Site Specific Reviews

Southwest Michigan Water Resources Council

March 15, 2012

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DEQ Water Resources Division

Site Specific Reviews (SSR)

- When is a SSR Required?
- Components of the Review
- What is the Review Process?
- What Information is Reviewed?
- What Difference Does it Make? – Examples
- What if the SSR Does Not Change WWAT Determination?

When is a Site Specific Review Required?

- **Site Specific Review (SSR) Conducted When Withdrawal May Cause an Adverse Resource Impact (ARI)**
- **SSR Required for WWAT Determinations:**
  - **Zone B in Cold-Transitional River System**
  - **Zone C or Zone D**

Three Models Interact Within the WWAT

- Water Withdrawal Component - How much water is in the aquifer and stream, withdrawal rate, location, impact on stream flow
- Stream Flow Component - How much water is flowing in the stream during summer low flow periods
- Fish Impact Component - What fish are in the stream and what is the likely effect of removing water on those groups of fish

SITE SPECIFIC REVIEW (SSR) Process

- Examine Available Data in Watershed
- How Accurately Does WWAT Data Describe the Watershed?
- Apply Modified Watershed Information in a Custom Tool Run
- Modify Withdrawal Zone or Depletions, as Warranted

What Information is Reviewed?

- Geology-Hydrogeology Review
- Surface Water-Stream Flow Review
- Fish Population and Stream Classification Review
- Compliance-Registration Review

If WWAT Determines a Withdrawal May Cause an ARI

- Withdrawal is Flagged for SSR
- DEQ Receives an Email Notification
- DEQ Reviews the SSR Submittal
- Requestor Contacted to:
  - Confirm Pumping Schedule
  - Determine if it is a Replacement Well
  - Confirm the Withdrawal Source

How are Withdrawals Tracked?

WWAT Accounting Database

- Ledger of statutorily available water
  - Checkbook – withdrawals and deposits
  - Required minimum balance – Zone D (ARI)
- By watershed (5,400 in the state)
- Available water balance determines Zone

WWAT Accounting database

View Accounting

View All

View Modified

Find Watershed:

ACCOUNTING TABLE (Showing records with changes made to available water)

Modify	Watershed ID	Index Flow	Stream Type	A/B Zone Break	B/C Zone Break	C/D Zone Break	A/B Adjusted Break	B/C Adjusted Break	C/D Adjusted Break	Cold Mod Flag
Edit	78	13.8	Cold stream	435	435	621	435	435	621	
Edit	625	168.1	Cool large river	5280	7166	9429	5278	7134	9397	
Edit	684	2.9	Cold stream	93	93	132	81	81	120	
Edit	724	0.4	Cold stream	13	13	19	5	5	11	
Edit	759	1.2	Cold stream	133	133	190	-56	-56	1	
Edit	775	1.3	Cold stream	41	41	58	87	87	195	
Edit	776	1.6	Cold stream	51	51	73	33	33	55	
Edit	777	2.2	Cold stream	69	69	99	-21	-21	8	
Edit	790	1.2	Cold stream	36	36	52	22	22	38	
Edit	801	224.8	Cool large river	7044	9573	12596	7048	9567	12590	

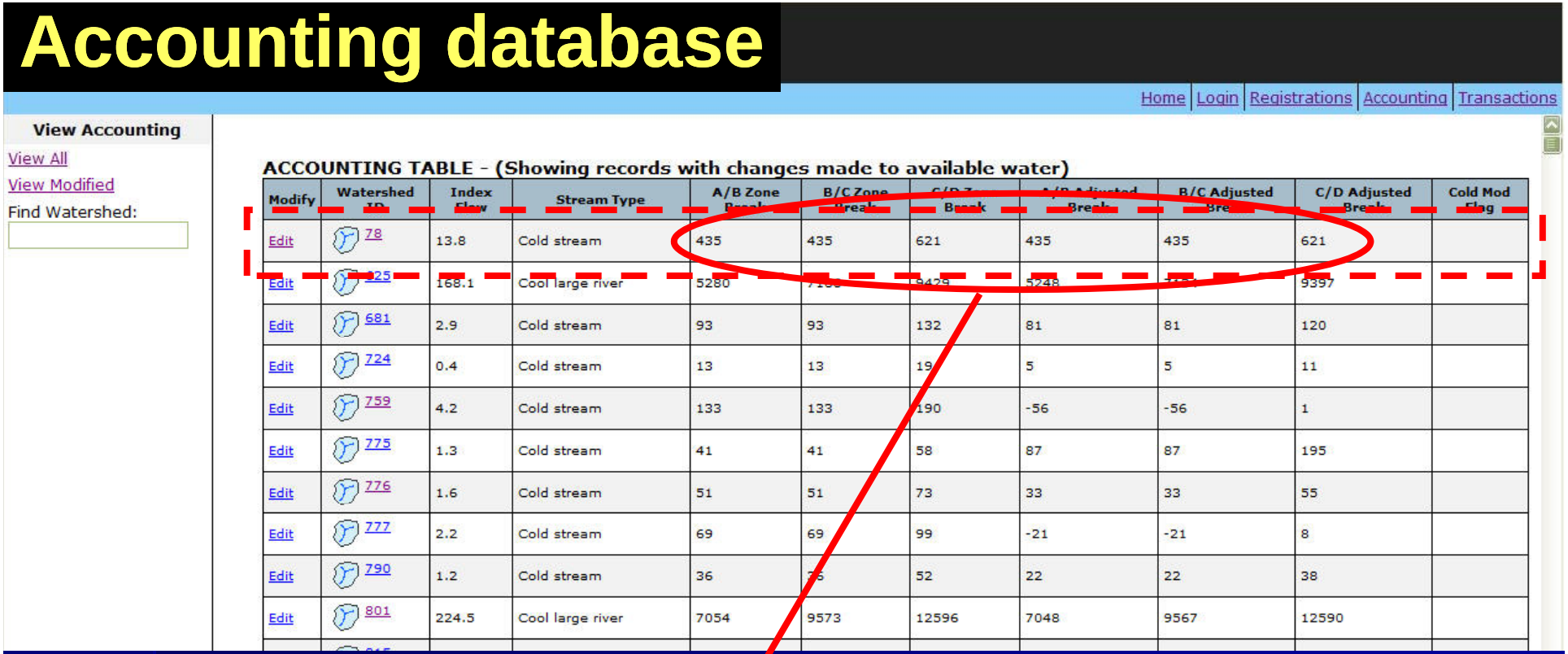
Index Flow - *median low (summer) streamflow*

Stream Type - *stream size & temperature*

C/D Zone Break - *original GPM available in Zones*

C/D Adjusted Break - *adjusted (depleted) GPM available*

Accounting database



Modify	Watershed ID	Index Flow	Stream Type	A/B Zone Break	B/C Zone Break	C/D Zone Break	A/B Adjusted Break	B/C Adjusted Break	C/D Adjusted Break	Cold Mod Flag
Edit	78	13.8	Cold stream	435	435	621	435	435	621	
Edit	325	168.1	Cool large river	5280	[illegible]	9429	5248	[illegible]	9397	
Edit	681	2.9	Cold stream	93	93	132	81	81	120	
Edit	724	0.4	Cold stream	13	13	19	5	5	11	
Edit	759	4.2	Cold stream	133	133	190	-56	-56	1	
Edit	775	1.3	Cold stream	41	41	58	87	87	195	
Edit	776	1.6	Cold stream	51	51	73	33	33	55	
Edit	777	2.2	Cold stream	69	69	99	-21	-21	8	
Edit	790	1.2	Cold stream	36	[illegible]	52	22	22	38	
Edit	801	224.5	Cool large river	7054	9573	12596	7048	9567	12590	

A/B Zone Break	B/C Zone Break	C/D Zone Break	A/B Adjusted Break	B/C Adjusted Break	C/D Adjusted Break
435	435	621	435	435	621

No depletion = no registration

Accounting database – Transaction table

ACCOUNTING TABLE - (Showing watershed ID# 20038)

Modify	Watershed ID	Index Flow	Stream Type	A/B Zone Break	B/C Zone Break	C/D Zone Break	A/B Adjusted Break	B/C Adjusted Break	C/D Adjusted Break
Edit	20038	3	Cool stream	40	99	166	122	8	152

Index Flow
3

Index flow = 3 cfs (1330 gpm)

*Safety factor = 665 gpm index flow

Stream Type
Cool stream

Zone D is 25% of index flow

C/D Zone Break
166

665 x 0.25 = 166 gpm available

C/D Adjusted Break
152

Why 152 gpm available?

Accounting database – Transaction table

TRANSACTION TABLE - (Showing all transactions within watershed id: 20038)

	ID	Reg ID	Wellogic ID	Watershed ID	Transaction Date	Amount (GPM)	Transaction Code	Transaction Type	Home/Neighbor	Status	Status Change	Created By	Exp-Flag	FP-Flag	Notes
Edit	2600	1502-20121-21			/2012 :21 PM	93	Reg	WD	N	Open		Auto	0		
Edit	2580	1495-20121-5			/2012 :05 PM	14	Reg	WD	N	Open		Auto	0		
Edit	2568	1473-20121-0			6/2012 :42	184	SSR-B	DP	H	Closed		JVD	0		|The index flow review determined a revised index flow of 3.2 cfs. The continuous schedule was revised to 5 days/wk, 12 hrs/day, for June,, July, and August with a deeper well depth of 101 ft. This resulted in a deposit of 184 gpm. New cut off values of -15, 115, 259 were entered.
Edit	2527	1473-20121-0			11/2012 :00	223	SSR	WD	H	Closed	1/26/2012 11:33:42 AM	Auto	0		|Closed by: JVD. Transaction logged in using ID: 2568
Edit	1523	1039-20111-8			/2011 :08 PM	62	Reg	WD	N	Open		Auto	0		

Notes

|The index flow review determined a revised index flow of 3.2 cfs.

Index flow = 3.2 (1436 gpm)

