

APPLICATION CHECKLIST

*Washington Co. SW 1/4 # 16, Permit #
 Newport Pwp. Sawmill Disposal
 # 1*

	Date	Initials
Enter on Agenda	12/21/11	[Signature]
Completeness Review	12/21/11	[Signature]
Date - Time Stamp	12/14/11	[Signature]
Area of Review	12/21/11	[Signature]
Site Evaluation	1/9/12	[Signature]
Permitting Section	12/14/11	[Signature]
Memo to Inspector	12/21/11	[Signature]
Public Notice	12/21/11	[Signature]
Letter	12/21/11	
Date Run	1/3/12	
15 Days	1/18/12	
Review Public Notice	1/10/12	[Signature]
Affidavit of Notification	12/21/11	[Signature]
Objections Received Yes _____ No <u>X</u>	1/29/12	[Signature]
Public Hearing Date	NA	[Signature]
Chief's Order, if Required	NA	[Signature]
Schematic	12/21/11	[Signature]
Plot on Map	12/21/11	[Signature]
Review by Geologist		[Signature]
Permit Conditions (Same date as permit)		[Signature]
Enter on Computer (Same or later date than Chief's Order)		[Signature]
Enter on Master List	12/21/11	[Signature]
EPA Form	12/21/11	[Signature]
Mail Permit		[Signature]
Update Agenda		[Signature]
File		[Signature]

RECORD OF CONVERSATION

Paid by Check on 12/29/11

State of Ohio, County of Washington, SS.

Jennifer Houtman, being duly sworn, says that the attached notice was published in The Marietta Times, a newspaper with average daily circulation in excess of 10,414 printed in and of general circulation in Washington county, Ohio, for one time beginning _____, Division of Land & Resources Management, 3, 2012.

RECEIVED

Jennifer Houtman

 sworn to before me this _____ day of _____, 2012.

Jennifer Houtman
 Notary Public, Washington County, Ohio
 # L19655

Printer's Fee	\$ 106.32
Notary Fee	\$ 2.00
Total Amount	\$ 108.32

00GC Disposal Co.
 PATRICIA S. PERRY, Notary Public
 In and For the State of Ohio
 My Commission Expires 12/29/12

O.O.G.C.
Disposal Company

1-800-846-6642
FAX 740-828-3660

P.O. Box 698
Zanesville, Ohio 43702-0698

RECEIVED

AUG 07 2012

August 4, 2012

Mr. Tom Tomastik, Geologist 4
Division of Oil and Gas Resources Management
2045 Morse Road, F-2
Columbus, Ohio 43229-6693

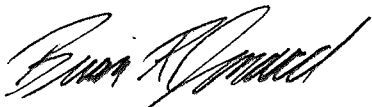
Re: Sawmill Run Disposal Well Application

Dear Mr. Tomastik:

Pursuant to your request regarding the proposed UIC permit for Sawmill Disposal #1, OOGC Disposal will commit to seismic monitoring around the referenced well if after completion, a seismic event occurs near the Sawmill Disposal #1 injection well.

Please let me know if you require additional information regarding the permit for this well.

Respectfully,



Brian R. Jonard

**PROPOSED CLASS II SALTWATER INJECTION WELL APPLICATION NO.
APATT020289 – OOGC DISPOSAL COMPANY**

COUNTY: Washington

TOWNSHIP: Newport

PERMIT NUMBER: New well

LEASE NAME: Sawmill Run Disposal #1

PROPOSED INJECTION ZONE: Clinton-Medina sandstones

PROPOSED TOTAL DEPTH: 7550 feet

TOP OF PRECAMBRIAN ROCKS: approximately 11,700 feet

1. The Precambrian basement faults mapped by the Ohio Division of Geological Survey in 2002 show all faults in Washington County as being “inferred” faults. There are no wells penetrating the Precambrian basement and no additional deep well data in this area since this map was created in 2002.
2. Proposed injection zone is approximately 4150 feet above the top of the Precambrian basement rocks.

**ADDITIONAL REQUIRED NEW UIC CONDITIONS TO THE PERMIT
(PURSUANT TO GOVERNOR’S EXECUTIVE ORDER) ALONG WITH THE
STANDARD SET OF DRILLING, CONSTRUCTION, AND OPERATIONAL
CONDITIONS**

1. Requires continuous monitoring of the injection and annulus pressures.
2. Requires automatic shut-off device on the injection pump set to the maximum allowable surface injection pressure.
3. Shall run a minimum geophysical logging suite that includes: a gamma ray, compensated density-neutron and resistivity log.
4. Shall use Class A cement with bow-string or rigid centralizers to provide sufficient casing stand off and foster effective circulation of cement to isolate critical zones including aquifers, flow zones, voids, lost circulation zones, and hydrocarbon production zones.
5. OOGC Disposal Company may commit to a seismic monitoring plan in the event of seismic activity occurring within the immediate vicinity of the Sawmill Run Disposal #1 saltwater injection well.
6. Conduct a pressure-fall off test to determine injection flow and record original pressures.

Tomastik, Tom

From: Brian Jonard [bjonard@ohiooil.com]
Sent: Monday, July 30, 2012 7:34 AM
To: Tomastik, Tom
Subject: RE: Sawmill Disposal #1I injection application in Washington County
Tom,

Did we respond? If not, I will send response this week. I hope all is well.

Thanks,
Brian

From: Tomastik, Tom [mailto:Tom.Tomastik@dnr.state.oh.us]
Sent: Monday, July 23, 2012 9:33 AM
To: Brian Jonard
Cc: Simmers, Rick; Worstall, Robert
Subject: Sawmill Disposal #1I injection application in Washington County

Brian:

We will be starting on moving forward with the injection applications starting later next week. Would you be willing to submit a letter to me for the proposed Sawmill injection well application in Washington County to commit to do seismic monitoring if a seismic event happens near the Sawmill Disposal #1 injection well? It will help in moving your application forward for permit issuance. Green Hunter has already done it for their Washington County application. Please let me know. If you can commit to such a letter, please send it to my attention.

Tom Tomastik, Geologist 4
Division of Oil and Gas Resources Management
2045 Morse Road, F-2
Columbus, Ohio 43229-6693
(614) 265-1032

8/6/2012



Ohio Department of Natural Resources
 Division of Mineral Resources Management
 2045 Morse Rd. Bldg. H-3 – Columbus OH 43229-6693



Pre-Construction Permit Conditions

Application Number _____	Permit Number _____	Inspection Date <u>1/9/2012</u>	Modification Date (if applicable) _____
Company <u>Ohio Oil Gathering Disposal Company</u>	Lease Name/Well # <u>Sawmill Disposal Well #1)</u>		
County <u>Washington</u>	Township <u>Newport</u>		
Section/Lot <u>29</u>	Urban Area (if applicable) _____		
Inspected By <u>C VanDyke</u>			
Accompanied By <u>Bruce Phipps</u>			

Directions to Location 3/4 mile north of Newport on St. Rt. 7, turn left onto Cty Rd. 25 - access road is on right about 1/2 mile from highway. Current access road will be one used to get to well.

ITEM	<u>LEASE ROAD, WELL SITE CONSTRUCTION</u>	<u>Comments:</u>
1	Tree/Brush Removal/Disposition	Brush will be removed, stockpiled and disposed of properly
2	Topsoil Removal/Stockpiles/Placement	Property was part of old saw mill and mostly just weeds for ground cover.
3	Erosion/Sediment Control (Silt Fence, Berms)	yes
4	Drainage Controls (Diversion Ditches, Culverts, Waterways, Crossings)	Silt fences as needed
5	Signage	No culverts or crossings
6	Apron/Culverts/Road Materials	as required
7	Pull Off Area	gravel
8	Parking	n/a
9	GPS – Access Road	n/a
10	GPS – Well Stake	N39.40567, W81.22343
11	GPS – Tank Battery	N39.40721, W81.22327
12	GPS – Pit Location	unknown
13	Site Construction Plan	unknown
		as proposed

ITEM	<u>DRILLING CONSIDERATIONS</u>	<u>Comments:</u>
14	Location Dimensions (Length, Width, Approximate Acreage)	n/a
15	Multiple Wells	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
16	Rig Type	rotary
17	Is a blow-out preventer required?	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
	If No, explain:	unknown
18	Equipment Placement/Orientation (Rig/Frac Tanks/Etc.)	

19	Mine Voids	Yes	<input checked="" type="checkbox"/>	No	
20	Verify Water Wells Within 300'	none			
21	Verify Structures Within 500'	Pole barn used to store equipment within 500'			
22	Verify Streams and Drainage	none			
23	Flood Plain	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
24	Stream Crossing	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
	Corps of Engineers Notified	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
25	Wetlands	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No
	EPA Notified	<input type="checkbox"/>	Yes	<input checked="" type="checkbox"/>	No

ITEM	PITS	Comments:
26	Source of water for drilling	River or streams nearby
27	Source of water for hydrofrac	River or streams
28	Drilling Pits (Placement/Orientation)	unknown
29	Pit Dimensions (Length, Width, Depth)	unknown
30	Estimated Volume/Capacity	unknown
31	Number & Type of Liners	unknown
32	Thickness of Liner	unknown
33	Type of Material Under Liner	unknown
34	Pit Construction Plan	unknown
35	Fencing (Pits/Entire Location)	unknown

ITEM	RESTORATION	Comments:
36	Pit Closure – (Standard/Solidification/Off-Site Disposal – state time frame)	yes, as required
37	Site-Specific Time Frame for Restoration	6 mos
38	Erosion/Sediment Control	as needed
39	Drainage Control	as needed

ITEM	PRODUCTION	Comments:
40	Is the Access Road Gate required? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
	If No, explain:	

ITEM	WAIVERS	Comments:
41	Is the Company required to submit a waiver? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	
	If yes, submit the following waiver requests:	

Is the Company required to submit revised drawings? Yes No

THE FOLLOWING ITEMS HAVE BEEN CHANGED FROM THE ORIGINAL APPLICATION:

There is a large mound of saw dust near the location of the well. Poses no danger, no hazards or additional requirements. Water will be pumped to well, as with other disposal wells in the area, owned by OOG. Pipelines will have to be laid and buried...

