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**west virginia** department of environmental protection

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Office of Oil and Gas  
601 57th Street SE  
Charleston, WV 25304  
(304) 926-0450  
(304) 926-0452 fax

Earl Ray Tomblin, Governor  
Randy C. Huffman, Cabinet Secretary  
www.dep.wv.gov

February 20, 2015

**WELL WORK PERMIT**

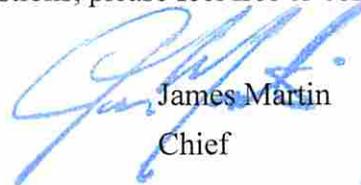
**Horizontal 6A Well**

This permit, API Well Number: 47-10303049, issued to GASTAR EXPLORATION INC., is evidence of permission granted to perform the specified well work at the location described on the attached pages and located on the attached plat, subject to the provisions of Chapter 22 of the West Virginia Code of 1931, as amended, and all rules and regulations promulgated thereunder, and to all conditions and provisions outlined in the pages attached hereto. Notification shall be given by the operator to the Oil and Gas Inspector at least 24 hours prior to the construction of roads, locations, and/or pits for any permitted work. In addition, the well operator shall notify the same inspector 24 hours before any actual well work is commenced and prior to running and cementing casing. Spills or emergency discharges must be promptly reported by the operator to 1-800-642-3074 and to the Oil and Gas inspector.

Please be advised that form WR-35, Well Operators Report of Well Work is to be submitted to this office within 90 days completion of permitted well work, as should form WR-34 Discharge Monitoring Report within 30 days of discharge of pits, if applicable. Failure to abide by all statutory and regulatory provisions governing all duties and operations hereunder may result in suspension or revocation of this permit and, in addition, may result in civil and/or criminal penalties being imposed upon the operators.

In addition to the applicable requirements of this permit, and the statutes and rules governing oil and gas activity in WV, this permit may contain specific conditions which must be followed. Permit conditions are attached to this cover letter.

Per 35CSR-4-5.2.g this permit will expire in two (2) years from the issue date unless permitted well work is commenced. If there are any questions, please feel free to contact me at (304) 926-0499 ext. 1654.



James Martin  
Chief

Operator's Well No: LACKAWANNA 4H  
Farm Name: M. B. INVESTMENTS

**API Well Number: 47- 10303049**

**Permit Type: Horizontal 6A Well**

Date Issued: 02/20/2015

**Promoting a healthy environment.**

## PERMIT CONDITIONS

West Virginia Code § 22-6A-8(d) allows the Office of Oil and Gas to place specific conditions upon this permit. Permit conditions have the same effect as law. Failure to adhere to the specified permit conditions may result in enforcement action.

### CONDITIONS

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1. This proposed activity may require permit coverage from the United States Army Corps of Engineers (USACE). Through this permit, you are hereby being advised to consult with USACE regarding this proposed activity.
2. If the operator encounters an unanticipated void, or an anticipated void at an unanticipated depth, the operator shall notify the inspector within 24 hours. Modifications to the casing program may be necessary to comply with W. Va. Code § 22-6A-5a (12), which requires drilling to a minimum depth of thirty feet below the bottom of the void, and installing a minimum of twenty (20) feet of casing. Under no circumstance should the operator drill more than fifty (50) feet below the bottom of the void or install less than twenty (20) feet of casing below the bottom of the void.
3. When compacting fills, each lift before compaction shall not be more than 12 inches in height, and the moisture content of the fill material shall be within limits as determined by the Standard Proctor Density test of the actual soils used in specific engineered fill, ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort, to achieve 95 % compaction of the optimum density. Each lift shall be tested for compaction, with a minimum of two tests per lift per acre of fill. All test results shall be maintained on site and available for review.
4. Operator shall install signage per § 22-6A-8g (6) (B) at all source water locations included in their approved water management plan within 24 hours of water management plan activation.
5. Oil and gas water supply wells will be registered with the Office of Oil and Gas and all such wells will be constructed and plugged in accordance with the standards of the Bureau for Public Health set forth in its Legislative rule entitled *Water Well Regulations*, 64 C.S.R. 19. Operator is to contact the Bureau of Public Health regarding permit requirements. In lieu of plugging, the operator may transfer the well to the surface owner upon agreement of the parties. All drinking water wells within fifteen hundred feet of the water supply well shall be flow tested by the operator upon request of the drinking well owner prior to operating the water supply well.
6. Pursuant to the requirements pertaining to the sampling of domestic water supply wells/springs the operator shall, no later than thirty (30) days after receipt of analytical data provide a written copy to the Chief and any of the users who may have requested such analyses.
7. If any explosion or other accident causing loss of life or serious personal injury occurs in or about a well or well work on a well, the well operator or its contractor shall give notice, stating the particulars of the explosion or accident, to the oil and gas inspector and the Chief, within 24 hours of said accident.
8. During the casing and cementing process, in the event cement does not return to the surface, the oil and gas inspector shall be notified within 24 hours.
9. Operator shall provide the Office of Oil & Gas notification of the date that drilling commenced on this well. Such notice shall be provided by sending an email to DEPOOGNotify@wv.gov within 30 days of commencement of drilling.