1436 x 0.25 = 360 available

Accounting database – Transaction table

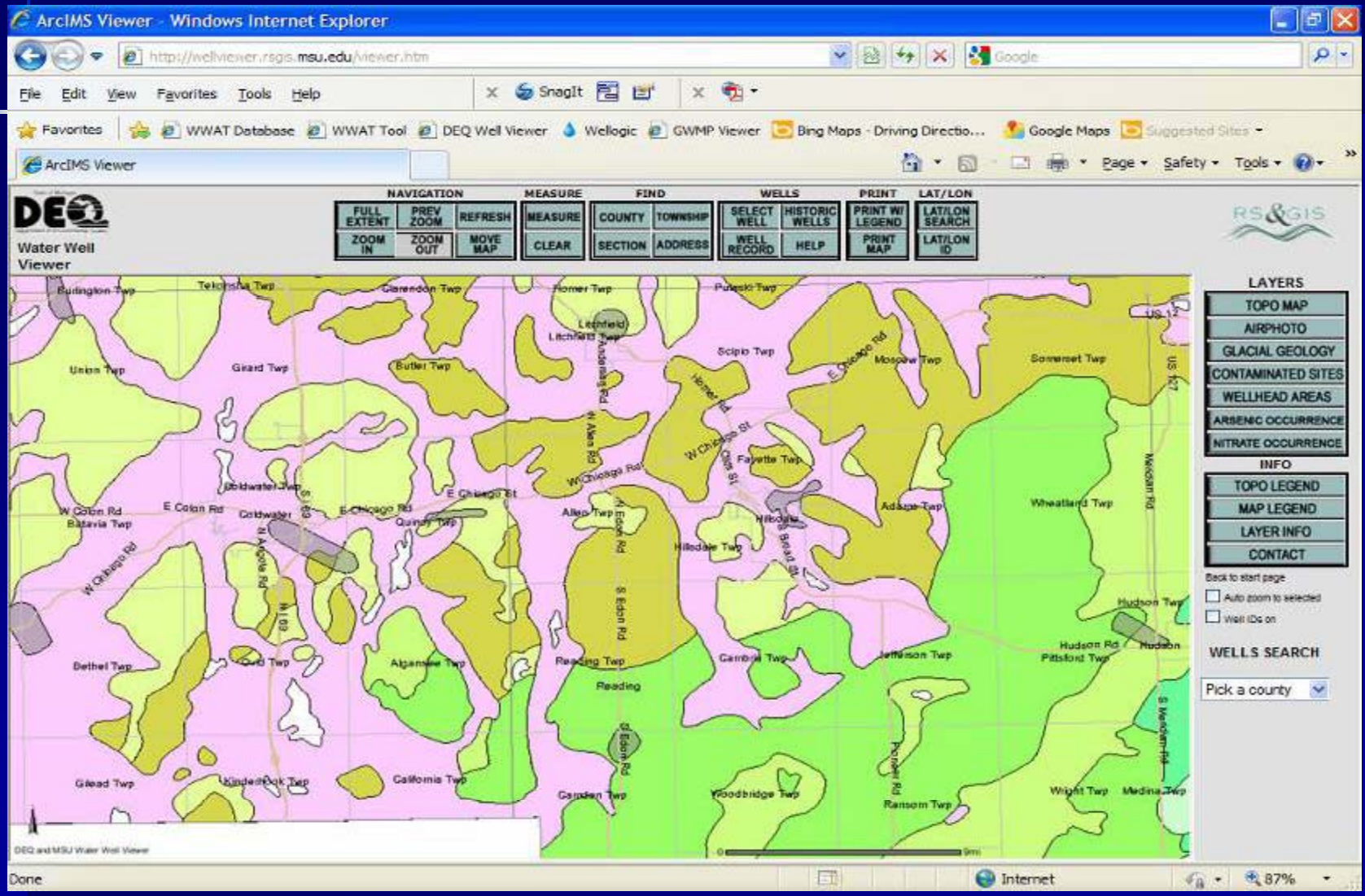
TRANSACTION TABLE - (Showing all transactions within watershed id: 20038)

	ID	Reg ID	Wellogic ID	Watershed ID	Transaction Date	Amount (GPM)	Transaction Code	Transaction Type	Home/Neighbor	Status	Status Change	Created By	Exp-Flag	FP-Flag	Notes
Edit	2600	1502-20121-21		20038	1/30/2012 3:28:21 PM	93	Reg	WD	N	Open		Auto	0		
Edit	2580	1495-20121-5		20038	1/26/2012 9:49:05 PM	14	Reg	WD		Open		Auto	0		
Edit	2568	1473-20121-0		20038	1/26/2012 11:33:42 AM	184	SSR-B	DP	H	Closed		JVD	0		|The index flow review determined a revised index flow of 3.2 cfs. The continuous schedule was revised to 5 days/wk, 12 hrs/day, for June,, July, and August with a deeper well depth of 101 ft. This resulted in a deposit of 184 gpm. New cut off values of -15, 115, 259 were entered.
Edit	2527	1473-20121-0		20038	1/11/2012 10:33:00 PM	223	SSR	WD	H	Closed	1/26/2012 11:33:42 AM	Auto	0		|Closed by: JVD. Transaction logged in using ID: 2568
Edit	1523	1039-20111-8		20038	1/20/2011 6:43:08 PM	62	Reg	WD	N	Open		Auto	0		

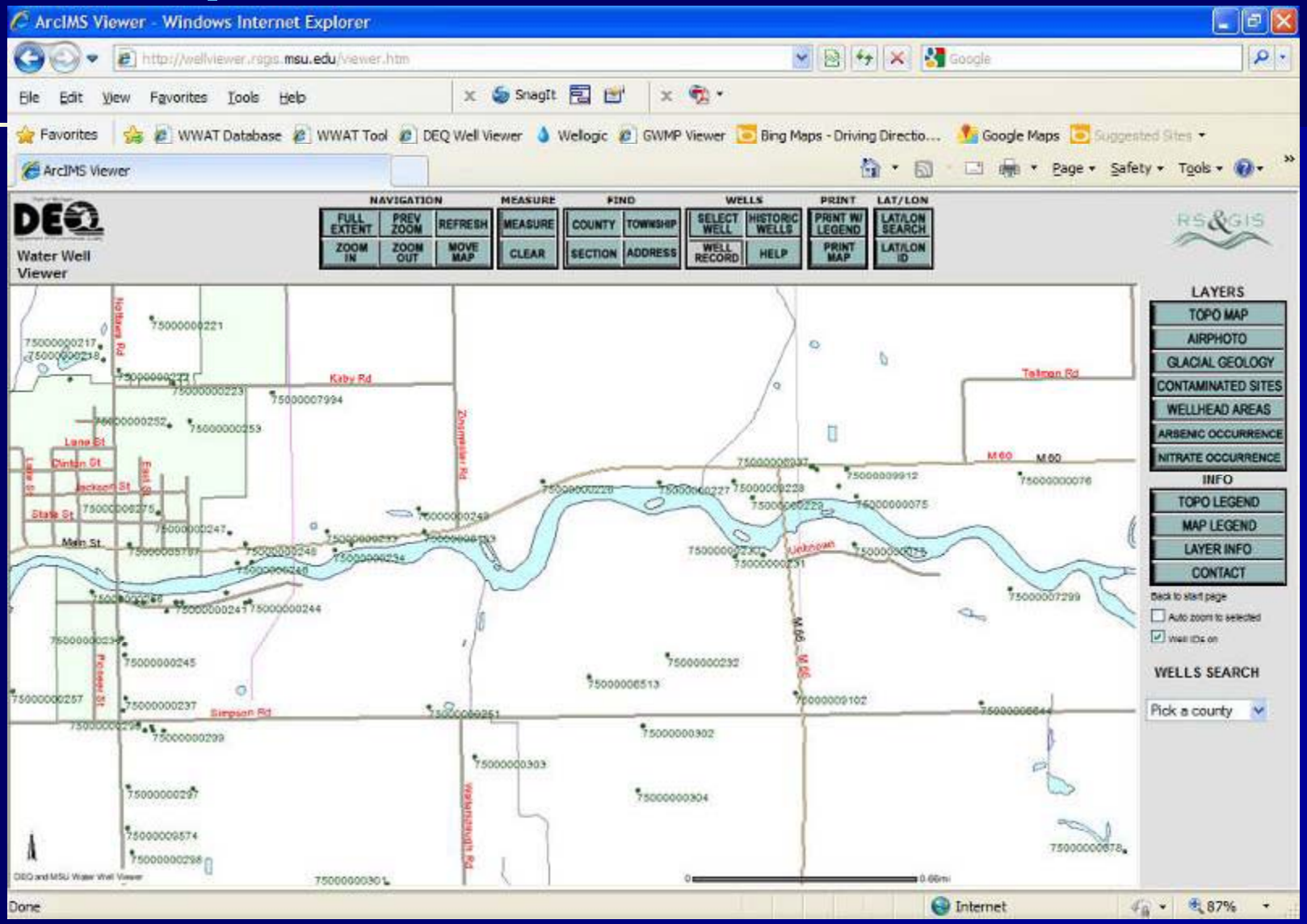
360 - 62 - 223 + 184 - 14 - 93 = 152

Geology-Hydrogeology Review

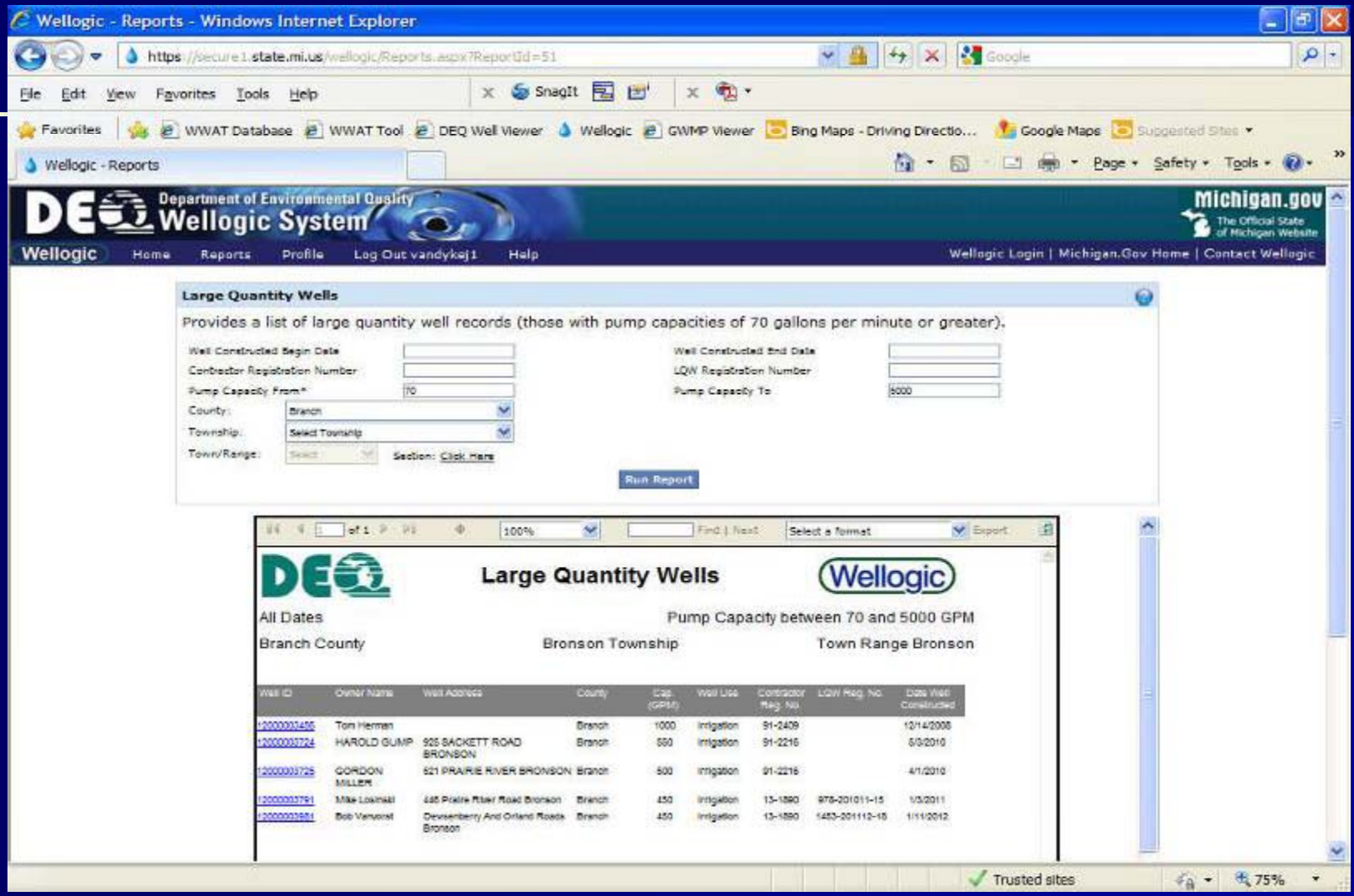
Glacial Geology – DEQ Well Viewer Example