**PROPOSED CLASS II SALTWATER INJECTION WELL APPLICATION NO.
APATT020289 – OOGC Disposal Company**

COUNTY: Washington

TOWNSHIP: Newport

PERMIT NUMBER: New well

LEASE NAME: Sawmill Run Disposal #1

PROPOSED INJECTION ZONE: Clinton – Medina sandstones

PROPOSED TOTAL DEPTH: 7550 feet

TOP OF PRECAMBRIAN DEPTH: (approximately) 11,700 FEET

1. Review of existing geologic data for known faults – **No known faults or seismic activity within a 2-1/2 mile radius of the proposed injection well location. There will be a requirement to do a geologic evaluation of the Clinton-Medina sandstones** ~~to be submitted with the logs, down hole pressure readings and~~ evaluated by the Division of Oil and Gas Resources Management and Division of Geological Survey prior to approval of injection.
2. Complete suite of geophysical logs – **A gamma ray, compensated density – neutron and resistivity geophysical logging suite will be required.**
3. Evaluation for potential requirement of a seismic survey – **The proposed injection zone is at least 4150 feet above the top of the Precambrian rocks, therefore there is no potential communication with the Precambrian rocks or a need to conduct a seismic survey.**
4. Well penetrating the Precambrian or plug back from Precambrian – **This proposed injection well is at least 4150 feet above the Precambrian rocks, therefore there will be no penetration into the Precambrian rocks.**
5. Measurement or calculation of original downhole reservoir pressure – **Since this is a moderate depth proposed injection well; there is no reason to collect original bottomhole pressures. A number of Clinton-Medina oil and gas wells have been drilled in Washington County, so pressure data is available.**
6. Conducting a pressure fall-off test or step-rate test – **Since the well does not penetrate into the deep geologic reservoirs, there is no need to perform these tests. Maximum allowable injection pressure will be set by the formula within the Ohio Administrative Code. Would it be better to say that in that this is a conversion of a production well already hydraulically fractured to an injection well, therefore these tests are not applicable.**
7. Continuous pressure monitoring of the annulus and injection pressures **This condition will be required. and has been required on all injection well application since October of 2011.**

8. Installation of an automatic shut-off switch on the injection pump set to the maximum allowable surface injection pressure - **This condition will be required. and has been required on all injection well application since October of 2011.**



Ohio Department of Natural Resources

JOHN R. KASICH, GOVERNOR

JAMES ZEHRINGER, DIRECTOR

Division of Oil and Gas Resources Management

Richard J. Simmers, Chief

2045 Morse Road, Bldg. H-2

Columbus, OH 43229-6693

Phone: (614) 265-6633 Fax: (614) 265-7998

December 21, 2011

Mr. Mike McKee
OOGC Disposal Company
P.O. Box 430
Frazeyburg, Ohio 43822

RE: Public Notification for SWIW application for Washington County, Newport Twp., New well, OOGC Disposal Company, Sawmill Run Disposal #1 injection well

Dear Mr. McKee:

As outlined in Rule 1501: 9-3-06 (E) (1) of the Ohio Administrative Code, please consider this letter as notification from the Division for you to proceed with the public notice. Enclosed, please find a copy of the notice you will need to have run in the newspaper of general circulation in the area of the proposed injection well. **The public notice must be run for only one day. After running this notice in the newspaper, please send me the original proof-of-publication from the newspaper as soon as possible.**

If you have any questions regarding this matter, please feel free to contact me at (614) 265-1032.

Sincerely,

A handwritten signature in black ink, appearing to read "Tom Tomastik".

Tom Tomastik, Geologist

UIC Section

Division of Oil and Gas Resources Management

2045 Morse Road, H-3

Columbus, Ohio 43229-6693

Cc: File

PUBLIC NOTICE

OOGC Disposal Company, P.O. Box 430, Frazeyburg, Ohio, 43822, (740) 828-2891 is applying to permit a well for the injection of brine water produced in association with oil and natural gas. The location of the proposed injection well is the Sawmill Run Disposal #1 well, new well, Section 29(E), Newport Township, Washington County, Ohio. The proposed well will inject into Clinton and Medina sandstones at a depth of 7207 to 7397 feet. The average injection is estimated to be 200 barrels per day. The maximum injection pressure is estimated to be 1970 psi. Further information can be obtained by contacting OOGC Disposal Company or the Division of Oil and Gas Resources Management. The address of the Division is: Ohio Department of Natural Resources, Division of Oil and Gas Resources Management, 2045 Morse Road, Building H-3, Columbus, Ohio 43229-6693, (614) 265-6633. For full consideration, all comments and objections must be received by the Division, in writing, within fifteen calendar days of the date of this published legal notice.

Proof Sheet

APPL NUMBER	aPATT020289		URBANIZED AREA ? <input type="checkbox"/>
OWNER NUMBER	2153	NAME	
OWNER NAME	OHIO OIL GATHERING CORP <i>OOGC Disposal Co.</i>		
EXISTING WELL	0		
API PERMIT NO		DISPOSAL PLAN 1	ND
APPL TYPE	NW	DISPOSAL PLAN 2	
TYPE OF WELL	SWD	DISPOSAL PLAN 3	
VARIANCE REQUEST		DISPOSAL PLAN 4	
WELL NAME	SAWMILL RUN DISPOSAL	DISPOSAL PLAN 5	
WELL NUMBER	1	MP Check #	0
PREV/PROPOSED TD	7550		
DRILL UNIT ACRES	0		
TYPE OF TOOL	RTAF	PROPOSED FORMATIONS	
WELL CLASS		CLINTON-MEDINA	
FIRE PHONE	(740) 473-1506		
MEDICAL PHONE	(740) 373-2833		
COUNTY CODE	167		
COUNTY NAME	WASHINGTON		
COAL (Y=-1/N=0)	-1		
CIVIL TOWNSHIP	NEWPORT	TARG CIVIL TWP	
SURF QUAD	RAVEN ROCK	TARG QUAD	
Nad 27 SURF ORIG X	2,360,763	Nad 27 TARG ORIG X	
Nad 27 SURF ORIG Y	515,069	Nad 27 TARG ORIG Y	
GROUND ELEVATION	639	TARG ELEV	0
SURF SEC	29	TARG SECTION	
SURF LOT		TARG LOT	
SURF QTR TWP		TARG QTR TWP	
SURF ALLOT		TARG ALLOT	
SURF TRACT		TARG TRACT	
SURF FRACTION		TARG FRACTION	

Geologic Review for Class II Wells

Application No. aPATT020289

SWIW (Salt Water Injection Well)

Proposed Well Depth: 7,550 ft

Proposed Injection Zone: Clinton-Medina

Washington County, Newport Twp.

Study area investigated ~ 15 mile radius centered on the proposed well location for all maps except the gravity and magnetic maps, which used 30 mile radius.

Gravity Bouguer Anomaly

- Nothing of note.

Gravity Free Air

- Nothing of note.

Magnetic First Derivative

- There is a northeast-southwest trend located about 8 miles to the northwest of the permit application.

Magnetic Second Derivative

- There is a northeast-southwest trend located about 8 miles to the northwest of the permit application.

Magnetic Reduce Dipole

- There is a northeast-southwest trend located about 8 miles to the northwest of the permit application.

Precambrian Structure from PG-23

- The northwest-southeast trending Cambridge CSSD is present approximately 13 miles northwest of the permit application.
- An unnamed east-west trending fault that terminates against the Cambridge CSSD is approximately 6 miles from the permit application.
- An unnamed north-south trending fault that is a northern extension of the Burning Springs feature underlies the permit application.
- A northeast-southwest trending fault (western bounding fault of the Rome Trough) is ½ mile east of the permit application.

Knox Structure

- The northwest-southeast trending Cambridge CSSD is present approximately 13 miles northwest of the permit application.
- An unnamed east-west trending fault that terminates against the Cambridge CSSD approximately 6 miles from the permit application.
- An unnamed north-south trending fault that is a northern extension of the Burning Springs feature underlies the permit application.

Trenton Structure

- The northwest-southeast trending Cambridge CSSD is present approximately 13 miles northwest of the permit application.
- An unnamed east-west trending fault that terminates against the Cambridge CSSD approximately 6 miles from the permit application.
- An unnamed north-south trending fault that is a northern extension of the Burning Springs feature underlies the permit application.

EGSP Onondaga Structure

- The northwest-southeast trending Cambridge CSSD is present approximately 13 miles northwest of the permit application.

MRCSP Onondaga Structure

- The northwest-southeast trending Cambridge CSSD is present approximately 13 miles northwest of the permit application.

EGSP Berea Structure

- The northwest-southeast trending Cambridge CSSD is present approximately 13 miles northwest of the permit application.

Mississippian/Pennsylvanian Unconformity Surface

- The Mississippian-Pennsylvanian unconformity surface indicates a structure parallel to the Cambridge CSSD.

Middle Kittanning Coal Structure

- The Middle Kittanning coal structure indicates a structure parallel to the Cambridge CSSD.

Pittsburgh Coal Structure

- The Pittsburgh coal structure indicates a structure parallel to the Cambridge CSSD.

Bedrock Geology

- The top of bedrock for the permit application is the Upper Pennsylvanian Conemaugh group.

Bedrock Topography

- The bedrock topography map indicates a topographic high to the east-northeast adjacent to the permit application.

EGSP Aerial Photo Lineament

- Numerous lineaments generally less than 1 mile in length have been interpreted from aerial photos by Gray and others (1982) over and in the immediate vicinity of the permit application with 2 dominant directions oriented northwest-southeast and northeast-southwest.

EGSP LANDSAT Lineament

- A north-south lineament is present about 1 mile to the north northeast. This lineament map also shows a much larger (approximately 9 miles) northeast-southwest trending lineament approximately 4 miles to the northwest trending northeast-southwest.

Mason Lineament

- A lineament approximately 13 miles to the west-northwest of the permit application coincides with the Cambridge CSSD on the structure maps. Another north-south lineament is present approximately 10 miles away.

Oil and gas fields

- Production in the study area is in the Pennsylvanian, Berea, Devonian Shale, and Clinton. The nearest “Clinton” producing field is approximately 12 miles to the northwest.

Earthquakes

- There have been 4 earthquake epicenters that have occurred within the 30 mile study area, the nearest being about 2 miles and the furthest about 14 miles away. All four of these earthquake epicenters have occurred since 2010. The three closest epicenters are all within 7 miles and were 2.8, 3.0, and 2.6 in magnitude. The most distant fourth epicenter was 3.1 in magnitude.

Injection Wells

- There are 5 SWD (active salt water disposal) wells within the 30 mile study area that are injecting in the “Clinton” sandstone. The nearest injection well is a SWD well approximately 2 miles to the west-northwest of the permit application.

To summarize, this well is of concern because of 2 intersecting fault systems on the Precambrian structure in close proximity to the permit application. The permit application overlies the unnamed north-south trending fault that is a northern extension of the Burning Springs feature, and is approximately ½ mile north and east of the northwest-southeast trending fault that is the western bounding fault of the Rome Trough. The north-south trending unnamed fault that underlies the permit application is also shown on the Knox and Trenton structure maps. Four earthquakes have occurred within the study area since 2010, two of which are within a 3 mile radius. There are currently 5 SWD wells injecting in the “Clinton” sandstone in the study area. The oil and gas fields map indicates the nearest “Clinton” producing field is approximately 12 miles to the northwest. It is uncertain if the

“Clinton” and deeper formations in this area possess sufficient porosity and permeability to accommodate additional injection wells.

aPATT020289

Class II Injection Well Permit Review Package

- Overview
- Basic Permit Review
 - Bedrock Topography Layer
 - Water Well Layer
 - Underground Coal Mine Layer
 - Surface Water Layer
 - Surface Topography layer
 - Quaternary Geology Layer
 - Oil and gas Layer
 - Groundwater-Source Water Protection Layer
 - Groundwater-Pollution Potential Layer
 - Coal Layer
- Extended Class II Injection Permit Review
 - Bedrock Topography
 - Bedrock Geology
 - EGSP Arial Photo Lineament
 - EGSP LANDSAT Lineament
 - Mason Lineament
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 - Knox Structure
 - Precambrian Structure from PG-23
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- Disclaimer
- References

