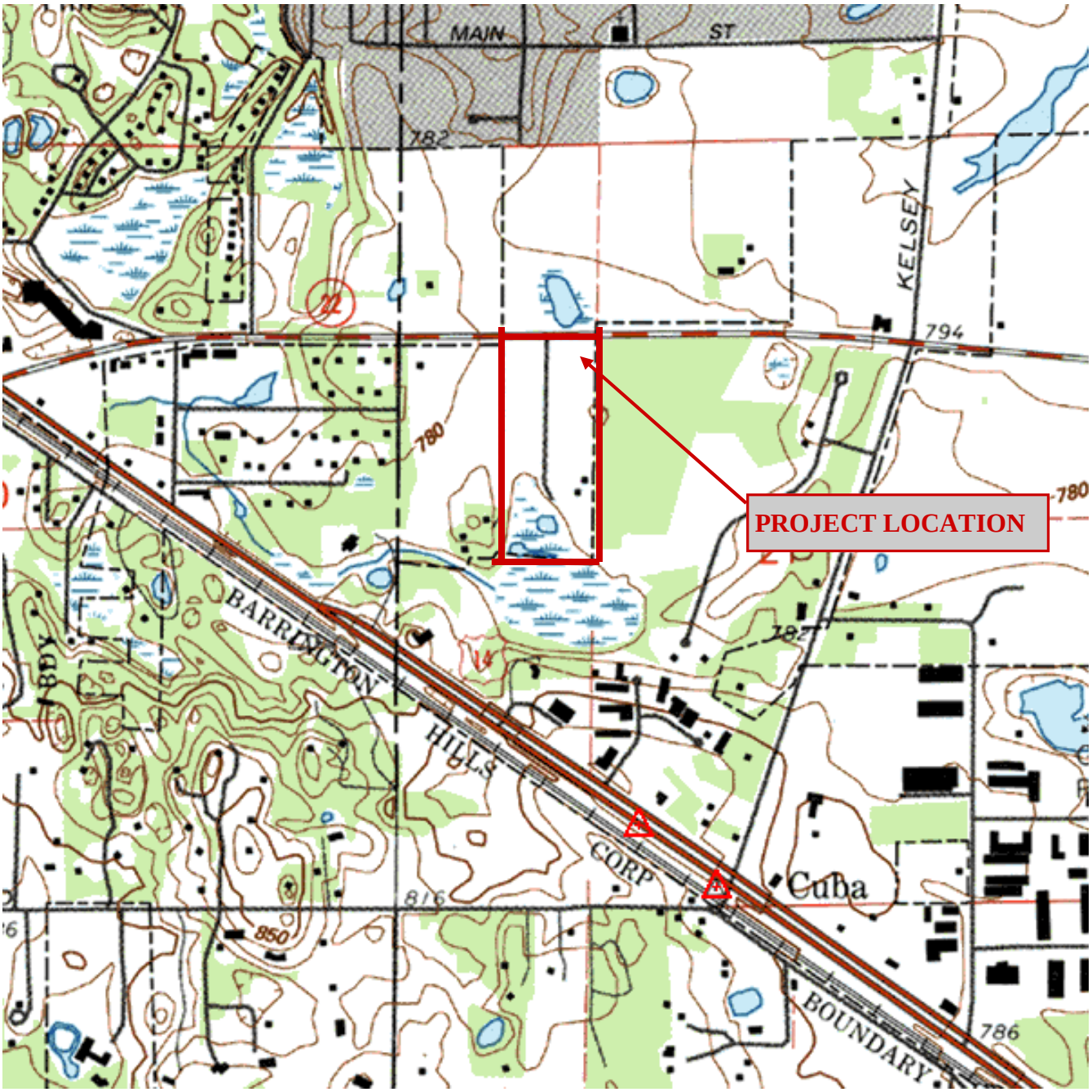
EXHIBIT A

SITE LOCATION & AERIAL MAP

REDWOOD - FOX RIVER GROVE ILLINOIS ROUTE 22

T43N, R9E, SEC. 21

BARRINGTON QUADRANGLE



CEMCON, Ltd.	PROJECT / CLIENT: Redwood USA, LLC 7510 East Pleasant Valley Road Independence, OH 44131 216-360-9441	DRAWN BY:	ARF	1/5/22
		CHECKED BY:		
		APPROVED:		
		SCALE: N.T.S.		

REDWOOD - FOX RIVER GROVE ILLINOIS ROUTE 22

T43N, R9E, SEC. 21

BARRINGTON QUADRANGLE

CEMCON, Ltd.

PROJECT / CLIENT:

Redwood USA, LLC
7510 East Pleasant Valley Road
Independence, OH 44131
216-360-9441

DRAWN BY:	ARF	1/5/22
CHECKED BY:		
APPROVED:		
SCALE: N.T.S.		

EXHIBIT B

USDA NRCS SOILS MAP

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Lake County, Illinois

December 29, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,730 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 40 80 160 240

Feet: 0 100 200 400 600

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Lake County, Illinois
Survey Area Data: Version 16, Aug 31, 2021

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

Date(s) aerial images were photographed: Jun 13, 2020—Jul 1, 2020

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.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
153A	Pella silty clay loam, 0 to 2 percent slopes	8.4	41.4%
153A+	Pella silt loam, 0 to 2 percent slopes, overwash	5.5	27.0%
696A	Zurich silt loam, 0 to 2 percent slopes	0.3	1.5%
696C2	Zurich silt loam, 4 to 6 percent slopes, eroded	0.0	0.1%
697A	Wauconda silt loam, 0 to 2 percent slopes	0.9	4.5%
1103A	Houghton muck, undrained, 0 to 2 percent slopes	0.0	0.2%
4103A	Houghton muck, ponded, 0 to 2 percent slopes	5.1	25.4%
Totals for Area of Interest		**20.3**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit

descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Lake County, Illinois

153A—Pella silty clay loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2smzn
Elevation: 490 to 830 feet
Mean annual precipitation: 34 to 41 inches
Mean annual air temperature: 46 to 54 degrees F
Frost-free period: 150 to 195 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Pella, drained, and similar soils: 96 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pella, Drained

Setting

Landform: Outwash plains, till plains, lake plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess or silty material over calcareous loamy outwash

Typical profile

Ap - 0 to 12 inches: silty clay loam
Bg - 12 to 28 inches: silty clay loam
2Bkg - 28 to 36 inches: silt loam
2Cg - 36 to 60 inches: stratified sandy loam to silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Minor Components

Harpster, drained

Percent of map unit: 3 percent
Landform: Depressions on till plains, depressions on outwash plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R110XY025IL - Ponded Calcareous Sedge Meadow
Hydric soil rating: Yes

Urban land

Percent of map unit: 1 percent
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

153A+—Pella silt loam, 0 to 2 percent slopes, overwash

Map Unit Setting

National map unit symbol: v2td
Elevation: 540 to 1,020 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Pella, overwash, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pella, Overwash

Setting

Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Loess or other silty material and in the underlying outwash

Typical profile

H1 - 0 to 16 inches: silt loam
H2 - 16 to 30 inches: silty clay loam
H3 - 30 to 53 inches: silty clay loam
H4 - 53 to 62 inches: silt loam
H5 - 62 to 80 inches: stratified loamy sand to silty clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: Very high (about 13.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Minor Components

Houghton

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Harpster

Percent of map unit: 5 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R110XY025IL - Ponded Calcareous Sedge Meadow
Hydric soil rating: Yes

696A—Zurich silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 2wsqr
Elevation: 610 to 1,100 feet
Mean annual precipitation: 31 to 37 inches
Mean annual air temperature: 43 to 48 degrees F
Frost-free period: 124 to 192 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Zurich and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zurich

Setting

Landform: Lake plains
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty drift over stratified, calcareous sandy and silty outwash

Typical profile

Ap - 0 to 5 inches: silt loam
E - 5 to 10 inches: silt loam
Bt1 - 10 to 29 inches: silty clay loam
2Bt2 - 29 to 36 inches: silt loam
2C - 36 to 79 inches: stratified loamy sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Ecological site: F110XY011IL - Dry Glacial Drift Upland Forest
Forage suitability group: High AWC, adequately drained (G095BY008WI)
Other vegetative classification: High AWC, adequately drained (G095BY008WI)
Hydric soil rating: No

