Site Assessment – In Office

3/16/21

BOARD OF WATER AND SOIL RESOURCES

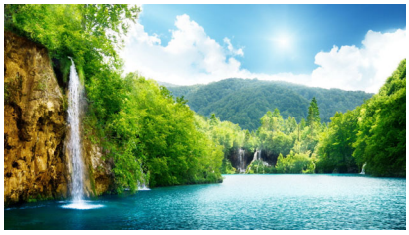
Hi My name is Aaron Peter. … As we introduce the items you need to consider for site assessments, you are going to start to hear restoration strategies and components and some of it may sound like we're repeating the material. But you'll notice we continue to build on and get more specific about these concepts with the hope that it'll help you understand these.

When we have a client interested in restoring their land to what was there historically as a wetland, we need to do a certain amount of investigation and research to try to understand a site. I'm going to cover the tools you can use to complete research from your desk. Amanda will cover what to investigate while on site in the field. And we'll combine those thought processes to go through some example concept plans based on the research done.

What's Restorable

Landowner Vision

- Depth of water, extent of restoration, habitat envisioned, flood control, groundwater protection, etc.



Expectation
vs. Reality

What's Reasonable

- What was there historically
- What can be accomplished based on constraints

To assess a wetland site's restorability, we can first start with the Landowner's vision…
Even some of the items that the landowner didn't think about can be extremely important for water quality in Minnesota and should be part of our vision.
Then we need to look at what's restorable. "Restoration" means put back what WAS there if at all possible.

Site Assessment –Off Site

GOALS -determine:

- What's been removed (i.e. hydrology) and how
- What's reasonable
  - Boundary constraints
  - Water flowage impacts
- What's still there

Our Goals of an assessment are to determine what we can restore by looking at:
What type of vegetation, hydrology WERE present. Has the hydrology been removed by drainage?
What's Reasonable to restore based on property lines, topography, and the size of the basin. Natural wetlands do not pay attention to land ownership, but we need to! Impacts of the restoration may be based on who owns what, and the site's topography, which affects where water will flow. Those impacts on water could be surface or subsurface flows.
What's still there: soils, as well as the hydrology that hasn't been altered.

MN Wetland Restoration Guide. Section 3 is 64 pages.
It's broken down into 9 sub sections and has detailed checklists on items you should consider for your Assessment.
We have about an hour to give you some of the highlights and demonstrate specific examples of how to apply the guidance. So instead of us reading every last detail, you may want to take the time to read through the Restoration Guide to have a broader understanding of the many things to consider during your site assessment.

Online - Web Soil Survey

Suitability & Limitations

- Hydric Soils

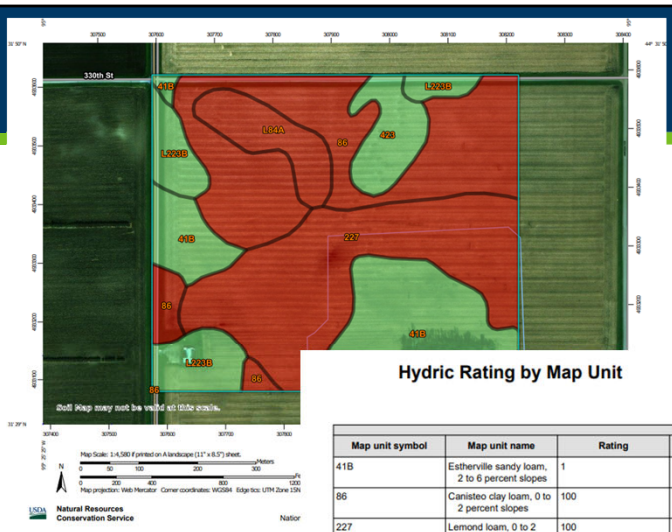
Soil Properties & Qualities

- Drainage Class
- Depth to Water Table
- Ponding Frequency

Maps and Reports

First, we'll start with the easier one and determine what's unchanged on the site – that's the soils.
These soil attributes and where to find them are listed in the handout. Navigating web soil survey is pretty easy, other than the fact that there is tons of information, so you need to know where to look.
Probably the most important attribute is found under Suitability & Limitations section, you can pull up the hydric soils map.

Printable Map



Description

This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit.

The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components, 66 to 99 percent hydric components, 33 to 65 percent hydric

Hydric Rating by Map Unit

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
41B	Estherville sandy loam, 2 to 6 percent slopes	1	18.6	22.1%
86	Canisteo clay loam, 0 to 2 percent slopes	100	24.5	29.1%
227	Lemond loam, 0 to 2 percent slopes	100	24.1	28.5%
423	Seaforth loam, 1 to 3 percent slopes	14	4.5	5.3%
L84A	Glencoe clay loam, 0 to 1 percent slopes	100	5.0	5.9%
L223B	Amiret-Swanlake loams, 2 to 6 percent slopes	9	7.6	9.1%
Totals for Area of Interest			**84.3**	**100.0%**

Rating 100 = 100% of map unit components in that map unit are hydric soils.

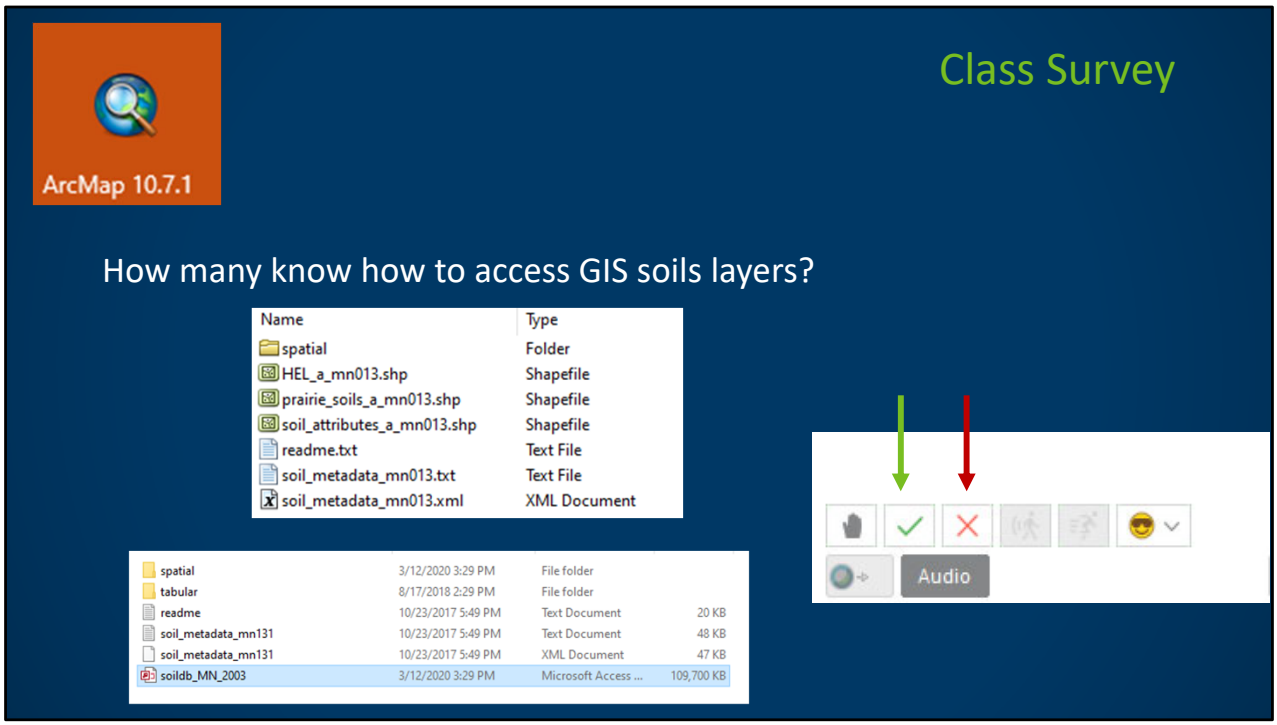
Engineering Properties Report

Report — Engineering Properties (MN)

Redwood County, Minnesota

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number —				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
L84A—Glencoe clay loam, 0 to 1 percent slopes														
Glencoe	80	C/D	0-9	Silty clay loam, clay loam	OH, OL, CL, ML, MH	A-7-6, A-7-5	0-5	0-2	98-100	85-100	79-100	66-88	47-71	19-26
			9-39	Silty clay loam, clay loam	OH, CL, OL, MH	A-7-6, A-6, A-7-5	0-3	0-1	98-100	89-100	81-100	64-83	40-62	18-25
			39-50	Silty clay loam, clay loam	CH, CL	A-6, A-7-6	0-3	0-1	88-100	73-98	67-98	56-84	38-51	19-25
			50-79	Clay loam, loam	SC, CL	A-7-6, A-6	0-3	0-1	89-100	75-98	65-97	49-75	30-44	12-24

Gives you the various layers and their texture classification.