STATE OF WEST VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION, OFFICE OF OIL AND GAS  
WELL WORK PERMIT APPLICATION

1) Well Operator: Gastar Exploration Inc. 494487685 Wetzel Magnolia Porters Falls  
Operator ID County District Quadrangle

2) Operator's Well Number: 4H Well Pad Name: Lackawanna

3) Farm Name/Surface Owner: M.B. Investments Public Road Access: County Route 30 Whiteman Hill Road

4) Elevation, current ground: 1329' Elevation, proposed post-construction: 1302'

5) Well Type (a) Gas  Oil  Underground Storage   
Other

(b) If Gas Shallow  Deep   
Horizontal

6) Existing Pad: Yes or No No

7) Proposed Target Formation(s), Depth(s), Anticipated Thickness and Associated Pressure(s):  
The Marcellus is the target formation at a depth of 6829', thickness of 46' and an anticipated pressure of approx. 3200 psi.

8) Proposed Total Vertical Depth: 6975'

9) Formation at Total Vertical Depth: Onondaga

10) Proposed Total Measured Depth: 13,997'

11) Proposed Horizontal Leg Length: 6250'

12) Approximate Fresh Water Strata Depths: 750'

13) Method to Determine Fresh Water Depths: Noticeable flow at flowline or when needed to start soaping

14) Approximate Saltwater Depths: 1740'

15) Approximate Coal Seam Depths: Sewickley at 1079' and Pittsburgh at 1220'

16) Approximate Depth to Possible Void (coal mine, karst, other): None Anticipated

17) Does Proposed well location contain coal seams directly overlying or adjacent to an active mine? Yes  No

(a) If Yes, provide Mine Info: Name: \_\_\_\_\_  
Depth: \_\_\_\_\_  
Seam: \_\_\_\_\_  
Owner: \_\_\_\_\_

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**Office of Oil & Gas**  
**FEB 11 2015**

18)

CASING AND TUBING PROGRAM

<u>TYPE</u>	<u>Size</u>	<u>New or Used</u>	<u>Grade</u>	<u>Weight per ft. (lb/ft)</u>	<u>FOOTAGE: For Drilling</u>	<u>INTERVALS: Left in Well</u>	<u>CEMENT: Fill-up (Cu. Ft.)</u>
Conductor	20"	New	PE	54.5#/ft		40'	241 cuft (CTS)
Fresh Water	13 3/8"	New	H-40	48#/ft		1275'	885 cuft (CTS)
Coal	13 3/8"	New	H-40	48#/ft		1275'	885 cuft (CTS)
Intermediate	9 5/8"	New	J-55	36#/ft		2650'	901 cuft (CTS)
Production	5 1/2"	New	P-110	20#/ft		13,997'	3579 cuft (CTS)
Tubing	2 3/8"	New	N-80	4.7#/ft		7309'	N/A
Liners							

<u>TYPE</u>	<u>Size</u>	<u>Wellbore Diameter</u>	<u>Wall Thickness</u>	<u>Burst Pressure</u>	<u>Cement Type</u>	<u>Cement Yield (cu. ft./k)</u>
Conductor	20"	26"	.25"	880 psi	Class A	1.2
Fresh Water	13 3/8"	17.5"	.33"	1730 psi	Class A	1.2
Coal	13 3/8"	17.5"	.33"	1730 psi	Class A	1.2
Intermediate	9 5/8"	12.25"	.352"	3520 psi	Class A	1.2
Production	5.5"	8.875" & 8.75"	.361"	12,640 psi	Class H	1.18
Tubing	2 3/8"	4.653"	.19"	11,200 psi		
Liners						