006C

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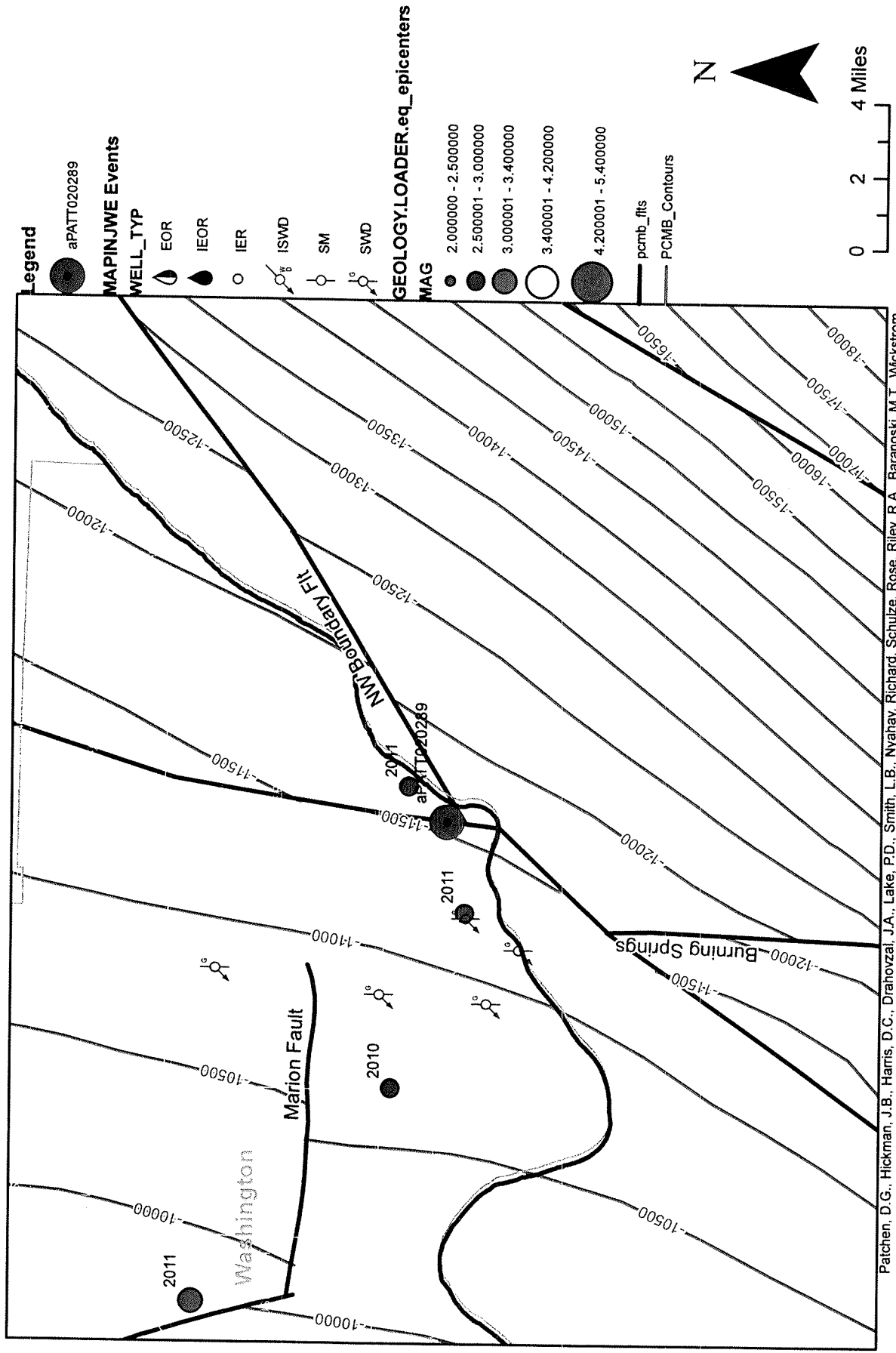
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Precambrian Structure Contours (C.I. = 500 feet)



Patchen, D.G., Hickman, J.B., Harris, D.C., Drahovzal, J.A., Lake, P.D., Smith, L.B., Nyahay, Richard, Schulte, Rose, Riley, R.A., Baranoski, M.T., Wickstrom, L.H., Laughrey, C.D., Kostelnik, Jaime, Harper, J.A., Avary, K.L., Bocan, John, Hohn, M.E., and McDowell, Ronald, 2006

aPatt 020289

Fault and Lineament Review for Class II Wells

Application No. aPATT020289

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Proposed Well Depth: 7,550 ft

Proposed Injection Zone: Clinton-Medina

Faults and lineaments were reviewed in a 30 mile study area for the permit application. Gravity and magnetic maps were examined in a 60 mile study area for possible deep-seated Precambrian faults. The presence of mapped subsurface faults were examined from published studies and include the following structure maps in ascending stratigraphic order: top of Precambrian, top of Knox unconformity, top of Trenton Limestone, top of Onondaga Limestone, top of Berea Sandstone, Mississippian-Pennsylvanian unconformity, top of Middle Kittanning coal, top of Upper Freeport coal, and top of Pittsburgh coal. Bedrock topography, bedrock geology maps and published studies using surface topography were examined for lineaments that may reflect possible subsurface faulting. Published studies of interpreted surface lineaments also were included that were based on LANDSAT and aerial photos. All active and inactive class II wells and all known earthquake epicenters are shown within the study area on all maps.

The top of bedrock for the permit application is the Upper Pennsylvanian Conemaugh Group. The bedrock topography map indicates a topographic high directly south adjacent to the permit application.

A network of surface lineaments is interpreted within the 30 mile study area. Based on Mason (1999) one of these north-northeast trending lineaments, approximately 10 miles to the west-northwest of the permit application, coincides with the Cambridge CSSD (Cross-Strike Structural Discontinuity) on the structure maps. Numerous lineaments generally less than 1 mile in length have been interpreted from aerial photos by Gray and others (1982) over and in the immediate vicinity of the permit application. There are 2 dominant directions which are oriented northwest-southeast and northeast-southwest. The LANDSAT lineament map of Gray and others (1982) indicates a north-south lineament directly adjacent to the north. This lineament map also shows a much larger (approximately 9 miles) northeast-southwest trending lineament approximately 4 miles to the northwest trending northeast-southwest.

The gravity Bouguer Anomaly and Free Air maps do not show any major trends in this region. However the magnetic maps do show some regional trends, the most dominant of which is a northeast-southwest trend located about 8 miles to the northwest of the permit application. This trend can be seen on the first derivative, second derivative, and reduce dipole maps.

The Precambrian structure map indicates the following fault systems in the study area: the northwest-southeast trending Cambridge CSSD, an unnamed east-west trending fault that terminates against the Cambridge CSSD, an unnamed north-south trending fault that is a northern extension of the Burning Springs feature, and a northeast-southwest trending fault that is thought to be the western bounding fault of the Rome Trough. Approximately ½ mile south of the application well, the unnamed north-south fault intersects the bounding fault of the Rome Trough. The unnamed north-south fault is also recognized on structure maps on the top of Knox unconformity and top of Trenton. The

Mississippian-Pennsylvanian unconformity surface, the Pittsburgh Coal, and the Middle Kittanning coal structure indicate a structure parallel to the Cambridge CSSD.

Based on the RBDMS database, there are 5 SWD (active salt water disposal) wells within the 30 mile study area that are injecting in the "Clinton" sandstone. The nearest injection well is a SWD well approximately 2 miles to the west of the permit application. There have been 4 earthquake epicenters that have occurred within the 30 mile study area, the nearest being about 1 ½ miles and the furthest about 15 miles away. All four of these earthquake epicenters have occurred since 2010. The three closest epicenters are all within 8 miles and were 2.8, 3.0, and 2.6 in magnitude. The most distant fourth epicenter was 3.1 in magnitude.

To summarize, there are 2 intersecting fault systems evident on the Precambrian structure in close proximity to the permit application. The permit application overlies the north-south trending fault, and is approximately ½ mile north of the northwest-southeast trending fault. The north-south trending unnamed fault is also shown on the Knox and Trenton structure maps. Four earthquakes have occurred within the study area since 2010, three of which are within an 8 mile radius. There are currently 5 SWD wells injecting in the "Clinton" sandstone in the study area. The oil and gas fields map indicates the nearest "Clinton" producing field is approximately 12 miles to the northwest.

Disclaimer

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References

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- Ohio Division of Geological Survey, 2003, Structure map of the Lower Kittanning coal, unpublished digital (GIS) map.
- Ohio Division of Geological Survey, 2003, Structure map of the Middle Kittanning coal, unpublished digital (GIS) map.
- Ohio Division of Geological Survey, 2003, Structure map of the Mississippian-Pennsylvanian unconformity, unpublished digital (GIS) map.
- Ohio Division of Geological Survey, 2003, Structure map of the Pittsburgh coal, unpublished digital (GIS) map.

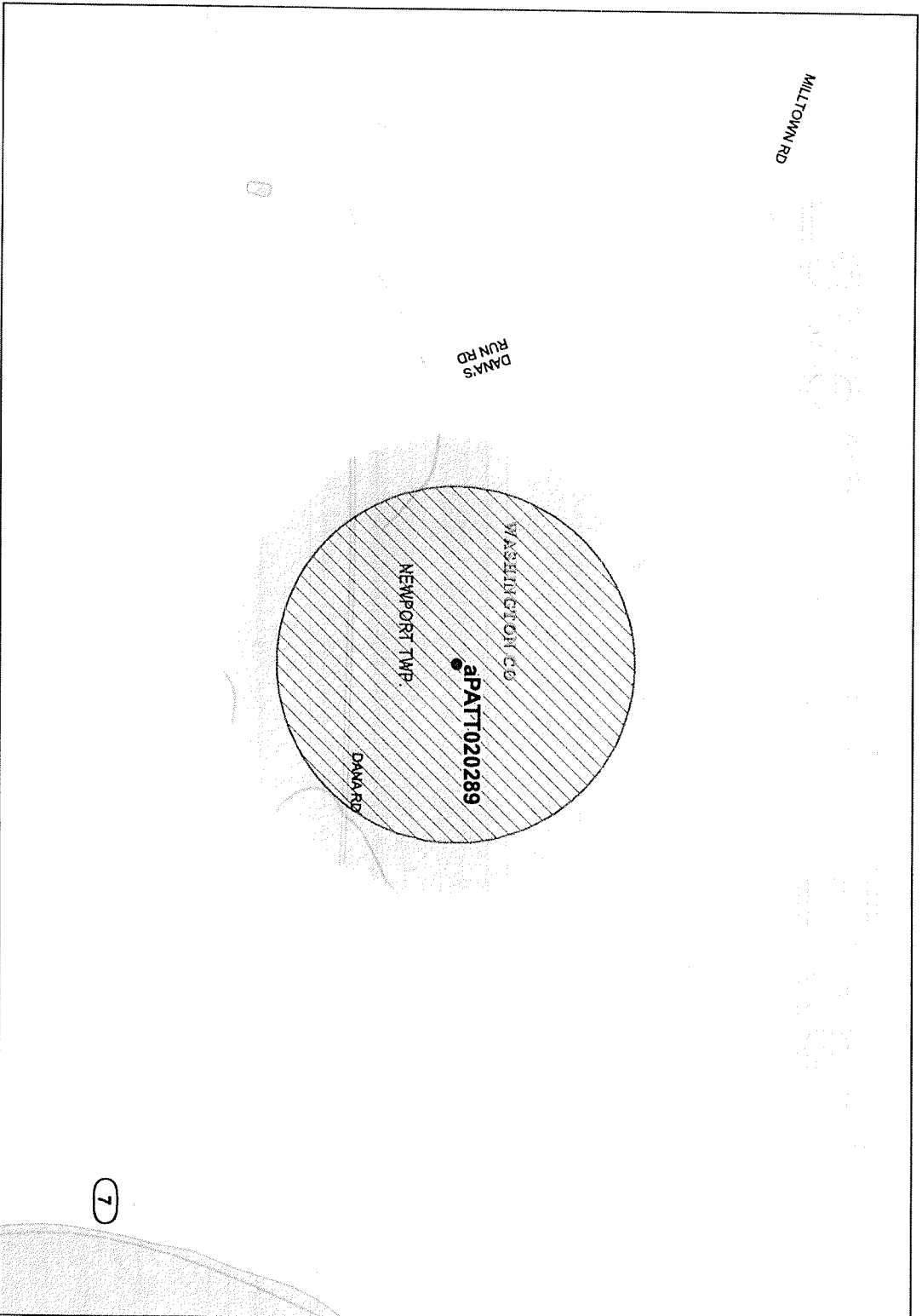
Ohio Division of Geological Survey, 2003, Structure map of the Upper Freeport coal, unpublished digital (GIS) map.

