MICHIGAN ENVIRONMENT, GREAT LAKES, AND ENERGY - OIL, GAS AND MINERALS DIVISION

Application for Permit To:

Drill

and Operate a Well

By authority of Part 615 or Part 625 of Act 451 PA 1994, as amended.
Non-submission and/or falsification of this information may result in fines and/or imprisonment.

Part 615 Supervisor of Wells	Part 625 Mineral Wells
	MSM

Is the Well Directional

YES

List all previous permit numbers

Conformance bond		Bond Number	Bond Amount	I authorize EGLE 4 additional days to process this application
Blanket	OnFile	DEPN0114507721	440000.00	YES

Lease or Well Name (be as brief as possible)	Well Number
MPC	8D
Surface Owner DOUBLE ZS RANCH, LLC	

Applicant (name of permittee as bonded)		
MICHIGAN POTASH OPERATING LLC		
Address:	600 17TH STREET, SUITE 2300	Phone
	DENVER	231-577-9616
	CO	
	80203	
MICHIGAN POTASH OPERATING LLC		
Address:	2960 SIMMS DRIVE	Phone
	LAKEWOOD	231-577-9616
	CO	
	80215	

Loc Type	Sec	Twp	Rng	County	Township Name	Quarter Quarter Quarter	Quarter Quarter	Quarter	Footage NS	NS	Footage EW	EW	
SURF	36	17N	9W	OSCEOLA	HERSEY	SE	NE	SE	1475	S	402	E	Section Line
													Drilling Unit
BH	36	17N	9W	OSCEOLA	HERSEY	SW	NW	SW	1312	S	420	W	Section Line
													Drilling Unit

Kind of Tools	Is sour oil or gas expected?	H2S Cont. Plan Enclosed	Base of Lowest known fresh water aquifer	
Rotary	Y	N	GLACIAL DRIFT	620
Intended total depth				
MD	TVD	Formation at total depth	Producing/injection formation	Objective pool, field, or project
8173	4060	DUNDEE	DUNDEE	HERSEY POTASH

Hole					Casing					Cement		
Depth (MD)	Formation	Hole Diam	Mud	Gel Viscosity	Diameter	Wt Ft	Grade	Condition	Depth (MD)	Sacks	T.O.C.	W.O.C.
100	GLACIAL DRIFT	DRIVE N			16		COND	NEW	100			
900	PENNSYLVANIAN	12.25	9	28	9.625	36	K-55		900	310		12
4400	DUNDEE	8.75	9.6	40	7	23	L-80		4400	460		12
8173	DUNDEE	6.125	9.6	40	4.5				8172			

DETAIL CEMENTING PROGRAM. IDENTITFY ALL CEMENT CLASSES, ADDITIVES, AND VOLUMES (IN CU. FT.) FOR EACH CASING STRING.	
Surface	111 SK LITE BLEND LEAD 6% GEL 3% CAC12 1.69 CUFT/SK AND 199 SK CLASS A TAIL 1.18 CUFT/SK (50% EXCESS)
Contingency	
Intermediate	463 SK CLASS A 1.47 CUFT/FT=782 CUFT TAIL: 83 SK CLASS A 1.18 CUFT/SK = 880 CUFT (30% EXCESS)
Intermediate 2	
Production/Injection	slotted liner

Form Submission Details:

Type:	APD	**Status:**	ACCEPTED
Name:	4259	**Date:**	5/6/2024 11:45:00 AM
Submitted by:			

APD 999


People
Providing
Strengthening
Securing
FARM USE
FARMERS MARKET
Paula Red

MICHIGAN POTASH OPERATING, LLC

MPC 8D
NON-HAZARDOUS NON-COMMERCIAL
PART 625 MINERAL WELL, BRINE INJECTION

APPLICATION FOR PERMIT TO DRILL AND OPERATE
OSCEOLA COUNTY, MICHIGAN

MAY 2024

THE UNITED STATES POTASH PROJECT

A Submission to

EGLE

PERMIT APPLICATION SUPPLEMENT

TABLE OF CONTENTS

The U.S. Potash Project

1 Describe in detail the purpose of the well and its anticipated life expectancy

<u>NEED FOR PROPOSED ACTION</u>

Potassium is one of the three primary nutrients essential to support carbohydrate production and plant life. It a natural fertilizer to improve productivity, efficiency, and yields of agribusiness.

The major source of potassium is potash (potassium chloride), extracted form sylvite, a naturally occurring mineral containing both potassium chloride (potash) and sodium chloride (table salt). Since 1965, world consumption of potash grew from 14 million to an approximate 80 million short tons today. In 50 years, potash consumption has increased over 5 fold, and is necessary for global food security. In the last two decades, potash consumption has more than doubled.

The American farmer, the most efficient in the world, consumes about ten million short tons of potash annually. Over 94% of U.S. potash consumption is imported. Domestic potash supply comes principally from the Designated Potash Area in New Mexico; established in 1939 as a strategic resource. Over the past 80 years, the Designated Potash Area has become critically depleted, producing less than 300,000 tons of muriate of potash, or 3% of the US needs.

Despite being required for food growth, potash is the world's tightest controlled commodity. It is utilized throughout the globe, but commercial production occurs in only 12 countries and from 11 companies, creating high concentration risk. Current supply chain disruption has increased potash prices by 300% in two years, resulting in increased food prices, creating a global fertilizer, food, and inflationary security crisis.

The State of Michigan controls *one of three* domestic supplies for potash. Michigan potash was discovered in 1980, making it the youngest global commercial deposit of sylvite. Potash is a U.S. Department of the Interior designated Strategic and Critical Mineral, and shortage of which poses critical and national harm. Michigan has the only proven and probable, commercial, potash available and ready for development.

Fertilizer is the American farmer's greatest cost of production. A Further increase in U.S. imports and tighter control of potash has resulted in a currently distressed supply chain. This has resulted in less staple crop growth, which in turn is quickly leading to global food shortages, price instability, and significantly higher costs and food costs, and food shortages.

Michigan's potash is critically important to the American farmer, who provides our food.

- The State of Michigan, as a contributive part of the U.S. soybean and corn belt, is a large producer of sugar beets and potatoes, and resides within the greatest potash demand region in all of North America.
- There are 53,000 Farms in Michigan. A 91 Billion dollar economic contribution to the State.
- The State of Michigan contains the world's purest and highest grade potash and it resides in the U.S. corn belt, closest to the U.S. farmer.
- Discovered in 1980, and successfully produced between 1989 and 2013, this concentrated area is only *one of three* known potash producing regions in the United States. The other two have been critically depleted. There is only one, marginal potash producer in the United States.
- The known, delineated, deposit in Michigan has the capability to more than triple domestic potash production for over a century.

The proposed action will:

- Create a competitive potassium fertilizer price for the US farmer, which helps the noblest of professions. Helping our farmer, means supporting their choice to 'keep the farm' and grow food for us.
- Potassium levels and crops the most critical component to a farmer's water management, allowing growers to get the most efficient use of what water they have available for a specific crop.
- Reduce over-irrigation, and increase crop water use and efficiency.
- Provide domestic production of a material critical to the US farmer, the nation's agricultural health, and the nation's food security.
- Reduce the need for import and improve the nation's balance of trade.
- Reduce transportation costs to key agricultural areas throughout the US.
- Create a new and sizable opportunity in Rural Western Michigan, providing jobs directly and indirectly to an area with a great need.

ALTERNATIVES TO THE PROPOSED ACTION

There are no commercial alternatives for potash as 50% of the world's supply is controlled by nations that are, on occasion, antagonistic to our initiatives (Russia, Belarus, China). The principle alternative is to not undertake the action.

THE PROPOSED ACTION

The proposed action is the perpetuation of pre-established potash production from Hersey Michigan, where production has occurred since 1989, but ceased in 2013. The MPC team was historically responsible for the development of the Hersey area potash, and maintains a continuity of expertise particular to the subsurface, surface, and environmental stewardship.

Michigan potash deposits occur at great depths, over 7,600' below ground level. Therefore, deep, directionally drilled wells are utilized to access the deposit. This creates a favorable means of potash and salt extraction, which impacts less than 1.0% of the surface. In other words, there is minimal to no surface disturbance, substantially reducing environmental impact and risk.

During the manufacturing of potash, sodium chloride, or "table salt", is also made. Michigan Potash Operating does make food grade quality salt, but there is an excess, and therefore, some salt has to be re-dissolved and re-injected. Although expressly clean brine, small increases in Magnesium and Calcium (natural human supplements) reduce operating and water conservation efficiency in the MPC process, and therefore are removed from the system so as to maintain upwards of 96% water recycling efficiency.

This is the purpose of the subject Part 625 NON-HAZARDOUS, NON-COMMERCIAL injection permit application. The Proposed Action requires that excess salt water, or an increase in 'Hard Water' by magnesium or calcium be re-injected. The disposed water, is cleaner than the resident displaced water.

The drilling and operation of Part 625 brine injection well (EPA Class I, Non-Hazardous, Non Commercial) in the state of Michigan are currently subject to approval and permitting processes governed separately by the U.S. Environmental Protection Agency (EPA) and the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

In the state of Michigan, there are numerous Part 625 brine operations; principally for extracting sodium chloride, which has a long history in Michigan. One such area, is immediately offset and currently operating less than one and a half (1.5) miles away.

The Michigan Department of Environment, Great Lakes, and Energy calls for the submittal of comprehensive project supporting data in the form of a series of attachments and project clarifications, respectfully submitted hereto.

Michigan Potash Operating proposes to develop the proposed Part 625 brine injection wells (as defined 324.62501(d).

The anticipated life of the projected well is 20 years, subject to operating conditions, which may enable it to exist for a longer or shorter duration.

The proposed injection horizon is the Dundee formation and the subgroup Reed City Dolomite, from approximately 3913 – 4200 feet below surface.

Extensive work has been performed to identify and understand the lowermost underground source of drinking water ("USDW") within the Area of Review ("AOR"). The lowermost possible USDW is the base of the glacial till. The deepest anticipated occurrence of glacial till in the AOR can range from 614 to 712 feet, but a value of 620' has been used for calculations in this application. Over 308 historical hydrological test holes and approximately 60 piezometers, and 50 drawdown tests, cataloging over 33,833 feet of groundwater and soil data was amalgamated for the purposes of adequately understanding and protecting as part of the separate Class III and related potash permitting efforts; these data coincide with the MPC 8D Michigan Potash Area of Review ("AOR"). This area has been extensively studied and consists of one of the highest density gatherings of data of glacial till and hydrogeological data not only in Michigan, but possibly in Indiana and Illinois as well.

Injection well operating procedures, and environmental, health, and safety precautions are well established due to well understood and best practice operations currently in the immediate area of review, where several Part 625 injection wells and artificial brine wells are currently active and have been since 1984.

The proposed well shall be located as follows:

Well Name :	**MPC 8D**
Location:	**Township 17 North, Range 9 West, Hersey Township, Michigan Meridian**
	Surface: Section 36: SE ¼, NE ¼, SE ¼
	SHL Lat, Long: 43.818506, - 85.325927
	New drill horizontal

2 Notification: At the same time as submitting the permit application, mail via first-class United States mail, a copy of the first page of the permit application and cover letter to the clerk of the township and the surface owner of record of the land on which the well is to be located.

Letters were sent to Hersey township, Osceola County. The surface owner is Double ZS Ranch, LLC, who has also been notified by electronic mail.

MICHIGAN POTASH OPERATING, LLC

May 1st, 2024

Hersey Township Clerk
Susan Martinez
PO Box 290
Hersey, MI 49639

Re: Notification of Drilling Operations:
MPC 8D Well
Township 17 North, Range 9 West, Hersey Township
Section 36: NE/4 SE/4
Osceola County, Michigan

Dear Ms. Martinez:

This Letter shall serve as notification by Michigan Potash Operating, as per Michigan Statute R324.201(2)(d) of drilling operations for the non-hazardous brine disposal well, the MPC 8D at the location described above. This well is anticipated to be drilled within the 3Q or 4Q of 2023.

Should you have any questions, please feel free to contact me directly at the below listed phone number.

Sincerely

Michigan Potash Operating, LLC

Theodore A. Pagano
General Manager
970 590 3944 (cell)

Received and returned, on this ____________day of ________________2023.

By:______________________________
Ms. Susan Martinez
Hersey Twp., Osceola County

1225 17th Street, Suite 2200, c/o Fox Rothschild
Denver, CO 80202, USA

MICHIGAN POTASH OPERATING, LLC

May 1st, 2024

Double ZS Ranch, LLC
900 Monroe Ave NW
Grand Rapids, MI 49503

Re: Notification of Drilling Operations:
MPC 8D Well
Township 17 North, Range 9 West, Hersey Township
Section 36: NE/4 SE/4
Osceola County, Michigan

VIA ELECTRONIC MAIL, CONFIRMATION REQUESTED

To Whom It May Concern:

In accordance with Michigan Statute R324.201(2)(d), this letter serves as a written notice by Michigan Potash Operating LLC of its intention to drill the MPC 8D well from the above captioned location. Michigan Potash Operating, LLC operations are estimated to begin within the 3Q or 4Q of 2023 pending receipt of the required permits, approval of title and drilling rig availability.

As the surface owner, it is your responsibility to notify any affected tenant farmer, lessee or other party that may own or have an interest in any crops or surface improvements that could be affected by these proposed operations.

Please see the enclosed drilling application enclosed herewith.

If you have any questions please don't hesitate to call me at 970-590-3944 (cell).

Sincerely

Michigan Potash Operating, LLC

Theodore A. Pagano
General Manager

1225 17th Street, Suite 2200, c/o Fox Rothschild
Denver, CO 80202, USA

3 Form EQP 7200-1, Application for Permit to Drill, Deepen, Operate, with an original signature from the applicant or the applicant's agent. See instructions on reverse of form.

MPC 8D

MICHIGAN POTASH OPERATING, LLC

EGLE MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY - OIL, GAS, AND MINERALS DIVISION

APPLICATION FOR PERMIT TO:
☒ DRILL ☐ DEEPEN ☐ CONVERT
AND OPERATE A WELL

By authority of Part 615 or Part 625 of Act 451 PA 1994, as amended. Non-submission and/or falsification of this information may result in fines and/or imprisonment.

1a. Part 615 Supervisor of Wells
☐ Oil and Gas
☐ Brine Disposal
☐ Hydrocarbon Storage
☐ Injection for Secondary Recovery

1b. Part 625 Mineral Wells
☐ Waste Disposal
☐ Brine Production
☒ Processed brine disposal
☐ Storage
☐ Test, fee sched. on rev.

1c. Fee enclosed
☒ Yes
☐ No, revision of application
☐ No, leg of horz drainhole

2. List all previous permit numbers: None

3. Fed. ID. No. (do not use SSN): 81-1570592

4. Conformance bond: ☒ Blanket ☐ Single well

5. ☐ Attached ☒ On file

6. Bond number: DEPN0114507721

7. Bond amount: 440,000

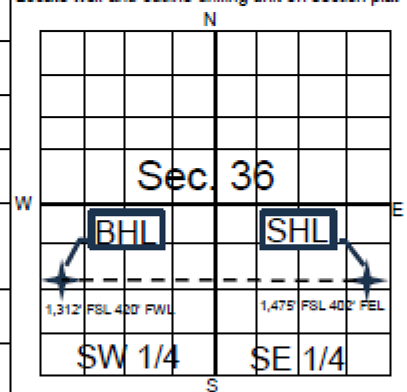
8. Applicant (name of permittee as bonded): Michigan Potash Operating, LLC

9. Address:
Michigan Potash Operating, LLC
600 17th Street, Suite 2300
Denver, CO 80203

Phone: 231-577-9619

I authorize EGLE 4 additional days to process this application. ☒ Yes ☐ No

Locate well and outline drilling unit on section plat



10. Lease or well name (be as brief as possible): MPC — Well number: 8D

11. Surface owner ☒ Private ☐ State ☐ Federal ☐ Indian ☐ Other, identify
Double ZS Ranch, LLC

12. Surface location: SE 1/4 of NE 1/4 of SE 1/4 of Sec 36 T 17N R 09W — Township: Hersey — County: Osceola

13. If directional, bottom hole location: SW 1/4 of NW 1/4 of SW 1/4 of Sec 36 T 17N R 09W — Township: Hersey — County: Osceola

14. The surface location for this well is
1475 feet from **nearest** (N/S) South section line AND 402 feet from **nearest** (E/W) East section line

15. Is this a directional well? ☐ No ☒ Yes If yes, complete line15. The bottom hole location for this well is
1312 feet from **nearest** (N/S) South section line AND 420 feet from **nearest** (E/W) West section line

16. The bottom hole location (whether straight or directional) of this well is
NA feet from **nearest** (N/S) ____ drilling unit line AND NA feet from **nearest** (E/W) ____ drilling unit line

17. Kind of tools: ☒ Rotary ☐ Cable ☐ Combination

18. Is sour oil or gas expected? ☐ No ☒ Yes ☐ H_2S Cont. plan enclosed

19. Base of lowest known fresh water aquifer: Formation Drift — Depth 620

20. Intended total depth: MD 8,173 TVD 4,060

21. Formation at total depth: Dundee/Reed City

22. Producing/injection formation(s): Dundee/Reed City

23. Objective pool, field, or project: Hersey Potash

24. PROPOSED DRILLING, CASING AND CEMENTING AND SEALING PROGRAM

HOLE			CASING			CEMENT			MUD	
Depth (MD)	Geol. Formation	Bit Dia.	O.D. Size	Wt/Ft Grade Condition	Depth (MD)	Sacks	T.O.C.	W.O.C	Wt.	Vis.
100	Drift	Driven	16	Conductor, new	100	NA	NA	NA	NA	NA
900	Pennsylvanian	12 1/4	9 5/8	36# K55	900	310	Surface	12	9	28+
4400	Dundee/Reed	8 3/4	7	23# L80	4400	460	Surface	12	9.6	40+
8173	Dundee/Reed	6 1/8	4 1/2	Slotted liner	8172	NA	NA	NA	9.6	40+

25. DETAIL CEMENTING PROGRAM. IDENTIFY ALL CEMENT CLASSES, ADDITIVES, AND VOLUMES (IN CU. FT.) FOR EACH CASING STRING.

Surface 111 sk Lite Blend lead 6% Gel 3% CaCl2 1.69 cuft/sk and 199 sk Class A Tail 1.18 cuft/sk (50% excess)

Intermediate Lead: 463 sk Class A 1.47 cuft/ft=782cuft TaiL: 83 sk Class A 1.18cuft/sk = 880 cuft (30% excess)

Production/Injection Slotted liner

26. Send correspondence and permit to
Name Theodore A. Pagano — E-mail tpagano@mipotash.com
Address 600 17th Street, Suite 2300 Denver, CO 80203 — Phone 231-577-9616

CERTIFICATION "I state that I am authorized by said applicant. This application was prepared under my supervision and direction. The facts stated herein are true, accurate and complete to the best of my knowledge."

Enclose the receipt of electronic payment or a check made payable to State of Michigan.The permit fee is $300 for Part 615 wells; $2,500 for a Part 625 waste disposal well; $500 for brine production, processed brine disposal, or storage

Cashier use only.

27. Application prepared by (print or type): Theodore A. Pagano — Phone

28. Signature: [signature] — Date: May 1st, 2024

Oil, Gas, and Minerals Division Use Only

Permit number	API number	Date issued	Owner number

EQP 7200-1 (rev. 4/2021) PLEASE SEE INSTRUCTIONS FOR COMPLETING AND PROCESSING ON REVERSE

4 Form EQP 7200-2, Survey Record of Well Location signed and sealed by a surveyor licensed in the state of Michigan which identifies:

A. A readily visible stake or marker must be set at the well location. If the well will be directionally drilled also identify the bottom hole location.

B. A flagged route or explanation of how the well location may be reached.

C. Footages of the surface location (and if directionally drilled, the bottom hole location) from the nearest property and section lines.

D. Identification of the existing local zoning designation of the surface location of the well.

E. The surveyor must include an attached plat that shows all of the following information relative to the approximate distances and directions from the stake or marker to special hazards or conditions, including all of the following:

i. Surface waters and other environmentally sensitive areas within 1,320 feet of the proposed well.

ii. Floodplains associated with surface waters within 1,320 feet of the proposed well.

iii. Wetlands, as identified by the provisions of Part 303 of the NREPA, within 1,320 feet of the proposed well.

iv. Natural rivers, as identified by the provisions of Part 305 of the NREPA, within 1,320 feet of the proposed well.

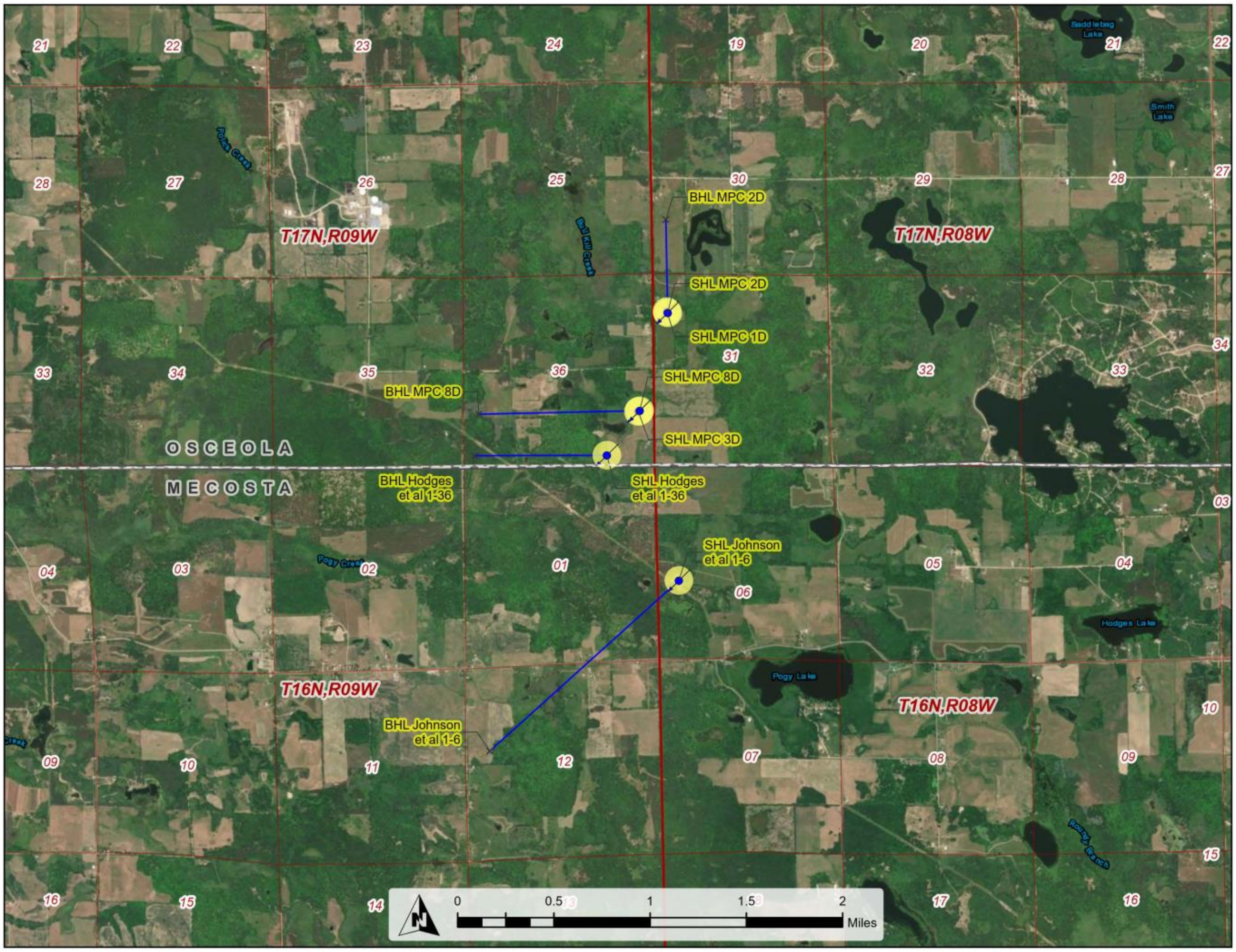
v. Threatened or endangered species, as identified by the provisions of Part 365 of the NREPA, within 1,320 feet of the proposed well.

vi. All buildings, recorded freshwater wells and reasonably identifiable freshwater wells utilized for human consumption, public roads, railroads, pipelines, power lines and other man-made objects that lie within 600 feet of the proposed well location.

vii. All public water supply wells identified as type I and II that lie within 2,000 feet of the proposed well location and type IIb and III that lie within 800 feet of the proposed well location, as defined in Act No. 399 of the Public Acts of 1976, as amended, being §325.1001 et seq. of the Michigan Compiled Laws.

Form EPQ 7200-02, signed and sealed by a State of Michigan Surveyor, is included at the end of this section for Well MPC-8D. The Survey includes a supplemental plat that identifies most of the required information presented in Item E, above, including the proposed well location. A map is also presented below showing the well location in an aerial photograph.

Michigan Potash Aerial Photograph



The Survey Plat shows the roadways near and to the facility. Access is off of 120th Avenue from which a 400 ft pre-existing access road occurs that extends west to the proposed drilling location.

i. Surface Waters and other environmentally sensitive areas within 1,320 feet of the proposed well.

The survey plat shows
ii. Floodplains associated with surface waters within 1,320 feet of the proposed wells.

There are no federal floodplains within 1,320 feet of the proposed wells as per 44 CFR 9.4.

iii. Wetlands, as identified by the provisions of Part 303 of the NREPA, within 1,320 feet of the proposed well.

The survey shows wetland proximity and areal extent. No wetland disturbance is anticipated.

iv. Natural rivers, as identified by the provisions of Part 305 of the NREPA, within1,320 feet of the proposed well.

There are no natural rivers as provided by Part 305 of NREPA were identified within the specified radius of 1,320 feet from the proposed well location.

v. Threatened or endangered species, as identified by the provisions of Part 365 of the NREPA, within 1,320 feet of the proposed well.

There are no threatened or endangered species, as identified in the provisions of Part 365 of NREPA within 1,320 feet of the proposed well.

The Michigan Natural Features Inventory (MNFI) was consulted for a database review of known occurrences of State and Federal listed threatened and endangered species that may be present in the immediate project vicinity. In addition, the United States Fish and Wildlife Service's (USFWS) list of threatened and endangered species for Osceola County was reviewed by independent consulting biologists and ecologists. The USFWS indicates the potential for the threatened northern long-eared bat (Myotis septentrionalis), and the eastern massasauga rattlesnake (Sistrurus catenatus) to occur in Osceola County. Neither have been observed during survey on the location of the proposed actions, which is on tilled farm land and an unsuitable habitat or natural environment for either species. A breeding bird survey was conducted at the proposed project location. Forty Six bird species were observed and all were considered to be common to mid-Michigan (Lipar, 2016, 2023), and no endangered or threatened species were identified.

vi. All buildings, recorded fresh water wells, wells and reasonably identifiable fresh water wells utilized for human consumption, public roads, railroads, pipelines, power lines and other man-made objects that lie within 600 feet of the proposed well.

Available information indicates that there is one private well within 1,320 feet of MPC 8D. There are no public freshwater wells within a 600 foot, 800 foot or 1,320 foot radius of the proposed well. There is one structure within 600 feet of the proposed well location: a pole barn that is 136 feet from the proposed well location. A private road from 120th Street shall serve as access to the proposed well location. The well location survey plot identifies the location of public roads and other features within 600 feet of the proposed well location. No railroads are present, as verified by survey. A map showing the general location of groundwater wells is provided on Figure B4.

vii. All public water supply wells identified as Type I and IIa that lie within 2,000 feet of the proposed well location and Type IIb and III that lie within 800 feet of the proposed well location, as defined in Act No. 399 of the Public Acts of 1976, as amended, being part 325.1001 et. Seq., of the Michigan Compiled Laws.

Based on available data, there are no Type I or IIa public water supply wells within 2,000 feet of the proposed MPC 8D well location. There are no Type IIb or III public water supply wells within 800 feet of the proposed MPC 8D well location.

MPC 8D

/1400/984.24

EGLE MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY - OIL, GAS, AND MINERALS DIVISION

SURVEY RECORD OF WELL LOCATION

This information is required by authority of Part 615 Supervisor of Wells, or Part 625 Mineral Wells, of Act 451 PA 1994, as amended, in order to obtain a drilling permit.

Applicant: Michigan Potash Operating

Well name and number: MPC 8D

1a. Surface location

								Township	County
SE	1/4 of	NE	1/4 of	SE	1/4 of section	36	T 17N R 09W	Hersey	Osceola

1b. If this is a directional well, bottom hole location will be

								Township	County
SW	1/4 of	NW	1/4 of	SW	1/4 of section	36	T 17N R 09W	Hersey	Osceola

Instructions: Outline drilling unit for oil/gas wells (Part 615) or property boundary for mineral wells (Part 625) and spot well location on plat shown. Locate the well in two directions from the **nearest** section, quarter section, and unit (or property, Part 625) lines.

2. The surface location is

1475 ft. from nearest (N/S) South section line

402 ft. from nearest (E/W) East section line

and

1148 ft. from nearest (N/S) North quarter section line

2216 ft. from nearest (E/W) West quarter section line

3. Bottom hole will be (if directional)

1312 ft. from nearest (N/S) South section line

420 ft. from nearest (E/W) West section line

and

1268 ft. from nearest (N/S) North quarter section line

2193 ft. from nearest (E/W) East quarter section line

4. Bottom hole will be (directional or straight)

NA ft. from nearest (N/S) NA drilling unit line

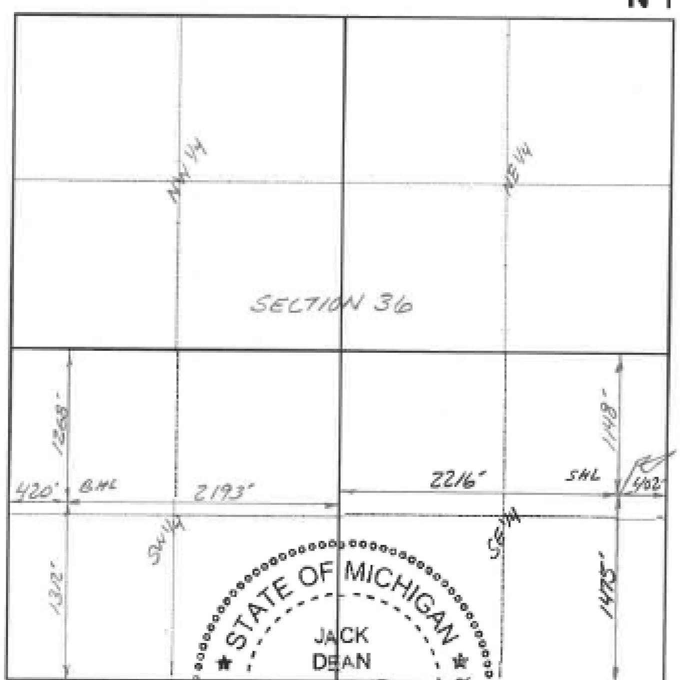
NA ft. from nearest (E/W) NA drilling unit line

5. Show access to stake on plat and describe if it is not readily accessible. From the intersection of Schofield Rd and 120th Ave., go south ±1200' on 120th Ave to drive on the right, then go west ±400' to well stake.

6. Zoning
☐ Residential, effective date ____________
Initial date of residential zoning ____________
☒ Other No Zoning

PLAT BELOW REPRESENTS ONE FULL SECTION
(1 MILE SQUARE)

N ↑



STATE OF MICHIGAN
JACK DEAN GEERS JR.
License No. 4001033977
LICENSED PROFESSIONAL SURVEYOR

ON SEPARATE PLAT OR PLOT PLAN, LOCATE, IDENTIFY AND SHOW DISTANCES TO:
A. All roads, power lines, buildings, residences, fresh water wells, and other man-made features, within 300 feet of the stake.
B. All lakes, streams, wetlands, drainage-ways, floodplains, environmentally sensitive areas, natural rivers, critical dune areas, and threatened or endangered species within 1320 feet of the stake.
C. All type I and IIa public water supply wells within 2000 feet and all type IIb and III public water supply wells within 800 feet of the well stake.

Name of individual who surveyed site	Company	Date of survey
J. Dean Geers	Atwell	5-09-2022

Address	Phone
7192 E. 34 Road, Suite 4, Cadillac, MI 49601	231-775-300

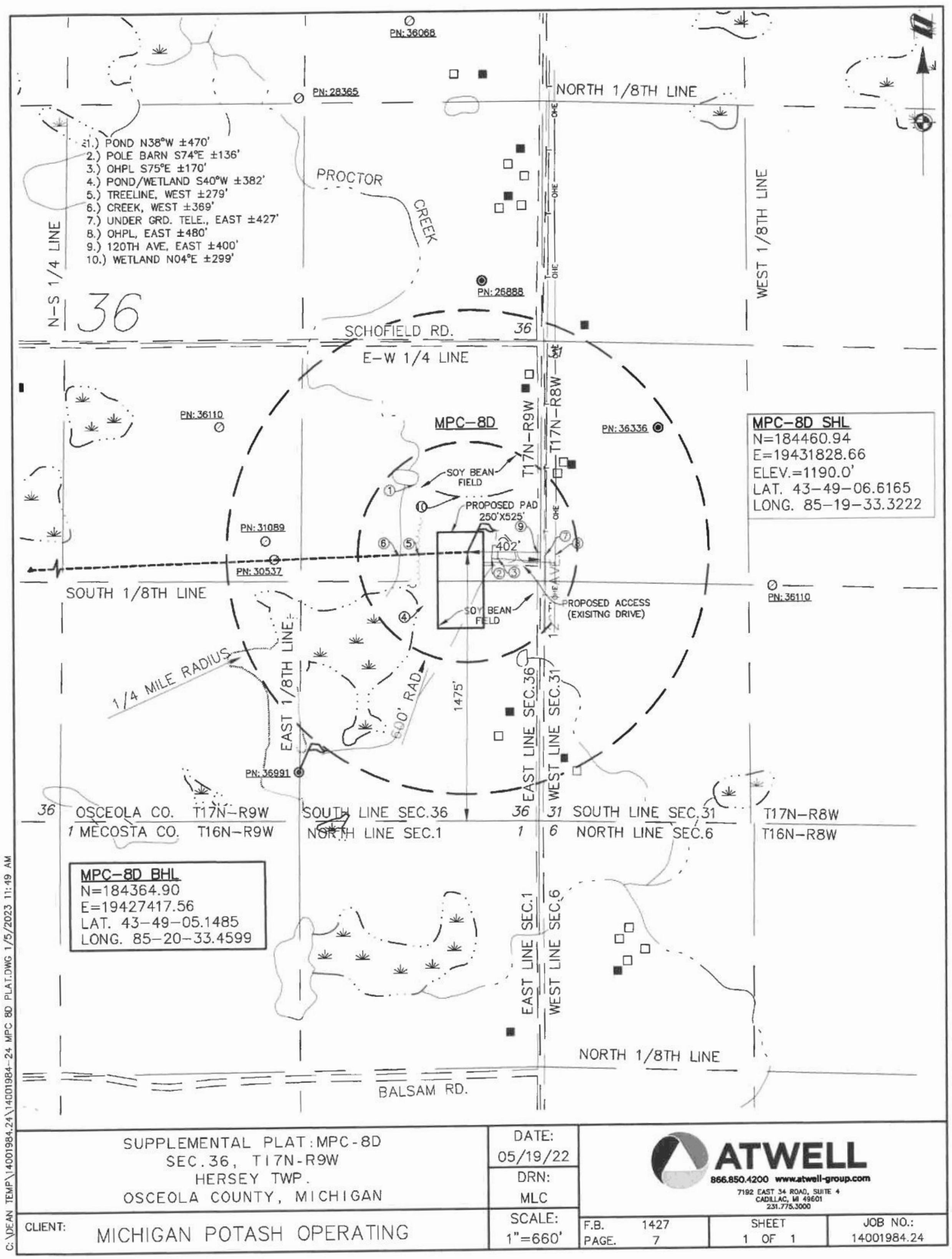
I CERTIFY THE ABOVE INFORMATION IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

Signature of licensed surveyor (affix seal) [signature]

Date 5-20-22

EQP 7200-2 (rev. 4/2021) ENCLOSE WITH APPLICATION TO DRILL OR DEEPEN

MPC 8D



NORTH 1/8TH LINE
1.) POND N38°W ±470'
2.) POLE BARN S74°E ±136'
3.) OHPL S75°E ±170'
4.) POND/WETLAND S40°W ±382'
5.) TREELINE, WEST ±279'
6.) CREEK, WEST ±369'
7.) UNDER GRD. TELE., EAST ±427'
8.) OHPL, EAST ±480'
9.) 120TH AVE, EAST ±400'
10.) WETLAND N04°E ±299'
PROCTOR CREEK
N-S 1/4 LINE
WEST 1/8TH LINE
SCHOFIELD RD.
E-W 1/4 LINE
MPC-8D
T17N-R9W
T17N-R8W
SOY BEAN FIELD
PROPOSED PAD 250'X525'
402'
MPC-8D SHL
N=184460.94
E=19431828.66
ELEV.=1190.0'
LAT. 43-49-06.6165
LONG. 85-19-33.3222
SOUTH 1/8TH LINE
PROPOSED ACCESS (EXISITNG DRIVE)
1/4 MILE RADIUS
EAST 1/8TH LINE
600' RAD.
1475'
EAST LINE SEC.36
WEST LINE SEC.31
OSCEOLA CO. T17N-R9W
MECOSTA CO. T16N-R9W
SOUTH LINE SEC.36
NORTH LINE SEC.1
SOUTH LINE SEC.31
NORTH LINE SEC.6
T17N-R8W
T16N-R8W
MPC-8D BHL
N=184364.90
E=19427417.56
LAT. 43-49-05.1485
LONG. 85-20-33.4599
EAST LINE SEC.1
WEST LINE SEC.6
NORTH 1/8TH LINE
BALSAM RD.
SUPPLEMENTAL PLAT: MPC-8D
SEC.36, T17N-R9W
HERSEY TWP.
OSCEOLA COUNTY, MICHIGAN
DATE: 05/19/22
DRN: MLC
SCALE: 1"=660'
CLIENT: MICHIGAN POTASH OPERATING
ATWELL
F.B. 1427 PAGE. 7
SHEET 1 OF 1
JOB NO.: 14001984.24

5 Form EQP 7200-4, Wellhead Blowout Control System.

The blowout control system for drilling the proposed well is presented in form EQP-7200-04.

EGLE MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY - OIL, GAS, AND MINERALS DIVISION

6

WELLHEAD BLOWOUT CONTROL SYSTEM

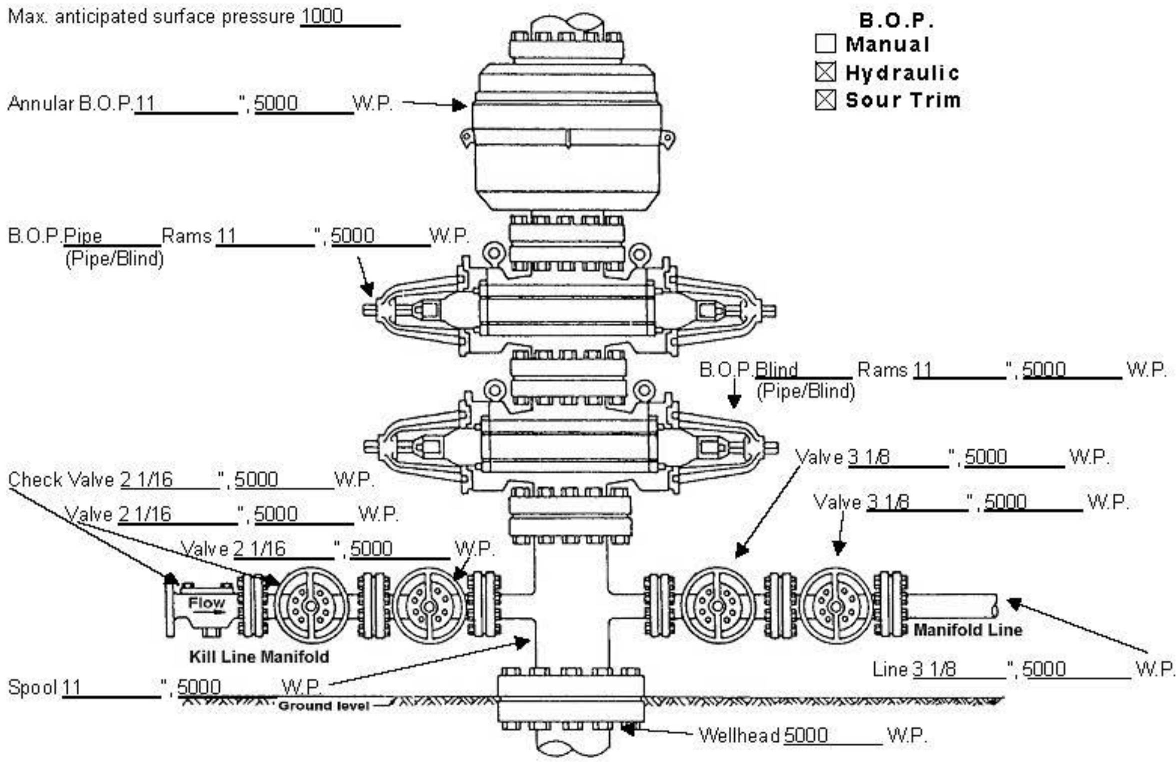
Worksheet supplement for "Application for Permit to Drill or Deepen a Well"

This information is required by authority of Part 615 Supervisor of Wells or Part 625 Mineral Wells, Act 451 PA 1994, as amended, in order to obtain a permit.

Applicant: Michigan Potash Operating, LLC

Well name and number: MPC 8D

The



Fill above blanks with applicable information. If not applicable, enter "N.A." or cross-out item shown.
Describe test pressures and procedure for conducting pressure test. Identify any exceptions to R 324.406 being requested

All BOPS by drilling contractor will be no less than 5000 psi working pressure. Blowout equipment, including the pipe and blind rams, and annular preventor, will be tested to a pressure commensurate with the expected formation pressure and according to EGLE regulations.

Initial BOP test will be conducted after nipping up to the 9 5/8 inch casing and will be pressure tested to 1500 psi for 20 minutes. Subsequent BOP test to be conducted at 72 hour intervals with rams and annular tested to 1500 psi for 20 minutes. Prior notification will be give to the area supervisor/geologist for witness

EQP 7200-04 (Rev. 4/2021)

MPC 8D

Form EQP 7500-3, Environmental Impact Assessment for Mineral Wells and Surface Facilities

Environmental Impact Assessment of Mineral Wells Surface Facilities is presented in/on Form EQP 7500-3; the completed form for the MPC 8D well is presented at the end of this section.

EGLE

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY - OIL, GAS, AND MINERALS DIVISION

ENVIRONMENTAL IMPACT ASSESSMENT FOR MINERAL WELLS AND SURFACE FACILITIES

To be submitted with an application for a well permit pursuant to Part 625, 1994 PA 451, as amended or prior to construction of associated surface facilities located more than 300 feet from the proposed well. Check all boxes and fill in all blanks that apply to the proposed well(s) or proposed surface facility.

This EIA is for (check one)

☒ Well only. Complete Parts A, B, D, E, F, G, H, and I.
☐ Surface facility only (to be constructed more than 300 feet from the well). Complete Parts A1, A2, C, D, E, F, G, H, & I.
☐ Well and surface facility. Complete all Parts.

A. PROJECT DESCRIPTION

1. Applicant
Michigan Potash Operating, LLC

2. Well name and number
MPC 8D

3. Well type
☐ Artificial brine production well
☐ Natural brine production well
☐ Test well greater than 250' deep or penetrating below deepest freshwater aquifer
☐ Blanket test well(s) Number of proposed wells __ Anticipated maximum depth ____________
☒ Processed brine disposal well
☐ Single-source, non-commercial, waste disposal well
☐ Multi-source commercial non-hazardous waste disposal well
☐ Multi-source commercial hazardous waste disposal well
☐ Storage well

4. ☐ **Yes** ☒ **No** **Is this well a replacement for an existing well?**
If Yes, list
Existing well name and number
Current owner
Existing well type and status
Existing well location
Reason for replacement
Disposition of existing well

5. ☐ **Yes** ☒ **No** **Is this well a reentry of an existing well?**
If Yes, list
Existing well name and number
Current owner
Existing well type and status
Reason for reentry

6. ☒ **Yes** ☒ **No** **Is the well expected to encounter hydrogen sulfide (H_2S)?**
If Yes, list formations expected to contain H_2S and anticipated depths to tops of formations
Lucas Formation/Detroit River Group 4170
Dundee Formation - 3945 ft

7. ☒ **Yes** ☐ **No** **Is the well expected to encounter oil or gas?**
If Yes, list formations expected to contain oil or gas and anticipated depths to tops of formations
Antrim (2653 top) 3100' (trace gas)
Traverse Formation Top: 3296, Traverse Lime: 3600' (trace gas)
Reed City Dolomite (Member of Dundee) 3980' (trace gas)

8. ☐ **Yes** ☒ **No** **Will the well be drilled from an existing drill pad?**
If Yes, list well name, number, permit number and status of all existing wells on the drill pad (if no wells, write "none")

Show proposed well and all existing wells on accompanying scale map identified as applying to Part A1 of the EIA.

B. DRILLSITE

1. Drill site access route dimensions 402 feet x 20 feet.
Provide a detailed description of topography, drainage, soil type(s), direction and percentage of slopes, land cover and present land use for the drill site access route. Show route on accompanying scale map labeled **Part B1**. No new access road will need to be constructed for this project. An exsiting drive entrace and acess road will be utilized from 120th Avenue. The existing access road is approximately 402 feet long, 20 feet wide.

2. Drill site dimensions 250 feet x 525 feet.
Provide a detailed description of topography, drainage, soil types(s), direction and percentage of slopes, land cover and present land use for the drill site. Show well site on accompanying scale map labeled **Part B2** Well is located on a hill in a cultivated field. Ground to north drops 8% in 125', drops 16% for 100'; east it rises at 2% for 135' to building, south it is flat for 125', then drops 6% for 100'; west it drops 2% for 100', then drops 9% for 100'. Drainage is N, S & W. Land use is agricultural. Soils are sandy clay loam.

NOTE: If any "Yes" box in items B3, B4, B5, B6, B7 or B8 is checked, the corresponding feature(s) must be identified on an accompanying scale map identified as applying to Part B of the EIA.

3. ☐ **Yes** ☒ **No Are drain tiles present on the drill site?**
If Yes, how they will be handled if they are encountered?

4. Are any of the following located within 600 feet of the proposed wellhead?
☒ Yes ☐ No Buildings
☐ Yes ☒ No Domestic fresh water wells
☒ Yes ☐ No Public roads
☐ Yes ☒ No Railroads
☒ Yes ☐ No Power lines
☐ Yes ☒ No Pipelines
☒ Yes ☐ No Other man-made features (list individual features)

Pond N38W ± 470'	Pole Barn S74E ±136'	Overhead Powerline S75E ±170'
Pond S40W ± 382'	Creek West ±369'	Telephone East ±427'
120th Ave East ±400	Wetland N04E ±299	Overhead Powerline East ±480'

5. Are any of the following located within 800 feet of the proposed wellhead?
☐ Yes ☒ No Type IIB public water wells (Type II is a non-community water supply with ≥ 15 service connections or ≥ 25 individuals for not less than 60 days per year. Type IIB have an average daily water production of less than 20,000 gallons per day)
☐ Yes ☒ No Type III public water wells (Type III is a public water supply which is neither Type I nor type II.)

