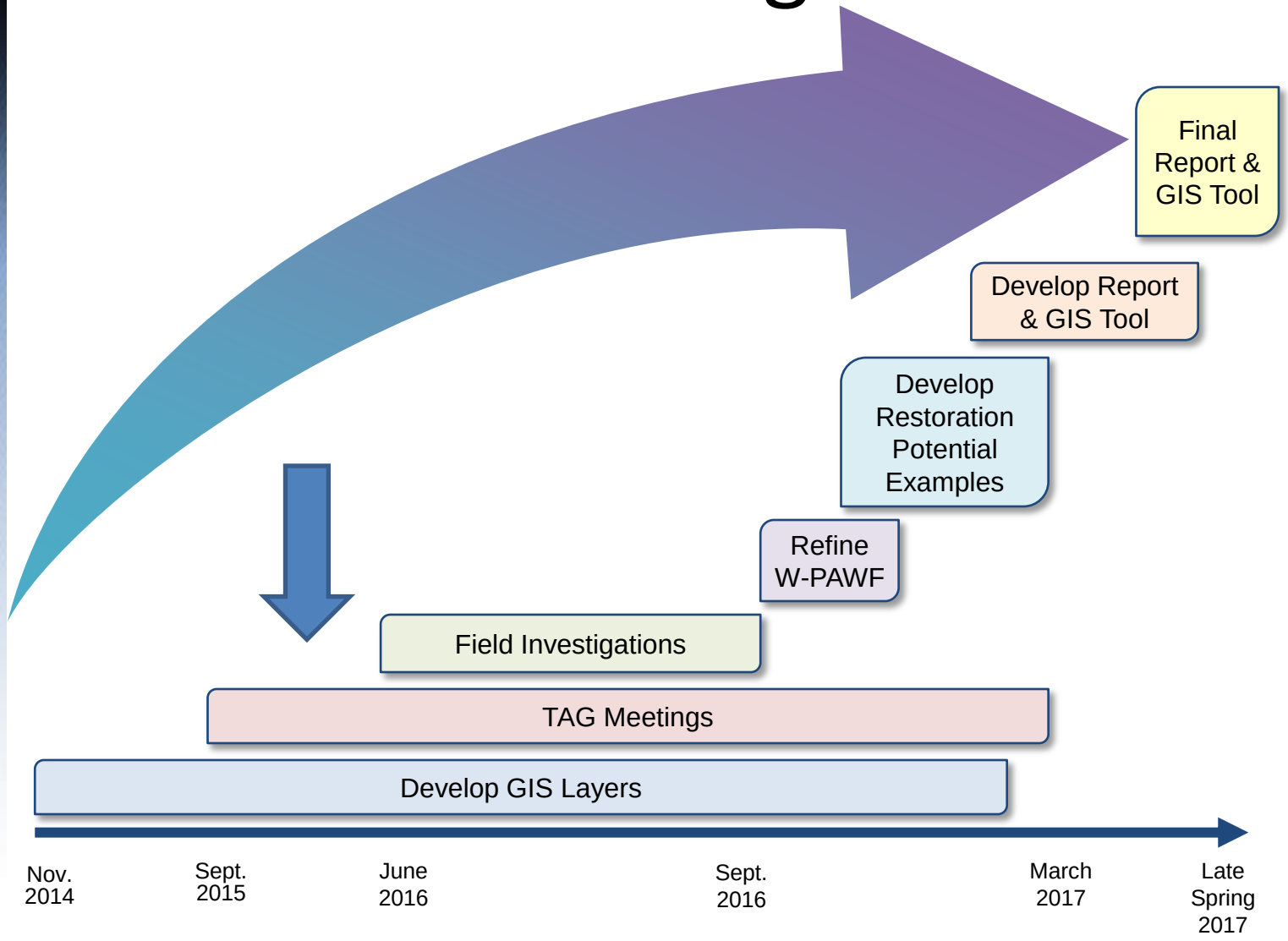
WRAPP Working Timeline

Timeline



WRAPP Stages

Stage 1: Wetland Inventory

- SMC lead; TAG input
- GIS exercise – Create dataset of existing wetlands ($LCWI_e$) & pre-settlement wetlands ($LCWI_h$)
- Assign NWI (Cowardin) classification code to each existing and pre-settlement wetland – "NWI+"
- Assign hydrogeomorphic descriptors (HGM) to each existing and pre-settlement wetland – "LLWW"

Stage 2: W-PAWF (Desktop)

- TAG lead (working groups); SMC input
- Select suite of functions for assessment
- Determine functional significance rating scheme (e.g., High, Moderate, Low)
- Assess functions – use criteria in previous reports, refine by TAG expertise

Stage 3: Field Studies

- SMC lead; TAG participation as available
- Determine Field Rapid Assessment Methodology (RAM)
- Select representative (reference) wetland study sites
- Data collection & compilation

WRAPP Stages

Stage 4: Refine Functional Assessment

- TAG lead (working groups); SMC input
- Refine/finalize functional assessment ratings, based on field data
- GIS – assign functional assessment ratings to each existing and pre-settlement wetland according to LLWW codes

Stage 5: Restoration Sites ID & Rating

- SMC lead; TAG input
- Develop rating criteria for prioritizing restoration sites (numeric? qualitative?)
- GIS – identify potential restoration sites, apply rating criteria, generate example exhibits