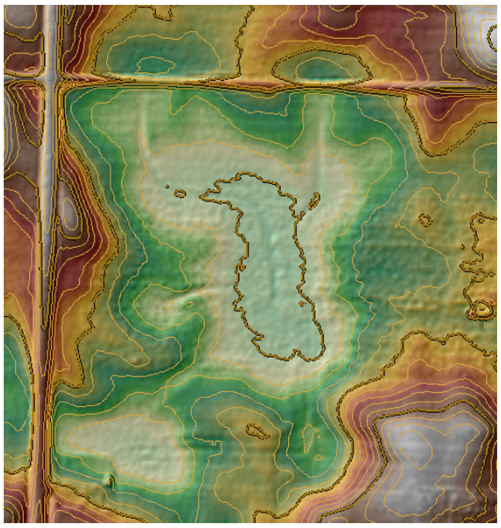
You should be able to at least get a copy of the soils layers and the soils' Access Database for your county.
You can run the reports from the county soils Access database.

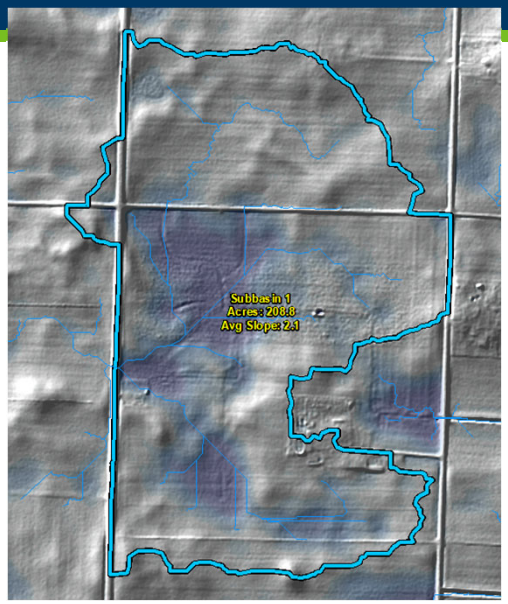
ArcGIS - Soils

Hydric Soils attribute

Web Soil Survey gives you information and defines the attributes. Once you understand that, you can probably do most of your research and map making through GIS.

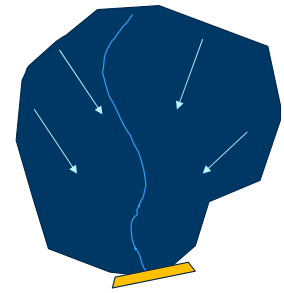
ArcGIS - Topography

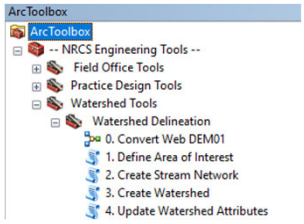


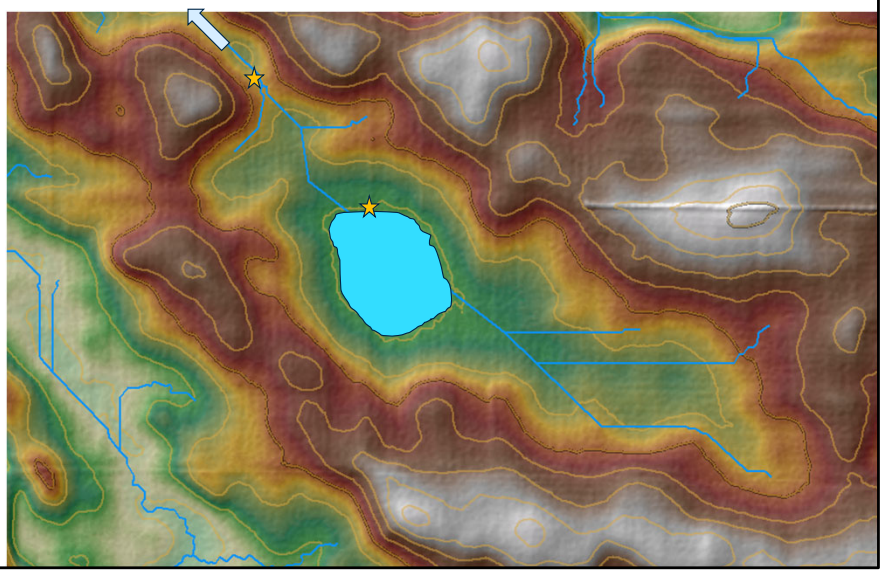


LiDAR (from MNTopo)
Using a DEM, this contour map with hillshade makes it easy to the landscape and topography. We can even estimate potential off-site issues based on elevation.
Using GIS we can delineate the watershed that will be contributing surface water

Surface Hydrology

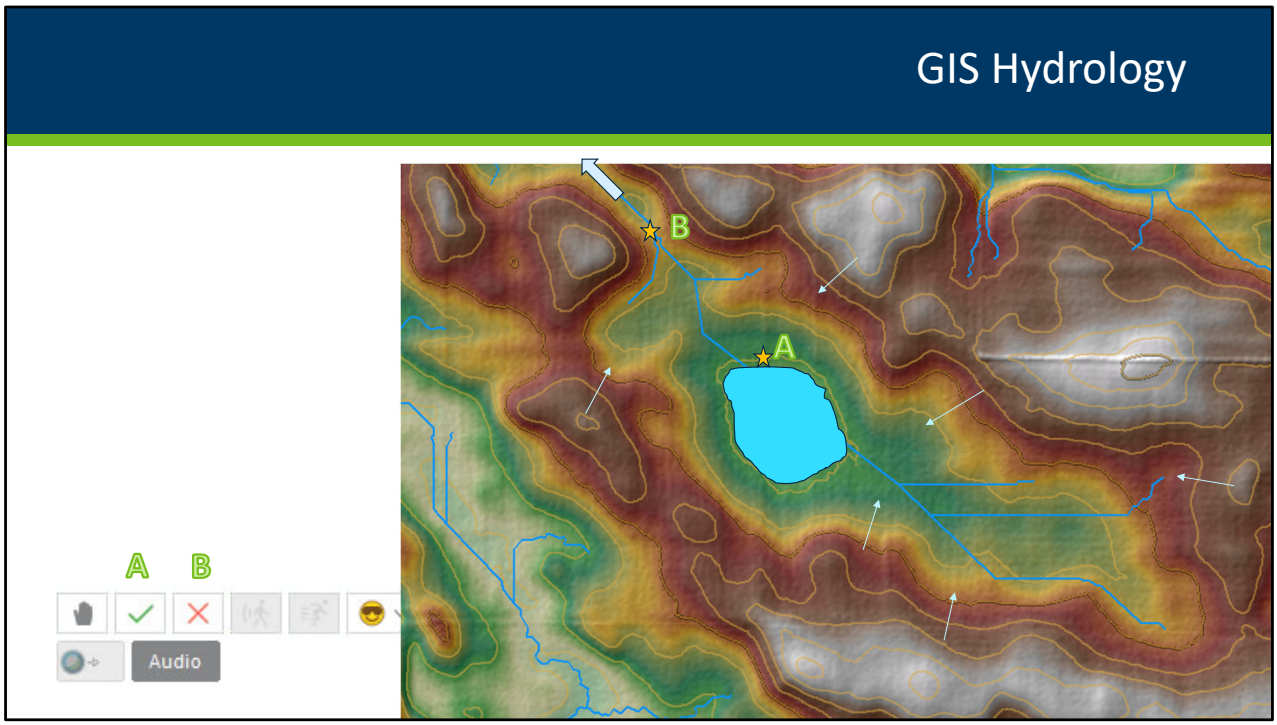






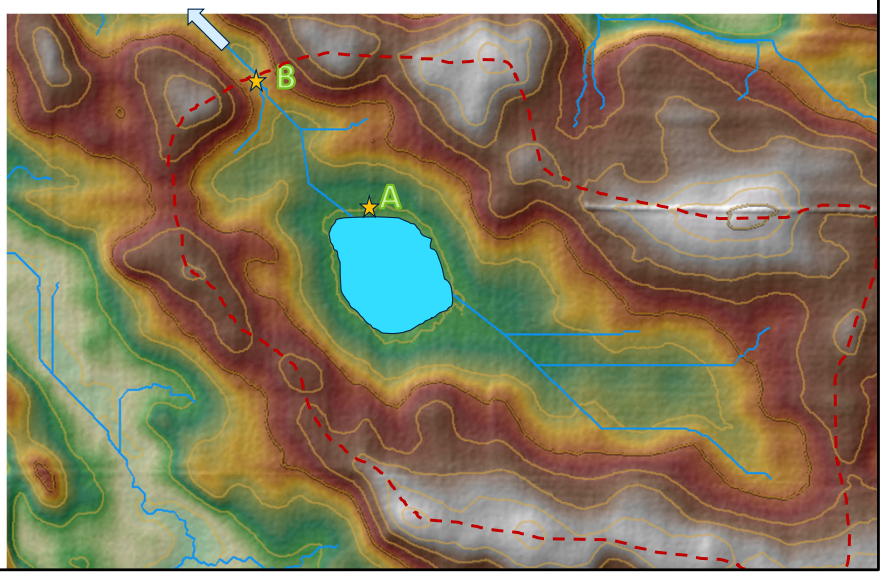
A big part of assessing a potential wetland site is understanding the site's hydrology. I'm going to spend a few minutes discussing hydrology for wetlands.
Watershed- all of the land that contributes runoff toward a particular point. When we delineate the watershed for most conservation practice designs, the end point is our engineering structure (e.g. end of a waterway, WASCOB, 410). Delineating a watershed, by hand or using GIS tools, is a separate training. -Basic Hydrology. For some wetlands, such as a depressional area like this shown, the delineation may need to be a little different.