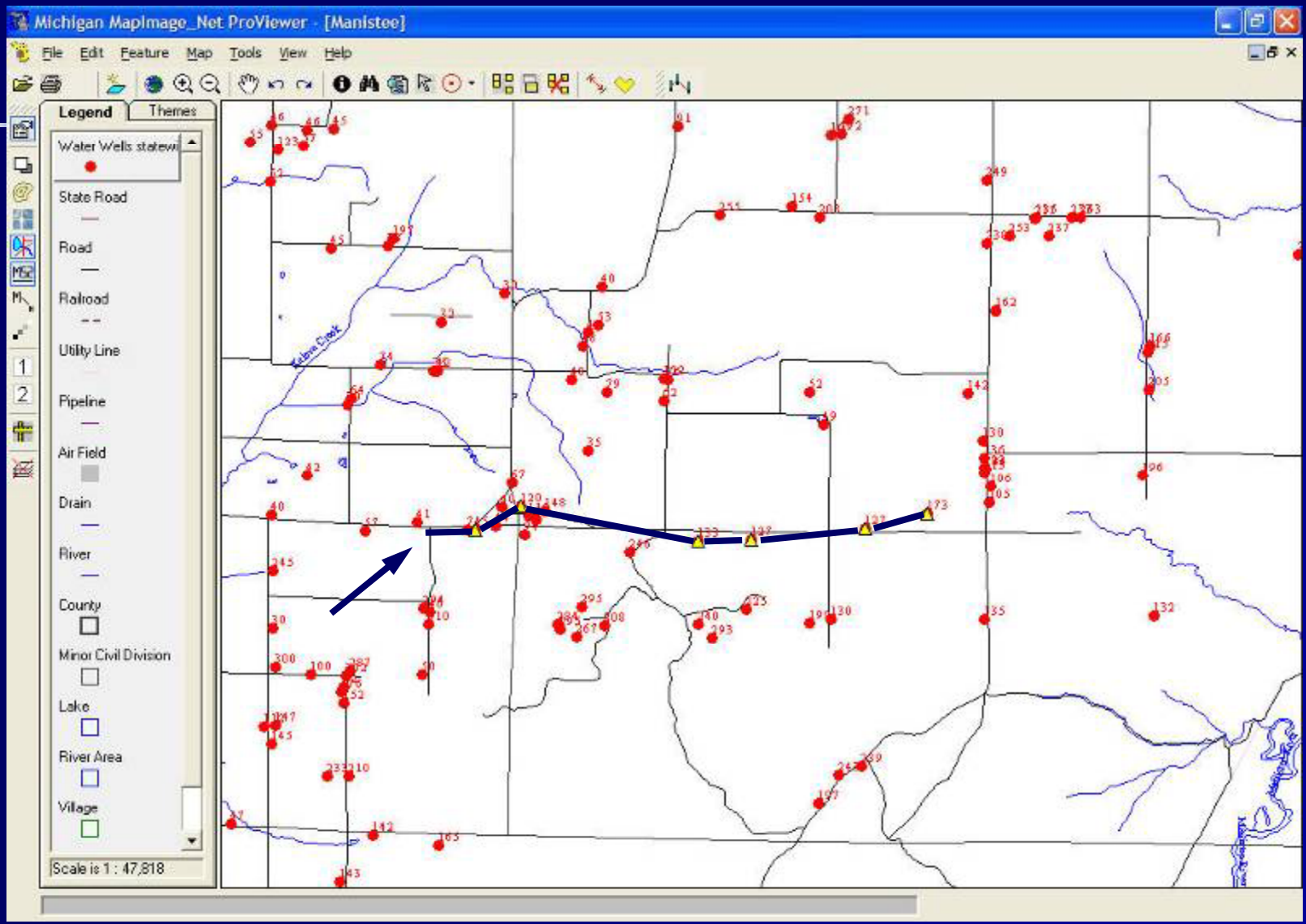
Well Records – DEQ Well Viewer Example



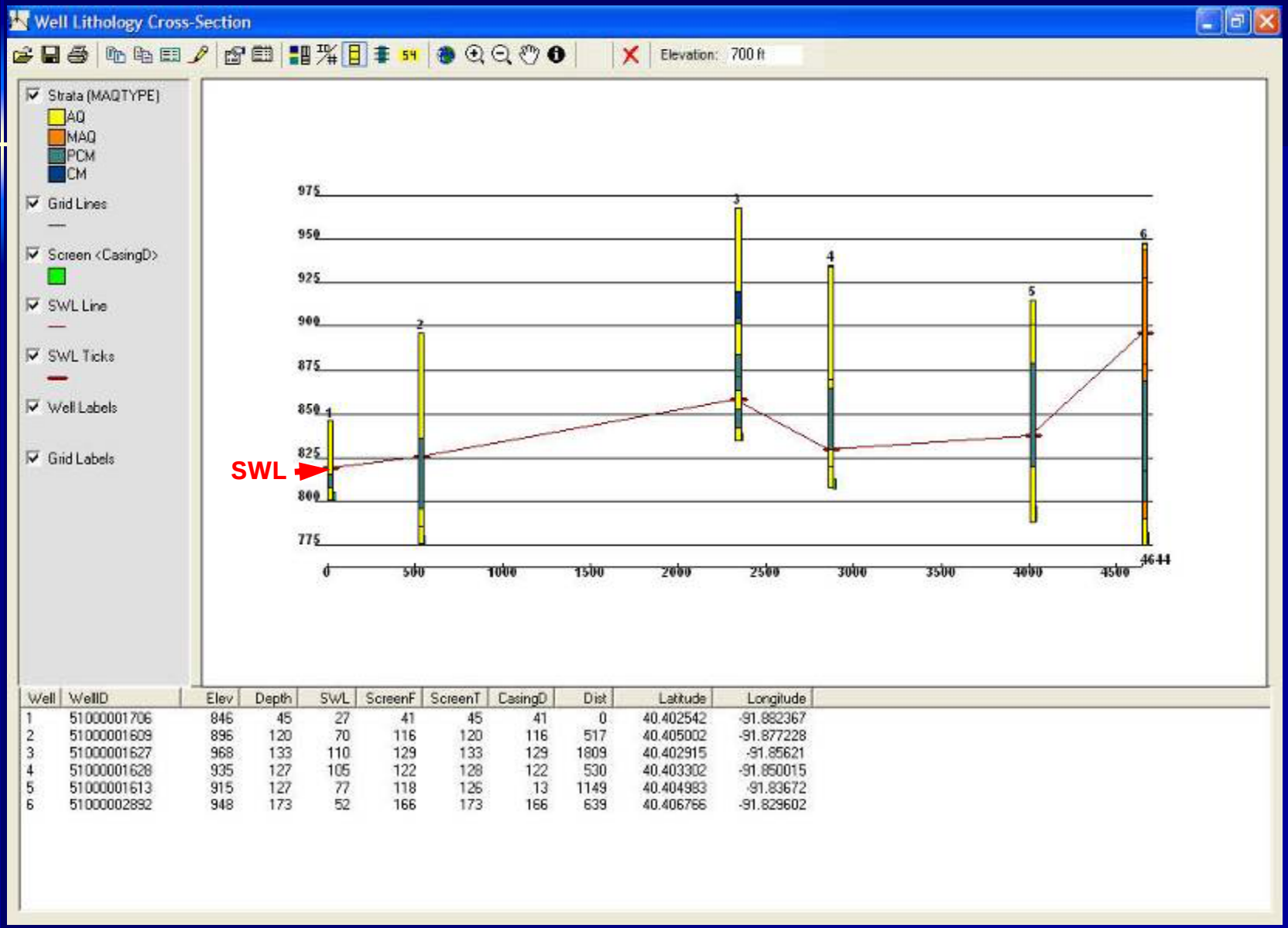
Large Quantity Well (LQW) Reports – Wellogic