Patchen, D.G., Hickman, J.B., Harris, D.C., Drahovzal, J.A., Lake, P.D., Smith, L.B., Nyahay, Richard, Schulze, Rose, Riley, R.A., Baranoski, M.T., Wickstrom, L.H., Laughrey, C.D., Kostelnik, Jaime, Harper, J.A., Avary, K.L., Bocan, John, Hohn, M.E., and McDowell, Ronald, 2006, A Geologic Play Book for Trenton-Black River Appalachian Basin Exploration: Final report prepared for U.S. Department of Energy, contract no. DE-FC26-03NT41856, 601 p.

Slucher, E. R., compiler, Swinford, E. M., Larsen, G. E., Schumacher, G. A., Shrake, D. L., Rice, C. L., Caudill, M. R., and Rea, R. G., 2006, Bedrock geologic map of Ohio: Ohio Division of Geological Survey Map BG-1, scale 1:500,000.

Water Well Layer

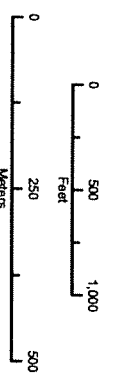
Well APPNO - aPATT020289



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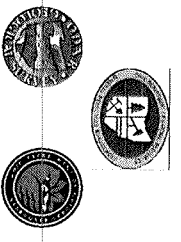
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- State Route
- U.S. Highway
- Interstate
- Hydrography Line
- Hydrography Polygon
- Hydrography Polygon
- Hydrography Polygon
- City
- Township
- County

Overview



Data Source: Water Well Layer, Division of Soil and Water Resources (DSWR)

Date Created: 12/16/2011

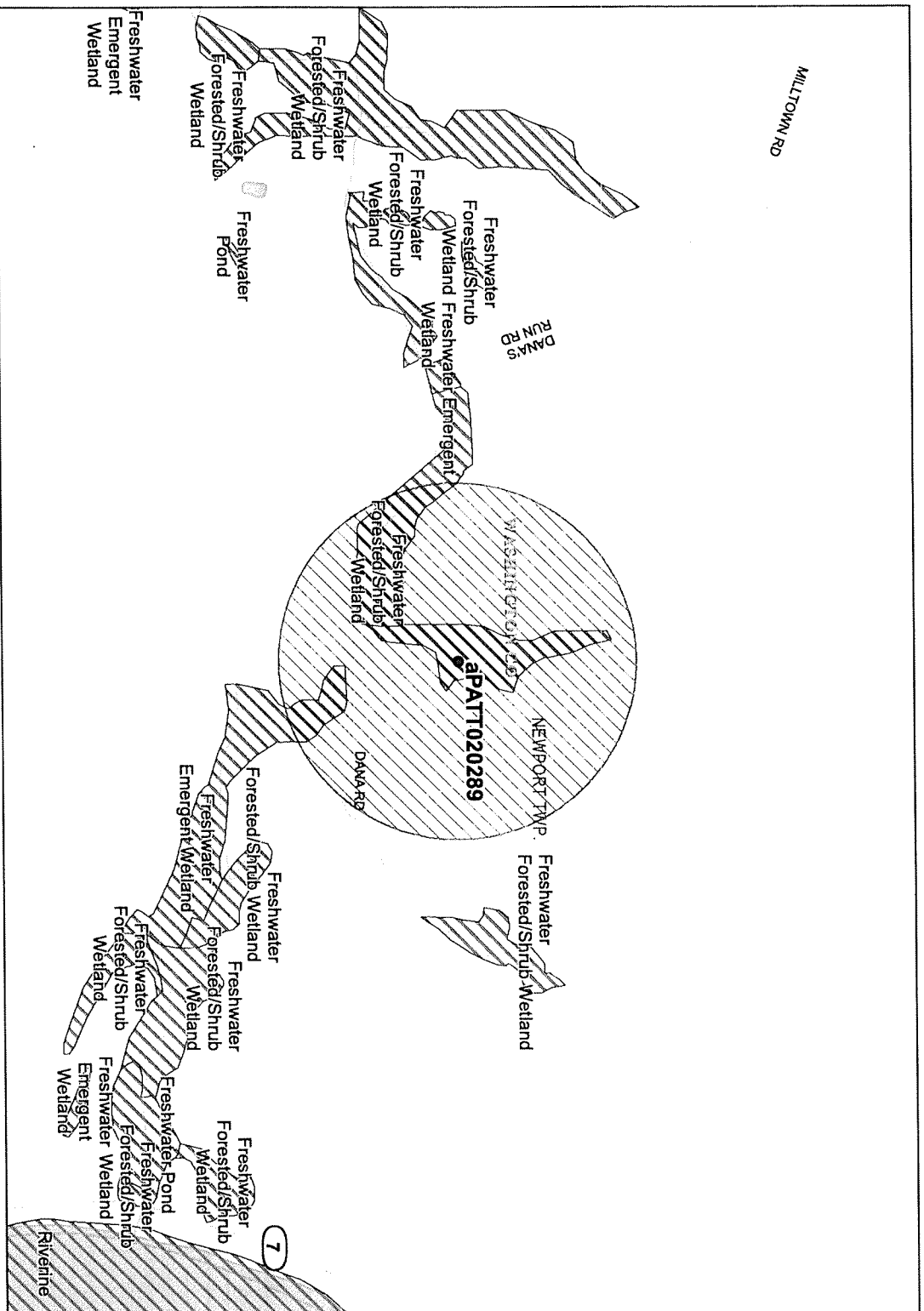


Well Symbols

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- Well Symbol 3
- Well Symbol 4
- Well Symbol 5
- Well Symbol 6
- Well Symbol 7
- Well Symbol 8
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- Well Symbol 100

Surface Water Layers

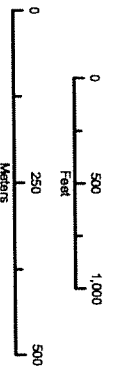
Well APPNO - aPATT020289



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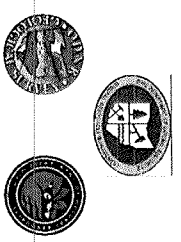
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- State Route
- U.S. Highway
- Interstate
- Hydrography Line
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- Hydrography Polygon Identifier
- City
- Township
- County

Overview



Data Sources: Surface Water Layers, Federal Emergency Management Agency (FEMA), and Division of Watercraft (DWC)

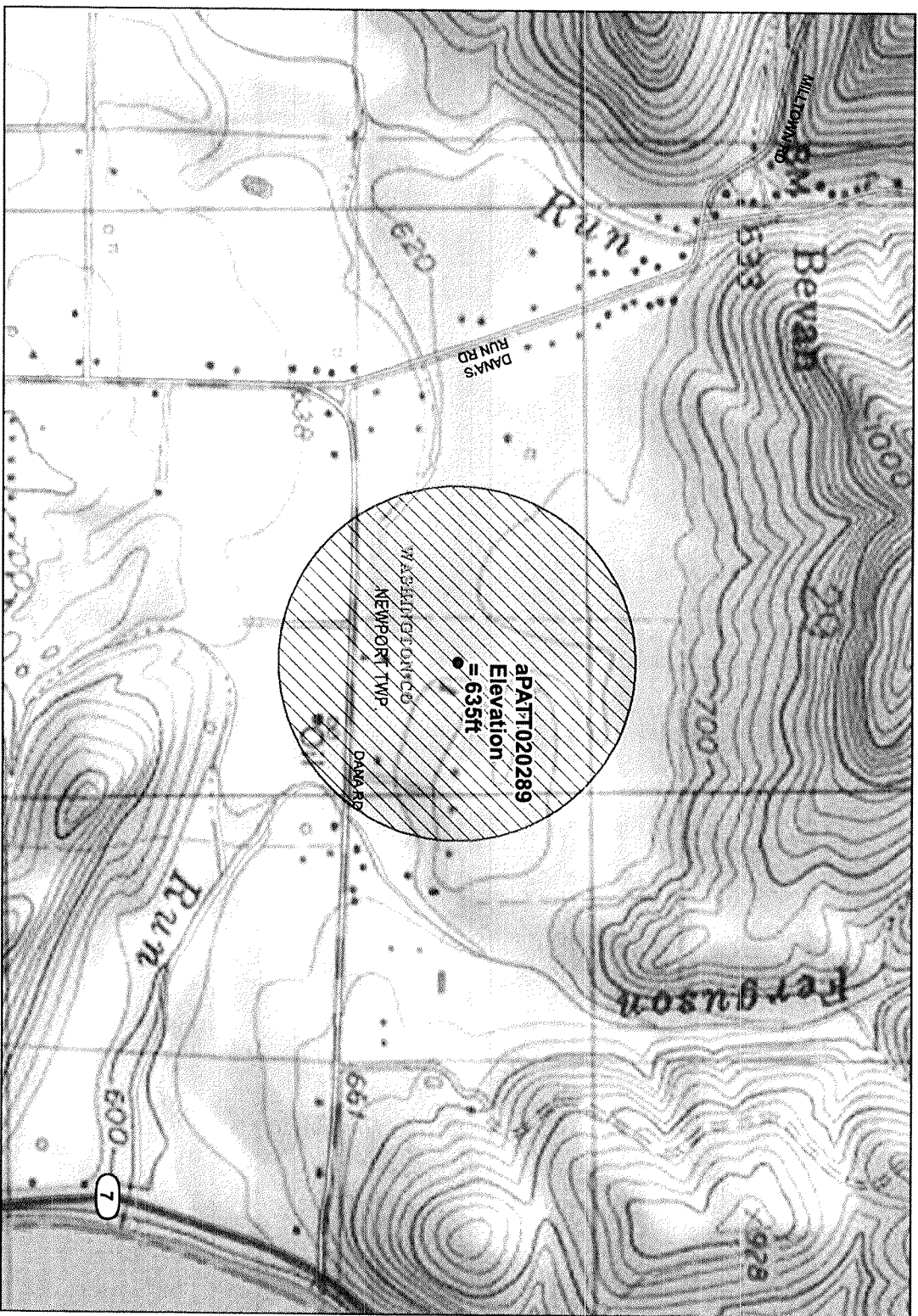
Date Created: 12/16/2011



- Well Point Mark
- Obstruction Line
- Well Median Type
- DIP
- Check Above Ground
- Check Below Ground
- Not Check Above Ground
- Check Status
- National Wetland Inventory (NWI)
- Proprietary
- Hour Meter Zone (Unknown)

Surface Topography Layers

Well APPNO - aPATT020289

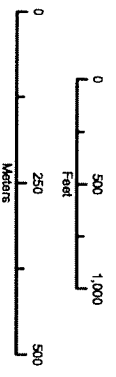


- Basemaps**
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 - Local Road
 - State Route
 - US Highway
 - Hydrography Line
 - Hydrography Polygon
 - Hydrography Point
 - City
 - Township
 - County