GIS Hydrology



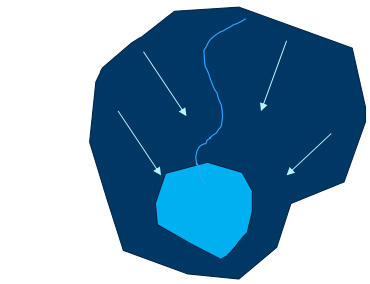
On this site shown, we're going to put an intake structure at point A to control the water level in our pool.
We're using GIS tools to determine the restoration's drainage area. You can see the streams layer created from the watershed tool.
Where would you choose as your watershed delineation point?
Vote check for A, X for B.
[pause] Correct Answer is B.

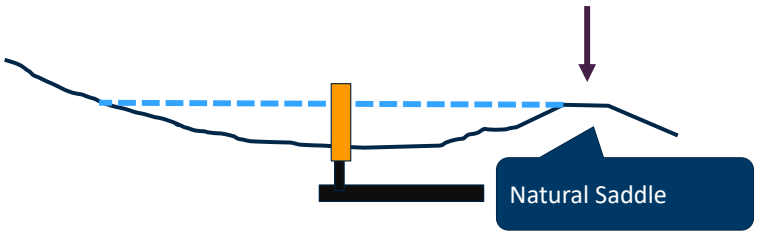
GIS Hydrology

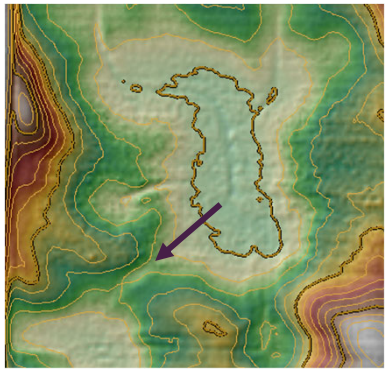


Delineation tools look for all land upstream of the point you choose.

Surface Hydrology

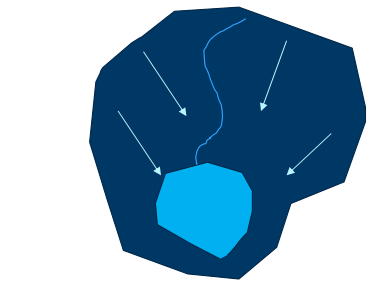


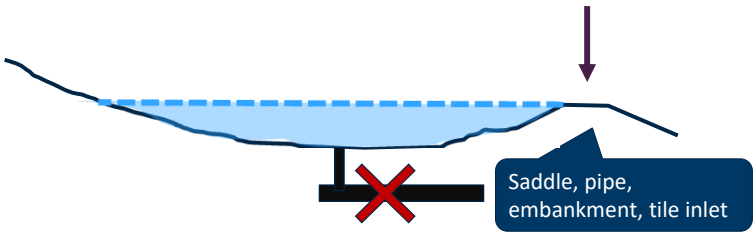


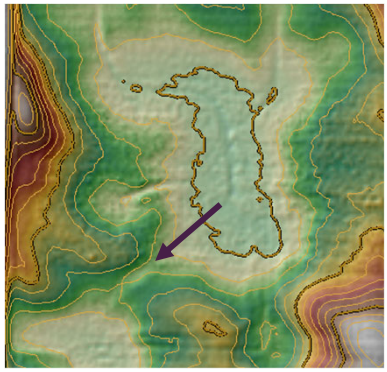


Now let's look at surface hydrology impacts on design decisions.
In a pothole wetland with existing drainage, the tile line will empty the pothole within a matter of days. May include an intake, or not.
Under "natural" conditions, a large enough event will fill up and leave the pothole over a natural saddle, into a road ditch or stream. Sometimes it takes a small event, sometimes a huge event before it overtops.

Surface Hydrology

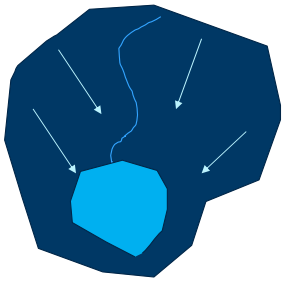


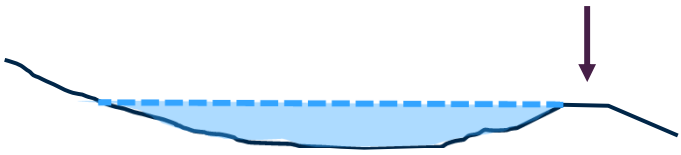




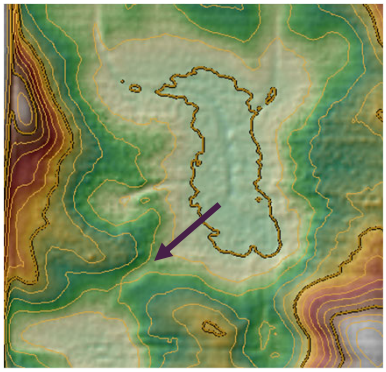
For restorations that include plans for some open water: remove the drainage feature to help retain water and control the elevation of that pool. HOWEVER, all runoff has to be stored on top of that pool or discharged out.
Now we're not going to talk structural hydraulics and get into design details yet. But during the site assessment process, you need to recognize and get a feel for the factors that will affect what is restorable. And you need to assess what impact will occur when water that once filled a pothole temporarily, now has to be stored up to a higher elevation.
QUESTION: [next slide]

Surface Hydrology



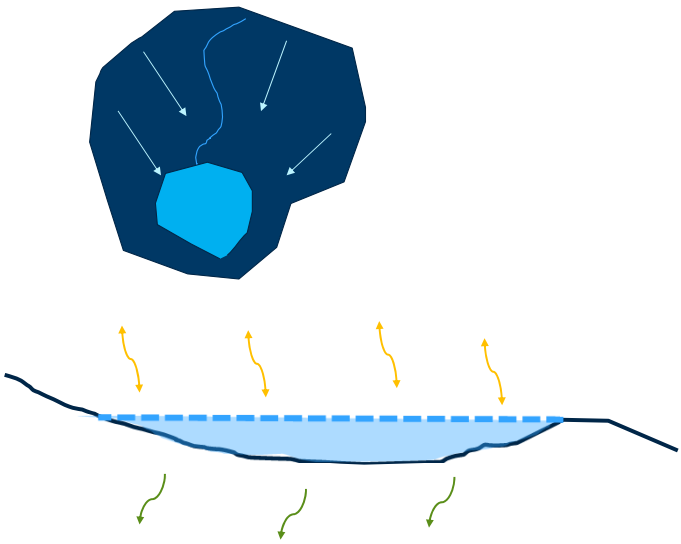


Enter answers in CHAT



QUESTION: A-M names. Use Chat. What hydrology factors have we not taken into account when we say we're holding water permanently at that elevation?