*Handwritten:* 2/13/15

PACKERS

Kind:	n/a			
Sizes:	n/a			
Depths Set:	n/a			

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FEB 11 2015

19) Describe proposed well work, including the drilling and plugging back of any pilot hole:

Drill through the Marcellus tagging less than one hundred (100') feet from the top of the Onondaga to get depths and log data. Then plug the well back to proposed kick off point (TBD). Drill the horizontal section to planned and proposed TD. Run casing and cement back to surface. Run a bond log from approximately 60 degrees back to surface, pressure test casing and set a master valve. Make a clean out-run on the casing and perforate then stimulate.

20) Describe fracturing/stimulating methods in detail, including anticipated max pressure and max rate:

Gastar Exploration plans to fracture the well using a typical slickwater fracture design. Gastar will pump roughly 7000 bbls of water and 320,000 lbs of sand per stage. There will be approximately 29 stages. The designed frac rate will be 80 bpm and an anticipated max pressure of 8500 psi.

21) Total Area to be disturbed, including roads, stockpile area, pits, etc., (acres): 25.45

22) Area to be disturbed for well pad only, less access road (acres): 4.01

23) Describe centralizer placement for each casing string:

Gastar will run 3 centralizers on the surface casing at an equal distance. The intermediate casing will have 7 centralizers at 300' spacing. The production casing will have one centralizer every other joint in the lateral, one centralizer per joint through the curve and one centralizer every other joint in the vertical section.

24) Describe all cement additives associated with each cement type:

Class A + 2% CaCl<sub>2</sub> + 1/4# Flake - Surface Cement mixed at 15.6 ppg. CaCl<sub>2</sub> (calcium chloride), Flake (cellophane flake)  
Class A + 1% CaCl<sub>2</sub> + 1/4# Flake - Intermediate Cement mixed at 15.6 ppg. 50:50 Class H .2%CD32 1.2%FL62 .1% ASA301 .4%SMS - Long String Lead mixed 14.5 ppg. CD32 (cement dispersant), FL 62 (fluid loss), SMS (sodium metasilicate), ASA (minimizes free fluid). 50:50 TYPE 1 .4% R3 1%FL62 .15%ASA301 .3%CD32-Long String Tail-14.5ppg

25) Proposed borehole conditioning procedures:

Gastar will circulate the hole a minimum of 3 hours upon TD. We will then pull out to the bottom of the curve and circulate for another 2 hours. Then come out of the hole.

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FEB 11 2015

\*Note: Attach additional sheets as needed.

4710303049

Lackawanna 4H  
Wetzel County, WV

WELLBORE 26"

20" 54.5# PE @ 40'

Cement to Surface

3 Centralizers @ Even Spacing

WELLBORE 17.5"

13 3/8" 48# H-40 ST&C

Set @ 1275' MD

Cement to Surface

Cement to Surface

Wellbore 12.25"

7 Centralizers @ 300' Spacing

9 5/8" 36# L-55

Set @ 2650' MD

8 7/8" wellbore

*Drift  
10-2-14*

Cement to Surface

5 1/2" 20# P-110

Set @ 13,987' MN

Pilot Hole

TD Pilot Hole @ 5,975' TVD

LP @ 7,747' MD

6,842' TVD

One Centralizer every other ft from toe to bot. of the curve and one Centralizer every joint in the curve and one centr. Every other joint in their vertical section.

