Client: Illinois Central College Client Interest: Constructed Wetland

Planning and site evaluation

- What to look for when visiting the site
- What to consider when evaluating the site
- What to ask the landowner

Preliminary design

- Size and depth to meet criteria
- Treatment area size and layout
- Additional considerations





LOCATION

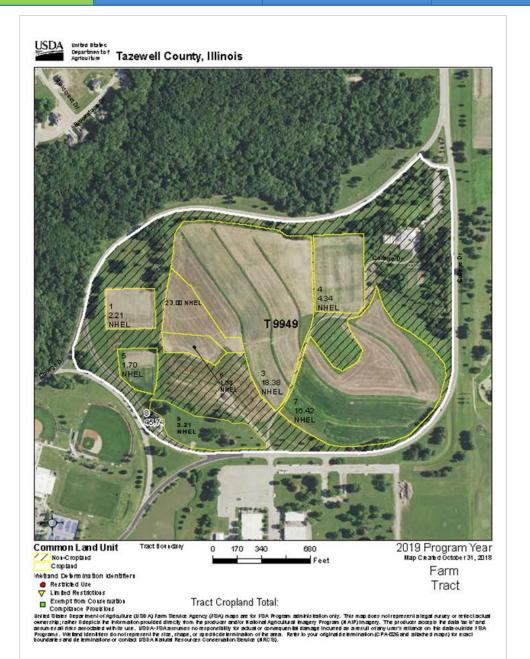
- A. Property Location & Boundary
- B. Wetland Compliance
- C. Landscape Position
- D. Landowner Preference
- E. Receiving Waterbody
- F. Floodplain

SOURCES

- USDA Farm Map
- County tax assessor (GIS)
- Plat book

EXHIBIT A





LOCATION

- A. Property Location & Boundary
- B. Wetland Compliance
- C. Landscape Position
- D. Landowner Preference
- E. Receiving Waterbody
- F. Floodplain

SOURCES

- USDA Farm Map
- County tax
 assessor (GIS)
- Plat book





LOCATION

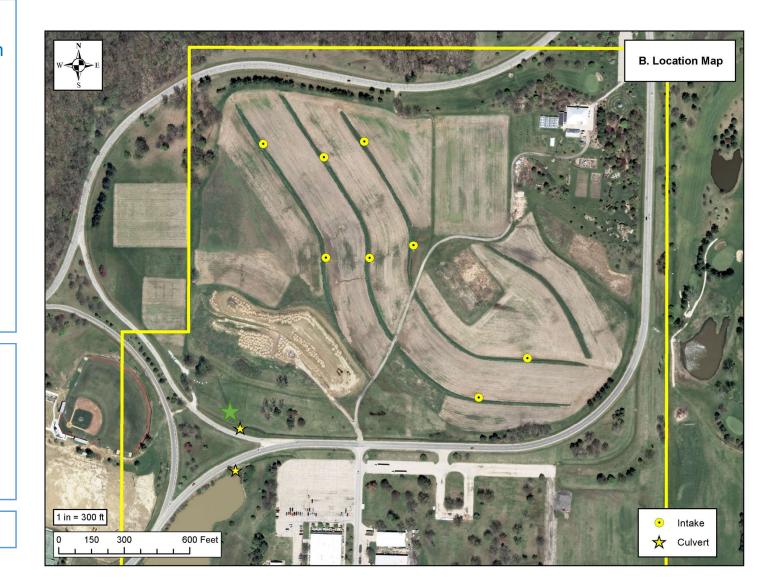
- A. Property Location & Boundary
- B. Wetland Compliance
- C. Landscape Position
- D. Landowner Preference
- E. Receiving Waterbody
- F. Floodplain