6. Are any of the following located within 1320 feet of the proposed wellhead?
☒ Yes ☐ No Surface waters and other environmentally sensitive areas
☐ Yes ☒ No Floodplains associated with surface waters
☒ Yes ☐ No Wetlands, as identified by sections 30301 to 30323 of the Act.
☐ Yes ☒ No Natural rivers, as identified by sections 30501 to 30515 of the Act
☐ Yes ☒ No Threatened or endangered species as identified by sections 36501 to 36507 of the Act

7. Are any of the following located within 2000 feet of the proposed wellhead?
☐ Yes ☒ No Type I public water wells (Type I is a community water supply with year-round service, ≥ 15 living units or ≥ 25 residents.)
☐ Yes ☒ No Type IIA public water wells (Type II is a non-community water supply with ≥ 15 service connections or ≥ 25 individuals for not less than 60 days per year. Type IIA have an average daily water production of greater than 20,000 gallons per day)

8. ☐ **Yes** ☒ **No Are Great Lakes shorelines located within 1500 feet of the proposed wellhead?**

9. ☒ **Yes** ☐ **No Will fresh water be used to drill this well?**
If Yes, will the water be supplied from
☐ A "permanent" water well, to be retained after final completion OR used for drinking water (to be drilled and installed pursuant to Part 127 of 1979 PA 368, as amended) **OR**
☐ A "temporary" water well, to be plugged upon final completion and not used for drinking water **OR**
☒ Another source (identify) Private water source to be determine
If No, identify the drilling fluid to be used. Fresh water will be hauled from a pre-registered private water source, possibly water well ID Private water well ID 67000007651, and/or registrations numbers (9325-20242-56 and 9326-20242-18), or others to be determined. It will not be from a municipal source.

10. Drilling fluid pit location and handling and disposal of drill cuttings, muds and fluids

Anticipated depth to groundwater >14' Depth determined by map interpretation

Pit type

☐ On site in-ground pit. Anticipated dimensions: L ___ W ___ D ___

Show proposed pit location on accompanying scale map labeled **Part B10**.

☐ Remote in-ground pit. Anticipated dimensions: L ___ W ___ D ___

Attach approval of landowner and show remote pit location on accompanying scale map labeled **Part B10**.

☒ On-site steel tanks with no in-ground pits (complete 10a and 10d below, do not complete 10b and 10c)

a. ☒ **Yes** ☐ **No Will the well be drilled into or through bedded salt deposits?**

If Yes,

☒ Yes ☐ No Will the drill cuttings contain solid salt?

If Yes, describe plans for handling and disposing of drill cuttings.

Any solid salts will be dissolved via salt washing screen producing brine which will be utilized for drilling and any excess will be disposed of by a licensed waste hauler upon completion.

b. ☐ **Yes** ☐ **No Will the drilling fluid pit contents be solidified after drilling?**

If Yes, identify the pit solidification contractor and pit solidification method.

c. ☐ **Yes** ☐ **No Will the drilling fluid pit contents be removed after drilling?**

If Yes, identify the site for disposal of the removed material.

d. ☒ **Yes** ☐ **No Will any pit fluid be disposed by a licensed liquid waste hauler?**

If Yes, identify the waste hauler.

Waste Management of Michigan, or other licensed liquid waste hauler to be determined

If No, describe disposal plans for pit fluids.

C. SURFACE FACILITY

1. ☒ **Yes** ☐ **No Will the well have associated surface facilities?**

If No, Do not complete the remainder of Part C.

If Yes,

☐ **Yes** ☒ **No Does a surface facility currently exist?**

If Yes, show facility location relative to the wellhead on a scale map labeled Part C1. Do not complete the remainder of Part C.

If No,

☐ **Yes** ☒ **No Has a location for the surface facility been chosen?**

If Yes, complete Parts C2 through C10

If No, at least 60 days prior to beginning construction, submit an EIA for the Surface Facility (this form), a facility plan, and a Soil Erosion and Sedimentation Control Plan (EQP 7200-18) to the Oil, Gas, and Minerals Division District Supervisor.

2. ☐ **Yes** ☐ **No Is the proposed surface facility site more than 300 feet from the wellhead?**

If Yes, complete Parts C3 through c10 and submit a map showing the location of the surface facility site relative to the wellhead.

If No, do not complete the remainder of Part C.

3. Dimensions of surface facility access road: ___feet x ___feet.
Describe the topography, drainage, soil type(s), direction and percentage of slopes, land cover and present land use:

4. Dimensions of surface facility site: ___feet x ___feet.
Describe the topography, drainage, soil type(s), direction and percentage of slopes, land cover and present land use:

NOTE: If any "Yes" box in items C5, C6, C7, C8, C9, or C10 is checked, the corresponding feature(s) must be identified on an accompanying scale map identified as applying to the appropriate section of Part C of the EIA.

5. ☐ **Yes** ☐ **No** **Are drain tiles present on the proposed surface facility site**?
If Yes, discuss how they will be handled if they are encountered?

6. Are any of the following located within 600 feet of the proposed surface facility site?
☐ Yes ☐ No Buildings
☐ Yes ☐ No Domestic fresh water wells
☐ Yes ☐ No Public roads
☐ Yes ☐ No Railroads
☐ Yes ☐ No Power lines
☐ Yes ☐ No Pipelines
☐ Yes ☐ No Other man-made features (list individual features)

7. Are any of the following located within 800 feet of the proposed surface facility site?
☐ Yes ☐ No Type IIB public water wells. (Type II is a non-community water supply with ≥ 15 service connections or ≥ 25 individuals for not less than 60 days per year. Type IIB have an average daily water production of less than 20,000 gallons per day)
☐ Yes ☐ No Type III public water wells. (Type III is a public water supply which is neither Type I nor type II.)

8. Are any of the following located within 1320 feet of the proposed surface facility site?
☐ Yes ☐ No Surface waters and other environmentally sensitive areas
☐ Yes ☐ No Floodplains associated with surface waters
☐ Yes ☐ No Wetlands, as identified by sections 30301 to 30323 of the Act.
☐ Yes ☐ No Natural rivers, as identified by sections 30501 to 30515 of the Act
☐ Yes ☐ No Threatened or endangered species as identified by sections 36501 to 36507 of the Act

9. Are any of the following located within 2000 feet of the proposed surface facility site?
☐ Yes ☐ No Type I public water wells. (Type I is a community water supply with year-round service, ≥ 15 living units or ≥ 25 residents.)
☐ Yes ☐ No Type IIA public water wells (Type II is a non-community water supply with ≥ 15 service connections or ≥ 25 individuals for not less than 60 days per year. Type IIA have an average daily water production of greater than 20,000 gallons per day).

10. ☐ Yes ☐ No **Are Great Lakes shorelines located within 1500 feet of the proposed surface facility site?**

D. FLOWLINE

☒ Yes ☐ No **Will the well have an associated flow line?**

If Yes,

Flow line rout dimensions ___________ feet x Facility and associated flow line route are undetermined at this time.

Show flow line route from well to the surface facility, junction with an existing flowline or gathering system, on a scale map labeled **Part C2.**

Anticipated maximum operating pressure (psig): 2000

Describe leak detection program, including schedules of periodic pressure testing and periodic flowline patrols.

Above ground pipe path with two daily inspections. Real-time presure monitoring and flow rate monitoring at pump house and wellhead via digital transducers and flow meters.

Flow line material: 4-6" Schedule 80 Crete-line pipe

Describe the topography, drainage, soil type(s), direction and percentage of slopes, land cover and present land use along the flow line route. Specific route has not been determined.

☐ Yes ☒ No **Will the flowline be buried?**

If Yes

Burial depth: ______ feet

Describe flowline route marking scheme.

If No, describe measures to protect flowline from vehicular damage.

E. MITIGATION OF IMPACTS FROM DRILLING AND/OR PRODUCTION

Describe additional measures to be taken to protect environmental and/or land use values

Soil erosion and sedimentation control measures will be utilized to control water runoff. The drilling will not curtail the use of the surrounding environment. Minimal long term environmental impact is anticipated. Site was selected to minimize any impact to surrounding low areas and surface use.

F. ADDITIONAL PERMITS

Identify additional permits to be sought None

G. SOIL EROSION AND SEDIMENTATION PLAN

Submit a soil erosion and sedimentation plan (form EQP 7200-18) which addresses **each** well site, surface facility, and flow line route identified in this application. (Refer to requirements under Part 91, 1994 PA 451)

H. ALTERNATE WELL AND SURFACE FACILITY LOCATIONS

Were alternate surface locations considered for this well or surface facility?

☒ No, alternate sites did not seem necessary or more desirable

☐ Yes, the following locations were considered

Why were they rejected in favor of the proposed location?

I. CERTIFICATION

"I state that I am authorized by said applicant to prepare this document. It was prepared under my supervision and direction. The facts stated herein are true, accurate and complete to the best of my knowledge."

Theodore Pagano P.E., P.G.	[signature]	5/1/2024
Name and title (printed or typed)	Authorized Signature	Date

Enclose with *Application For Permit To Drill*

EQP 7500-3 (rev. 5/2019) Page 5 of 5

7 Form EQP 7200-18, Soil Erosion and Sedimentation Control Plan

The Soil Erosion and Sediment Control Plan is presented in/on Form EQP 7200-18; a plat is attached to the form that includes detailed information concerning Soil Erosion and Sedimentation Control during drilling. The Form for the MPC-8D well is presented at the end of this Section.

EGLE MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY – OIL, GAS, AND MINERALS DIVISION

SOIL EROSION & SEDIMENTATION CONTROL PLAN

By authority of Part 91, and Part 615 or Part 625 of Act 451 PA 1994, as amended. Non-submission and/or falsification of this information may result in fines and/or imprisonment. Applicants for multisource commercial hazardous waste disposal wells under Part 625 are required to obtain a Part 91 permit from a county or local enforcing agency

☐ Part 615 Oil/Gas Well ☒ Part 625 Mineral Well

1. Name and address of applicant
Michigan Potash Operating, LLC
600 17th Street, Suite 2300
Denver, CO 80203
Phone: (231) 577-9619 Fax: ( )

2. Well or project name: MPC 8D

3. Well or project location: Section(s) 36 T17N R09W

4. Name and address of County or local Enforcement Agent (CEA)
Osceola County Soil Erosion & Sedimentation Control
22054 Professioinal Drive
Reed City, MI 49677
Phone: (231) 832-6117 Fax: (231) 832-7345

5. Township: Hersey

6. County: Osceola

7. Date earth changes expected to start: Within 30 days of permit issuance, weather permitting

8. Date of expected completion: Within 90 days of well completion, weather permitting

9. Name and address of person responsible for earth change:
Not yet selected
Phone: ( ) Fax: ( )

10. Name and address of person responsible for maintenance:
Mr. Theodore Pagano
600 17th Street, Suite 2300
Denver, CO 80203
Phone: (231) 577-9616 Fax: ( )

11. Send copies of supplemental plat required by Part 615, R 324.201(2)(b) or R 324.504(4), and this form and all attachments, to CEA. For Part 625 Mineral Wells, send to CEA only as instructed by OGMD staff.
Date sent to CEA ______

EARTH CHANGE ACTIVITIES

12. Project description: (Project activities may be permitted sequentially.)

a. Number of well sites 1 , ±2.4 acres
b. Number of surface facility sites 0 , 0 acres
c. New access roads 0 feet, 0 acres
d. Flow line(s) trenched in off well site* 0 feet, 0 acres
e. Flow line(s) plowed in off well site* 0 feet, 0 acres
*Contact CEA for fee schedule

13. Describe sites for which permits are being sought under Part 301 (Inland Lakes & Streams) None
Describe sites for which permits are being sought under Part 303 (Wetlands) None
List file numbers if known ______

14. Attach detail map at scale of 1"=200' or larger, with contour lines at a minimum of 20' intervals OR percent slope descriptions.

15. Areas requiring control structures

Will earth changes occur in areas with slopes of 10% or greater; areas where runoff water is likely, such as runs greater than 500' of moderate slope (5% to 10%), narrow valley bottoms, etc.; areas within 500' of a lake or stream; or other areas where sedimentation to a wetland or drainage way may occur?
☒ Yes ☐ No

Indicate any of the following erosion control structures that will be utilized. Identify location on detail map and attach detail plan. Indicate on plan whether erosion control structures are temporary or permanent.

☐ Diversions ☐ Culverts ☒ Sediment basins ☒ Silt fences ☐ Rip-rap ☒ Berms ☐ Check dams
☐ Other ______

16. Site restoration
☒ Topsoil will be segregated from subsoil and stockpiled OR ☐ No topsoil on site
☒ Recontour and revegetate as soon as weather permits. Seed mix per land owners request
☐ Describe other proposed methods of restoration ______

17. Application prepared by (name) Signature Date
I. Dean Geers, Agent, Atwell

FOR USE OF COUNTY OR LOCAL ENFORCING AGENT

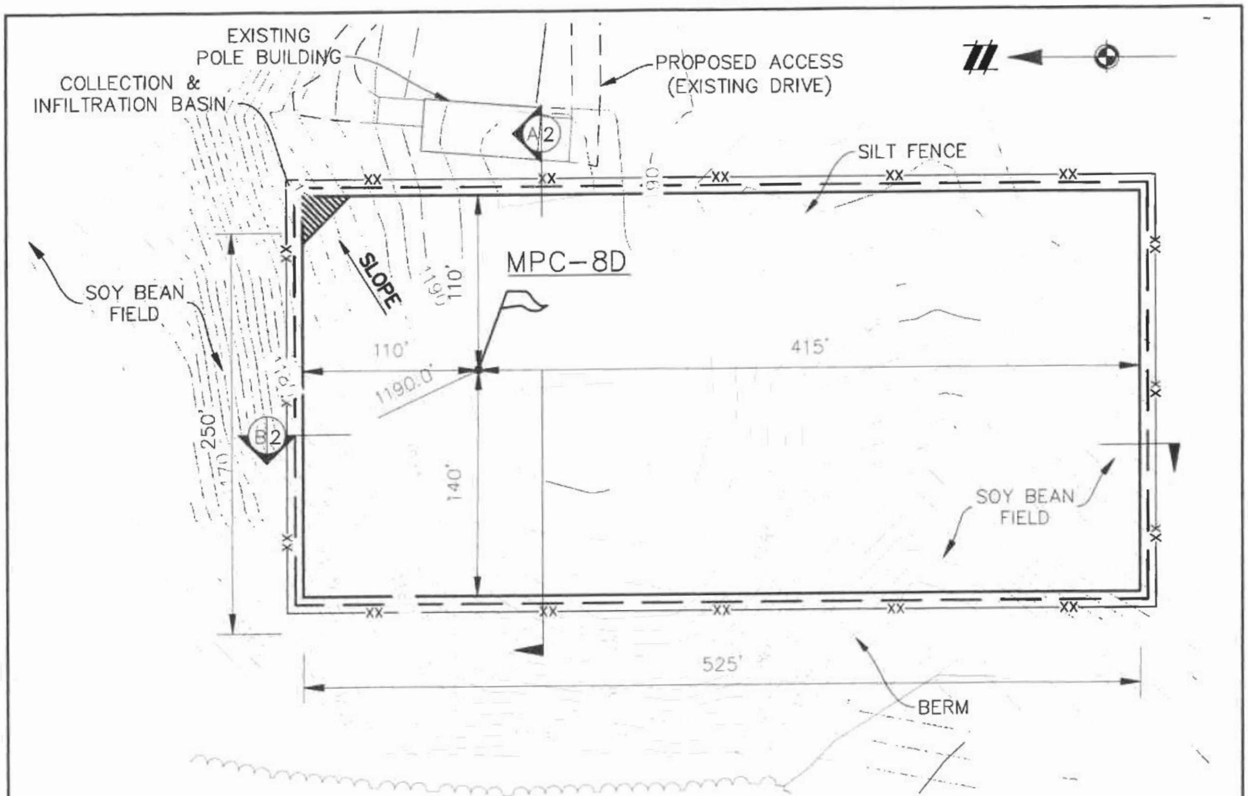
INSTRUCTIONS TO COUNTY OR LOCAL ENFORCMENT AGENT: Copies of supplemental plat required by Part 615, R324.201(2)(b) or R324.504(4), and this form and all attachments are provided for CEA review and informational purposes only. For activities issued under Part 615, local permitting for SESC is not necessary; OGMD staff will evaluate and enforce SESC measures (SEE R324.9115 (3) of Part 91, Soil Erosion and Sedimentation Control, NREPA, PA 451 of 1994). Submittal to CEA is not a requirement under Part 615 or 625. Part 615 and 625 Permits to Drill and Operate include erosion control plan approval for well sites, access roads, flow lines, and surface facilities. Return this form to the applicable field or district office of the Oil, Gas, and Minerals Division (OGMD) within 30 days of receipt. OGMD will consider all comments and recommendations in reviewing the application.

17. Comments

☐ Conducted on-site inspection Date ______ ☐ Inspected site with representative of applicant Date ______

CEA (name) ______ Date ______

EQP 7200-18 (rev. 5/2019) ENCLOSE WITH APPLICATION FOR PERMIT TO DRILL



NOTES:

1.) EROSION AND SEDIMENTATION CONTROL DEVICES SHALL BE IN PLACE PRIOR TO START OF GRADING OPERATIONS.

2.) EROSION AND SEDIMENTATION CONTROL DEVICES SHALL BE CLEANED AND/OR REPLACED WHEN THEY REACH 40% CAPACITY (INCLUDING INFILTRATION BASIN).

3.) ALL EROSION AND SEDIMENTATION CONTROL MEASURES SHALL BE INSTALLED PER ACT 347, P.A.1972 AS AMENDED.

4.) SET ELEVATIONS FOR WELL PAD TO MINIMIZE MASS GRADING QUANTITY (1190'±).

5.) SLOPE WELL PAD NORTHEASTERLY AT ±2% TO MAINTAIN A WELL DRAINED WORK AREA DURING DRILLING OPERATIONS.

6.) A COLLECTION & INFILTRATION BASIN SHALL BE CONSTRUCTED AT THE NORTHEAST CORNER OF PAD IF NEEDED.

7.) SLOPES SHALL BE FINE GRADED TO MAXIMUM SLOPE TO 2:1 TO MINIMIZE EROSION. IN ALL FILL AREAS, THE EDGES SHALL BE DIKED TO PREVENT EROSION. CUT SLOPES SHALL BE CONTOURED AND COMPACTED.

8.) AN UPSLOPE DIVERSION BERM AND DIVERSION CHANNEL SHALL BE CONSTRUCTED ALONG THE SOUTH AND WEST SIDES OF THE LOCATION.

9.) ARMOR, SILT FENCING OR OTHER SOIL EROSION CONTROL MEASURES SHALL BE UTILIZED AS NEEDED.

10.) ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED FOLLOWING THE COMPLETION OF GRADING OPERATIONS, WEATHER PERMITTING.

EROSION CONTROL PLAN: MPC-8D SEC.36, T17N-R9W HERSEY TWP. OSCEOLA COUNTY, MICHIGAN	DATE: 05/19/22 DRN: MLC	ATWELL 866.850.4200 www.atwell-group.com 7192 EAST 34 ROAD, SUITE 4 CADILLAC, MI 49601 231.775.3000		
CLIENT: MICHIGAN POTASH OPERATING	SCALE: 1"=100'	F.B. 1427 PAGE. 7	SHEET 1 OF 2	JOB NO.: 14001984.24

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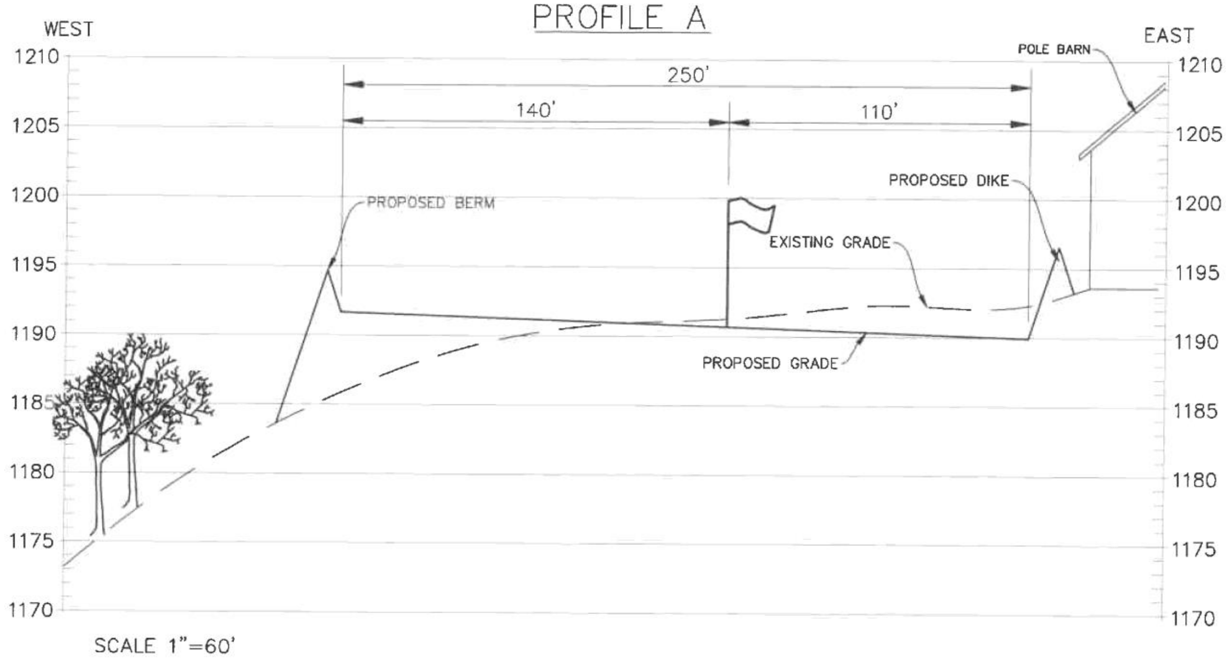
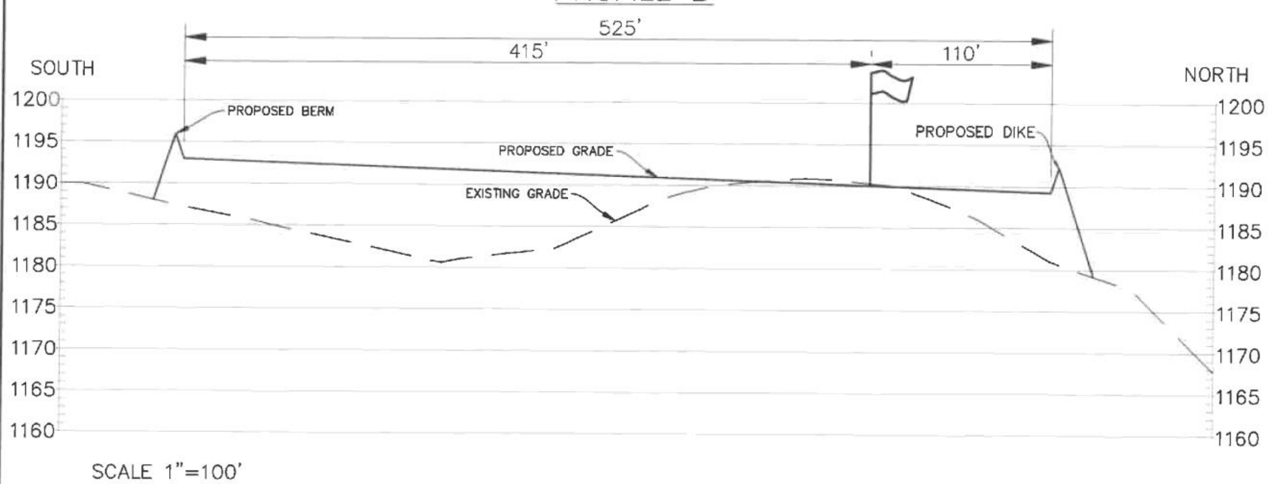
MPC 8D

PROFILE A



PROFILE B



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EROSION CONTROL PLAN: MPC-8D
SEC. 36, T17N-R9W
HERSEY TWP.
OSCEOLA COUNTY, MICHIGAN

CLIENT: MICHIGAN POTASH OPERATING

DATE: 05/19/22
DRN: MLC
SCALE: AS SHOWN

ATWELL
866.850.4200 www.atwell-group.com
7192 EAST 34 ROAD, SUITE 4
CADILLAC, MI 49601
231.775.3000

F.B. 1427
PAGE. 7
SHEET 2 OF 2
JOB NO.: 14001984.24

8 Provide a conformance bond.

Michigan Potash Operating, LLC has a blanket bond for disposal, storage, or brine production. The bond number is DEPN0114507721.

9 The permit application fee as specified by statute.

Michigan Potash Operating, LLC has paid the $500 for a disposal well for processed brine. The receipt is below.

10 An organization report, form EQP 7200-13, if not on file with the supervisor.

Michigan Potash Operating, LLC has form EQP 7200-13 filed with EGLE.

11 Description of the drilling program, including the drilling fluid and mud program, how the fluids will be handled and ultimate disposition of the drilling fluids. Include a discussion of whether over pressured zones are anticipated and how the mud program will be modified to accommodate such a condition.

The proposed injection wells will be drilled and cased according to the following detailed construction procedure.

Construction Procedure:

1. Provide 48 hour notice of move in rig up to all regional, State, and Federal authorities.
2. Drive 20" conductor casing to 71'
3. Move in Rig Up drilling rig
4. Pick up BHA and drill the 12-1/4" surface hole to 900'.
5. Run and cement 9-5/8" surface casing
6. WOC for 12 hours, Nipple up 5K BOPE and pressure test.
7. PU 8-3/4" bit and BHA, drill to KOP, TOOH (See directional plan, no anti-collision is required.
8. PU directional assembly, RIH and drill curve, TOOH.
9. Run 7" 23# L80 BTC casing to surface and cement.
10. WOC 12 hours, run CBL.
11. PU new directional BHA and drill the 6 1/8" hole to TD (Total Depth), TOOH.
12. Run 4.5" casing and slotted liner. A liner hanger will be placed at or near 3,900' MD or 3,850' TVD.
13. PU production packer and set just above the liner hanger.
14. PU and run the 4-1/2" non slotted production tubing and land in the production packer assembly.
15. Install tubing hanger, install tree, and pressure test.
16. Rig down move out Drilling Unit.

Stimulation Procedure:

1. MIRU coil tubing unit and acid treatment. Various concentration of HCl will be used based on the lithology of the proposed injection zone. Higher concentrations of HCl will be utilized for dolomite.
2. RIH to toe, spot acid pill(s) while pulling to heel.
3. Pump 1,000 gallon increments of 15% HCl into the well.
   a. Pump occasional 50 gallons of soap in the well if hydrocarbon plugging is suspected
   b. Displace acid pills by pressuring up back side and pumping salt water for displacement.
   c. Repeat as necessary to treat the horizontal leg.
   d. Initiate injection tests.

Proposed Injectivity Step Rate Test:

Run Step Rate injection test as follows:

a. Install a calibrated pressure gauge and recorder on the discharge line of the pump.
b. Pump water into well at increasing rates and pressure, obtaining stabilized injection pressures. The duration of this test will be variable. Record rates, pressures, and time duration of entire test.
c. Plot data and determine formation parting pressure.

Conduct pressure fall-off test. After injection test is completed, shut well in and record the pressure until a stabilized pressure is obtained, or pressure drops below zero gauge pressure. If it is below zero gauge pressure, measure the fluid level. If test results prove unsatisfactory, additional stimulation may be done to improve the effective permeability at the well bore. This may include additional acid treatment.

Proposed Mud Program

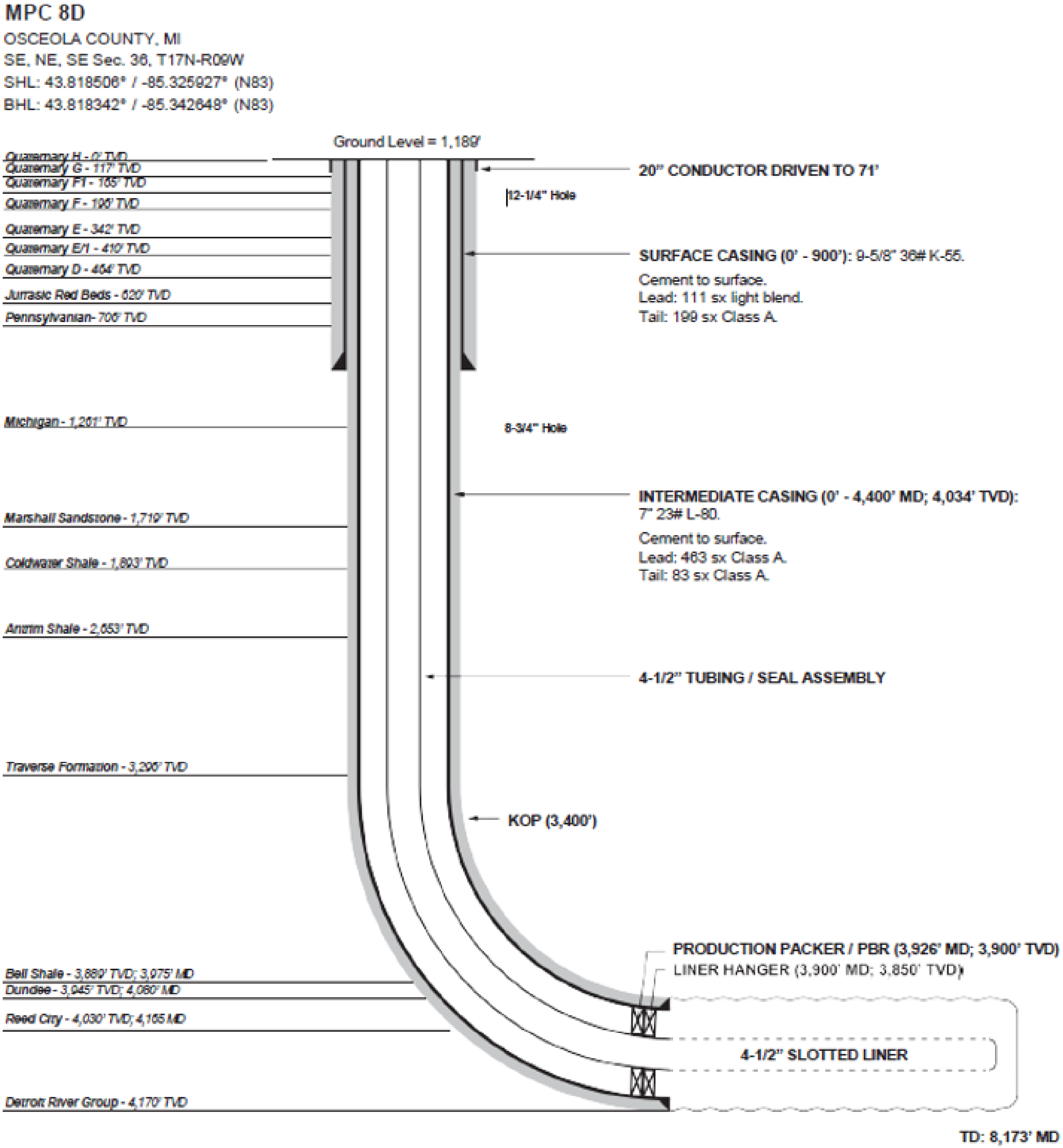
All drilling is to be done via a closed loop circulation system. Any solid salts brought to surface will be dissolved via a salt washing screen, which will dissolve residual salt, or salt on the cuttings with freshwater, tuning the salt to brine. The brine will then be stored on location specifically for another well. All cuttings are to be dried on location and hauled directly to a landfill as necessary.

No over pressured zones are anticipated, however appropriate materials will be kept on site to address any unanticipated pressure if the need arises.

The drilling fluid will consist of a 9.0 – 9.6+ ppg water based mud system with 40-50 viscosity units and less than 10 fluid loss units. LCM pills will be pumped when required. Barite will be on location if any pressure is encountered. At TD the hole will be circulated clean with 2-3 sweeps.

MPC 8D

Proposed Wellbore Diagram for MPC 8D



MPC 8D

MICHIGAN POTASH OPERATING, LLC

Proposed Directional Plan:

MICHIGAN POTASH OPERATING

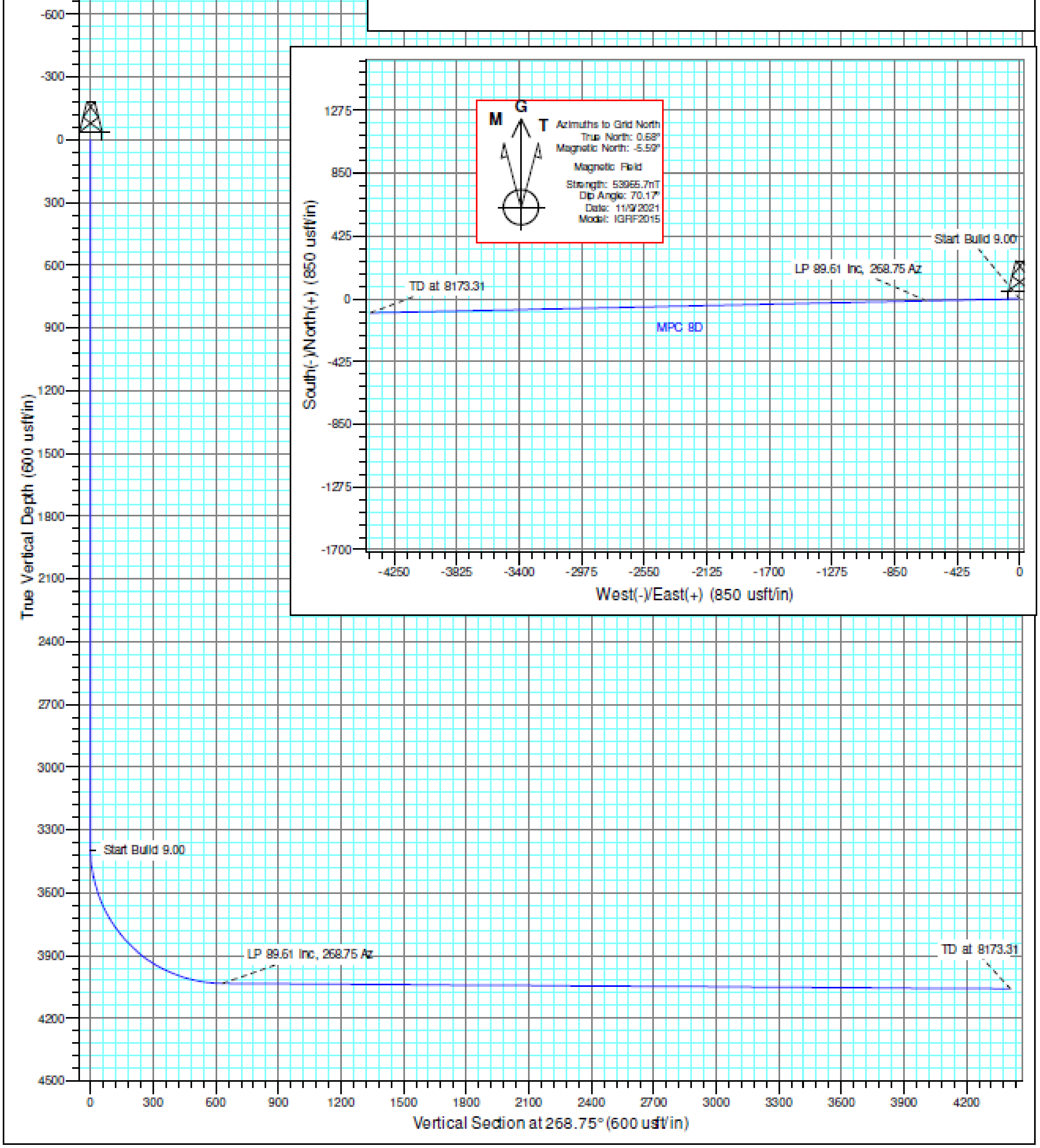
Well Name: MPC 8D
Surface Location: PAD 3
North American Datum 1983
US State Plane 1983 , Michigan Central Zone
Ground Elevation: 1189.70
WELL @ 1202.70usft (Original Well Elev)

+N/-S	+E/-W	Northing	Easting	Latittude	Longitude	Slot
0.00	0.00	184460.938	19431788.685	43.818506	-85.325927	

Project: Oscoda County, MI (NAD83) MICZ
Site: PAD 3
Well: MPC 8D
Wellbore: Wellbore #1
Design: Design #1

ANNOTATIONS

MD	Inc	Azi	TVD	+N/-S	+E/-W	VSect	Departure	Annotation
3397.69	0.00	0.00	3397.69	0.00	0.00	0.00	0.00	Start Build 9.00
4393.36	89.61	268.75	4034.30	-13.76	-632.14	632.29	632.29	LP 89.61 Inc, 268.75 Az
8173.31	89.61	268.75	4060.00	-96.04	-4411.10	4412.15	4412.15	TD at 8173.31



MICHIGAN POTASH OPERATING

MICHIGAN POTASH OPERATING, LLC

Osceola County, MI (NAD83) MICZ
PAD 3
MPC 8D

Wellbore #1

Plan: Design #1

Standard Planning Report - Geographic

10 November, 2021

MICHIGAN POTASH OPERATING

Planning Report - Geographic

Database:	EDM 5000.15 Single User Db	**Local Co-ordinate Reference:**	Well MPC 8D
Company:	MICHIGAN POTASH OPERATING, LLC	**TVD Reference:**	WELL @ 1202.70usft (Original Well Elev)
Project:	Osceola County, MI (NAD83) MICZ	**MD Reference:**	WELL @ 1202.70usft (Original Well Elev)
Site:	PAD 3	**North Reference:**	Grid
Well:	MPC 8D	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Design #1		

Project	Osceola County, MI (NAD83) MICZ		
Map System:	US State Plane 1983	**System Datum:**	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Michigan Central Zone		

Site	PAD 3				
Site Position:		**Northing:**	184,460.938 usft	**Latitude:**	43.818506
From:	Map	**Easting:**	19,431,788.665 usft	**Longitude:**	-85.325927
Position Uncertainty:	0.00 usft	**Slot Radius:**	13-3/16 "	**Grid Convergence:**	-0.68 °

Well	MPC 8D					
Well Position	**+N/-S**	0.00 usft	**Northing:**	184,460.938 usft	**Latitude:**	43.818506
	+E/-W	0.00 usft	**Easting:**	19,431,788.665 usft	**Longitude:**	-85.325927
Position Uncertainty		0.00 usft	**Wellhead Elevation:**		**Ground Level:**	1,189.70 usft

Wellbore	Wellbore #1				
Magnetics	**Model Name**	**Sample Date**	**Declination (°)**	**Dip Angle (°)**	**Field Strength (nT)**
	IGRF2015	11/9/2021	-6.27	70.17	53,965.68328693

Design	Design #1				
Audit Notes:					
Version:		**Phase:**	PLAN	**Tie On Depth:**	0.00
Vertical Section:	**Depth From (TVD) (usft)**	**+N/-S (usft)**	**+E/-W (usft)**	**Direction (°)**	
	0.00	0.00	0.00	268.75	

Plan Survey Tool Program **Date** 11/10/2021

	Depth From (usft)	Depth To (usft)	Survey (Wellbore)	Tool Name	Remarks
1	0.00	8,173.31	Design #1 (Wellbore #1)	MWD OWSG MWD - Standard	

Plan Sections

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3,397.69	0.00	0.00	3,397.69	0.00	0.00	0.00	0.00	0.00	0.00	
4,393.36	89.61	268.75	4,034.30	-13.76	-632.14	9.00	9.00	0.00	268.75	
8,173.31	89.61	268.75	4,060.00	-96.04	-4,411.10	0.00	0.00	0.00	0.00	BHL MPC 8D

MICHIGAN POTASH OPERATING

Planning Report - Geographic

Database:	EDM 5000.15 Single User Db	**Local Co-ordinate Reference:**	Well MPC 8D
Company:	MICHIGAN POTASH OPERATING, LLC	**TVD Reference:**	WELL @ 1202.70usft (Original Well Elev)
Project:	Osceola County, MI (NAD83) MICZ	**MD Reference:**	WELL @ 1202.70usft (Original Well Elev)
Site:	PAD 3	**North Reference:**	Grid
Well:	MPC 8D	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Design #1		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
0.00	0.00	0.00	0.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
100.00	0.00	0.00	100.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
200.00	0.00	0.00	200.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
300.00	0.00	0.00	300.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
400.00	0.00	0.00	400.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
500.00	0.00	0.00	500.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
600.00	0.00	0.00	600.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
700.00	0.00	0.00	700.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
800.00	0.00	0.00	800.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
900.00	0.00	0.00	900.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,000.00	0.00	0.00	1,000.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,100.00	0.00	0.00	1,100.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,200.00	0.00	0.00	1,200.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,300.00	0.00	0.00	1,300.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,400.00	0.00	0.00	1,400.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,500.00	0.00	0.00	1,500.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,600.00	0.00	0.00	1,600.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,700.00	0.00	0.00	1,700.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,800.00	0.00	0.00	1,800.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
1,900.00	0.00	0.00	1,900.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,000.00	0.00	0.00	2,000.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,100.00	0.00	0.00	2,100.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,200.00	0.00	0.00	2,200.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,300.00	0.00	0.00	2,300.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,400.00	0.00	0.00	2,400.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,500.00	0.00	0.00	2,500.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,600.00	0.00	0.00	2,600.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,700.00	0.00	0.00	2,700.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,800.00	0.00	0.00	2,800.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
2,900.00	0.00	0.00	2,900.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
3,000.00	0.00	0.00	3,000.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
3,100.00	0.00	0.00	3,100.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
3,200.00	0.00	0.00	3,200.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
3,300.00	0.00	0.00	3,300.00	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
3,397.69	0.00	0.00	3,397.69	0.00	0.00	184,460.938	19,431,788.665	43.818506	-85.325927
Start Build 9.00									
3,400.00	0.21	268.75	3,400.00	0.00	0.00	184,460.938	19,431,788.661	43.818506	-85.325927
3,500.00	9.21	268.75	3,499.56	-0.18	-8.20	184,460.760	19,431,780.464	43.818505	-85.325958
3,600.00	18.21	268.75	3,596.61	-0.69	-31.87	184,460.244	19,431,756.797	43.818503	-85.326048
3,700.00	27.21	268.75	3,688.77	-1.53	-70.42	184,459.405	19,431,718.243	43.818499	-85.326194
3,800.00	36.21	268.75	3,773.75	-2.68	-122.91	184,458.262	19,431,665.751	43.818494	-85.326393
3,900.00	45.21	268.75	3,849.48	-4.09	-188.05	184,456.844	19,431,600.613	43.818488	-85.326640
4,000.00	54.21	268.75	3,914.08	-5.75	-264.23	184,455.186	19,431,524.434	43.818481	-85.326928
4,100.00	63.21	268.75	3,965.97	-7.61	-349.58	184,453.328	19,431,439.089	43.818473	-85.327251
4,200.00	72.21	268.75	4,003.86	-9.62	-441.98	184,451.316	19,431,346.680	43.818465	-85.327601
4,300.00	81.21	268.75	4,026.83	-11.74	-539.18	184,449.200	19,431,249.482	43.818456	-85.327969
4,393.36	89.61	268.75	4,034.30	-13.76	-632.14	184,447.176	19,431,156.524	43.818447	-85.328321
LP 89.61 Inc, 268.75 Az									
4,400.00	89.61	268.75	4,034.34	-13.91	-638.78	184,447.031	19,431,149.889	43.818447	-85.328346
4,500.00	89.61	268.75	4,035.02	-16.08	-738.75	184,444.855	19,431,049.915	43.818438	-85.328725
4,600.00	89.61	268.75	4,035.70	-18.26	-838.72	184,442.678	19,430,949.941	43.818428	-85.329104
4,700.00	89.61	268.75	4,036.38	-20.44	-938.70	184,440.502	19,430,849.967	43.818419	-85.329482
4,800.00	89.61	268.75	4,037.06	-22.61	-1,038.67	184,438.325	19,430,749.993	43.818410	-85.329861
4,900.00	89.61	268.75	4,037.74	-24.79	-1,138.65	184,436.148	19,430,650.019	43.818401	-85.330239

MICHIGAN POTASH OPERATING

Planning Report - Geographic

Database:	EDM 5000.15 Single User Db	**Local Co-ordinate Reference:**	Well MPC 8D
Company:	MICHIGAN POTASH OPERATING, LLC	**TVD Reference:**	WELL @ 1202.70usft (Original Well Elev)
Project:	Osceola County, MI (NAD83) MICZ	**MD Reference:**	WELL @ 1202.70usft (Original Well Elev)
Site:	PAD 3	**North Reference:**	Grid
Well:	MPC 8D	**Survey Calculation Method:**	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Design #1		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Map Northing (usft)	Map Easting (usft)	Latitude	Longitude
5,000.00	89.61	268.75	4,038.42	-26.97	-1,238.62	184,433.972	19,430,550.045	43.818391	-85.330618
5,100.00	89.61	268.75	4,039.10	-29.14	-1,338.59	184,431.795	19,430,450.071	43.818382	-85.330997
5,200.00	89.61	268.75	4,039.78	-31.32	-1,438.57	184,429.619	19,430,350.097	43.818373	-85.331375
5,300.00	89.61	268.75	4,040.46	-33.50	-1,538.54	184,427.442	19,430,250.123	43.818364	-85.331754
5,400.00	89.61	268.75	4,041.14	-35.67	-1,638.52	184,425.266	19,430,150.149	43.818354	-85.332132
5,500.00	89.61	268.75	4,041.82	-37.85	-1,738.49	184,423.089	19,430,050.175	43.818345	-85.332511
5,600.00	89.61	268.75	4,042.50	-40.03	-1,838.46	184,420.912	19,429,950.201	43.818336	-85.332890
5,700.00	89.61	268.75	4,043.18	-42.20	-1,938.44	184,418.736	19,429,850.227	43.818327	-85.333268
5,800.00	89.61	268.75	4,043.86	-44.38	-2,038.41	184,416.559	19,429,750.253	43.818318	-85.333647
5,900.00	89.61	268.75	4,044.54	-46.56	-2,138.39	184,414.383	19,429,650.279	43.818308	-85.334026
6,000.00	89.61	268.75	4,045.22	-48.73	-2,238.36	184,412.206	19,429,550.305	43.818299	-85.334404
6,100.00	89.61	268.75	4,045.90	-50.91	-2,338.33	184,410.030	19,429,450.331	43.818290	-85.334783
6,200.00	89.61	268.75	4,046.58	-53.09	-2,438.31	184,407.853	19,429,350.357	43.818281	-85.335161
6,300.00	89.61	268.75	4,047.26	-55.26	-2,538.28	184,405.677	19,429,250.383	43.818271	-85.335540
6,400.00	89.61	268.75	4,047.94	-57.44	-2,638.26	184,403.500	19,429,150.409	43.818262	-85.335919
6,500.00	89.61	268.75	4,048.62	-59.61	-2,738.23	184,401.323	19,429,050.435	43.818253	-85.336297
6,600.00	89.61	268.75	4,049.30	-61.79	-2,838.20	184,399.147	19,428,950.461	43.818244	-85.336676
6,700.00	89.61	268.75	4,049.98	-63.97	-2,938.18	184,396.970	19,428,850.487	43.818234	-85.337054
6,800.00	89.61	268.75	4,050.66	-66.14	-3,038.15	184,394.794	19,428,750.513	43.818225	-85.337433
6,900.00	89.61	268.75	4,051.34	-68.32	-3,138.13	184,392.617	19,428,650.539	43.818216	-85.337812
7,000.00	89.61	268.75	4,052.02	-70.50	-3,238.10	184,390.441	19,428,550.565	43.818207	-85.338190
7,100.00	89.61	268.75	4,052.70	-72.67	-3,338.07	184,388.264	19,428,450.591	43.818197	-85.338569
7,200.00	89.61	268.75	4,053.38	-74.85	-3,438.05	184,386.087	19,428,350.617	43.818188	-85.338947
7,300.00	89.61	268.75	4,054.06	-77.03	-3,538.02	184,383.911	19,428,250.643	43.818179	-85.339326
7,400.00	89.61	268.75	4,054.74	-79.20	-3,638.00	184,381.734	19,428,150.669	43.818170	-85.339705
7,500.00	89.61	268.75	4,055.42	-81.38	-3,737.97	184,379.558	19,428,050.695	43.818160	-85.340083
7,600.00	89.61	268.75	4,056.10	-83.56	-3,837.94	184,377.381	19,427,950.721	43.818151	-85.340462
7,700.00	89.61	268.75	4,056.78	-85.73	-3,937.92	184,375.205	19,427,850.747	43.818142	-85.340840
7,800.00	89.61	268.75	4,057.46	-87.91	-4,037.89	184,373.028	19,427,750.773	43.818132	-85.341219
7,900.00	89.61	268.75	4,058.14	-90.09	-4,137.87	184,370.851	19,427,650.799	43.818123	-85.341598
8,000.00	89.61	268.75	4,058.82	-92.26	-4,237.84	184,368.675	19,427,550.825	43.818114	-85.341976
8,100.00	89.61	268.75	4,059.50	-94.44	-4,337.81	184,366.498	19,427,450.851	43.818105	-85.342355
8,173.31	89.61	268.75	4,060.00	-96.04	-4,411.10	184,364.903	19,427,377.561	43.818098	-85.342632
TD at 8173.31 - BHL MPC 8D									

Design Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
BHL MPC 8D - plan hits target center - Point	0.00	360.00	4,060.00	-96.04	-4,411.10	184,364.903	19,427,377.561	43.818098	-85.342632

Plan Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates +N/-S (usft)	Local Coordinates +E/-W (usft)	Comment
3,397.69	3,397.69	0.00	0.00	Start Build 9.00
4,393.36	4,034.30	-13.76	-632.14	LP 89.61 Inc, 268.75 Az
8,173.31	4,060.00	-96.04	-4,411.10	TD at 8173.31

12 Description of the cementing program including the type, properties and compressive strength of cement to be used on each casing string. Indicate if DV tools will be used.