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Office of Oil and Gas

OCT 08 2014

WV Department of  
Environmental Protection



WW-9  
(9/13)

API Number 47 - 103 - \_\_\_\_\_  
Operator's Well No. 4H \_\_\_\_\_

STATE OF WEST VIRGINIA  
DEPARTMENT OF ENVIRONMENTAL PROTECTION  
OFFICE OF OIL AND GAS

4710303049

FLUIDS/ CUTTINGS DISPOSAL & RECLAMATION PLAN

Operator Name Gastar Exploration Inc. OP Code 494487685

Watershed (HUC 10) Outlet Middle Island Creek (undefined) Quadrangle Porters Falls 7.5'

Elevation 1302' County Wetzel District Magnolia

Do you anticipate using more than 5,000 bbls of water to complete the proposed well work? Yes  No

Will a pit be used? Yes  No

If so, please describe anticipated pit waste: Frac water for frac and flow back water

Will a synthetic liner be used in the pit? Yes  No  If so, what ml.? 60

Proposed Disposal Method For Treated Pit Wastes:

- Land Application
- Underground Injection ( UIC Permit Number UIC 359; UIC 2D0732540; UIC 2D0732523 )
- Reuse (at API Number \_\_\_\_\_)
- Off Site Disposal (Supply form WW-9 for disposal location)
- Other (Explain \_\_\_\_\_)

*DMB  
10-2-14*

Will closed loop system be used? If so, describe: Yes, for vertical and horizontal drilling

Drilling medium anticipated for this well (vertical and horizontal)? Air, freshwater, oil based, etc. Air for vertical / Oil for horizontal

-If oil based, what type? Synthetic, petroleum, etc. Synthetic oil base

Additives to be used in drilling medium? Barite for weight

Drill cuttings disposal method? Leave in pit, landfill, removed offsite, etc. All drill cuttings will be disposed of in Wetzel County Sanitary Landfill (SWF-1021/WV0109185)

-If left in pit and plan to solidify what medium will be used? (cement, lime, sawdust) \_\_\_\_\_

-Landfill or offsite name/permit number? Wetzel County Sanitary Landfill (SWF-1021/WV0109185)

I certify that I understand and agree to the terms and conditions of the GENERAL WATER POLLUTION PERMIT issued on August 1, 2005, by the Office of Oil and Gas of the West Virginia Department of Environmental Protection. I understand that the provisions of the permit are enforceable by law. Violations of any term or condition of the general permit and/or other applicable law or regulation can lead to enforcement action.

I certify under penalty of law that I have personally examined and am familiar with the information submitted on this application form and all attachments thereto and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment.

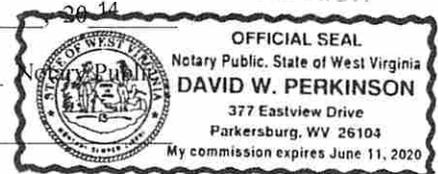
Company Official Signature *Michael McCown*

Company Official (Typed Name) Michael McCown

Company Official Title Senior VP & COO

Subscribed and sworn before me this 29th day of September

My commission expires 06/11/2020



Gastar Exploration Inc.

Proposed Revegetation Treatment: Acres Disturbed 25.45 Prevegetation pH

Lime 3 Tons/acre or to correct to pH 6.5

Fertilizer type 10-20-20 or equivalent

Fertilizer amount 1/3 ton lbs/acre

Mulch 2.5 Tons/acre

Seed Mixtures

Temporary		Permanent	
Seed Type	lbs/acre	Seed Type	lbs/acre
Annual Ryegrass	40	Fox / Grassy	40
		Perennial Rye	30
		Crown Vetch	20

Attach:

Drawing(s) of road, location, pit and proposed area for land application (unless engineered plans including this info have been provided)

Photocopied section of involved 7.5' topographic sheet.

Plan Approved by: [Signature]

Comments:

RECEIVED Office of Oil and Gas

NOV 08 2014

WV Department of Environmental Protection

Title: Oil + Gas Inspector

Date: 10-2-14

Field Reviewed? (X) Yes ( ) No

ALL TREES 6-INCHES AND ABOVE ARE TO BE CUT AND STACKED. BRUSH SLASHINGS ARE TO UTILIZED DOWN SLOPE OF SITE AND STRUCTURES TO ACT AS A CONTROL BARRIER IF AVAILABLE.