Wellogic Wells- MapImage Viewer

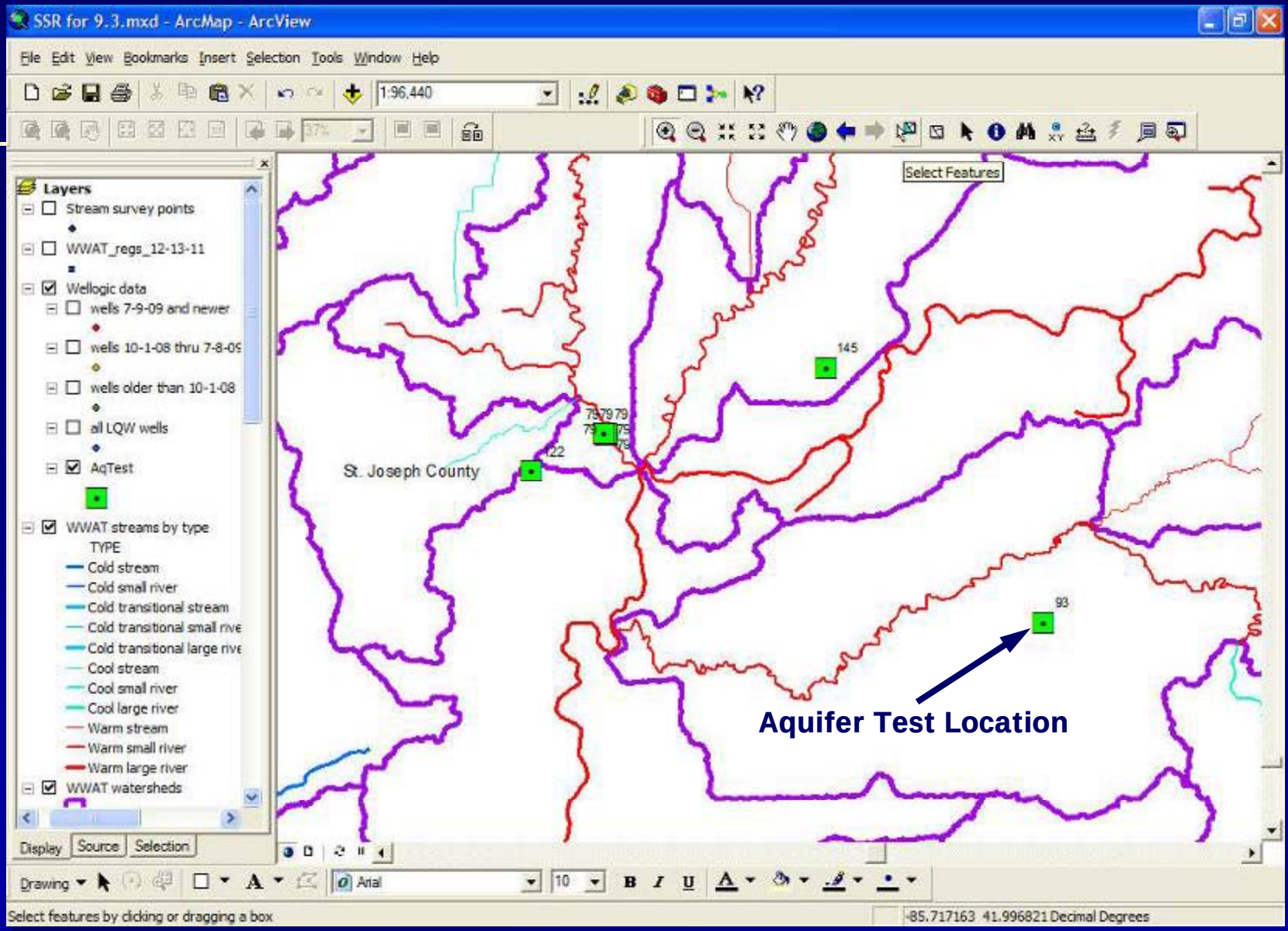


MapImage Viewer – Cross-Sections

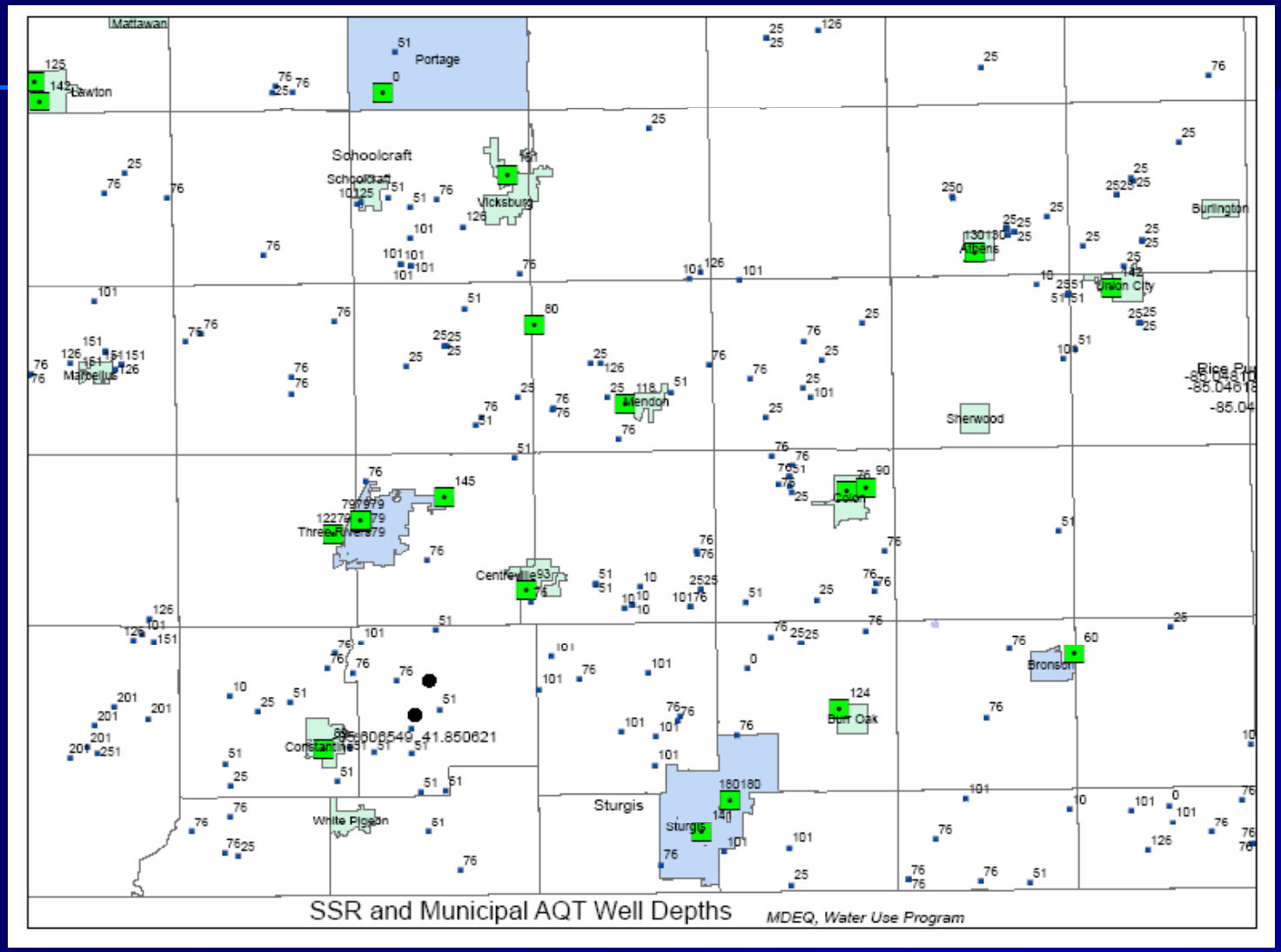


Well	WellID	Elev	Depth	SWL	ScreenF	ScreenT	CasingD	Dist	Latitude	Longitude
1	51000001706	846	45	27	41	45	41	0	40.402542	-91.882367
2	51000001609	896	120	70	116	120	116	517	40.405002	-91.877228
3	51000001627	968	133	110	129	133	129	1809	40.402915	-91.85621
4	51000001628	935	127	105	122	128	122	530	40.403302	-91.850015
5	51000001613	915	127	77	118	126	13	1149	40.404983	-91.83672
6	51000002892	948	173	52	166	173	166	639	40.406766	-91.829602