Stage 6: Report

- SMC lead; TAG input
- Develop summary report

Stage 7: GIS Tool

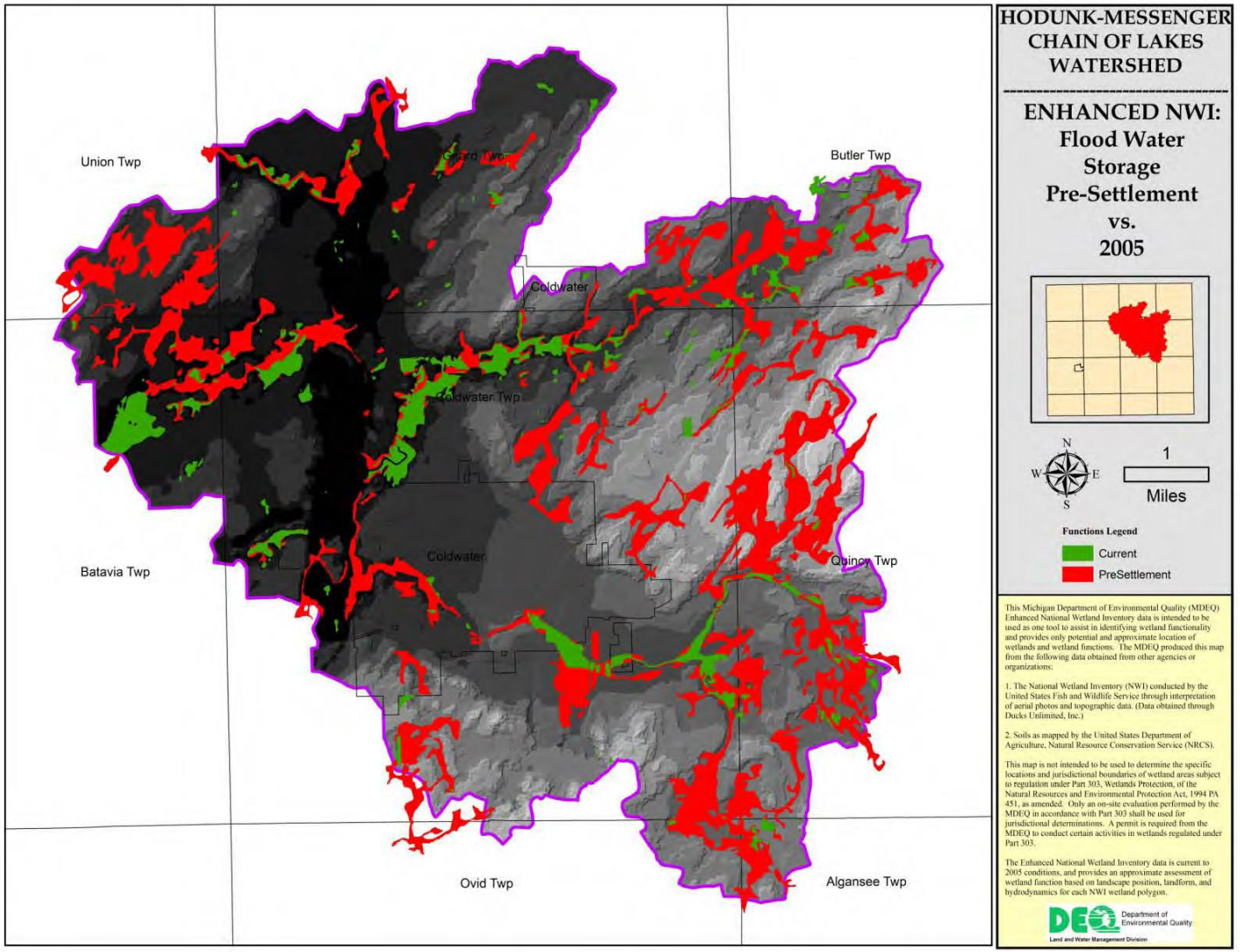
- SMC lead; TAG input
- Develop on-line GIS tool for end-users to identify and rate potential restoration sites

Landscape Level Wetland Functional Assessment

"LLWFA"

- Every existing wetland ($LCWI_e$) will be evaluated for the functions it <u>currently</u> performs.
- Every historically lost wetland ($LCWI_h$) will be evaluated for the functions it <u>likely would perform</u>, if restored.

MDEQ Watershed Example



Flood Water Storage Function: Pre-European settlement (red) and wetlands circa 2005 (green).

"Cowardin" Descriptors

"Cowardin" Descriptors

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION

System	Subsystem	Class	Subclass
M - Marine	1 - Subtidal	RB – Rock Bottom	1 Bedrock 2 Rubble
		UB – Unconsolidated Bottom	1 Cobble-Gravel 2 Sand 3 Mud
		AB – Aquatic Bed	1 Algal 3 Rooted Vascular
		RF – Reef	1 Coral 3 Worm
	2 - Intertidal	AB – Aquatic Bed	1 Algal 3 Rooted Vascular
		RF – Reef	1 Coral 3 Worm
		RS – Rocky Shore	1 Bedrock 2 Rubble
		US – Unconsolidated Shore	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic

System	Subsystem	Class	Subclass
E - Estuarine	1 - Subtidal	RB – Rock Bottom	1 Bedrock 2 Rubble
		UB – Unconsolidated Bottom	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic
		AB – Aquatic Bed	1 Algal 3 Rooted Vascular 4 Floating Vascular
		RF – Reef	2 Mollusk 3 Worm
	2 - Intertidal	AB – Aquatic Bed	1 Algal 3 Rooted Vascular 4 Floating Vascular
		RF – Reef	2 Mollusk 3 Worm
		SB – Streambed	1 Bedrock 2 Rubble 3 Cobble-Gravel 4 Sand 5 Mud 6 Organic
		RS – Rocky Shore	1 Bedrock 2 Rubble
		US – Unconsolidated Shore	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic
		EM – Emergent	1 Persistent 2 Non-persistent 5 *Phragmites australis*
		SS – Scrub-Shrub	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen
		FO – Forested	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 Deciduous 7 Evergreen

System	Subsystem	Class	Subclass
R - Riverine	1 - Tidal	RB** – Rock Bottom	1 Bedrock 2 Rubble
		UB – Unconsolidated Bottom	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic
		SB** – Streambed	1 Bedrock 2 Rubble 3 Cobble-Gravel 4 Sand 5 Mud 6 Organic 7 Vegetated
		AB – Aquatic Bed	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular
		RS – Rocky Shore	1 Bedrock 2 Rubble
		US – Unconsolidated Shore	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated
		EM – Emergent	2 Nonpersistent
	2 – Lower Perennial		
	3 – Upper Perennial		
	4* - Intermittent		
	5* – Unknown Perennial		

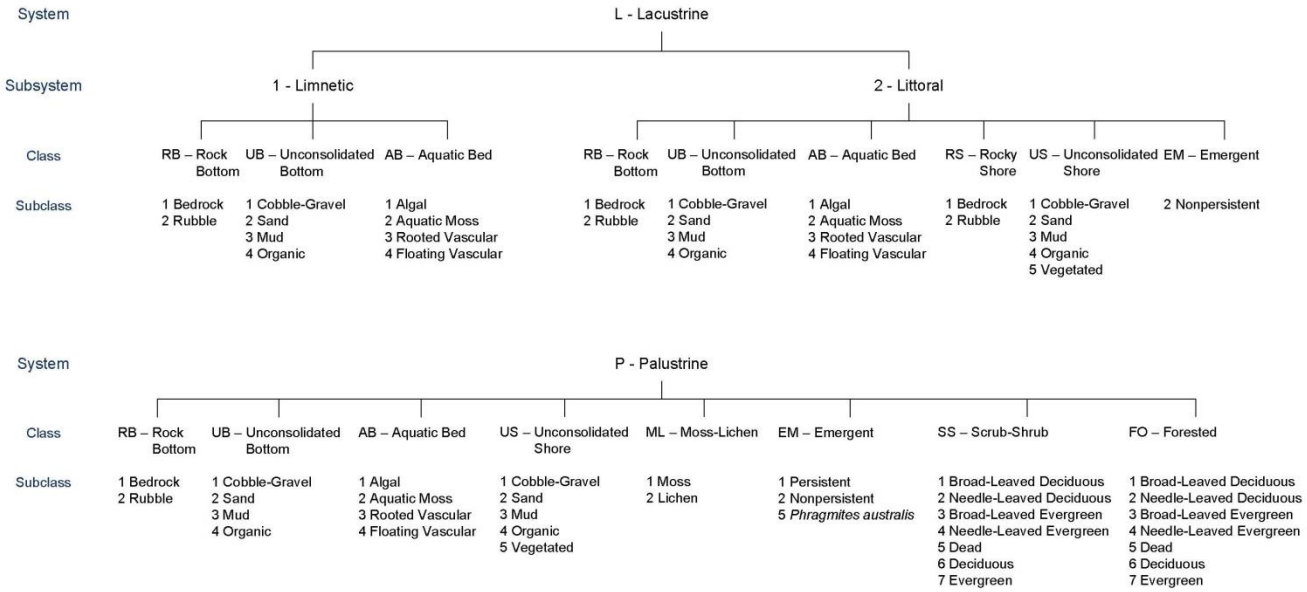
* **Intermittent** is limited to the **Streambed** Class;
Unknown Perennial is limited to **Unconsolidated Bottom** Class code **R5UB** only
** **Rock Bottom** is not permitted for the **Lower Perennial** Subsystem;
Streambed is limited to **Tidal** and **Intermittent** Subsystems

Classification of Wetlands and Deepwater Habitats of the United States, Cowardin *et al.* 1979

"Cowardin" Descriptors

"Cowardin" Descriptors

WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



MODIFIERS

In order to more adequately describe the wetland and deepwater habitats, one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

Water Regime			Special Modifiers	Water Chemistry			Soil
Nontidal	**Saltwater Tidal**	**Freshwater Tidal**		**Coastal Halinity**	**Inland Salinity**	**pH Modifiers for all Fresh Water**	
A Temporarily Flooded	L Subtidal	S Temporarily Flooded-Tidal	b Beaver	1 Hyperhaline	7 Hypersaline	a Acid	g Organic
B Saturated	M Irregularly Exposed	R Seasonally Flooded-Tidal	d Partly Drained/Ditched	2 Euhaline	8 Eusaline	t Circumneutral	n Mineral
C Seasonally Flooded	N Regularly Flooded	T Semipermanently Flooded-Tidal	f Farmed	3 Mixohaline (Brackish)	9 Mixosaline	i Alkaline	
E Seasonally Flooded/ Saturated	P Irregularly Flooded	V Permanently Flooded-Tidal	h Diked/Impounded	4 Polyhaline	0 Fresh		
F Semipermanently Flooded			r Artificial	5 Mesohaline			
G Intermittently Exposed			s Spoil	6 Oligohaline			
H Permanently Flooded			x Excavated	0 Fresh			
J Intermittently Flooded							
K Artificially Flooded							