DRAWING NOT TO SCALE

Charles Clegg  
Tax Map: 12  
Parcel: 129

M.B. Investments  
Tax Map: 12  
Parcel: 109.1

STORAGE BUILDING 0303049

MATCH LINE "A" (SEE PAGE 1B)  
MATCH LINE "A" (SEE PAGE 1A)

Lackawanna Transport Co.  
Tax Map: 12  
Parcel: 122

WETZEL COUNTY LANDFILL PERMIT #SWF1021/WW0109185

Lackawanna Transport Co.  
Tax Map: 12  
Parcel: 130

MB Investments  
Tax Map: 17  
Parcel: 2

Lackawanna Transport Co.  
Tax Map: 12  
Parcel: 130

Lackawanna Transport Co.  
Tax Map: 17  
Parcel: 7.1

Jerry W. & Deloris Thompson  
Tax Map: 17  
Parcel: 6

REFERENCE IS HEREBY MADE TO THE WV D.E.P. OFFICE OF OIL & GAS, "EROSION AND SEDIMENT CONTROL FIELD MANUAL" FOR REQUIREMENTS AND BMPs FOR AVERAGE FIELD CONDITIONS CONCERNING THE MAINTENANCE OF EXISTING ROADS AND THE CONSTRUCTION OF PROPOSED ROADS. FIELD CONDITIONS MAY REQUIRE VARIANCE FROM THESE GUIDELINES AND THE EARTHWORK CONTRACTOR IS RESPONSIBLE FOR NOTIFICATION TO THE INSPECTOR AND THE OPERATOR SHOULD THESE CONDITIONS OCCUR.

INSTALL CULVERTS AS SHOWN ON RECLAMATION PLAN OR AS FIELD CONDITIONS REQUIRE.

ENTRANCES ONTO PUBLIC ROADS SHALL BE CONSTRUCTED OR MAINTAINED IN ACCORDANCE WITH WV D.O.T. REGULATIONS. ADDITIONAL PERMITS MAY BE REQUIRED.

Note:

© — Denotes install 18" HDPE pipe and apply appropriate sediment outlet control (Rip Rap splash pad).

EC — Denotes existing culvert in place.

\* \* \* Silt Fence and or Sediment and Erosion Control Measure.

HOUSE  
SHED  
GARAGE  
SHED

HOUSE  
GARAGE

TEMPORARILY SEED AND MULCH ALL SLOPES UPON CONSTRUCTION OF LOCATION.  
ALL CUT AND FILL SLOPES ARE 2H : 1V SLOPE.

PEACH FORK

Lackawanna Transport Co.  
Tax Map: 17  
Parcel: 10.1

DMH  
10-2-14

ALL TREES 6-INCHES AND ABOVE ARE TO BE CUT AND STACKED. BRUSH SLASHINGS ARE TO UTILIZED DOWN SLOPE OF SITE AND STRUCTURES TO ACT AS A CONTROL BARRIER IF AVAILABLE.