Please see 3 Form EQP 7200-1.

The 7" casing will be set at the bottom of the curve and cemented back to surface.

Surface Casing Cement:
Lead: 111 sk Lite Blend 6% Gel, 3% $CaCl_2$, 1.69 cuft/sk
Tail: 199 sk Class A 1/18 cuft/sk (50% excess)

Long Casing Cement:
Lead: 463 Class A 1.47 cuft/ft = 782 cuft
Tail: 83 sk Class A 1.18 cuft/sk = 880 cuft (30% excess)

If there are lost circulation problems a LCM might be added.

No DV tool will be used.

Compressive Strength = 2400 psi at 24 hrs

To Estimated TOC = Surface

The 4.5" injection string will not be cemented.

13 Description of the proposed wireline logging program.7200-14

During drilling, a MWD gamma ray log will be ran. It will also take a temperature reading.

CDL-CNL-GR and GR-IDL are anticipated.

A CBL will be ran to determine the top of cement.

14 Description of the testing program, including pressure tests on casing strings, and any planned drill stem tests.

The mechanical integrity of the production string on all the proposed injection wells will be tested according to the requirements of R 299.2391, Part 625. All testing shall also be in compliance with United States EPA 40 CFR 146.8(c)(3-4). Operating tests for mechanical integrity shall be conducted at the required frequency and dictated by permit and according to pro-active best practice.

Notice will be made to the EGLE prior to the date of the schedule MIT. Tests must be witnessed by a representative of EGLE. A written report of the results of the MIT will be made to EGLE within 45 days following completion of the MIT.

No drill stem test will be performed.

15 Description of any planned coring program.

There are no cores planned on the subject well.

Additional Information required for an application for a permit to drill and operate a disposal well or to convert a previously drilled well to such a well.

MPC 8D

MICHIGAN POTASH OPERATING, LLC

1 Form EQP 7200-14, Injection Well Data.

EGLE MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY - OIL, GAS, AND MINERALS DIVISION

INJECTION WELL DATA

Supplemental information for drilling or converting to an injection well
By authority of Part 615 or Part 625 of Act 451 PA 1994, as amended.
Non-submission and/or falsification of this information may result in fines and/or imprisonment.

INSTRUCTIONS: Complete all portions of form which apply to this well.
Attach supplemental documents as needed.

Applicant: Michigan Potash Operating, LLC

Well name and number: MPC-8D

1. Notification information: provide name and address of the permittee of each oil, gas, and injection well and permitted location(s) within 1,320 feet of this proposed well, and the name and address of the last surface owner(s) of record within 1,320 feet of this proposed well.
2. File a separate plat which identifies the depth and location of this proposed well and all oil, gas, injection, and abandoned well within 1,320 feet. Also identify the permittee of each producing well within 1,320 feet of this proposed well, the surface owner(s) of record of the lands within 1,320 feet of this proposed well, and all freshwater, irrigation, and public water supply wells within 1,320 feet of this proposed well.
3. Enclose a copy of the completion reports for all wells and the plugging records for all plugged wells shown on the plat. Identify what steps will be necessary to prevent injected fluids from migrating up or into inadequately plugged or completed wells.
4. If this is an existing well to be converted to an injection well, enclose this form with a full permit application package per EQC 7200. Also enclose a copy of the completion report and geologic description and electric logs for this well.
5. Identify and describe all faults, structural features, karst, mines, and lost circulation zones within the area of review that can influence fluid migration, well competency, or induced seismicity. Include a plan for mitigating risks of identifiable features.
6. Attach a proposed plugging and abandonment plan (EQP 7200-6), along with a schematic detailing the depths, volumes, and types of cement and mechanical plugs, and depths where casing will be recovered.
7. Provide information demonstrating that construction of the well will prevent the movement of fluid that causes endangerment to an Underground Source of Drinking Water (USDW).

8. Type of fluids to be injected
☒ Brine ☐ Natural Gas (omit #10 & #15)
☐ Fresh Water (omit #15) ☐ Other ____

9. Maximum anticipated daily injection rate (bbls/day or MCF/day)
40,115 bbls/day

10. Specific gravity of injected fluid 1.20 w/0.05 safety factor = 1.25

11a. Maximum anticipated injection pressure 1,028 psi

11b. Maximum injection pressure 1,028 psi @ 0.8 FPG

Show calculations (see R324.807) Mineral Well/Part 625

[{0.8-(0.433*(1.2+0.05))}*4030]-14.7 = 1,028 psi

12. Maximum bottom hole injection pressure 3,209 psi

Show calculations Hyd Head = .433*1.25*4030 = 2,181 psi

[{0.8-(0.433*(1.2+0.05))}*4030]-14.7 + 2,181 = 3,209 psi

13. Fracture pressure of confining interval 3,111 psi

Show calculations (Top of Confining Interval)

0.8 psi/ft * 3889 ft = 3,111 psi

14. Fracture pressure of injection interval 3,224 psi

Show calculations (Top of Injection Interval)

0.8 psi/ft * 4,030 ft = 3224 (offsets demonstrate 4,030*1.17=4715)

15. Chemical analysis of representative samples of injected fluid

Specific conductance TBD

Cation (mg/l)		Anions (mg/l)	
Calcium	<0.2 %	Chloride	Var
Sodium	Var	Sulfate	<0.4%
Magnesium	<0.2 %	Sulfide	<30 mg/l
Total Iron	<10 mg/l	Carbonate	<1 mg/l
Barium	< 8 mg/l	Bicarbonate	<220 mg/l

What was the source of this representative sample? Adjacent well

16. Is this well to be completed in a potential, previous, or current oil or gas producing formation? ☐ Yes ☒ No

If yes, provide a list of all offset permittees and proof of service of notification of this application to all permittees by certified mail.

Schematic of wellbore construction

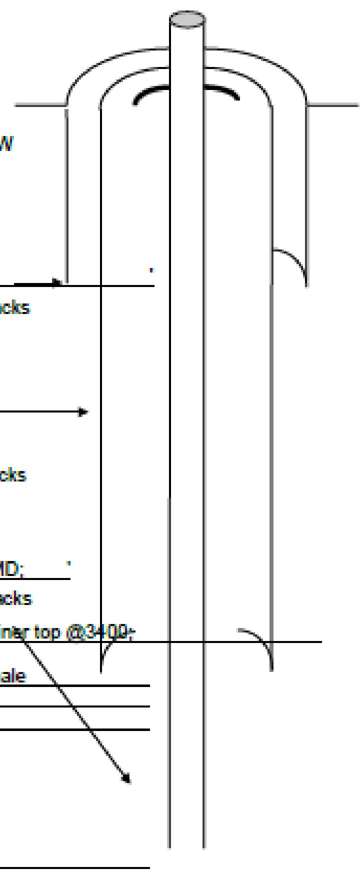
Complete bottom of diagram as needed to conform with proposed construction (e.g. show rat hole below casing, open hole completion, packer loc. etc.)

Underground Source(s) of Drinking Water formation name(s), top & bottom depths

USDW(s) Glacial till

Depth to top 0

Depth to base 620



Vertical distance (in feet) between top of injection interval and base of deepest USDW

3,269'

Surface casing 9 5/8 " x 900 '

Amount of cement 310 sacks

T.O.C. 0

Intermediate casing (if applicable)

-- " x -- '

Amount of cement -- sacks

T.O.C. --

Long string casing 7 " x 4400'MD; '

Amount of cement 546 sacks

T.O.C. GL- Liner Hanger and 4.5" slotted liner top @3400;

Confining Interval(s) Dundee Lime / Bell Shale

Depth to top 3,889' (TVD)

Depth to base 3,945' (TVD)

Injection Interval(s) Reed City

Depth to top 4,030 (TVD)

Depth to base 4170 '(TVD)

Tubing ____ " x ____ '

Packer Depth Packer: 3400';

Bottom TD or PBTD 4060 TVD, 8173 MD ft

17. Application prepared by (print or type): Theodore Pagano, P.E., P.G.

Signature [signature]

Date May 1st, 2024

EQP 7200-14 (rev. 5/2019) Enclose with *APPLICATION FOR PERMIT TO DRILL* or CONVERT

MPC 8D

1. Notification information: provide name and address of the permittee of each oil, gas, and injection well and permitted location(s) within 1,320 feet of this proposed well, and the name and address of the last surface owner(s) of record within 1,320 feet of this proposed well.

There are no oil, gas, or injection operators, or permitted locations within 1,320 feet of the proposed well.

The MPC 3D is a permitted location located to the N-NE approximately 1,490 feet.

Surface Owner and Mailing Address within 1320 feet of the Proposed Well

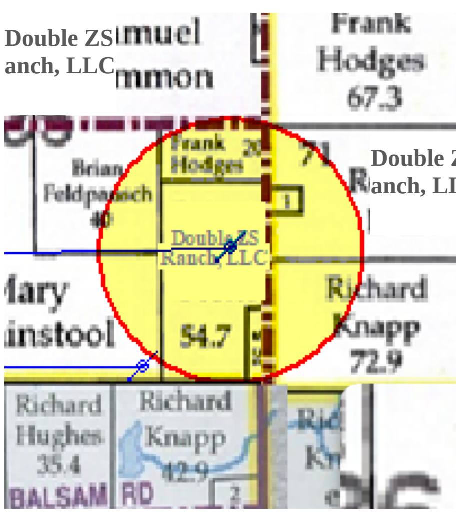
Mary E. Brininstool, P.O. Box 1007 Evert, MI 49631
Double ZS Ranch, 900 Monroe Ave NW Grand Rapids, MI 49503
Brian E. Feldpausch, 11350 W Dexter Trail, Westphalia, MI 48894
Heirs & Divisees of Richard Knapp C/O
Bobbi Ann Knapp, 185 Scotty Drive, Carbondale, IL 62903
Jason & Tracy Storch, 125 120th Ave Hersey, MI 49639

There are no oil, gas, or injection operators, or permitted locations within 1,320 feet of the proposed well (please see Figure A8, Tables and).

2. File a separate plat: Which identifies the depth and location of this proposed well and all oil, gas, injection, and abandoned well within 1,320 feet. Also identify the permittee of each producing well within 1,320 feet of this proposed well, the surface owner(s) of record of the lands within 1,320 feet of this proposed well, and all freshwater, irrigation, and public water supply wells within 1,320 feet of this proposed well.

Please see supplemental plat submitted as a part of 7200-2, Page 19.

There are no producing wells within 1,320 feet. Surface owners are illustrated below as per Osceola and Mecosta County Plat map.



3. Enclose a copy of the completion reports: for all wells and the plugging records for all plugged wells shown on the plat. Identify what steps that will be which identifies the depth and location of this proposed well and all oil, gas, injection, and abandoned well within 1,320 feet. Please see Appendix 1, for the extended AOR, which includes all wells within 1,320 feet of the proposed wells.

4. If this is an existing well: to be converted to an injection well, enclose this form with a full permit application package per EQC 7200. Also enclose a copy of the completion report and geologic description and electric logs for this well.

Please refence all sections to the supplemental checklist and forms, and Appendix 1. The electric logs available are those within possession of EGLE currently.

5. Identify and describe all faults, structural features, karst, mines, and lost circulation zones: within the area of review that can influence fluid migration, well competency, or induced seismicity. Include a plan for mitigating risks of identifiable features.

Please reference this supplemental report herein; as the AOR is expressly large. There are no faults, structural features, karsts, mines, or lost circulation zones that can influence fluid migration, well competency, or induced seismicity. There are no identifiable features.

6. Attach a proposed plugging and abandonment plan (EQP 7200-6): along with a schematic detailing the depths, volumes, and types of cement and mechanical plugs, and depths where casing will be recovered.

Please see section 14.

7. Provide information demonstrating that construction of the well will prevent the movement of fluid: that causes endangerment to an Underground Source of Drinking Water (USDW).

Please reference sections within this supplemental report in its entirely.

2 A calculation of the area of review in the injection interval over the anticipated life of the well.

The Area of Review is voluntarily assigned as a two-mile radius around the surface wellhead locations of MPC-8D, Hodges 1-36 and the Johnson 1-6A well locations. Figure A1 presents the location of these wells within the state. Figure A2(a) presents the cumulative AOR assigned by Michigan Potash, as allowed by regulation.

> "Area of review" means ether of the following:
>
> A. For a well disposing of non-hazardous waste, that area the radius of which is the greater of 1/4 mile or the lateral distance in which the pressures in the injection zone are sufficient to increase hydrostatic head in the injection zone above the base of the lowermost underground source of drinking water, but not more than 2 miles.
>
> B. For a well disposing of hazardous waste that area the radius of which is the greater of 2 miles or the lateral distance in which the pressures in the injection zone are sufficient to increase hydrostatic head in the injection zone above the base of the lowermost underground source of drinking water.

The proposed well is a non-hazardous brine well, and therefore the **area of review ("AOR")** is to be the radius of which is greater of ¼ mile or the lateral distance in which the pressures in the injection zone are sufficient to increase hydrostatic head in the injection zone above the base of the lowermost underground source of drinking water, but not more than 2 miles.

A calculation of the area of influence in the injection interval over the anticipated life of the well:

In conjunction with the University of Missouri Rolla, the National Water Well Association and the Municipal Experimental Research Laboratory, and Robert S. Kerr Environmental Research Laboratory, of the EPA, Warner and Lehr established and contributed a means of knowledge essential to establish and enforce control standards on deep water injection, the method of calculation for which is demonstrated herein. The cone of influence for injection is defined as that area around a well within which increased injection zone pressures caused by injection could be sufficient to drive fluids into an underground source of drinking water provided a hypothetical pathway that penetrates all the confining intervals between the injection zone and the base of the lowermost USDW.

The pathway for this theoretical fluid movement must assume a hypothetical, deep, open, and abandoned well, which has penetrated all of the numerous confining zones between the postulated injection zone and the lowermost USDW.

The following calculations are being demonstrated by the applicant for use at the 2-mile AOR boundary, and show that in the event of a hypothetical open path to surface, a cone of influence exceeding the calculated critical pressure is unlikely to exist in the postulated operation; meaning, migration to a USDW would not overcome resident hydrostatic pressure, even in the event of a hypothetical open path.

The critical pressure rise is determined via the following;

$$Pc = 0.433 * [SG_i * (D_i - D_{usdw}) + SG_{usdw} * (D_{usdw} - WL)] - Po;$$

where

Pc	= Critical Pressure rise, psi
SG_i	= Specific Gravity of the injectate or resident water, unitless
D_i	= Depth injection interval, feet

D_{usdw} = Depth to the base of the lowermost USDW

SG_{usdw} = Specific Gravity of the USDW, unitless

WL = observed water level below ground level, feet

Po = original reservoir pressure in the injection horizon, psi

EPA 600/2-77-240, equation 3-9a expresses the pressure rise in injection wells after Warner and Leher, 1977; whereby the rise in pressure in relation as a function of time and distance is given as per the following;

$$dP\ (t,r) = \frac{162.6Qu}{\overline{K}b} * \left[\log\frac{\overline{K}t}{\overline{\emptyset}cr^2} - 3.23\right]$$

where

dP (t,r) = Change is reservoir pressure as a function of time, days and radius, feet

Q = Rate of injection, barrels per day

u = viscosity of injectate, centipoise

$\overline{K}$ = Average permeability of the injection zone, md

t = time since injection began, hours

b = injection zone thickness, feet

c = injection zone compressibility, 1/psi

$\overline{\emptyset}$ = average injection zone porosity, percent,

r = radial distance from wellbore, feet

Information summarized and applied in in the following calculations have been determined from real core data, real historical operating data, real historical drilling data, and site specific geophysical logs. The values and calculations are utilized to establish an estimated, theoretical output according to the laws of diffusivity and dispersion following 20 years of theoretical uninterrupted, continuous injection at the site specific location.

The range of inputs can be changed as approximations, ultimately being refined with real, observed site specific injectivity tests, fall off, and step rate tests via real time reservoir monitoring as is done on all brine injection wells during the course of operation.

Base of the Lowermost USDW

The base of the USDW at Hodges Et Al 1-36, which is in proximity to proposed MPC 8D is determined to be 712' based on sample picks during the original drilling..

As Per Michigan Statute, Part 625 R 299.2302(u) defines "Fresh water" as water which is free of contamination in concentrations that may cause disease or harmful physiological effects and which is safe for human consumption.'

R 299.2304(k) defines Underground Source of Drinking Water, which defines total dissolved solids to not exceed 10,000 mg/L TDS, similar to those standards posed by the U.S. EPA at CFR 40 146.3, which also sets TDS at greater than 10,000 total dissolved solids.

It is known that intervals deeper than 200' in the area of review, may contain naturally occurring arsenic and are not suitable for safe drinking as per Part 625 R 299.2302 (See section 6), and the deeper E-1 aquifer in the glacial till tends to be high in TDS, and calcium sulfate. As per Figure D2, the deepest slotted well in the 2 mile AOR is 340' and is utilized for potash/salt solution mining purposes and is not an underground source of drinking water. A conservative regulatory approach sets the USDW at the base of the glacial till at 712; rather than at the deepest probable source of 'Fresh Water' which is safe for human consumption. As a result, Surface casing setting depths have been designed to be set at 900', which 188' below the base of the glacial till.

Site Specific Variables and Critical Pressure Rise

Injection Well Data Form EQP 7200-14 has been adjusted to conform to the pressure rise calculations as per the following, specifically incorporating established injection test data from the Thomas 1-26 and the Woodward 1-26.

Pressure rise calculations are submitted to demonstrate that the proposed injection fluid and volumes would not change the hydrostatic head at the base of the lowermost USDW via a hypothetical path to surface

The values and calculations are utilized to establish an estimated, theoretical output according to the laws of diffusivity and dispersion following 20 years of theoretical uninterrupted, continuous injection. The range of inputs can be changed as approximations, ultimately being refined with real, observed site specific injectivity tests, fall off, and step rate tests via real time reservoir monitoring as is done on all brine injection wells during the course of operation.

Injection Well Data Form EQP 7200-14 and the variables requested therein, conform to the range as specified in the table below:

Parameter	Value	Comment/Source
SG_i	1.23	Site specific resident water from the Ward 1-11 from the Reed City Formation (1.211) and Injectate high side (1.25) average
D_i	4056'	Top of Reed City Dolomite from site specific geophysical logs.
D_{usdw}	640'	Conservative selection of site specific measured depth of USDW as per US EPA CFR 40 146.3, at 10,000 TDS. Base of the Glacial Till by samples.
SG_{usdw}	1.05	fresh water
WL	97.5	Site specific average as observed in the nearest water wells (120, 75, 105, 90)
Po	1695	0.433 psi/ft
u	0.95	24% NaCl saturated brine at injection horizon site specific temperature of 125 degrees F

b	135	Site specific observed net porosity thickness based on real geophysical well logs
c	0.0000052	Dimensionless per psi, dolomite
$\overline{\emptyset}$	15.0%	Site specific determination based on real geophysical well logs. Effective porosity cross plot average as discussed in part 9.D.
$\overline{K}$	536	Average determination based on permeability determination from step rate data from the Thomas and Woodward (907 md avg) the Park Well Logs (1-12) vs real core observed (~ 350 md average) and measured in DST in the area (Ward 362 md, Pilarski 166 md).

Parameter	Value	A Value/ B Value, Comment/Source
Pc	341	Critical Pressure Rise, Calculated

EPA 600/2-77-240, equation 3-9a expresses the pressure rise in injection wells after Warner and Leher, 1977; whereby the rise in pressure in relation as a function of time and distance is given as per the following;

$$dP\,(t,r) = \frac{162.6Qu}{\overline{K}b} * \left| \log \frac{\overline{K}t}{\overline{\emptyset}cr^2} - 3.23 \right|$$

where

dP (t,r) = Change is reservoir pressure as a function of time, days and radius, feet

Q = Rate of injection, barrels per day

u = viscosity of injectate, centipoise

$\overline{K}$ = Average permeability of the injection zone, md

t = time since injection began, hours

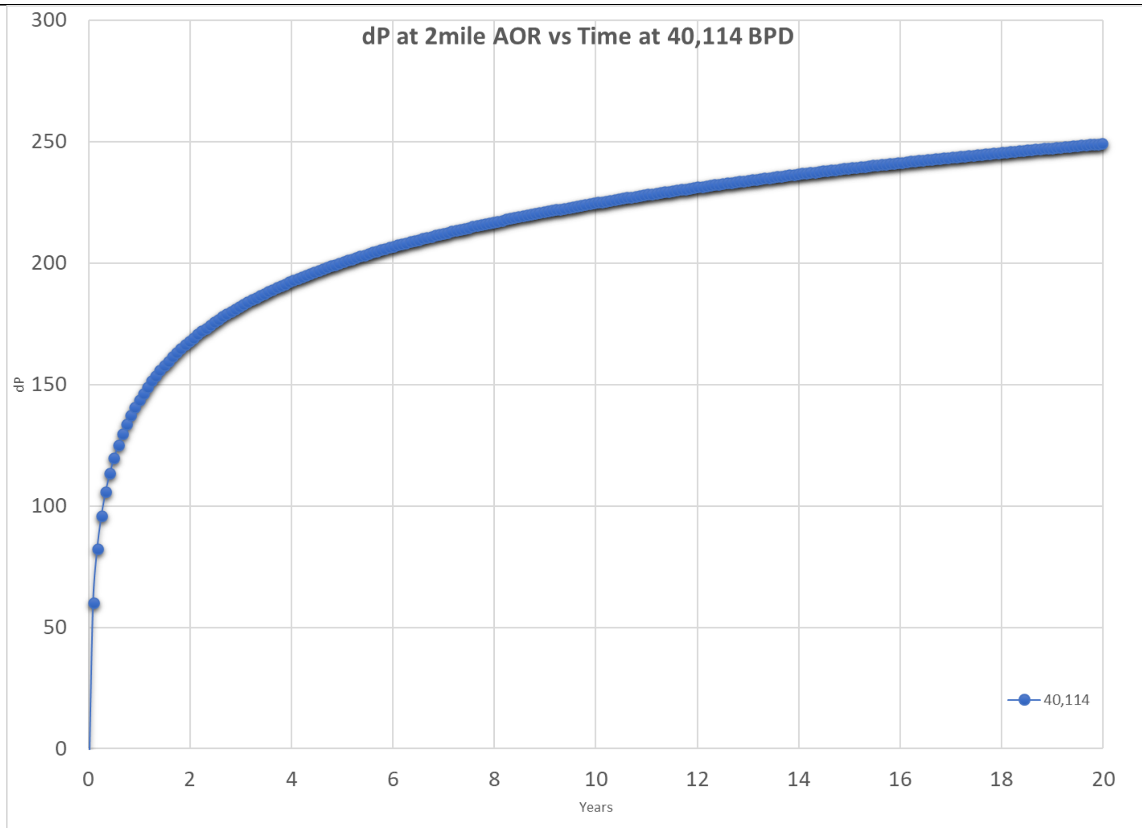
b = injection zone thickness, feet

c = injection zone compressibility, 1/psi

$\overline{\emptyset}$ = average injection zone porosity, percent,

r = radial distance from wellbore, feet

And therefore, the pressure rise at a 2 mile radial distance away from the well, at the maximum injection rate versus time is expressed below:



Now, considering EPA 600/2-77-240 can be adjusted (in part) for a horizontal well, as to its productivity index as:

$$q_o = \frac{7.08 \times 10^{-3} kh}{B\mu\left(\ln\frac{2r_e}{L_h} + \ln(2) + F\right)}\left(p_i - p_{wf}\right)$$

where F is

$$F = -\frac{h}{L_h}\sqrt{\frac{k_x}{k_z}}\ln\left\{4\sin\left[\frac{\pi}{2h}\left(2z_w + r_w\right)\sqrt{\frac{k_z}{k_y}}\right]\sin\left(\frac{\pi}{2h}r_w\sqrt{\frac{k_z}{k_y}}\right)\right\}$$

and where

$L_{/h}$	= Horizontal well, feet
$\overline{kx}$	= Average permeability of the injection zone x direction, md
$\overline{ky}$	= Average permeability of the injection zone y direction, md
$\overline{kz}$	= Average permeability of the injection zone z direction, md
B	= Fluid compressibility, reservoir bbl /standard bbl
rw	= radius of the wellbore, feet
$\overline{\emptyset}$	= average injection zone porosity, percent,

r = radial distance from wellbore, feet

The productivity index, when -Q equals injection, the change in pressure (pressure rise) can be inferred by the ratio of the Productivity index of the vertical well versus the horizontal well in the same formation with the same features.

The productivity of a vertical well with the observed reservoir characteristics approximates

Jv = 58 Q/(detla p)

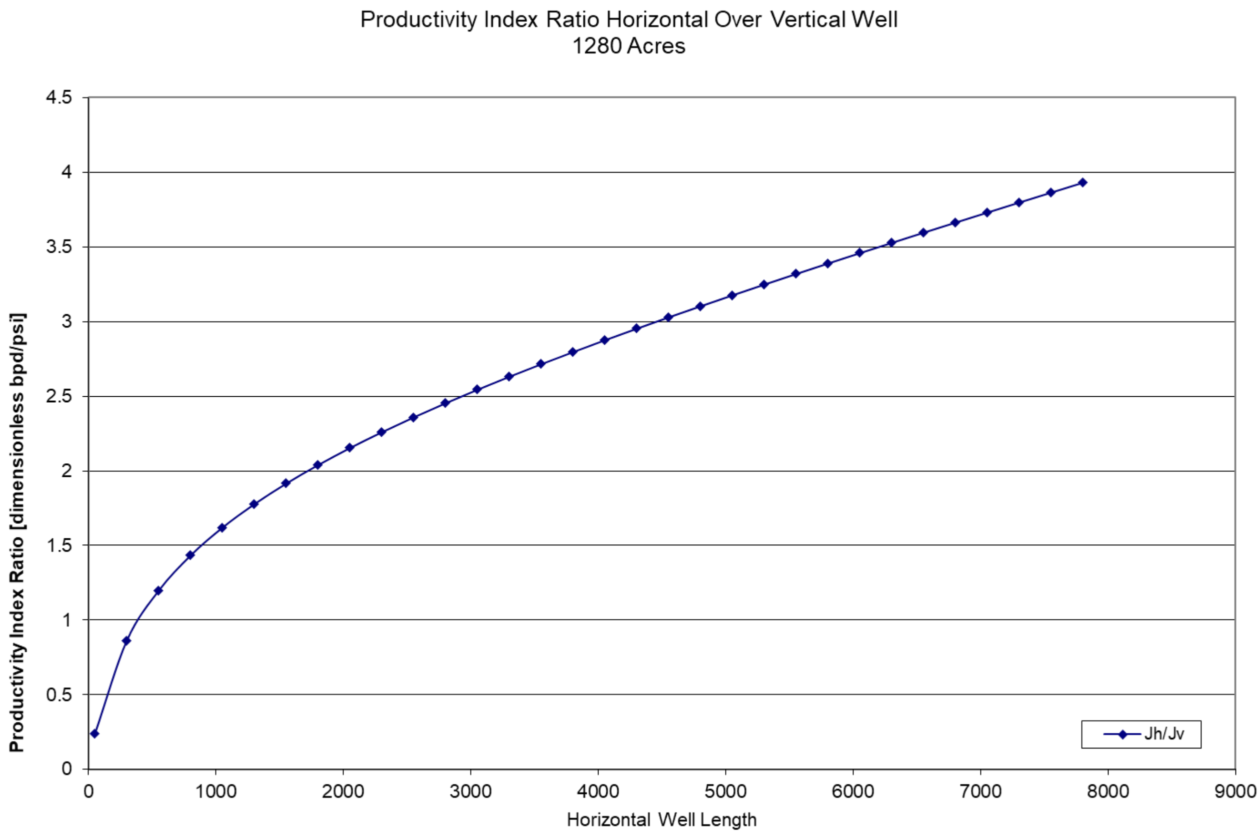
And the productivity index of a horizontal well with the proposed length of the Johnson 1-6A, at 7100, is

Jh = 220 Q/(delta p)

And therefore the performance of the horizontal well, as it concerns the acceptance of fluid at the same pressure is expressed as

Jv/Jh = 3.7 times more fluid intake

This horizontal advantage is graphically illustrated here, at varying lengths. It would be implied then, that the horizontal well substantially reduces critical pressure rise (in this case, potentially by 3.7 times).



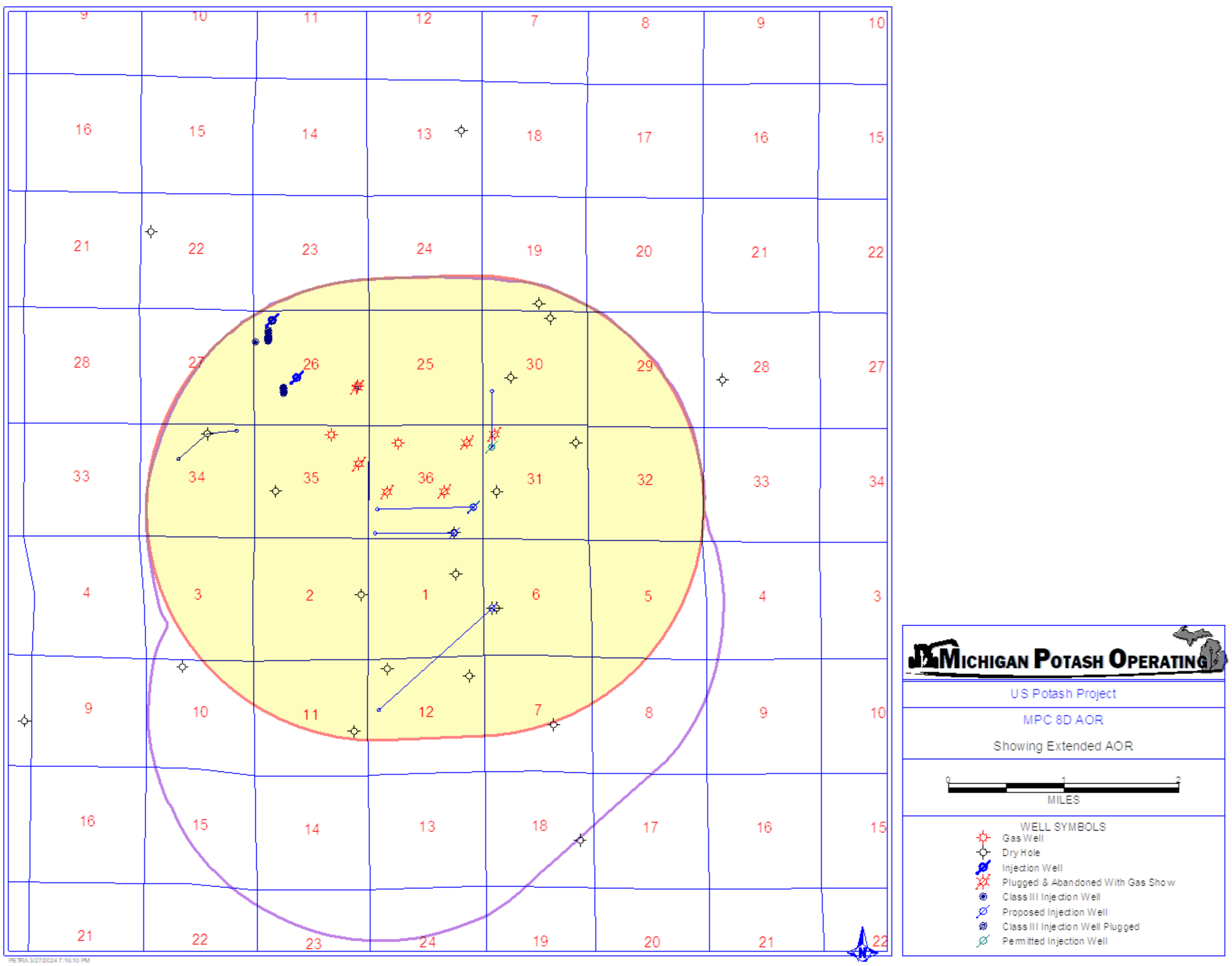
MPC 8D

A description of the Area of Review

The **Area of Review** ("AOR"), by the applicant is expressly differentiated from the area of influence of the subject well.

The AOR, is hereby surrendered, graphically and technically when expressly requested as a two mile radial distance along the lateral trajectory of the propositioned Johnson 1-6D; and concurrently with a two mile radial distance along the lateral trajectory of the *proposed* Hodges 1-36D, and MPC 8D. The Hodges 1-36D, and the MPC 8D are two proposed project wells for similar purpose to the subject well.

Appendix 1.0 includes a visual demonstration of the AOR, including a 2 mile AOR around the lateral length of the Hodgest1-36D. Further, it also includes all wells in an expanded AOR, which includes the MPC 8D, and Johnson 1-6D. The MPC 8D and Johnson 1-6Dare contemporaneous submissions by the applicant to EGLE; as per the following:



The applicant has reviewed the surrounding area substantially beyond the ¼ area of influence.

- Figure A1 is a locator map, showing the proposed surface well location for the Johnson 1-6D, as well as the Hodges 1-36D, and the MPC 8D wells. The well names are shown, as are roads, water bodies, and townships.

- Figure A2(a) is a map illustrating a 2 mile AOR radius around the lateral trajectory of the Johnson 1-6D, the Hodges 1-36D, and the MPC 8D. Permit applications for each well are expected to be submitted concurrently, therefore a combined "AOR" surrounding all is surrendered herein.

- Figure A2(b) is a map showing all deep wells that penetrate the confining zone within the AOR, as well as the ¼ mile radius along the lateral trajectory of the MPC 8D.

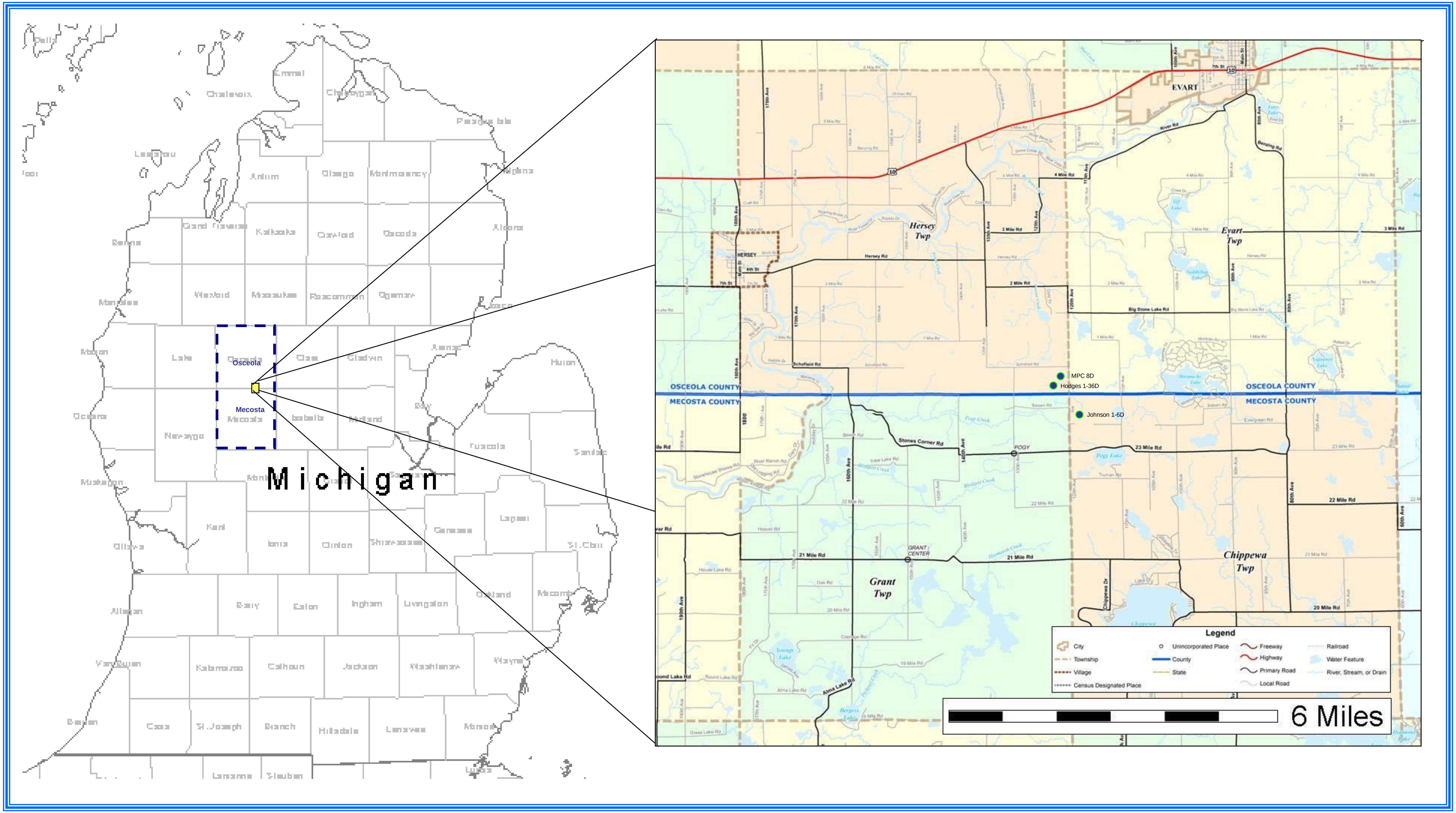


Figure A1. Location Map, showing the proposed surface well locations for the Johnson 1-6D, MPC 8d and Hodges 1-36D wells. The well names are shown, as are roads, water bodies, and townships.

MICHIGAN POTASH OPERATING, LLC

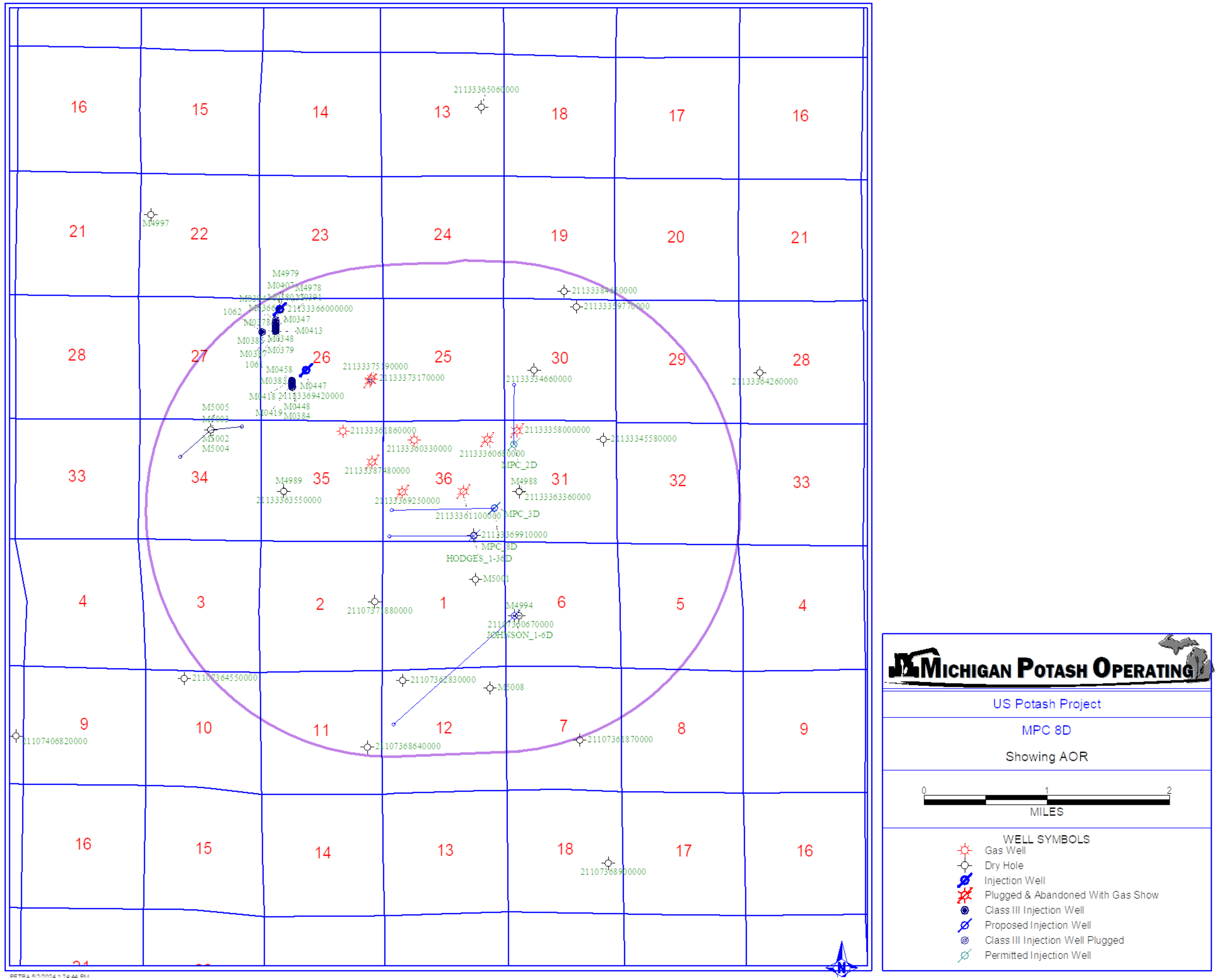


Figure A2a. AOR showing a two mile radius around the bottom hole trajectory of the MPC 8D, the PLSS, and all deep wells that penetrate the confining interval. API or mineral well numbers are shown in green.

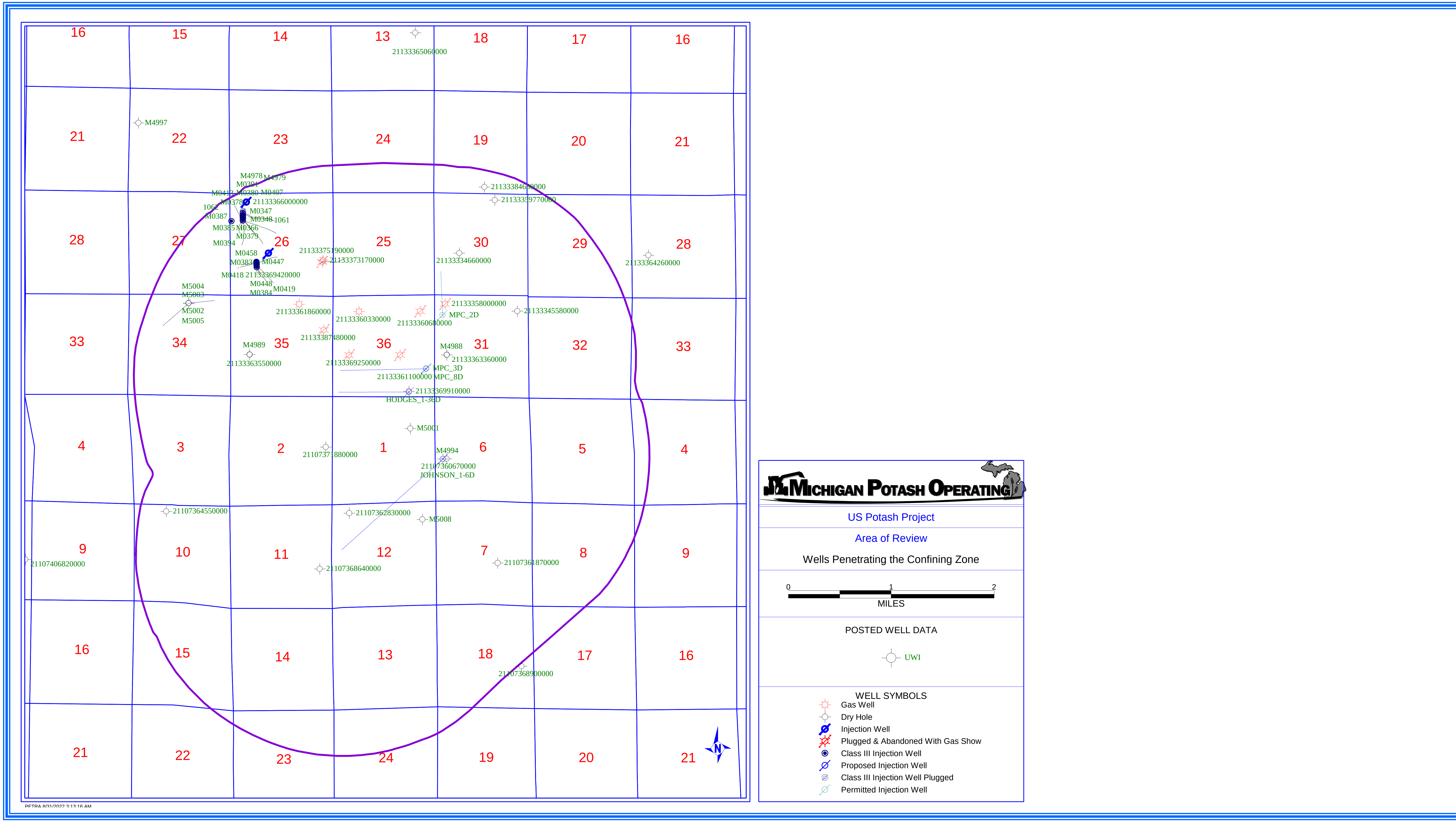


Figure A2b. Cumulative 2 mile AOR radius along the lateral trajectory of the Johnson 1-6D, the Hodges 1-36D, and the MPC 8D and wells Penetrating the Confining Zone in the AOR.

3 A discussion of the effect of injection on the present and potential mineral resources in the area of review.

The postulated injection operation in the AOR, as graphically illustrated in Figure A2(a) and Figure A2(b) will not impact present or potential mineral resources in the area of review, but rather promulgate and enable the development of the potash and salt mineral resources. The proposed action is necessary to administer the production of potash and high grade salt.

The AOR includes three marginally producing, depleted oil and gas wells from the deep Clinton formation at 8100' or greater.

