



Prepared in cooperation with
the West Virginia Bureau for Public Health, Office of Environmental Health Services

Aquifer-Characteristics Data for West Virginia

Water-Resources Investigations Report 01-4036

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By Mark D. Kozar and Melvin V. Mathes

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Charleston, West Virginia
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CONVERSION FACTORS AND VERTICAL DATUM

	Multiply	By	To obtain
	inch (in.)	25.4	millimeter
	foot (ft)	0.3048	meter
	foot squared per day (ft ² /d)	0.09290	meter squared per day
	gallon per minute (gal/min)	0.00006309	cubic meter per second
	gallons (gal)	0.2642	liters
	mile (mi)	1.609	kilometer
	square foot (ft ²)	0.09290	square meter
	square mile (mi ²)	2.590	square kilometer
	gallons per minute per foot (gal/min/ft)	12.418	liters per minute per meter
	gallons per day per foot (gpd/ft)	0.0124	square meters per day
	foot per day (ft/d)	0.3048	meters per day
	inches per year (in./yr)	2.540	centimeters per year

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

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Abstract

Specific-capacity, storage-coefficient, and specific-yield data for wells in West Virginia were compiled to provide a data set from which transmissivity could be estimated. This data can be used for analytical and mathematical ground-water flow modeling. Analysis of available storage-coefficient and (or) specific-yield data indicates that the Ohio River alluvial aquifer has a median specific yield of 0.20, which is characteristic of an unconfined aquifer. The Kanawha River alluvial aquifer has a median specific yield of 0.003, which is characteristic of a semi-confined aquifer. The median storage coefficient of fractured-bedrock aquifers is only 0.007, which is characteristic of confined aquifers.

The highest median transmissivity of a specific aquifer in West Virginia occurs in Ohio River alluvium ($4,800 \text{ ft}^2/\text{d}$); the second highest occurs in Kanawha River alluvium ($1,600 \text{ ft}^2/\text{d}$). The lowest median transmissivity ($23 \text{ ft}^2/\text{d}$) is for the McKenzie-Rose Hill-Tuscarora aquifer. Rocks of Cambrian age within the Waynesboro-Tomstown-Harpers-Weverton-Loudon aquifer had a low median transmissivity of only $67 \text{ ft}^2/\text{d}$. Other aquifers with low transmissivities include the Hampshire Formation, Brallier-Harrell Formations, Mahantango Formations, Oriskany Sandstone, and the Conococheague Formation with median transmissivities of 74, 72, 92, 82, and $92 \text{ ft}^2/\text{d}$, respectively. All other aquifers within the

State had intermediate values of transmissivity ($130\text{-}920 \text{ ft}^2/\text{d}$). The highest median transmissivities among bedrock aquifers were those for aquifers within the Pennsylvanian age Pocahontas Formation ($1,200 \text{ ft}^2/\text{d}$) and Pottsville Group ($1,300 \text{ ft}^2/\text{d}$), and the Mississippian age Mauch Chunk Group ($1,300 \text{ ft}^2/\text{d}$). These rocks crop out primarily in the southern part of the State and to a lesser extent within the Valley and Ridge Physiographic Province in West Virginia's Eastern Panhandle.

The highest mean annual ground-water recharge rates within West Virginia (24.6 in.) occur within a band that extends through the central part of the State within the eastern part of the Kanawha River Basin. This area of relatively high relief has peaks higher than 4,000 ft and precipitation greater than 50 in./yr. The band of high recharge rates extends northward towards Pennsylvania and includes the Monongahela River Basin, which has a mean annual recharge of 21.4 inches.

To the west of this central band lies a region of lower relief with much lower mean annual precipitation (approximately 40 in.). Consequently, this area has much lower ground-water recharge rates. Mean annual recharge for the Tug Fork, Twelvepole Creek, and Guyandotte River Basins is only 12.6 inches. For the western part of the Kanawha River Basin, mean recharge is 11.9 inches. The lowest mean annual recharge rates (8.4 in.) within the State occur in the Little

Kanawha River Basin and the tributary streams in the region that discharge directly to the Ohio River.

West Virginia's Eastern Panhandle is an area characterized by long linear northeast to southwest trending ridges and valleys. The mean annual ground-water recharge rate for this region, which is drained almost entirely by the Potomac River and its tributaries, is 9.4 inches. This area, which is located within a rain shadow resulting from orographic lifting in the higher altitude area to the west, receives less precipitation (approximately 30 in.) than the region to the west.