SOURCES

- USDA Farm Map
- County tax assessor (GIS)
- Plat book

EXHIBIT B





percent slopes

Rozetta silt loam, 2 to 5

percent slopes, eroded

34.0

92.8

36.6%

100.0%



279B2

Totals for Area of Interest



٠

٠

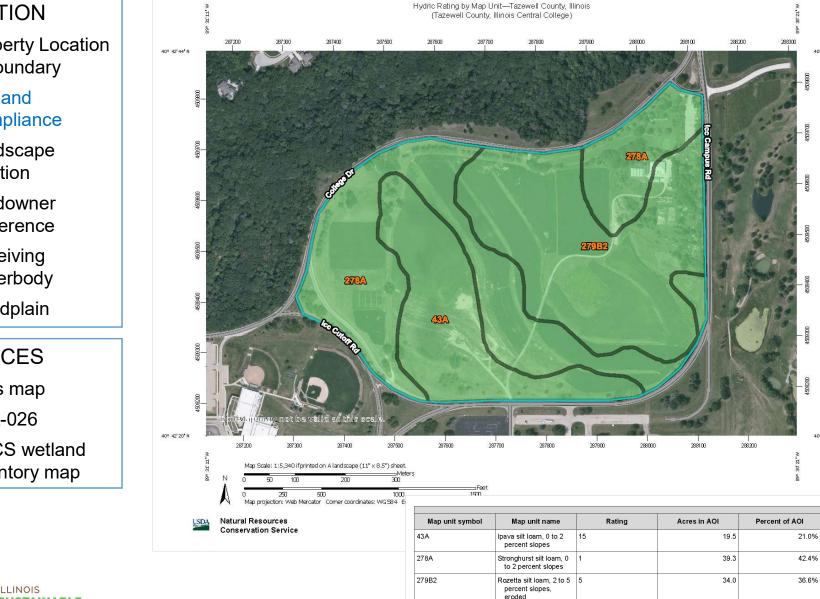
٠

40° 42' 44' N

40° 42' 20' N

100.0%

92.8



Totals for Area of Interest

LOCATION

- A. Property Location & Boundary
- B. Wetland Compliance
- C. Landscape Position
- D. Landowner Preference
- E. Receiving Waterbody
- F. Floodplain

SOURCES

- Soils map ٠
- CPA-026 ٠
- NRCS wetland ٠ inventory map

SUSTAINABLE

AG PARTNERSHIP

LOCATION

- A. Property Location & Boundary
- B. Wetland Compliance
- C. Landscape Position
- D. Landowner Preference
- E. Receiving Waterbody
- F. Floodplain

SOURCES

- USGS topo
- LiDAR
- On-ground topo

EXHIBIT C





• Low on the landscape (be able to daylight the tile)

PLANNING	1. Location	2. Site Conditions	3. Drainage Area	4. Review	
LOCATION					
A. Property Location & Boundary					
B. Wetland Compliance					
C. Landscape Position					
D. Landowner Preference					
E. Receiving Waterbody	What questio	ons should you	ask landowne	r/operator?	
F. Floodplain					



PLANNING 2. Site Conditions 3. Drainage Area 4. Review Maintain primary research farm plots LOCATION • and bioreactor location A. Property Location Consider proposed ICC Sustainability • EAST PEORIA CROSS COUNTRY & Boundary **Center** location B. Wetland Consider existing cross-country course . Compliance Variety of wetland and buffer habitats C. Landscape Position D. Landowner Preference E. Receiving Waterbody F. Floodplain



LOCATION

- A. Property Location & Boundary
- B. Wetland Compliance
- C. Landscape Position
- D. Landowner Preference
- E. Receiving Waterbody
- F. Floodplain

What is the receiving waterbody?

- Tile main
- Grassed waterway
- Pond
- Ditch/Stream

What are the main considerations?

- Capacity
- Erosion
- Stream bank stability
- Water level (normal and storm event)
- Downstream" impacts



LOCATION

- A. Property Location & Boundary
- B. Wetland Compliance
- C. Landscape Position
- D. Landowner Preference
- E. Receiving Waterbody
- F. Floodplain



300 600 300 150 0

12" HPDE drain discharges to a 42" concrete culvert that runs beneath Dingledine and College Drives into campus pond, which outlets to a tributary of Farm Creek.

TFeet

ICC Topographic Map

FEMA FLOOD MAP

ZONE X

LOCATION

- A. Property Location & Boundary
- B. Wetland Compliance
- C. Landscape Position
- D. Landowner Preference
- E. Receiving Waterbody
- F. Floodplain

SOURCE

 FEMA Flood Map Service (FIRMette)



	LEGEND
1000	SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
1% chance of area subject	ual chance flood (100-year flood), also known as the base flood, is the flood that has a of being equiled or exceeded in any given year. The Special Flood Hazerd Area is the to flooring by the Samand Cancer flood. Areas of Special Flood Hazerd nabulize Zones O, APA, A99, v, and VE. The Base Flood Elevation is the water-surface elevation of the arear Flood.
ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined. Flood depths of 1 to 3 feet (usually areas of ponding): Base Flood Elevations
LONE AN	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 Anasa formerly protected from the 1% annual chance flood by a flood control system that was subsequently detectified. 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
ZONE V	protection system under construction; no Base Flood Elevations determined. Coastal flood zone with velocity hazard (wave action); no Base Flood
ZONE V	Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
2///2	FLOODWAY AREAS IN ZONE AE
	$_{\rm I}$ is the channel of a stream plus any adjacent floodplain areas that must be kept free of it so that the 1% annual chance flood can be carried without substantial increases in
	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 foctor with delange areas less than 1 square mile; and areas protected by leves 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
<u> </u>	