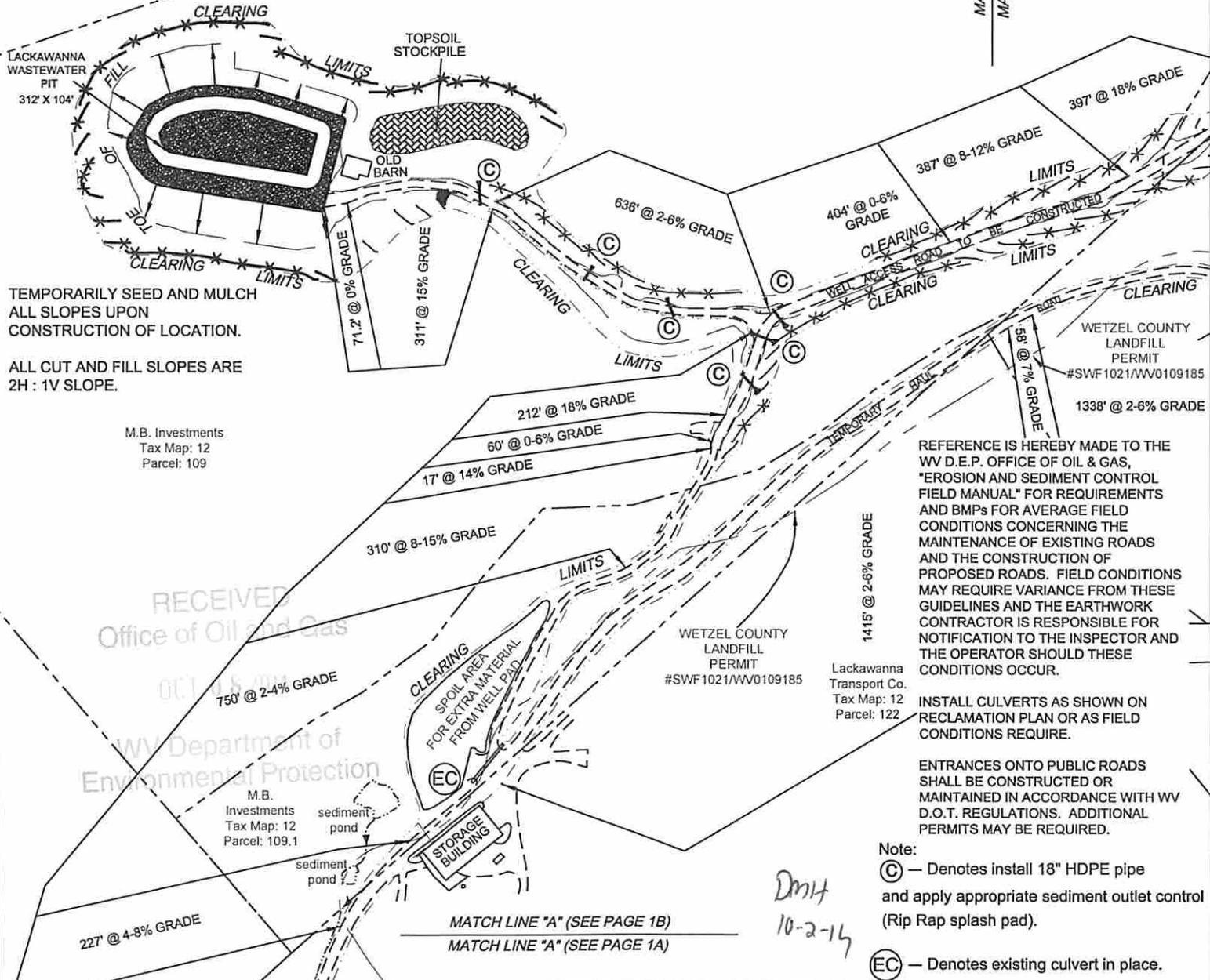
4710303049



MB Investments  
Tax Map: 12  
Parcel: 108

M.B. Investments  
Tax Map: 12  
Parcel: 109

MATCH LINE "A" (SEE PAGE 1B)  
MATCH LINE "A" (SEE PAGE 1C)



TEMPORARILY SEED AND MULCH ALL SLOPES UPON CONSTRUCTION OF LOCATION.

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M.B. Investments  
Tax Map: 12  
Parcel: 109

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Note:

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ⓔ — Denotes existing culvert in place.

— \* \* — Silt Fence and or Sediment and Erosion Control Measure.