INTRODUCTION

The West Virginia Bureau for Public Health, Office of Environmental Health Services (OEHS), has been mandated by the U.S. Environmental Protection Agency (USEPA) to delineate well-head (source-water) protection areas for all public-supply wells and well fields within West Virginia. These delineations can be used to help protect water supplies from the effects of land-use activities. OEHS delineates most well-head protection areas for ground-water supplies using analytical ground-water flow models, but also plans to use the mathematical flow model MODFLOW 2000 (Harbaugh and others, 2000) to delineate well-head protection areas for certain ground-water supplies that cannot be adequately described using simplified analytical models.

The development of analytical or numerical ground-water flow models requires data such as aquifer thickness, transmissivity, hydraulic conductivity, hydraulic gradient, storage coefficient and (or) specific yield, water levels, and the amounts of recharge and water withdrawn from the aquifer. Such "aquifer-characteristic data" are difficult to obtain, especially transmissivity, hydraulic conductivity, ground-water recharge, storage coefficient and (or) specific yield. These data are needed to allow OEHS to effectively delineate realistic well-head protection areas for public-supply water systems within the State. Currently, OEHS uses the data available for West Virginia aquifers that have been published in past hydrogeologic reports, but little published information is available for many areas within the State. The United States Geological Survey (USGS), in cooperation with OEHS, compiled this data to help OEHS effectively delineate

well-head protection areas for public-supply water systems within West Virginia.

All data within this report are first aggregated by hydrogeologic unit and then by county. The formation and group names used within this report are those adopted by the West Virginia Geologic and Economic Survey (WVGES) as they appear on the 1968 State geologic map of West Virginia (Cardwell and others, 1968). The level of detail needed to display geologic information necessary to locate transmissivity data for a respective area was not possible on a page size map. In order to locate within the appropriate hydrogeologic unit, the wells for which transmissivity values are presented in this report, the reader must obtain large-scale geologic maps of the area of interest and then match the hydrogeologic unit (aquifer) with those values in the appendix. Geologic maps for individual counties and localities, as well as for the State of West Virginia may be obtained from the WVGES (<http://www.wvgs.wvnet.edu>).

Purpose and Scope

This report presents estimates of transmissivity for aquifers throughout West Virginia. Published estimates of saturated aquifer thickness, hydraulic conductivity, storage coefficient and (or) specific yield are documented. Three sources of data were used to develop these estimates. First, published data from existing hydrogeologic reports were tabulated and organized by aquifer. Second, estimates of transmissivity were made from specific-capacity data stored in the USGS National Water Information System (NWIS) ground-water site inventory (GWSI) database. Additional aquifer test and specific-capacity data were obtained from OEHS files maintained for public ground-water supplies.

This report also provides estimates of ground-water recharge, which are needed for development of analytical and numerical ground-water flow models. Recharge estimates were made by analysis of stream-flow data using the USGS software package RORA (Rutledge, 1998). The software RORA uses the recession-curve displacement method to estimate ground-water recharge rates (Rorabaugh, 1964). Hydrograph-separation methods (Sloto and Crouse, 1996) were used to estimate ground-water discharge and recharge.

Acknowledgments

The authors thank the staff of OEHS for providing data used in this report. These data enhanced the number of transmissivity estimates published in this report and helped to fill data gaps in areas of the State where USGS data were minimal.

Description of Study Area

The study area for this report is the State of West Virginia (fig. 1). It includes (1) Quaternary age alluvial aquifers primarily along the Kanawha and Ohio Rivers, (2) Cambrian and Ordovician age karst limestone and dolomite aquifers in the State's Eastern Panhandle, (3) Mississippian age sandstone, shale, and limestone aquifers including the karst limestone aquifer in the Greenbrier Formation, (4) Silurian and Devonian age limestone, shale, siltstone and sandstone aquifers in the State's eastern portion, (5) lower Pennsylvanian age fractured sandstone, limestone, coal, shale and siltstone aquifers in the southern portion of the State, and (6) upper Pennsylvanian through Permian age fractured shale, siltstone, sandstone, coal, and limestone aquifers of Pennsylvanian through Permian age in the northern portion of the State (fig. 2).

DATA SOURCES, COMPILATIONS, AND LIMITATIONS

Data referenced in this report were obtained from several sources. Once data were obtained, it was compiled into one large data set for analysis (see appendix). There are, however, limitations of the available data. To understand the quality of the data presented, it is necessary to discuss its sources, compilation, and limitations.

Data Sources

Data compiled, analyzed, and presented were obtained from three sources. First, literature was reviewed and pertinent hydrogeologic reports containing aquifer-

characteristic data were obtained. In addition to the actual aquifer-test data, additional data were compiled including the county in which the data were obtained, the aquifer (hydrogeologic unit) tested, well depth, and casing length. Much of the published data were obtained from U.S. Geological Survey or West Virginia Geological and Economic Survey reports. The second source of data was the USGS GWSI database. It contains data for wells inventoried or sampled by the USGS as part of hydrogeologic investigations. Even though the database was not established until 1977, USGS personnel in West Virginia entered available historical data from paper files into the database. The database contains well data from as far back as 1940 and continues to grow as additional USGS hydrogeologic investigations are conducted. It currently contains data for approximately 13,090 wells within West Virginia.