Minor Components

Pella

Percent of map unit: 4 percent
Landform: Drainageways
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R110XY024IL - Ponded Depressional Sedge Meadow
Hydric soil rating: Yes

Mundelein

Percent of map unit: 3 percent
Landform: Lakebeds (relict)
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Linear
Ecological site: R110XY007IL - Moist Glacial Drift Upland Prairie
Hydric soil rating: No

Wauconda

Percent of map unit: 2 percent
Landform: Lakebeds (relict)
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Kibbie

Percent of map unit: 1 percent
Landform: Lakebeds (relict)
Landform position (three-dimensional): Talf
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

696C2—Zurich silt loam, 4 to 6 percent slopes, eroded

Map Unit Setting

National map unit symbol: v395
Elevation: 510 to 980 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 54 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Zurich, eroded, and similar soils: 96 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Zurich, Eroded

Setting

Landform: Outwash plains, stream terraces, lake plains
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Interfluve, tread
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loess or other silty material and in the underlying outwash

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 27 inches: silty clay loam
H3 - 27 to 40 inches: silt loam
H4 - 40 to 60 inches: stratified loamy sand to silt loam

Properties and qualities

Slope: 4 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F110XY011IL - Dry Glacial Drift Upland Forest
Hydric soil rating: No

Minor Components

Urban land

Percent of map unit: 2 percent
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Orthents, loamy

Percent of map unit: 2 percent
Landform: Outwash plains, ground moraines, lake plains
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Interfluve
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

697A—Wauconda silt loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: v399
Elevation: 510 to 1,020 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 54 degrees F

Frost-free period: 140 to 180 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Wauconda and similar soils: 92 percent
Minor components: 8 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wauconda

Setting

Landform: Outwash plains, stream terraces, lake plains
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess or other silty material and in the underlying outwash

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 14 inches: silt loam
H3 - 14 to 30 inches: silty clay loam
H4 - 30 to 38 inches: loam
H5 - 38 to 60 inches: stratified loamy sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: R110XY010IL - Moist Glacial Drift Upland Savanna
Hydric soil rating: No

Minor Components

Pella

Percent of map unit: 2 percent
Landform: Outwash plains, ground moraines, lake plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R110XY008IL - Wet Glacial Drift Upland Prairie
Hydric soil rating: Yes

Orthents, loamy

Percent of map unit: 2 percent
Landform: Lake plains, ground moraines
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Urban land

Percent of map unit: 2 percent
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Drummer

Percent of map unit: 2 percent
Landform: Outwash plains, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R108AY013IL - Wet Outwash Prairie, R110XY008IL - Wet Glacial Drift Upland Prairie
Hydric soil rating: Yes

1103A—Houghton muck, undrained, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: vzv4
Elevation: 500 to 1,020 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Houghton, undrained, and similar soils: 91 percent
Minor components: 9 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Houghton, Undrained

Setting

Landform: Ground moraines, outwash plains, end moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Herbaceous organic material

Typical profile

Oa1 - 0 to 7 inches: muck
Oa2 - 7 to 60 inches: muck

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: A/D
Ecological site: R110XY020IL - Ponded Organic Acidic Peatland, R110XY021IL - Ponded Organic Alkaline Peatland
Hydric soil rating: Yes

Minor Components

Lena, undrained

Percent of map unit: 3 percent
Landform: Depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R110XY021IL - Ponded Organic Alkaline Peatland, R108AY001IL - Organic Sedge Meadow
Hydric soil rating: Yes

Drummer, undrained

Percent of map unit: 3 percent
Landform: Outwash plains, ground moraines
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R108AY013IL - Wet Outwash Prairie, R110XY008IL - Wet Glacial Drift Upland Prairie
Hydric soil rating: Yes

Pella, undrained

Percent of map unit: 3 percent
Landform: Outwash plains, ground moraines, lake plains
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R110XY008IL - Wet Glacial Drift Upland Prairie

Hydric soil rating: Yes

4103A—Houghton muck, ponded, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: vzv9
Elevation: 510 to 1,020 feet
Mean annual precipitation: 28 to 40 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 140 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Houghton and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Houghton

Setting

Landform: Outwash plains, lake plains, ground moraines
Landform position (two-dimensional): Toeslope
Parent material: Herbaceous organic material

Typical profile

O1 - 0 to 9 inches: muck
O2 - 9 to 60 inches: muck

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water supply, 0 to 60 inches: Very high (about 23.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A/D
Ecological site: R110XY020IL - Ponded Organic Acidic Peatland, R110XY021IL - Ponded Organic Alkaline Peatland
Hydric soil rating: Yes

Minor Components

Pella

Percent of map unit:

Landform: Outwash plains, ground moraines, lake plains
Landform position (two-dimensional): Toeslope
Ecological site: R110XY008IL - Wet Glacial Drift Upland Prairie
Hydric soil rating: Yes

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

EXHIBIT C

FEMA FLOOD INSURANCE RATE MAP

NUMBER 17097C0205K

(SEPTEMBER 18, 2013)

necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

In the State of Illinois, any portion of a stream or watercourse that lies within the **floodway** fringe of a studied (AE) stream may have a state regulated floodway. This FIRM may not depict these state regulated floodways.

Floodways restricted by anthropogenic features such as bridges and culverts are drawn to reflect natural conditions and may not agree with the model computed widths listed in the Floodway Data table in the Flood Insurance Study report.

Multiple **topographic sources** may have been used in the delineation of Special Flood Hazard Areas. See Flood Insurance Study report for details on source resolutions and geographic extent.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 16. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services, NOAA, N/NGS12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242, or visit its website at www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by the Department of Information and Technology GIS Division, Lake County, Illinois. Color digital orthophotos with a 6-inch pixel resolution were photogrammetrically compiled from aerial photography obtained during the spring of 2007.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The Special Flood Hazard Areas and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

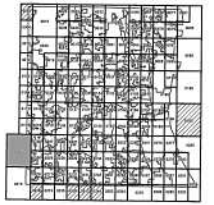
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

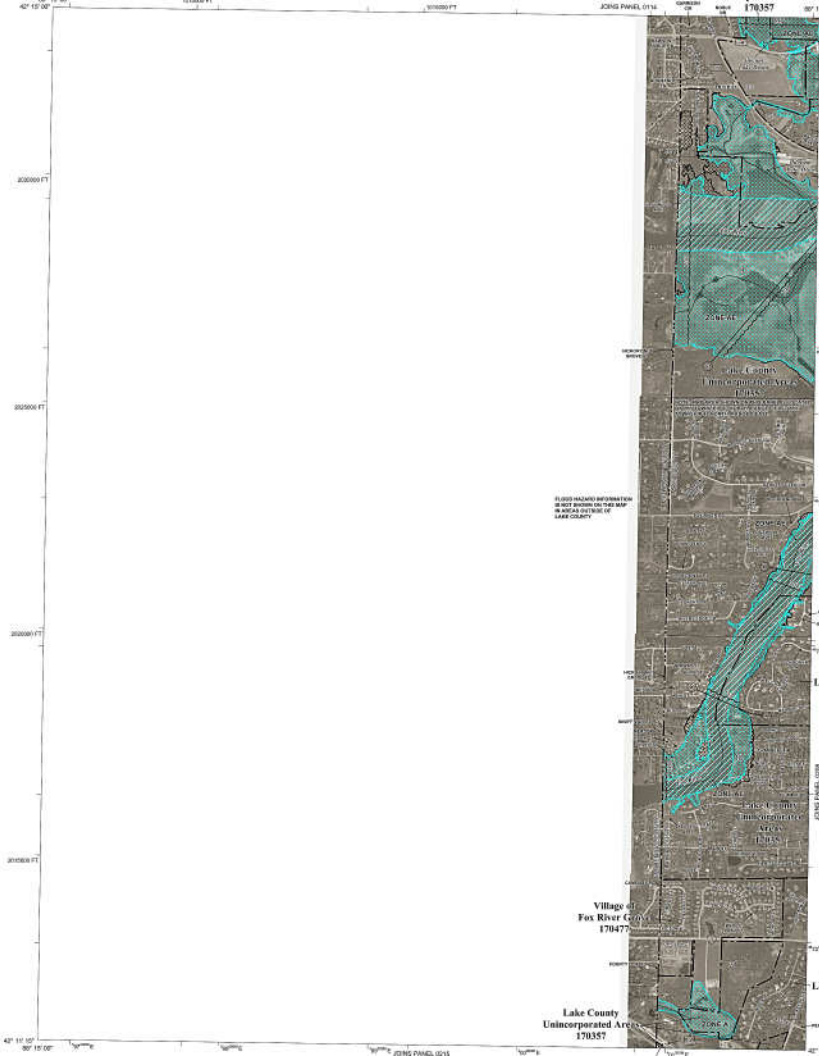
Please refer to the separately printed **Map Index** for an overview map of this county showing the layout of map panels; community map repository addresses; and a listing of Communities Table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the Map Service Center (MSC) website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map**, how to order products or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