Injection into the Dundee formation does not interfere with any oil and gas interest, postulated mineral development or offset salt production from the Salina salt formations. Provided surface disturbance is limited to a single drilling pad, surface resources are also preserved.

For ease of reference and review, multiple graphical maps have been illustrated over the AOR. All of the maps in this section include the proposed injection well locations and the Public Land Survey System on top of the United States Geological Survey Topographic Quadrangle for the AOR.

- Figure A3 presents all hydrocarbon producing wells in relation to the proposed injection wells in the AOR. The Public Land Survey System is included on top of the United States Geological Topographic Quadrangle. There are three producing wells.

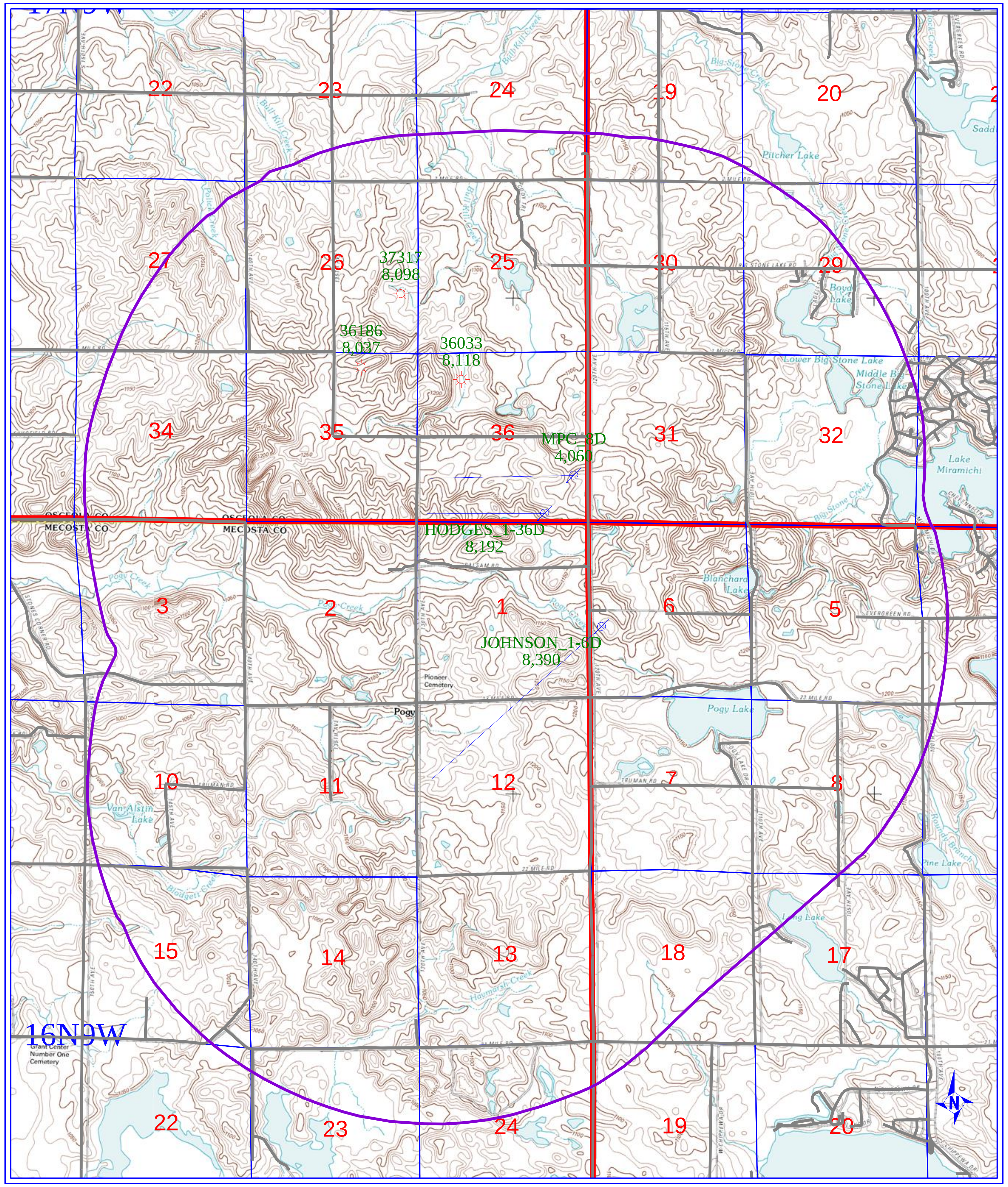
- Figure A4 presents the two currently active Class I NON-HAZARDOUS Injection Wells; the Thomas 1-26 (NW4NW4 Section 26) and the Woodward 1-26 (NE4SW4 Section 26), both operated by Cargill, Inc. and recently re-permitted on 11/20/2020. The Thomas 1-26 and Woodward 1-26 began injection operations in 1989 and remain active. Also shown are permitted injection wells the MPC 1D and MPC 2D that share a similar pad location, and the proposed MPC 8D that shares a pad location with the MPC 3D.

- Figure A5 presents established Class III AREA Injection Permit No. MI-133-3G-A0002 & MI-133-3G-0028; Class III Injection Permit No. MI-133-3G-A0002 (Yellow NW-SE Cross Hatch) and established Class III Injection Permit No. MI-133-3G-0028 (Yellow NE-SW Cross Hatch). Active Class III Injection Wells are also shown, which occur only on MI-133-3G-A0002.

As illustrated in Figures A6-A8, the area around proposed well MPC 8D has been the subject of extensive prior injection, permitting, operations, and regulatory supervision, since 1980.

The previously defined AOR has been the subject of extensive and comprehensive prior geological and environmental review, and re-review by all interested stake holders and regulatory agencies and predecessor companies to Michigan Potash Operating, LLC, having been the subject of prior permit applications for both EPA regulated Class I and Class III non hazardous injection and also Part 625 artificial brine wells and Part 625 brine disposal wells. Predecessor owners of interest include (either offset or in the MPO AOR) Kalium Chemicals, Ltd., IMC Kalium, Ltd., PPG Industries, Inc, Mosaic Hersey Potash, LLC, Michigan Potash Operating, and Cargill Incorporated.

The proposed wells MPC 8D, Hodges 1-36 and Johnson 1-6D are immediately adjacent to an ongoing Part 625 brine injection operation occurring in the Dundee/Reed City; the ongoing operation is being used for brine disposal associated with potash/salt extraction, similar to the brine source included in this application. After 35 years of



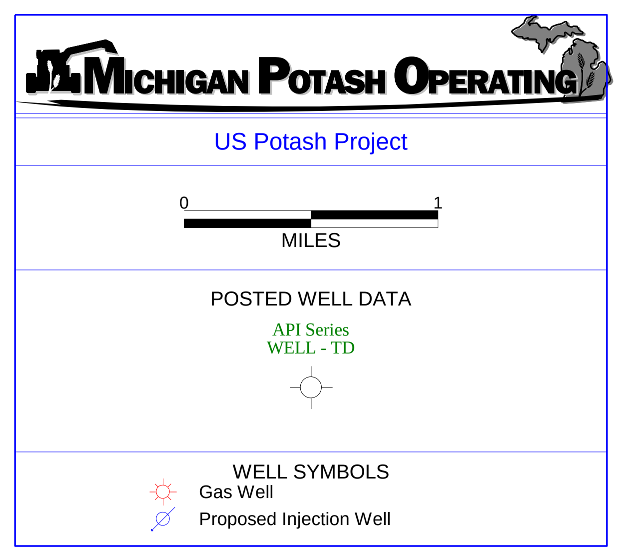


Figure A3. Hydrocarbon Producing Wells and proposed injection wells. Public Land Survey System is included. A blue box measures one section, or one square mile.

Michigan Potash Operating, LLC

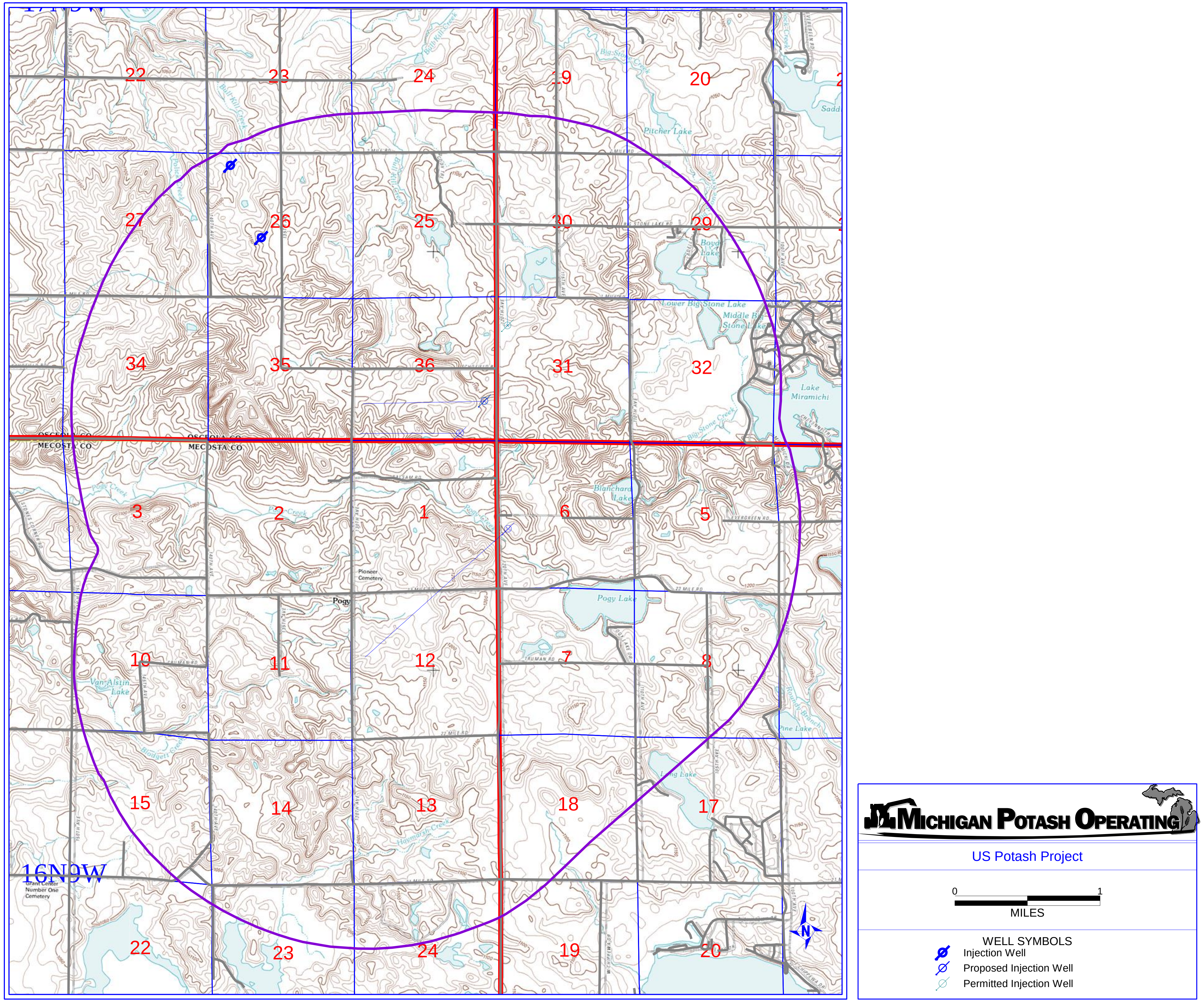


Figure A4. Map showing Existing Class I NON-HAZARDOUS Injection Wells, the Thomas 1-26 (NW4NW4 Section 26) and the Woodward 1-26 (NE4SW4 Section 26). Also shown are permitted injection wells the MPC 1D, MPC 2D, and MPC 3D. The Proposed 8D shares a pad location with the MPC 3D.

MICHIGAN POTASH OPERATING, LLC

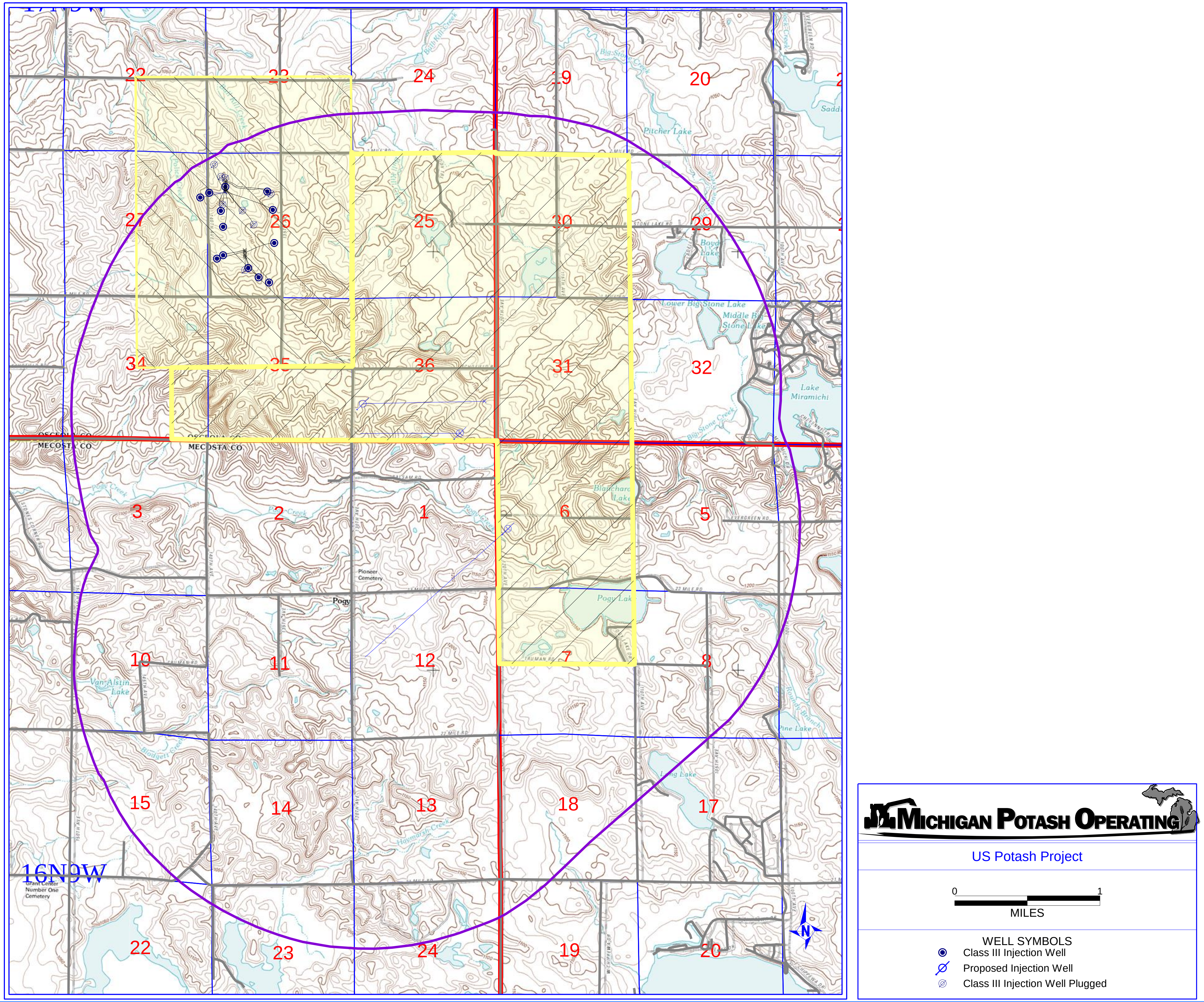


Figure A5. Map showing established Class III Injection Permit No. MI-133-3G-A0002 (Yellow NW-SE Cross Hatch) and established Class III Injection Permit No. MI-133-3G-0028 (Yellow NE-SW Cross Hatch). Active Class III Injection Wells are also shown, which occur only on MI-133-3G-A0002 at the time of the application.

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successful operation, there has not be an indication that the regulatory scheme failed to identify every wellbore or that any wellbore serves as a hypothetical conduit that can increase the hydrostatic head in a USDW.

4 A plat which shows the location and total depth of the proposed well, shows each abandoned, producing, or dry hole within the area of influence, and each operator of a mineral or oil and gas well within the area of influence.

- Figure A6 Cumulative AOR and Map showing all well types, active and inactive, within the Area of Review. Shown in blue highlight are surface water bodies. Roads are also shown (black). PLSS is also shown (Blue). Well API series, and Total Depth are listed in GREEN. Mineral Wells are preceded with an M.

- Figure A7 is a map presenting a ¼ mile area around the MPC 8D well path, expressly showing the ¼ mile minimum area of influence. The map also shows all producing, abandoned and dry holes within the AOR, both deep and shallow boreholes. There are no oil and gas operators within the ¼ mile area of influence for the subject well. The map extends more than one mile beyond the facility property boundary, and illustrates the project injection well(s), well pad(s), and/or project area, and the applicable area of review.

- Figure A8 is a plat map showing third party survey, with a ¼ mile area around the well path. Also showing a 1 mile radius from the wellhead location. There are no oil and gas operators within the ¼ mile length of the subject well, or within the one mile boundary beyond the facility property boundary. The plat also illustrates the project injection well(s), well pad(s).

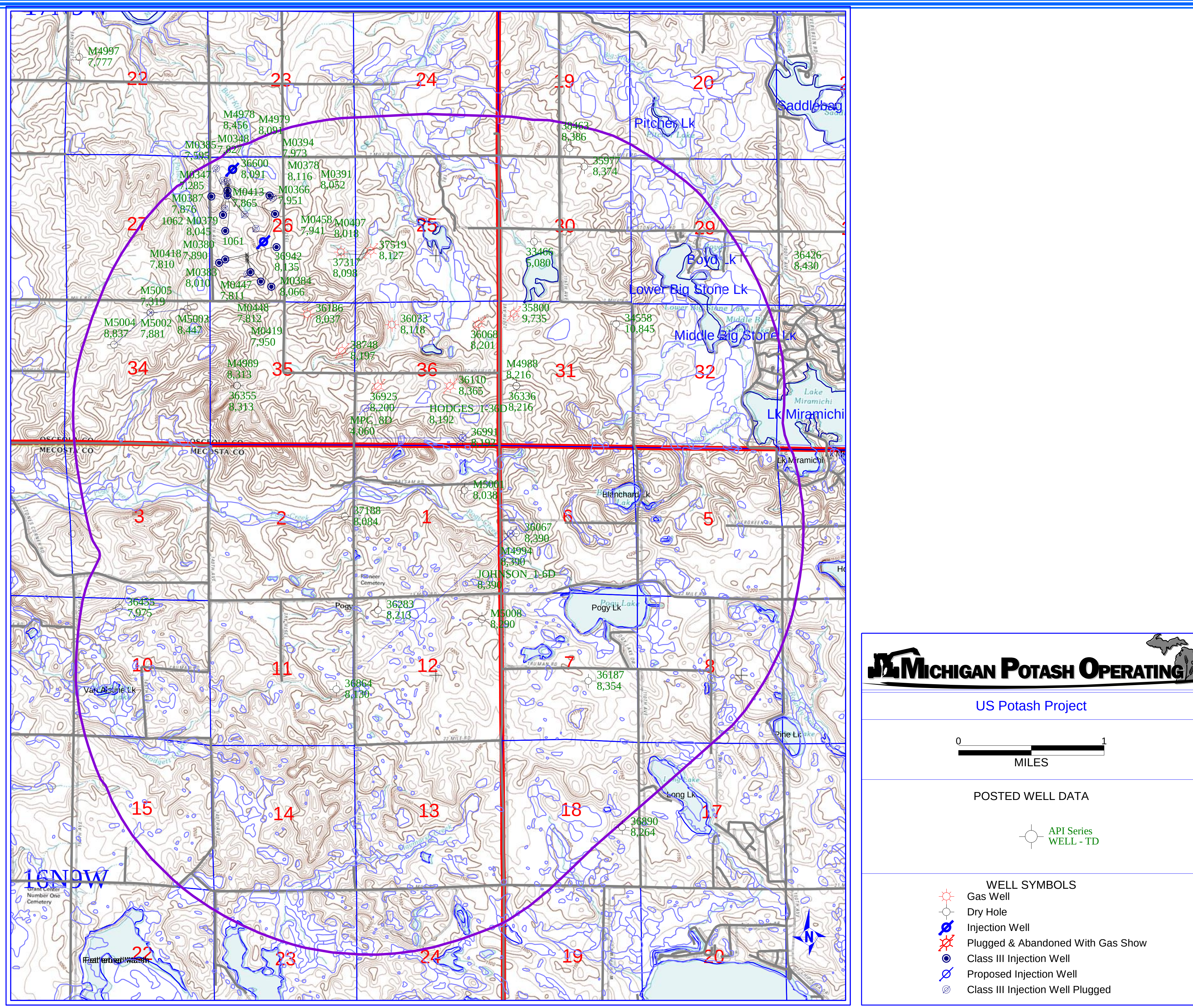

Figure A6. Cumulative AOR and Map showing all well types, active and inactive, within the Area of Review. Shown in blue highlight are surface water bodies. Roads are also shown (black). PLSS is also shown (Blue). Well API series, and Total Depth are listed in GREEN. Mineral Wells are preceded with an M.

MICHIGAN POTASH OPERATING, LLC

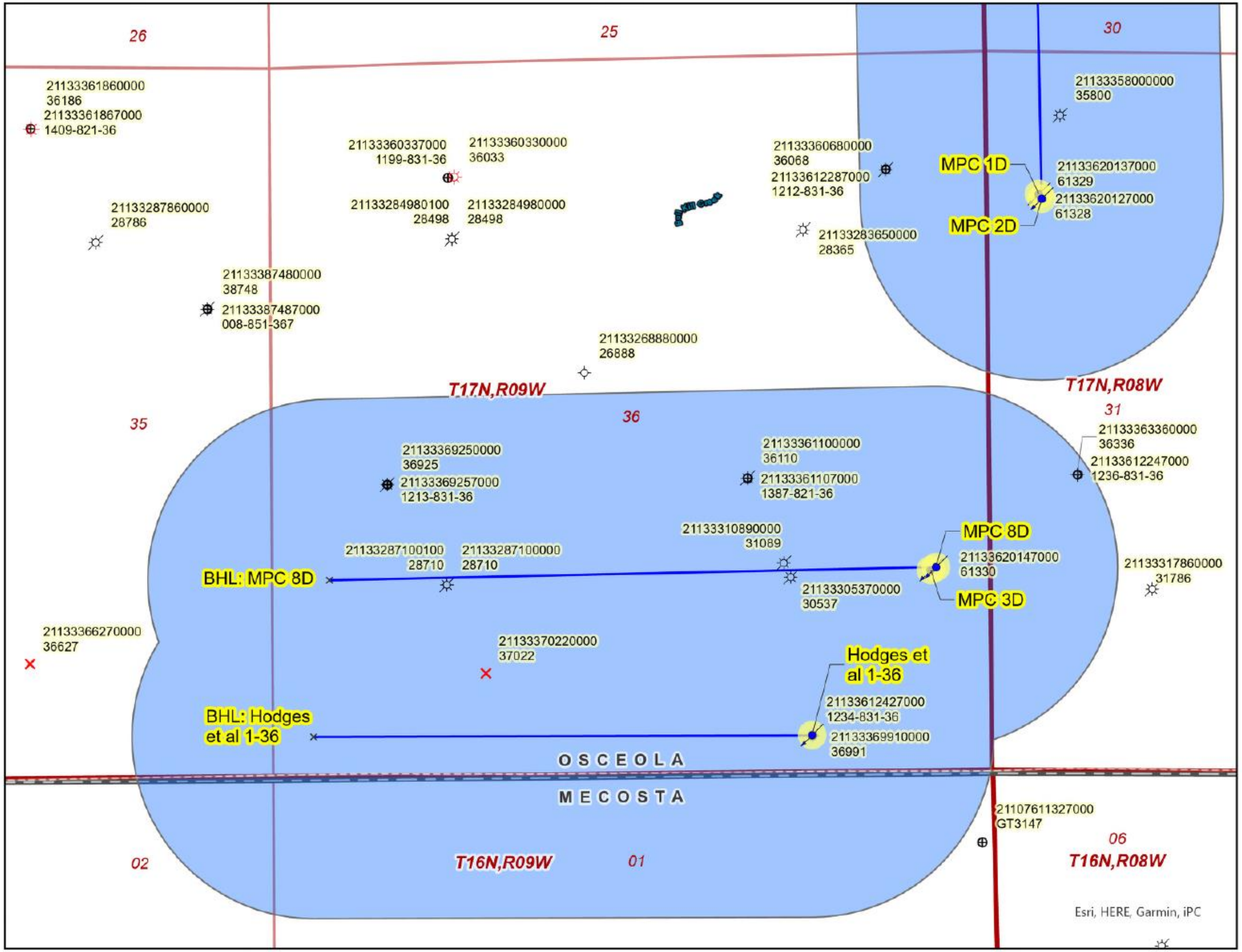

Figure A7. Area of Interest, ¼ mile area around MPC 8d and Hodges et al 1-36.

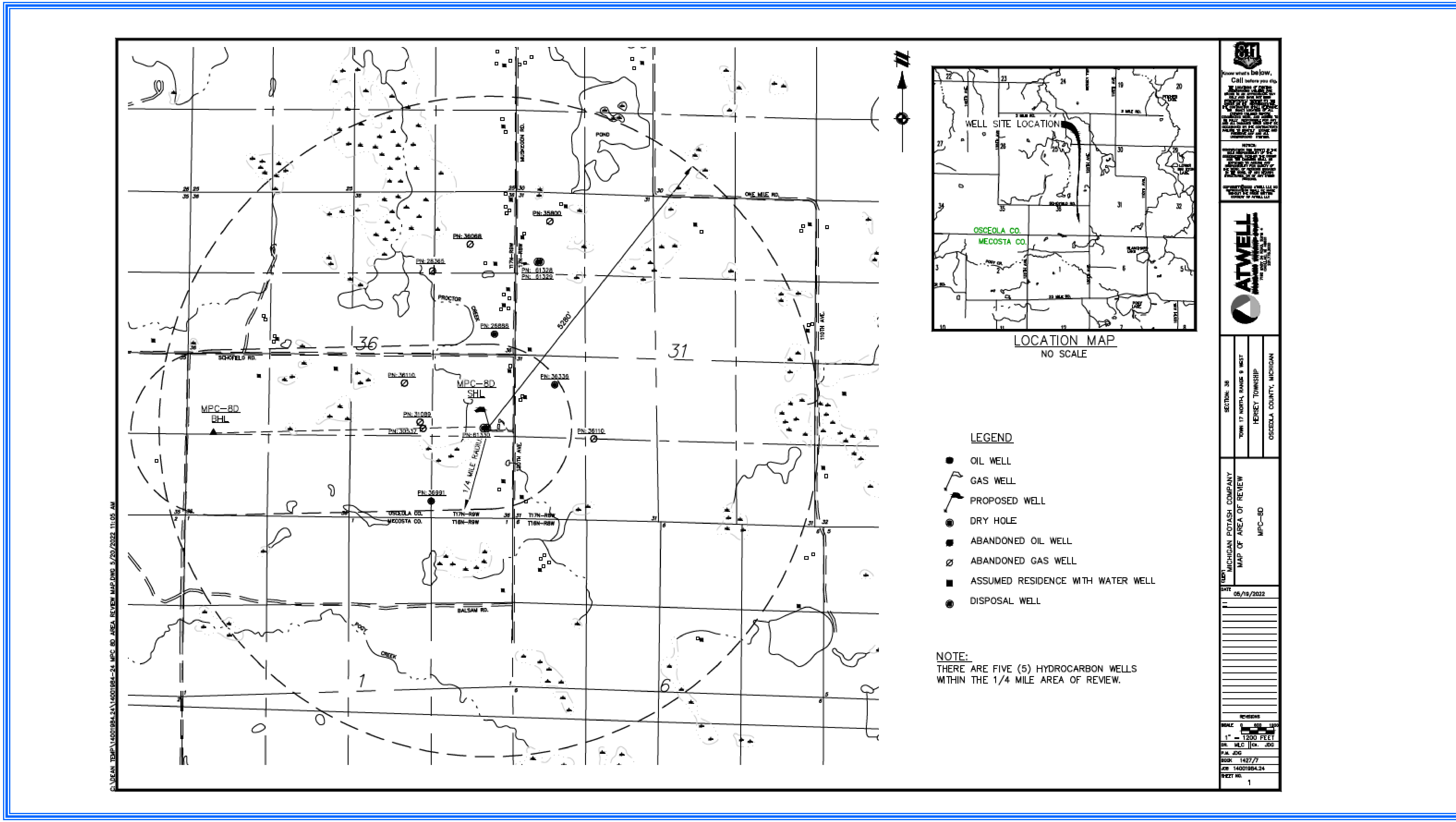

Figure A8. Area of Interest, ¼ mile Around the MPC 8D

For ease of reference, a tabulation of the existing drilled wells in the AOR are provided in the following tables. Records of oil and gas producing wells the state of Michigan are maintained by the EGLE Division of Oil and Gas and Minerals and the Geological Survey Division. Well permits, completions, and plugging records filed with this agency are organized by county, township, range, and section number.

<u>Tabulation of active producing oil and gas wells within the AOR are as follows:</u>

TRS	API Number	Permit Number	Well Name and Number	Total Depth	Formation at Total Depth	Drill Date	Well Status	Well Type	WH_Lat	WH_Long	Operator Name
17N-9W-36	21-133-36033-00-00	36033	GREIN ET AL 2-36	8141	CABOT HEAD	Aug-83	ACTIVE	NATURAL GAS WELL	43.82640	-85.33910	Mccool John E
17N-9W-35	21-133-36186-00-00	36186	PAINE 1-35	8309	CINCINNATIAN	Dec-82	ACTIVE	NATURAL GAS WELL	43.82740	-85.35080	Mccool John E
17N-9W-26	21-133-37317-00-00	37317	PAINE 1-26	8095	CABOT HEAD	Feb-84	ACTIVE	NATURAL GAS WELL	43.83360	-85.34620	Mccool John E

Cross Reference with **Figure A6** which shows all producing wells in relation to the proposed injection locations.

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Tabulation of Part 625 Mineral Brine Disposal Injection Wells within the AOR

Within the AOR, there are two qualifying classes of injection well: Part 625 Non Hazardous Brine Disposal Wells (EPA Class I NON HAZARDOUS) and Part 625 Artificial Brine (EPA Class III Solution Wells). They are listed here separately for ease of reference. Records of injection wells are maintained by the US EPA and the state of Michigan EGLE Division of Oil and Gas and the Geological Survey Division. Well permits, completions, and plugging records filed with this agency are organized by county, township, range, and section number.

Active Part 625 Non Hazardous Brine Disposal Wells (EPA Class I, Non Hazardous Injection Wells) are as follows:

TRS	API Number	Permit Number	Well Name and Number	Total Depth	Formation at Total Depth	Drill Date	Well Status	Well Type	WH_Lat	WH_Long	Operator Name
17N-9W-26	21-133-00349-70-00	349	WOODWARD 1-26	8140	A-1 SALT	Oct-83	ACTIVE	PART 625, CLASS I NON HAZARDOUS	43.83460	-85.35680	Cargill Incorporated
17N-9W-26	21-133-00350-70-00	350	THOMAS 1-26	8091	A-1 SALT	Jan-84	ACTIVE	PART 625, CLASS I NON HAZARDOUS	43.84180	-85.36110	Cargill Incorporated

Cross Reference **Figure A4** show active Part 625 Non-Hazardous Brine Disposal Wells, and Class I NON-HAZARDOUS Injection Wells; the Thomas 1-26 (NW4NW4 Section 26) and the Woodward 1-26 (NE4SW4 Section 26), both operating by Cargil Incorporated.

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Tabulation of Part 625 Mineral Production Injection Wells

Within the AOR, there are two qualifying classes of injection well: Class I NON HAZARDOUS and Class III NON HAZARDOUS. This section lists here Class III wells only for ease of reference. Records of injection wells are maintained by the US EPA and the state of Michigan EGLE Division of Oil and Gas and the Geological Survey Division. Well permits, completions, and plugging records filed with this agency are organized by county, township, range, and section number.

Active Class III, Part 625 Injection Wells are as follows:

TRS	API Number	Permit Number	Well Name and Number	Total Depth	Formation at Total Depth	Drill Date	Well Status	Well Type	WH_Lat	WH_Long	Operator Name
17N-9W-26	21-133-00449-70-00	449	KALIUM HERSEY 2042	UNK	A-1 SALT	Jun-00	ACTIVE	PART 625, CLASS III	43.83310	-85.35910	Cargill Incorporated
17N-9W-26	21-133-00474-70-00	474	I M C POTASH HERSEY 1061	UNK	A-1 SALT	Jan-02	ACTIVE	PART 625, CLASS III	43.83910	-85.36170	Cargill Incorporated
17N-9W-26	21-133-00384-70-00	384	KALIUM 2061	8066	A-1 SALT	May-85	ACTIVE	PART 625, CLASS III	43.83290	-85.35920	Cargill Incorporated
17N-9W-26	21-133-00391-70-00	391	KALIUM HERSEY 1044	8052	A-1 SALT	Nov-93	ACTIVE	PART 625, CLASS III	43.83950	-85.36190	Cargill Incorporated
17N-9W-26	21-133-00383-70-00	383	KALIUM 2031	8010	A-1 SALT	Mar-85	ACTIVE	PART 625, CLASS III	43.83330	-85.35920	Cargill Incorporated
17N-9W-26	21-133-00366-70-00	366	KALIUM 1041	7951	A-1 EVAPORITE	May-90	ACTIVE	PART 625, CLASS III	43.84020	-85.36190	Cargill Incorporated
17N-9W-26	21-133-00409-70-00	409	KALIUM HERSEY 2062	7950	A-1 SALT	Aug-96	ACTIVE	PART 625, CLASS III	43.83300	-85.35920	Cargill Incorporated
17N-9W-26	21-133-00380-70-00	380	KALIUM 1051	7890	A-1 SALT	May-85	ACTIVE	PART 625, CLASS III	43.83990	-85.36190	Cargill Incorporated
17N-9W-26	21-133-00387-70-00	387	KALIUM HERSEY 1054	7876	A-1 SALT	Aug-93	ACTIVE	PART 625, CLASS III	43.83980	-85.36190	Cargill Incorporated
17N-9W-26	21-133-00403-70-00	403	KALIUM HERSEY 1014	7865	A-1 SALT	Jul-95	ACTIVE	PART 625, CLASS III	43.83920	-85.36180	Cargill Incorporated
17N-9W-26	21-133-00408-70-00	408	KALIUM HERSEY 2032	7810	A-1 SALT	Jul-96	ACTIVE	PART 625, CLASS III	43.83340	-85.35920	Cargill Incorporated
17N-9W-26	21-133-00385-70-00	385	KALIUM HERSEY 1013	7595	A-1 SALT	May-92	ACTIVE	PART 625, CLASS III	43.83960	-85.36190	Cargill Incorporated

Cross Reference **Figure A5** shows all established Class III *AREA* Injection Permit No. MI-133-3G-A0002 (Yellow Cross Hatch) and Active and Inactive Class III Injection Wells. The AOR has undergone extensive prior regulatory review provided the pre-established injection activity within the AOR.

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Tabulation of Well Data for all Abandoned Wells, Plugged Wells, and Dry Holes

Records of abandoned wells, plugged wells, and dry holes in the state of Michigan are maintained by the EGLE and the Geological Survey Division. Well permits, completions, and plugging records filed with this agency are maintained by county, township, range, and section number. Locations of wells were searched in the following AOR sections, and publicly available well data are presented in Appendix 1.

The last two wells highlighted in green are new wells submitted by the applicant. The Lutz wells fall within the AOR of the Thomas 1-26 and Woodward 1-26, and therefore have been reviewed as part of the Thomas and Woodward permit application processes. The Boyd 1-10 is a new submission that may not have fallen in a previously reviewed AOR. The Stein 1-18 is outside the applicant's AOR, but included here due to its proximity.

The following is a list of wells found within or near to the AOR.

TRS	API Number	Permit Number	Well Name and Number	Total Depth	Formation at Total Depth	Drill Date	Well Status	Well Type	WH_Lat	WH_Long	Operator Name
17N-9W-26*	21-133-00397-70-00	397	Kalium Hersey 1032	8366	A-1 SALT	Nov-94	INACTIVE	PART 625, CLASS III	43.8393	-85.3618	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-26*	21-133-00438-70-00	438	Kalium Hersey 2082	8366	A-1 SALT	Jun-07	INACTIVE	PART 625, CLASS III	43.8327	-85.3592	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-26*	21-133-00347-70-00	347	Kalium 1012	8366	A-1 SALT	Jan-85	INACTIVE	PART 625, CLASS III	43.8405	-85.3619	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-36	21-133-36068-00-00	36068	BABCOCK ET AL 1-36	8200	CABOT HEAD	Sep-83	INACTIVE	NATURAL GAS WELL	43.8265	-85.3272	Marathon Oil Co.
17N-9W-36	21-133-36925-00-00	36925	BALDINO 1-36	8200	CABOT HEAD	Sep-83	INACTIVE	NATURAL GAS WELL	43.8203	-85.341	Marathon Oil Company
17N-9W-36	21-133-36991-00-00	36991	HODGES ET AL 1-36	8198	CLINTON	Oct-83	INACTIVE	DRY HOLE	43.8152	-85.3294	Marathon Oil Co.
17N-9W-36	21-133-26888-00-00	26888	GREIN, DONALD 1	1649	BROWN LIMESTONE	Aug-67	INACTIVE	DRY HOLE	43.8225	-85.3356	Consumers Energy Company
17N-9W-36	21-133-31089-00-00	31089	THOMPSON, DON; HODGES, FRANK; SMITH, RALPH 2-36	1616	MICHIGAN STRAY	Jul-76	INACTIVE	NATURAL GAS WELL	43.8186	-85.3301	Mutch Harry L
17N-9W-36	21-133-30537-00-00	30537	THOMPSON, DON; HODGES, FRANK; SMITH, RALPH 1-36	1602	MARSHALL	Nov-75	INACTIVE	NATURAL GAS WELL	43.8183	-85.3299	Mutch Harry L
17N-9W-36	21-133-2871-00-000	28710	THOMPSON & RANDOLPH 1	1586	MICHIGAN STRAY	Dec-71	INACTIVE	NATURAL GAS WELL	43.8182	-85.3394	Mutch Harry L
17N-9W-36	21-133-28710-01-00	28710	THOMPSON & RANDOLPH 1	1586	MICHIGAN STRAY	Dec-71	INACTIVE	NATURAL GAS WELL	43.8182	-85.3394	Mutch Harry L
17N-9W-36	21-133-28498-01-00	28498	GREIN, DONALD 1	1539	MICHIGAN STRAY	Aug-71	INACTIVE	NATURAL GAS WELL	43.8252	-85.3392	Hersey Oil and Gas Co.
17N-9W-36	21-133-28498-00-00	28498	GREIN, DONALD 1	1526	MICHIGAN STRAY	Aug-71	INACTIVE	NATURAL GAS WELL	43.8252	-85.3392	Hersey Oil and Gas Co.
17N-9W-36	21-133-28365-00-00	28365	THOMPSON, EDITH 1	1518	MICHIGAN STRAY	Jun-71	INACTIVE	NATURAL GAS WELL	43.8253	-85.3295	Mutch Harry L
17N-9W-36	21-133-36110-7000	36110	THOMPSON 1-36	8366	CINCINNATIAN	Sep-82	INACTIVE				Marathon Oil Co.
17N-9W-35	21-133-36627-00-00	36627	STATE HERSEY 1-35			Apr-83	INACTIVE	LOCATION	43.8167	-85.3509	Rovsek Aldolph E and Muskegon Development Company
17N-9W-35	21-133-36355-00-00	36355	STATE HERSEY 2-35	8310	CINCINNATIAN	Jan-83	INACTIVE	DRY HOLE	43.8203	-85.3604	Marathon Oil Co.
17N-9W-35	21-133-38748-00-00	38748	GREIN 1-35	8206	CABOT HEAD	Jun-85	INACTIVE		43.8238	-85.346	Marathon Oil

								NATURAL GAS WELL			
17N-9W-35	21-133-28888-00-00	28888	RANDOLPH & PAINE & THIEL UNIT 1	1655	MICHIGAN STRAY	Jul-72	INACTIVE	DRY HOLE	43.825	-85.3592	Mutch J O
17N-9W-35	21-133-28786-00-00	28786	GREIN, DONALD & PAINE, HENRY 1	1638	MICHIGAN STRAY	Mar-72	INACTIVE	NATURAL GAS WELL	43.8251	-85.349	Hersey Oil and Gas Co.
17N-9W-26	21-133-37519-00-00	37519	MILLER 1-25	8425	CABOT HEAD	Aug-84	INACTIVE	NATURAL GAS WELL	43.8334	-85.3463	Marathon Oil Co.
17N-9W-26	21-133-36942-00-00	36942	WOODWARD ET AL 1-26	8135	CABOT HEAD	Oct-83	INACTIVE	DRY HOLE	43.8346	-85.3568	PPG Oil and Gas Company, Inc.
17N-9W-26*	21-133-00378-70-00	378	KALIUM 1042*	8116	A-1 SALT	Feb-85	INACTIVE	PART 625, CLASS III	43.8401	-85.3619	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-26*	21-133-366-00-0000	36600	THOMAS 1-26*	8085	CABOT HEAD	Jan-84	INACTIVE	DRY HOLE	43.8418	-85.3611	PPG Oil and Gas Company, Inc.
17N-9W-26*	21-133-00379-70-00	379	KALIUM 1052*	8045	A-1 SALT	Mar-85	INACTIVE	PART 625, CLASS III	43.8398	-85.3619	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-26*	21-133-00394-70-00	394	KALIUM HERSEY 1031*	7973	A-1 SALT	Oct-94	INACTIVE	PART 625, CLASS III	43.8394	-85.3618	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-26*	21-133-00448-70-00	448	KALIUM HERSEY 2041*	7941	A-1 SALT	Jun-00	INACTIVE	PART 625, CLASS III	43.8332	-85.3591	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-26*	21-133-00348-70-00	348	KALIUM 1011*	7827	A-1 EVAPORITE	Nov-84	INACTIVE	PART 625, CLASS III	43.8405	-85.3615	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-26*	21-133-00437-70-00	437	KALIUM HERSEY 2081*	7811	A-1 SALT	7-Jun	INACTIVE	PART 625, CLASS III	43.8327	-85.3592	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-26*	21-133-00381-70-00	381	KALIUM 1031*	4800	A-1 SALT	Feb-92	INACTIVE	PART 625, CLASS III	43.8396	-85.3619	Mosaic USA LLC, DBA Mosaic Potash Hersey, LLC
17N-9W-26	21-133-28635-00-00	28635	PAINE, HENRY 1	1558	MICHIGAN STRAY	Nov-71	INACTIVE	NATURAL GAS WELL	43.8324	-85.3494	Mutch Harry L
17N-9W-25	21-133-30341-00-00	30341	MILLER, DOUGLAS & THIEL, HAULDAH 1-25	1561	BROWN LIMESTONE	Aug-75	INACTIVE	DRY HOLE	43.8319	-85.3392	Mutch Harry L
17N-9W-25	21-133-30384-00-00	30384	JOHNSON, WALT & MILLER, DOUG & THIEL, H 1-25	1529	MICHIGAN STRAY	Aug-75	INACTIVE	DRY HOLE	43.8326	-85.3286	Mutch J O
17N-9W-25	21-133-12066-00-00	12066	JOHNSON-CODY ET AL COMM. 1	1520	MARSHALL	Jan-46	INACTIVE	DRY HOLE	43.8392	-85.3297	Oryx Energy Co. and Carter Oil Co.
17N-8W-32	21-133-27307-00-00	27307	MANEY, NORMAN 1	1660	MARSHALL	Jul-68	INACTIVE	DRY HOLE	43.8223	-85.3049	Consumer Power and Michigan Consolidated Gas
17N-8W-31	21-133-34558-00-00	34558	FREUDENBURG 1-31	10858	PRAIRIE DU CHIEN	Jul-81	INACTIVE	DRY HOLE	43.8265	-85.3083	JEM Petroleum Corp.
17N-8W-31	21-133-358-00-0000	35800	GRAY 1-31	9769	PRAIRIE DU CHIEN	Aug-82	INACTIVE	NATURAL GAS WELL	43.8275	-85.3224	Marathon Oil Co.
17N-8W-31	21-133-36336-00-00	36336	PARK 1-31	8216	CLINTON	Feb-84	INACTIVE	DRY HOLE	43.8203	-85.322	Marathon Oil Co.
17N-8W-31	21-133-34558-01-00	34852	FREUDENBURG 1-31A	8183	DUNDEE	Aug-81	INACTIVE	DRY HOLE	43.8265	-85.3083	JEM Petroleum Corp.
17N-8W-31	21-133-31786-00-00	31786	KNAPP, GERALD & PARKS, ROBERT 1-31	1590	MICHIGAN STRAY	Sep-77	INACTIVE	NATURAL GAS WELL	43.818	-85.32	Hersey Oil and Gas Co.
17N-8W-30	21-133-35977-00-00	35977	WARK 1-30	8371	CINCINNATIAN	Sep-82	INACTIVE	DRY HOLE	43.8421	-85.3128	Willmet Inc.
17N-8W-30	21-133-33466-00-00	33466	MANEY, NORMAN 1-30	5080	AMHERSTBURG	Feb-80	INACTIVE	DRY HOLE	43.8347	-85.3196	Dart Oil and Gas Co.
17N-8W-30	21-133-27159-00-00	27159	MADDERN, H 1	4030	DUNDEE	Feb-68	INACTIVE	DRY HOLE	43.8333	-85.3126	Madlou Inc.
17N-8W-19	21-133-38463-00-00	38463	VUKIN UNIT 1-19	8385	CINCINNATIAN	Feb-85	INACTIVE	DRY HOLE	43.844	-85.3148	

											PPG Oil and Gas Company, Inc. and Amoco Production Co.
17N-8W-19	21-133-38463-70-00	5006	VUKIN UNIT 1-19	8385		Dec-84	INACTIVE	DRY HOLE	43.844	-85.3148	PPG Oil and Gas Company, Inc. and Amoco Production Co.
16N-9W-2*	21-107-37188-00-00	37188	JENSEN 1-2*	8085	CABOT HEAD	Nov-83	INACTIVE	DRY HOLE	43.8073	-85.3455	Marathon Oil Co.
16N-9W-12	21-107-00340-70-00	340	PILARSKI 1-12	8318	CINCINNATIAN	Aug-84	INACTIVE	DRY HOLE	43.7974	-85.3266	PPG Industries, Inc.
16N-9W-12*	21-107-36283-00-00	36283	PARK 1-12*	8215	CINCINNATIAN	Jan-83	INACTIVE	DRY HOLE	43.798	-85.3409	Willmet Inc.
16N-9W-11	21-107-00339-70-00	339	WARD 1-11*	8121	CINCINNATIAN	Aug-84	INACTIVE	DRY HOLE	43.7901	-85.3466	PPG Industries, Inc.
16N-9W-1	21-107-00377-70-00	377	JOHNSON 2-1	8085	A-1 SALT	Apr-84	INACTIVE	DRY HOLE	43.8098	-85.3291	PPG Industries, Inc.
16N-9W-1	21-107-00337-70-00	337	JOHNSON 3-1	8073	A-1 EVAPORITE	May-84	INACTIVE	DRY HOLE	43.8098	-85.329	PPG Industries, Inc.
16N-8W-7	21-107-36187-00-00	36187	STEIN 1-7	8380	CINCINNATIAN	Nov-82	INACTIVE	DRY HOLE	43.7911	-85.312	Willmet Inc.
16N-8W-6	21-107-36067-00-00	36067	JOHNSON ET AL 1-6	8386	CINCINNATIAN	Oct-82	INACTIVE	DRY HOLE	43.8057	-85.322	Marathon Oil Co.
16N-8W-6	21-107-30728-00-00	30728	MCLACHLAN, GEORGE 1-6	1670	MICHIGAN STRAY	May-76	INACTIVE	DRY HOLE	43.8033	-85.3101	Mutch Harry L
16N-8W-6	21-107-30654-00-00	30654	KNAPP, GERALD & JOHNSON, DON 1-6	1610	MICHIGAN STRAY	Dec-75	INACTIVE	NATURAL GAS WELL	43.8109	-85.3198	Mutch Harry L
16N-8W-18*	21-107-3689-00-000	36890	STEIN 1-18 **(Outside the AOR)**	8264	CINCINNATIAN	Aug-83	INACTIVE	DRY HOLE	43.7765	-85.3074	PPG Oil and Gas Company, Inc.
16N-9W-10	21-107-36455-00-00	36455	BOYD 1-10	7975	CINCINNATIAN	May-83	INACTIVE	DRY HOLE	43.7982	-85.37647	Willmet Inc.
17N-9W-34	21-133-61237-70-00	61237	LUTZ 1-34, 34A, 34B, 34C	8837	NIAGARAN	Jun-84	INACTIVE	DRY HOLE	43.8275	-85.37228	PPG Oil and Gas Company, Inc.