Avoid 100-year floodplain unless you:

- Build to withstand flood events
- Meet permit requirements (building in a floodplain)
- Make sure landowner agrees to additional maintenance requirements

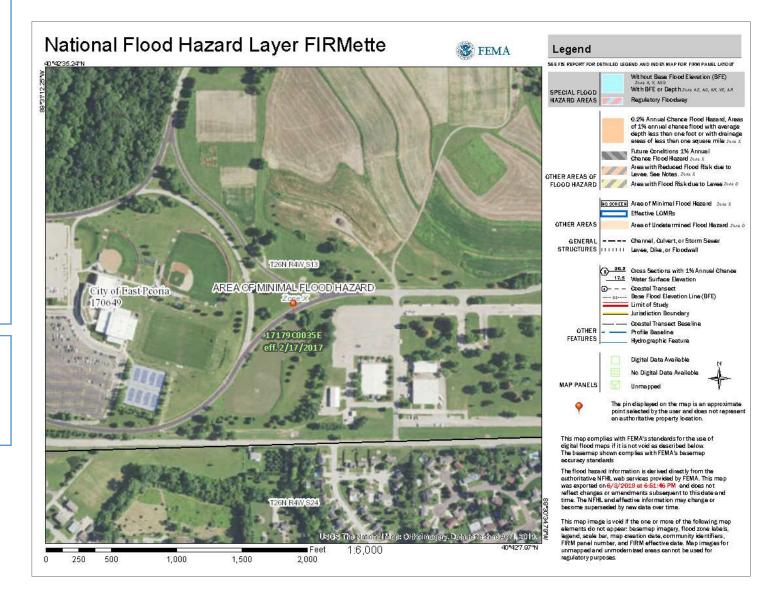


LOCATION

- A. Property Location & Boundary
- B. Wetland Compliance
- C. Landscape Position
- D. Landowner Preference
- E. Receiving Waterbody
- F. Floodplain

SOURCE

 FEMA Flood Map Service (FIRMette)





Any red flags at this point in the planning process?



A. Soils

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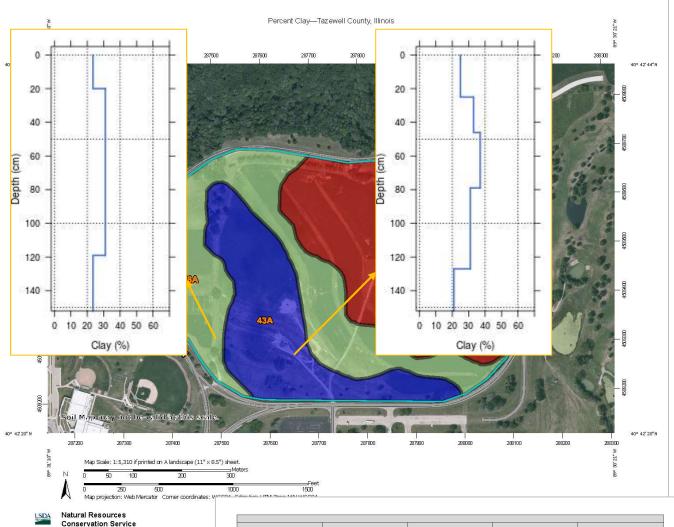
43A	Ipava silt loam, 0 to 2 percent slopes	19.5	21.09
278A	Stronghurst silt loam, 0 to 2 percent slopes	39.3	42.49
279B2	Rozetta silt loam, 2 to 5 percent slopes, eroded	34.0	36.6%
Totals for Area of	Interest	92.8	100.0%

SITE CONDITIONS:

- A. Soils
- **B.** Elevations
- C. Existing Conditions

SOURCES

- Web Soil Survey
- On-site investigation





Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI	
43A	Ipava silt loam, 0 to 2 percent slopes	30.8	19.2	21.2%	
278A	Stronghurst silt loam, 0 to 2 percent slopes	29.0	37.2	41.0%	
279B2	Rozetta silt Ioam, 2 to 5 percent slopes, eroded	28.3	34.3	37.8%	
Totals for Area of Inter	est		90.7	100.0%	



1. Location

SITE CONDITIONS:

- A. Soils
- B. Elevations
- C. Existing Conditions

SOURCES

- Web Soil Survey
- On-site investigation

EXHIBIT D



>			C	onse	rvation Se Illinois	rvice,									
					ral Colleg	ge, District 514				Hol	Hole No.: BH-A				
					y, Illinois			Site No	220		et:	1 of 1			
					W, Sec 1				System						
									.707145			g.: -89.515006W			
					Giddings	Vodel # 2	5-SHDGSRPS					D x 4' SP			
	onnel				D.C.			Surface		on (ft):	~66	4.0' (est. from topo map)		
	Logge	a by	: D. L	amb,	PG				evei: epth: 8	0'					
-1								TOLATO	epun: a	5.0 I	<u> </u>				
Run No.	Depth (ft)	Recovery (ft)	Elevation (ft)	Sample type/No.	Lithology graphic		Descriptio	n	Borehole detail	SSU CL/	CPT -Blows/6"	Notes			
Τ	_				Y	ellow-bro	wn, Clayey SILT,	slightly				10YR5/4	_		
							a, with grass, fine	roots	backfill	M	-				
1	4_ 5	3.9'	660.0			ark yellov vith trace	w-brown, CLAY, I gravel	noist, stiff,		сн		10YR4/6			
	-				E	ecomes v	ery moist, soft,	Clayey SILT		CL		10YR4/6			
	6 - 7 - 7						w-brown, Sandy, rately soft	clayey GRAVE		GC		10YR4/6			
	-		556.0				wn, fine SAND,	wet,		SP		10YR5/6			
2	8 - 9 - -	4.0'	65			noderatel	y soft <i>EOB = 8.0</i> '					End of Boring (EOB)			
	10 ⁻		-1				Exploration Me	thod SPT - spli	spoon			non-distinct boundary			

SITE CONDITIONS:

- A. Soils
- B. Elevations
- C. Existing Conditions

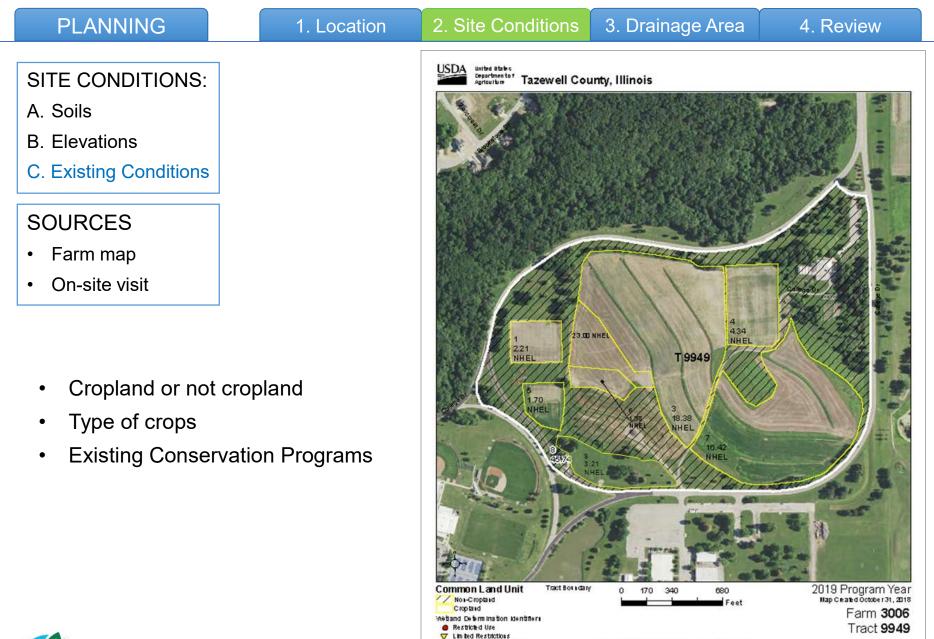
SOURCES

- Web Soil Survey
- On-site
 investigation

EXHIBIT D



	SD/		C		ural Res	ource Service,	Weather: Sun	ny, wari	n, ~70°F		Date	e: 05	5/10/2017, 2	::05pm
~				Unisei	Illinois									
and	lowne	r: Illi	inois	Cent		ge, District	514		Hole No.: BH-B					
Cour	nty: Tazewell County, Illinois Site No.:								Shee	et:	1 of 1			
.ega	l Locat	tion:	T26	N, R4	W, Sec	13			Coord. System:					
							gledine Rd		Lat.: 40.70				g.: -89.51445	58W
					Gidding	s Model # 2	5-SHDGSRPS		Exploration					
	onnel:										(ft):	~66	2.5' (est. fro	om topo map)
	Logge	d by:	: D. L	amb,	PG				Water Leve	30000				
				-					Total Dept	h: 8.0				
Run No.	Depth (ft)	Recovery (ft)	Elevation (ft)	Sample type/No.	Lithology graphic		Descripti			Borehole detail	uscs	CPT -Blows/6"		Notes
1		3.9'	658.5			moist, firm Dark yello with yello firm, trace Becomes i moist, mo Dark yello Sandy CLA Dark yello	w-brown, Claye n, with grass, fir w-brown, Claye w-brown (10YR! dark mottles gray-brown, Silt derately firm, tr w-brown, Claye Y, wet, modera w-brown, Sandy	y SILT, - 5/4), mc v CLAY, mc v CLAY, mc v SAND tely soft	mottled,	backfill	CL/ ML CH SM/ SC		10YR4/4 10YR4/6 10YR5/2 10YR4/6	
2	7 - - 8 - 4 - 9 - - - 10 -		654.5				vet, moderately	soft					End of Borii	
	ple Ty						Exploration M	ethod		on	-		non-distinct b	
	oil borin			SM - s	small		FA -Flight auger HSA - Hollow sten		BH - Backhoe	e			distinct bound water table (V	