From: Cowardin (1979)

"LLWW" Descriptors

"LLWW" Descriptors =

HGM-based coding for wetland maps

- **L** Landscape Position
- **L** Landform
- **W** Water Flow Path
- **W** Waterbody Type

"LLWW" Descriptors

Landscape Position

- Lentic (Lake)
- Lotic (Stream/River)
- Terrene (Other)

"LLWW" Descriptors

General Landscape Positions

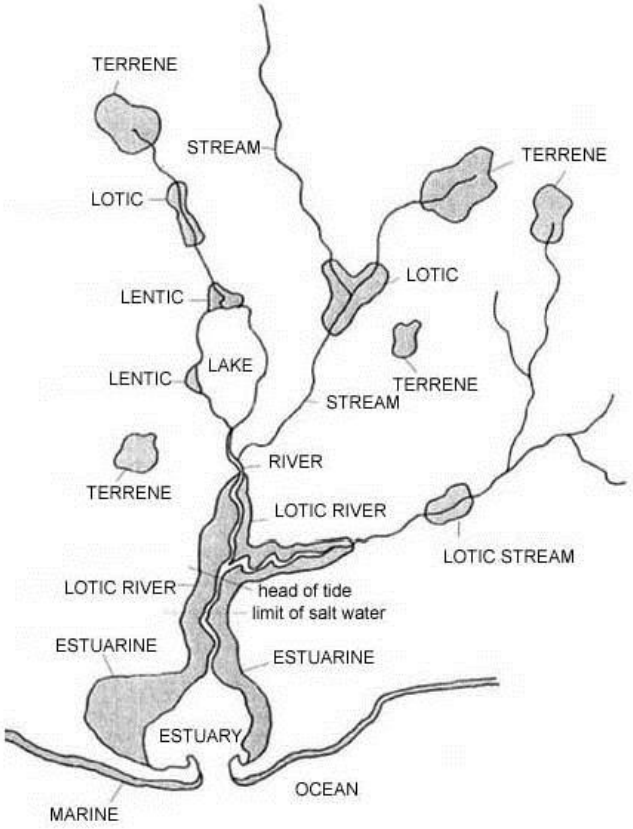


Figure 1. General landscape positions for wetlands, with a few waterbodies shown (ocean, estuary, lake, river, and stream)..

From: USFWS (2011)

Landscape Position – Lentic (Lake)

Images courtesy of MDEQ,
Zbiciak & Fizzell (2010)

Landscape Position – Lotic (Stream)

Images courtesy of MDEQ,
Zbiciak & Fizzell (2010)

Landscape Position – Terrene (Other)

Images courtesy of MDEQ,
Zbiciak & Fizzell (2010)