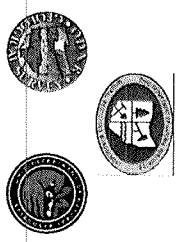


Overview

Data Source: Surface Topography Layers, Division of Geological Survey (DGS) and Environmental Science Research Institute (ERSI)



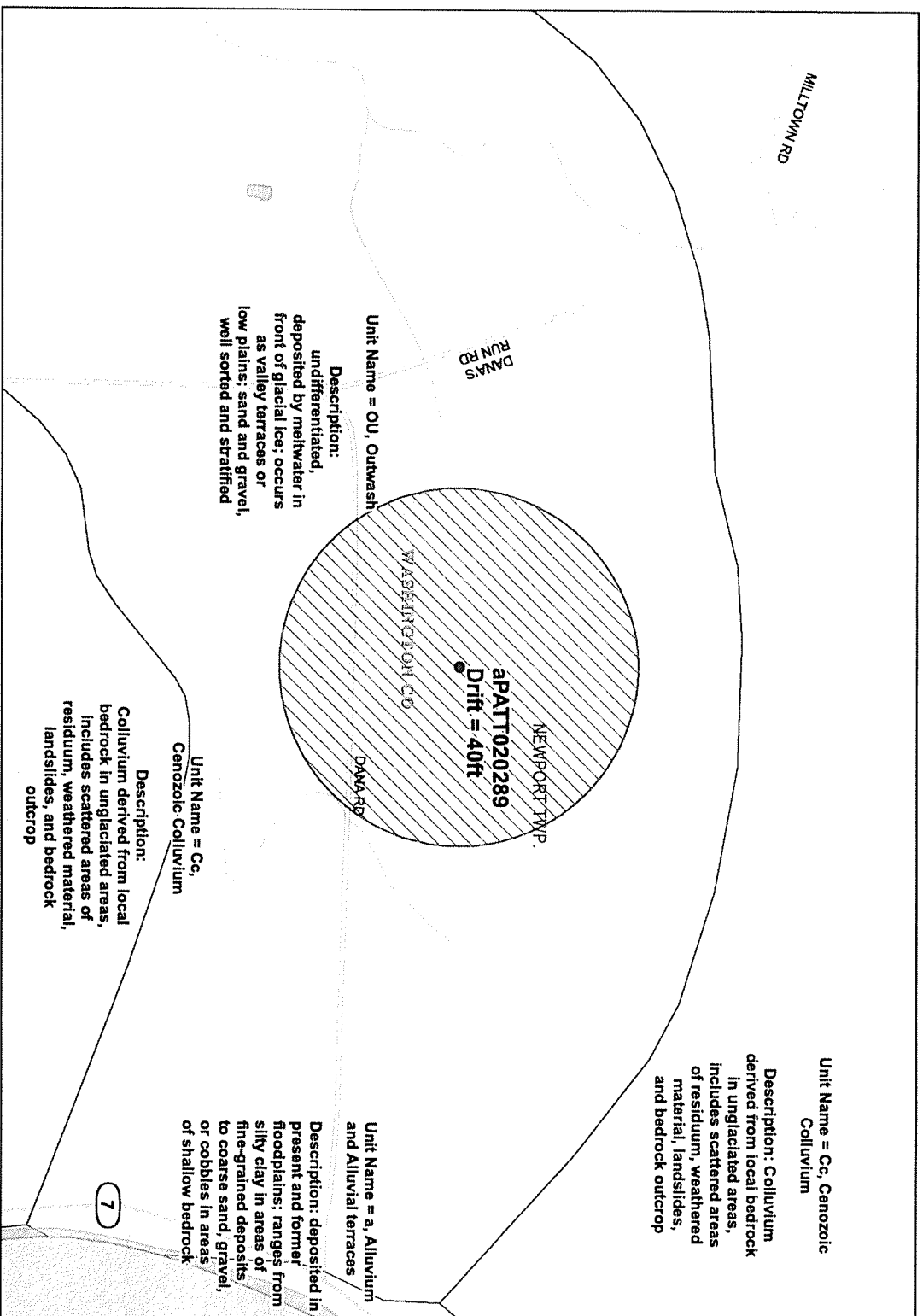
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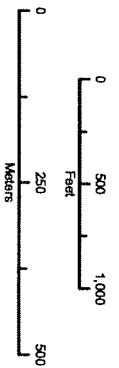
- Well Point Well
- Well Head Type
- Well Status
- Well Depth
- Well Diameter

Quaternary Geology Layers

Well APPNO - aPATT020289



- Basemaps**
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 - Local Road
 - State Route
 - U.S. Highway
 - Interstate
 - Township
 - County
 - City
 - Hydrography Line
 - Hydrography Polygon
 - Hydrography Polygon Intersect



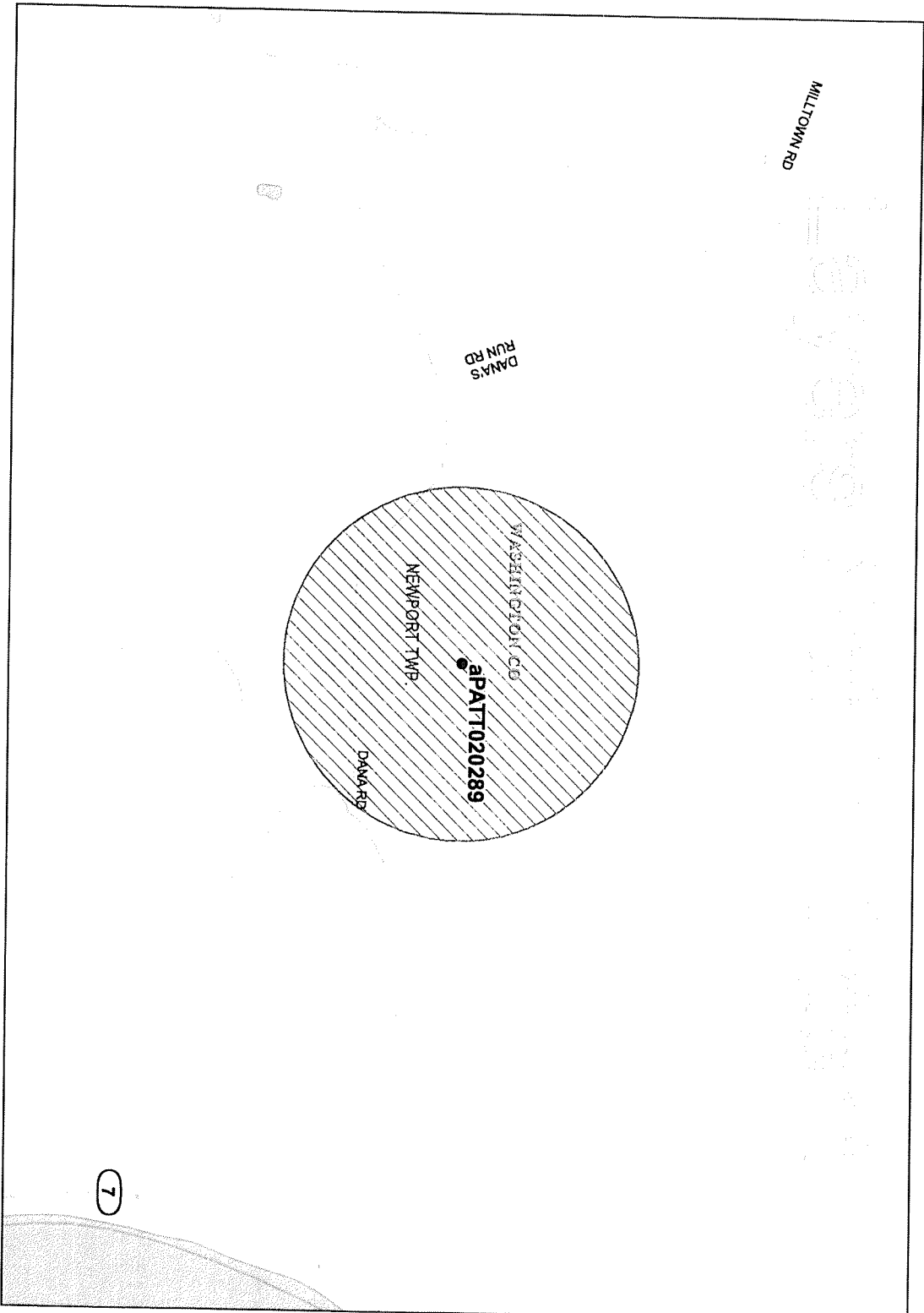
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- On Data Point Value
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- DR
- On Decision Bound
- On Data Point Bound
- Not On Decision Bound

Groundwater - Source Water Protection Area Layers

Well APPNO - aPATT020289



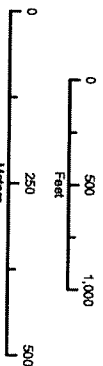
Basemaps

- Railroad
- Local Road
- State Route
- U.S. Highway
- Interstate
- Hydrography Line
- Hydrography Polygon
- International City
- Township
- County

Overview



Data Source: Groundwater - Source Water Protection Areas Layers, Ohio Environmental Protection Agency (OEPA)



Date Created: 12/16/2011



- Well Point Well
- Well (Shaded) Well
- Well (Outline) Well
- Well (Dashed) Well
- Well (Dotted) Well
- Well (Dashed) Well
- Well (Dotted) Well
- Well (Dotted) Well
- Well (Dotted) Well
- Well (Dotted) Well