Exempt from Coase mation Compliance Prouisions

ILLINOIS SUSTAINABLE AG PARTNERSHIP

Compliance Productors While States to part mention Agriculture (USD A) Farm Stenice Agency (FSA) maps are for FSA Program administration only. This map does not represent a legal survey or mitect lactual oursership; raher II depicts the hormation products directly from the producer and/or Katoral Agricultural II magery. Program (KAIP) imagery. The producer accept the data has triand assumes all direct accepts due to his use. USDA FSA assumes non-sportability for advance on concepture tail damagera in a survey of a state of the data base of t

Tract Cropland Total: 47.43 acres

PLANNING	1. Location	2. Site Conditions	3. Drainage Area	4. Review
SITE CONDITIONS: A. Soils B. Elevations C. Existing Conditions	Top of tile is 30" belo Tile is DW HDPE (12 Ground cover is "co Swale to culvert for s	2" ID, 14.5" OD) over crop"	at outlet swale	
SOURCES Farm map 				

On-site visit ٠







SITE CONDITIONS:

- A. Soils
- B. Elevations
- C. Existing Conditions

SOURCES

Topo Survey

EXHIBIT E



3. Drainage Area

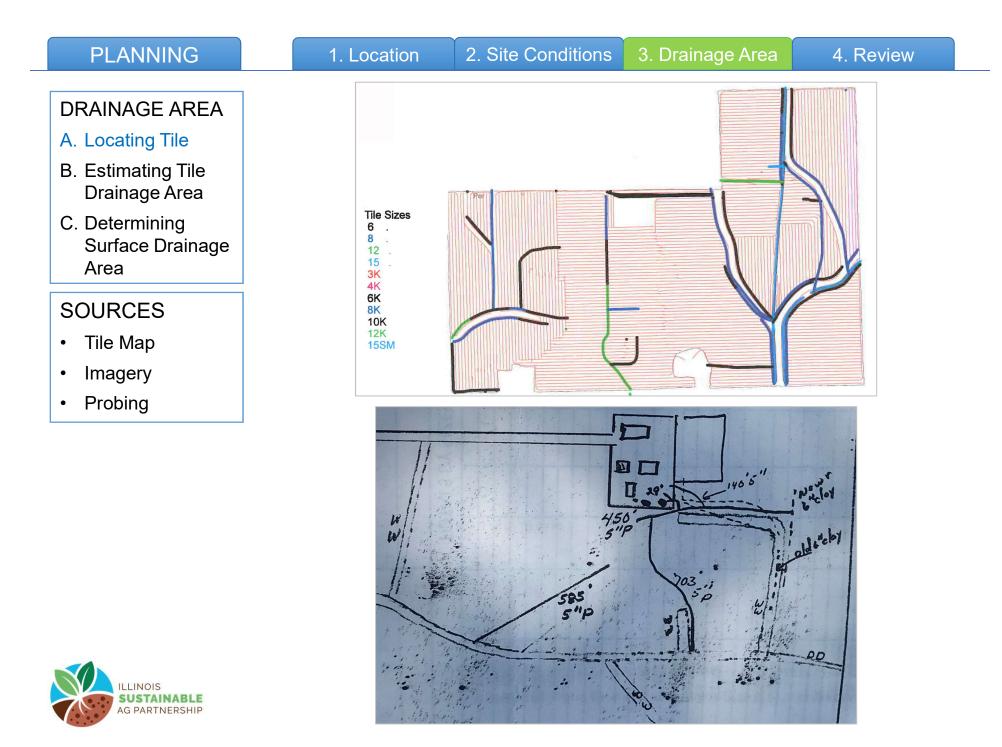
Concrete culvert invert = 657.3 ft Elev.