Surface Hydrology



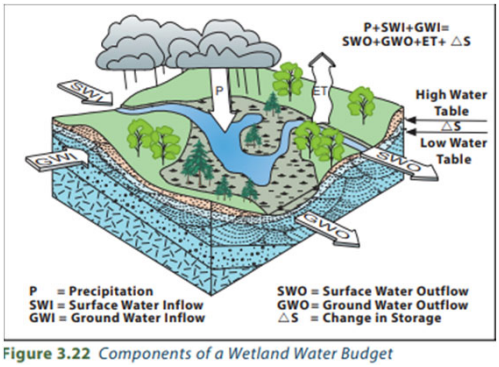
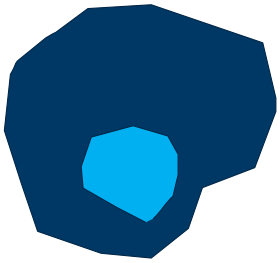


Figure 3.22 *Components of a Wetland Water Budget*

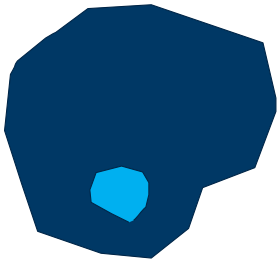
Restoration: maintain a pool (ignore evaporation and infiltration).
I don't want to minimize those, they are huge benefits of having a wetland, but they typically can't be accounted for. We can't assume the water is down to a lower elevation when the storm event comes.

Surface Hydrology

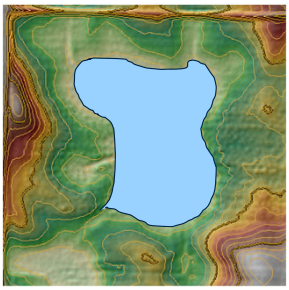
Drainage Area to Pool Area ratio



12 ac : 4 ac
(3:1)



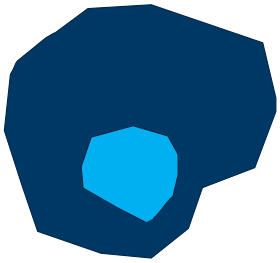
12 ac : 2 ac
(6:1)



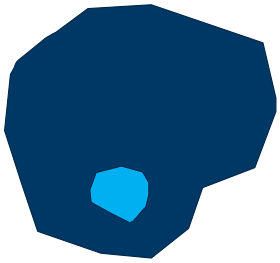
Left has 3x drainage area per acre of pool
Right has 6x drainage area per acre of pool
That means a couple things. 1) the pool on the right has a greater source of water relative to the size of pool you want to maintain.
2) [next slide]

Wetland Surface Hydrology

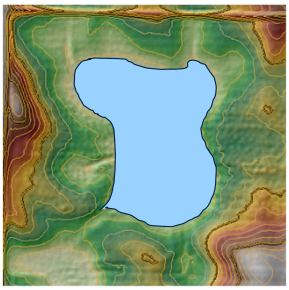
Drainage Area to Pool Area ratio



12 ac : 4 ac



12 ac : 2 ac



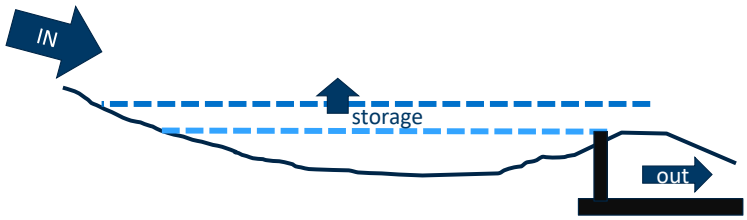
2) You have different bounces which you'll have to account for in your design.
For the left situation, the storm runoff spreads out on a larger pool and so the bounce is less than the pool on the right.
One is not necessarily bad or wrong, it's just showing that the DA to PA ratio is a way to recognize what's restorable.

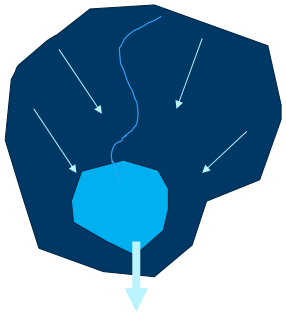
Surface Hydrology

Drainage Area to Pool Area ratio

Total Runoff – affects bounce

Peak Flow – affects structure hydraulics, outflows, and bounce



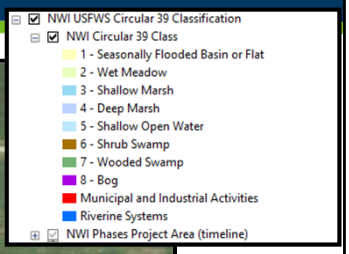


So the total volume of runoff greatly affects the bounce. But how fast the runoff comes to our outlet will also affect the bounce and need to be accounted for when you design outlets. If you have a tile line as your main outlet, its capacity is important and may be your limiting factor in your design.
Since what comes in has to be handled by a combination of storage or leaving the site, if what's leaving the site is limited, your site will need more storage to handle the incoming water, at least temporarily until it can be released.

More Resources

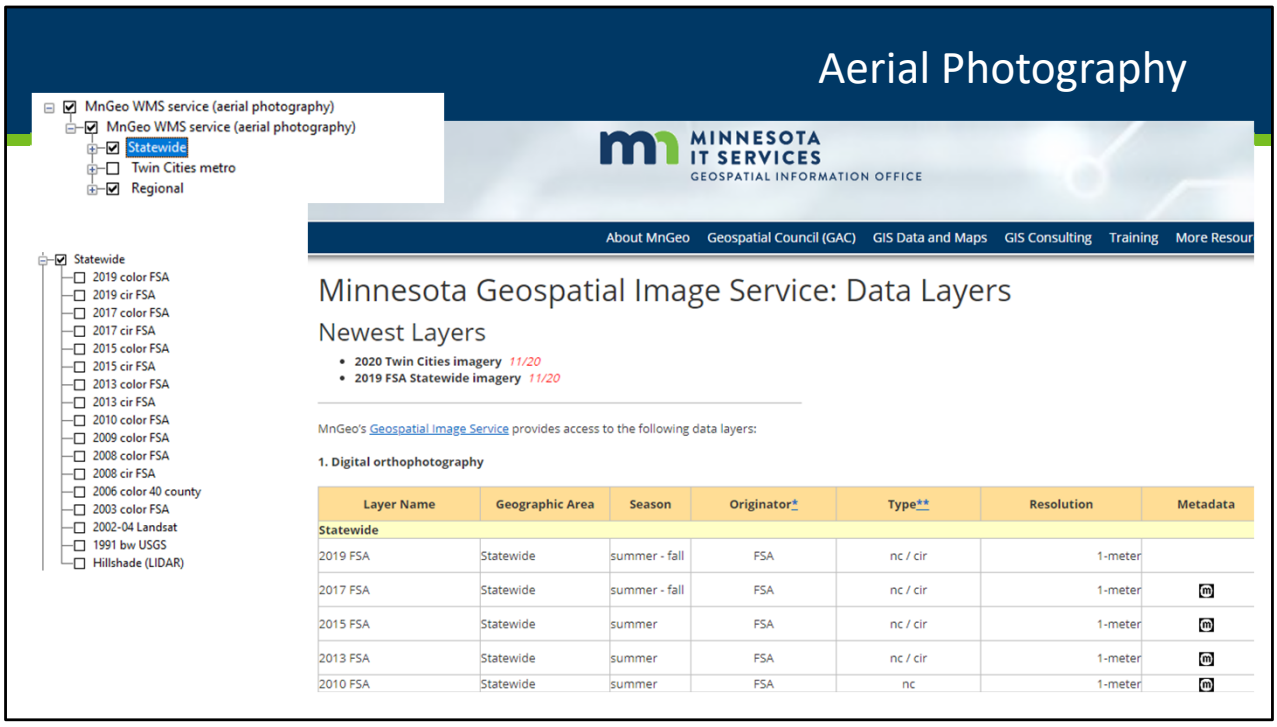
Any questions on wetland hydrology?
I spent a little more time on surface hydrology than the other sections, because that is something all staff should assess and start to look at, probably even before your first site visit.
You have to do some hydrology analysis and calculations to have a good understanding of what will be restorable.