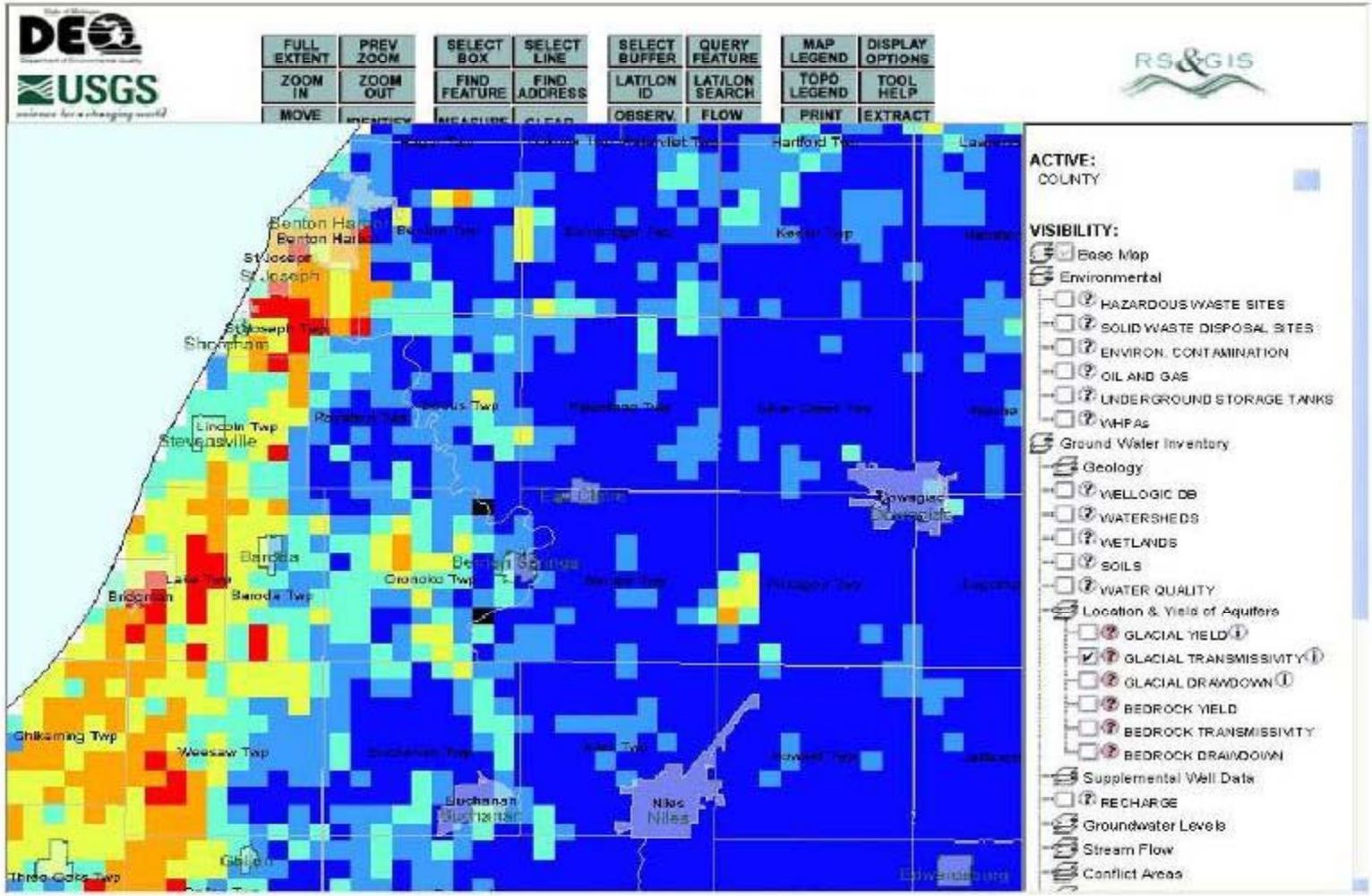
DEQ Aquifer Test Data



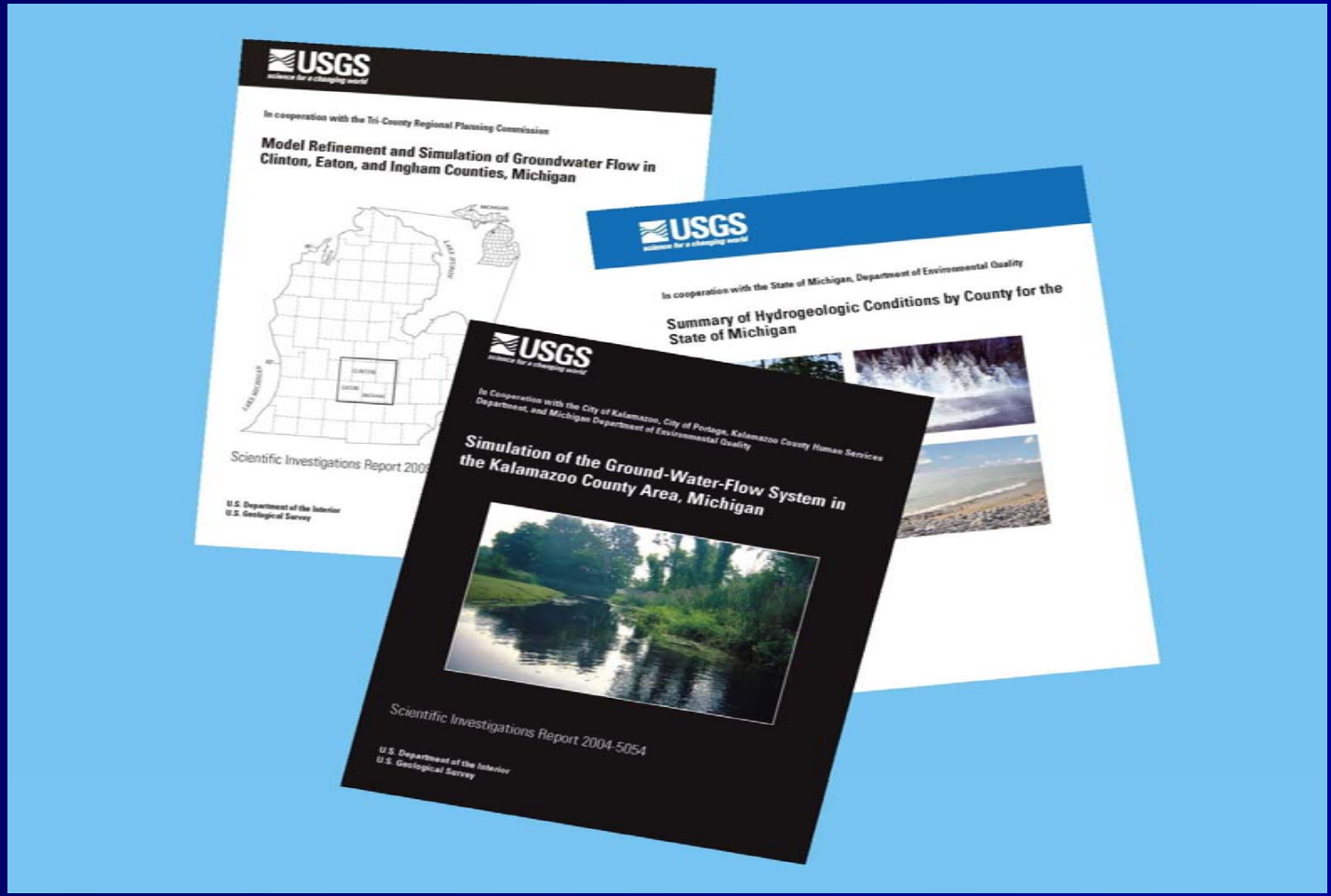
Aquifer Test Data and SSR Locations



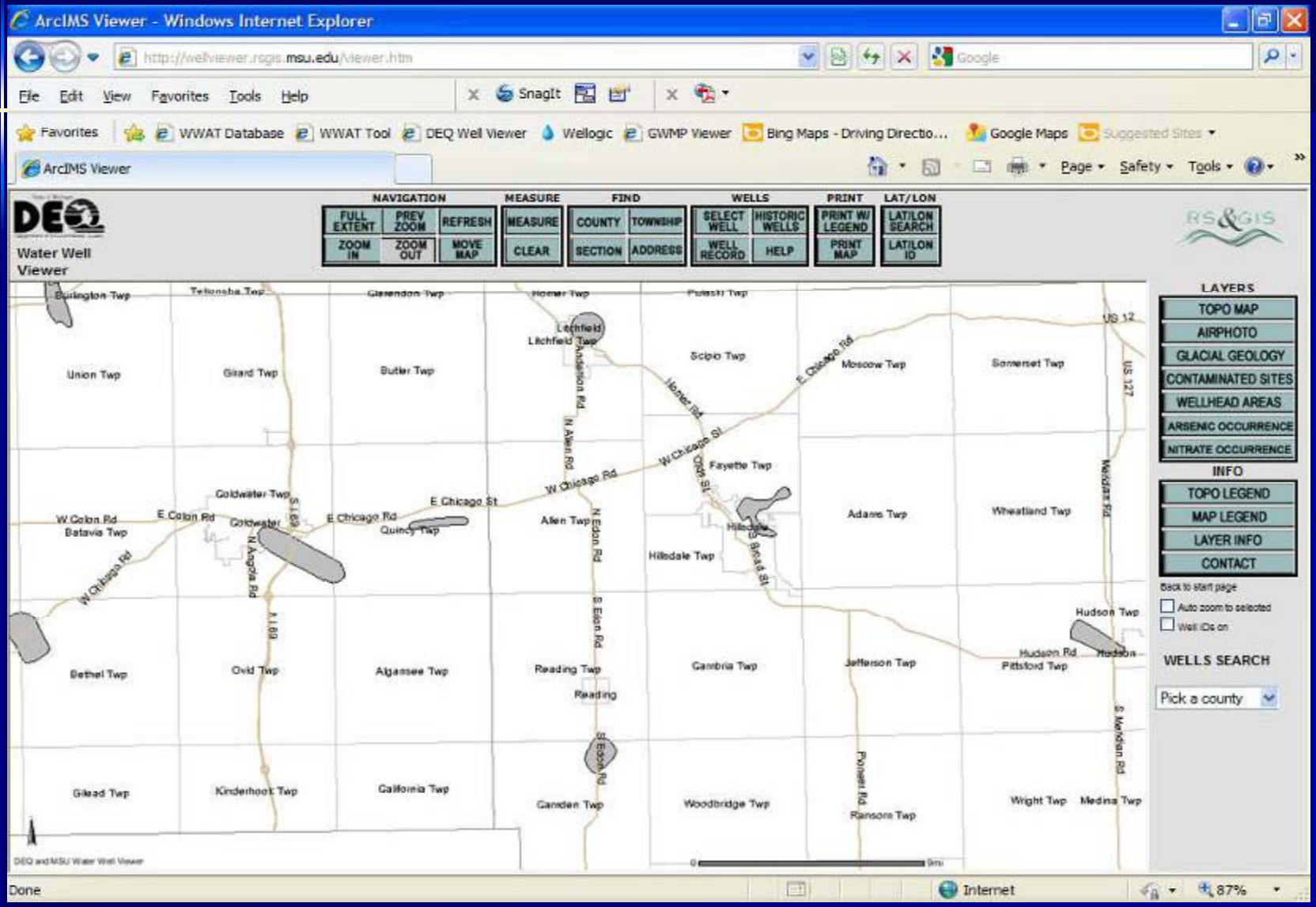
Aquifer Data – Groundwater Inventory & Mapping Project



Review USGS and Other Published Reports



DEQ Well Viewer – WellHead Protection Areas



Return Flow Credit

Consumptive Use Coefficients

Water Use Category	ILLINOIS	INDIANA	MICHIGAN	MINNESOTA	NEW YORK	OHIO	ONTARIO	PENNSYLVANIA	QUEBEC	WISCONSIN
Public Supply	10-15%	15%	10-15%	10-15%	10%	10-15%	15%	10%	10-15%	10-15%
Self-Supply Domestic	10-15%	15%	10-15%	10-15%	10%	10-15%	15%	10%	10-15%	10-15%
Self-Supply Irrigation	90%	90%	90%	90%	90%	90%	78%	90%	90%	70%
Self-Supply Livestock	80%	80%	80%	80%	90%	80%	80%	80%	80%	90%
Self-Supply Industrial	Varies by plant & SIC code	6%	10-15%	Varies by plant & SIC code	25%	10%; salt mining is 90%	Varies by plant & SIC code	Varies by plant & SIC code	10% for pulp & paper industry	10.2% for manufac-turing & mining

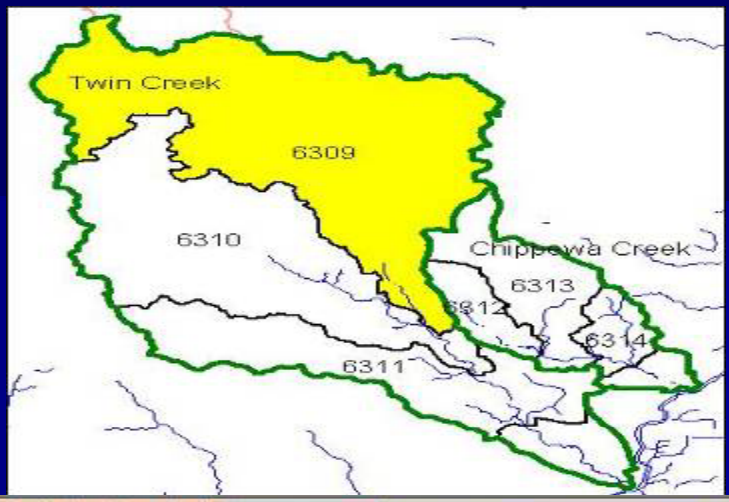
Surface Water –Stream Index Flow Review

- Look for USGS Gage in Watershed or Nearby
  - Long-Term (>10 Years)
  - Short-Term (<10 Years)
- Verify WWAT Index Flow
  - Drainage Area Ratio
  - Correlation Long-Term Gage with Miscellaneous Measurements
- Verify the Stream Type
- Note Geology in Vicinity of Stream
- Geographic - Topographic Information
- Verify Drainage Area in WWAT

Index Flow – What is it?

- The median flow for the lowest flow month in the watershed
- Lowest Flow Month is Usually August
- Greatest Potential for Impacting Ecosystem
- Index Flow Determines Available Water Based on Stream Type

Index Flow Calculations- Program Engineer
USGS Gage Data and Spreadsheet Program



USGS Gages

04124500

Drainage Area: 58.9 mi²

Period of Record: 1952-2004

Last Update: 1999/05/27 - 16:23:0

Years of Record: 24

Statistics Required

- [x] Mean
- [x] 90dQ10
- [x] Harmonic Mean
- [ ] Frequency Curve
- [x] 95%
- [x] 50%
- [x] Default
- [ ] All

Compute | Print | Correlation | Return | Zeroed Flows

Stats	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
95%	8.51	11.6	11.41	9.3	8.5	13.15	24.12	10.49	7	6.1	5.3	6.6	7.22
50%	17.32	25.83	20.64	17.81	18.5	37.86	61.77	32.04	15.33	11.24	9.62	11.49	19.64
Mean	26.02	33.51	25.96	23.43	25.17	55.95	83.32	37.64	24.03	16.64	18.05	15.34	32.04
Harm Mean													16.484
90dQ10													6.88

Site

Water Course: TWIN CREEK TRIB

Drainage Area: 9.9 mi²

County: OSCEOLA

Town: 18N

Range: 8W

Section: 20

Description: AT THE MOUTH, LOCATION A

A and B values

A: 1

B: 1

Correlation Coefficient: N/A

Equal Line

Yield: 1

Discharge: 9.9

Methodology

- (•) DAR
- ( ) CORR/DAR
- ( ) ADDITION
- ( ) PRORATED
- ( ) COMBINATION
- ( ) OTHER

0

Stats	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Ann
95%	1.4	1.9	1.9	1.6	1.4	2.2	4.1	1.8	1.2	1	0.9	1.1	1.2
50%	2.9	4.3	3.5	3	3.1	6.4	10	5.4	2.6	1.9	1.6	1.9	3.3
Mean	4.4	5.6	4.4	3.9	4.2	9.4	14	6.3	4	2.8	3	2.6	5.4
Harm Mean													2.8
90dQ10													1.2

Index Flow is Used to Determine Water Available Based on Stream Type

FISH CURVE REDUCTIONS TO DEFINE ZONES IN FINAL VERSION OF THE WWAT

	A/B	% IF Reduction	B/C	% IF Reduction	ARI	% IF Reduction	IF (cfs)= 18	A/B	B/C	ARI	Depletion (gpm) = 1942	A/B	B/C	ARI
COLD							(gpm)							
stream	1%T	0.14	1%T	0.140001	3%T	0.2	8100	1134	1134	1620		-808	-808	-322
small river	50% of ARI	0.105	50% of ARI	0.105001	1%T	0.21		851	851	1701		-1092	-1091	-241
COLD TRANSITIONAL				0.04		0.040001		0	324	324		-1942	-1618	-1618
stream, small river, large river	—	0	5%T	0.02	5%T	0.020001		0	162	162		-1942	-1780	-1780
				0.03		0.030001		0	243	243		-1942	-1699	-1699
COOL														
stream	10%T	0.06	20%T	0.15	10%C	0.25		486	1215	2025		-1456	-727	83
small river	5%T	0.15	10%T	0.19	15%T	0.25		1215	1539	2025		-727	-403	83
large river	8%T	0.14	10%T	0.19	12%T	0.25		1134	1539	2025		-808	-403	83
WARM														
stream	10%T	0.1	15%T	0.18	5%C	0.24		810	1458	1944		-1132	-484	2
small river	10%T	0.08	20%T	0.13	10%C	0.17		648	1053	1377		-1294	-889	-565
large river	10%T	0.1	20%T	0.16	10%C	0.22		810	1296	1782		-1132	-646	-160

A/B = Percent reduction at limit of A zone
B/C = Percent reduction at limit of B zone
ARI = Maximum reduction before causing an Adverse Resource Impact (limit of C zone)
IF = Index Flow

Calculation does not include safety factor.

DNR Fish Population and Stream Classification Review

- Desktop Review
- Site Visit
- Stream Geomorphology
- Stream Temperature
- Vegetation Types
- Sedimentation Patterns
- Stream Macroinvertebrates
- Supported Fish Communities

Compliance-Registration Review

- Search Wellogic for LQW Well Records
- Correlate Well Records with Registrations
- Registration Expires if Not Drilled and Operating Within 18 Months
- Verify Wells Completed as Registered
  - Review Well Record & SSR