PLANNING 1.1	Location 2. Site Conditions	3. Drainage Area	4. Review
--------------	-----------------------------	------------------	-----------

Any concerns at this point in the planning process?





DRAINAGE AREA

A. Locating Tile

- B. Estimating Tile Drainage Area
- C. Determining Surface Drainage Area

SOURCES

- Tile Map
- Imagery
- Probing







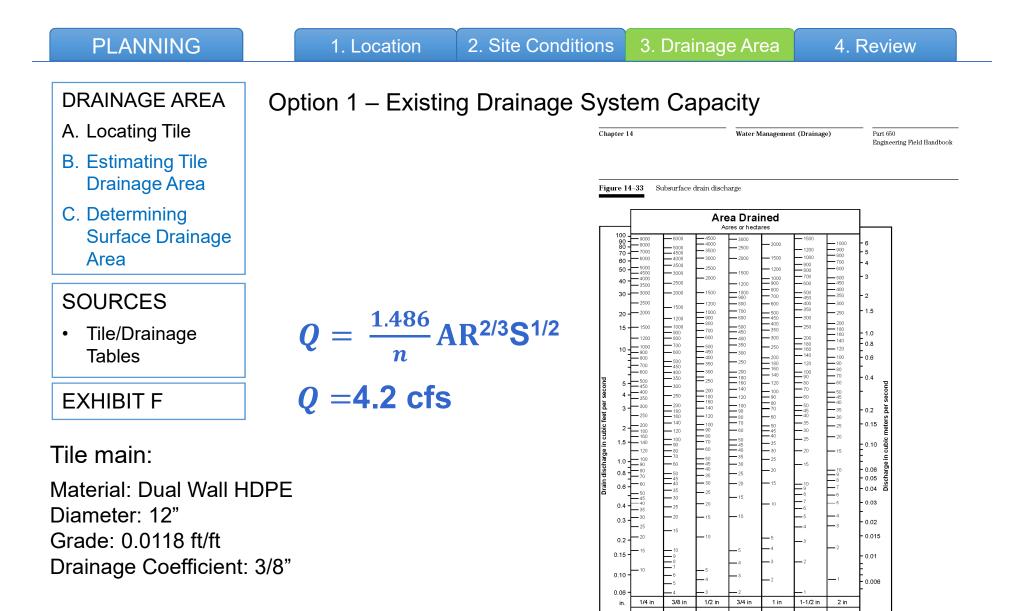






TRANSMITTER





mm

6.4

9.5

12.7

19.1

Depth removed in 24 hours Drainage coefficient Note: Use acres with ft³/s and hectares with m³/s (Source-ASAE Standard EP260.4)

25.4



(210-VI-NEH, April 2001)

38.1

50.8

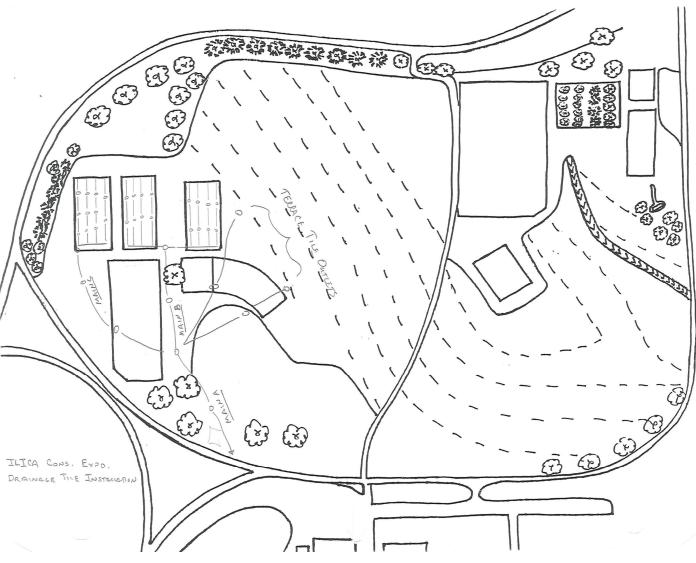
DRAINAGE AREA

- A. Locating Tile
- B. Estimating Tile Drainage Area
- C. Determining Surface Drainage Area

SOURCES

- Tile Map
- Imagery
- Probing





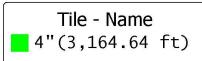


ICC Tile Design Map (2001)

PLANNING 1. Location 2. Site Conditions 3. Drainage Area 4. Review DRAINAGE AREA A. Locating Tile B. Estimating Tile Drainage Area C. Determining Surface Drainage Area SOURCES Tile Map • Imagery ٠ Probing •



ICC Tile Map (2017)