PANEL INDEX





BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A — No Base Flood Elevations determined.
ZONE AE — Base Flood Elevations determined.
ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR — Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V — Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

Cross section line
Transect line
97° 07' 30" 42° 02' 30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
1000-meter Universal Transverse Mercator grid values, zone 16
5000-foot grid ticks: Illinois State Plane East Coordinate System, 2776 (FIPSZONE 1201) Transverse Mercator
Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
SEPTEMBER 2, 1987

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET
150 0 300 600 METERS

PANEL 0205K

FIRM
FLOOD INSURANCE RATE MAP
LAKE COUNTY, ILLINOIS
AND INCORPORATED AREAS

PANEL 205 OF 295

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
FOX RIVER GROVE, VILLAGE OF	170477	0205	K
LAKE BARRINGTON, VILLAGE OF	170372	0205	K
LAKE COUNTY	170357	0205	K
PORT BARRINGTON, VILLAGE OF	170478	0205	K

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
17097C0205K

MAP REVISED

NATIONAL FLOOD INSURANCE PROGRAM

EXHIBIT D

RELEVANT PERMITS

Illinois Department of
Natural Resources

One Natural Resources Way Springfield, Illinois 62702-1271
http://dnr.state.il.us

JB Pritzker, Governor
Colleen Callahan, Director

January 05, 2022

Kellie McIvor
Redwood USA, LLC
7007 East Pleasant Valley Road
Independence, OH 44131

RE: Redwood Fox River Grove
Project Number(s): 2208323
County: Lake

Dear Applicant:

This letter is in reference to the project you recently submitted for consultation. The natural resource review provided by EcoCAT identified protected resources that may be in the vicinity of the proposed action. The Department has evaluated this information and concluded that adverse effects are unlikely. Therefore, consultation under 17 Ill. Adm. Code Part 1075 is terminated.

This consultation is valid for two years unless new information becomes available that was not previously considered; the proposed action is modified; or additional species, essential habitat, or Natural Areas are identified in the vicinity. If the project has not been implemented within two years of the date of this letter, or any of the above listed conditions develop, a new consultation is necessary.

The natural resource review reflects the information existing in the Illinois Natural Heritage Database at the time of the project submittal, and should not be regarded as a final statement on the site being considered, nor should it be a substitute for detailed site surveys or field surveys required for environmental assessments. If additional protected resources are encountered during the project's implementation, you must comply with the applicable statutes and regulations. Also, note that termination does not imply IDNR's authorization or endorsement of the proposed action.

Please contact me if you have questions regarding this review.

Adam Rawe

Adam Rawe
Division of Ecosystems and Environment
217-785-5500

CEMCON, Ltd.
CONSULTING ENGINEERS, LAND SURVEYORS & PLANNERS

Via electronic submittal SHPO.review@illinois.gov

January 6, 2022

State Historic Preservation Office - IHPA
Illinois Department of Natural Resources
Attn: Review and Compliance
1 Old State Capitol Plaza
Springfield, IL 62701

Re: Redwood of Fox River Grove
Fox River Grove, Lake County, Illinois
848.013

To Whom It May Concern:

Enclosed please find a Survey with the legal description, a Location Map within the Concept Plan for the above-referenced Project, an Aerial Location Map and a USGS Map for this 21.3 acre residential Project. Many of the surrounding properties have been previously developed without encountering artifacts of historical significance. In that this site has not been designated as a high probability area for archaeological resources, it is our opinion this Project is exempt from further review requirements.

We respectively request your review and concurrence.

Sincerely,
CEMCON, Ltd.

Paul R. Passi, P.E.
Senior Project Engineer
630.484.7007

Enc.

cc: Kellie McIvor – Redwood USA, LLC

L:\848013\Permits\IHPA\2022-01-06 IHPA Cover Letter.docx

2280 White Oak Circle, Suite 100 • Aurora, Illinois 60502-9675
Phone: 630.862.2100 Fax: 630.862.2199 Website: www.cemcon.com

EXHIBIT E

“WITHOUT PROJECT”