Cross reference **Figure A6,** which shows all wells active and inactive within the area of review that penetrate the confining interval. Total depths of the each well is listed next to its well symbol. Also shown on this map are the API Serial number. The serial number is illustrated below:

State –	County –	**Serial** –	Completion
21 -	133 -	**#####** -	00-00

Mineral wells available to the public record or made known to the applicant are also shown. These wells are preceded with the letter "M" before the listed Serial No. The State of Michigan has adapted a 'pseudo API No,' utilizing the mineral permit number as an API Serial No. As an example; M4999 would have the equivalent Mineral Well API designation of :

State –	County –	**Serial** –	Completion
21 -	133 -	0**4999** -	**70**-00

These numbers can be quickly cross referenced with public records, and or the tabular section above.

5 If a well is proposed to be converted to a disposal well, a copy of the completion report, together with the written geologic description log or record and borehole and stratum evaluation logs for the well.

MPC 8D is a new well; conversion of an existing well is not proposed.

MPC 8D

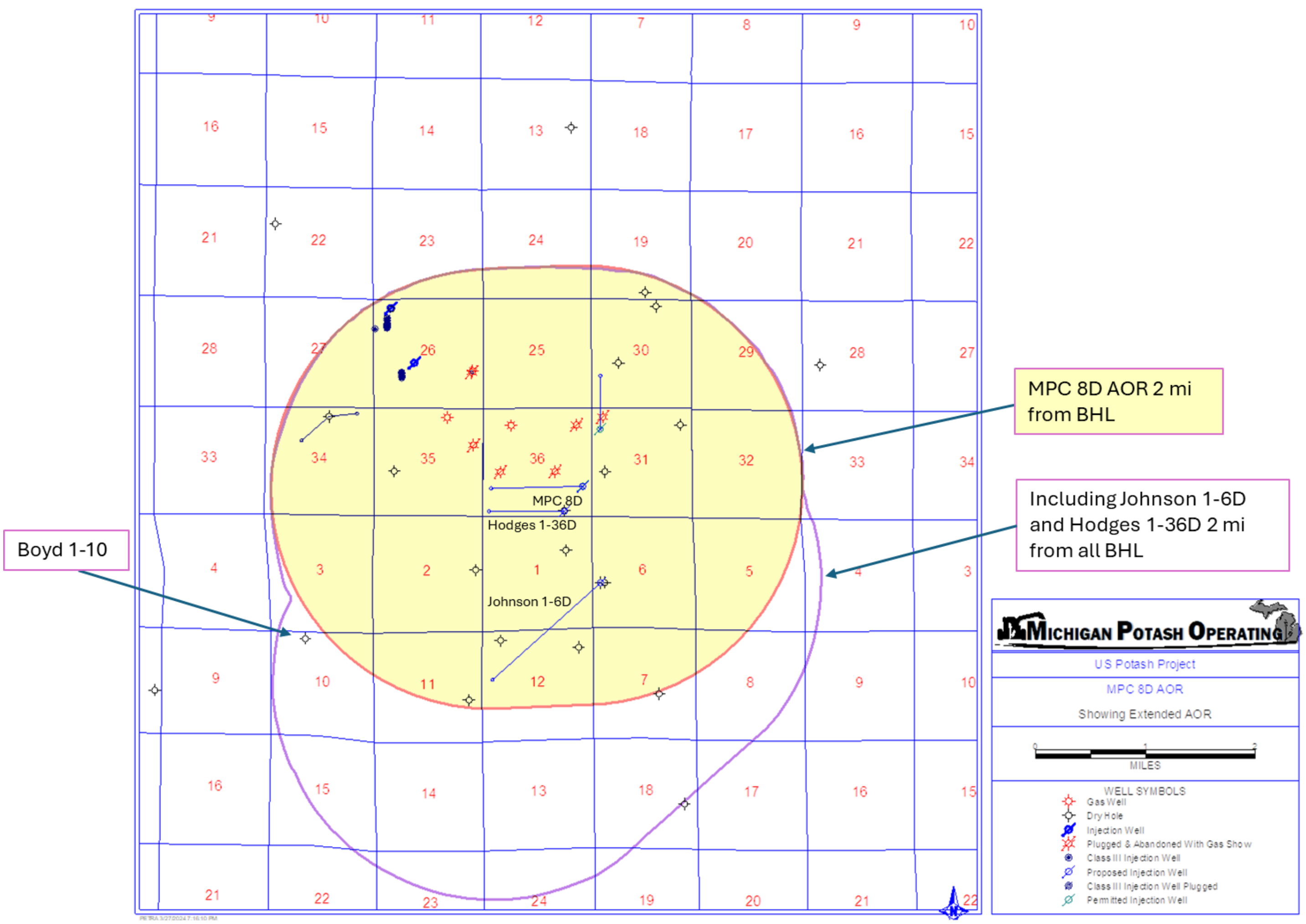
6 Plugging records of all abandoned wells and casing, sealing, and completion records of all other wells and artificial penetrations within the area of influence of the proposed well location and a map identifying all such artificial penetrations. An applicant shall also submit a plan reflecting the steps or modifications believed necessary to prevent proposed injected waste products from migrating up, into, or through inadequately plugged, sealed, or completed wells.

There are no perceived modifications necessary to prevent proposed brine injection from migration.

Appendix 1.0 has been attached to the application, and has is titled <u>APPENDIX 1.0; CEMENT, PLUGGING, AND WELL HISTORIES OF ALL WELLS IN THE AOR THAT PENETRATE THE INJECTION OR CONFINING HORIZONS.</u> Appendix 1.0 includes a visual demonstration of the AOR, including a 2 mile AOR around the lateral length of the MPC 8D. Further, it also includes all wells in an expanded AOR, which includes the MPC 8D, and Hodges 1-36D.

All wells within the Johnson 1-6D AOR, MPC 8D AOR, and Hodges 1-36D AOR have been reviewed by EGLE for either the MPC 1D, MPC 2D, MPC 3D, and Cargil Thomas 1-26 and Cargil Woodward 1-26; except the

Boyd 1-10; API 21-107-36455-00-0; illustrated below. However, the Boyd 1-10 is out of the MPC-8D Area of Review.



7 A map showing the vertical and areal extent of surface waters and subsurface aquifers containing water with less than 10,000-ppm total dissolved solids. A summary of the present and potential future use of the waters must accompany the map.

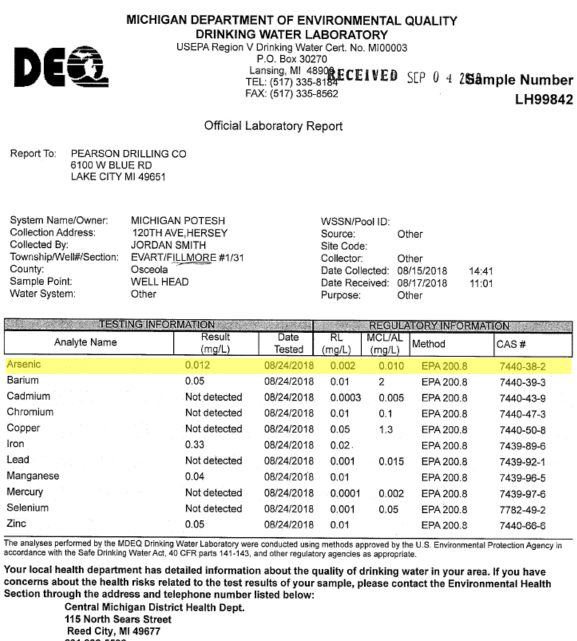
Surface water features and their areal extent are expressly highlighted on Figure A2(a) .

- Figure B1 shows the vertical and areal extent of subsurface aquifers, within the AOR, identifying the base of the lowermost aquifer above which groundwater contains less than 10,000-ppm total dissolved solids. The formations are shown in proportion to the depth associated with the proposed injection horizon, on a 1:1 ratio, with no vertical exaggeration. This presentation was done intentionally to illustrate the amount of interlayered and non-permeable intervals between any potential injection zone and the lowermost USDW.

- Figure B2 is a map showing the static water level as encountered in water wells within the AOR, presented as depth in feet below ground level. These contours are generated principally from reported and measured static water levels as extensively gathered and made available by the Michigan State ground water mapping project and Michigan Department of Environment Great Lakes and Energy, Water Division. Potentiometric surface values are used to determine the general flow direction of water through the AOR, implying a general northwestern depth increase (flow direction) within the AOR,

- Figure B3 is a surface soil map collected from soil surveys from over 308 hydrological test holes and approximately 60 piezometers cataloging over 33,833 feet of groundwater and soil data compiled by W.A. Menley over the AOR. Contours present the elevation of the water table within the Upper Unit F and are shown on top of the soil catalogue. This water table maps also demonstrate the direction of flow of water through the AOR.

A Underground Source of Drinking Water is defined by the EPA as 10,000 ppm TDS or less; however a 2018 hydrological investigation identified unsafe levels of naturally occurring arsenic below +/- 200' in an area north of the proposed MPC 8D injection well. Although below 10,000 ppm, this source is prohibited from human consumption, or a source of underground drinking water and can only be used for industrial or agricultural purpose.



MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
DRINKING WATER LABORATORY
USEPA Region V Drinking Water Cert. No. MI00003
P.O. Box 30270
Lansing, MI 48909
TEL: (517) 335-8184
FAX: (517) 335-8562

RECEIVED SEP 0 4 2

Sample Number
LH99842

Official Laboratory Report

Report To: PEARSON DRILLING CO
6100 W BLUE RD
LAKE CITY MI 49651

System Name/Owner: MICHIGAN POTESH
Collection Address: 120TH AVE,HERSEY
Collected By: JORDAN SMITH
Township/Well#/Section: EVART/FILLMORE #1/31
County: Osceola
Sample Point: WELL HEAD
Water System: Other

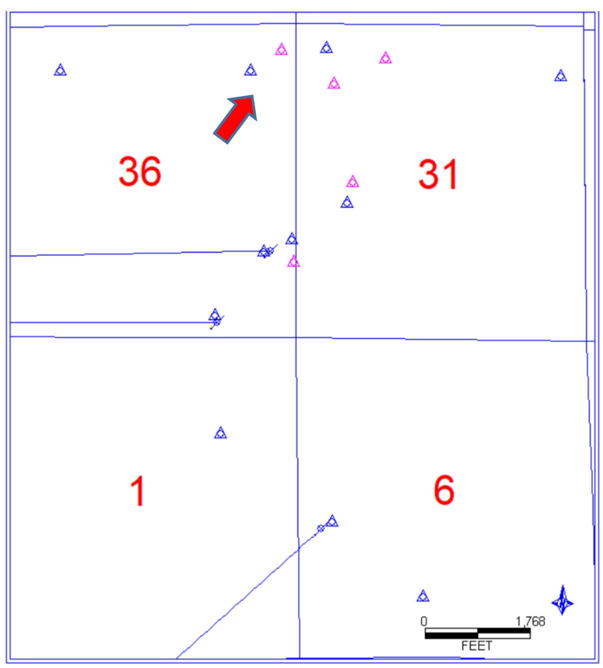
WSSN/Pool ID:
Source: Other
Site Code:
Collector: Other
Date Collected: 08/15/2018 14:41
Date Received: 08/17/2018 11:01
Purpose: Other

TESTING INFORMATION			REGULATORY INFORMATION			
Analyte Name	Result (mg/L)	Date Tested	RL (mg/L)	MCL/AL (mg/L)	Method	CAS #
Arsenic	0.012	08/24/2018	0.002	0.010	EPA 200.8	7440-38-2
Barium	0.05	08/24/2018	0.01	2	EPA 200.8	7440-39-3
Cadmium	Not detected	08/24/2018	0.0003	0.005	EPA 200.8	7440-43-9
Chromium	Not detected	08/24/2018	0.01	0.1	EPA 200.8	7440-47-3
Copper	Not detected	08/24/2018	0.05	1.3	EPA 200.8	7440-50-8
Iron	0.33	08/24/2018	0.02		EPA 200.8	7439-89-6
Lead	Not detected	08/24/2018	0.001	0.015	EPA 200.8	7439-92-1
Manganese	0.04	08/24/2018	0.01		EPA 200.8	7439-96-5
Mercury	Not detected	08/24/2018	0.0001	0.002	EPA 200.8	7439-97-6
Selenium	Not detected	08/24/2018	0.001	0.05	EPA 200.8	7782-49-2
Zinc	0.05	08/24/2018	0.01		EPA 200.8	7440-66-6

The analyses performed by the MDEQ Drinking Water Laboratory were conducted using methods approved by the U.S. Environmental Protection Agency in accordance with the Safe Drinking Water Act, 40 CFR parts 141-143, and other regulatory agencies as appropriate.

Your local health department has detailed information about the quality of drinking water in your area. If you have concerns about the health risks related to the test results of your sample, please contact the Environmental Health Section through the address and telephone number listed below:

Central Michigan District Health Dept.
115 North Sears Street
Reed City, MI 49677
231 832-5532



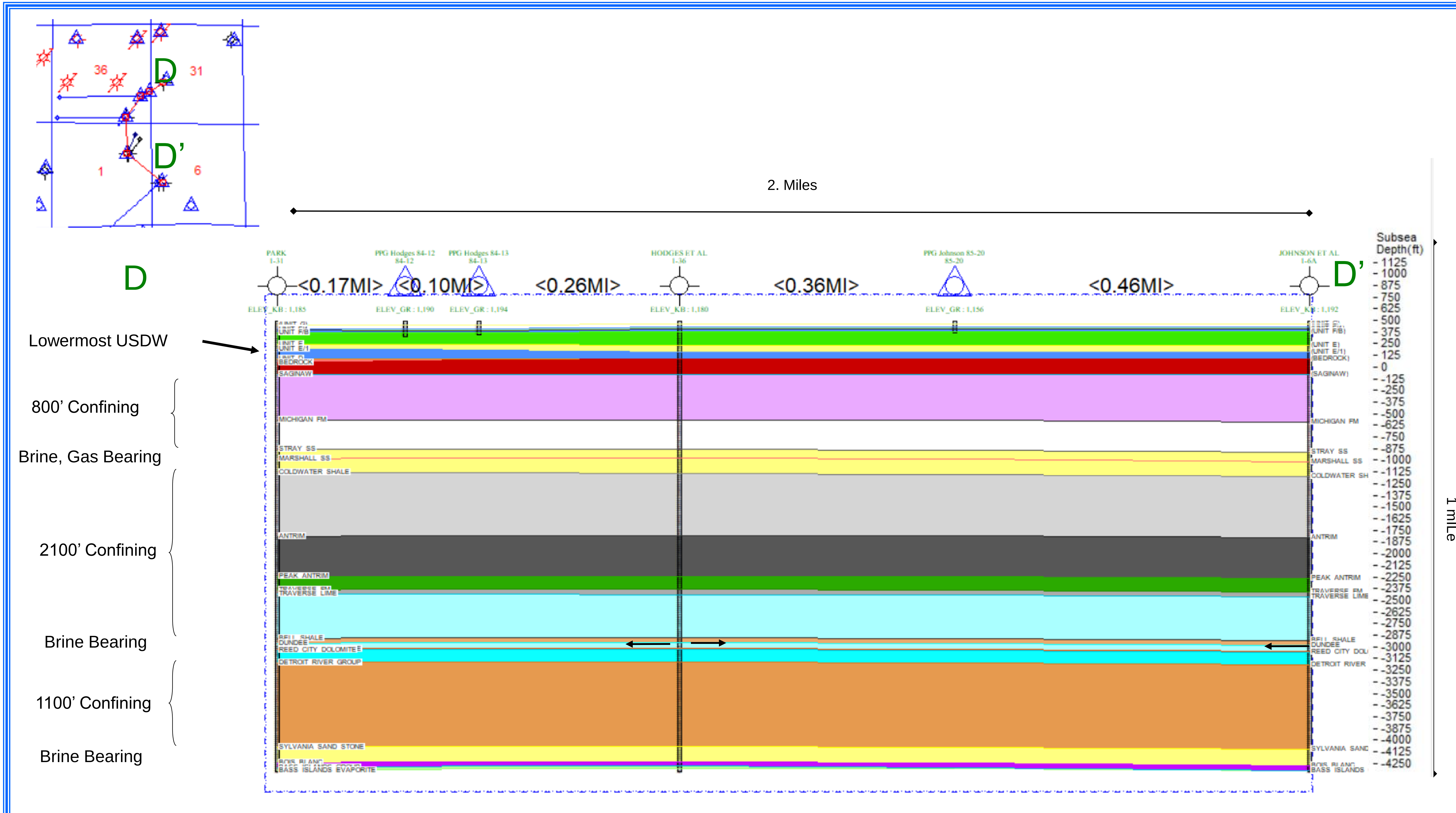


Figure B1 Lowermost USDW in relation to the proposed injection zone in the proximity of the proposed wellbores. The larger cross section is intentionally shown on a 1:1 ratio, with no vertical exaggeration to illustrate the amount of interlayered and non-permeable intervals between any potential injection zone and any potential USDW.

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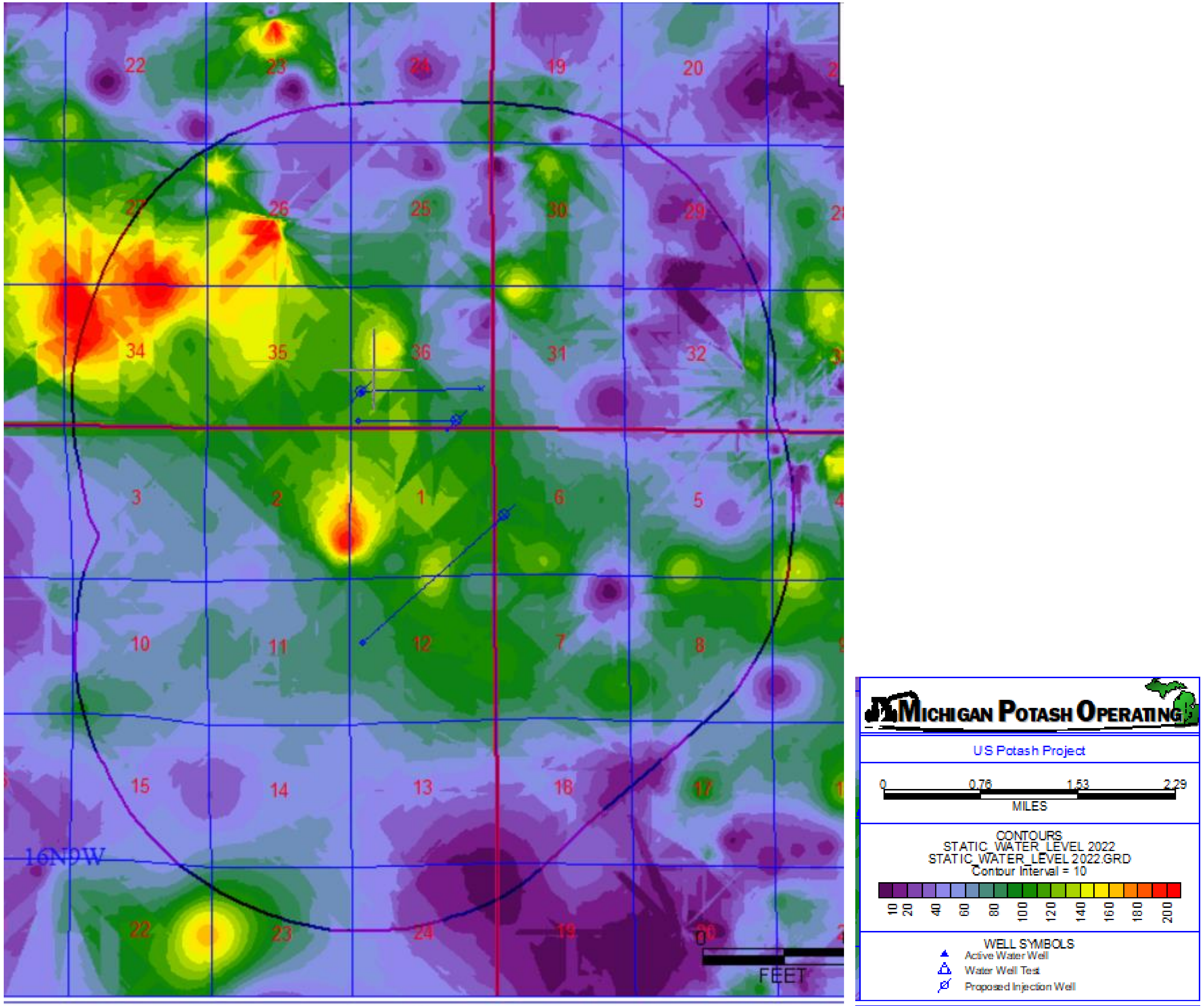

Figure B2. Static water level, Measured Depth.

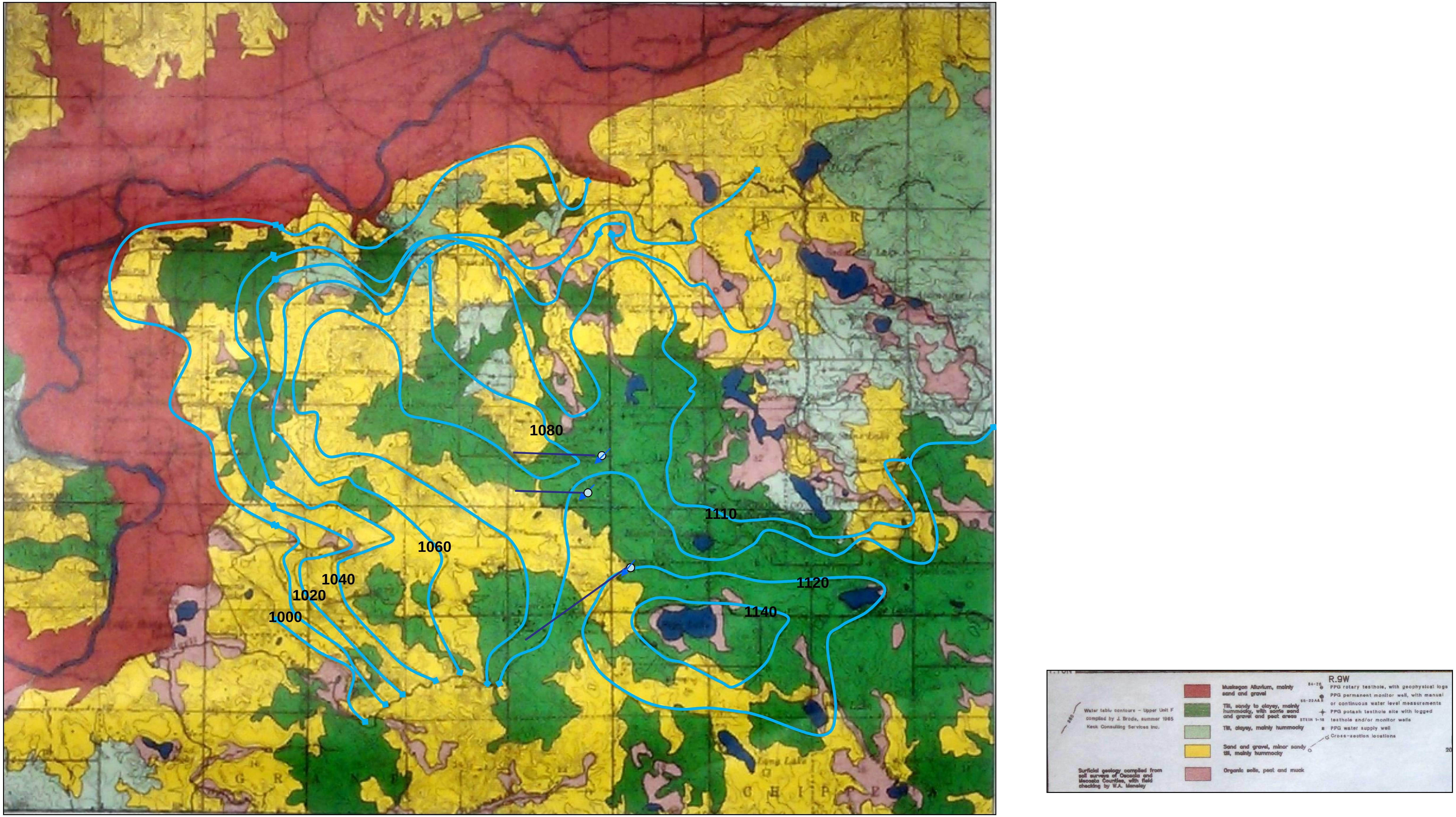

Figure B3. Surficial geological soil map, Area of Revie. Map compiled from soil surveys from over 308 hydrological test holes and approximately 60 piezometers cataloging over 33,833 feet of groundwater and soil data compiled by W.A. Menley over the AOR. Contours showing the observed water table of the Upper Unit F are shown on top of the soil catalogue. Each of the proposed wells are shown..

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The well log showing the screened depth at 240-280 in the F Unit with arsenic is shown below.

DEQ

Water Well And Pump Record

Completion is required under authority of Part 127 Act 368 PA 1978.
Failure to comply is a misdemeanor.

Wellogic

Import ID:

Tax No: 67-05-036-010-00	**Permit No:** JBES-AY4LKH	**County:** Osceola	**Township:** Evart

Town/Range: 17N 08W	**Section:** 31	**Well Status:** Active	**WSSN:**	**Source ID/Well No:**

Well ID: 67000007649

Elevation:

Latitude: 43.826035

Longitude: -85.322044

Method of Collection: GPS Std Positioning Svc SA Off

Distance and Direction from Road Intersection:
Filmore Well. Approx 1/4 mile north of intersection of 120th Ave and Schofield Road east side of 120th Ave.

Well Owner: Double ZS Ranch

Well Address: 243 120th Ave, Hersey, MI 49639

Owner Address: 900 NW Monroe, Grand Rapids, MI 49503

Drilling Method: Rotary
Well Depth: 282.00 ft. **Well Use:** Irrigation
Well Type: New **Date Completed:** 8/10/2018

Casing Type: PVC plastic **Height:** 1.00 ft. above grade
Casing Joint: Spline joint/CertaLok
Casing Fitting: None

Diameter: 6.90 in. to 100.00 ft. depth SDR: 21.00
6.90 in. to 240.00 ft. depth SDR: 17.00

Borehole: 10.62 in. to 283.00 ft. depth

Pump Installed: No
Pressure Tank Installed: No
Pressure Relief Valve Installed: No

Static Water Level: 117.00 ft. Below Grade
Well Yield Test: **Yield Test Method:** Test pump
Pumping level 206.50 ft. after 2.00 hrs. at 298 GPM

Screen Installed: Yes **Filter Packed:** Yes
Screen Diameter: 5.00 in. **Blank:** 0.00 ft. Above
Screen Material Type: Stainless steel-wire wrapped

Slot	Length	Set Between
20.00	42.00 ft.	240.00 ft. and 282.00 ft.

Fittings: Other

Well Grouted: Yes **Grouting Method:** Grout pipe outside casing

Grouting Material	Bags	Additives	Depth
Bentonite slurry	24.00	None	0.00 ft. to 230.00 ft.

Wellhead Completion: Pitless adapter

Formation Description	Thickness	Depth to Bottom
Brown Clay	10.00	10.00
Sand	3.00	13.00
Brown Clay	4.00	17.00
Sand Fine To Medium	22.00	39.00
Gray Clay	57.00	96.00
Sand & Gravel	9.00	105.00
Gray Clay Soft	10.00	115.00
Sand Fine To Medium	6.00	121.00
Gray Clay	19.00	140.00
Sand Fine To Medium	9.00	149.00
Gray Clay	2.00	151.00
Sand Fine	9.00	160.00
Gray Clay	4.00	164.00

(Continued On Page 2)

Geology Remarks:

Nearest Source of Possible Contamination:

Type	Distance	Direction
None		

Drilling Machine Operator Name: John Pearson
Employment: Employee

(Continued on page 2)

General Remarks:
Other Remarks: Screen Fittings:6.25"x6"x5"fpt

EQP-2017 (4/2010) Page 1 of 2 Contractor 8/20/2018 12:07 PM

DEQ

Water Well And Pump Record

Completion is required under authority of Part 127 Act 368 PA 1978.
Failure to comply is a misdemeanor.

Wellogic

Import ID:

Tax No: 67-05-036-010-00	**Permit No:** JBES-AY4LKH	**County:** Osceola / **Township:** Evart

Well ID: 67000007649

Elevation:

Latitude: 43.825597

Longitude: -85.324105

Method of Collection: GPS Std Positioning Svc SA Off

Town/Range:	Section:	Well Status:	WSSN:	Source ID/Well No:
17N 08W	31	Active		

Distance and Direction from Road Intersection:
Filmore Well. Approx 1/4 mile north of intersection of 120th Ave and Schofield Road east side of 120th Ave.

Well Owner: Double ZS Ranch

Well Address:
243 120th Ave
Hersey, MI 49639

Owner Address:
900 NW Monroe
Grand Rapids, MI 49503

(Continued from Page 1)

Formation Description	Thickness	Depth to Bottom
Sand Silty	11.00	175.00
Gray Clay	3.00	178.00
Sand Fine To Coarse	17.00	195.00
Gray Clay	2.00	197.00
Sand Fine To Medium	20.00	217.00
Gray Clay	1.00	218.00
Sand Fine To Medium	12.00	230.00
Gray Clay	4.00	234.00
Sand Fine Silty	7.00	241.00
Sand Fine To Medium	41.00	282.00
Gray Clay W/Gravel	11.00	293.00
Gray Clay	6.00	299.00
Sand Fine To Medium	3.00	302.00
Gray Clay Hard	56.00	358.00

OTHER REMARKS:
Screen Fittings:6.25"x6"x5"fpt

Contractor Type: Water Well Drilling Contractor **Reg No:** 57-1943
Business Name: Pearson Drilling Co
Business Address: 6100 W Blue Road, Lake City, MI, 49651

Water Well Contractor's Certification

This well/pump was constructed under my supervision and I hereby certify that the work complies with Part 127 Act 368 PA 1978 and the well code.

[signature] 4-24-19

Signature of Registered Contractor **Date**

EQP-2017 (4/2010) Page 2 of 2 Contractor 8/20/2018 12:07 PM

Discussion of Regional Hydrogeology

The area of the proposed facilities are mantled by glacial drift, the result of multiple periods of glaciation in central Michigan.

The surficial geology in the area is made up of water laid moraine and outwash deposits. The area within the AOR occupies an interlobate position between the Michigan Lobe to the west and the Saginaw and Erie Lobes to the east and south during the final glaciation of Michigan. Glaciofluvial and glaciolacustrine sediments were deposited into the interlobate area and the Muskegon Valley formed the major outlet channel for glacial melt water. Because the major ice flow axes were governed by the major topographic elements of the Great Lakes Region, it is probable that similar ice lobes occupied similar positions during earlier glaciations as well. Thus, the stratigraphic sequence encountered in the surface in the plant area may be expected to have sediments which were deposited in similar interlobate depositional environments during each episode of continental glaciation of North America.

Materials representative of sedimentation in several different depositional environments have been identified within the AOR. These include: 1) till - sediment deposited directly from a glacier by lodgment or melt out and without subsequent re-sedimentation by melt water; 2) stagnant ice deposits - sediment deposited in an ice marginal environment where the ice is relatively immobile; 3) glaciolacustrine deposits - sediment deposited in ice marginal glacial 'lakes under relatively low energy conditions; and 4) glaciofluvial deposits - sediment deposited in an ice marginal environment under relatively high energy conditions.

Discussion of Local (AOR) Hydrogeology

Bedrock is identified as Jurassic age ‘Red Beds,’ the top of which occurs at approximately 650’ below ground level, below the glacial till.

According to the Geologic Atlas of Michigan compiled by the Department of Geology, Western Michigan University in 1981, Red Beds of Jurassic age should be encountered at the bedrock surface. All of the test holes which penetrated the bedrock surface have encountered red sandstone and siltstone inter-bedded with gypsum.

The "Red Bed" sequence made up of red sandstone and siltstone inter-bedded with anhydrite of Jurassic age, forms the uppermost bedrock formation encountered in the AOR. The greatest depth at which potable water can be obtained is considered to be the top of the bedrock surface (i.e., base of the glacial till).

The base of local groundwater exploitation, that is, the greatest depth at which potable groundwater can be obtained, has been determined to be the bedrock surface. Historically, all of the water-bearing zones tested in the AOR that are at or below the bedrock surface yield saline water, with greater than > 35,000 mg/L concentration, (Hydrogeology of Part of Osceola and Mecosta Counties, Michigan, W.A. Menley 3/1985).

Between 1983 and 1989, over 308 hydrological test holes and approximately 60 piezometers cataloging over 33,833 feet of groundwater and soil data was amalgamated for the purposes of adequately understanding and protecting groundwater within the Michigan Potash Operating AOR. The area has been extensively studied from 1983 to 1989 for the sole purpose of hydrological investigation. These test holes and all the associated data has been comprehensively reviewed by the applicant and the data incorporated herein.

- Figure B4 is a map showing hydro-geological investigation wells (some, not all) drilled for the sole purpose of understanding, in order to protect, the groundwater and USDW within the AOR. These well locations have been used, in addition to water wells, to test and map the hydrological units and associated static ground water level.

- Figure B5 is a stratigraphic column describing the glacial till and sources of USDWs and the source of USDWs as extensively mapped and defined by W.A. Menley between 1983 and 1989. Glacial Deposits are highly variable, especially closer to ground level. Depths approximate those encountered throughout the AOR. A detailed description of each hydrological and potential USDW follows Figure B5.

Stratigraphic Column of the Hydrological Units, MPC Area

Stratigraphic Column and Nomenclature of the Hydrological Units in the AOR, as Defined by W.A. Menley

K			Valley train outwash	Sand and gravel coarsening upward, fine to v-coarse sand, pebbles and cobbles, locally cemented, typical of a high energy glacio-fluvial environment.	~ 0'-60' Below GL
J			Glaciolacustrine	Clay and silty clay, laminated to bedded, some interbeds of silt, massive silty sandy clay with pebbles common, typical of a low energy glacio-fluvial environment	~ 0'-60' Below GL
H			Stagnant ice/outwash	Silty sandy clay, some pebbles, in part stratified, typical of a stagnant ice depositional environment	~ 0'-60' Below GL
G			Till	Sandy clay till, sparse coarse fraction, typical of a sub glacial depositional environment	~ 0'-60' Below GL
		G/1	Glaciolacustrine	Clay and silty clay, laminated to bedded, some interbeds of silt, massive silty sandy clay with pebbles common.	~ 0'-60' Below GL
F	F/1	F/1/d	Outwash	Medium to coarse sand minor gravel, interbeds of silty clay	~ 60'-220' Below GL
		F/1/c	Glaciolacustrine	Clay and silty clay, laminated to bedded, some interbeds of silt, massive silty sandy clay with pebbles common.	
		F/1/b	Outwash	Medium to coarse sand minor gravel, interbeds of silty clay	

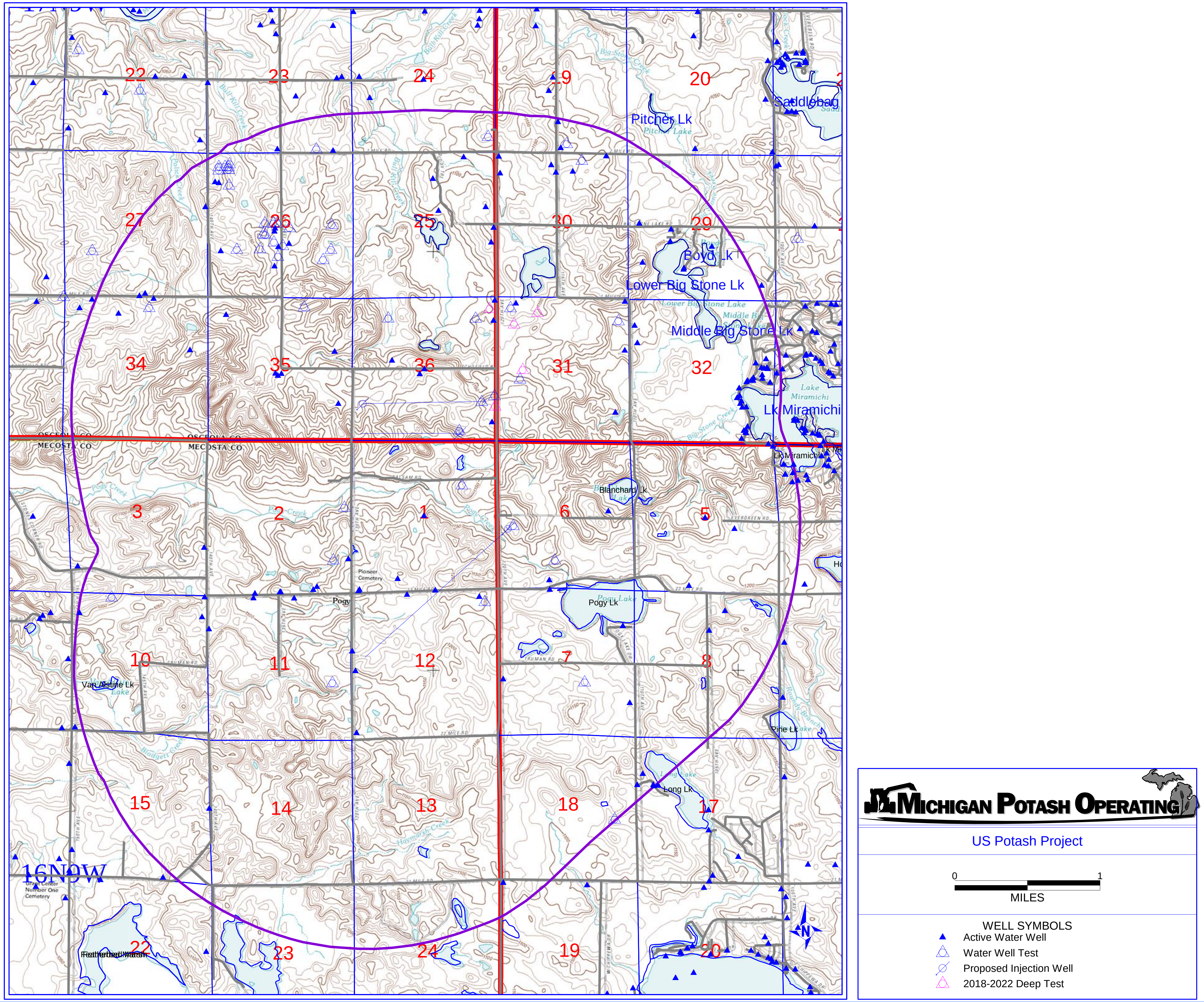


Figure B4. Hydro-geological investigation wells, water wells, and recent 2018-2022 hydrological investigation wells in and around AOR. Hydrological investigation wells (some, not all) drilled for the sole purpose of understanding groundwater occurrence to protect groundwater and lowermost USDW within the AOR.

MICHIGAN POTASH OPERATING, LLC

		F/1/a	Glaciolacustrine	Clay and silty clay, laminated to bedded, some interbeds of silt, massive silty sandy clay with pebbles common.	
	Lower F (F/B)		Outwash	Medium to coarse sand, minor silty clay interbeds, minor fine gravel interbeds, K= 650/gpd/sq.ft. Principle USDW when away from surface charge.	~ -80'-220' Below GL Natural Arsenic detected in AOR
E	Upper E		Stagnant ice	Silty sandy clay, some pebbles, in part stratified	~ 220'-300' Below GL
	E/1		Outwash	Medium to coarse sand minor gravel, interbeds of silty clay, K = 600 gpd/sq.ft, LOWEST USDW.	~ 300'-400' Below GL
D			Till	Sandy clay till, sparse coarse fraction	~ 400-620' Below GL
			BEDROCK	Jurassic Red Beds, >35,000 TDS "BRINE" from here to Center of the Earth	~ 580'-620' Below GL

Figure B5 Stratigraphic description of USDW in the AOR.

When in the immediate proximity to surface charge, such as the Muskegon River or a Lake, it is typical to find static water levels at less than 20'-30' Below GL in Units K, J, H, and/or G.
Unit F/1 serves as a plastic clay barrier and confining layer to Unit F. Above sub Unit F/1, perched water tables or unconfined aquifers may be found.

A detailed description of each glacial till deposition feature from shallowest to deepest, is as follows:

Unit K:
Unit K represents the sand and gravel deposits that form the upper part of the alluvial fill along the course of the Muskegon Valley. This unit is well exposed in the Hersey Sand and Gravel pit east of Hersey, located across the Muskegon River. The texture of this unit becomes coarser upward, with coarse clean gravel beds deposited in channels cut into the dominantly sand size overbank deposits. Excellent exposures of these channel sands and overbank deposits can be seen in the high walls of the quarry.

In the gravel pit, the sand and gravel deposits that are being quarried east of 170th Avenue and south of the washing facility are part of older glacio-fluvial deposits that make up Unit F. The sand and gravel deposits west of 170th Avenue and north of the washing plant are part of the alluvial fill along the Muskegon River (Unit K) laid down as part of the outwash deposits during the final de-glaciation of this part of Michigan.

Unit J:
During the final de-glaciation of the study area the Muskegon Valley functioned as a major melt water outlet stream. A melt water valley was incised through the previously deposited Units G and H into Unit F, eroding and removing Sub-Unit F/1 along the course of the Muskegon Valley down to an elevation of about 875 ft. Unit J is made up of fine textured silt and silty clay beds that were deposited in the channel bottom as the channel was in-filled with fine grained alluvial deposits.

Unit H:

Unit H is made up of inter-bedded sand, gravel and till which mantles the hummocky moraine upland in the eastern part of the study area. This unit represents the stagnant ice depositional environment of the final episode of de-glaciation of the study area. Most of the material in Unit H was deposited by melt water on top of stagnant ice. As the ice eventually melted out these materials were re-deposited by slumping and subject to re-sorting by runoff to form the highly variable and complex deposits which form the present land surface in the upland area east and south of the Muskegon River Valley.

Unit G:

Unit G is a silty clay till which is present beneath parts of the hummocky moraine upland east of the Muskegon River deposited during the final glaciation of the study area.

Unit F:

Unit F is a primary aquifer in the AOR. It is a thick sequence of inter-bedded sand and gravel which was encountered in all of the test holes drilled in the study area. Thin interbeds of clay, silty clay and till were encountered within this unit in all test holes. One such interbed has been separately identified as Sub-Unit F/1. The sand and gravel beds are made up mainly of subrounded clasts of igneous, metamorphic and sedimentary rocks. This unit is considered to represent deposition in a high energy glacial outwash environment.

The Muskegon Valley has been incised into Unit F exposing the sand and gravel deposits which have been quarried at the Hersey Sand and Gravel operations east of Hersey. The sand and gravel deposits east of 170th Avenue and south of Hersey Road are part of Unit F.

The hydraulic conductivity of this unit is considered to be about the same as Sub-Unit E/1, that is, k = 600 gpd/ft^2.

The specific yield is considered to be about 0.20. The specific yield is defined as the volume of water released from storage in the aquifer per unit surface area per unit decline of the water table (Freeze and Cherry, 1979, p.61).

The sand beds which overlie Sub-Unit F/1 become finer upward and more silt interbeds are present. A "perched water table" is typically present in the sand overlying Sub-Unit F/1. Similarly, unsaturated sand and gravel beds are typically present beneath Sub-Unit F/1. The presence of unsaturated sands can be detected from the resistivity log. Resistivity values > 100 ohm ft are considered to be indicative of unsaturated sand and gravel. This interpretation has been verified by comparison of the geophysical logs with the water level in nearby wells and auger holes in which direct observation of the position of the water table can be made.

Sub-Unit F/1:

Sub-Unit F/1 is an extensive layer of plastic silty clay to clayey till that is present throughout the study area except where it has been removed by subsequent erosion along the course of the Muskegon Valley or where its continuity has been disrupted in collapse structures.

The Sub-Unit F/1 is a continuous glacio-lacustrine deposit present within Unit F throughout most of the AOR. It serves as a barrier and confining interval to aquifers below.

The Sub-Unit F/1 is a saturated, plastic, silty clay. The upper part of the clay is indistinctly laminated and mottled pink and gray, grading downward to a drab light gray color. In some test holes, floating sand grains are present in the silty clay, at other locations the texture approaches that of a silty clay till. Sub-Unit F/1 ranges in thickness from about 8 - 15 ft beneath the plant site.

In Section 36, Township 17N, Range 9W, Sub-Unit F/1 thickens to about 70 ft. It is made up of 2 to 3 distinct clay beds separated by sandy till.

In Section 26, Township 17N, Range 9W Sub-Unit F/1 is about 40 ft thick. It is made up of an upper and lower silty clay bed separated by a sandy till layer.

Unit E:

This unit is a complex mixture of inter-bedded sand, gravel, and till, characterized by highly variable resistivity and gamma ray log signatures. It is considered to represent deposition in the marginal region of a stagnant continental glacier.

Sub-Unit E/1:

Sub-Unit E/1 is a principle aquifer in the AOR. This unit is present at the base of Unit E throughout the AOR. It is made up of sand and gravel which is considered to have been deposited in a high energy outwash environment. Sub-Unit E/1 is the lowermost useable aquifer present above the base of groundwater exploration, noting that the base of the lowermost USDW is defined as the base of Unit D/top of the underlying Jurassic Red Beds.

Due to the number of accessible sources of ground water above the Sub-Unit E-1 at shallower depths, Sub-Unit E-1 is not used as a common source of household water. Prior to 1984, no well was completed in this interval. In 1984, the PPG Bass 84-06 was completed as an observation well in Sub-Unit E/1. This well provided the first information about the aquifer coefficients of Sub-Unit E/1 as well as the hydraulic head and water quality because there were no existing water wells completed in this aquifer in the AOR.

In November of 1984 a short duration pumping test was run to estimate the transmissivity of Sub-Unit E/1. The test was conducted at a rate of 27 US gpm for 2 hrs, followed by a 40 minute recovery test, with a determinate $Transmissivity_a = T_a = 36{,}000$ gpd/ft, and $k = T/m = 36{,}000/60 = 600$ gpd/ft^2.

Several of the deeper wells, drawing from the Quaternary Unit E/1 are of industrial purpose, owned and operated by Cargil, Inc. 80.00% of all water wells in the area are 200' or shallower, indicating that while groundwater exhibiting TDS less than 10,000 ppm is present in Sub-Unit E/1, it is not typically used for groundwater consumption. Due to the number of accessible sources of ground water above the Sub-Unit E-1, at shallower depths, it is not used as a common source of household water. Industrial use is preferentially taken to deeper horizons, so as to access water that is not being drawn by household use.