Well Feature Type

Well Feature Type

Well Feature Type

Well Feature Type

Well Feature Type

Well Feature Type

Well Feature Type

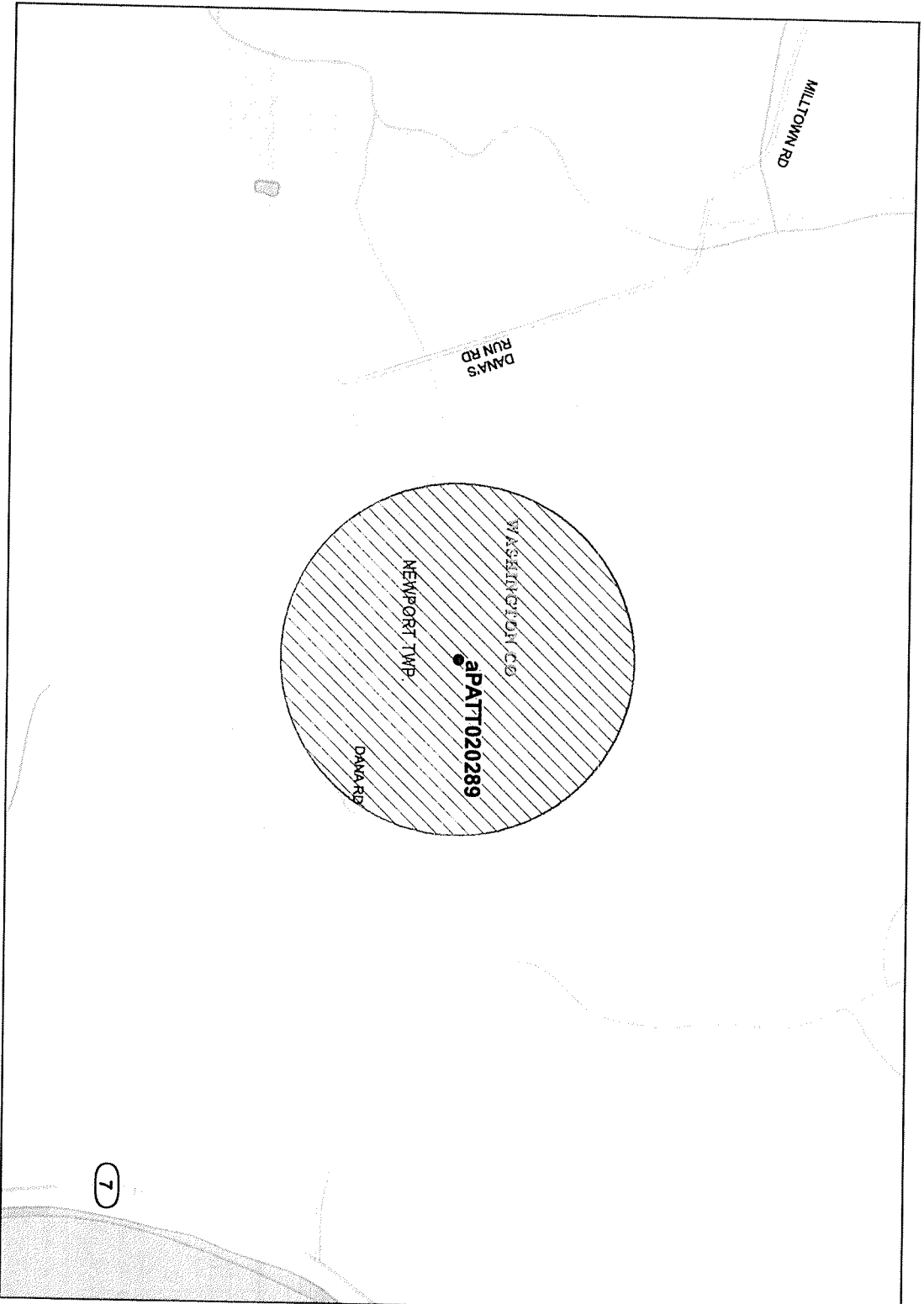
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Well Feature Type

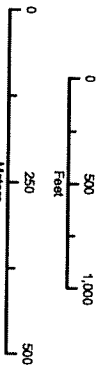
Well Feature Type

Groundwater - Pollution Potential Layers

Well APPNO - aPATT020289

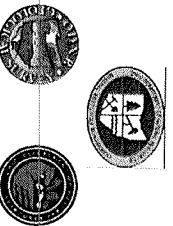


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 - U.S. Highway
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 - Intermittent
 - City
 - Township
 - County



Data Source: Groundwater - Pollution Potential Layers, Division of Geological Survey (DGS)

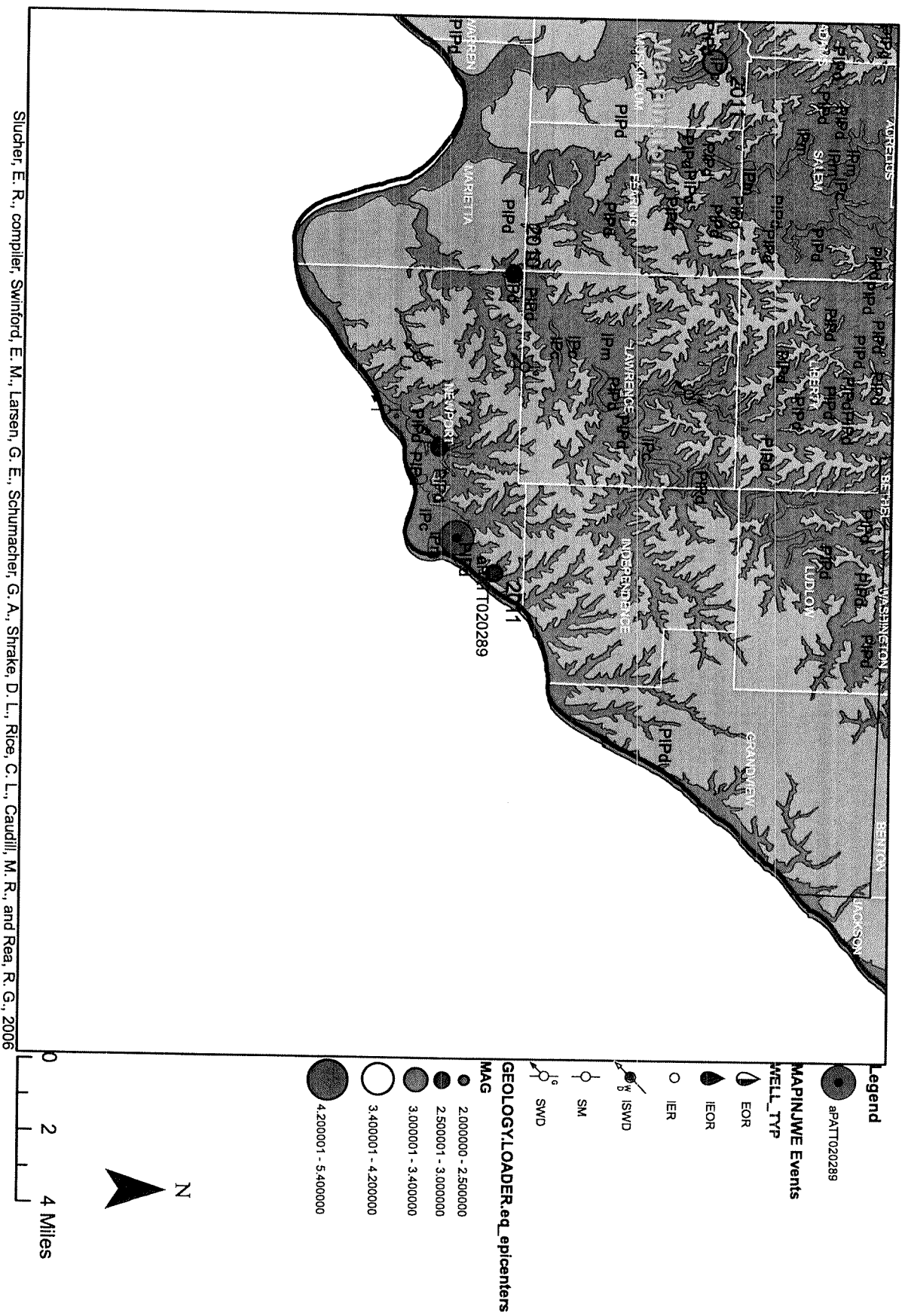
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- Well Head
 - Optional Line
 - Well Feature Type
 - DR
 - Shed Above Ground
 - Shed Below Ground
 - Open Water Above Ground
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- DRASTIC AUM and Strip Mines
 - National Underground Mine
 - Strip Mine
 - DRASTIC Rating

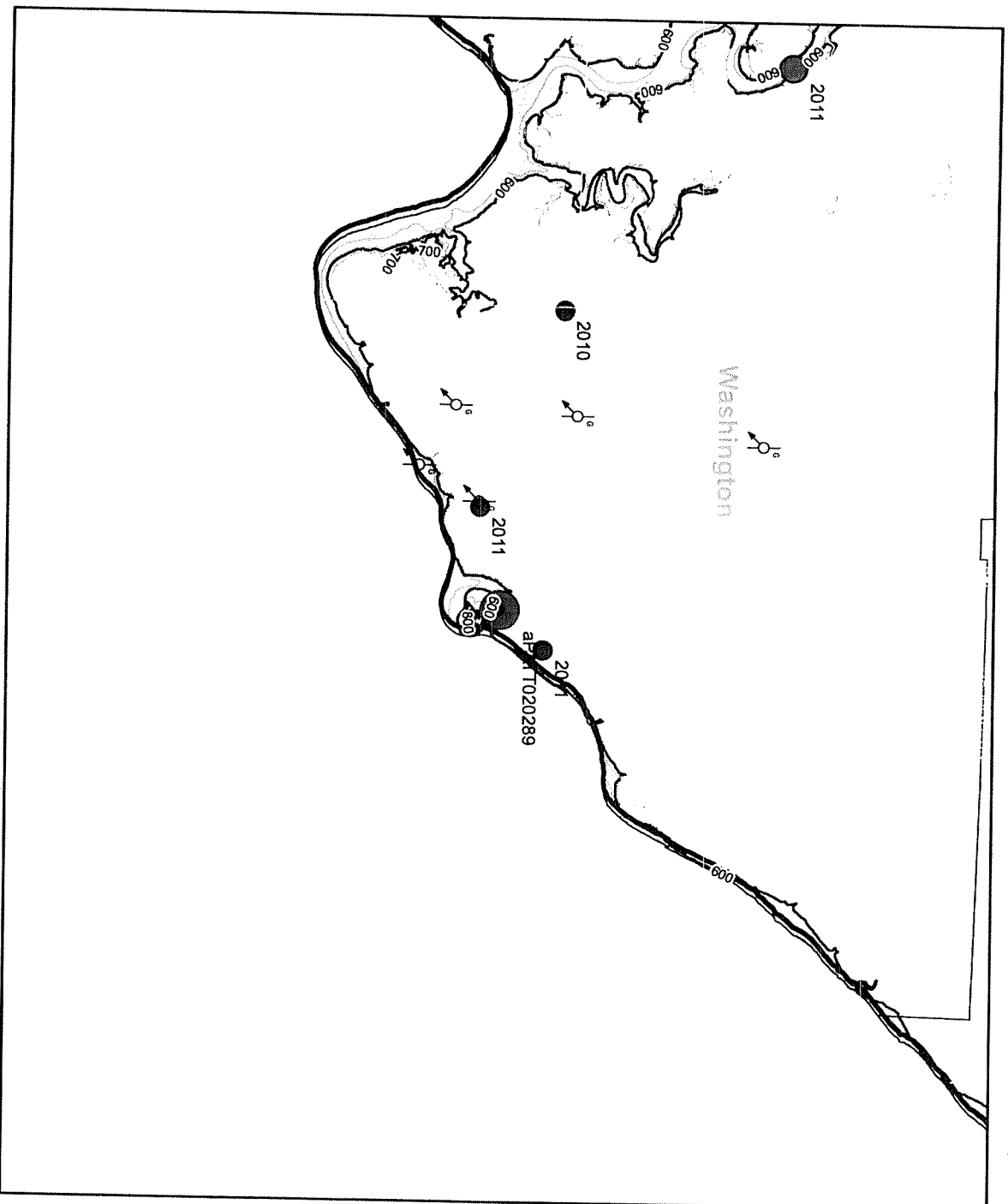
Basemaps

Bedrock Geology



Sluiter, E. R., compiler; Swinford, E. M.; Larsen, G. E.; Schumacher, G. A.; Shrake, D. L.; Rice, C. L.; Caudill, M. R.; and Rea, R. G., 2006

Bedrock Topography (C.I. = 50 feet)