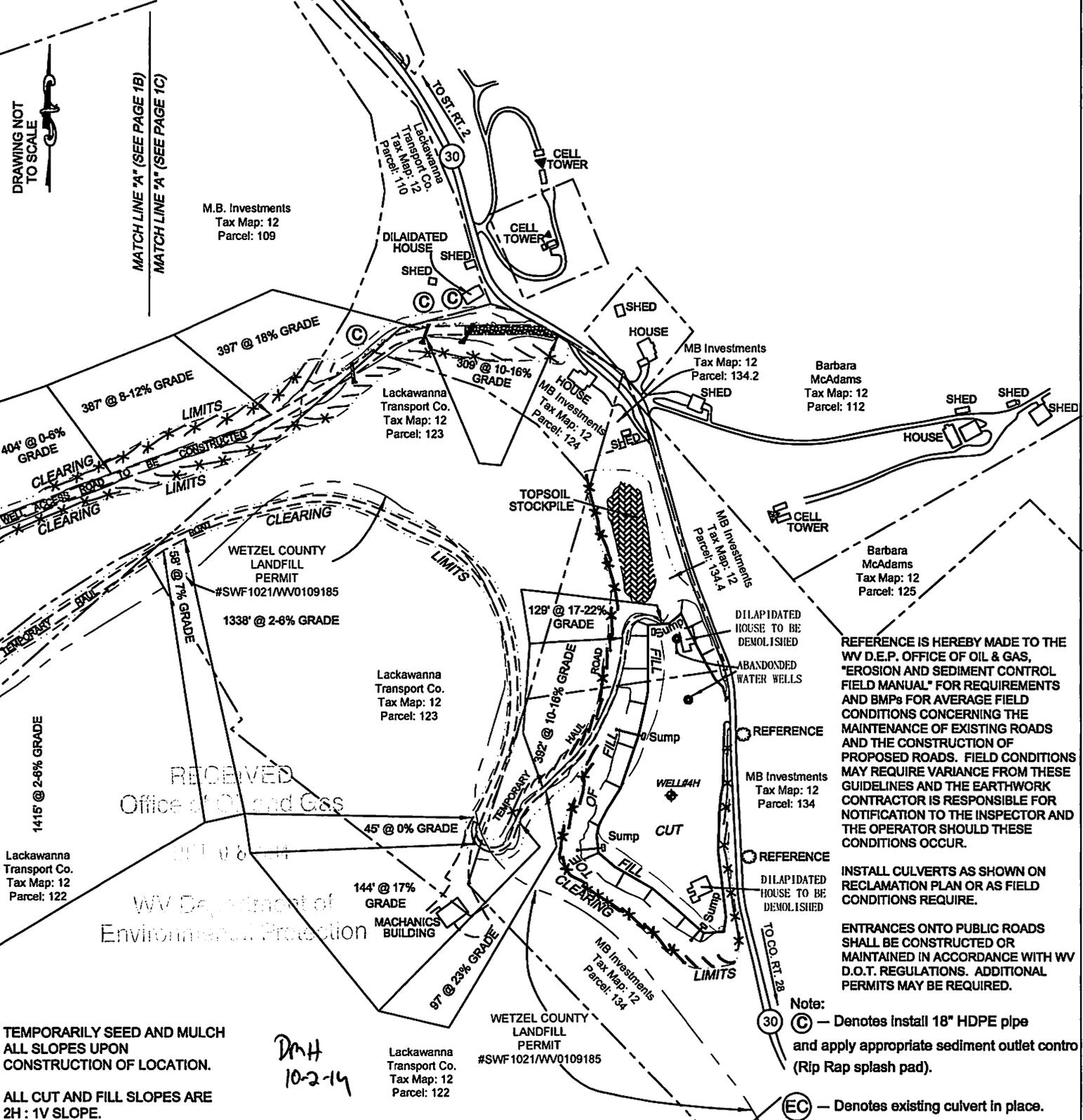
*Dmit*  
*10-2-14*

MATCH LINE "A" (SEE PAGE 1B)  
MATCH LINE "A" (SEE PAGE 1A)

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WV Department of  
Environmental Protection

47 10 30 30 49

ALL TREES 6-INCHES AND ABOVE ARE TO BE CUT AND STACKED. BRUSH SLASHINGS ARE TO UTILIZED DOWN SLOPE OF SITE AND STRUCTURES TO ACT AS A CONTROL BARRIER IF AVAILABLE.



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Note:  
 (C) — Denotes install 18" HDPE pipe and apply appropriate sediment outlet control (Rip Rap splash pad).  
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TEMPORARILY SEED AND MULCH ALL SLOPES UPON CONSTRUCTION OF LOCATION.  
 ALL CUT AND FILL SLOPES ARE 2H : 1V SLOPE.