Sub-Unit E/1 water quality in PPG Bass 84-06 was determined on a water sample collected January 16, 1985. Water quality results are present in the table to the left of this text. The water is a calcium-sulphate/bicarbonate water having a concentration of about 730 mg/L and a specific conductance of 1,025 micro ohms/cm @ 25°C. The total hardness of the water is about 463 mg/L as $CaCO_3$. Similar to the F Unit in the AOR, The E/1 also has arsenic in its source in offset analysis at the existing Cargil facility. Other average elements in the F, are also shown in the table. In summary, the E/1 unit, which is principally utilized for industrial purposes, is a calcium sulfate (CaSO4) base water as described by W.A. Menley. $CaSO_4$ is the principle natural composition of gypsum and anhydrite.

		E/1	F
Calcium	mg/l	122.4	76
Magnesium	mg/L	38	39
Sodium	mg/L	40.2	11
Potassium	mg/L	2.1	1.86
Bicarbonate	mg/L	205	230
Carbonate	mg/L	0	10
Sulphate	mg/L	258	29.6
Chloride	mg/l	15.8	17.5
Iron	mg/L.	1.1	1.22
Manganese	mg/1	.03	0.04
Nitrate as N	mg/L		6.3
Total Phosphorous as P, mg/L			0.023
PH			7
Specific Conductivity, uahos/cm@25C		1025	552
Concentration	mg/l	730	404
Total Hardness, mgiL as CaCO3	mg/l	463	335
Sum of cations, epm			6.97
Sum of Anions,epm			5.04

<u>Unit</u> <u>D</u>

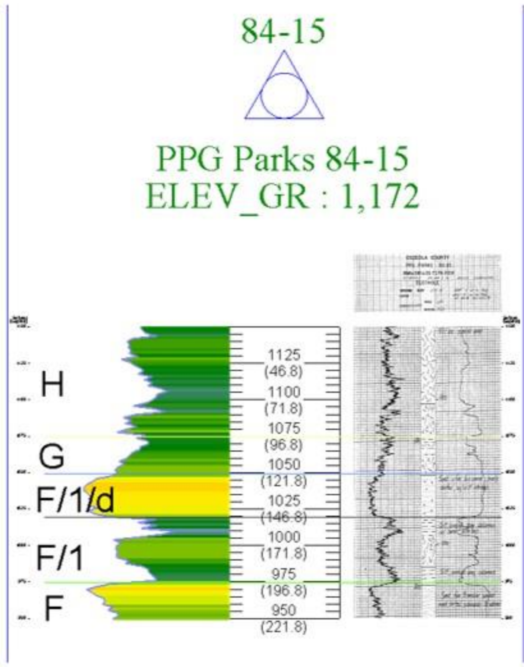
Unit D is glacial till which was encountered overlying the bedrock surface or Unit A throughout the study area. It is a reddish brown to pinkish gray, calcareous sandy till which has very uniform geophysical log characteristics. Unit D represents sedimentation in a glacial depositional environment, either as lodgment till or as till deposited by basal melting of a stagnant ice sheet.

The area is highly rural and future possible use is limited to residential use, agricultural use, or Part 625 use within the immediate area of influence.

No wells are completed within Unit D in the AOR. The deepest screen completion depth within the AOR is no greater than 340' below ground level (Sub-Unite E/1); another 200' of Unit D glacial till occurs below and it is assumed that potential sources of water with less than 10,000 TDS may occur until the Jurassic
Red beds. However, it is more likely that the lower most glacial till Unit D, is a clayey, silty, confining layer with minimal to no vertical permeability. Below Unit D, observed TDS is greater than 35,000 in the Jurassic Red beds. This is likely due to the increasing concentration of anhydrite and gypsum deposition as depths are increased.

- Figure B6 is a type curve of the natural gamma ray radioactivity of the hydrological unit in the AOR. This is from the PPG Parks 84-15, located in the NW/4SW/4 Section 31, Evart Township. This is in the immediate proximity to the proposed injection wells. The depth scale shows both measured depth and depth subsea.

Figure B6 Hydrologic Unit Type Curve at PPG Parks 84-15 Well

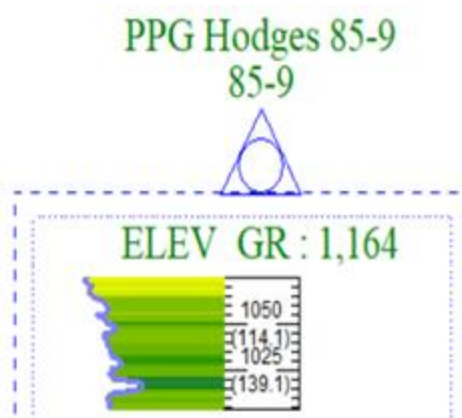


The F/1 Unit which is described as a clay and silty clay, laminated to bedded, some interbeds of silt, massive silty sandy clay with pebbles common, serves as a hydrological barrier between confined and unconfined subsurface water systems.

The F/1 Unit confines the lower F Unit aquifer. It also serves as a vertical transmissibility barrier.

- Figure B7 is the PPG Hodges 85-9 just to the SW of the proposed pad location. The F/1 and F Unit were not penetrated at 145' below GL.

Figure B7 Hydrologic GR of the PPG Hodges 85-9



- Figure B8 is a hydrological cross section from the above referenced PPG Parks 84-15 hydrological well to the PPG Babcock 85-13 hydrological well located in the NE/4NE/4 Section 36. The cross section moves from South to Northerly. There are control wells in this cross section that penetrate the entire quaternary aquifer system and encounter the Jurassic Bedrock. Also in the cross section is a proposed injection location to give point of reference to the quaternary hydrological units that will be intersected by the proposed injection well.

- Figure B9 is a hydrological cross section extending across the entire AOR, spanning an approximate 3.5 mile length from South to North, crossing the reference wells utilized in Figure **B10**.

- Figure B10 is a hydrological cross section extending across the entire AOR, spanning an approximate 5.5 mile length from West to East, crossing the reference wells utilized in Figure D5. Also in the cross section is a proposed injection location to give point of reference to the quaternary hydrological units that will be intersected by the proposed injection well.

- Figure B11 is a hydrological cross section generated by W.A. Menley, spanning and approximate 4.0 mile length from Northwest to Southeast across the AOR.

The extensive geological understanding and well control of the hydrological units within the area give extra assurance that all USDW or potential USDW or any freshwater sources of water of any kind, whatsoever, are thoroughly and adequately protected and monitored.

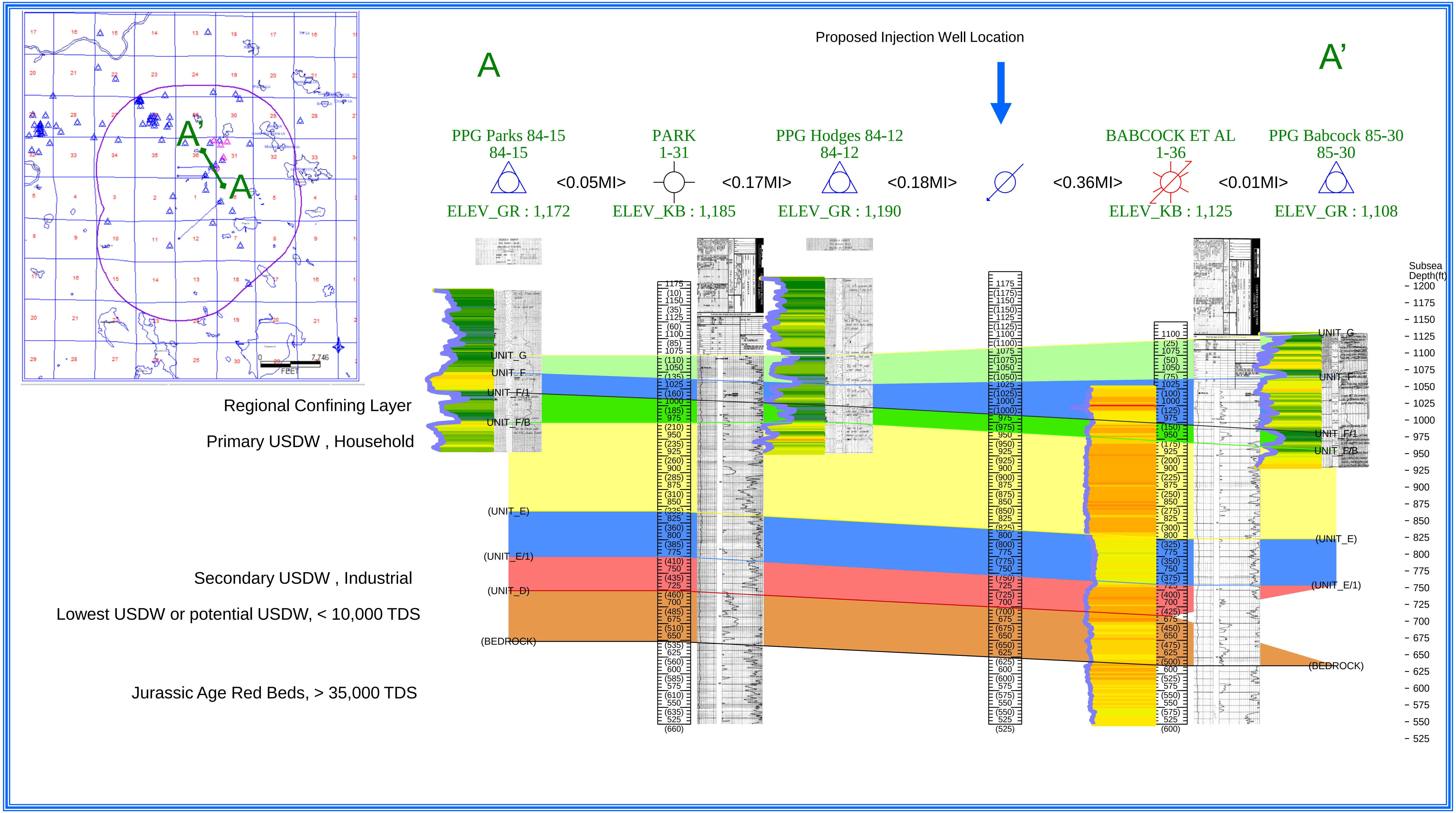


Figure B8. Cross section of Glacial Till across in the immediate vicinity of the proposed injection wells. The cross Section A-A’ and the path that it follows from South to Northerly, can be seen in the samll reference map in the upper left corner. This cross section included hydro-geological wells, mineral wells and gas wells.

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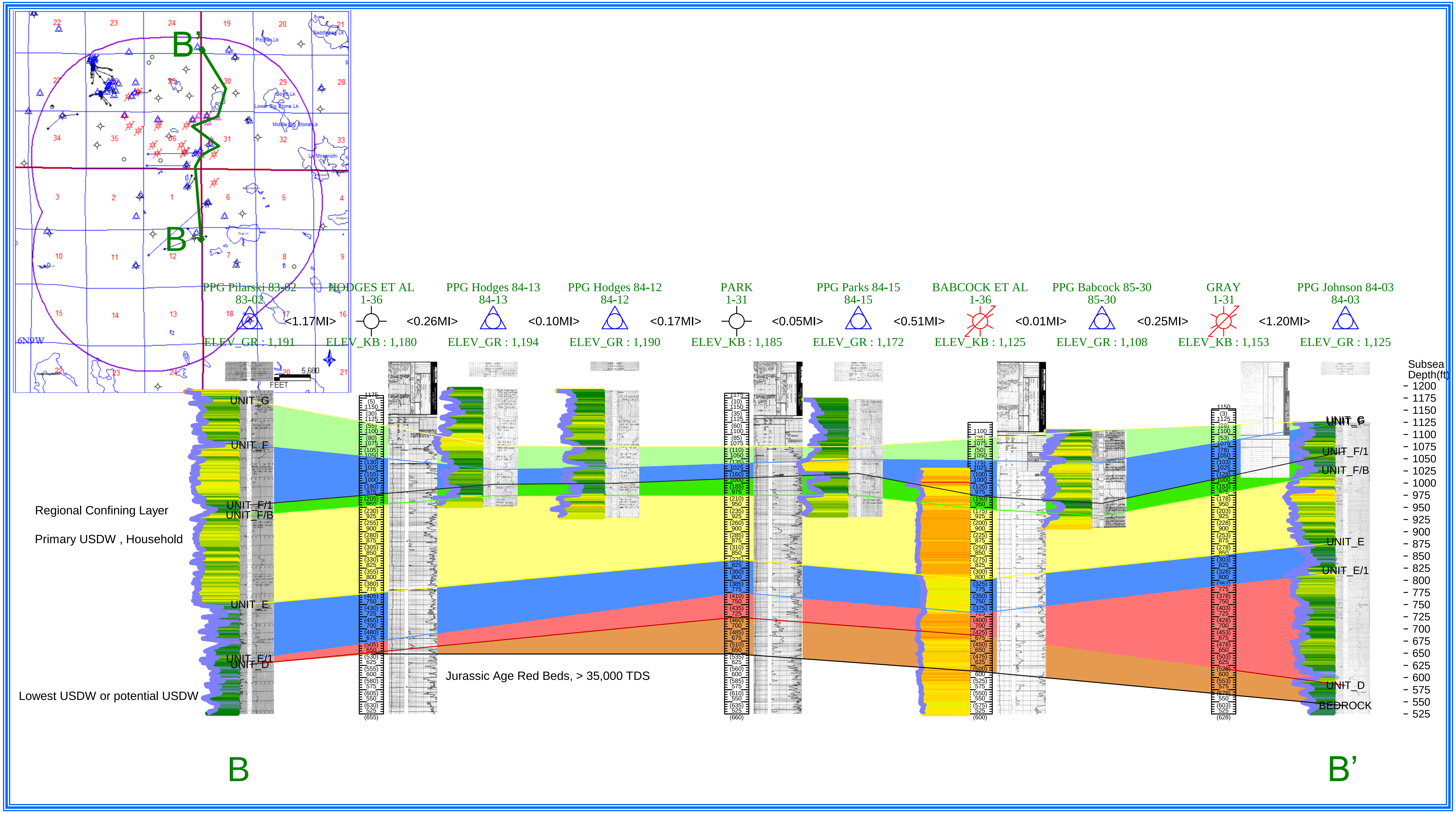

Figure B9 Hydrologic cross section extending across the entire AOR. Cross section spans an approximate 3.5 mile length from South to North, crossing the reference wells utilized in Figure D5. The cross section path can be referenced by the small map in the upper left hand corner.

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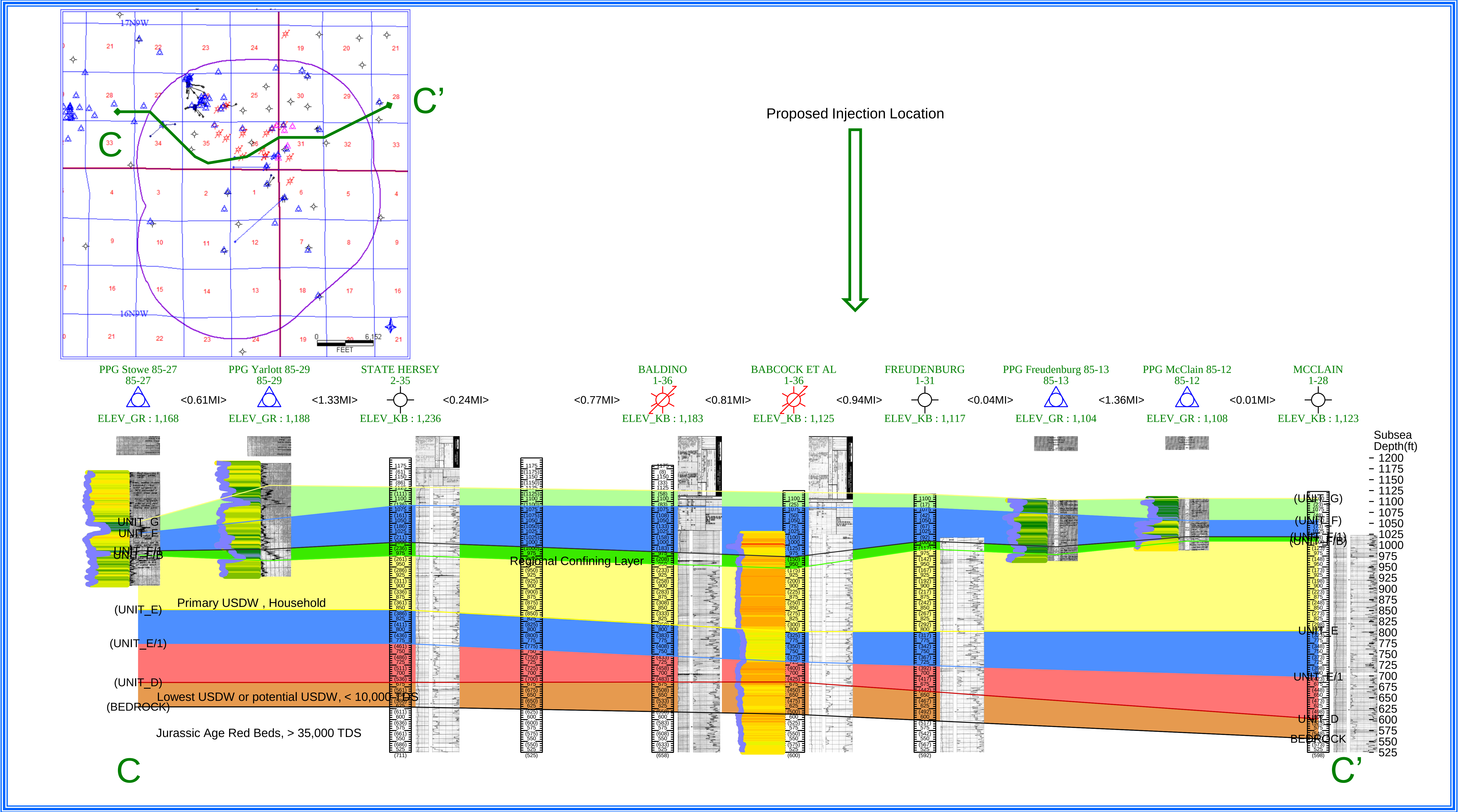

Figure B10. West-East Hydrologic cross section extending across the entire AOR. Cross section spans an approximate 5.5 mile length from West to East, crossing the reference wells utilized in Figure D5. The cross section path can be referenced by the small map in the upper left hand corner.

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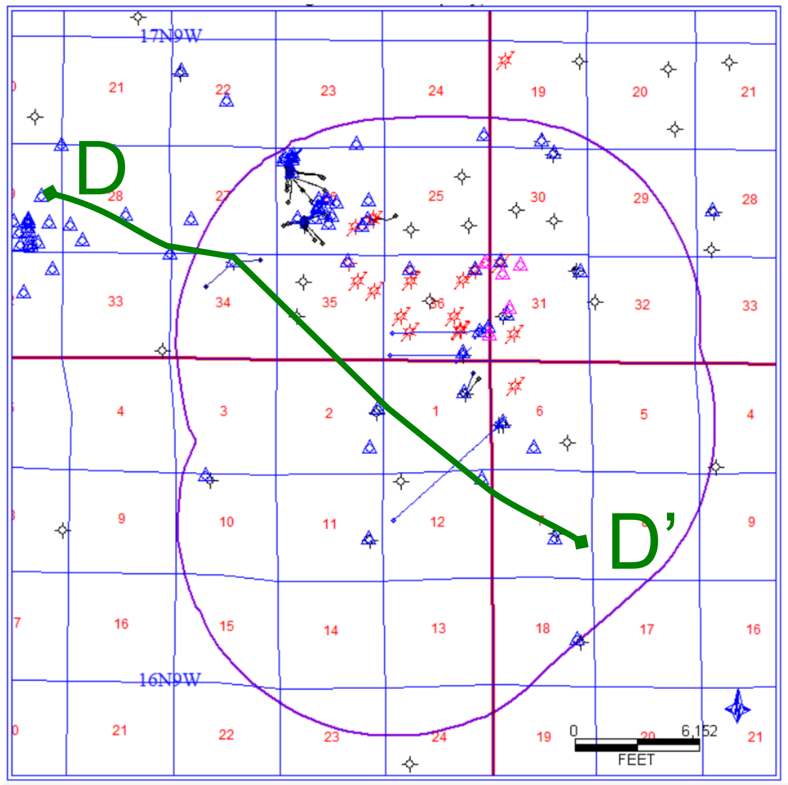

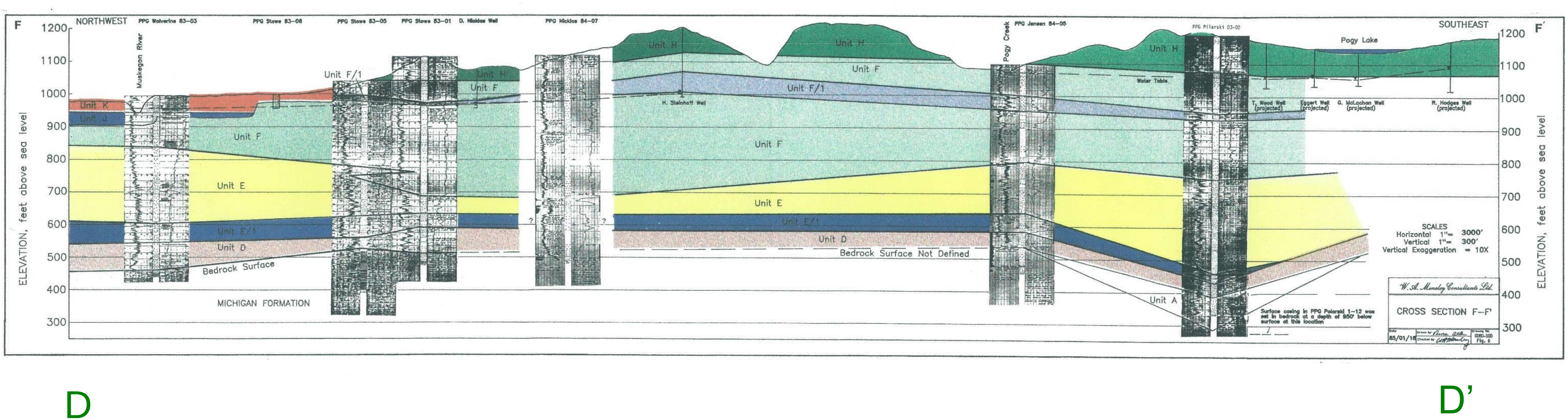

Figure B11. Hydrological cross section generated by W.A. Menley, spanning and approximate 4.0 mile length from Northwest to Southeast across the AOR.

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Lowermost USDW

As described above, while the lowest underground source of drinking water in the AOR is the Sub Unit E/1 at 340 feet, the base of the lowermost USDW is considered the base of clay/till in unit D above saline Jurassic age Red Beds.

Within the entire AOR, the base of the glacial drift typically occurs approximately 614 feet below ground surface, although the base is at 638 feet below ground surface at the Johnson 1-6D. The base of the glacial till is considered to be the base of the lowermost USDW - an area defined by the USEPA as an aquifer containing less than 10,000 parts per million of total dissolved solids (TDS). Below the glacial till and in the Jurassic Red Beds, , TDS is typically in excess of 35,000.

Quaternary Aquifers

All USDWs described above occur in Quaternary glacial deposits. Quaternary deposits come in direct contact with Jurassic age, bedrock in the AOR, as previously described.

The cross sections and the data compiled by PPG has been incorporated into all regional studies performed over the AOR.

Restated, three main quaternary aquifers exist in the AOR:

- Along Muskegon River - shallow wells (<50 feet) completed in valley fill deposits within the river valley - not a really extensive but can sustain high pumping volumes.
- Unit H - shallow wells (<100 feet) completed in moraine deposits - not a really extensive but adequate for most domestic and agricultural potable water sources.
- Unit F - wells completed from 150 to 250 ft in a really extensive prolific producing outwash deposits

Unit E/1 – 250 to 614 ft water wells are completed principally for industrial use.

Bedrock Aquifers

There are NO Bedrock aquifers in the AOR supplying any water, whether fresh or saline, for any purpose. Within the AOR, which is deep and basin centered, no bedrock aquifers contain water that exhibits a TDS less than 35,000 mg/L (Hydrogeology of Part of Osceola and Mecosta Counties, Michigan, W.A. Menley 3/1985).

For clarification purposes, an aquifer is defined as a system that has the ability to transmit water with porosity and potential permeability. All of the below listed zones within the AOR may have that ability, but are deep, confined, and saturated with extremely highly TDS and chloride content water, and/or oil and natural gas and are not suitable for any use, industrial or otherwise.

Restated, the below systems do not constitute any source of potable or usable source of water for industrial or any other purpose. They are deep, confined, and highly saline. In fact, most of the below mentioned zones are either Oil and Gas bearing reservoirs, or have been used as disposal horizons throughout Michigan and in Osceola or Mecosta County.

Pennsylvanian Aquifer System

Chemical analysis data indicate TDS and chloride content in Palma Sandstone and other Pennsylvanian age systems contain of 234,000 mg/1 and 141,000 mg/1, respectively in Mecosta County.

This system includes the sandstones of the Saginaw and Grand River Formations. It overlies the Mississippian sandstones of the Marshall and Michigan Formations and is overlain by the "Red Beds" of Jurassic time. No areas of subsidence or catastrophic collapse due to solution mining are known to occur in Pennsylvanian rocks.

Mississippian Aquifer System

Chemical analysis data indicates the average TDS and chloride content in the Marshall Sandstone are 254,880 mg/1 and 150,136 mg/l, respectively, in Mecosta County and 267,000 mg/1 and 142,000 mg/l, respectively, in Osceola County.

This system includes the sandstones of the Marshall Sandstone and the Michigan Formation which includes the Bayport Limestone. It overlies the Mississippian Coldwater Shales and is overlain by the Pennsylvanian sandstone and shales. The Mississippian Berea Sandstone is an aquifer in the area of subcrop beneath the glacial drift in southeast Michigan. No areas of subsidence or catastrophic collapse due to solution mining are known to occur in Mississippian rocks.

Devonian Aquifer System

Chemical analysis data indicates an average TDS and chloride content in the Dundee are 305,000 mg/1 and 162,000 mg/1, respectively, in Mecosta County and 270,000 mg/1 and 147,000 mg/1, respectively in Osceola County.

The Devonian Aquifer System includes the sandstones of the Sylvania Sandstone and the carbonate rocks of the Detroit River, Dundee Limestone and Traverse Groups. It overlies evaporate and carbonate rocks of Silurian age and is overlain by shale of Mississippian or Devonian age. No areas of subsidence or catastrophic collapse due to solution mining are known to occur in Devonian rocks.

Silurian Aquifer System

This system includes the carbonate and evaporate rocks of the Niagara Series, the Burnt Bluff and Manistique Groups and the Engadine Dolomite, the Cayugan Series, Salina and Bass Island Groups. It overlies the Silurian shades and carbonates of the Cataract Group and is overlain by Devonian carbonate rocks of the Garden Island Formation and Detroit River Group. Silurian formations are important hydrocarbon producing formations in Michigan. No areas of subsidence or catastrophic collapse due to solution mining are documented for Silurian rocks, though the Salina Group evaporate are the most important source formations for artificial brine production in Michigan.

Source of Information for the Geologic Data and Formation TDS

Chung, P.K., Mississippian Coldwater Formation of the Michigan Basin, Unpublished PhD Dissertation, Michigan State University, 1973.

Dali, A.H., Depositional Environment of the Upper Silurian of the Michigan Basin, Unpublished M.S. Thesis, Michigan State University, 1975.

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Hydrogeology of Parts of Osceola and Mecosta Counties Michigan, Menley, W.A., 1984

Hydrological Supplement, Menley, W.A., May 1986

Hydrogeologic Evaluation of the Woodward Site - Kalium Chemicals Potash Plant, Menlyy, W.A., 1988.

Fisher, James H., Traverse Limestone Structure, Plate 4, Dow Chemical Company, Department of Energy, Report No. FE 2346-80, 1980.

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Vugrinovich, R., Patterns of Regional Subsurface Fluid Movement in the Michigan Basin, Michigan Department of Natural Resources, Geological Survey Division, 1986.

Studies of the Precambrian Michigan Basin, Michigan Basin Geological Society, 1969

Hydrological Atlas of Michigan, Western Michigan University, Department of Geology, 1981

Oil and gas wells: _IHS Well Data
http://ww2.deq.state.mi.us/GeoWebFace/
Mineral Wells: Michigan Mineral Well Database
http://ww2.deq.state.mi.us/GeoWebFace/
http://gwmap.rsgis.msu.edu//.
http://www. zipcodemapping.com/ez/4993 9.html
http: //www. deq. state.mi.us/part201ss
http:/lwww.deu.state.mi.us/wdspi
http://www.epa.Rov/superftind/sites/npl/rai.htm
http://www.epa. gov/reRion5/waterluic/cUsites.htm

http ://ww2. deq . state. mi.us/mir/
http:/lwww.dnr.state.mi.us/spatialdatalibrary/pdf_maps/mineral_lease_information/osceola lease information.pdf
http://www.dnr.state.mi.us/spatialdataiibrary/pdf_maps/mineral_lease_information/mecosta lease information.pdf
http://www. deq. state. mi.us/well-logs/

Comprehensive Freedom of Information Act Request for prior applications and reviews: Michigan Department of Environment, Great Lakes and Energy, EPA Region V, UIC Division Core and database reviews from the Michigan Geological Repository for Research and Education

8 Geologic maps and stratigraphic cross sections of the local and regional geology.

Regional Geologic Setting

The Michigan Basin is a sedimentary basin centered in the Lower Peninsula of the US State of Michigan. The feature is represented by a circular pattern of geologic sedimentary strata with a nearly uniform structural dip toward the center of the peninsula (Figure C1). The extent of evaporative deposits and other shallow water deposits suggest concurrent subsidence during basin filling. High evaporation rates during the Silurian and Devonian geologic periods resulted in massive and pure bedded halite (NaCl), and the possibility of potassium chloride (KCl) in select locations due to mineral rich sea water.

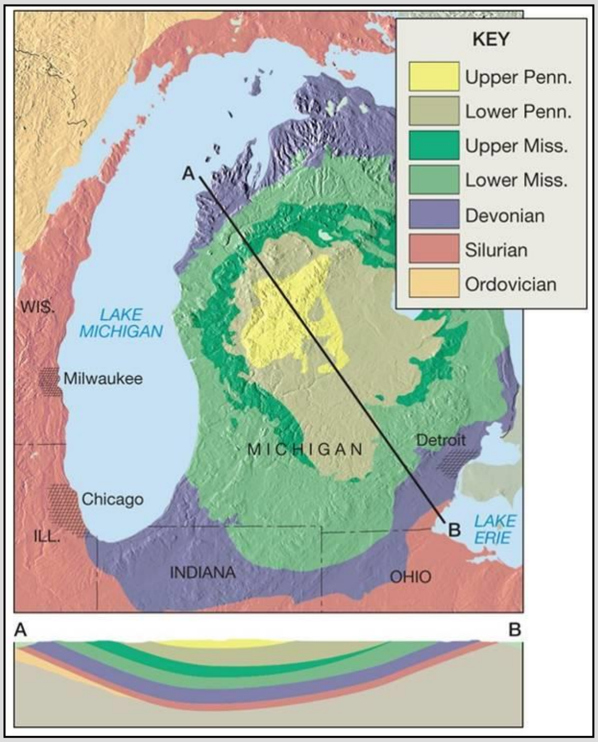


Figure C1. A geologic map of the sedimentary basin of Michigan, with a cross section shown from A to B. Salt occurs in Devonian Age (Blue). Salt and Potash occur in the Silurian Age (Red).

Massive bedded halite occurs in beds of the Silurian Salina Formation, and the Devonian Detroit River Group. Dow Chemical began mining Michigan's salt rich brines in 1897, creating a commercial source of potassium, calcium, and magnesium salts, bromine, and iodine. Dow Chemical remains headquartered in Midland, Michigan. Morton International, Martian Marietta Materials, and The Detroit Salt Company are other salt and mineral producers with an economic interest in salt and salt related deposits in Michigan.

The Michigan Basin is the dominant structural feature of the Michigan southern peninsula. It is a nearly circular and symmetrical structural and sedimentary basin. A maximum aggregate thickness of about 14,000 feet of Cambrian through Jurassic sedimentary strata was deposited in the basin. The basin first developed as a structural feature in late Silurian time during which approximately the middle one-third of the total sedimentary rock formation was deposited.

- Figure C1 is a generalized map of the Michigan Basin.
- Figure C2 is the Michigan stratigraphic column illustrating the lithology of the sediments which fill the Michigan Basin and occur in the AOR.

The southern Osceola/northern Mecosta County area is covered by several hundred feet of Pleistocene glacial drift. The glacial deposits rest on Jurassic "Red Bed" sediments of Pennsylvanian shale and sandstone. The Paleozoic rock section, from Pennsylvanian to the Precambrian crystalline basement complex, likely exceeds 10,000 feet in thickness within the AOR, and includes shale, limestone, dolomite, sandstone, anhydrite, and salt units. The Precambrian basement beneath the Paleozoic deposits is not known to have been penetrated in the AOR but may occur over 11,000 feet below the surface based on regional information.

- Figure C3 is a detailed reproduction of the northwest-southeast regional cross-section as presented by Fenix and Scisson, 1984, which transects the AOR. The section utilizes the deepest well in the area

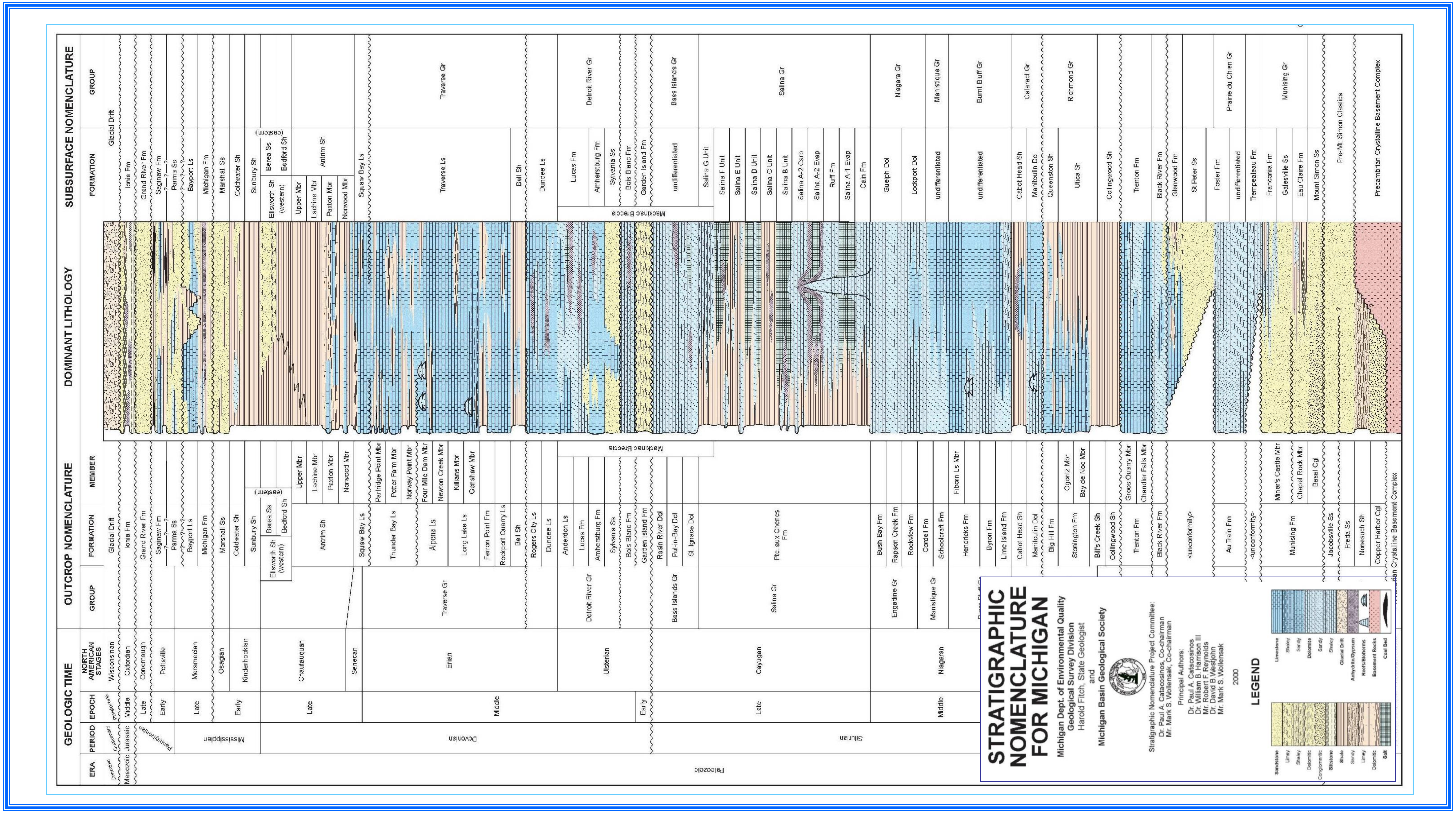
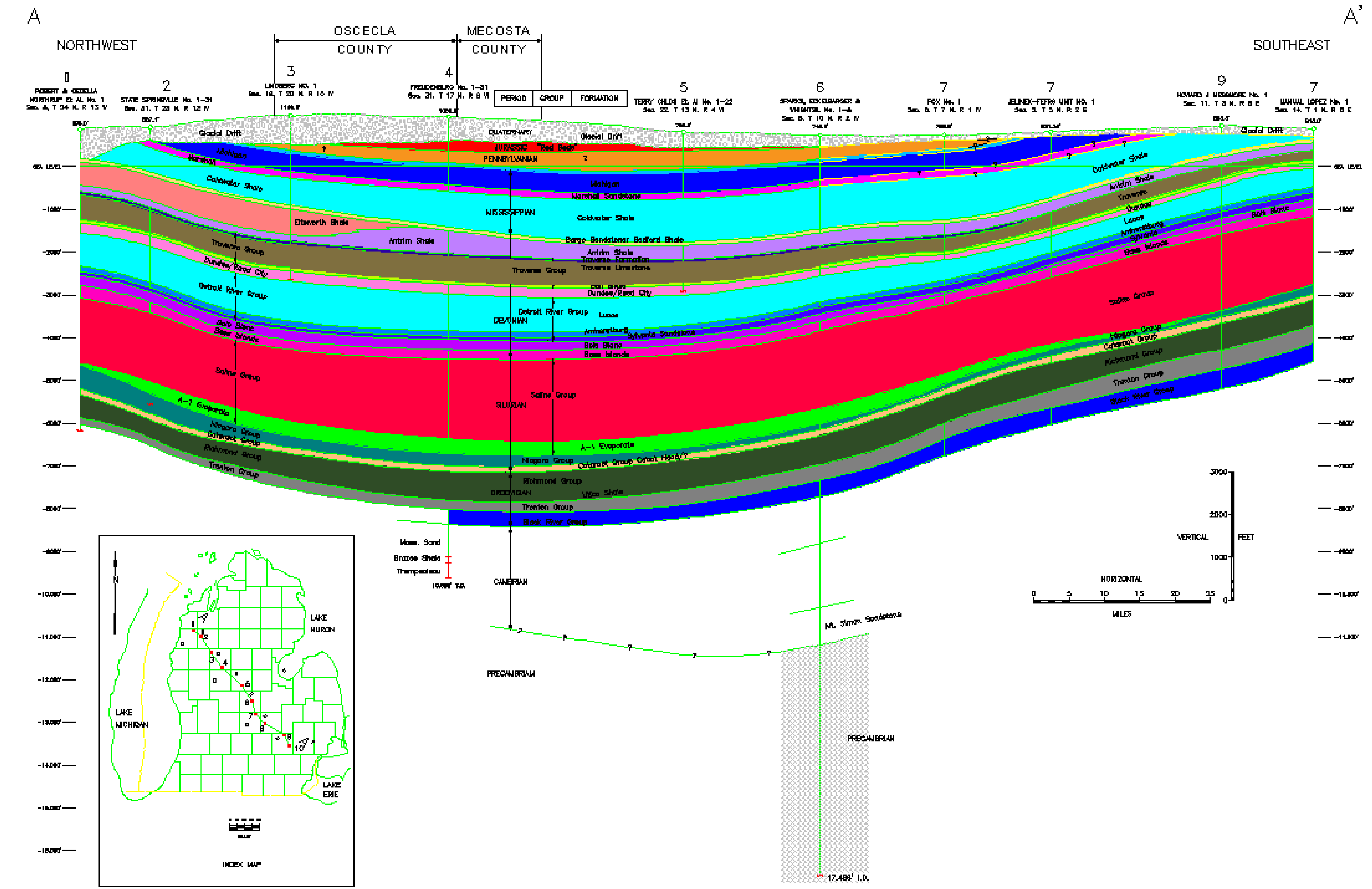


Figure C2. Stratigraphic Nomenclature for Michigan. Figure is the Michigan stratigraphic column illustrating the lithology of the sediments which fill the Michigan Basin and occur in the AOR.



Source: Fenix & Scisson, Feasibility Study, 1984

Figure C3. Regional Geologic Cross Section, State of Michigan. A detailed northwest-southeast regional cross-section through the state of Michigan, drawn through the AOR, utilizing the deepest well in the AOR (Fruedenburg 1-31 - 10,858 feet, Section 31, Evart Township, Osceola County, Michigan), which is in the same area as the MPC8D, Hodges 1-36, and Johnson 1-6 proposed injection well locations.

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(Freudenberg 1-31 - 10,858 feet),as well as the deepest reported well in the Michigan Basin (Sparks, Eckelberger, and Wrightsil 1-8 - 17,466 feet). This figure has a vertical exaggeration approximating 50 to 1.

- Figure C4 is a detailed portion of Figure C3 showing the proposed injection horizon in relation to the local stratigraphic column.

Local Geologic Setting

- Figure C5 is a local cross section through the AOR constructed using geophysical well logs that show porosity, bulk density, natural gamma ray, caliper log responses. The cross section shows the geological units of interest and their immediate confining layers from West to East, also presenting the thickness and lateral continuity of the confining zones (s) through the area of review. The confining zone(s) is the Bell Shale. Above the Bell Shale is the Traverse limestone, that may locally exhibit low porosity limestone and thus also serve as a confining zone. Above the Traverse Limestone is the Antrim Shale, which would also serve as a confining zone. The AOR is in an a structurally undisturbed area, with regional dip less than 1 degree to the northeast. There are no observable faults in the AOR.

- Figure C6 is a cross sectional trace of the path of the Johnson 1-6, from East to West, constructed using geophysical well logs that show porosity, bulk density, natural gamma ray, caliper log responses. The cross section shows the geological units of interest and their immediate confining layers from East to West, and is consistent with the well trace that the MPC 8D and Hodges 1-36 will follow in the Reed City Dolomite/Dundee. This cross section presents the continuity of both the proposed injection and confining zones within the AOR.

- Figure C7 is a cross sectional trace of the path of the MPC 8D and Hodges 1-36, from East to West, constructed using geophysical well logs that show porosity, bulk density, natural gamma ray, caliper responses. The cross section shows the geological units of interest and their immediate confining layers from East to West along the MPC 8D and Hodges 1-36 well traces within the Reed City Dolomite/Dundee. This cross section presents the continuity of both the proposed injection and confining zones within the AOR.

- Figure C8 is a structure map of the Dundee/Reed City Dolomite. The flat, undisturbed, geological character of the AOR is presented in Figures C5 through C8. Structural dip is minor, i.e. less than 50 ft/mile, and there are no known faults in the AOR.

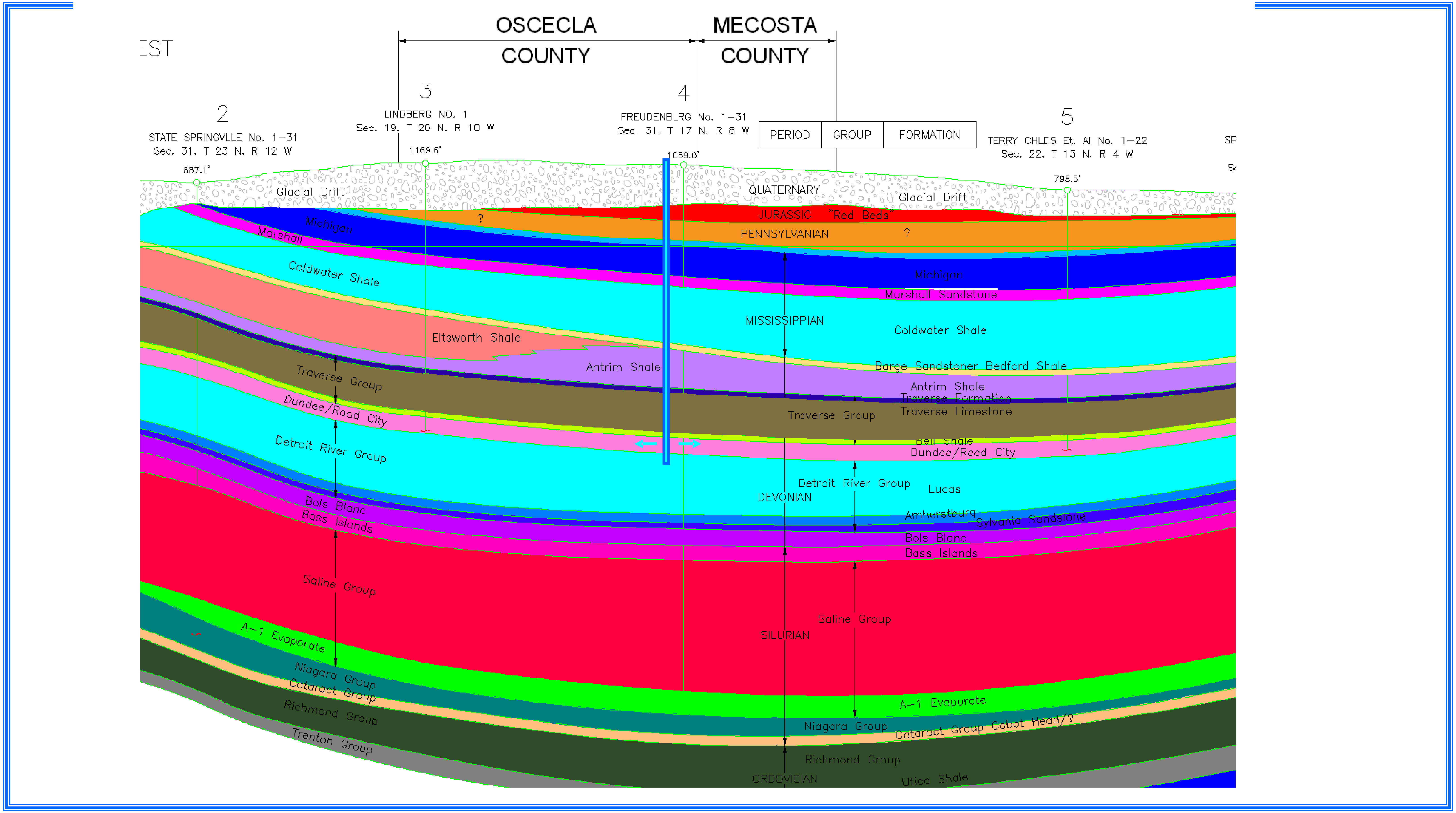

Figure C4. Detailed cross section area near AOR. The figure is a zoomed in portion of Figure C3 , showing the proposed injection horizon in relation to its stratigraphic column.