CONDITION HYDROLOGY

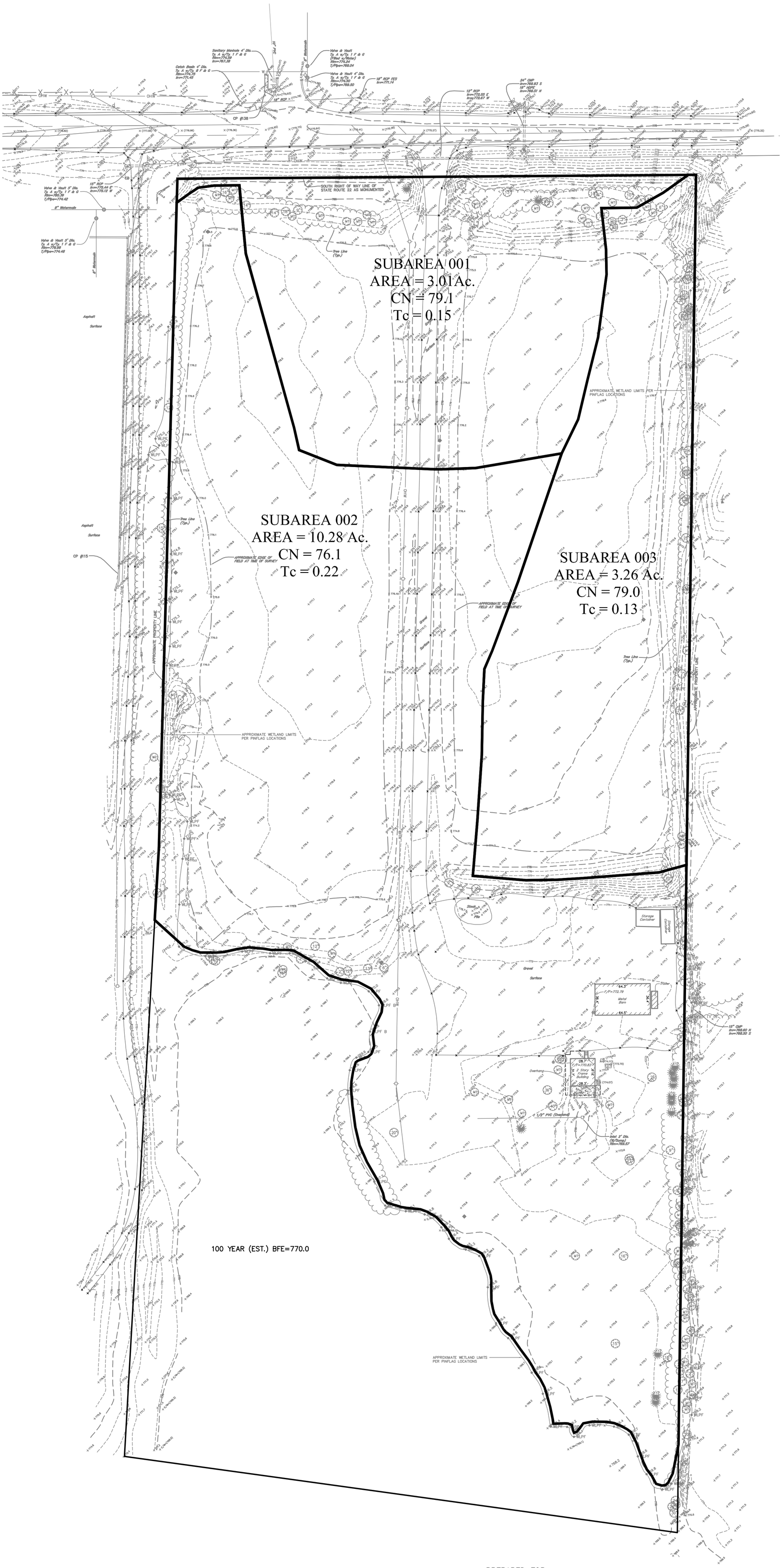
EXISTING CONDITIONS

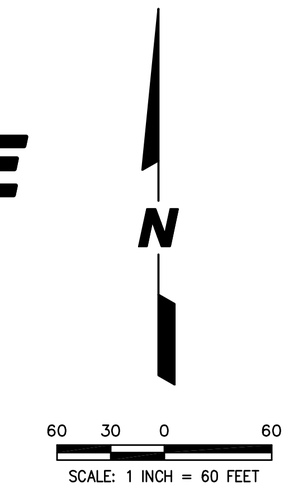
WATERSHED EXHIBIT

EXISTING WATERSHED EXHIBIT

FOR

REDWOOD FOX RIVER GROVE





PREPARED FOR:

REDWOOD USA, LLC
7510 EAST PLEASANT VALLEY ROAD
INDEPENDENCE, OH 44131
(216) 254-8425

PREPARED BY:

CEMCON, Ltd.
Consulting Engineers, Land Surveyors & Planners
2280 White Oak Circle, Suite 100
Aurora, Illinois 60502-9675
PH: 630.862.2100 FAX: 630.862.2199
E-Mail: cadd@cemcon.com Website: www.cemcon.com

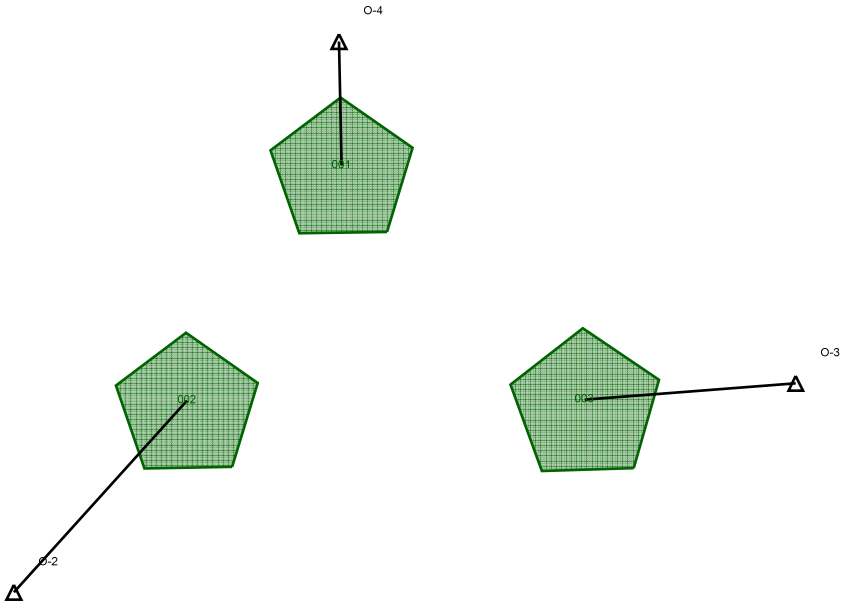
DISC NO.: 848013 FILE NAME: WATERSHED
DRAWN BY: BCD FLD. BK. / PG. NO.: BK./PG.
COMPLETION DATE: 01-06-2022 JOB NO.: 848.013
XREF : TOPO PROJECT MANAGER : KTS
REVISION DATE:

PLOT FILE CREATED: 1/6/2022 BY: DAVID DEMAY DRAWING PATH: P:\848013\DWG\ENG\DRAWINGS\EXHIBITS\WATERSHED.DWG

“EXIST” PONDPACK

OUTPUT AND INPUT FILES

Scenario: 100Yr 24 Hr



Scenario Calculation Summary

Scenario Summary	
ID	33
Label	2Yr 24Hr
Notes	
Active Topology	Base Active Topology
Hydrology	Base Hydrology
Rainfall Runoff	2Yr 24Hr
Physical	Base Physical
Initial Condition	Base Initial Condition
Boundary Condition	Base Boundary Condition
Infiltration and Inflow	Base Infiltration and Inflow
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	72Hr

Output Summary			
Output Increment	0.050 hours	Duration	72.000 hours

Rainfall Summary			
Return Event Tag	2	Rainfall Type	Time-Depth Curve
Total Depth	3.3 in	Storm Event	2YR-24HR

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
001	2Yr 24Hr	2	None	0.364	16.000	0.58	(N/A)	(N/A)
002	2Yr 24Hr	2	None	1.076	17.000	1.78	(N/A)	(N/A)
003	2Yr 24Hr	2	None	0.392	17.000	0.62	(N/A)	(N/A)
O-2	2Yr 24Hr	2	None	1.076	17.000	1.78	(N/A)	(N/A)
O-3	2Yr 24Hr	2	None	0.392	17.000	0.62	(N/A)	(N/A)
O-4	2Yr 24Hr	2	None	0.364	16.000	0.58	(N/A)	(N/A)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ac-ft)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction

Scenario Calculation Summary

Scenario Summary	
ID	1
Label	100Yr 24 Hr
Notes	
Active Topology	Base Active Topology
Hydrology	Base Hydrology
Rainfall Runoff	100Yr 24Hr
Physical	Base Physical
Initial Condition	Base Initial Condition
Boundary Condition	Base Boundary Condition
Infiltration and Inflow	Base Infiltration and Inflow
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	72Hr

Output Summary			
Output Increment	0.050 hours	Duration	72.000 hours

Rainfall Summary			
Return Event Tag	100	Rainfall Type	Time-Depth Curve
Total Depth	8.6 in	Storm Event	100YR-24HR

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
001	100Yr 24 Hr	100	None	1.518	16.000	2.06	(N/A)	(N/A)
002	100Yr 24 Hr	100	None	4.876	16.000	6.77	(N/A)	(N/A)
003	100Yr 24 Hr	100	None	1.641	16.000	2.23	(N/A)	(N/A)
O-2	100Yr 24 Hr	100	None	4.876	16.000	6.77	(N/A)	(N/A)
O-3	100Yr 24 Hr	100	None	1.641	16.000	2.23	(N/A)	(N/A)
O-4	100Yr 24 Hr	100	None	1.518	16.000	2.06	(N/A)	(N/A)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ac-ft)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction

Table of Contents

Subsection: Time-Depth Curve
Label: UPDATED 2YR 12HR-48HR

Return Event: 2 years
Storm Event: 2YR-24HR

Time-Depth Curve: 2YR-24HR	
Label	2YR-24HR
Start Time	0.000 hours
Increment	1.000 hours
End Time	24.000 hours
Return Event	2 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 1.000 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.1	0.1	0.2	0.3
5.000	0.4	0.5	0.6	0.7	0.8
10.000	0.9	1.0	1.2	1.5	1.7
15.000	2.0	2.3	2.6	2.8	3.0
20.000	3.1	3.2	3.2	3.3	3.3

Storm Event	2YR-24HR
Return Event	2 years
Duration	72.000 hours
Depth	3.3 in
Time of Concentration (Composite)	0.151 hours
Area (User Defined)	3.010 acres

Computational Time Increment	0.020 hours
Time to Peak (Computed)	16.026 hours
Flow (Peak, Computed)	0.58 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	16.000 hours
Flow (Peak Interpolated Output)	0.58 ft³/s