Legend
 ● APATT020289

MAPINJWE Events
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● EOR

● IEOR

○ IER

● ISWD

○ SM

○ SWD

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● 3.000001 - 3.400000

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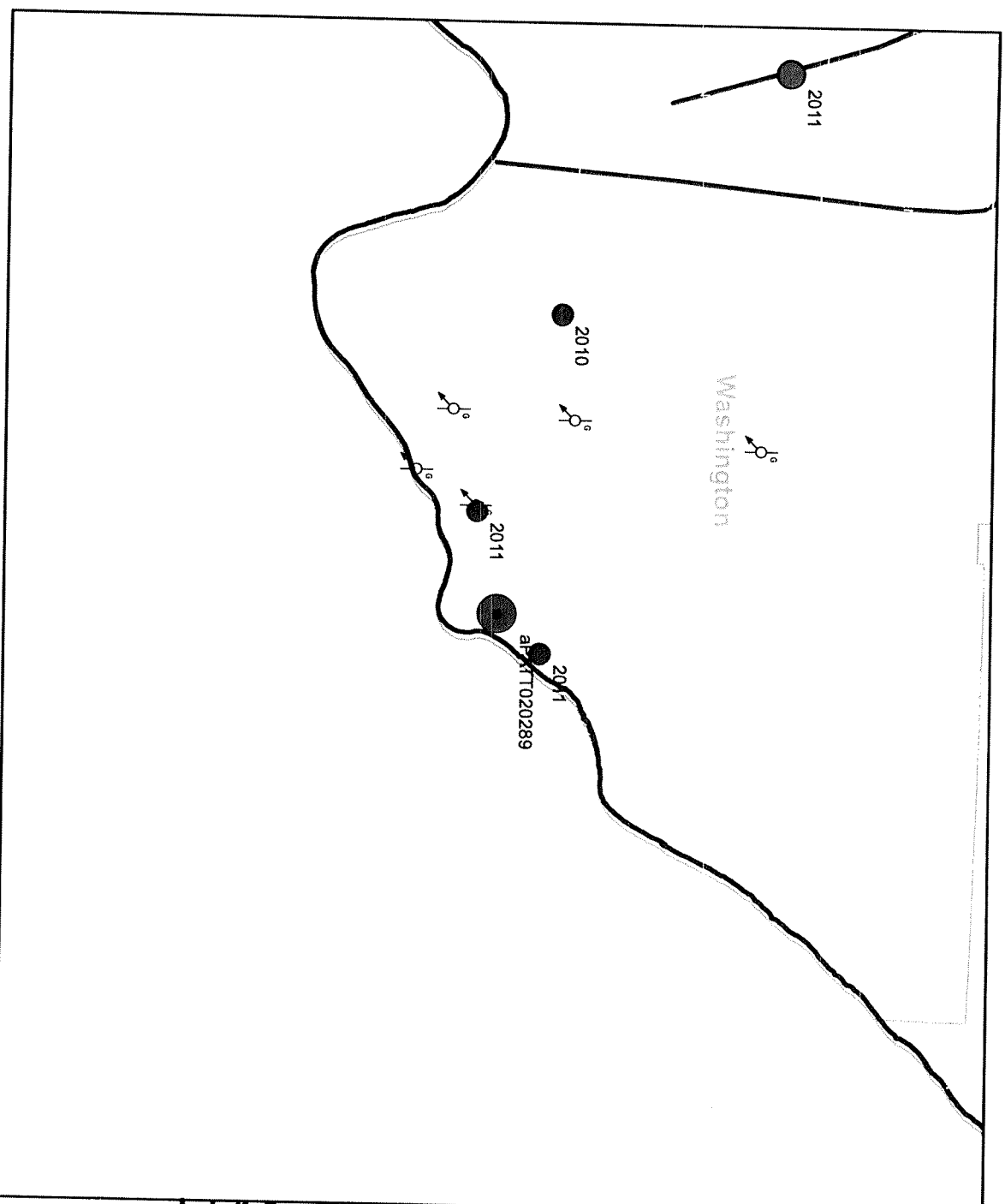
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--- 50's



Mason Lineament Map



Mason, Greg, 1999

Legend

- aPATT020289
- MAPINJWE Events**
- WELL_TYP**
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- ◑ IEOR
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- ◑ SM
- ◐ SWD

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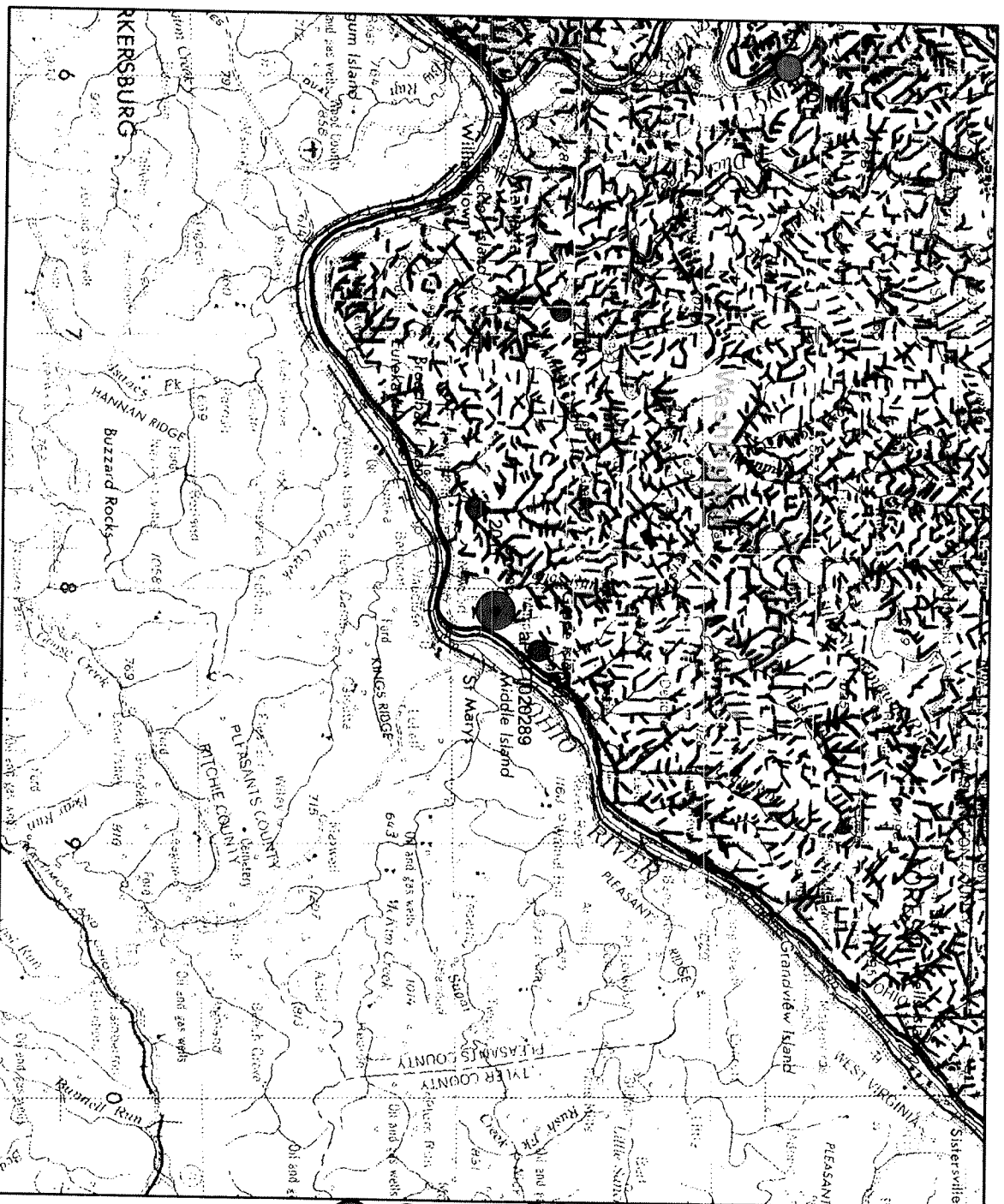
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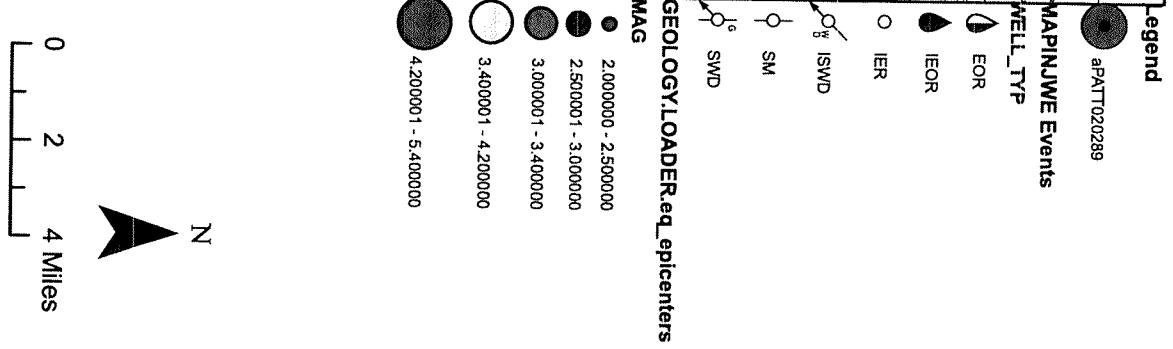
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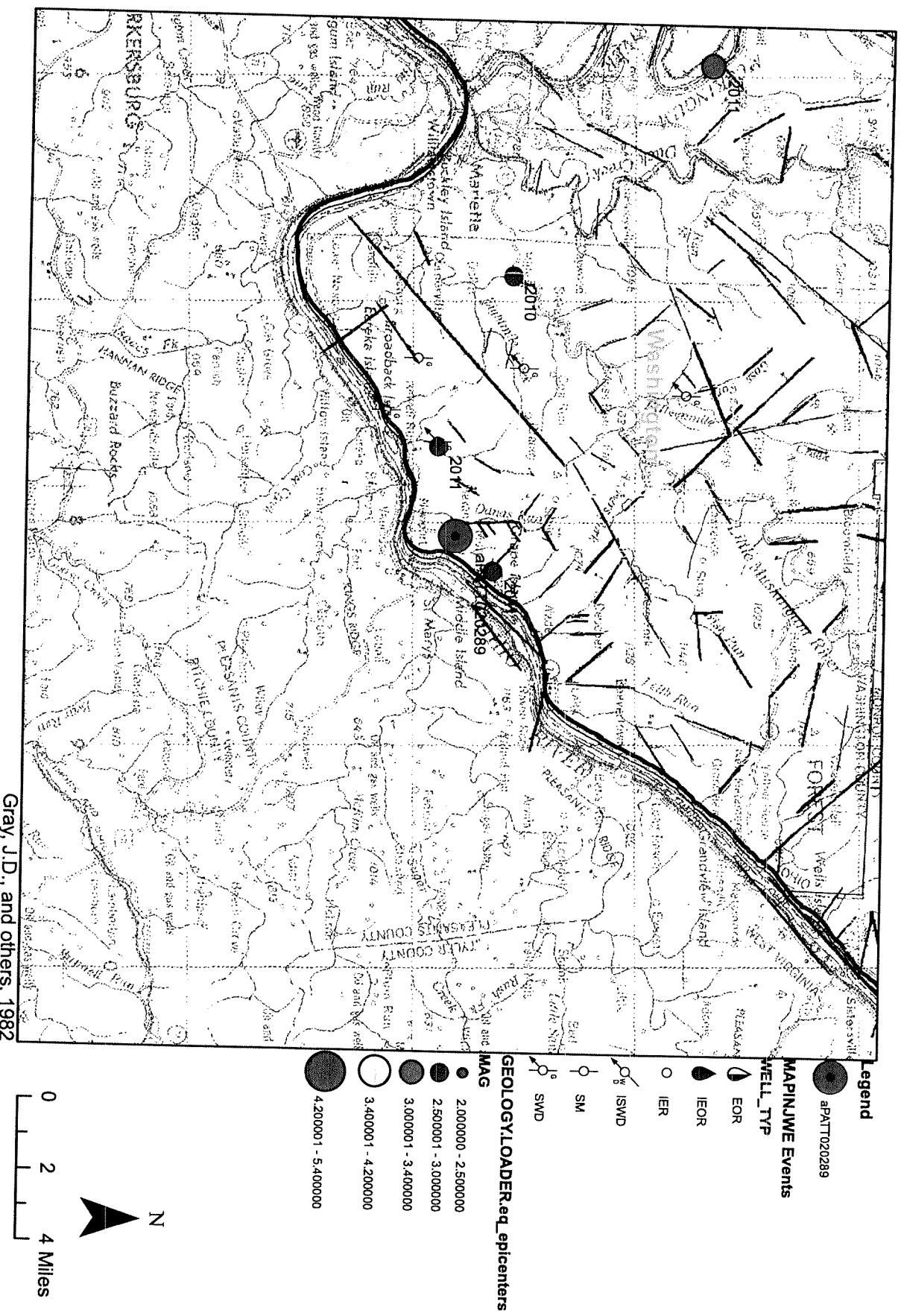
EGSP Aerial Photo Lineament