More Resources - GIS

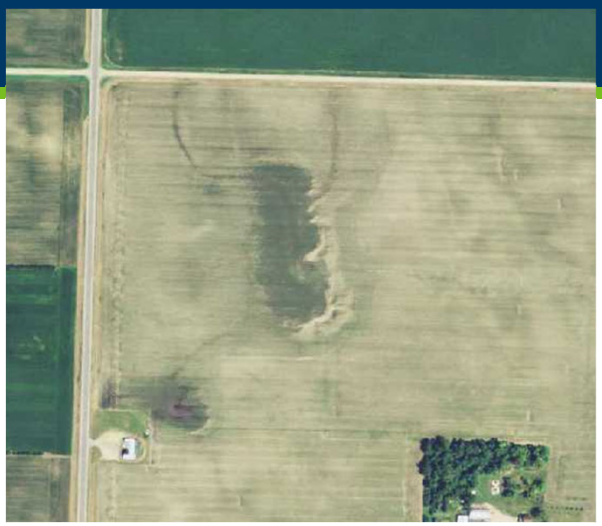


NWI – Circular 39 label

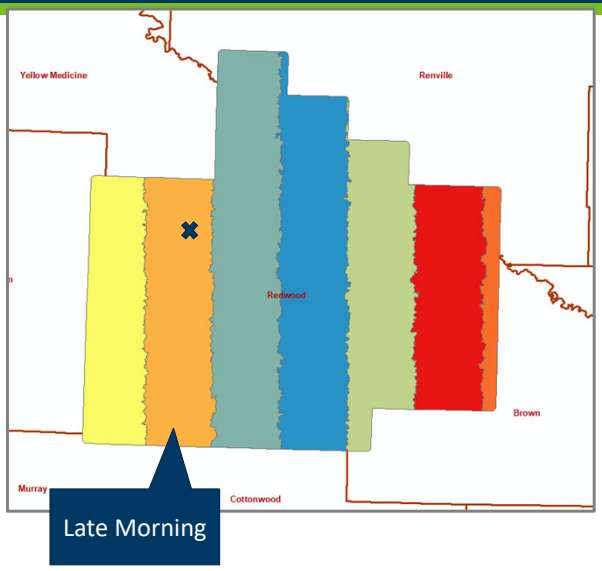
Aerial Photography



I like using Web Map Services or Image services. You can obtain those by connecting your GIS to their website. (Don't need to keep large files on your computer)
Then you have access to a number of years and sources of data.
On the MNGeo website, you can then find what time of year that photo was flown.



July 10th, 2013



You can even get more detailed. Most of the FSA photos have a separate shapefile to download that even narrows it down to the date and time of day.

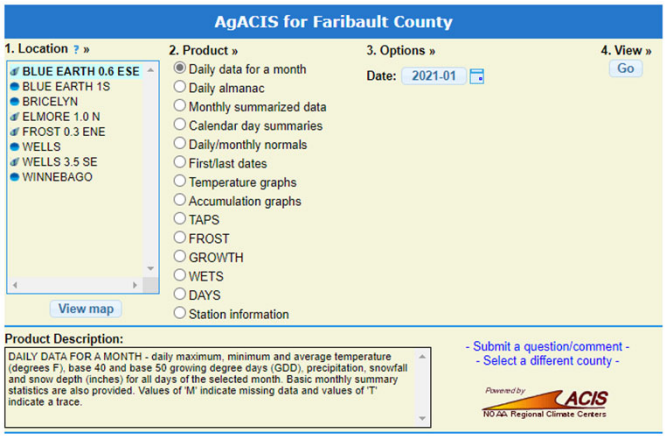
Mid-April 2011

June 16, 2010

Online: Rainfall + Photos

AgACIS

- eFOTG
  - Section II
    - Climatic Data

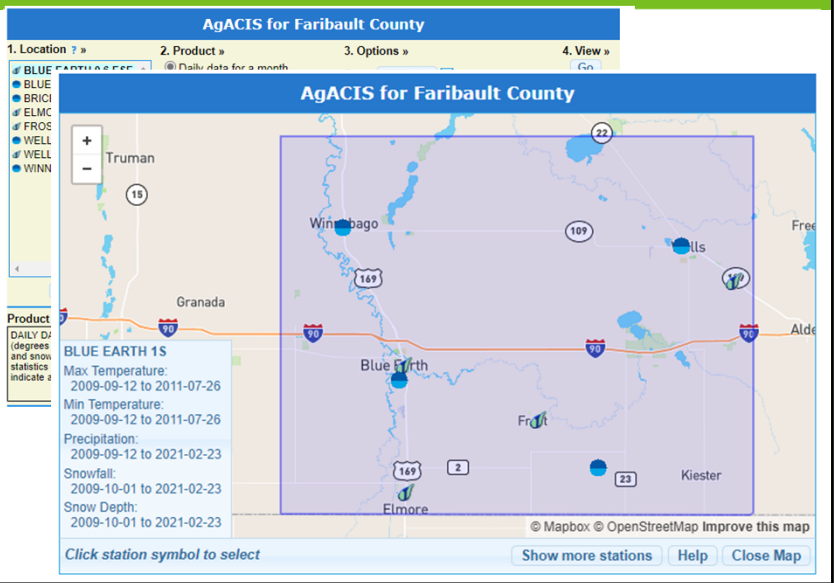


Maybe more useful for regulatory discussion.
Daily rainfall totals for a month. (Not all stations have all years of data)

Online: Rainfall + Photos

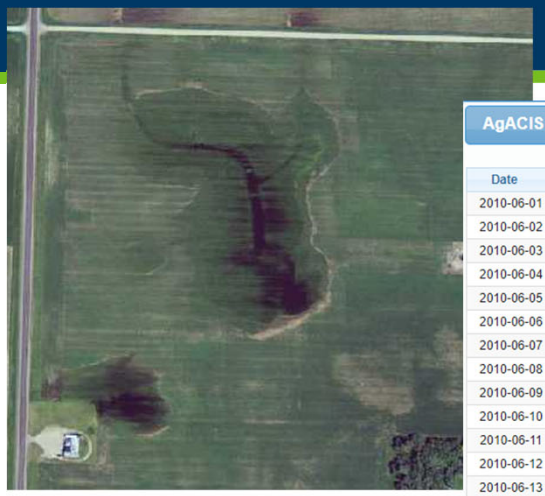
AgACIS

- eFOTG
  - Section II
    - Climatic Data



Daily rainfall totals for a month. (Not all stations have all years of data)

Online- Rainfall + Photos



June 16, 2010

AgACIS Copy CSV E

Click column heading to sort ascending, click again to sort descending.

Date	Max Temperature	Min Temperature	Avg Temperature	GDD Base 40	GDD Base 50	Precipitation
2010-06-01	84	48	66.0	26	16	0.00
2010-06-02	80	57	68.5	29	19	0.00
2010-06-03	75	51	63.0	23	13	0.00
2010-06-04	79	49	64.0	24	14	0.13
2010-06-05	85	62	73.5	34	24	0.01
2010-06-06	68	53	60.5	21	11	0.27
2010-06-07	79	53	66.0	26	16	0.00
2010-06-08	79	52	65.5	26	16	0.00
2010-06-09	76	59	67.5	28	18	0.03
2010-06-10	75	59	67.0	27	17	0.00
2010-06-11	72	59	65.5	26	16	2.81
2010-06-12	79	56	67.5	28	18	0.71
2010-06-13	61	54	57.5	18	8	0.31
2010-06-14	67	59	63.0	23	13	0.00
2010-06-15	70	60	65.0	25	15	0.37
2010-06-16	74	58	66.0	26	16	0.00

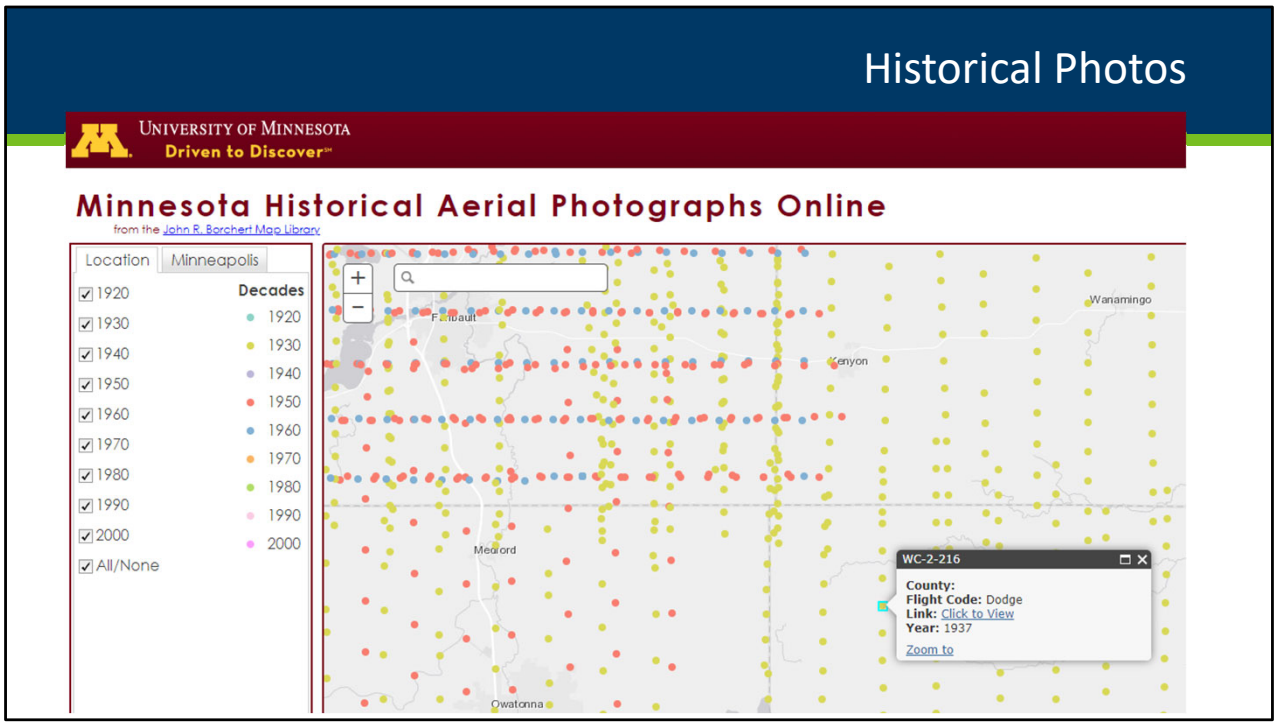
4+ inches rain

"Daily Data for a Month"

It's amazing what we can see from above!
Chat in: what are these two pictures of?!
The one on the left is more "local". The one on the right is not local at all.
Clue: the one on the right is related to a show.