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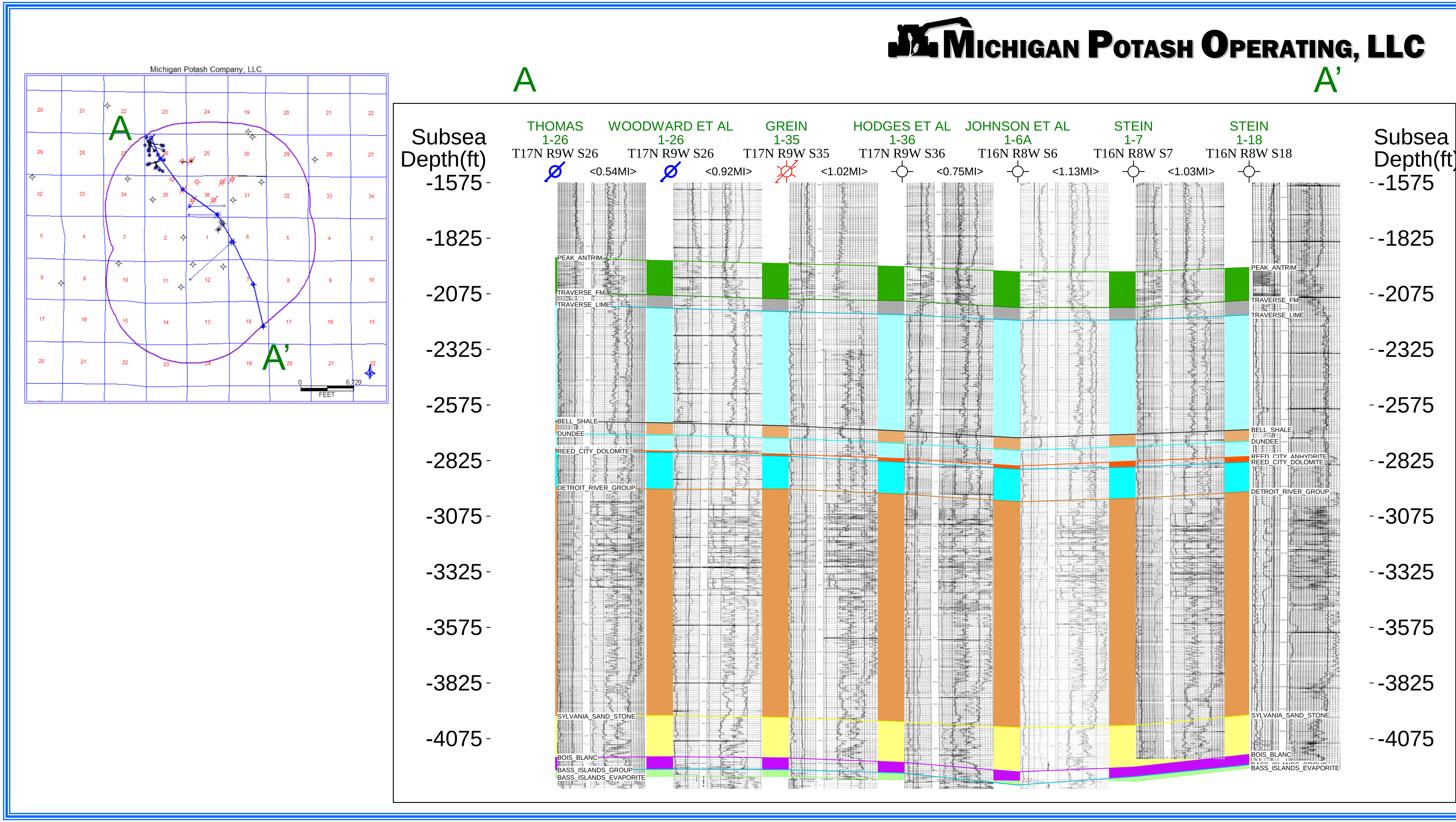


Figure C5. Cross section through the AOR, showing the geological units of interest and their immediate confining layers from North West (A) to South East (A').

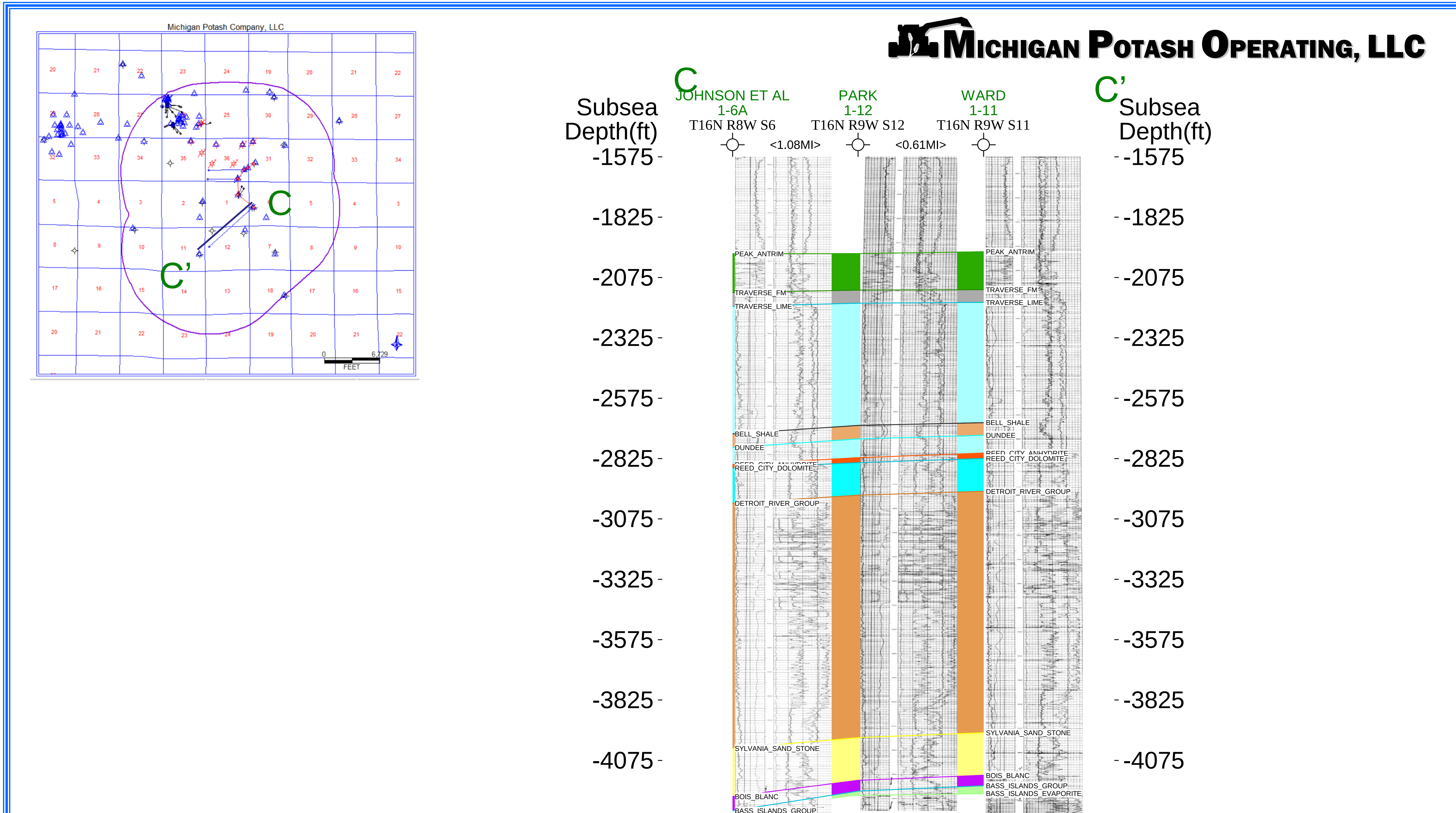


Figure C6. Cross section tracing the well path of the Johnson 1-6 from NE (C) to SW (C').

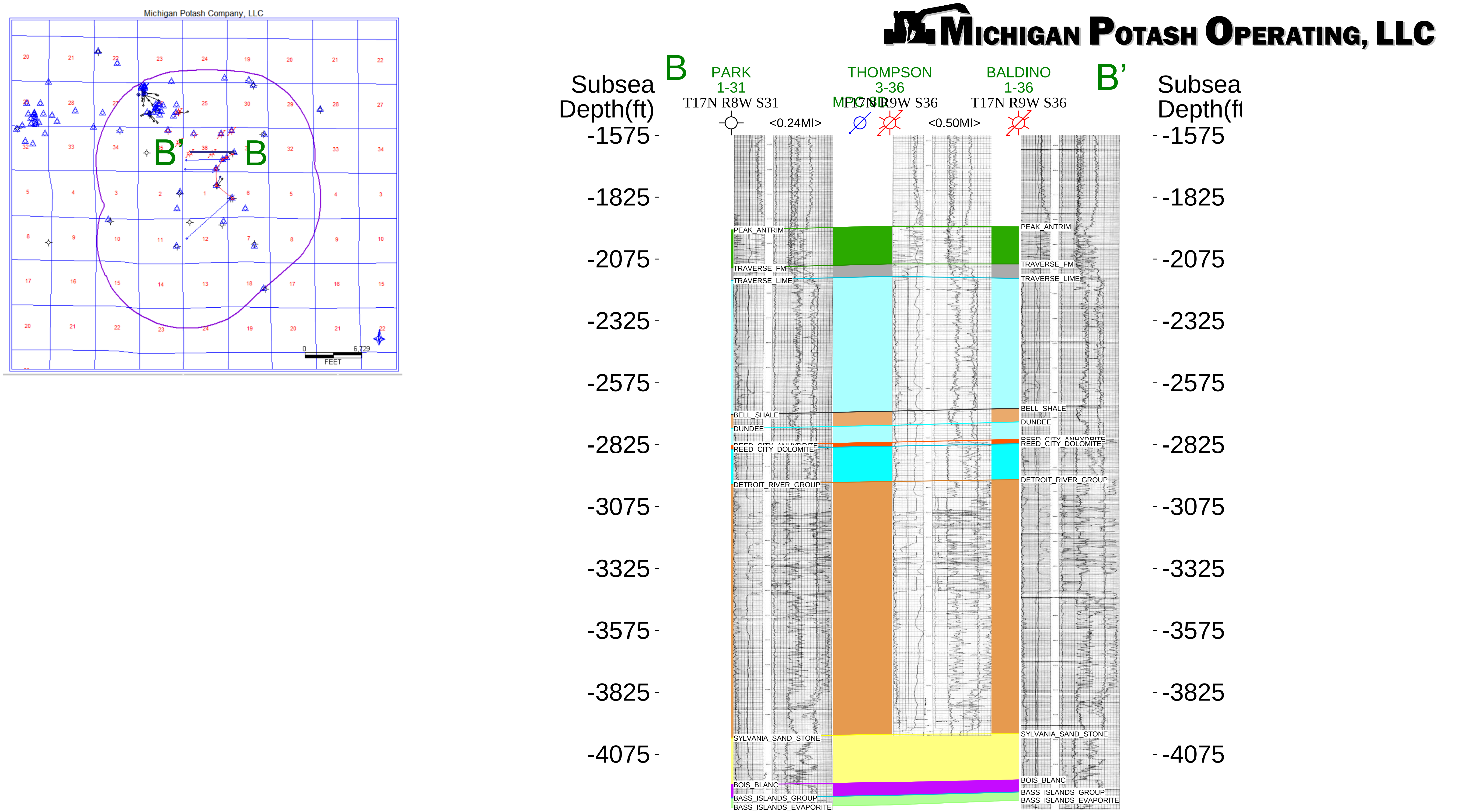


Figure C7. Cross section tracing the MPC 8D and Hodges from East (B) to West (B')..

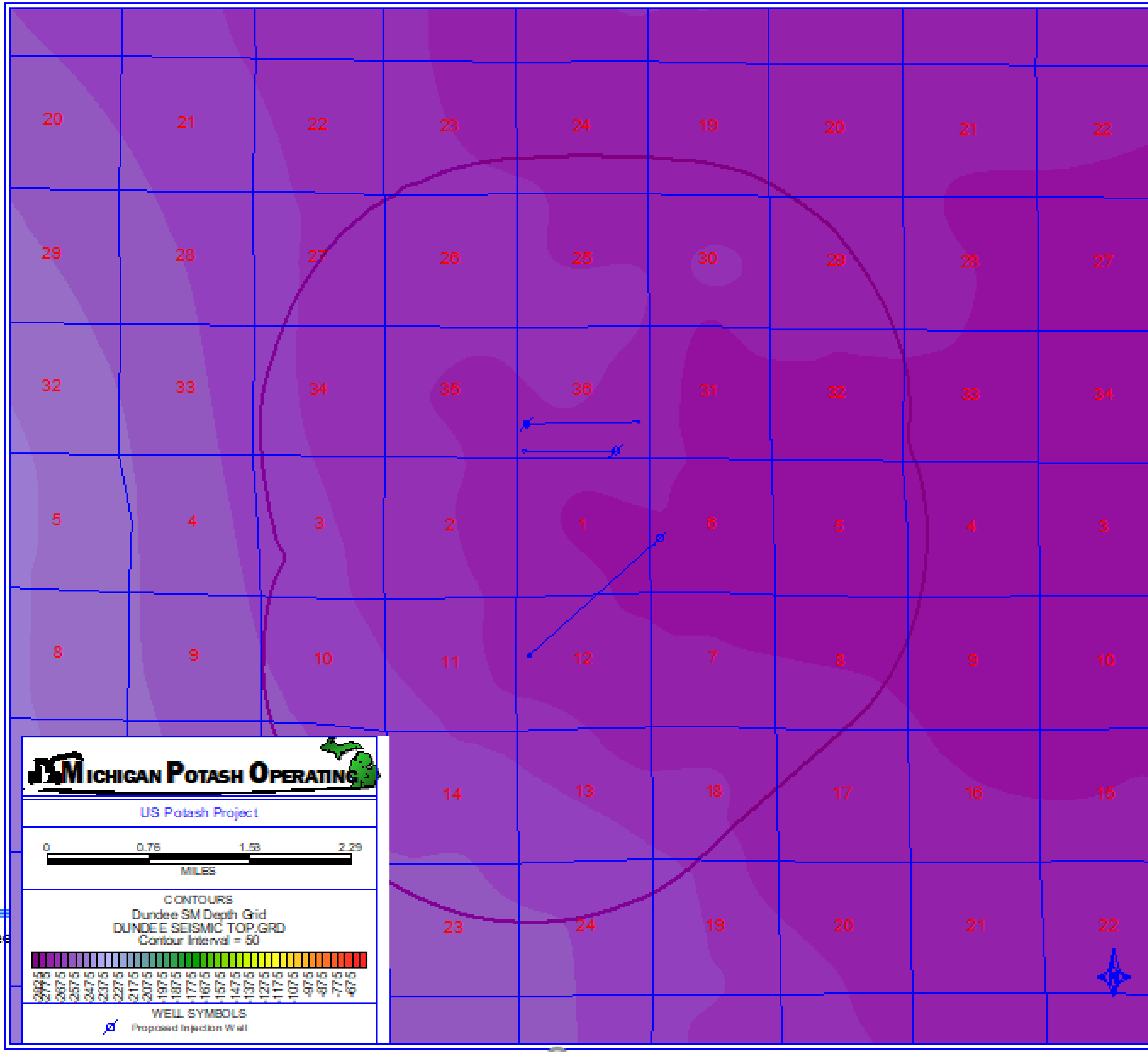


Figure C8. Structural Elevation of the Dundee Formation.

9 Chemical, physical and bacteriological characterizations of the waste stream before and after treatment and/or filtration. Include a characterization of the compatibility of the injectate with the injection zone and the fluid in the injection zone along with a characterization of the potential for multiple waste streams to react in the well bore or in the injection zone.

Chemical, physical and bacteriological characterizations of the waste stream before and after treatment and/or filtration:

The water stream to be injected into the proposed Class I Non Hazardous injection wells are non-hazardous brines (salt water) generated by the simple processing of food grade salt utilized on dinner tables across the world, Sodium chloride (NaCl), i.e. table salt or "salt", and potassium chloride (KCl) "potash", which is a natural, food safe fertilizer, applied to staple crops for food generation and consumption, KCl may also be added to table salts, or baking sodas as a low sodium based substitute for salt for human consumption.

Salt and potash brine is sent to a natural gas fired evaporator, which concentrates the salt and potash water. Concentration of the water crystallizes the salt from solution, and increases the concentration of the potash in the water. The water is then sent to potash crystallization processes, where temperature contrasts crystallize the potash from the water. The remaining water is recycled back for injection, or in the case of excess water that has been enriched in magnesium or calcium, is sent to Class I wells.

The facility is a food grade facility, and therefore, no hazardous, or non-naturally occurring materials are introduced into the system. There may be traces of sodium hydroxide in injectate used to strip naturally occurring H_2S from the brine that comes from the salt and potash bearing formation (Salina A1). Pump packing seal water (<10gpm) and a bleed system (<10gpm) both containing some sodium bisulfite may be added to the injection stream.

Concentrations of these predominant compounds vary during the course of operations. At times, the disposal fluid will be very dilute with respect to KC1 and NaC1; at other times the disposal fluid will contain higher concentrations of KC1 and NaC1. The following is a typical representation on the physical properties and chemical characteristics of the waste brine.

Chemical Characteristics:

Component	Weight Percent
H_2O	variable
NaC1	variable
KC1	variable
SO_4	<0.4
Br	<0.2
Ca	<0.2
Mg	<0.02

Physical Characteristics:

Specific Gravity	1.0 - 1.2
pH	5.5 - 8.0
Temperature	Ambient to 130 degrees F

Biological Characteristics:

The injection water from food grade salt and potash is mostly free of biological matter. However, groundwater used in the food grade salt and potash process will likely contain trace, naturally occurring biological matter, and the BODs will need occasional sampling and control. It is possible that the salinity of the disposal fluid would cause an overall decline in biological matter content.

Solid Waste:

The Part 625 Brine Disposal Wells include a means to handle solid waste generated from the KCl and food grade salt (NaCl) manufacturing process by dissolving excess, unmarketable, and off specification product (either KCl or NaCl) for subsequent transport, handling, and disposal by subsurface disposal and injection. The Part 625 Artificial Brine Wells are able to receive solid NaCl dissolved as a solute, and serve as a means of solid waste disposal and handling associated with the KCl and NaCl manufacturing process.

Radiological Characteristics:

The disposal fluid will contain trace amounts of the naturally occurring stable Cl 37 isotope and radiogenic K40 isotope associated with potassium chloride and sodium chloride. These are naturally occurring trace radionuclides and are not harmful to people, animals, or plant life in anticipated concentrations. Potash is intentionally placed on crops to increase health and growth. Sodium chloride is intentionally placed in food sources.

Fluid disposed of in the wells resulting from the solution processing of food grade salt and potash is comprised predominantly of only naturally occurring sodium chloride (NaC1) and naturally occurring potassium chloride (KC1).

As it concerns filtration:

Filtration is proposed via sand media filtration before injection into the postulated horizon to remove any potential suspended solids. Suspended solids are not a material concern provided before injection, much of the brine has been pretreated via a full clarification process, removing virtually all suspended solids.

As it concerns compatibility:

The brine produced by the manufacturing of food grade salt and potash have fewer dissolved constituents than the existing fluid in the injection horizons. There are fewer constituents in the injection fluid, and include only constituents that already exist in similar or greater concentrations in the resident injection horizons. Historical laboratory experiments have been conducted to evaluate the compatibility of the fluids; these experiments demonstrated no incompatibility. This is corroborated by long standing injection in analogous operations offset to the proposed injection wells. Provided the injectate is a clean, controlled fluid, and the injected chemical composition contains only those constituents that already exists in the injection horizon as resident, naturally occurring ions, no injectate formation/formation fluid incompatibilities are expected. Also, since the injectate is composed of a single, not multiple, waste streams, there is not potential for multiple stream interactions or reaction (See Section EGLE checklist 9 for detailed chemical and physical characteristics of the injection horizon's resident brine).

10 Information to characterize the proposed injection zone, including:

A. The geological name of the stratum or strata making up the injection zone and the top and bottom depths of the injection zone.

B. An isopach map showing thickness and areal extent of the injection zone

C. Lithology, grain mineralogy and matrix cementing of the injection zone.

D. Effective porosity of the injection zone including the method of determination.

E. Vertical and horizontal permeability of the injection zone and the method used to determine permeability. Horizontal and vertical variations in permeability expected within the area of influence.

F. The occurrence and extent of natural fractures and/or solution features within the area of influence.

G. Chemical and physical characteristics of the fluids contained in the injection zone and fluid saturations.

H. The anticipated bottom hole temperature and pressure of the injection zone and whether these quantities have been affected by past fluid injection or withdrawal.

I. Formation fracture pressure, the method used to determine fracture pressure and the expected direction of fracture propagation.

J. The vertical distance between the top of the injection zone from the base of the lowest fresh water strata.

K. Other information the applicant believes will characterize the injection zone.

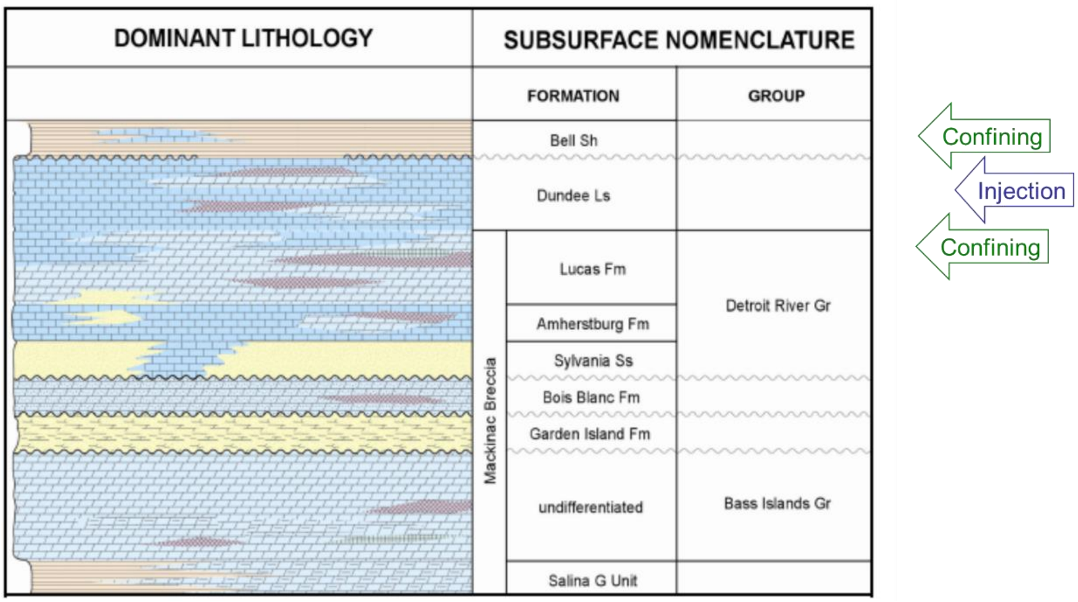
10.A The geological name of the stratum or strata making up the injection zone and the top and bottom depths of the injection zone.

Michigan Potash Operating proposes to inject into the Reed City Dolomite, which is a sub member of the Dundee, below the Reed City Anhydrite, and the Dundee Limestone. The Dundee Limestone is at approximately 3,945’ below surface. The Reed City Dolomite an interval below an established anhydrite marker in this region, that lies within the “Dundee Limestone Group”. While the Reed City Dolomite is the principal porosity target, the proposed injection zone includes the Reed City Dolomite, Reed City Anhydrite, and Dundee Limestone, similar the injection zone permitted in the Thomas and Woodward injection wells.

Both the Reed City Dolomite and Dundee Limestone intervals have been the subject of extensive study in Michigan as injection horizons, and have been injected into extensively. Michigan is a historical oil and gas province and rich brine producing province. As a result, there is well established data for injection and rock and fluid interaction with over +/- 2,070 established Dundee Limestone Group injection wells.

Figure C9 is an excerpt from Figure C2 with particular focus on the injection and confining zones closest to the proposed horizons (below). The Reed City Dolomite occurs in the Dundee LS Formation group. The Reed City Dolomite occurs below an anhydrite layer within the Dundee LS. The confining interval is the Bell Shale.

Figure C9 Portion of Michigan Stratigraphic Column Bell Shale- Salina



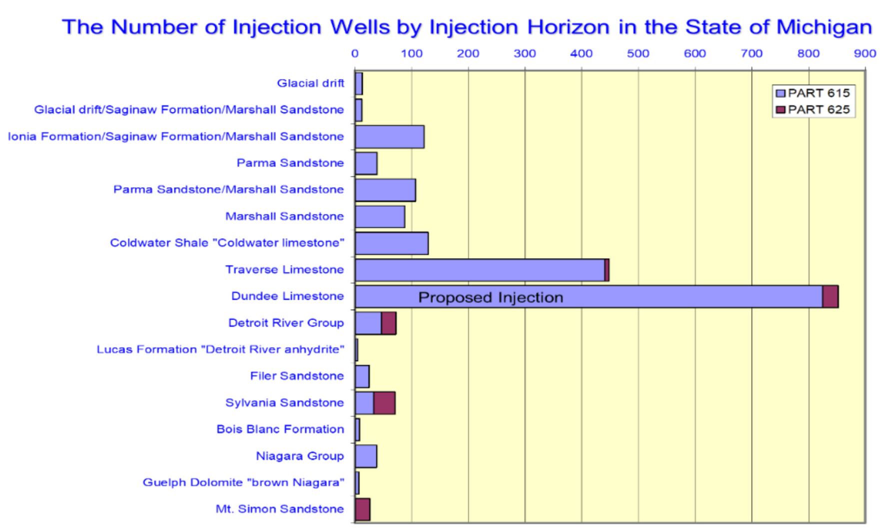
Target Injection Horizons

Reed City Dolomite. See Figure B6 for Detail

Michigan is a historical oil and gas province and rich brine producing province. As a result, there is well established data for injection and rock and fluid interaction, with over 2,000 established injection wells.

Figure C10 is a graphical illustration of the stratigraphic horizons currently being utilized in the State of Michigan for fluid injection (below). This graph shows both Part 615 Oil and Gas Wells and Part 625 Mineral Wells. This graph can be easily cross referenced with Figure C9 and Figure C2.

Figure C10 Graphical Depiction of Formations Used for Class I and Class II Injection



In the State of Michigan most injection occurs in the Dundee Limestone or shallower due to the ease of access of shallow injection horizons and excellent confining intervals at shallow depths.

10.B An isopach map showing thickness and areal extent of the injection zone.

Figure C11 is an isopach map of the Reed City Dolomite group of the Dundee Formation, showing the area extent of the proposed injection zone.

10.C Lithology, grain mineralogy and matrix cementing of the injection zone.

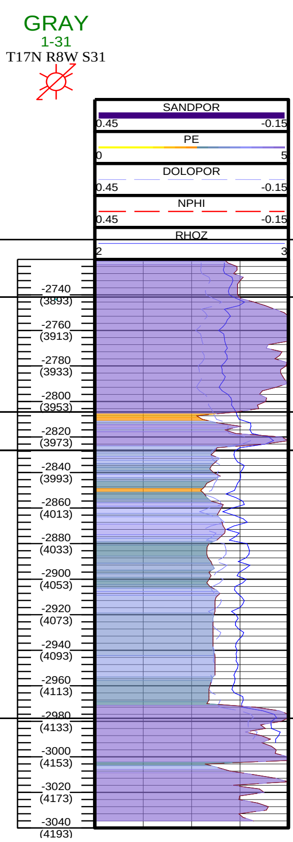
Figure C12 shows the following, noting that a portion of this figure is included below for ease of review:

(1) A regional map of Michigan, showing the structure of the Dundee formation in the entire state, with a reference to the AOR; and

(2) A geophysical type curve of the injection and confining horizon from the Bell Shale to the Detroit River Anhydrite in the Grey 1-31, located in the NW/4NW/4 Section 31, which is in the AOR; and

(3) The porosity of both the injection and confining intervals as determined from well log analysis and core observations; also shown below for ease of refence; and

Figure C12 Reed City Dolomite Injection Interval and Bell Shale Confining Interval Details (partial figure)



	Zone	Footage	Porosity	Permeability	Description
Confining	Bell Shale		0	0	Limestone, buff grey brown, f-micro crystaalin, argolicous, dololithic with grey shale
Confining	Dundee Limestone	60'	0-2%	<.1 md	Limestone, buff grey-brown, fine microcrystaline.
Confining	Reed City Anhydrite	10'	0	0	Anhydrite
Injection	Reed City Dolomite	150'	5-7%	50-100 md	Dolomite, brown, hard, medium to fine crystaline, succroustic, small sl argilicous, good inter crystaline porosity
Confining	Detroit River Anhydrite	60'	0	0	Minor dolomite, brown dark brown anhydrite with small brown limestone and grey-black shale. Anhydrite, white grey.

Derived permeability relationship as calculated from area drill stem testing in the AOR.

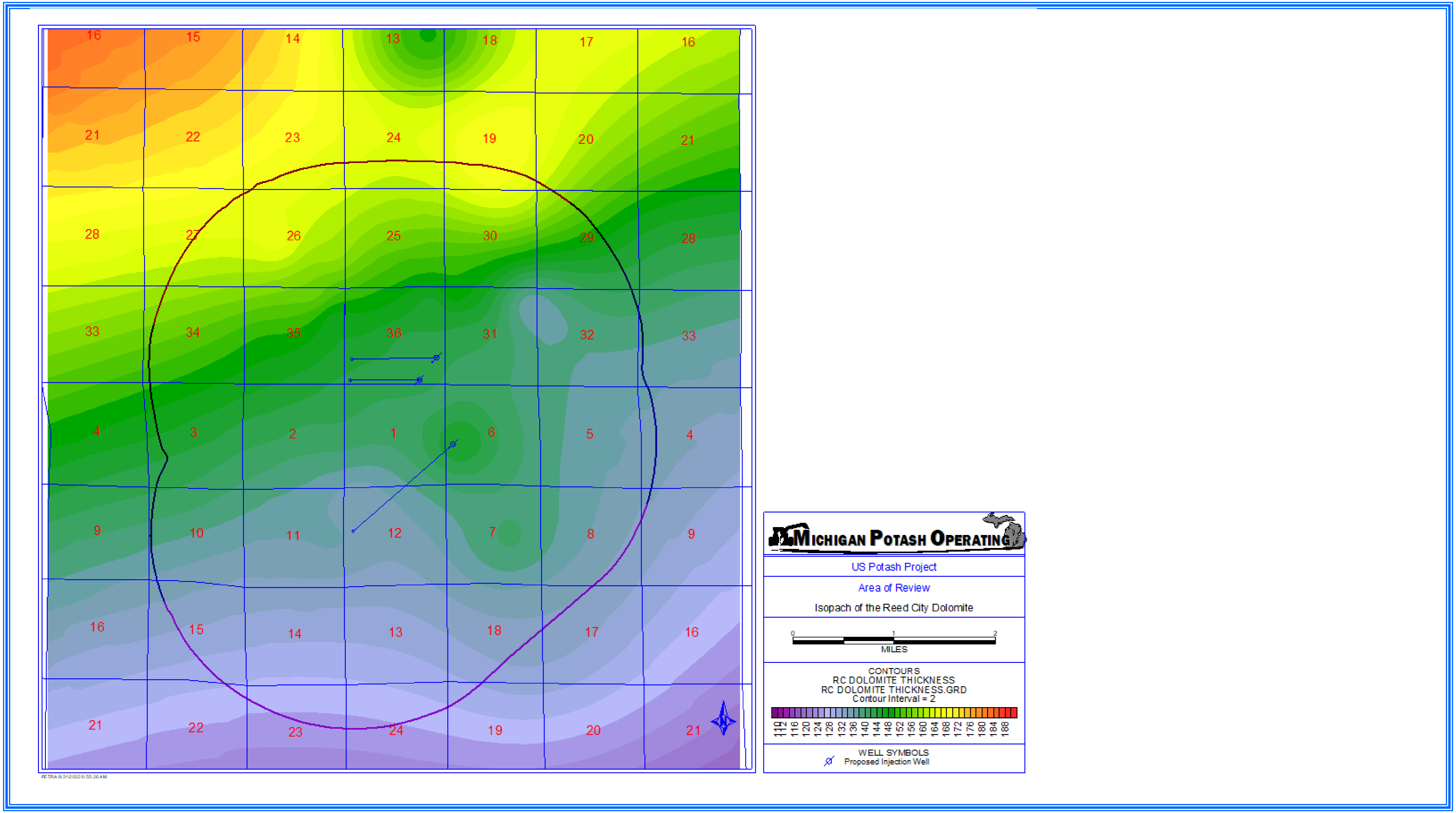
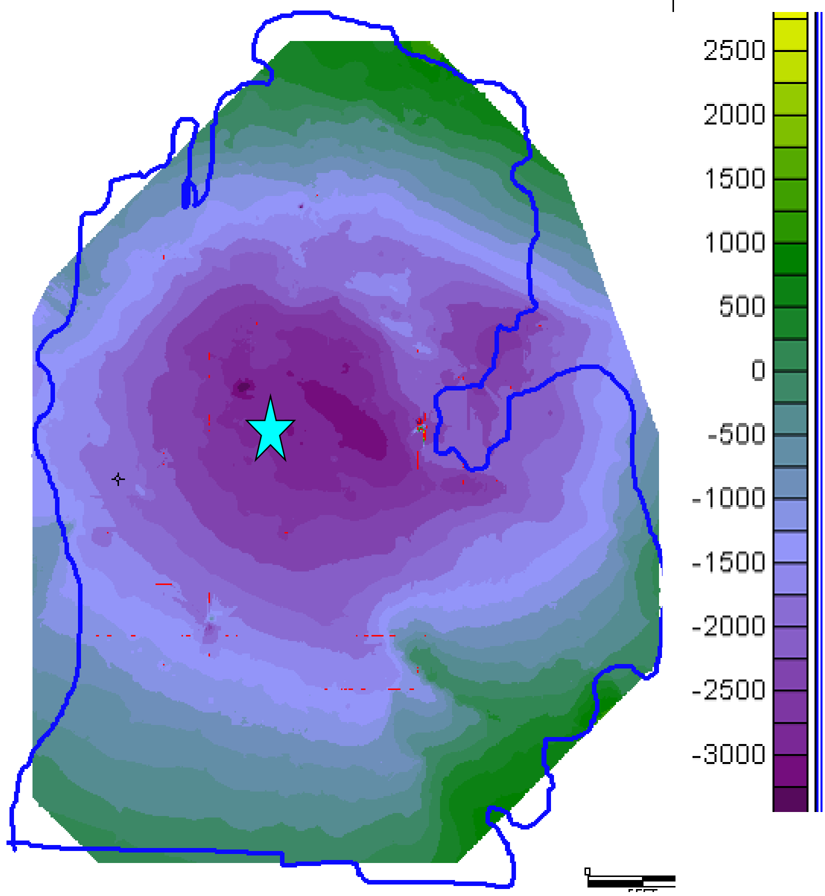


Figure C11. Isopach map of the Reed City Dolomite, Dundee Formation

Michigan Potash Operating, LLC

Reed City Dolomite Injection and Confining Interval Detail



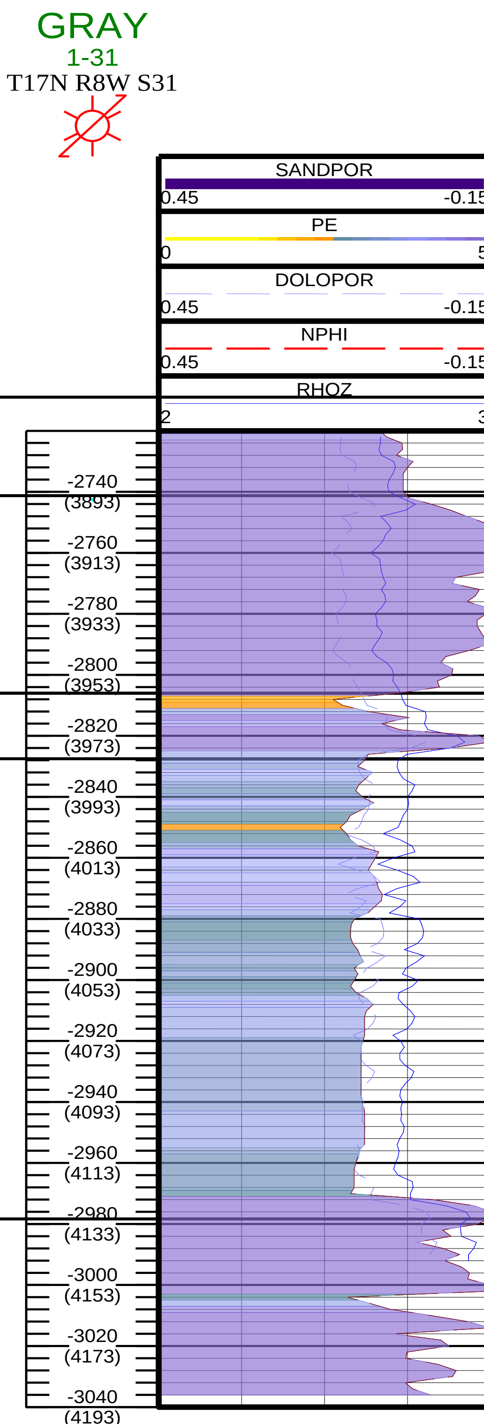
Dundee Structure Map,
Subsea Depth

Measured Permeability In AOR

REED CITY DOLOMITE POROSITY AND PERMEABILITY

WELL	THICKNESS POROSITY	UNCORRECTED LIMESTONE POROSITY (%)	MEASURED PERMEABILITY (MILLIDARCIES)
Johnson 1-1	147	3.69	< 1
McClain 1-28	140	.4.365	7 *
Pilarski 1-12	140	5.6425	166
Ward 1-11	154.5	7.0925	250 **
Grein 2-36	156	8.64	- ***
Compton 1-13	156	10.0325	244 ****
Woodward 1-26	150	5.65	86.5*****
Thomas 1-26	164	5.65	86.5*****

*/ Drill stem test included 2 feet of porous Dundee Formation above the Reed City Dolomite.
**/ Calculated 362 md. Plots do not permit high precision, reduced to 250 md to be conservative.
***/ Drill stem test unreliable due to tool leakage.
****/ Drill stem test included 14 feet of porous Dundee Formation above the Reed City Dolomite.
*****/As reported on Class I Non Hazardous Re-applicaton from Step Rate Tests



	Zone	Footage	Porosity	Permeability	Description
Confining	Bell Shale		0	0	Limestone, buff grey brown, f-micro crystaalin, argolicous, dololithic with grey shale
Injection	Dundee Limestone	60'	0-2%	<.1 md	Limestone, buff grey-brown, fine microcrystaline.
Injection	Reed City Anhydrite	10'	0	0	Anhydrite
Injection	Reed City Dolomite	150'	5-7%	50-100 md	Dolomite, brown, hard, medium to fine crystaline, succroustic, small sl argilicous, good inter crystaline porosity
Confining	Detroit River Anhydrite	60'	0	0	Minor dolomite, brown dark brown anhydrite with small brown limestone and grey-black shale. Anhydrite, white grey.

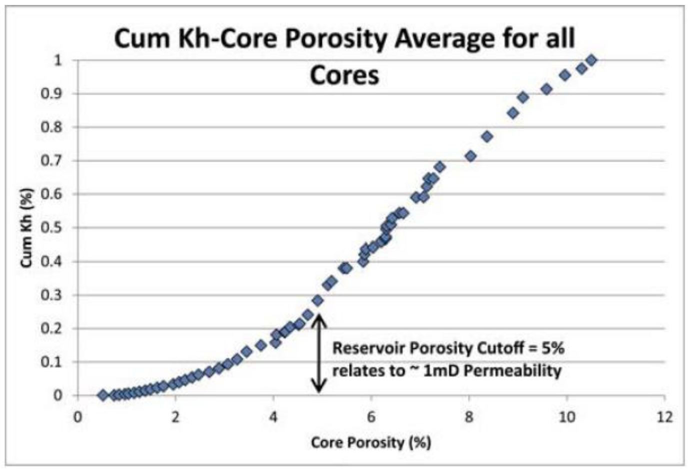
Figure C12. Reed City Dolomite Injection Interval and Bell Shale Confining Interval Details. Figure shows (1) a geophysical type curve of the injection and confining horizons in the Reed City Doloimite from the Grey 1-31, located in the NW/4NW/4 Section 31 (2) the calculated porosity (3) the real observed and determined permeability from extensive drill stem analsyis and step fall-off tests as performed and reported immediately in the AOR (4) a structure map of the top of the Dundee Limestone in the entire state, as it relates to the AOR (5) real lithologic descriptions as observed by the wellsite geologist when drilling through the Fruendenberg 1-31, located in the NE/4NE/4 Section 31.

(4) Real lithologic descriptions as observed by the wellsite geologist when drilling through the Freudenberg 1-31, located in the NE/4NE/4 Section 31, which is in the AOR, and re-referenced here, provided its appearance in Figure C3 and Figure C4.

The Reed City Anhydrite, the micro-crystalline limestone of the Dundee Formation, and the Bell Shale, all above the proposed injection zone have virtually no porosity or permeability and serve as additional confining layers. Above the Belle Shale are multiple, tight, dense limestones, shales, and anhydrites, including the Antrim Shale, Ellsworth Shale, Sunbury Shale, and the Coldwater Shale for another approximate 3,000 before any USDW is encountered.

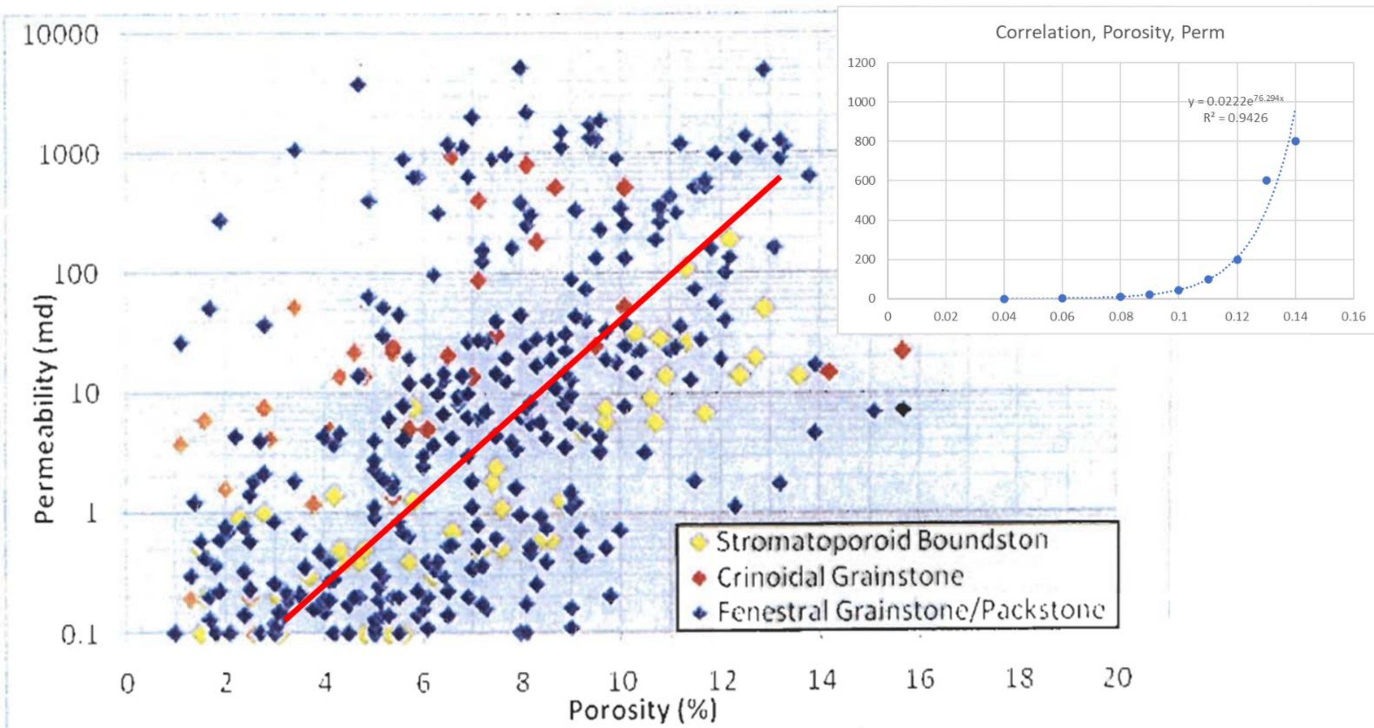
10.D Effective porosity of the injection zone including the method of determination.

Effective porosity has been identified by both direct and indirect methods. The Dundee formation (Reed City and Roger City Groups Included) has been extensively analyzed by direct porosity-permeability measurements throughout the Michigan Basin. While a direct correlation between the more limestone based Dundee and the more dolomitized Character of the Reed City Group may differ slightly, the effective porosity relationships provide reasonable rule of thumb for the site-specific Reed City Member at the proposed project location. The chart to the right is an excerpt from McClosky and Grammar (2018) that shows the cumulative Permeability-Porosity relationship from 26 cored wells through the Dundee formation in Gladwin County. The effective cutoff porosity was determined to be approximately 5.0%.



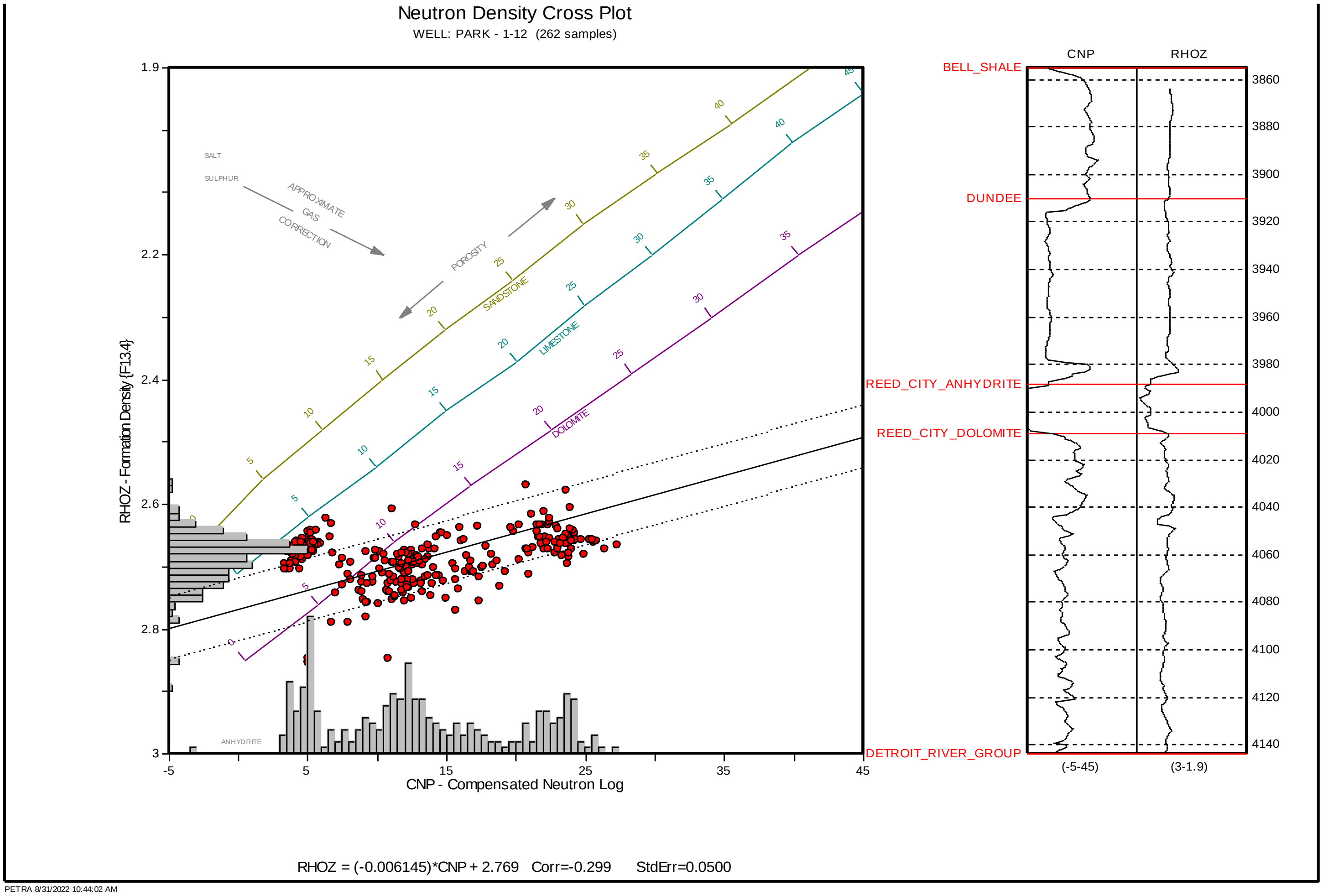
Cumulative permeability-feet percent (Cum Kh) versus core porosity average for all 26 wells with whole-core analysis reports. Average core porosity 0%–12% is located on *x* axis, and cumulative permeability-feet (decimal percent) 0–1 is on y axis. The inflection point occurs at 5% porosity and was used as a reservoir cutoff. This reservoir cutoff value may define economically producible hydrocarbons from noneconomical hydrocarbons.