Compliance-Registration Review

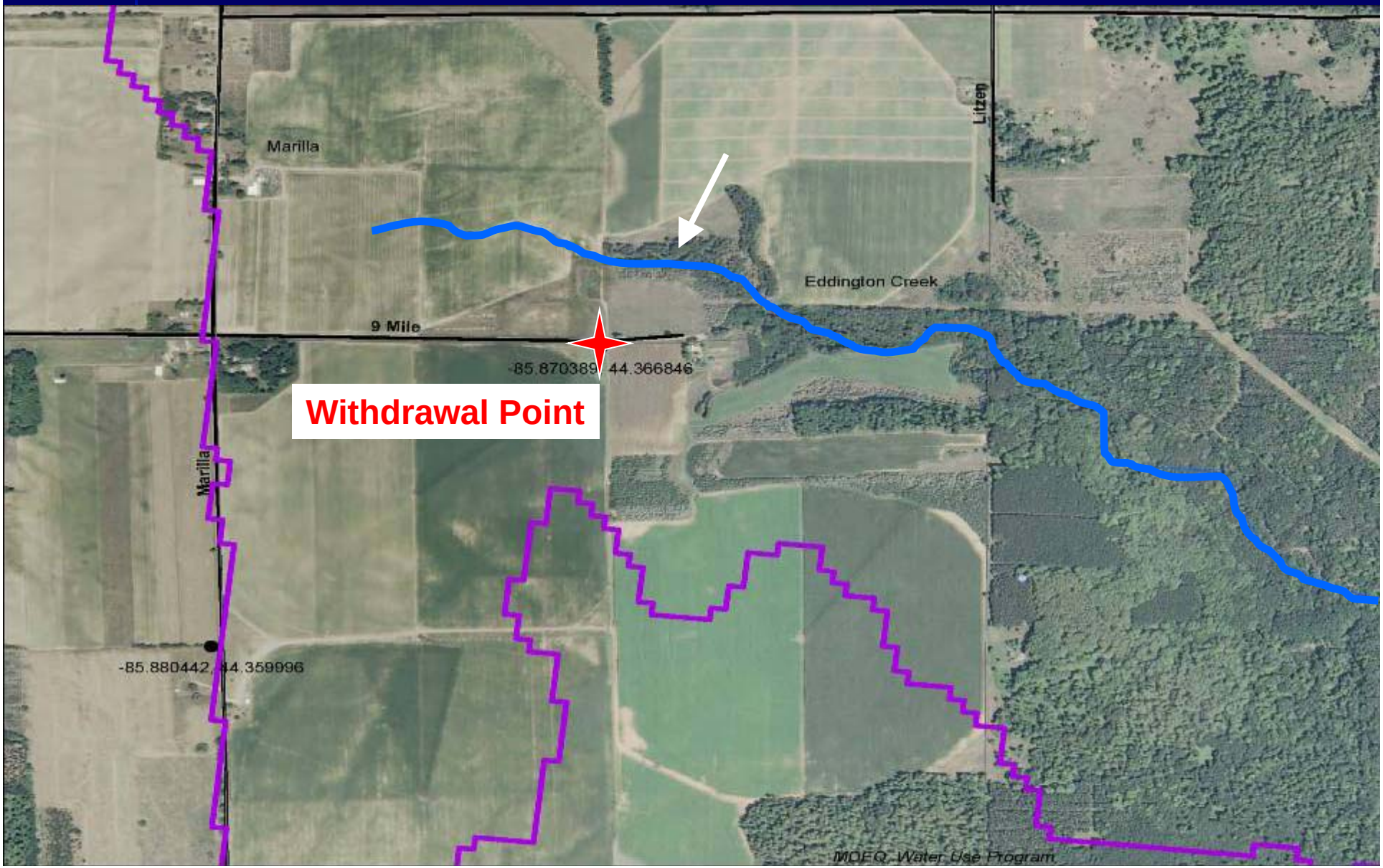
- Call Registrant to Verify
  - is well installed?
  - Is well active?
  - Verify pump capacity
  - Verify pumping schedule
- Modify Depletions in WWAT Database
- Updating data results in greater accuracy in decisions

What Difference Does it Make? – Examples

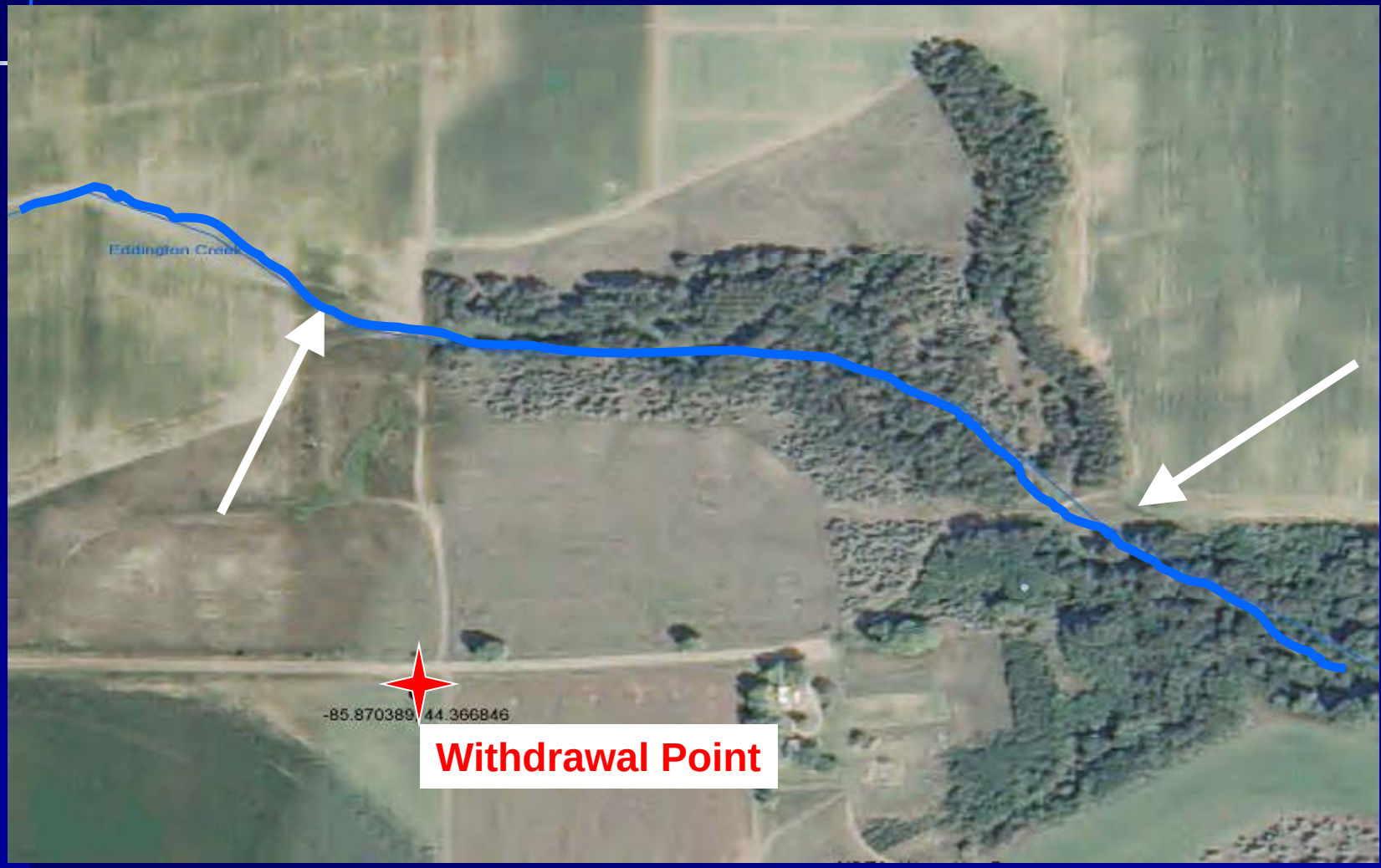
Example – Stream Truncation

- Initial Withdrawal – Zone D
- Sands and Gravels- Not Isolated
- Static Water Levels >80 ft