I-35 and St Anthony Falls. On right is is Oak Island.

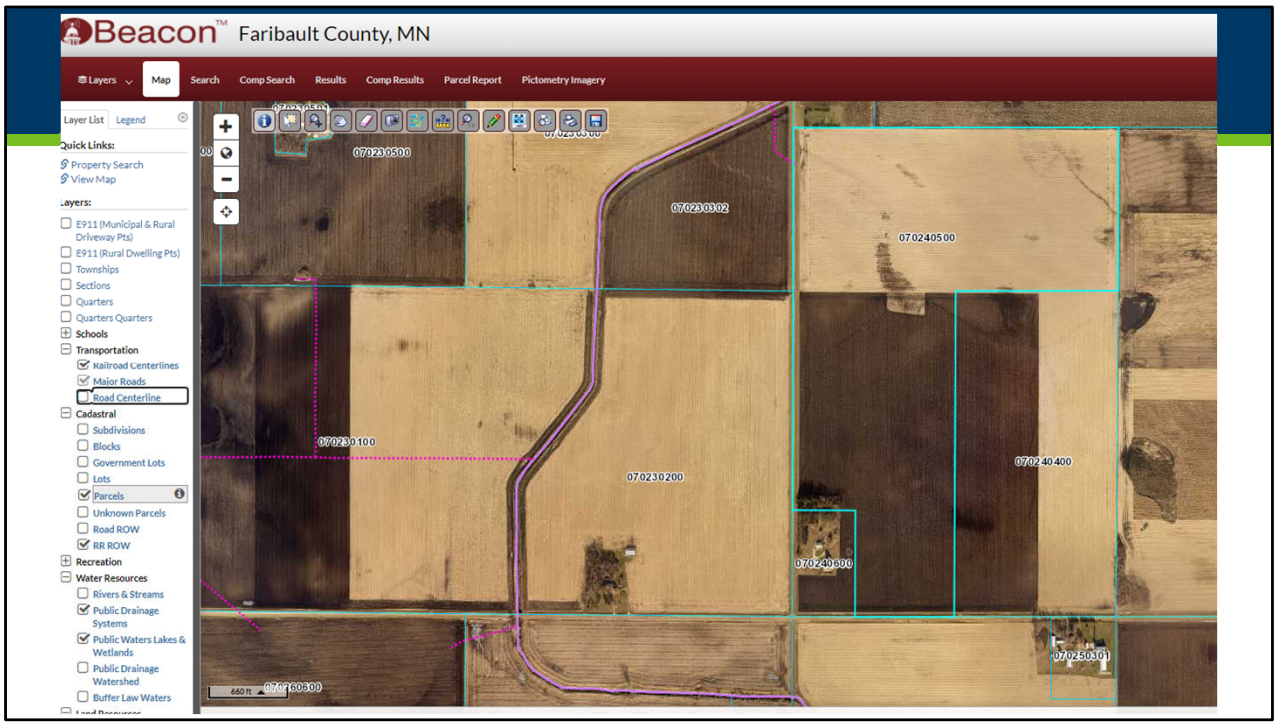
Historical Photos



Zoomed in on the corners of four counties, and you can see the different dots representing differing photos taken in that county.

Photo from 1955.

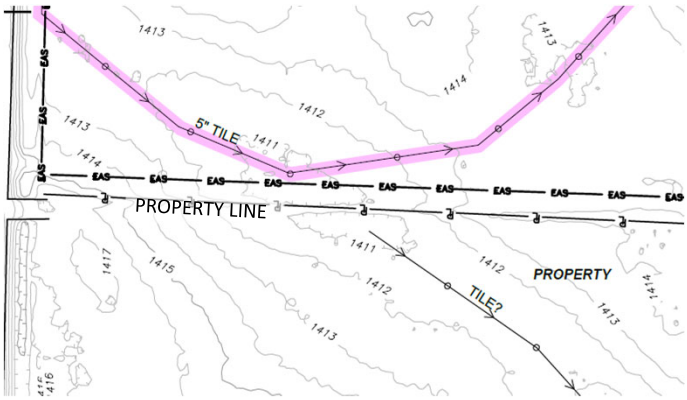
Note the faint lines from the old ditch.
Blowout or intake (picture on right) ?!



Knowing who owns the land is important. You may have to reach out to the neighbors to ask questions.
Beacon may also show public drainage features.

Reasonable Use rule

The landowner has the right to remove excess waters from his/her property without violating the reasonable use rule principles.



Looking at what's restorable based on property ownership and off-site impacts was one of our goals.
Restorations are often going to be of great interest to the neighbors, both because of wetness impacts and even perceived wetness impacts.

Reasonable Use rule

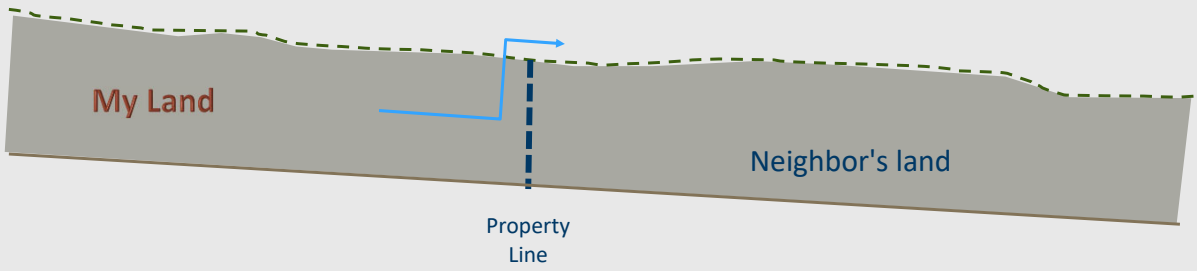
The landowner has the right to remove excess waters from his/her property without violating the reasonable use rule principles.

Acting in good faith, may drain land or surface waters, and send it downstream.

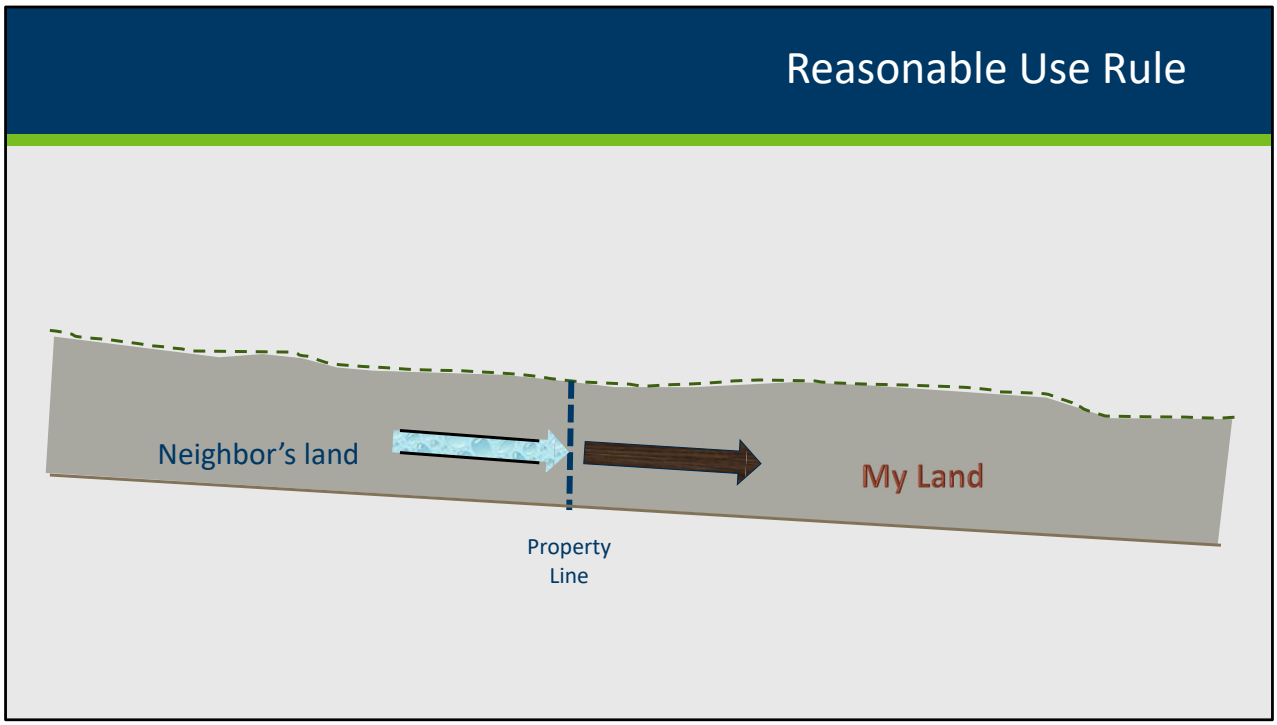
1) Has to be reasonable necessity;
2) Reasonable care take to avoid “injury” [damage] to the receiving land;
3) Benefit outweighs the gravity of harm;
4) Accomplished by reasonably improving the natural drainage.