Drainage Area	
SCS CN (Composite)	79.100
Area (User Defined)	3.010 acres
Maximum Retention (Pervious)	2.6 in
Maximum Retention (Pervious, 20 percent)	0.5 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.4 in
Runoff Volume (Pervious)	0.364 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.364 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.151 hours
Computational Time Increment	0.020 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	22.59 ft³/s
Unit peak time, Tp	0.101 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.403 hours
Total unit time, Tb	0.503 hours

Storm Event	2YR-24HR
Return Event	2 years
Duration	72.000 hours
Depth	3.3 in
Time of Concentration (Composite)	0.222 hours
Area (User Defined)	10.280 acres

Computational Time Increment	0.030 hours
Time to Peak (Computed)	17.020 hours
Flow (Peak, Computed)	1.78 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	17.000 hours
Flow (Peak Interpolated Output)	1.78 ft³/s

Drainage Area	
SCS CN (Composite)	76.100
Area (User Defined)	10.280 acres
Maximum Retention (Pervious)	3.1 in
Maximum Retention (Pervious, 20 percent)	0.6 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.3 in
Runoff Volume (Pervious)	1.076 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.076 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.222 hours
Computational Time Increment	0.030 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	52.47 ft³/s
Unit peak time, Tp	0.148 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.592 hours
Total unit time, Tb	0.740 hours

Storm Event	2YR-24HR
Return Event	2 years
Duration	72.000 hours
Depth	3.3 in
Time of Concentration (Composite)	0.127 hours
Area (User Defined)	3.260 acres

Computational Time Increment	0.017 hours
Time to Peak (Computed)	16.019 hours
Flow (Peak, Computed)	0.62 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	17.000 hours
Flow (Peak Interpolated Output)	0.62 ft³/s

Drainage Area	
SCS CN (Composite)	79.000
Area (User Defined)	3.260 acres
Maximum Retention (Pervious)	2.7 in
Maximum Retention (Pervious, 20 percent)	0.5 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.4 in
Runoff Volume (Pervious)	0.392 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.392 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.127 hours
Computational Time Increment	0.017 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	29.08 ft³/s
Unit peak time, Tp	0.085 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.339 hours
Total unit time, Tb	0.423 hours

Index

PONDPACK SUPPORT

CALCULATIONS

Worksheet 2: Runoff Curve Number and Runoff

Project 848.013 By CMZ Date 12/29/2021
Location Rev Date

Circle one: (Present) Developed **SUBAREA 001**

1. Runoff curve number (CN)

Soil Name and Hydroogic Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area _x_ acres __mi2 __%	Product of CN x Area
B	Straight Row Crops (Good Conditions)	78			2.85	222.22
B	Impervious Area	98			0.163	15.97
1/ Use only one CN source per line.			Totals =		3.01	238.196

CN (weighted) = Total Product / Total Area = 238.196 / 3.012 = 79.082

Use CN = 79.1

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall	in			
Runoff, Q	in			

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff Curve Number and Runoff

Project 848.013 By CMZ Date 12/29/2021
Location Rev Date

Circle one: (Present) Developed **SUBAREA 002**

1. Runoff curve number (CN)

Soil Name and Hydroogic Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	Fig. 2-3	Fig. 2-4	Area _x_ acres __mi2 __%	Product of CN x Area
B	Straight Row Crops (Good Conditions)	78			6.31	492.18
B	Impervious Area	98			1.31	128.38
B	Open Space (Fair Condition)	61			2.66	162.26
1/ Use only one CN source per line.			Totals =		10.28	782.820

CN (weighted) = Total Product / Total Area = 782.820 / 10.280 = 76.150

Use CN = 76.1

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall	in			
Runoff, Q	in			

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Worksheet 2: Runoff Curve Number and Runoff

Project 848.013 By CMZ Date 12/29/2021
Location Rev Date

Circle one: (Present) Developed **SUBAREA 003**

1. Runoff curve number (CN)

Soil Name and Hydroogic Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area _x_ acres __mi2 __%	Product of CN x Area
B	Straight Row Crops (Good Conditions)	78			3.09	241.02
B	Impervoius Area	98			0.17	16.66
1/ Use only one CN source per line.			Totals =		3.26	257.680

CN (weighted) = Total Product / Total Area = 257.680 / 3.260 = 79.043

Use CN = 79.0

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall	in			
Runoff, Q	in			

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Project	Fox River	By	CMZ	Date	12/29/2021
Location		Checked		Date	

Check one: ☑ Present ☑ Developed — Existing Condition

Check one: ☐ Tc ☐ Tt — TOP CENTER

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map. schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID				
1. Surface Description (Table 3-1)			Culitvated Soils			
2. Manning's roughness coeff., n (Table 3-1)			0.06			
3. Flow length, L (total L ≤ 300 ft)		ft	100			
4. Two-yr 24-hr rainfall, P_2		in	3.34			
5. Land slope, s		ft/ft	0.013			
6. $Tc = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$		hr	0.091	+	=	0.091

Shallow Concentrated Flow		Segment ID				
7. Surface description (paved or unpaved)			unpaved			
8. Flow length, L			331			
9. Watercourse slope, s			0.009			
10. Average velocity, V (figure 3-1)			1.54			
11. $T_t = \frac{L}{3600\,V}$		hr	0.060	+	=	0.060

Channel Flow		Segment ID				
12. Cross sectional flow area, a		ft^2				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r= a/pw compute r		ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. $V = 1.49\,r^{2/3}\,s^{1/2} / n$		ft/s	3			
18. Flow length, L		ft				
19. $T_t = \frac{L}{3600\,V}$		hr		+	=	

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr	0.151

Project	Fox River	By	CMZ	Date	12/29/2021
Location		Checked		Date	

Check one: ☑ Present ☑ Developed

Check one: ☐ Tc ☐ Tt

Existing Condition

Subarea 001B

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map. schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)

		Segment ID				
1.	Surface Description (Table 3-1)		Culitvated Soils			
2.	Manning's roughness coeff., n (Table 3-1)		0.06			
3.	Flow length, L (total L ≤ 300 ft)	ft	100			
4.	Two-yr 24-hr rainfall, P_2	in	3.34			
5.	Land slope, s	ft/ft	0.007			
6.	$Tc = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\, s^{0.4}}$	hr	0.117	+	=	0.117

Shallow Concentrated Flow

		Segment ID				
7.	Surface description (paved or unpaved)		unpaved	paved		
8.	Flow length, L		615	40		
9.	Watercourse slope, s		0.011	0.011		
10.	Average velocity, V (figure 3-1)		1.71	2.17		
11.	$T_t = \frac{L}{3600\, V}$	hr	0.100	+ 0.01	=	0.105

Channel Flow

		Segment ID				
12.	Cross sectional flow area, a	ft^2				
13.	Wetted perimeter, pw	ft				
14.	Hydraulic radius, r= a/pw compute r	ft				
15.	Channel Slope, s	ft/ft				
16.	Manning's roughness coeff., n					
17.	$V = 1.49\, r^{2/3}\, s^{1/2} / n$	ft/s	3			
18.	Flow length, L	ft				
19.	$T_t = \frac{L}{3600\, V}$	hr		+	=	

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) hr 0.222

Project	Fox River	By	CMZ	Date	12/29/2021
Location		Checked		Date	

Check one: ☑ Present ☑ Developed — Existing Condition

Check one: ☐ Tc ☐ Tt — Subarea 002

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map. schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)							
Segment ID							
1. Surface Description (Table 3-1)		Culitvated Soils					
2. Manning's roughness coeff., n (Table 3-1)		0.06					
3. Flow length, L (total L ≤ 300 ft)	ft	100					
4. Two-yr 24-hr rainfall, P_2	in	3.34					
5. Land slope, s	ft/ft	0.012					
6. $Tc = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$	hr	0.094	+		=	0.094	

Shallow Concentrated Flow							
Segment ID							
7. Surface description (paved or unpaved)		unpaved					
8. Flow length, L		250					
9. Watercourse slope, s		0.017					
10. Average velocity, V (figure 3-1)		2.12					
11. $T_t = \frac{L}{3600\,V}$	hr	0.033	+		=	0.033	