DMH  
10-2-14

4710303049

**SLR**



global environmental solutions

# Well Site Safety Plan

## Gastar Exploration USA, Inc.

**Well Name:** Lackawanna 4H

**Pad Location:** Lackawanna Pad  
Wetzel County, West Virginia

**UTM (meters), NAD 83, Zone 17:**  
Northing – 4,384,043.2  
Easting – 512,301.3

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*Dmt*  
*10-2-14*

SLR Ref: 116.01034.00008

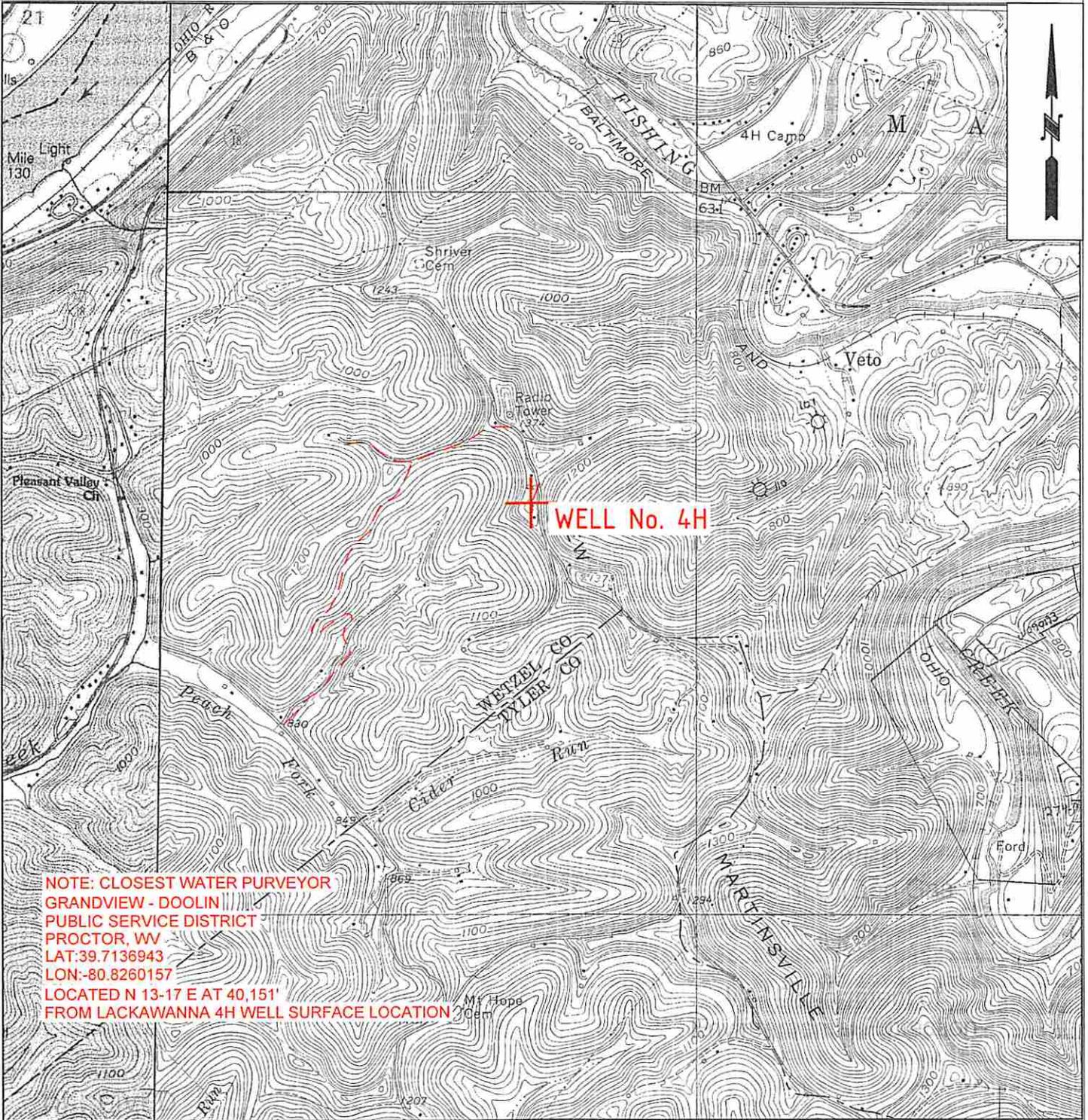
October 2014

WW-9

# PROPOSED LACKAWANNA WELL No. 4H

SUPPLEMENT PG 2

4710303049



NOTE: CLOSEST WATER PURVEYOR  
 GRANDVIEW - DOOLIN  
 PUBLIC SERVICE DISTRICT  
 PROCTOR, WV  
 LAT: 39.7136943  
 LON: -80.8260157  
 LOCATED N 13-17 E AT 40, 151'  
 FROM LACKAWANNA 4H WELL SURFACE LOCATION

Office of Oil and Gas

OCT 08 2014

DmH  
10-2-14

**OPERATOR**  
 GASTAR EXPLORATION INC.  
 229 W Main Street, Suite 301  
 Clarksburg, WV 26301

**TOPO SECTION**  
 PORTERS FALLS 7.5'  
**SCALE:**  
 1"=2000'

**LEASE NAME**  
 LACKAWANNA  
**DATE:**  
 DATE: 09/17/14

W0110309

WV Department of  
Environmental Protection