Paraphrased from the Minnesota Public Drainage Manual –Viewing and Appraising

Reasonable Use Rule



Looking at the soil profile here.
I can allow my water to drain onto the neighbor's land (not required to hold it or magically dispose of it).



If they've tiled their land, I'm probably hooked up to their line, I'm not required to maintain and keep it there (=restore wetland)
Two reasons why do maintain or provide an outlet:
1) most "neighbors" don't want to do that to each other, and certainly our organizations do not want to cause that type of issue.
2) Legal reason: Drainage Agreements

657 - Impacts

Criteria for Subsurface Drainage Alteration

…appropriate measure shall be included in the design to keep the upstream drainage system(s) maintained at its current capacity.

Hydrology Restoration

The work associated with the wetland shall not adversely affect adjacent properties or other water users unless agreed to by signed written letter, easement or permit.

The location, size, and geometry of earthen structures, if needed, shall match that of the original macrotopographic features to the extent practicable.

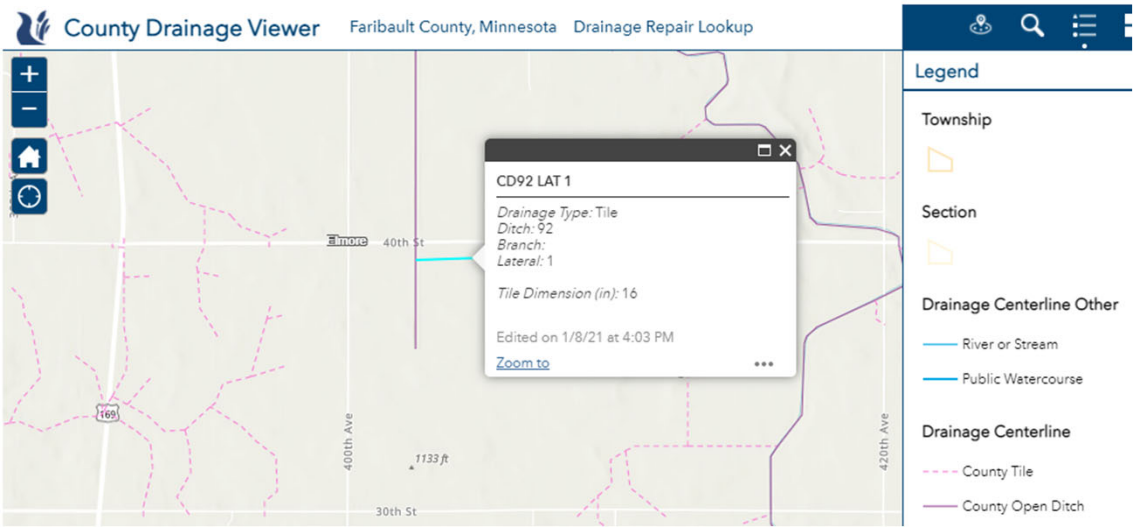
Wetland Subsurface Hydrology

To properly evaluate and design restoration plans for wetlands altered by subsurface tile, you ideally will want to know:

- Tile Locations/Drainage Direction
- Tile Drainage Extents
- Tile Sizes/Materials/Condition
- Tile Elevations and Grades

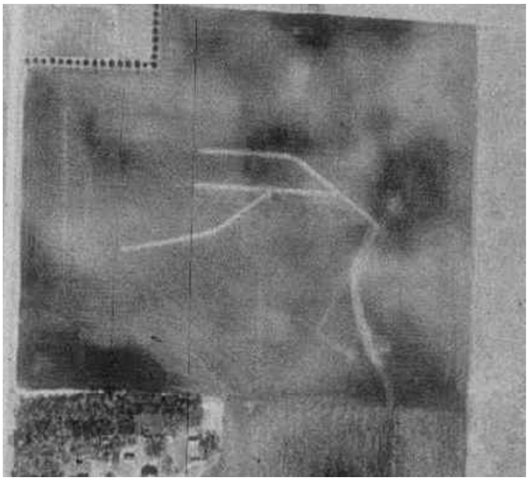
To understand our potential impacts as well as determine what's restorable, we need to learn as much as possible about existing tile sytems.
Drainage Direction: doesn't always follow surface topography
Extents: providing drainage for neighbors' land (upstream or downstream)
Sizes/Materials – if you have to replace it. Condition, is it even working now?
Elevations/grades – can you daylight the tile into the restoration, can it be rerouted?

Online Drainage info

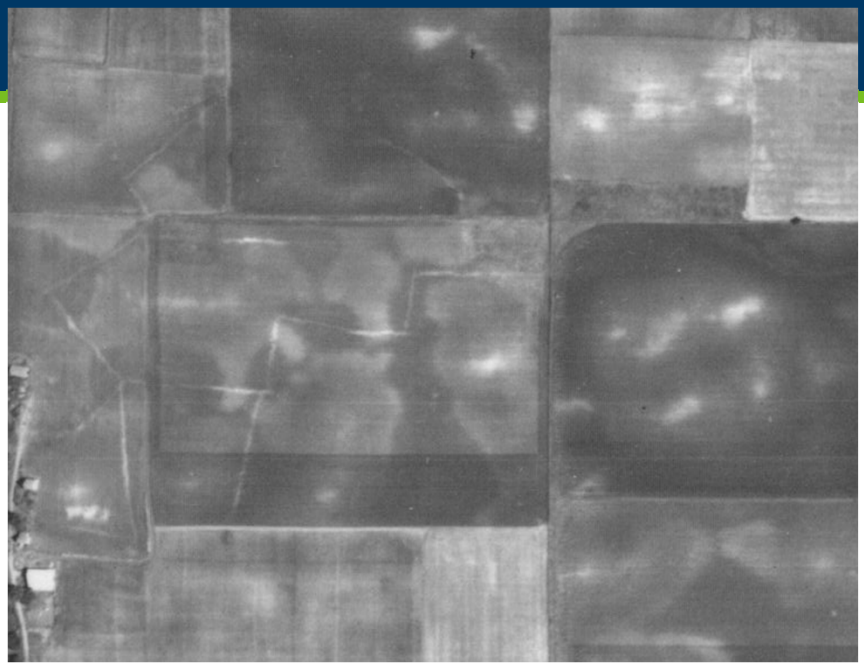


Faribault County – county tile system is online is a GIS viewer

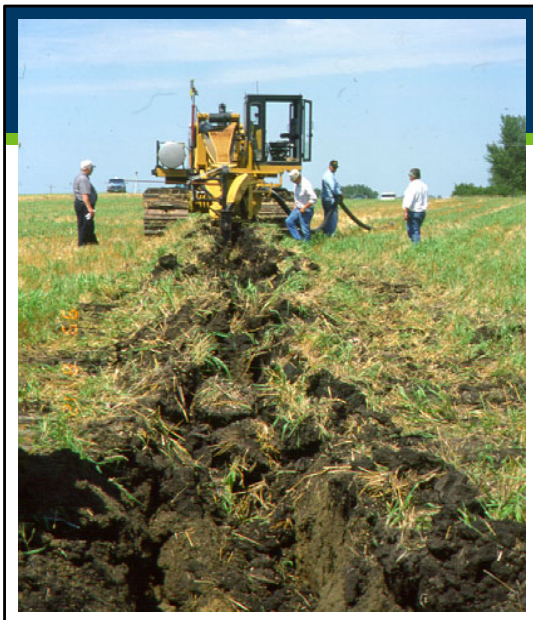
good ‘ol days



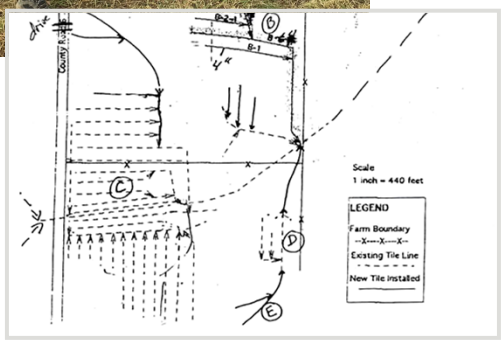
To find information about tile, you have to know a little bit about how tile was and is installed.
Here we see clay tile being installed by a trencher. Concrete was also very popular.
When tile installation was more labor intensive or relatively expensive, the lines were often only ran through the low spot.