This conclusion is comparable to that of Abduslam (2012) where a similar analysis was performed on extensive direct measure Dundee cores throughout numerous locations in the Michigan Basin. His correlation is shown below, and MPO has put a porosity-permeability relationship to the numerous analysis and has determine that the proper cut off also approximates 5.0% porosity, where permeability drops below 1 md.



A site specific porosity crossplot of the Neutron Density and Bulk Density over the Park 1-12 (Figure C15, which is clost to the target heel location of the subject directional plan. The logs demonstrate fully dolotimized Dundee in the Reed City Member, and high effective porosity. This would be indicative and corroborative of the high measured permeability via DST testing in the offset Ward 1-11, Woodward and Thomas, (>900 md).

- Figure C13 Density-Neutron Porosity Plot and Correlation to Detroit River-Bell Shale Section



The porosity permeability relationships demonstrate an increase in effective porosity and potential cutoffs of effective porosity. Net injection thicknesses have been determined provided the Reed City appears mostly ineffective below 5% porosity. These direct measurements of core have been utilized and applied to the indirect geophysical well log data. The effective porosity then, above the cutoffs, most likely approximates the true porosity, which has been calculated from the density log, as follows:

$$DPHI = (RHOMA - RHOB)/(RHOMA - RHOF).$$

A density of 2.87 is used in the calculation of true porosity from the bulk density log.

Effective porosity is net readily associated with the permeability increases; whereby the Porosity, Permeability relationship has been used as follows;

$$PERM=0.00222*EXP(76.294*DOLO\ TRUE\ POROSITY)$$

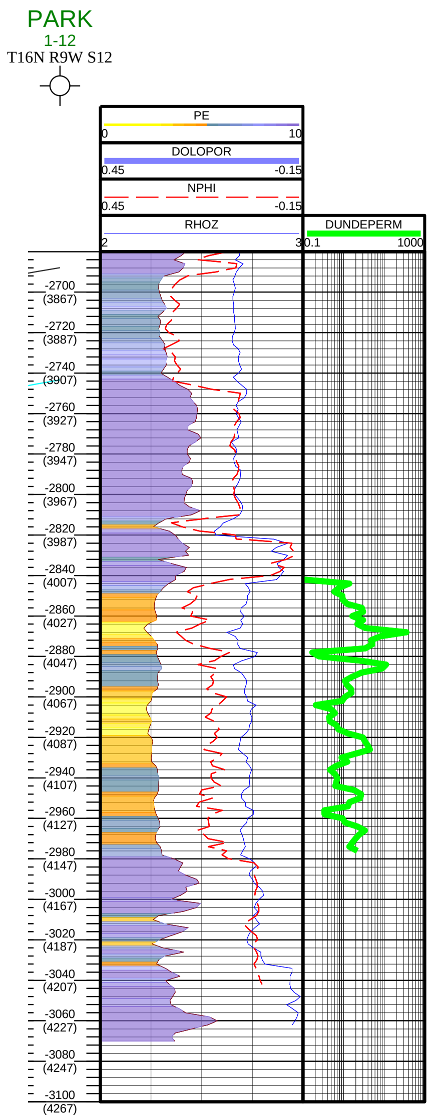
10.E Vertical and horizontal permeability of the injection zone and the method used to determine permeability. Horizontal and vertical variations in permeability expected within the area of influence.

Permeability has been identified by direct method via Klinkenberg permeability analysis on core throughout the Michigan Basin. These analyses have then been applied to the porosity permeability relationship of Abduslam (2012) as shown above via the following observed relationship expressed as follows:

The direct porosity permeability relationship in the Dundee/Reed City Member is expressed as follows:
Permeability = 0.00222* e^(76.294*porosity), (provided a 5% porosity cutoff).

Vertical permeability tends to be 1/10 of Horizontal permeability in most sedimentological applications. The direct core measurements of porosity permeability relationships applied to the calculated true porosity are shown below (Figure C16) along the trace of the nearby Park 1-12 lateral, which are expected to be comparable to the MPC 8D. The permeability correlations are verified by resistivity log separation and Caliper log indications of filter cake. Porosity and permeability increase in an eastward fashion from the heel of the two of the proposed lateral, hence the direction and horizontal design.

- Figure C14 - Park 1-12 Log Permeability Correlations



10.F The occurrence and extent of natural fractures and/or solution features within the area of influence.

The Reed City Dolomite is a dolomitized limestone, which maybe considered a solution feature although secondary dolomitization associated with fluid movement is a replacement feature that may not lead to classic solution features. There are no known natural fractures or other solutions features that control injectivity performance, that the applicant is aware of. Further, there are no known faults within the area. There is no seismic activity in the area. Michigan is one of the lowest areas of seismic activity in the United States. When activity does occur, it tends to occur in the southern area of the state, or roughly 200 miles southward from the

AOR. In the last six years, Michigan has recorded only one 4.0 magnitude or greater earthquake. The epicenter was 2.5 miles below ground, in Galesburg, Michigan.

10.G Chemical and physical characteristics of the fluids contained in the injection zone and fluid saturations.

The physical and chemical characteristics of the formation fluids have been gathered from the Ward 1-11 in the AOR is summarized as follows:

Property	Result
pH	5.5
Color	light brown
Specific gravity	1.2118
Specific conductance	94,000 microohms/crn @ 25°C
Viscosity	18 centipoise @ 23°C

Constituent	Concentration
Dissolved CO2	132 mg/1
Dissolved Oxygen	0.1 mg/l
Sulfide as H2S	<30 mg/1
Calcium	3,9%
Magnesium	0.59%
Potassium	1.6%
Sodium	5.9%
Barium	8 mg/1
Boron	57.5 mg/1
Cadmium	0.2 mg/1
Iron	<10 mg/1
Manganese	2.7 mg/I
Silica	2.4 mg/1
Strontium	0.14%
Bicarbonate	220 mg/l
Carbonate	<1 mg/1
Bromide	0.16%
Chloride	19%
Fluoride	0.4 mg/1
Iodide	28 mg/1
Nitrate	<0.1 mg/1
Sulfate	210 mg/1
Oil content	74 mg/1
Suspended solids	0.6%
Total dissolved solids	27%

The Reed City Dolomite porosity is saturated with a very briny formation fluid having over 320,000 mg/ liter total dissolved solids.

Fluid saturations would be 100% of porosity.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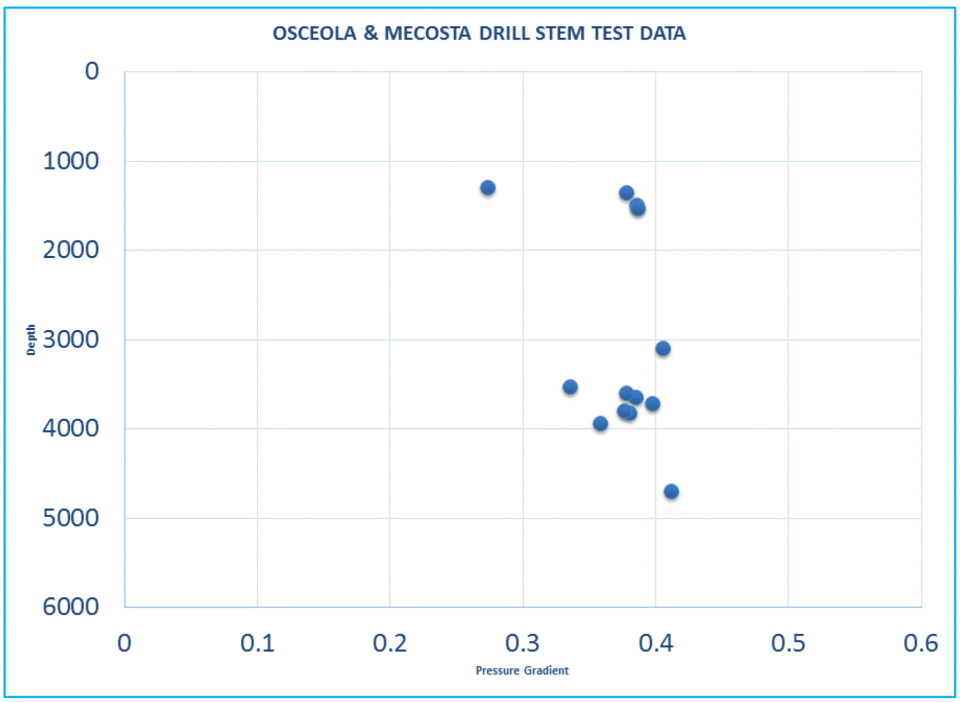
10.H The anticipated bottom hole temperature and pressure of the injection zone and whether these quantities have been affected by past fluid injection or withdrawal.

Historically observed bottom hole fluid pressure is 1600-1700 psi, fluid temperature is 80 degrees F, physical and chemical characteristics of the formation fluids have been gathered (see Ward 1-11 data below).

DSTs gathered in the AOR are graphically summarized in **Figure C15** have indicated a fluid pressure in the range of 1,600-1,700 psi in the Reed City Dolomite. This equates to a under-pressured gradient 0.41 psi/foot depth. Average horizontal permeability to fluid ranges from 10 to over 250 millidarcies in the more favorable areas of Injection. Drill stem tests have yielded up to 3,300 feet of formation fluid, with most of the flow occurring in the first 15 minutes in wells having very good porosity and permeability.

The following chart (Figure C13) presents actual well data pressure gradients experienced via drill stem testing in Osceola and Mecosta County Michigan between 0 and 6000' KB as compiled from AASG Geothermal Data. Pressure gradients are determined via the greater of initial shut in pressure or final shut in pressure divided by the top point of the test depth. Tabular data is also provided.

- Figure C15. Osceola and Mecosta DST Data with Well Information Table Presenting Pressure Gradient vs. Depth



WellName	ZONE	GREATER OF ISIP/FSIP	Pressure Gradient	At Depth
Golupski, Cleo M Mrs1-22	Traverse Limestone	1253	**0.405764249**	3088.0
Lindell, Carl1	Dundee Limestone "Reed City zone"	1455	**0.380790369**	3821.0
Mott, Charles Stewart Foundation1	Michigan Formation "Stray sandstone"	575	**0.386165212**	1489.0
Leach1	Dundee Limestone	1401	**0.384995878**	3639.0
Johnson & State Rose Lake1-27	Traverse Limestone	1183.7	**0.335325779**	3530.0
HAMPLE, LAWRENCE & JANE ET AL	Stray	355	**0.273708558**	1297.0
HAMPLE, LAWRENCE & JANE ET AL	Reed city	1430	**0.376811594**	3795.0
HAMPLE, LAWRENCE & JANE ET AL	Richfield	1935	**0.411789742**	4699.0
PEDERSEN, PATTY ANN	Stray	511	**0.378238342**	1351.0
PEDERSEN, PATTY ANN	Dundee	1479	**0.39768755**	3719.0
BURRETT, LILA	Dundee	1360.4	**0.378309232**	3596.0
Seger	Dundee	1409	**0.358250699**	3933.0
Mott Foundation	Stray	590	**0.38637852**	1527.0

For injection pressure calculations, a conservative, normal pressure gradient of 0.433 psi/ft is adequate and has been reported on Form 7200-14.

A DST in the Grey 1-31 in the Richfield Detroit River Group from 4,700 to 5,030 opened with no blow and recovered only 480' of drilling fluid, corroborating a weakly, under pressured gradient just below the propositioned injection horizons. It is not anticipated that the Dundee has been affected by past fluid injection. There has been no historical withdrawal from the Dundee.

Measured bottom hole temperature is catalogued by numerous drilling logs in the area, and is 115 degrees F.

Historical pressure injection fall off tests performed between 2005 and 2016 on behalf of, or by the U.S. EPA and on the Thomas 1-26 and Woodward 1-26 has been compiled and surrendered to the regulatory authorities, and is shown below. These tests are specific to the Reed City Dolomite member of the Dundee Group.

□

Comparison of Prior Tests and Evaluations								
Cargill Thomas 1-26 and Woodward 1-26								
Date of Test	Well Name	Analyst	Inj. Rate, gpm	P_{final}, psi	P*, psi	k, md	S	Bound Dist, ft
3/19/2005	Thomas 1-26	Subsurface	337.1		2275.6	1315	-1.74	892?
3/19/2005	Thomas 1-26	USEPA, Steve Roy	337.1	2227		1232.3	-2	525
3/21/2006	Thomas 1-26	Subsurface	324.2		2294.4	1521	-1.5	918
3/21/2006	Thomas 1-26	USEPA, Gerrish	324.2	2205	2284	1394	-1.1	88
3/24/2007	Thomas 1-26	Subsurface	288.54		2250.6	1403	-2.09	920
3/24/2007	Thomas 1-26	USEPA, Patterson	288.54	2173		1567.6	4	386
8/12/2008	Thomas 1-26	Subsurface	128		2177.1	1510	-1.72	351-456?
8/12/2008	Thomas 1-26	USEPA, Simmons	128	2115		674.5	-2.6	248
8/3/2010	Thomas 1-26	Petrotek	n/a		2177.8	1291.9	-3.5	n/a
7/31/2012	Thomas 1-26	Brock Engineering	422		1974	383	-6.9	n/a
7/31/2012	Thomas 1-26	USEPA, Bill Bates	421.7	2165	2220	3954	-3	
7/24/2014	Thomas 1-26	Brock Engineering	255		2008	295	-6.7	n/a
7/24/2014	Thomas 1-26	USEPA, Steve Roy	255	2077.9	n/a	n/a	n/a	n/a
3/19/2005	Woodward 1-26	Subsurface	122		2126.8	410	16.4	774?
3/19/2005	Woodward 1-26	USEPA, Steve Roy	122	2250	2314.1	355.4	13.5	420
3/21/2006	Woodward 1-26	Subsurface	205		2316.4	516.7	2.27	692
3/21/2006	Woodward 1-26	USEPA, Patterson	205	2257		497.8	2	351
8/22/2007	Woodward 1-26	Subsurface	140		2191.4	491.6	4.14	n/a
8/22/2007	Woodward 1-26	USEPA, Gerrish	140	2144		n/a	n/a	n/a
8/5/2009	Woodward 1-26	Petrotek	105		2138.5	337	7.94	n/a
8/5/2009	Woodward 1-26	USEPA, J. Wawczak	105	2142	2176	290.8	4.9	n/a
8/3/2011	Woodward 1-26	Brock Engineering	124		2176	163	-8.7	n/a
8/3/2011	Woodward 1-26	USEPA, Greenhagen	124	2224.1	2254	428.4	5.3	
7/31/2013	Woodward 1-26	Brock Engineering	96.45		2136	118	-8.5	n/a
7/21/2015	Woodward 1-26	Brock Engineering	128.99		2105.2	691	-14.3	n/a

Historical pressure injection tests performed between 2005 and 2016 on behalf of, or by the U.S. EPA and on the Thomas 1-26 and Woodward 1-26 has been compiled and surrendered to the regulatory authorities, and is shown below. These tests are specific to the Reed City Dolomite member of the Dundee Group.

Average Measured Bottom Hole Reservoir Pressure (P*) = 2,189 psi.

Depth to the Injection Interval in these two wells is 3,980. This is an observed pressure gradient of 0.55 psi/foot.

Average Measured Permeability (k) was measured as (k) 907 md. Pressure rise between 2005 and 2016 was not observed.

10.I Formation fracture pressure, the method used to determine fracture pressure and the expected direction of fracture propagation.

Historical injection tests were conducted in injection wells Woodward 1-26 and Thomas 1-26, both of which are in the AOR; tests were performed by pumping treated water into the Reed City Dolomite at rates of 28 bbls (1,176 gallons) per minute at a surface pressure of 2,960 psi. After deduction of calculated friction losses of 38 psi within the well, the pressure at the top of the Reed City Dolomite, while injecting treated fresh water, was 4,647 psi. No parting or fracturing of the formation was noted, indicating the fracture pressure must be greater than 4,647 psi, with a top perf at 3985'. For ease of reference, the offset data has been incorporated below:

Woodward 1-26:

II.2 Average and Maximum Injection Pressures

The maximum injection pressure has been set by permit at 2,576 psig for the Woodward 1-26 well.

Injection fluid may be water (specific gravity of 1.0) or a partially saturated sodium chloride/potassium chloride brine solution with a specific gravity as high as 1.2.

Previous documents submitted to the USEPA (*1995 Re-Permit Application (Attachment H-2 and Appendix A); 1984 Permit Application)* indicated a maximum injection pressure for water of 2,928 psi and for brine of 2,589 psi. This information was based upon previously conducted fracture testing at the top perforation of the injection zone (4,647 psi). A pressure gradient of 1.18 psi per foot was calculated.

Upon review of the previous ten years of operation records, the average injection pressure remains between 600 to 900 psi as stated in the previous *1995 Permit Re-Application.*

The Thomas 1-26:

H.2 Average and Maximum Injection Pressures

The maximum injection pressure has been set by permit at 2,533 psig for the Thomas 1-26 well.

Injection fluid may be water (specific gravity of 1.0) or a partially saturated sodium chloride/potassium chloride brine solution with a specific gravity as high as 1.2.

Previous documents submitted to the USEPA (*1995 Re-Permit Application (Attachment H-2 and Appendix A); 1984 Fenix & Scisson Permit Application)* indicated a maximum injection pressure for water of 2,928 psi and for brine of 2,589 psi. This information was based upon previously conducted fracture testing at the top perforation of the Reed City Dolomite injection interval (4,647 psi). A pressure gradient of 1.18 psi per foot was calculated.

Upon review of the previous ten years of operation records, the average injection pressure remains between 600 to 900 psi as stated in the previous *1995 Permit Re-Application.*

Utilizing this data, an estimate fracture pressure for the proposed well can be determined as follows:

Surface Pressure = 2,960
Treated freshwater gradient = 0.433 psi/ft, where SG = 1.0
Top perf at 3985 ft

Surface Pressure + 0.433 psi/ft x depth – 14.7 = BHP

4,647 +0.433 psi/ft x 3985 – 14.7 = 4,685 psi

Fracture Gradient = 4,685psi/3985ft = 1.18 psi/ft

The current fracture gradient utilized on the permitted Thomas and Woodward is 1.17 psi/ft.

Final Fracture Pressure Gradient Values

In 1992 and 1993, the Region 5 Underground Injection Control Program public noticed draft and final values for fracture pressure gradients for specific oil fields in Michigan. These values were published in the *Federal Register* in three groups. The column headed "FRN" indicates in which *Federal Register* Notice the final fracture pressure gradient (FPG) value for each field was published. (Internet-accessible copies of the *Federal Register* do not go back this far, so these notices are not viewable over the Internet at this time.)

County	Field	Formation	Township/Range/Section	FPG (psi/ft)	FRN*
Bay	Kawkawlin	Dundee	T15N, R4E, S27, 28, 33, 34 and T14N, R4E, S3	1.23	3
Calhoun	Pennfield 35	Niagaran Reef	T1S, R7W, S35	0.60	1
Clare	Cranberry Lake	Richfield	T20N, R6W, S1, 2, 11, 12	1.10	1
	Hamilton	Richfield	T19N, R3W, S5-8 and T19N, R4W, S1, 2 and T20N, R4W, S35,36	1.06	2
Crawford/Kalkaska	Beaver Creek	Richfield	T25N, R5W, S12, 13, 24 and T25N, R4W, S7, 8, 16-21, 28, 29	1.07	1
Gladwin	Beaverton	Dundee	T17N, R2W, S19	1.11	3
	Bentley-Dundee	Dundee	T17N, R2E, S18, 19, 20	1.15	1
	Billings:				
	Billings 2 Unit	Dundee	T17N, R1E, S2, 3, 10, 11	1.12	1
	Billings-Bentley Unit		T17N, R1E, S12, 13 and T17N, R2E, S18		
	Grout	Richfield	T18N, R2W, S10, 11, 14, 15	1.05	3
Ingham	Aurelius 35	Niagaran Reef	T2N, R2W, S26, 35, 36	0.65	1
	Ingham 13	Salina-Niagaran	T2N, R1E, S13	0.76	1
	Onondaga 10	Salina-Niagaran	T1N, R2W, S2-4, 10, 11, 14	0.61	1
	Onondaga 21A	A-1 Carbonate (Salina)	T1N, R2W, S15-17, 21, 22	0.81	3
Isabella	North Wise	Dundee	T16N, R3W, S17	1.12	3
Kalkaska	Kalkaska "21"	Salina-Niagaran	T27N, R8W, S22	0.92	1
Lapeer	Richfield	Richfield	T10N, R10E, S21-23, 26-28, 33-35	1.09	3
Manistee	Manistee	Niagaran	T22N, R17W, S36	0.82	2
	Bear Lake	Niagaran	T23N, R15W, S12	0.58	3
Missaukee	Enterprise	Richfield	T23N, R4W, S18 and T23N, R5W, S10-14	1.10	2
	East Norwich	Richfield	T24N, R5W, S1-3, 9-16, 21, 22 [illegible]	1.14	2
	Falmouth	Richfield	T22N, R6W, S30, 31 and T22N, R7W, S25, 36	1.10	3
Ogemaw	Rose City:				
	Rose City Unit	Richfield	T23, 24N, R2E, S3, 19-21, 27-30, 32-35	1.07	1
	Rose City Central Unit		T24N, R1E, 2E, S25		
	Rose City West Unit		T24N, R1E, S21		
	West Branch:				
	West Branch Unit (excluding West Branch 28: see below)	Dundee	T21N, R2E, S2 and T22N, R2E, S21, 26, 27, 33-36 and all of S28 except the S/2 of the NW/4	1.15	2
	Country Club Unit		T22N, R1E, S13, 24 and T22N, R2E, S18-21, 29		
	West Branch 28	Dundee	T22N, R2E, S28, S/2 of NW/4	1.25	3
Otsego	Chester:				
	Chester 18 Unit	A1 Carbonate & Niagaran	T30N, R2W, S7, 8, 17, 18, 19, 20	0.99	1
	Chester 21 Unit		T30N, R2W, S21, 22	0.78	1
	Hayes:				
	Hayes 15 Unit	Salina-Niagaran	T29N, R4W, S15	0.67	1
	Hayes 21A Unit		T29N, R4W, S21, 28		
Roscommon	Headquarters:				
	Headquarters Unit	Richfield	T21N, R3W, S19, 29, 30	1.22	1
	Headquarters-Sour Unit		T21N, R3W, S29, 30, 32, 33		
	St. Helen	Richfield	T24N, R1W, S16, 19-21, 27-30	1.16	2
St. Clair	Columbus 3	Niagaran	T5N, R15E, S3, 10 and T6N, R15E, S34	0.79	1

*FRN = *Federal Register* Notice:

Ref. No.	Page	Date
1	*FR* 57 (247): 61084	12/23/92
2	*FR* 58 (224): 61910	11/23/93
3	*FR* 58 (240): 65711	12/16/93

***Form EQP 7400-14,** has been filed with a default 0.8 psi/ft fracture gradient as directed by regulatory direction from the U.S. EPA despite substantial offset data available. Upon completion of the wells, step rate injection testing will be performed to obtain site specific data that will match the offsets and expected operating parameters listed in this section are anticipated; with 1.17 psi/ft FRACTURE GRADIENT.*

The expected direction of fracture propagation would be in the direction perpendicular to maximum stress. In the Michigan Basin, maximum stress is North-Northeast to South-southwest, approximating 45 degrees. The direction of minimum stress then would be at 135 degrees, if any fracture propagation at all were to occur. It is highly unlikely.

10.J The vertical distance between the top of the injection zone from the base of the lowest freshwater strata.

At the Hodgest 1-36, which is in proximity to the MPC 8D location, the estimated base of glacial till is 712 feet, with the top of the injection zone (i.e., base of the Bell Shale) estimated to occur at 3876'. As mentioned prior, the Reed City dolomite is the effectual injection horizon and the confining interval is the Dundee Lime.

The distance between the top of the injection zone and the base of the lowest fresh water strata is 3,109'.

Please reference **Figure B1** for a graphical illustration and cross section through the area presenting the vertical distance between the injection zone and base of the lowermost USDW.

11 Information to characterize the proposed confining zone, including

A. The geological name of the stratum or strata making up the confining zone and the top and bottom depths of the confining zone.

B. An isopach map showing thickness and areal extent of the confining zone

C. Lithology, grain mineralogy and matrix cementing of the confining zone.

D. Effective porosity of the confining zone including the method of determination.

E. Vertical and horizontal permeability of the confining zone and the method used to determine permeability. Horizontal and vertical variations in permeability expected within the area of influence.

F. The occurrence and extent of natural fractures and/or solution features within the area of influence.

G. Chemical and physical characteristics of the fluids contained in the confining zone and fluid saturations.

H. Formation fracture pressure, the method used to determine fracture pressure and the expected direction of fracture propagation.

I. The vertical distance between the top of the confining zone from the base of the lowest fresh water strata.

J. Other information the applicant believes will characterize the confining zone.

11.A The geological name of the stratum or strata making up the confining zone and the top and bottom depths of the confining zone.

The Bell Shale serves as the confining zone above the Dundee/Reed City injection zone, although the Dundee Limestone immediately below the Bell Shale may exhibit 50-60' of zero porosity above the Reed City Anhydrite, which also exhibits very low porosity. The Reed City Anhydrite occurs above the target injection interval within the Reed City Group.

The Bell Shale top is projected to occur at 3,821' and the Base at 3,872' at MPC 8D, similar to the Hodges 1-36

11.B An isopach map showing thickness and areal extent of the confining zone

- Figure C16 is an isopach map of the Bell Shale showing the areal extent.

11.C Lithology, grain mineralogy and matrix cementing of the confining zone.

The Bell shale is was described in the subject well as a shale that isa grey, blue, and non-calcareous interval.

11.D Effective porosity of the confining zone including the method of determination.

The confining zone is composed of a thick shale, with no permeability or effective porosity. This has been verified via well logs.

11.E Vertical and horizontal permeability of the confining zone and the method used to determine. Horizontal and vertical variations in permeability expected within the area of influence.

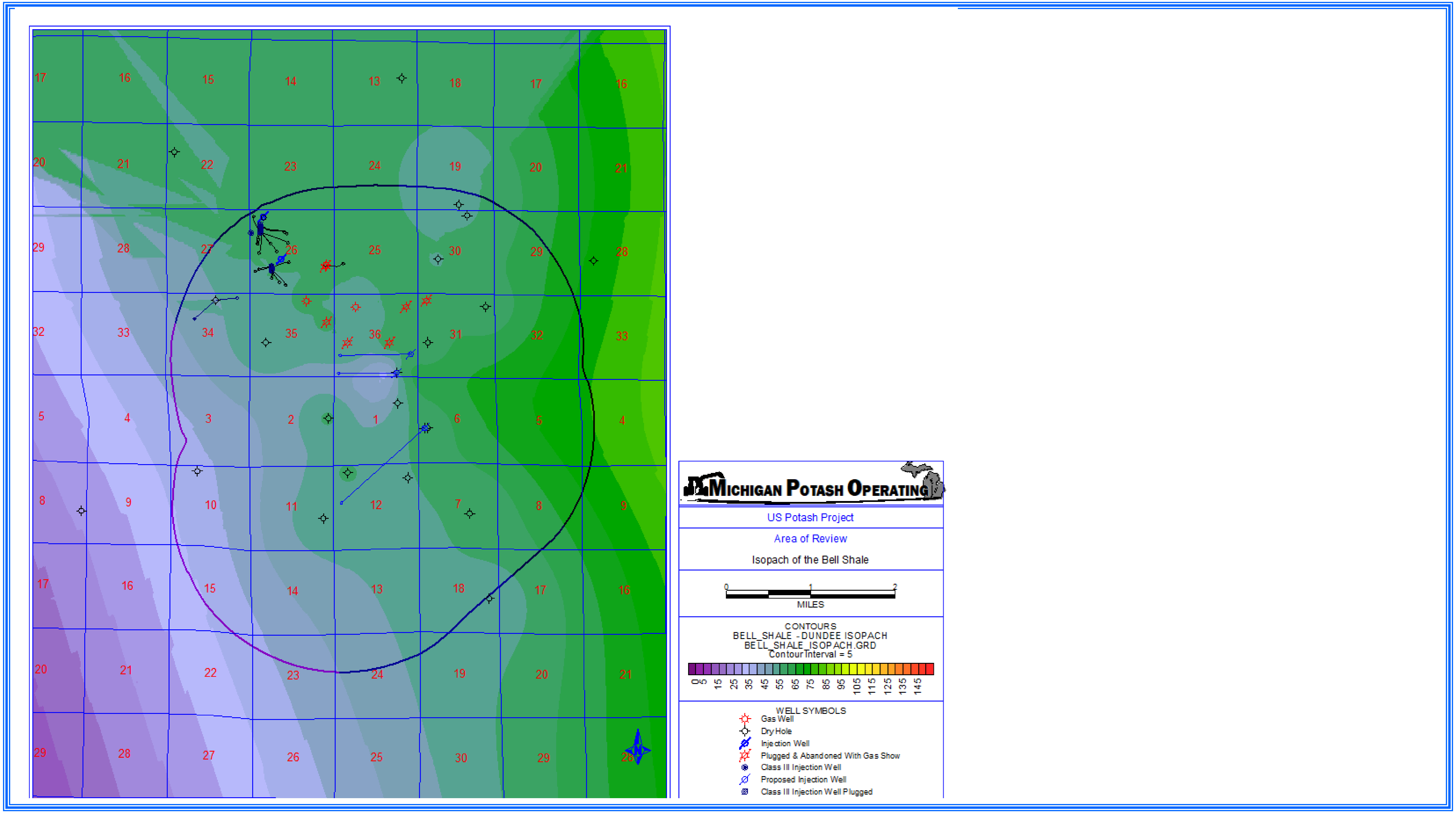


Figure C16. Isopach map of the Bell Shale

Provided the Bell Shale is a shale, there is little to no effective permeability or porosity, with no anticipated lateral or vertical variation expected within the AOR or area of influence.

11.F The occurrence and extent of natural fractures and/or solution features within the area of influence.

There are no known natural fractures or solution features within the confining zone, as observed either via indirect or direct methods.

11.G Chemical and physical characteristics of the fluids contained in the confining zone and fluid saturations.

Any porosity encountered above the injection horizons is sporadic, thin, and immediately interlayered with confining anhydrites, dolomites, cherts, or limestones, which will render data collection near impossible, impractical, or dangerous. Provided the confining zone is a shale, fluids will not flow and they cannot be recovered.

11.H Formation fracture pressure, the method used to determine fracture pressure and the expected direction of fracture propagation.

The high differential rock properties, (young modulus, Poisson's ratio and fracture toughness) associated with the Bell Shale, together with the dense limestone just below it in the Upper Dundee, and similarly dense limestone of the lower Traverse just above the Bell Shale provides reasonable assurance that the confining interval will not be inadvertently fractured, noting the substantially greater permeability of the injection interval (Reed City Dolomite). In the event fracturing of the confining zone were to occur, theoretically, it would occur under the same conditions and directions as those described for the injection horizon.

11.I The vertical distance between the top of the confining zone from the base of the lowest fresh water strata.

The top of the Bell Shale is at 3889' at MPC 8D, and the base of the lowermost fresh water source is 620' The vertical distance between the top of the confining zone from the base of the lowest fresh water strata is 3,269'.

Please see Figure B1 for a cross section showing the top of the confining zone and base of the lowermost USDW.

12 Information demonstrating injection of liquids into the proposed zone will not exceed the fracture pressure gradient and information showing injection into the proposed geological strata will not initiate fractures through the confining zone. Information showing the anticipated dispersion, diffusion and/or displacement of injected fluids and behavior of transient pressure gradients in the injection zone during and following injection.

Please see Section EGLE BRINE DISPOSAL WELL CHECKLIST ITEM 2, where pressure data based on the laws of transient pressure and fluid dispersion given real observed subsurface rock parameters were provided.

Pressure transient and injectivity testing will be performed and step rate data will be obtained; testing will be witnessed by the US EPA and/or EGLE.

There is also legacy data available within the AOR for Non-Hazardous Class I wells currently injecting in the into the Reed City Dolomite, which is summarized below for the Woodward 1-26 well, with the expectation that measurements at MPC 8D and at the Hodges 1-36 may be similar.

	Woodward 1-26	
Parameter	2005	2006
Permeability (k)	410 md	516.7 md
Perm-thick product (kb)	61,090 md-ft	76,988 md-ft
Skin factor (s)	16.4	2.27
Pressure change due to skin (Δp_{skin})	158.9 psi	29.22 psi
Flow efficiency (E)	0.36	0.80

A radial flow model with the Woodward 1-26 well positioned between parallel no-flow boundaries was utilized to evaluate the pressure transient data. Results of the pressure transient testing indicated the Woodward 1-26 well is positioned between parallel no-flow boundaries.

Please also see Section EGLE BRINE DISPOSAL WELL CHECKLIST ITEM 9.I which utilizes actual injection step rate testing that was initiated in the offset Class I Disposal wells, the Thomas 1-26 and the Woodward 1-26, where actual data was used to demonstrate that the injection rates did not, and still do not, initiate fractures under current regulatory observation.

The proximity of multiple wells (i.e., MPC 8D, Hodges 1-36 and Johnson 1-6) enables the possibility of observation and interference testing, wherein while one well is undergoing a step rate injection test, or injection volume, the offset well will be utilized as an observation well, allowing additional information as it concerns the proposed injection horizons and injectivity. This can be done for all injection horizons provided proper planning once injection is established. The procedures for estimating reservoir reaction to injected fluid are made by determination of the porosity, permeability, thickness, extent, and pressure of the reservoir. Formation samples and cores, geophysical logs, and drill stem tests, and observation of pressures between two points enables an analysis of reservoir extent by comparing and deducing this data.

13 Proposed operating data including all of the following data

A. The anticipated daily injection rates and pressures.

B. The types of fluids to be injected.

C. A plan for conducting mechanical integrity tests.

13.A The anticipated daily injection rates and pressures.

At any given time, disposal may occur to a single well or to all applicant wells simultaneously, thereby reducing or changing the injected rate and volume per well. Maximum total project rates are not expected to exceed the following rates. It is more likely than not, that injection pressures, or injection volumes will be the limiting threshold. The horizontal character of the proposed wellbore designs should enable high injection rates due to high reservoir surface area exposure.

Maximum, instantaneous injection rates have been incorporated into Form EQP 7200-14 as though all volumes would be sent to a singular well. Step rate injection data must suggest this singular wellbore is able to accommodate such volume.

Anticipated Injection rates:

Average Rate	Maximum Rate	Average Volume	Maximum Volume
Bpm	bpd	Bpd	bpd
9.5	27.85	13,680	40,104

All proposed injection zones are under-pressured in the area, with an anticipated pore pressure gradient of 0.41 psi/ft or less. Open hole logs suggest good injectivity across the proposed injection horizon.

Step rate and fracture data will be gathered for the target injection horizons in the subject wells.

Reed City Dolomite injection in the Woodward 1-26 and Thomas 1-26 wells over the previous ten years of operation demonstrates an average injection pressure into the Reed City Dolomite of 900 psi. This is reported regularly and summarized in re-application permits by the owner and operator of MI-133-1I-0002 and MI-133-1I-0001. These wells are injecting into the same Reed City Dolomite horizon as is proposed by Michigan Potash Operating. It is logical and expected that similar rates and pressures will be observed at the MPC 8D, Hodges 1-36 and Johnson 1-6 wells. As indicated in EGLE BRINE DISPOSAL WELL CHECKLIST ITEM 9.I, MI-133-1I-0002 (Thomas 1-26) and MI-133-1I-0001 (Woodward 1-26) have under gone fracture testing in the AOR in the Reed City Dolomite. Injection tests were made by pumping treated water in the Reed City Dolomite at rates up to 1,176 gallons per minute at a surface pressure of 2,960 psi. After deduction of calculated friction loses of 38 psi within the well, the pressure at the top of the Reed City Dolomite, while injected treating fresh water was 4,647 psi. No parting or fracturing of the formation was noted, indicated the fracture pressure must be greater than 4,647 psi. A pressure gradient of 1.18 psi per foot was calculated. No further attempts were made to facture the injection zone.

This is typical of the Dundee, which has fracture gradients in typically in excess of 1.10 (EPA Michigan Field Fracture Gradients by County).

The permitted maximum injection pressure for the Thomas 1-26 well and Woodward 1-26 well is 2,393 psi and 2,453 psig respectively. Both are in the immediate vicinity of the applicant wells, into the same horizon, and up structure.

If wells are demonstrated to be capable, MPO proposes operating the disposal wells at higher pressure to obtain greater, more efficient disposal capacity than the 900 psi currently used at the offset operation. Based on available data, the following operating pressures are expected.

Average Pressure psi	Maximum Pressure psi
1,700	2,580

Injection fluid may be water (specific gravity of 1.05) or a partially saturated sodium chloride/potassium chloride brine solution with a specific gravity of up to 1.20, with a safety factor of 0.05 applied to operating conditions.

[{1.17 psi/ft - (0.433 psi/ft x specific gravity)} x depth] - 14.7 psi =

[{1.17 psi/ft - (0.433 psi/ft x 1.25)} x 4065ft] - 14.7 psi =

2541 psi.

Form EQP 7400-14, *has been filed with a default 0.8 psi/ft fracture gradient as directed by regulatory direction from the U.S. EPA despite substantial offset data available. Upon completion of the wells, step rate injection testing will be performed to obtain site specific data that will match the offsets and expected operating parameters listed in this section are anticipated; with 1.17 psi/ft FRACTURE GRADIENT.*

13.B The types of fluids to be injected

The waste stream injected into the proposed Class I Non-Hazardous injection wells are non-hazardous brines (salt water) generated by the simple processing of food grade table salt (i.e. sodium chloride, NaCl) utilized on dinner tables across the world, and potassium chloride (KCl) "potash", which is a natural, food safe fertilizer, applied to staple crops for food generation and consumption.

Salt and potash brine is sent to a natural gas fired evaporator, which concentrates the salt and potash water. Concentration of the water crystallizes the salt from solution, and increases the concentration of the potash in the water. The water is then sent to potash crystallization processes, where temperature contrasts crystallize the potash from the water. The remaining water is recycled back for injection, or in the case of excess water, is sent to Class I wells.

The facility is a food grade facility, and therefore, no hazardous, or non-naturally occurring materials are introduced into the system.

There may be traces of sodium hydroxide, used to strip naturally occurring H_2S from the brine that comes from the salt and potash bearing formation (Salina A1). Pump packing seal water (<10gpm), and a bleed system (<10gpm) containing some sodium bisulfite may be added to the injection stream.

Class III wells under Area Permit MI-133-3G-0028, is the source of non-commercial, non-hazardous feed brine to the facility, and at times, to the proposed disposal wells. The field name has been dubbed the US Potash Project, Evart, MI.

Please also see Section EGLE BRINE DISPOSAL CHECKLIST ITEM 8.

13.C A Plan for Mechanical Integrity Tests

All required logs will be run before any perforations are added to the casing and before fluid injection commences.

The mechanical integrity of all the proposed injection wells will be tested according to the requirements of 40 CPR 146.8 to demonstrate that (1) there are no significant leaks in the casing, tubing, or packer and (2) there is no significant fluid movement into a USDW through vertical channels adjacent to the injection wellbores. As required by permit, mechanical integrity tests shall be conducted at the required frequency, and before any injection commences. The frequency of testing will be specified by permit and regulation, with timing of these test shall be dictated according to proactive best practice.

Required tests include:

1) an approved pressure test in accordance with 40 CFR 146.8(b)(1) [annually];

2) an approved radioactive tracer survey [every five years]; and

3) an approved temperature, noise, oxygen activation or other approved log [every five years];

or 1,2, & 3 above as otherwise directed by permit.

Gauges used in performance of the MIT will be calibrated to an accuracy of not less than 0.5 percent of full scale prior to field use. A copy of the calibration certificate will be submitted to USEPA each time the gauge is calibrated.

Notice will be made to the EGLE at least thirty days prior to the date of the schedule MIT. Tests must be witnessed by a representative of the USEPA and/or EGLE. An MIT report presenting test results will be provided to the EGLE within 45 days following completion of the MIT.

Brine is transmitted through the wells in tubing suspended from the wellhead and extending to a point near the top of the receiving formation. At or near the bottom of the tubing, the annulus between the tubing and the cemented casing is sealed with a packer; thus, the entire annulus from the wellhead to the packer is sealed off from the injected brine. The annulus is filled with an inhibited brine to a point slightly below the freeze line where the remainder of space is filled with oil. The annulus pressure is maintained to hold 20 psi at all times at surface and is monitored with a continuously recording pressure gauge.

If internal mechanical integrity was compromised, the annulus fluid pressure would change and immediately detected by the proposed monitoring program. If the injection tubing or packer developed a leak, a change in the annulus pressure would also develop and would be immediately detected by the continuously recording pressure gauge. In either case, investigative and remedial action would be promptly taken to replace or repair the part damaged following immediate notification and contingent operating procedures, as required by permit.

The multiple well application allows for an excess of disposal capacity and optionally to allow for system upsets, emergency shut-in, and contingent disposal capacity.

If failure were to occur in one well, that well would be shut-in immediately, and the entire disposal flow would be directed to the other well(s). If necessary , flow rates would be reduced as needed to remain below permitted injection pressure limits.

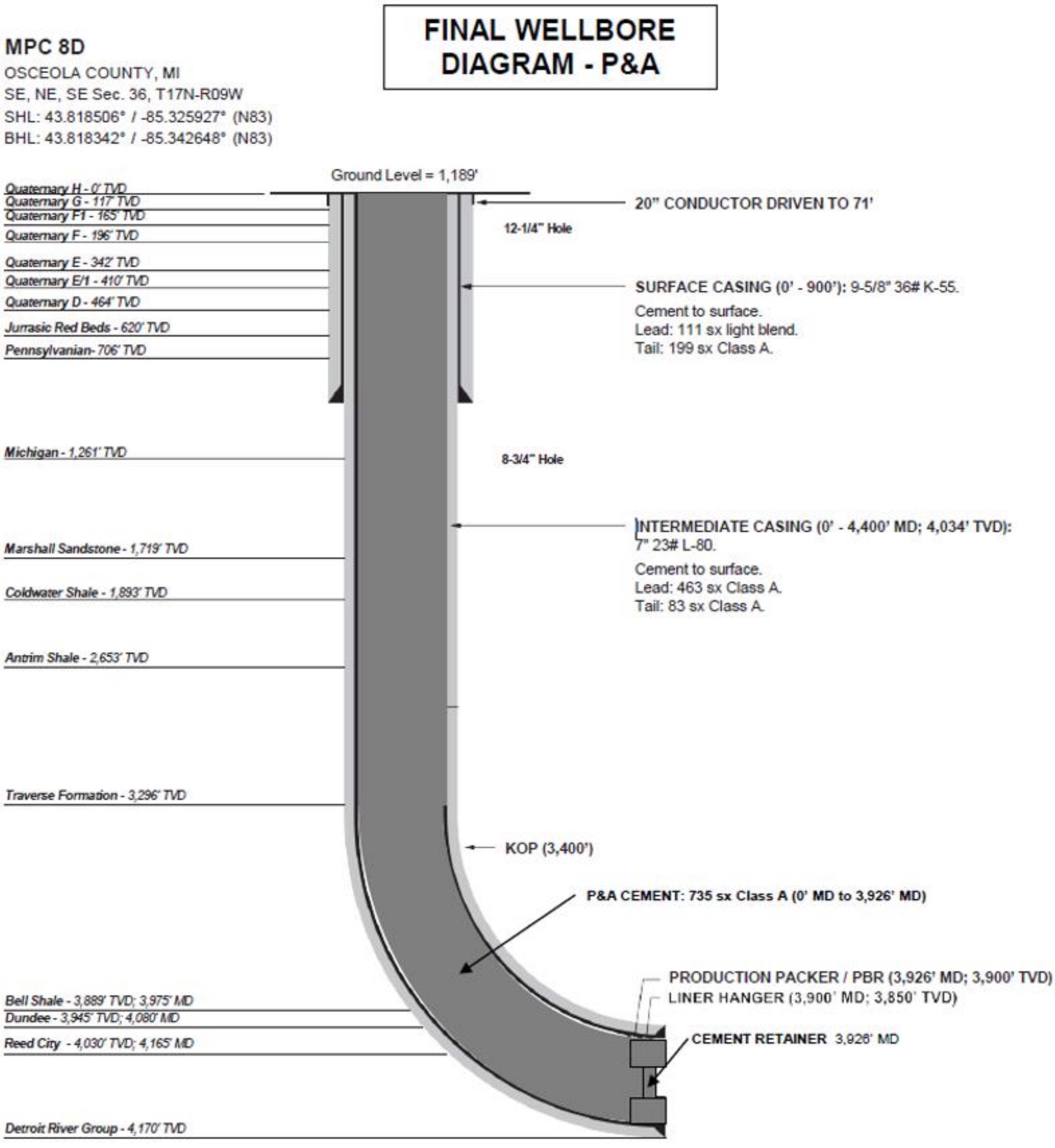
14 For a proposed disposal well to dispose of waste products into a zone that would likely constitute a producing oil or gas pool or natural brine pool, a list of all offset operators and certification that the person making application for a well has notified all offset operators of the person's intention by certified mail. If within 21 days after the mailing date an offset operator files a substantive objection with the supervisor, then the application shall not be granted without a hearing pursuant to part 12 of these rules. A hearing may also be scheduled by the supervisor to determine the need or desirability of granting permission for the proposed well.

The proposed injection horizons are not in a producing oil or gas pool or a natural brine pool.

MPC 8D

15 A proposed plugging and abandonment plan

Proposed Plugged Wellbore Diagram.



16 Identify the source or sources of proposed injected fluids. Identify if injected fluids will be considered hazardous or non-hazardous as defined by Part 111, Hazardous Waste Management, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA)

Please see EGLE Brine Disposal well Checklist Item 8.

The waste stream injected into the proposed Class I Non-Hazardous injection wells are non-hazardous brines (salt water) generated by the simple processing of food grade table salt (sodium chloride, NaCl) utilized on dinner tables across the world, and potassium chloride (KCl) "potash", which is a natural, food safe fertilizer, applied to staple crops for food generation and consumption.

Salt and potash brine is sent to a natural gas fired evaporator, which concentrates the salt and potash water. Concentration of the water crystallizes the salt from solution, and increases the concentration of the potash in the water. The water is then sent to potash crystallization processes, where temperature contrasts crystallize the potash from the water. The remaining water is recycled back for injection, or in the case of excess water, is sent to Class I wells.

The facility is a food grade facility. No hazardous materials as defined by Part 111 of Act 451 are anticipated.

17 Whether the well is to be a multisource commercial hazardous waste disposal well.

The well is expressly NOT a multisource commercial well and is expressly not a hazardous waste disposal well.