"LLWW" Descriptors

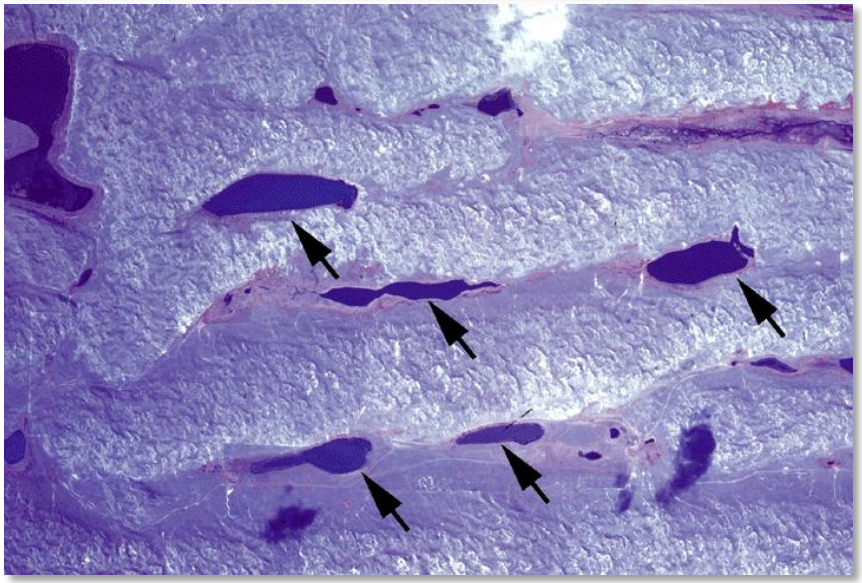
Landform

- ❑ Fringe
- ❑ Basin
- ❑ Flat
- ❑ Floodplain
- ❑ Slope
- ❑ Island

Landform – Fringe

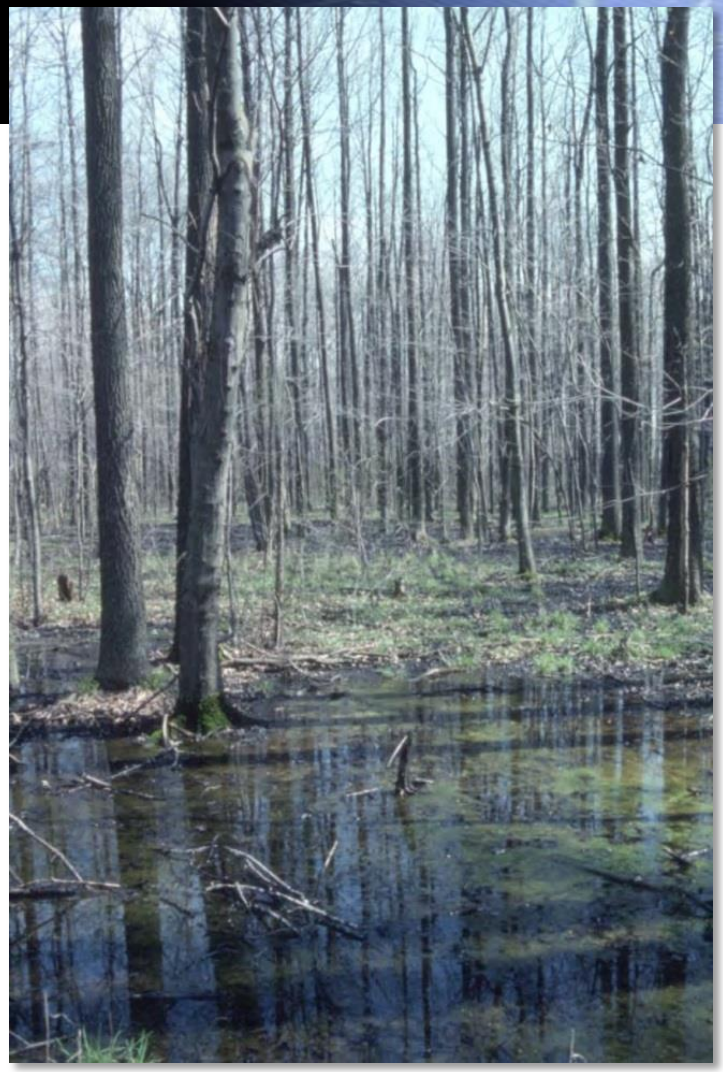
Images courtesy of MDEQ, Zbiciak & Fizzell (2010)

Landform – Basin



Images courtesy of MDEQ, Zbiciak & Fizzell (2010)

Landform – Flat



Images courtesy of MDEQ,
Zbiciak & Fizzell (2010)