Ag Leader Technology SMS Advanced

3. Drainage Area

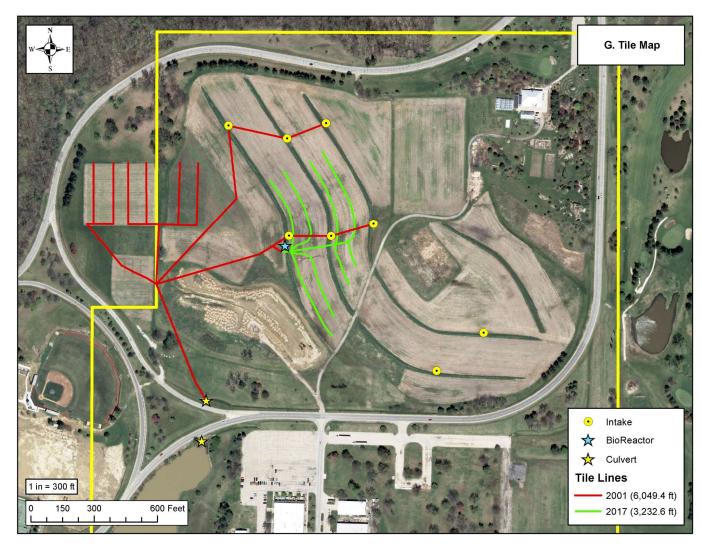
DRAINAGE AREA

- A. Locating Tile
- B. Estimating Tile Drainage Area
- C. Determining Surface Drainage Area

EXHIBIT G

- Delineate drained acres by drawing a line around the tile system, ¹/₂S on each side of the tile.
- Illinois Drainage
 Guide, S = 80-100'
- Length of tile = 9,282'

Option 2 – Existing Drainage System Capacity





DRAINAGE AREA

- A. Locating Tile
- B. Estimating Tile Drainage Area
- C. Determining Surface Drainage Area

SOURCES

• Soil map

Map unit symbol

43A

278A

279B2

Map unit name

Ipava silt Ioam, 0 to 2

Stronghurst silt loam, 0

to 2 percent slopes

Rozetta silt loam, 2 to 5

percent slopes

percent slopes,

eroded

Option 2 – Existing Drainage System Capacity if No tile map





Totals for Area of Interest

DRAINAGE AREA

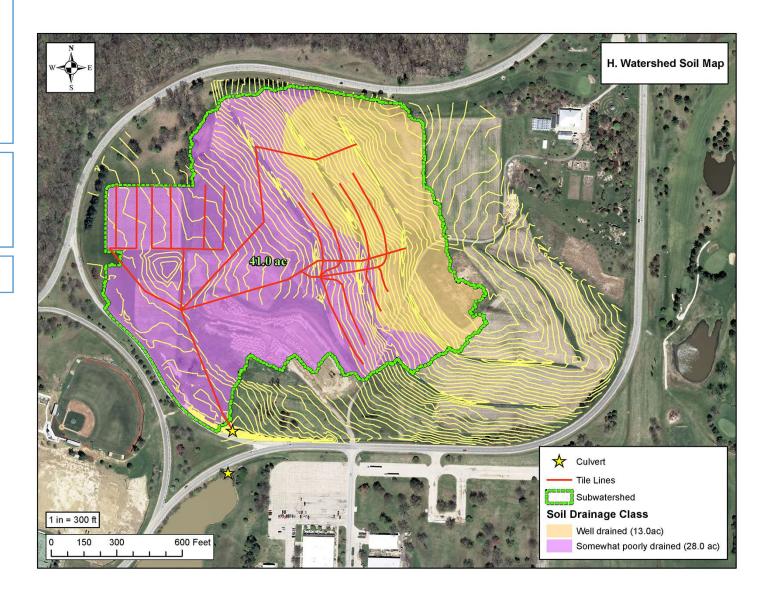
- A. Locating Tile
- B. Estimating Tile Drainage Area
- C. Determining Surface Drainage Area

SOURCES

 Soil map with topo

```
EXHIBIT H
```

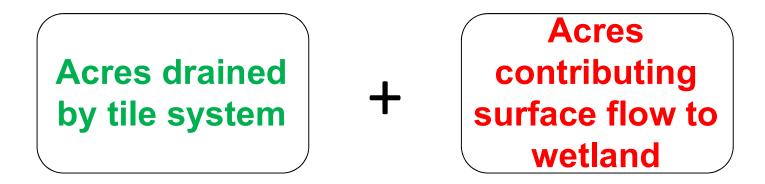
Option 2 – Existing Drainage System Capacity if No tile map







What is the contributing drainage area to your constructed wetland?