Channel Flow							
Segment ID							
12. Cross sectional flow area, a	ft^2						
13. Wetted perimeter, pw	ft						
14. Hydraulic radius, r= a/pw compute r	ft						
15. Channel Slope, s	ft/ft						
16. Manning's roughness coeff., n							
17. $V = 1.49\, r^{2/3}\, s^{1/2} / n$	ft/s	3					
18. Flow length, L	ft						
19. $T_t = \frac{L}{3600\,V}$	hr		+		=		

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr	0.127	

EXHIBIT F

“WITH PROJECT”

CONDITION HYDROLOGY

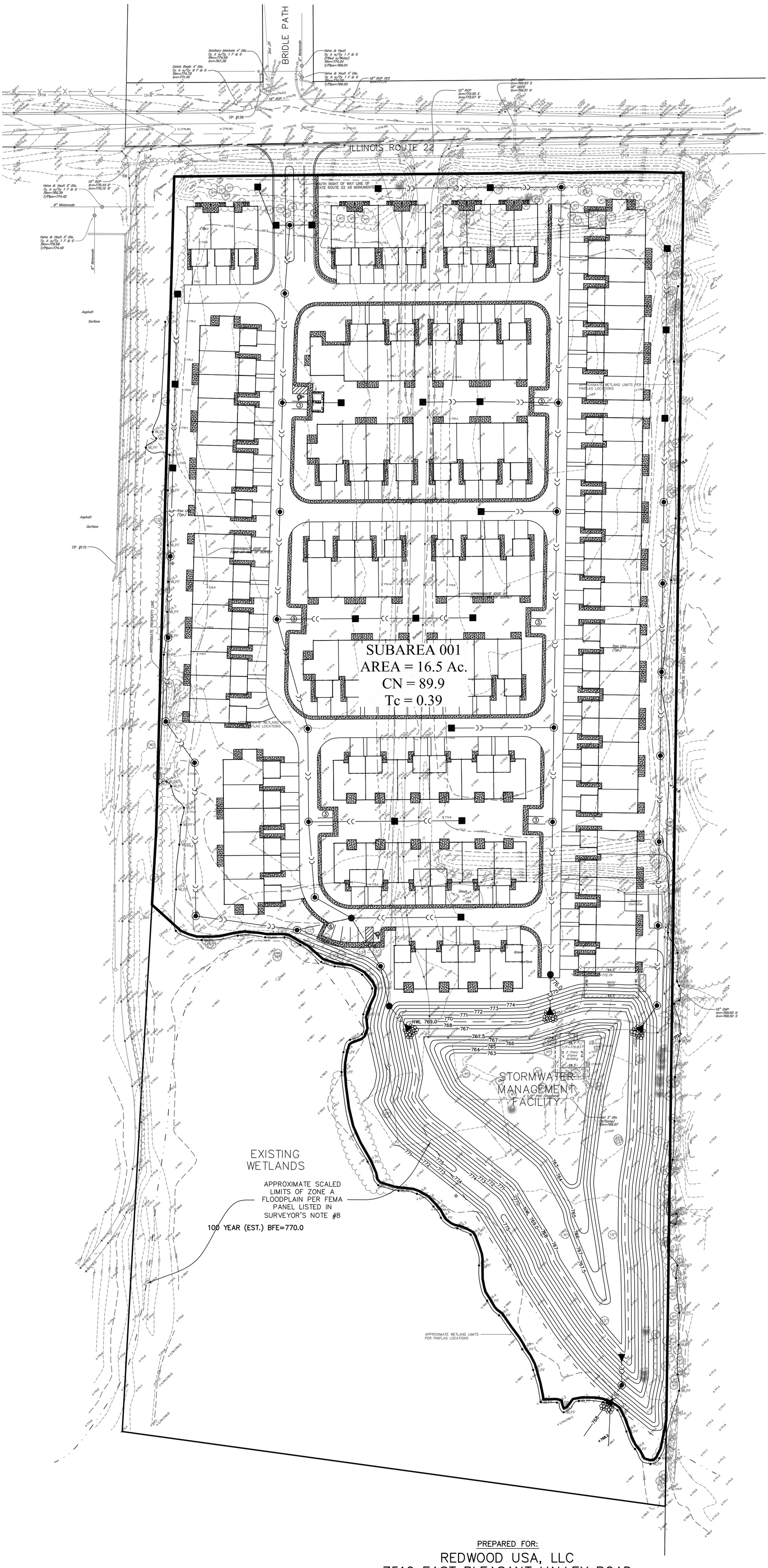
PROPOSED CONDITIONS

WATERSHED EXHIBIT

PROPOSED CATCHMENT EXHIBIT

FOR

REDWOOD FOX RIVER GROVE



N

60 30 0 60

SCALE: 1 INCH = 60 FEET

PREPARED FOR:

REDWOOD USA, LLC
7510 EAST PLEASANT VALLEY ROAD
INDEPENDENCE, OH 44131
(216) 254-8425

PREPARED BY:

CEMCON, Ltd.
Consulting Engineers, Land Surveyors & Planners
2280 White Oak Circle, Suite 100
Aurora, Illinois 60502-9675
PH: 630.862.2100 FAX: 630.862.2199
E-Mail: cadd@cemcon.com Website: www.cemcon.com

DISC NO.: 848013 FILE NAME: CATCHMENT
DRAWN BY: BCD FLD. BK. / PG. NO.: BK./PG.
COMPLETION DATE: 01-06-2022 JOB NO.: 848.013
XREF : TOPO PROJECT MANAGER : KTS
REVISION DATE:

PLOT FILE CREATED: 1/6/2022 BY: DAVID DEMAY DRAWING PATH: P:\848013\DWG\ENG\DRAWINGS\EXHIBITS\WATERSHED.DWG

“PROP” PONDPACK

OUTPUT AND INPUT FILES

Scenario Summary Report
Scenario: 2Yr 24Hr

Scenario Summary	
ID	33
Label	2Yr 24Hr
Notes	
Active Topology	Base Active Topology
Hydrology	Base Hydrology
Rainfall Runoff	2Yr 24Hr
Physical	Base Physical
Initial Condition	Base Initial Condition
Boundary Condition	Base Boundary Condition
Infiltration and Inflow	Base Infiltration and Inflow
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	72Hr

Element Details			
ID	44	Store Hydrographs (as Input)	False
Label	72Hr	Store Elevation-Flow-Tailwater Tables?	False
Notes			

Global Storm Settings			
Storm Tag Prefix	User Defined	User Tag	

Output Settings			
Minimum Tc	0.083 hours	Total Simulation Time	72.000 hours
Output Increment	0.050 hours	Peak Tolerance	1.5 %

Interconnected Pond Output Settings			
ICPM Time Step	0.050 hours	Flow Tolerance (Maximum)	0.010 ft^3/s
Flow Tolerance (Minimum)	0.000 ft^3/s	Maximum Iterations	35

Scenario Calculation Summary

Scenario Summary	
ID	1
Label	100Yr 24 Hr
Notes	
Active Topology	Base Active Topology
Hydrology	Base Hydrology
Rainfall Runoff	100Yr 24Hr
Physical	Base Physical
Initial Condition	Base Initial Condition
Boundary Condition	Base Boundary Condition
Infiltration and Inflow	Base Infiltration and Inflow
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	72Hr

Output Summary			
Output Increment	0.050 hours	Duration	72.000 hours

Rainfall Summary			
Return Event Tag	100	Rainfall Type	Time-Depth Curve
Total Depth	8.6 in	Storm Event	100YR-24HR

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
001	100Yr 24 Hr	100	None	10.113	16.000	12.30	(N/A)	(N/A)
O-1	100Yr 24 Hr	100	None	7.891	21.650	2.44	(N/A)	(N/A)
SWMF 01 (IN)	100Yr 24 Hr	100	None	10.113	16.000	12.30	(N/A)	(N/A)
SWMF 01 (OUT)	100Yr 24 Hr	100	None	7.891	21.650	2.44	773.58	7.823

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ac-ft)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction
SWMF 001 - Outlet	Pond Outlet	Upstream	10.113	16.000	12.30	SWMF 01	Pond Inflow
SWMF 001 - Outlet	Pond Outlet	Outflow	7.891	21.650	2.44	SWMF 01	Pond Outflow
SWMF 001 - Outlet	Pond Outlet	Link	7.891	21.650	2.44		