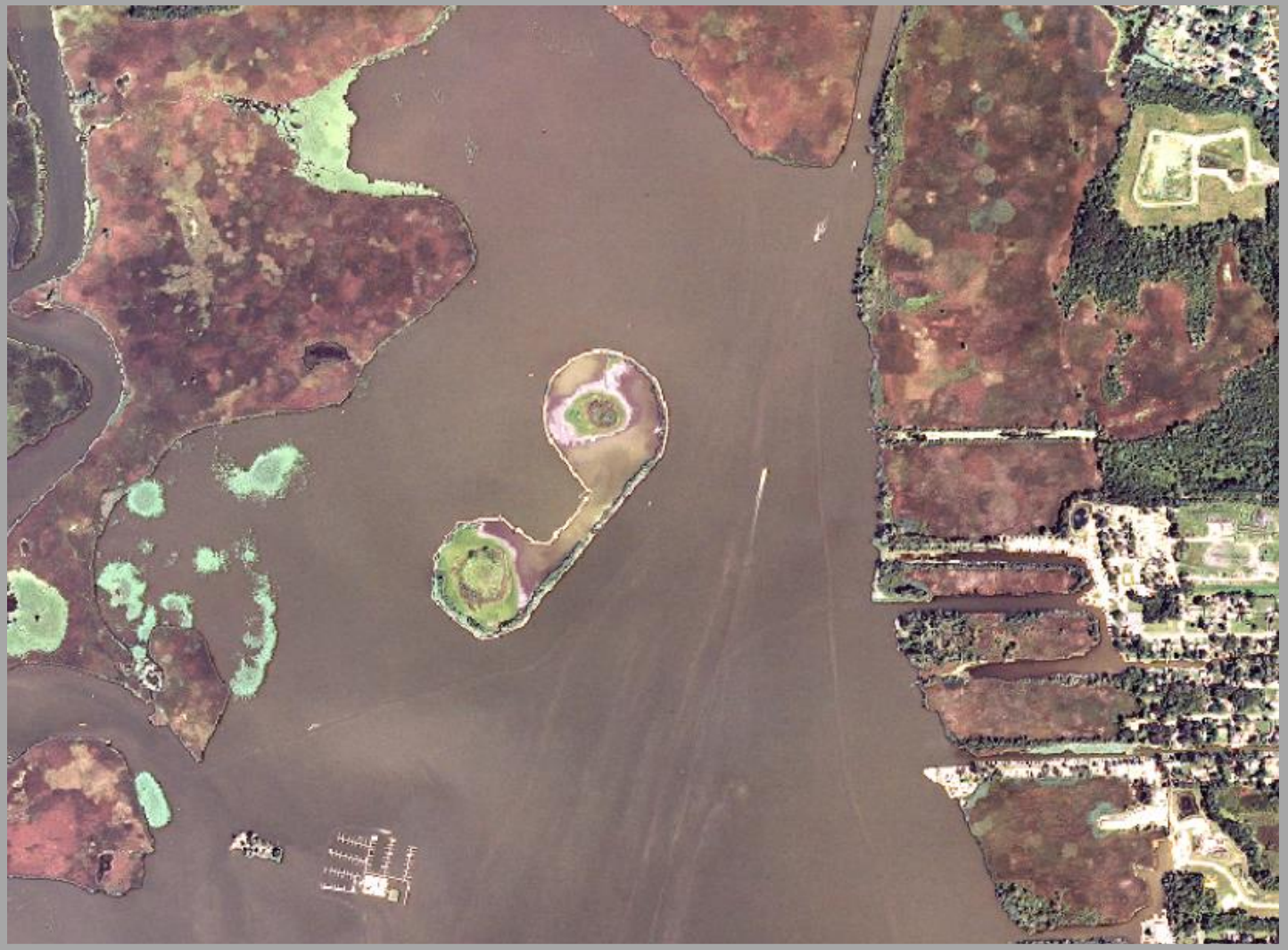
Landform – Floodplain

Images courtesy of MDEQ,
Zbiciak & Fizzell (2010)

Landform – Slope

Images courtesy of MDEQ,
Zbiciak & Fizzell (2010)

Landform – Island



"LLWW" Descriptors

Water Flow Path

- Inflow (water flows in, not out)
- Outflow (water flows out, not in)
- Through Flow (water flows in and out)
- Bi-directional (water flows back and forth)
- Isolated (surrounded by uplands)

"LLWW" Descriptors

Common Water Flow Paths

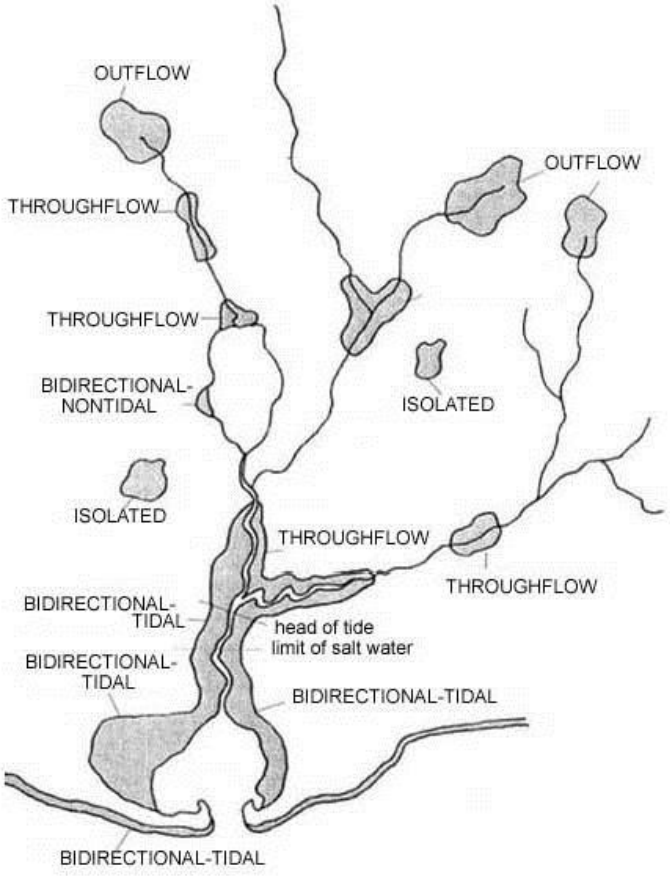


Figure 2. General depiction of common water flow paths across the landscape. Note: Flow for nontidal areas is from top of page downward.

From: USFWS (2011)