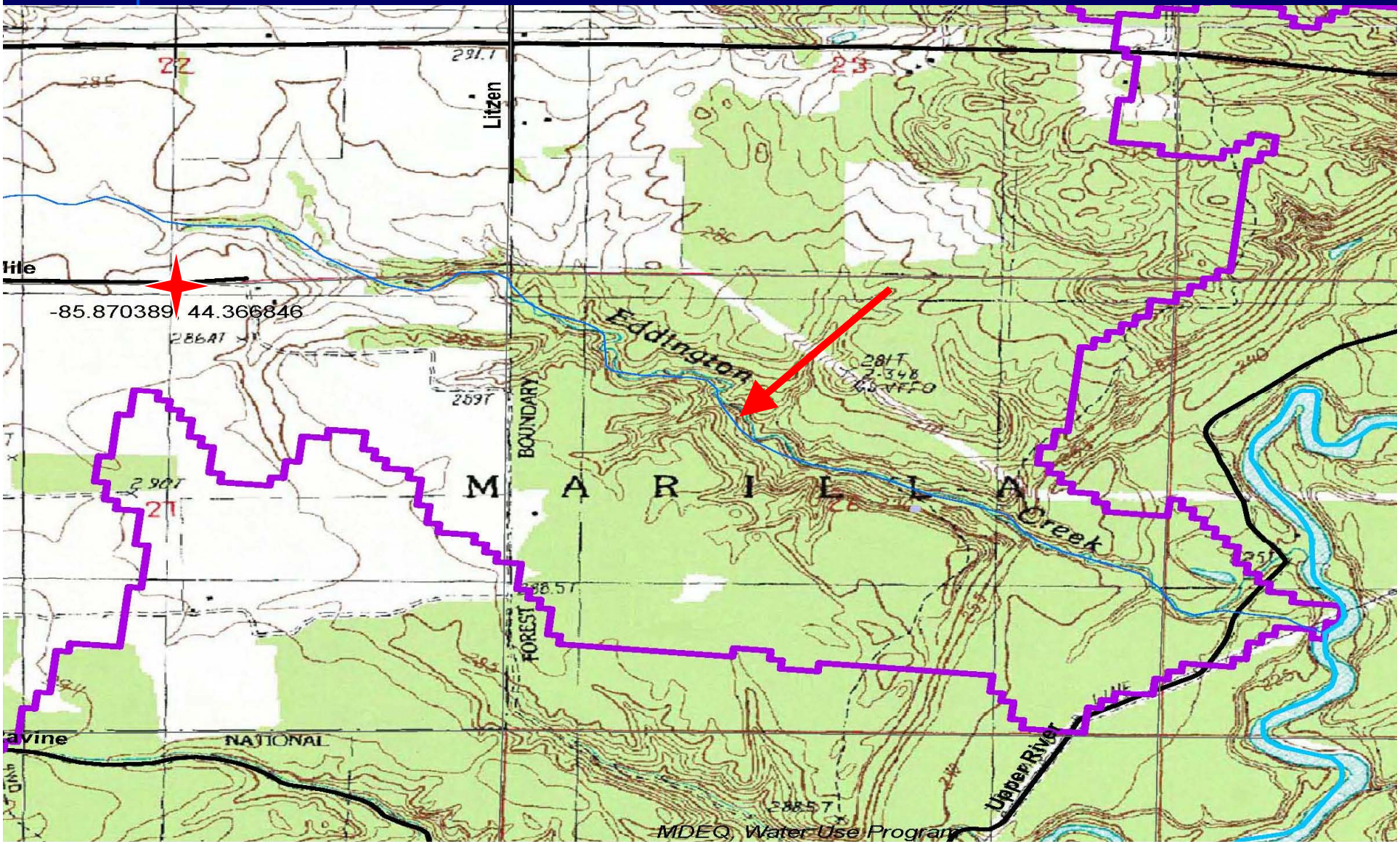
Stream Depleted in WWAT



Intermittent Stream Suspected



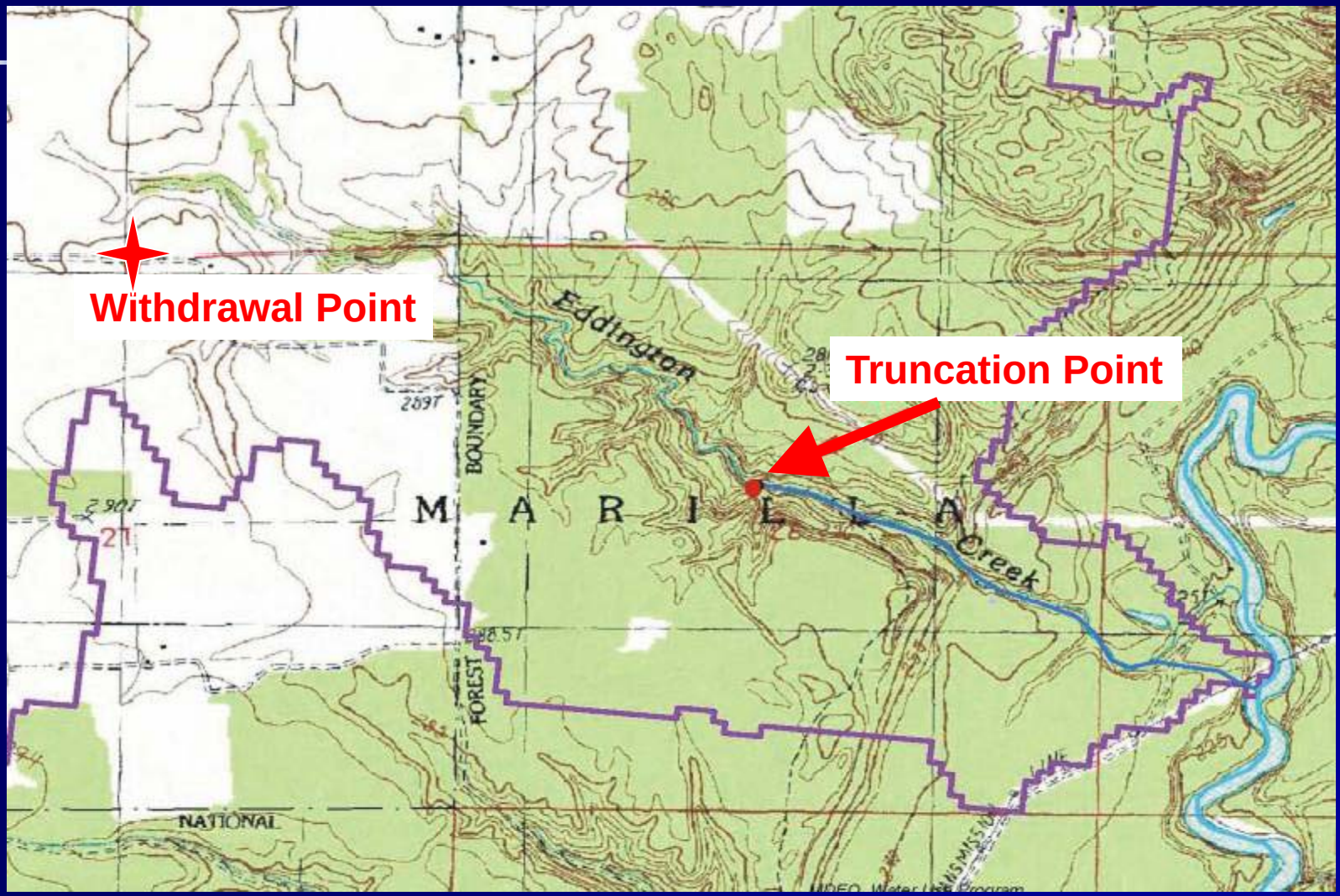
Potential Headwaters Located Based on Elevation Change