Gray, J.D., and others, 1982



EGSP LANDSAT Lineament



Gravity Bouguer Anomaly



Legend
 ● #PATT020289

MAPINJWE Events
 WELL_TYP

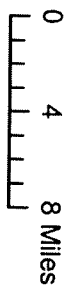
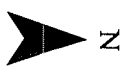
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gmggrav
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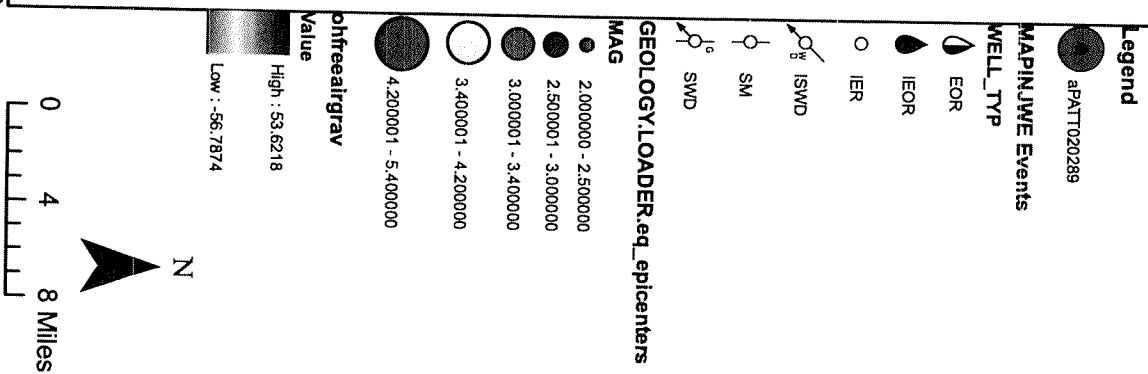


Hildenbrand, T.G. and Kucks, R.P., 1984b

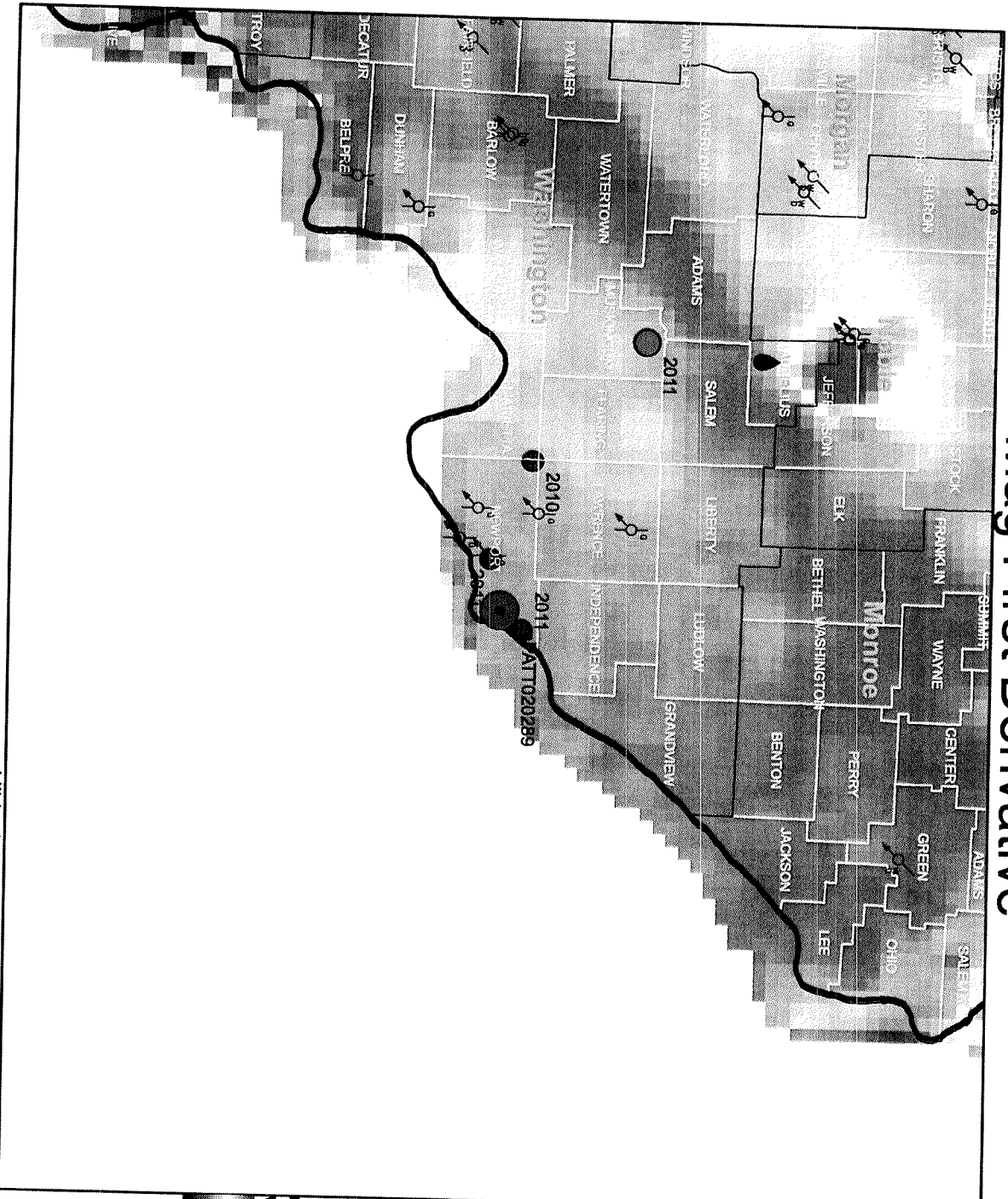
Gravity Free Air



Hildenbrand, T.G., 1986



Mag First Derivative



Legend
 aPATT020289

MAPINUWE Events
 WELL_TYP

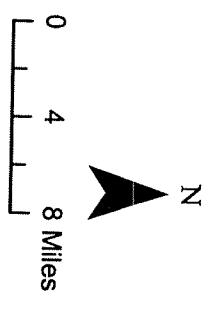
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 MAG

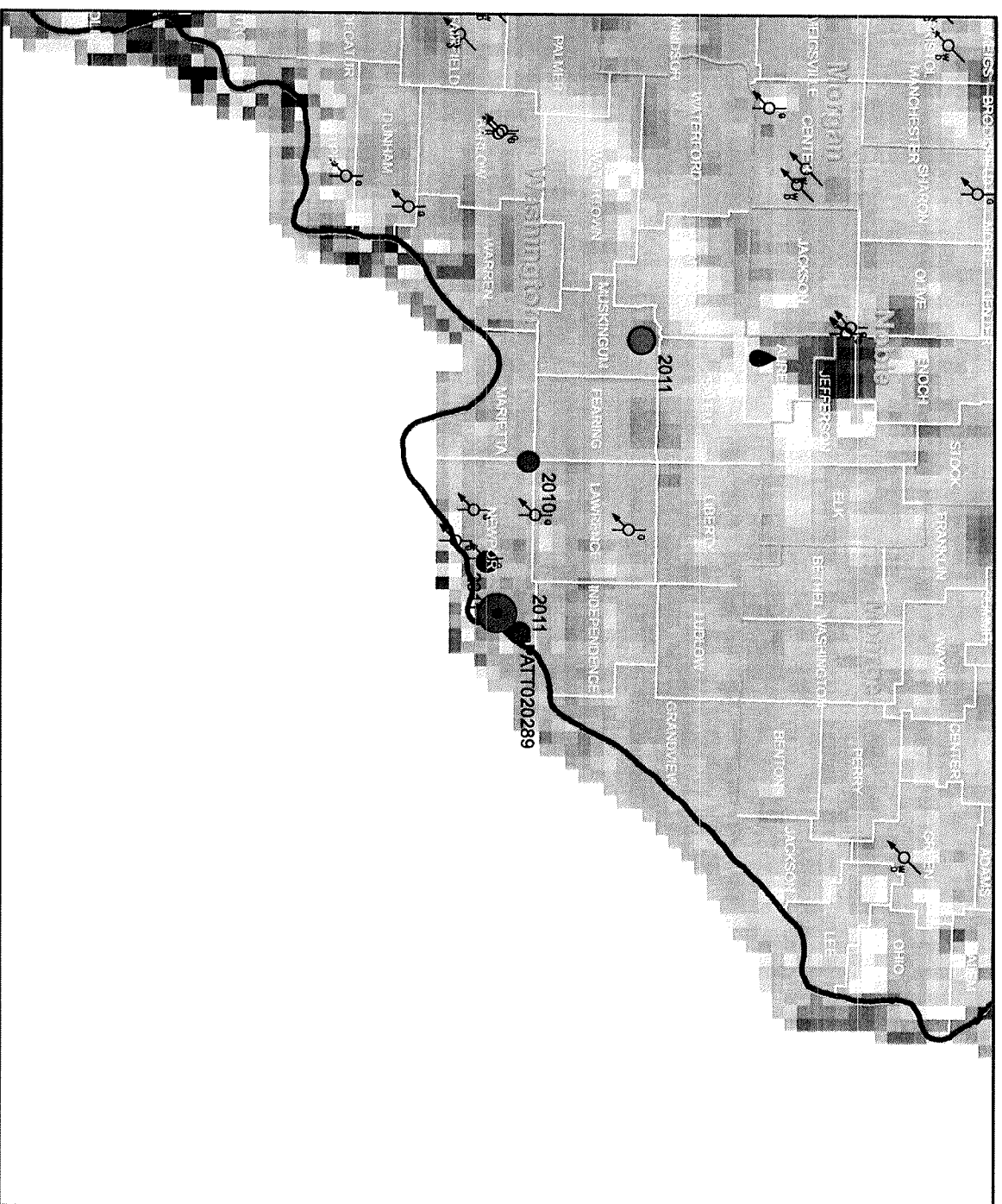
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 4.200001 - 5.400000

magnetic1st
 Value
 High : 1293.44
 Low : -1215.91



Hiddenbrand, T.G. and Kuks, R.P., 1984a

Magnetic Second Derivative



Hildenbrand, T.G. and Kucks, R.P., 1984a