Scenario Calculation Summary

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ac-ft)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction
SWMF 001 - Outlet	Pond Outlet	Downstream	7.891	21.650	2.44	O-1	

Table of Contents

Subsection: Time-Depth Curve
Label: UPDATED 100YR 12HR-48HR

Return Event: 100 years
Storm Event: 100YR-24HR

Time-Depth Curve: 100YR-24HR	
Label	100YR-24HR
Start Time	0.000 hours
Increment	1.000 hours
End Time	24.000 hours
Return Event	100 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 1.000 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.2	0.4	0.6	0.8
5.000	1.0	1.2	1.4	1.7	2.0
10.000	2.3	2.7	3.1	3.8	4.5
15.000	5.2	6.0	6.7	7.3	7.7
20.000	8.0	8.2	8.3	8.4	8.6

Storm Event	100YR-24HR
Return Event	100 years
Duration	72.000 hours
Depth	8.6 in
Time of Concentration (Composite)	0.387 hours
Area (User Defined)	16.500 acres

Computational Time Increment	0.052 hours
Time to Peak (Computed)	15.996 hours
Flow (Peak, Computed)	12.30 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	16.000 hours
Flow (Peak Interpolated Output)	12.30 ft³/s

Drainage Area	
SCS CN (Composite)	89.900
Area (User Defined)	16.500 acres
Maximum Retention (Pervious)	1.1 in
Maximum Retention (Pervious, 20 percent)	0.2 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	7.4 in
Runoff Volume (Pervious)	10.113 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	10.113 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.387 hours
Computational Time Increment	0.052 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	48.31 ft³/s
Unit peak time, Tp	0.258 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	1.032 hours
Total unit time, Tb	1.290 hours

Elevation-Volume

Pond Elevation (ft)	Pond Volume (ac-ft)
769.00	0.000
770.00	1.497
771.00	3.105
772.00	4.831
773.00	6.675
774.00	8.640
774.50	9.669
775.50	11.795

Requested Pond Water Surface Elevations	
Minimum (Headwater)	769.00 ft
Increment (Headwater)	0.10 ft
Maximum (Headwater)	775.50 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Orifice-Circular	100Yr Orifice	Forward	TW	771.30	775.50
Orifice-Circular	2 Year Orifice	Forward	TW	769.01	771.30
Rectangular Weir	100Yr Weir	Forward	TW	771.10	771.30
Rectangular Weir	Emergency Spillway	Forward	TW	774.50	775.50
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: 2 Year Orifice Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	768.80 ft
Orifice Diameter	4.5 in
Orifice Coefficient	0.600

Structure ID: Emergency Spillway Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	774.50 ft
Weir Length	20.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: 100Yr Orifice Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	768.80 ft
Orifice Diameter	7.0 in
Orifice Coefficient	0.600

Structure ID: 100Yr Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	771.10 ft
Weir Length	6.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Subsection: Composite Rating Curve
Label: SWMF 001 - Outlet

Return Event: 100 years
Storm Event: 100YR-24HR

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
769.00	0.00	769.00	0.00
769.10	0.06	769.06	0.01
769.20	0.18	769.09	0.01
769.30	0.24	769.09	0.01
769.40	0.29	769.11	0.01
769.50	0.32	769.14	0.01
769.60	0.36	769.13	0.01
769.70	0.39	769.16	0.01
769.80	0.42	769.16	0.01
769.90	0.45	769.18	0.01
770.00	0.47	769.20	0.01
770.10	0.51	769.19	0.01
770.20	0.53	769.21	0.01
770.30	0.55	769.21	0.01
770.40	0.58	769.23	0.01
770.50	0.60	769.25	0.01
770.60	0.62	769.24	0.01
770.70	0.64	769.25	0.01
770.80	0.66	769.27	0.01
770.90	0.68	769.28	0.01
771.00	0.70	769.27	0.01
771.10	0.72	769.28	0.01
771.20	1.26	769.50	0.01
771.30	1.64	769.66	0.01
771.40	1.68	769.69	0.01
771.50	1.73	769.68	0.01
771.60	1.76	769.72	0.01
771.70	1.81	769.73	0.01
771.80	1.84	769.75	0.01
771.90	1.88	769.76	0.01
772.00	1.91	769.79	0.01
772.10	1.96	769.79	0.01
772.20	1.99	769.81	0.01
772.30	2.03	769.81	0.01
772.40	2.06	769.84	0.01
772.50	2.10	769.83	0.01
772.60	2.13	769.86	0.01
772.70	2.16	769.88	0.01
772.80	2.20	769.88	0.01
772.90	2.23	769.90	0.01
773.00	2.26	769.92	0.01
773.10	2.30	769.91	0.01
773.20	2.32	769.94	0.01
773.30	2.35	769.96	0.01

Subsection: Composite Rating Curve
Label: SWMF 001 - Outlet

Return Event: 100 years
Storm Event: 100YR-24HR

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
773.40	2.39	769.95	0.01
773.50	2.42	769.97	0.01
773.60	2.44	769.99	0.01
773.70	2.47	770.01	0.01
773.80	2.51	769.99	0.01
773.90	2.54	770.01	0.01
774.00	2.56	770.04	0.01
774.10	2.59	770.06	0.01
774.20	2.62	770.05	0.01
774.30	2.65	770.07	0.01
774.40	2.67	770.09	0.01
774.50	2.70	770.08	0.01
774.60	4.41	770.78	0.01
774.70	7.48	771.99	0.01
774.80	11.31	773.52	0.01
774.90	16.33	774.10	0.01
775.00	22.32	774.26	0.01
775.10	28.95	774.42	0.01
775.20	35.31	774.61	0.01
775.30	40.90	774.75	0.01
775.40	46.00	774.89	0.01
775.50	51.47	775.00	0.01

Contributing Structures
None Contributing
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice
2 Year Orifice

Subsection: Composite Rating Curve
Label: SWMF 001 - Outlet

Return Event: 100 years
Storm Event: 100YR-24HR

Composite Outflow Summary

Contributing Structures
2 Year Orifice + 100Yr Weir
2 Year Orifice + 100Yr Weir
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway
100Yr Orifice + Emergency Spillway

Index

PONDPACK SUPPORT

CALCULATIONS

Worksheet 2: Runoff Curve Number and Runoff

Project 848.013 By CMZ Date 12/29/2021
Location Rev Date

Circle one: Present Developed **SUBAREA 001**

1. Runoff curve number (CN)

Soil Name and Hydroogic Group	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN 1/ Table 2-2	CN 1/ Fig. 2-3	CN 1/ Fig. 2-4	Area _x_ acres __mi2 __%	Product of CN x Area
D	1/8 acre or less (town houses)	92			11.39	1047.88
D	Stormwater Management Facility (HWL)	80			0.59	47.20
D	Stormwater Management Facility (NWL)	98			1.44	141.12
D	Open Space - Good Condition	80			3.08	246.40
1/ Use only one CN source per line.			Totals =		16.50	1482.600

CN (weighted) = Total Product / Total Area = 1482.600 / 16.500 = 89.855

Use CN = 89.9

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency	yr			
Rainfall	in			
Runoff, Q	in			

(Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)

Project	Fox River	By	CMZ	Date	12/29/2021
Location		Checked		Date	

Check one: ☐ Present ☑ Developed — Proposed

Check one: ☑ Tc ☐ Tt — 1

NOTES: Space for as many as two segments per flow type can be used for each worksheet.
Include a map. schematic, or description of flow segments.