"LLWW" Descriptors

Waterbody Type

- ❑ Pond
- ❑ Lake
- ❑ River
- ❑ Stream

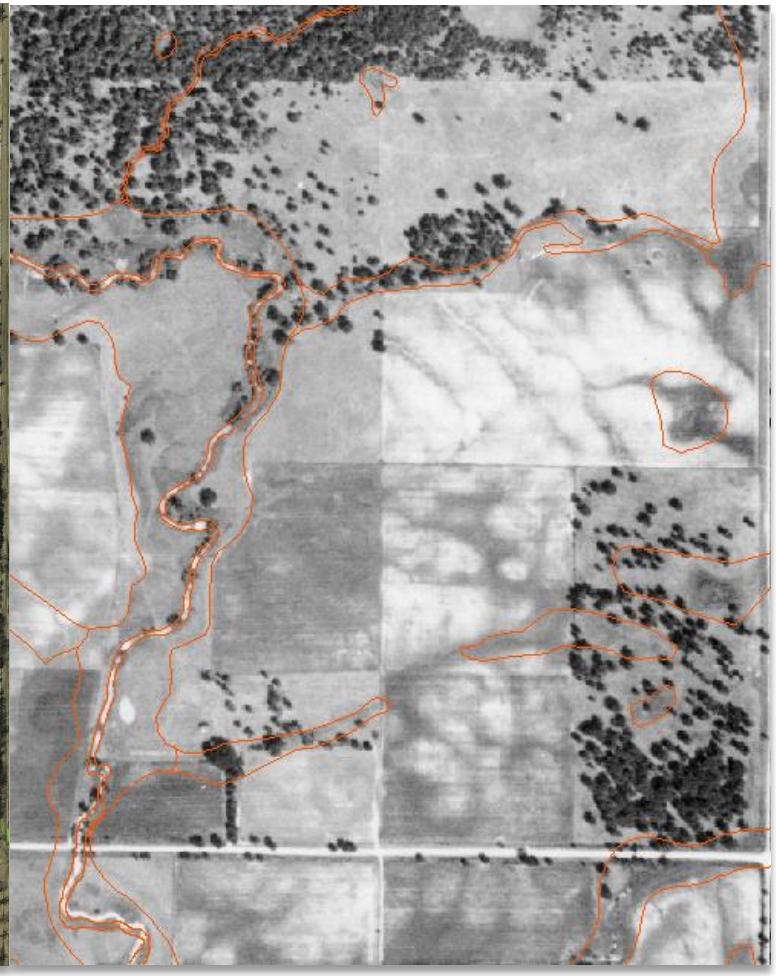
Question for TAG

- What is the size threshold that separates a pond from a lake?
  - WDO: 2 ac.
  - Others: 5+ ac.
  - Relevant to:
    - Guidance for GIS analysis
    - TAG functional assessments

LCWI Datasets

Sample of LCWI Datasets

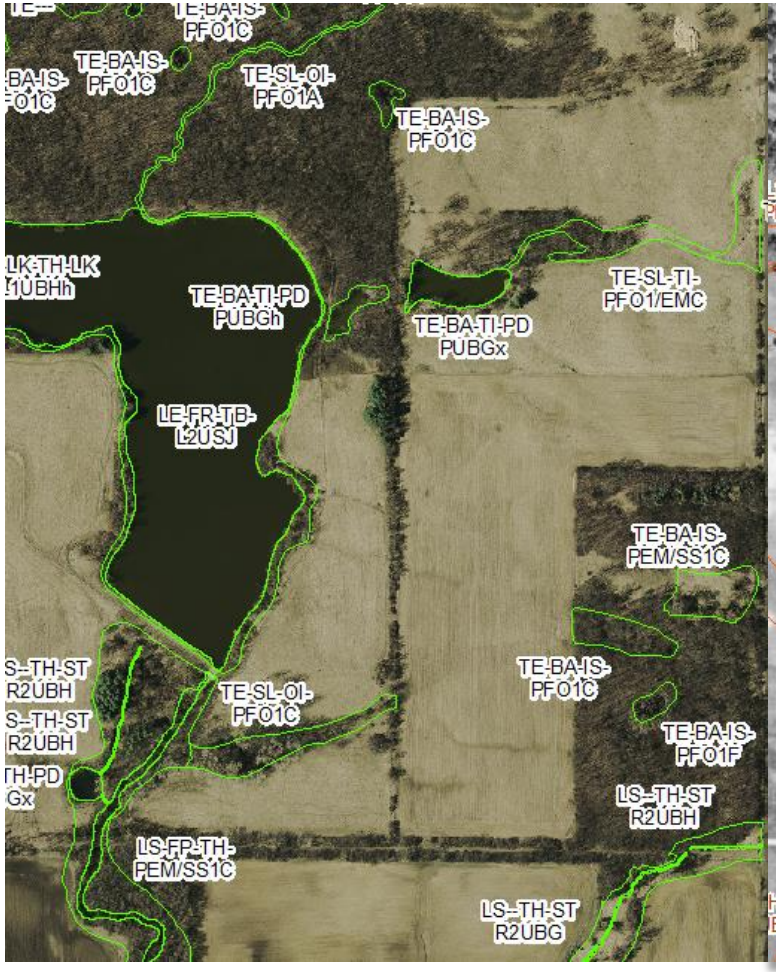
$LCWI_e$

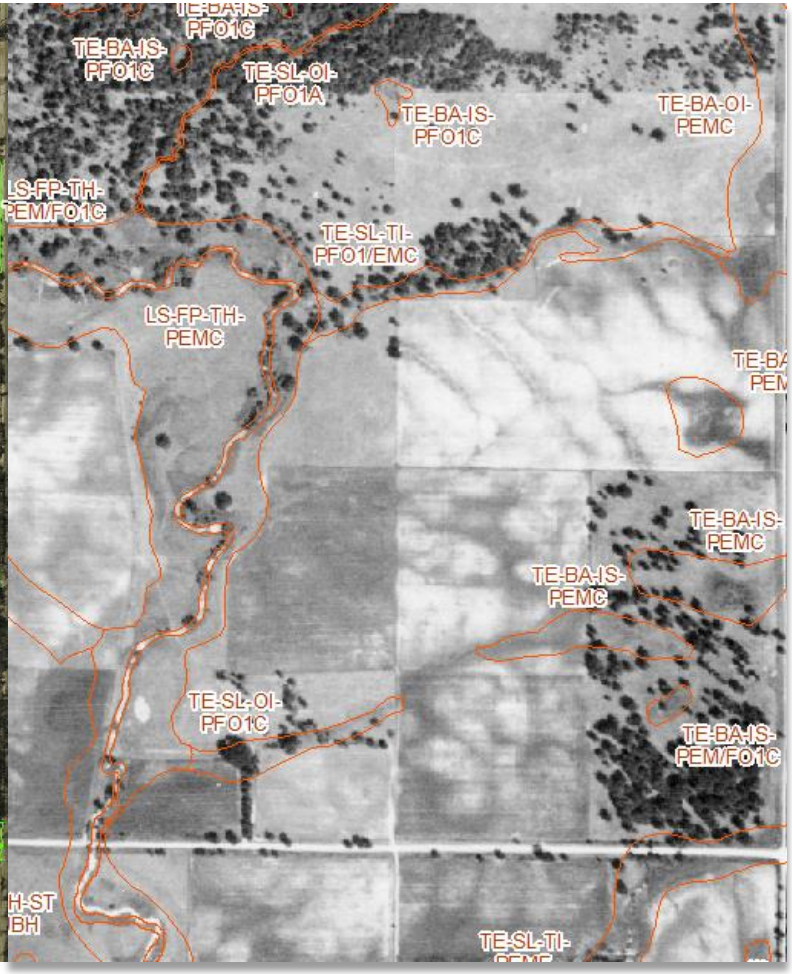


$LCWI_h$

Sample of "Enhanced" LCWI Datasets

LCWI "Enhanced"