- Does it have tile drainage?
- Is the land currently under a conservation program?
- Preferences of the client
 - Available location(s) on property
 - Size limitations
 - Vegetation preferences
- Will the site be used for monitoring/research?
- Site conditions
 - Vegetation on site (photos?)
 - Will the soil hold a water table?
 - Crops/ proximity
 - Receiving channel/ area (does it flood regularly?)
 - Elevations (baseflow, crop, proposed wetland site, etc.)
 - Bank stability (if applicable)



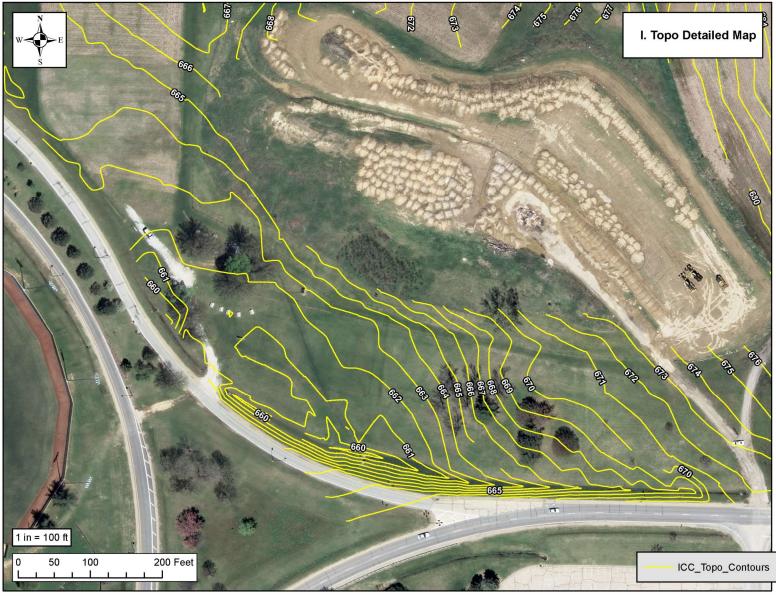
DESIGN 1. Size 2. Water Dept	h 3. Shape 4. Calculations
------------------------------	----------------------------

In small groups, you are going to design your constructed wetland.





Size 2.





DESIGN 1. Size	2. Water Depth	3. Shape	4. Calculations	
----------------	----------------	----------	-----------------	--

SIZE

Guidance Criteria?
Treatment area at least 1% of contributing watershed

Research Recommendations? Treatment area at 2.5-5% of contributing watershed

 Determine your wetland's treatment area based on your estimated drainage area (acres and square ft)



DEPTH

Guidance Criteria? Permanent pool must be at or below tile flow line

- At least 50% of treatment area should be 12" deep or less
- Count all areas between 24" below to 12" above permanent pool
- Account for accretion/sediment input

Are there any design constraints for the wetland depth?



DEPTH

Guidance Criteria? Permanent pool must be at or below tile flow line

- At least 50% of treatment area should be 12" deep or less
- Count all areas between 24" below to 12" above permanent pool
- Account for accretion/sediment input
- Determine where you want to intercept the tile (daylight)
- Determine what the tile flow line elevation
- Determine your wetland's treatment bottom depth, normal pool elevation (outlet), and max elevation.
- Sketch a cross-section to show elevations





SHAPE

- Guidance Criteria? Outlet hydraulically distant from inlet to maximize hydraulic retention time
 - Consider spreaders or interior berms to minimize short circuiting

Research Recommendations?

 Longer than wider

- Sketch out your proposed layout (show location, shape, inlet, outlet)
- Estimate your area, volume, and flow path length



HYDRAULIC RESIDENCE TIME CALCULATION

Try to maximize HRT

$$HRT(hours) = \frac{Volume(ft^3)}{Flow Rate(ft^3 per second)} \ge \frac{1}{3600}$$

Calculate your hydraulic residence time (100% flow & 10% flow capacity)



VELOCITY CALCULATION

- Maximum 1.5 ft/sec
 - During the 10-year, 24-hr storm event (if surface flow)
 - When the tile flows full
- Cross-sectional area at the limiting location along the path from inlet to outlet

$$Velocity \left(\frac{ft}{sec}\right) = \frac{Inflow \left(\frac{ft^3}{sec}\right)}{Limiting \ cross \ section \ (ft^2)}$$

Calculate your velocity (100% flow capacity)



FLOOD ROUTING

- Big enough to handle peak flow and volume from 25-year, 24-hour storm without overtopping
- Auxiliary should not flow until site receives more than 25-yr flow (10-yr if drainage area is ≤ 20 acres)