Sheet Flow (Applicable to Tc only)		Segment ID				
1. Surface Description (Table 3-1)			Dense Grass			
2. Manning's roughness coeff., n (Table 3-1)			0.24			
3. Flow length, L (total L ≤ 300 ft)		ft	100			
4. Two-yr 24-hr rainfall, P_2		in	3.34			
5. Land slope, s		ft/ft	0.02			
6. $Tc = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\, s^{0.4}}$		hr	0.233	+	=	0.233

Shallow Concentrated Flow		Segment ID				
7. Surface description (paved or unpaved)			unpaved			
8. Flow length, L			900			
9. Watercourse slope, s			0.01			
10. Average velocity, V (figure 3-1)			1.63			
11. $T_t = \frac{L}{3600\, V}$		hr	0.154	+	=	0.154

Channel Flow		Segment ID				
12. Cross sectional flow area, a		ft^2				
13. Wetted perimeter, pw		ft				
14. Hydraulic radius, r= a/pw compute r		ft				
15. Channel Slope, s		ft/ft				
16. Manning's roughness coeff., n						
17. $V = 1.49\, r^{2/3}\, s^{1/2} / n$		ft/s	3			
18. Flow length, L		ft				
19. $T_t = \frac{L}{3600\, V}$		hr		+	=	

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)	hr	0.387

Job #: 848.013
Project: Fox River

Date: December 29, 2018
Revised:
By: CMZ

SWMF 1				
BASIN STAGE/ STORAGE RELATIONSHIP				
ELEV.	AREA (S.F.)	AREA (AC.)	INCREM. VOLUME (AC.-Ft.)	**CUMULATIVE VOLUME (Ac-Ft)**
769.0	62793.65	1.442	0.000	**0.000**
770.0	67582.12	1.551	1.497	**1.497**
771.0	72583.58	1.666	1.609	**3.105**
772.0	77726.47	1.784	1.725	**4.831**
773.0	82909.56	1.903	1.844	**6.675**
774.0	88295.54	2.027	1.965	**8.640**
774.5	91023.09	2.090	1.029	**9.669**
775.5	94232.48	2.163	2.126	**11.795**

Job #: 848.013 Date: January 5, 2022
Project: Fox River Revised:
By: ARF

SWMF1 STAGE/ STORAGE RELATIONSHIP				
BELOW NWL				
ELEV.	AREA (S.F.)	AREA (AC.)	INCREM. VOLUME (AC.-Ft.)	**CUMULATIVE VOLUME (Ac-Ft)**
763.0	15630	0.359	0.000	**0.000**
764.0	18080	0.415	0.387	**0.387**
765.0	21460	0.493	0.454	**0.841**
766.0	25180	0.578	0.535	**1.376**
767.0	53540	1.229	0.904	**2.280**
768.0	58110	1.334	1.282	**3.561**
769.0	62790	1.441	1.388	**4.949**

RETENTION STORAGE CALCULATIONS

Proposed Impervious Area:	10.1	Ac.
Depth of Rainfall for Calc:	0.75	Inches
Retention Volume Required:	**0.631**	Ac.-ft.
Retention Volume Provided:	**4.949**	Ac.-ft.

EXHIBIT G

WETLAND DELINEATION REPORT BY MIDWEST ECOLOGICAL, INC. (UNDER SEPARATE COVER AND WILL BE SUBMITTED WITH FINAL)

EXHIBIT H

RUNOFF VOLUME REDUCTION (RVR) CALCULATIONS

CEMCON, Ltd.
CONSULTING ENGINEERS, LAND SURVEYORS & PLANNERS
2280 White Oak Circle, Suite 100
AURORA, ILLINOIS 60502-9675
(630) 862-2100

By ARF Date 1/5/22
Chkd _____ Date _____
Sheet _____ of _____

Project No. 848.013
Subject Redwood Fox River Grove
Illinois Route 22 RVR Credits

EXISTING 24R - 24HR RUNOFF VOLUME FOR EXISTG WETLAND:
= 1.8 AC FT

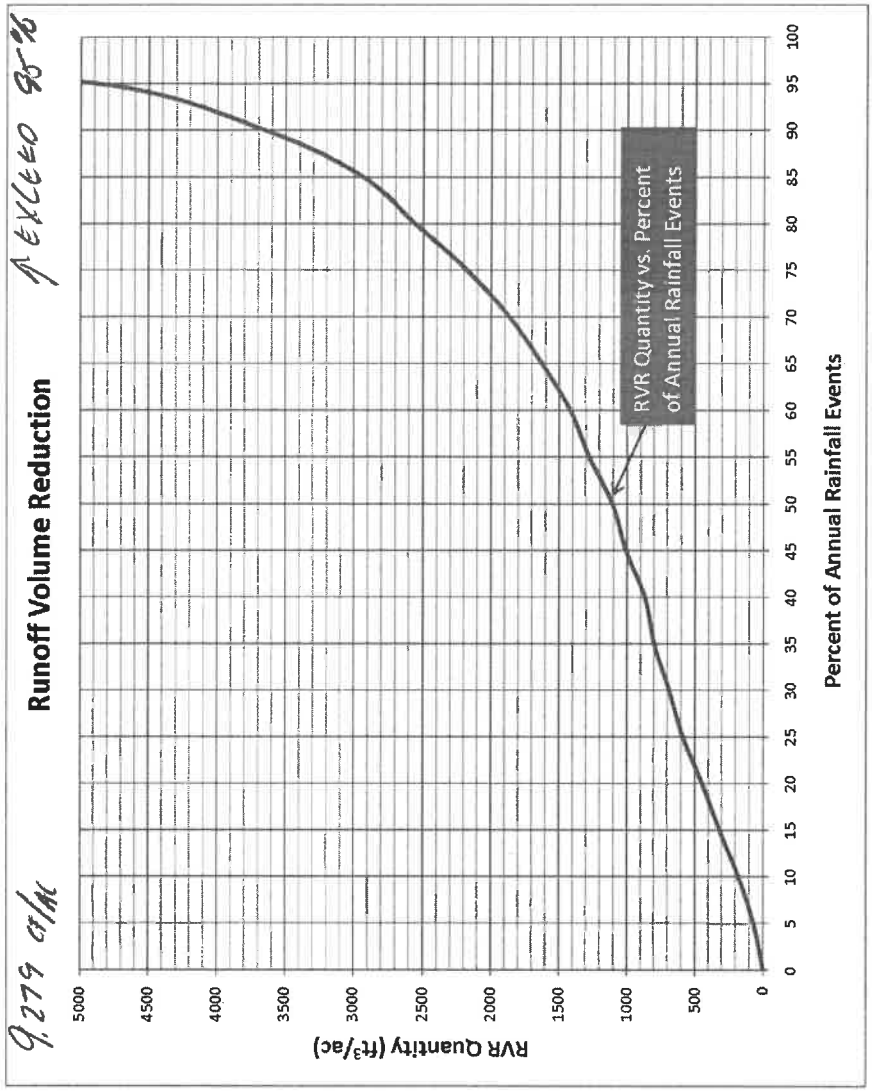
ISOLATED WETLAND HYDROLOGY CREDIT:
= 1.8 AcFT x 100%
= 1.8 AcFT

EXISTG IMPERVIOUS AREA = 1.64 AC
PROPOSED IMPERVIOUS AREA = 10.09 AC

NEW IMPERVIOUS AREA MINUS EXISTG IMPERVIOUS:
= 8.45 AC

RVR QUANTITY = 1.8 AcFT = $\frac{78408 \text{ CF}}{8.45 \text{ AC}}$ = 9,279 CF/AC

Appendix O: Runoff Volume Reduction



Percent of Annual Rainfall Events	100% impervious values	
	Runoff Depth (in)	RVR Quantity ft^3/ac new impervious
0	0	0
5	0.02	70
10	0.05	180
15	0.09	320
20	0.12	450
25	0.16	590
30	0.19	690
35	0.22	800
40	0.24	870
45	0.28	1010
50	0.30	1110
55	0.35	1280
60	0.39	1420
65	0.45	1630
70	0.51	1870
75	0.60	2180
80	0.70	2560
85	0.81	2940
90	1.01	3660
95	1.35	4900
99	2.41	8760

Runoff Depth based on Figure 3 of the Center For Watershed Protection Report.

Runoff Depth = P*R where:

P = Rainfall Depth (inches)

R=Volumetric Runoff Coefficient = 0.95 for 100% impervious cover [0.05+.009(I), where I is 100% (impervious cover)]

RVR Quantity = Runoff Depth (in) / 12 (in/ft) * 43560 (ft^2/ac)

EXHIBIT I

ELECTRONIC COPY OF

HYDROLOGIC MODELS