DNR and DEQ Site Visit – Located Perennial Stream Headwaters

Perennial Stream Starting Point - Spring Located

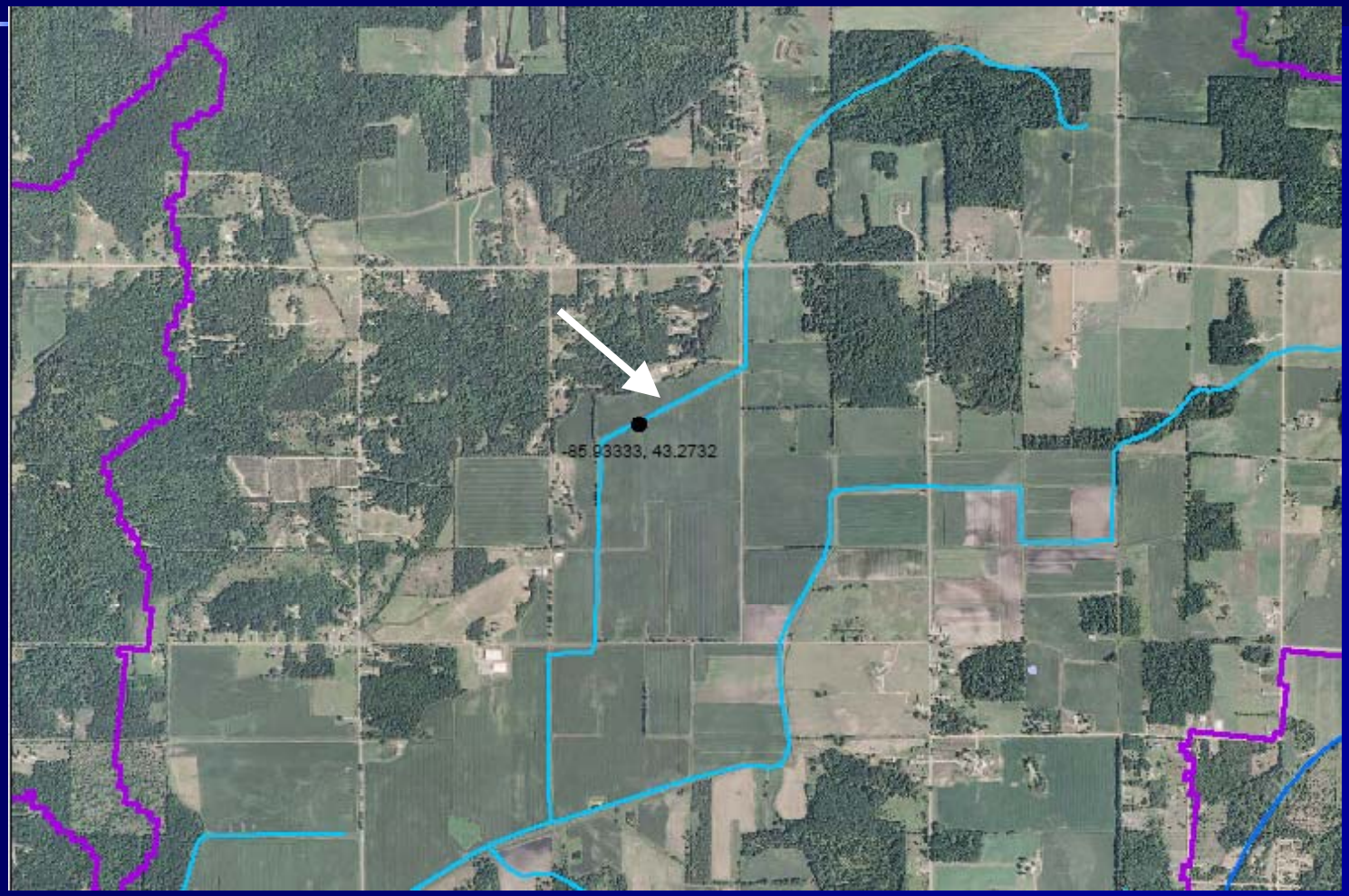
Stream Truncated – SSR Zone A Pass



Example – Stream Reclassification

- Initial WWAT Zone D
- Sands and Gravel – Not Isolated
- Shallow Well

Suspect Stream – Cold-Transitional



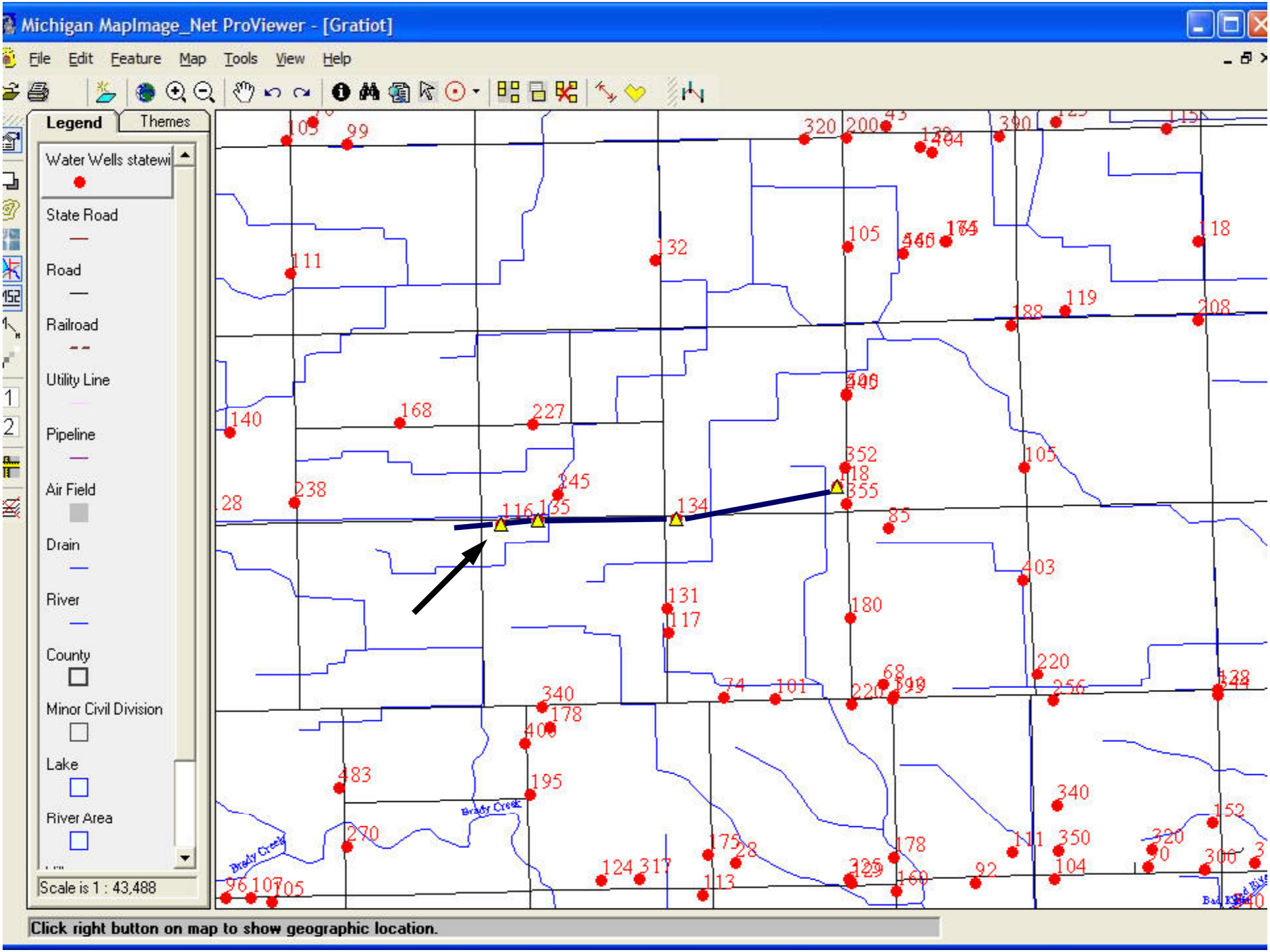
Suspect Stream – Closer Look

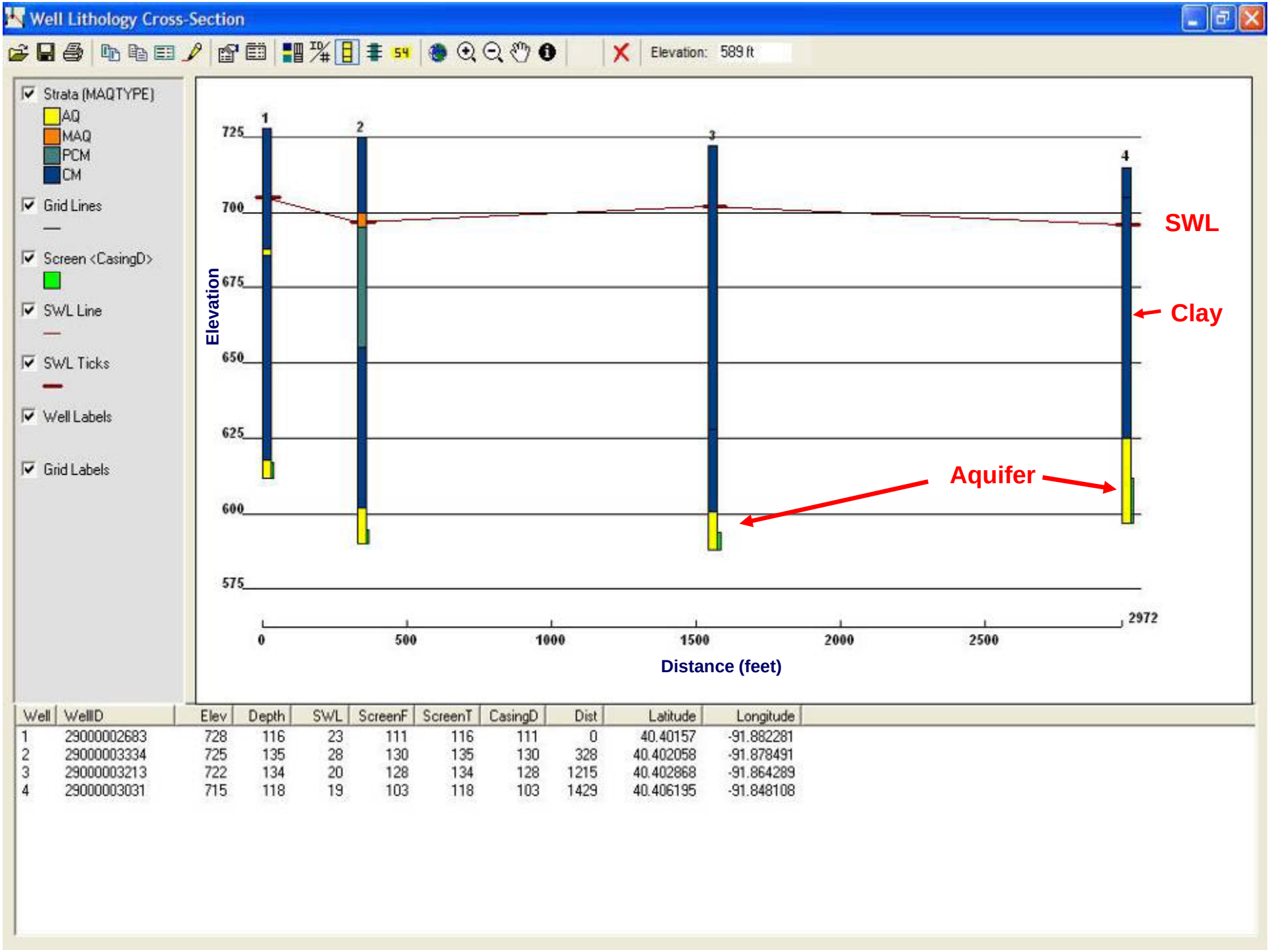
DNR Site Visit – Channel Beginning Identified

DNR Reclassified Stream to Cool – SSR Zone B Pass

Example – Aquifer Isolation: "Geology Pass"

- Initial WWAT Zone D
- Glacial Geology – Lacustrine Deposits, Fine Grained
- Deep Well – Possible Isolation

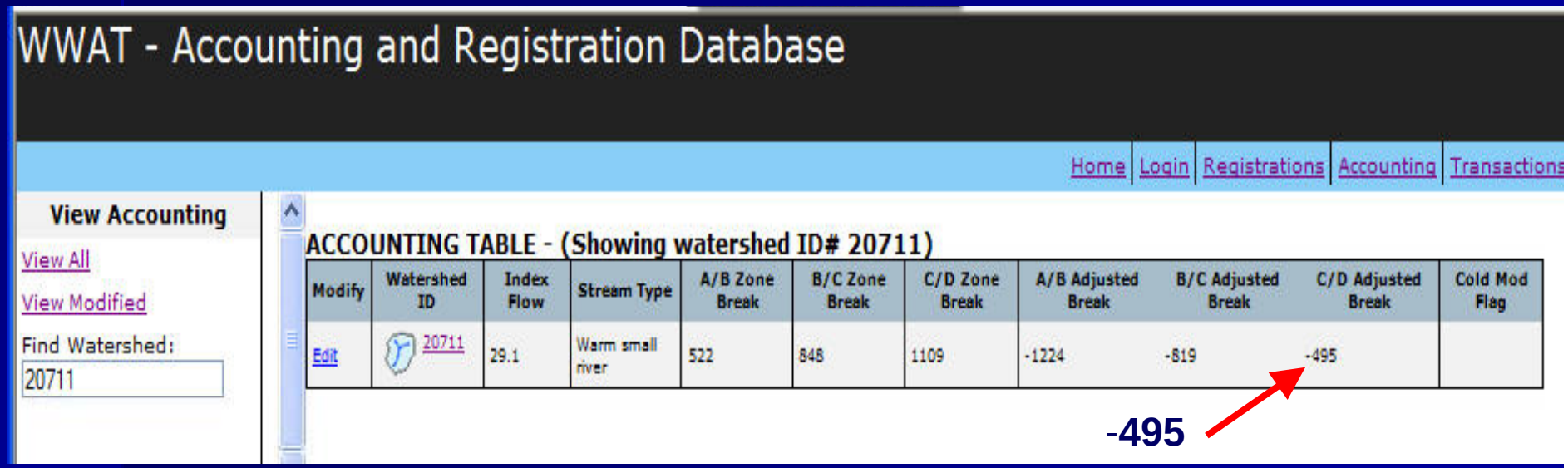

Michigan MapImage_Net ProViewer - [Gratiot]
File Edit Feature Map Tools View Help
Legend
Themes
Water Wells statewi
State Road
Road
Railroad
Utility Line
Pipeline
Air Field
Drain
River
County
Minor Civil Division
Lake
River Area
Scale is 1 : 43,488
Click right button on map to show geographic location.
Brady Creek



Well	WellID	Elev	Depth	SWL	ScreenF	ScreenT	CasingD	Dist	Latitude	Longitude
1	29000002683	728	116	23	111	116	111	0	40.40157	-91.882281
2	29000003334	725	135	28	130	135	130	328	40.402058	-91.878491
3	29000003213	722	134	20	128	134	128	1215	40.402868	-91.864289
4	29000003031	715	118	19	103	118	103	1429	40.406195	-91.848108

Example – 20711 Watershed

- **Watershed Status Zone D**



Watershed 20711 SSR Review – Zone D

- Geology Review – No Changes
  - Outwash Sands and Gravel
  - Coarse Textured Till
  - Semi-Confined to Unconfined
  - Well Logs
- Municipal Aquifer Tests Data Reviewed – No Changes
  - Custom Tool Run- No Significant Changes
  - No Valid Storage Info from Tests
  - Highly Variable Aquifer, Distance from Tests
- Reviewed USGS Publications Online Data Search
- Previously Applied Return Flow Credit – No Changes
- Intermittent Stream Investigation
  - DNR Site Visit Inconclusive Due to Time of Year
  - Only Applicable in Eastern Watershed Area
- No Alternative Locations Found
- Zone D – No Changes
  - Additional Information Needed

SSR Remains Zone D – What Now?

- Alternate Location Farther from Affected Stream
- Switch from Surface Water to Well, if Applicable
- Reduce Pumping Frequency
- Reduce Pump Capacity
- Change the Withdrawal Depth
- Request a DNR Review
- Provide Additional Site Specific Data
  - Aquifer Test - Transmissivity, Storage
  - Stream Flow, Stream Bed Conductance
  - Geological Core Data, Grain Size analysis

Other Examples

- Expired Registrations found During Compliance - Registration Review Changed Zone D to Zone C
- Application of a 10% Return Flow Credit Changed SSR Zone D to Zone C

WWAT Zone vs. SSR Zone

○ = WWAT Zone B

□ = WWAT Zone C

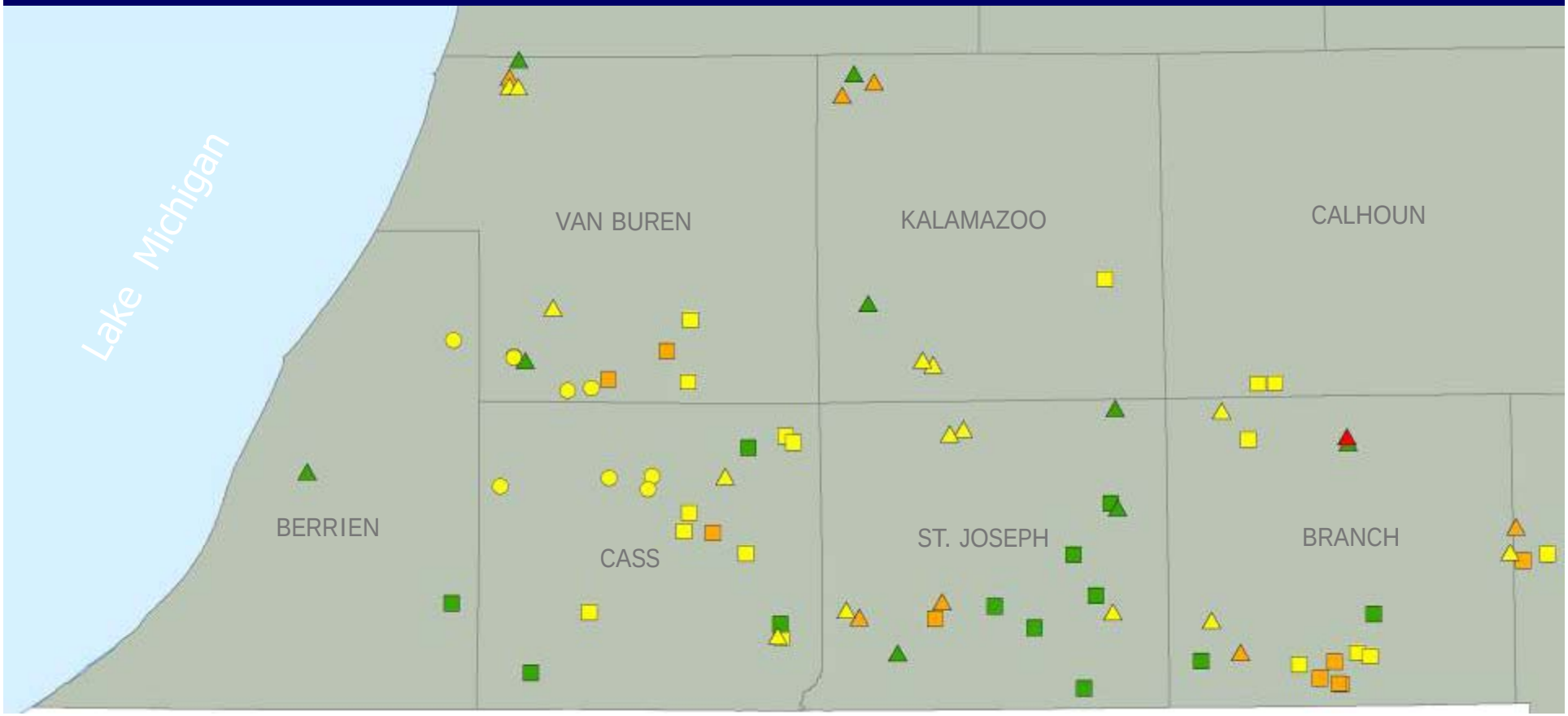
△ = WWAT Zone D

Green = SSR Zone A

Yellow = SSR Zone B

Orange = SSR Zone C

Red = SSR Zone D



Summary

- SSR if WWAT Determination:
  - Zone B in Cold-Transitional River System
  - Zone C or Zone D
- All Available Site Specific Data is Reviewed
  - Geology, Hydrogeology
  - Stream Flow, Index Flow, Watershed Area
  - Stream Classification, Fish Population Info
- A Determination is Made on How Accurately WWAT Data Describes the Watershed
- Custom Tool is Run to Test New Info, Modify Withdrawal, Update the Online WWAT

Summary (continued)

- SSRs Have Resulted in Changes from Zone D to Zone A, B, or C

- Withdrawal Options if Zone D:
  - Alternate Location
  - Well vs Surface Water Source
  - Reduce Pumping Frequency
  - Reduce Pumping Rate
  - Change Withdrawal Depth
  - Provide Additional Data, Pump Test, Stream Flow, Geology, Grain Size Analysis, etc.

QUESTIONS?

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