$LCWI_e$ $LCWI_h$

LCWI Attributes Table

OBJECT ID	ACRES	WL_WB	Lscape Pos	Landform	Wflow Path	Wbody Type	NWI Code	Function 1	Function 2	Function 3
25168	1.339834	WL	TE	SL	OI		PFO1C			
25092	8.782756	WB	LS		TH	ST	R2UBH			

Clipped example of attribute table for a wetland polygon and a waterbody polygon

Organization

WRAPP Functional Working Groups

Hydrologic Functions

Darren Olsen

Leslie Berns

Dan Krill

Rich Knodel

Biodiversity Functions

Jim Anderson

Vince Mosca

Maggie Cole

Tom Ganfield

Water Quality Functions

Mark Bramstedt

Dennis Dreher

Sue Elston

Mike Adam

Mike Murphy

TAG Group Exercise

- Preliminary Functional Assessment:
  - ✓ Flood Water Storage Function

This function is important for reducing downstream flooding and lowering flood heights, both of which aid in minimizing property damage and personal injury from such events.

Desktop W-PAWF

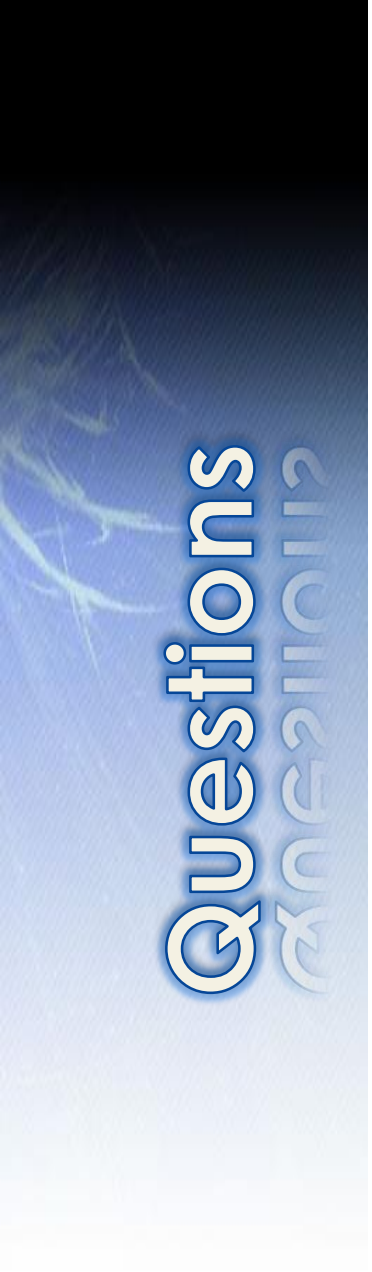
Criteria for Flood Water Storage Functional Significance

MDEQ (2011)

Functional Significance	Selection Criteria
High	▪ Wetlands along streams and rivers ▪ Island wetlands ▪ Ponds that are throughflow & throughflow intermittent ▪ Terrene basin, isolated
Moderate	▪ Terrene and outflow or outflow intermittent wetlands ▪ Other ponds ▪ Terrene wetlands that are associated with ponds ▪ All lake-side wetlands not already ranked high

TetraTech (2015)

Functional Significance	Selection Criteria
High	▪ Wetlands along streams and rivers ▪ Island wetlands ▪ Ponds that are throughflow, throughflow intermittent, bidirectional, and isolated ▪ Area equal or greater than a to-be-determined threshold
Moderate	▪ All of the above in the High category less than to-be-determined threshold ▪ Terrene basin isolated ▪ Terrene and outflow or outflow intermittent wetlands ▪ Other ponds/terrene wetlands associated with ponds connected to hydrography network ▪ Terrene wetlands that are associated with ponds ▪ All lake-side wetlands not already ranked high
Low	▪ All remaining wetlands



Question for TAG

- What rating system does TAG want to use for functional significance?
  - High, Moderate, Low?
  - Other?

Wetland Functions

WRAPP Working Groups

Hydrologic Functions

Flood Protection/Flood water storage/ "Surface Water Detention"

Groundwater baseflow (Streamflow & wetland hydrology maintenance)

Groundwater Recharge

Coastal storm surge protection (w/shed specific)

Biodiversity Functions

Fish habitat (& Shellfish)

Waterfowl & waterbird habitat

Shorebird habitat

Amphibian habitat

Invertebrate species habitat

Open wetlands and waters habitat

Riparian habitat

Beach habitat

Floristic Diversity, HQAR, ADID, Coastal (work group to decide)

Water Quality Functions

Nutrient retention/ transformation

Sediment & other particulate retention

Shoreline stabilization (incl. coastal storm surge as w/shed specific)

Air quality (Carbon sequestration/storage & oxygen production)