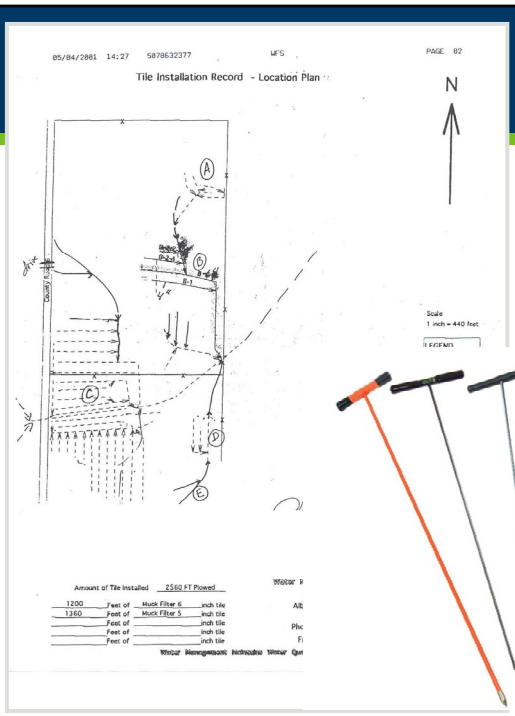


Now tile is installed miles at a time, 40’ parallel spacing.
Question: what are the darker circles? N-Z

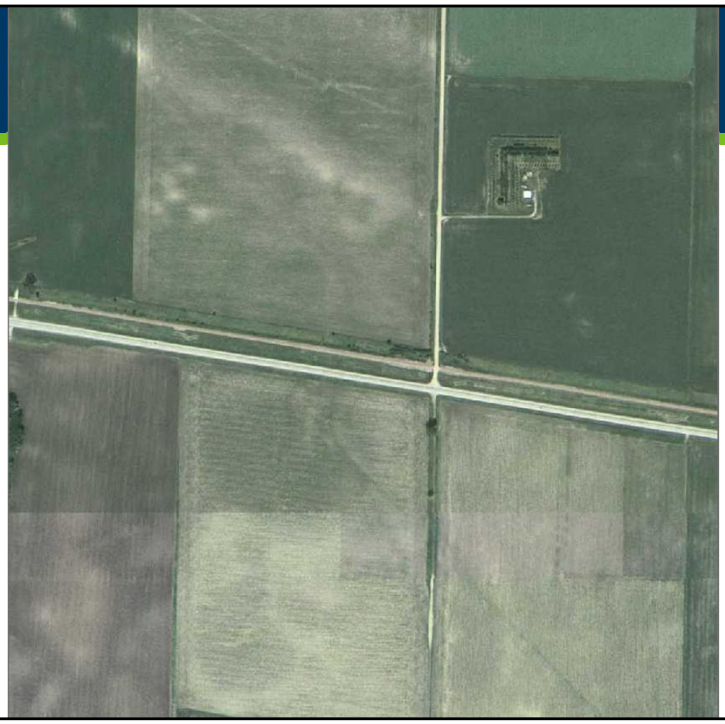


How the tile was installed affects what we can see from the air or on the ground when looking for tile line signatures.
Plow installation – minimal disturbance and lasting markers, little mixing layers of soils.
Trench installation – more obvious for a longer time. Also, can be found more easily when trenching perpendicular to the tile line.


Scale
1 inch = 440 feet
LEGEND
Farm Boundary
Existing Tile Line
New Tile Installed

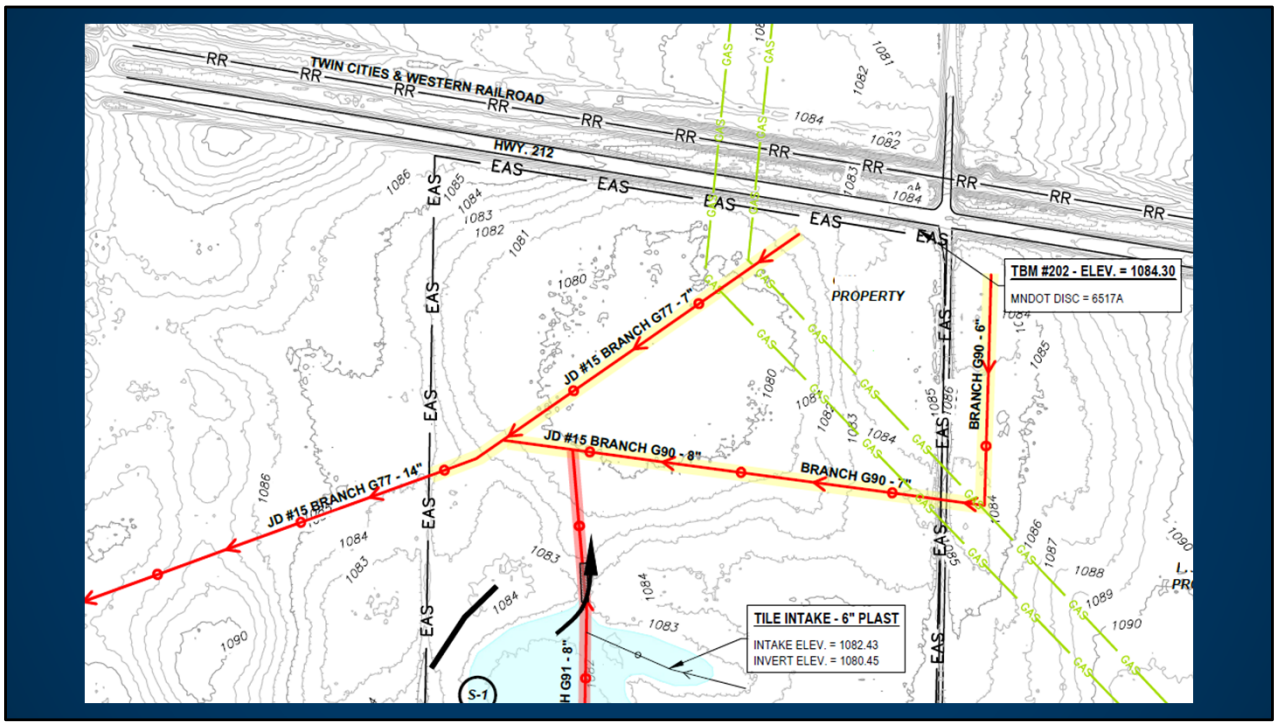

05/04/2001 14:27 5078632377 NRCS PAGE 02
Tile Installation Record - Location Plan
N
Scale
1 inch = 440 feet
Amount of Tile Installed 2560 FT Plowed
1200 Feet of Muck Filter 6 inch tile
1360 Feet of Muck Filter 5 inch tile

Enter answers in CHAT



Any guesses to the feature in the field? (Anyone can Chat in)


South facing Google Street View
North facing Google Street View


TWIN CITIES & WESTERN RAILROAD
RR
HWY. 212
EAS
GAS
PROPERTY
TBM #202 - ELEV. = 1084.30
MNDOT DISC = 6517A
JD #15 BRANCH G77 - 7"
JD #15 BRANCH G90 - 8"
JD #15 BRANCH G77 - 14"
BRANCH G90 - 7"
BRANCH G90 - 6"
TILE INTAKE - 6" PLAST
INTAKE ELEV. = 1082.43
INVERT ELEV. = 1080.45
S-1

Existing Determinations

Also gives you an idea if there is a wetland that's been drained, or if they're able to farm an otherwise non-altered wetland.

It’s amazing what we can see from above!
There are a LOT of resources available to us just at our computers. You need to do your research. There’s not one defined list of what to look at, but you need to find enough information to be comfortable understanding what’s been manipulated out there and what’s still there to know what’s reasonable to restore.