Third, in addition to historical published data and the GWSI database, data were available from the OEHS. OEHS maintains files for each public-supply well or well field within the State. Data for some sites, especially the larger public suppliers (primarily larger municipal water systems), includes data from aquifer tests. Aquifer-characteristic and specific-capacity data available from OEHS were included in the computer database developed in support of this project. Specific-capacity data are available from the GWSI database and OEHS for 677 wells from which 636 estimates of transmissivity were made.

In addition to estimates of transmissivity, ground-water recharge rates were estimated from historical streamflow data using hydrograph-analysis techniques. Streamflow data (daily discharge data) from 41 stream-gaging stations (fig. 3) throughout West Virginia were analyzed using computer software (Rutledge, 1998) to determine recharge rates for selected areas. The software uses the recession-curve displacement method (Rorabaugh, 1964). Data used in these analyses were obtained from the USGS Automated Data Processing Software (ADAPS) database.

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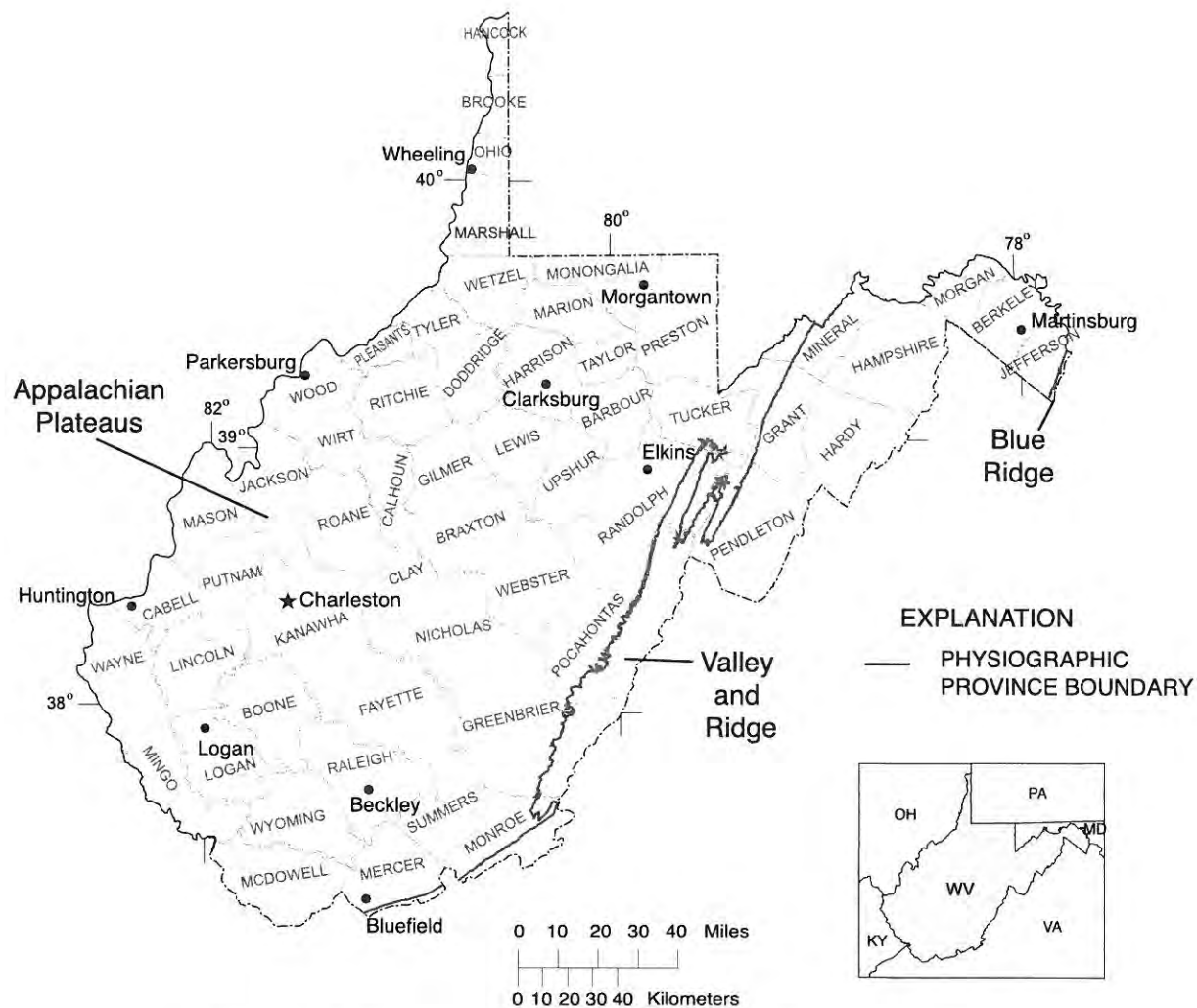
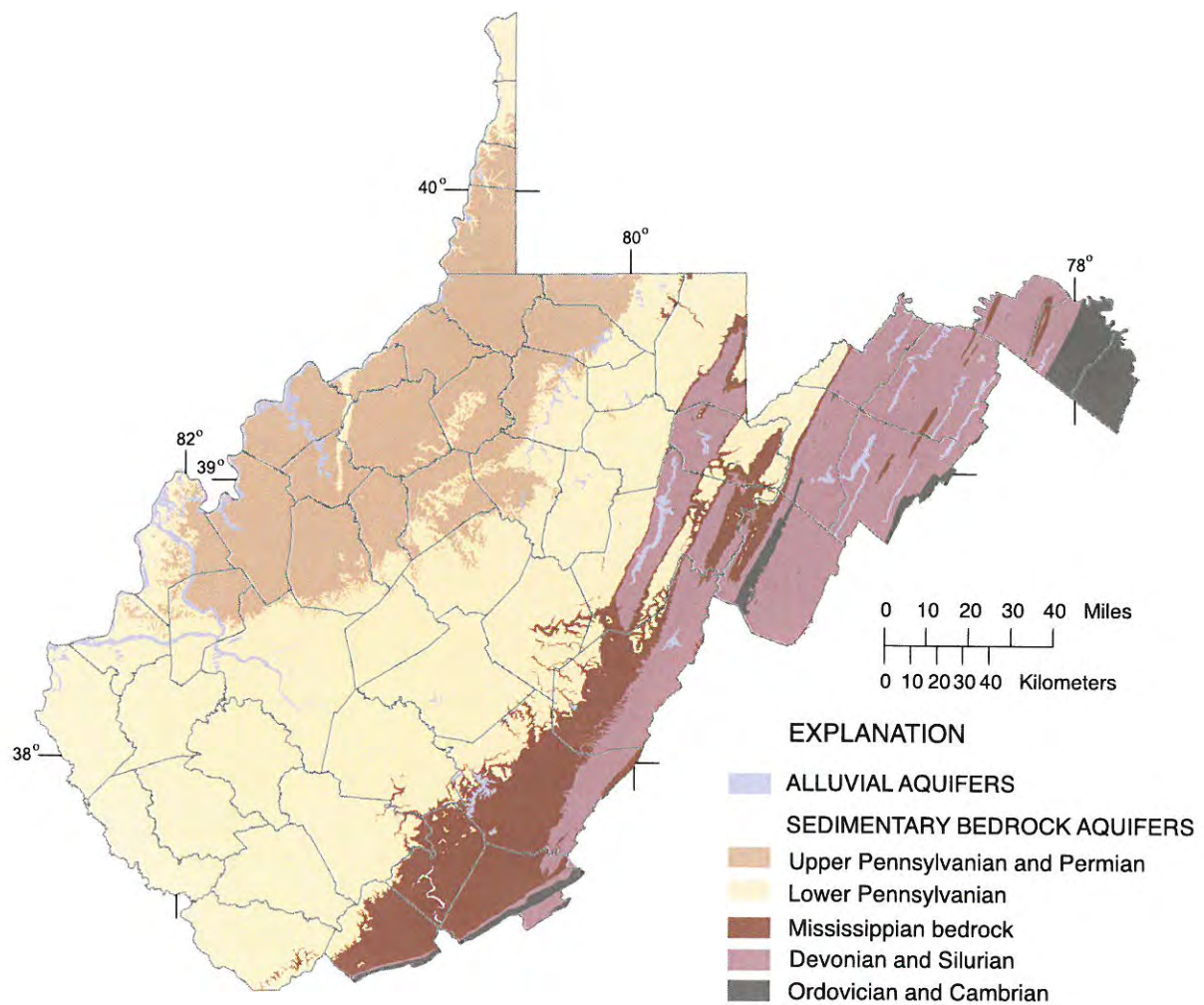


Figure 1. Physiographic provinces, counties, and selected towns in West Virginia.

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Modified from digital geology data from the West Virginia Department of Environmental Protection, 1998

Figure 2. Major hydrogeologic units in West Virginia.

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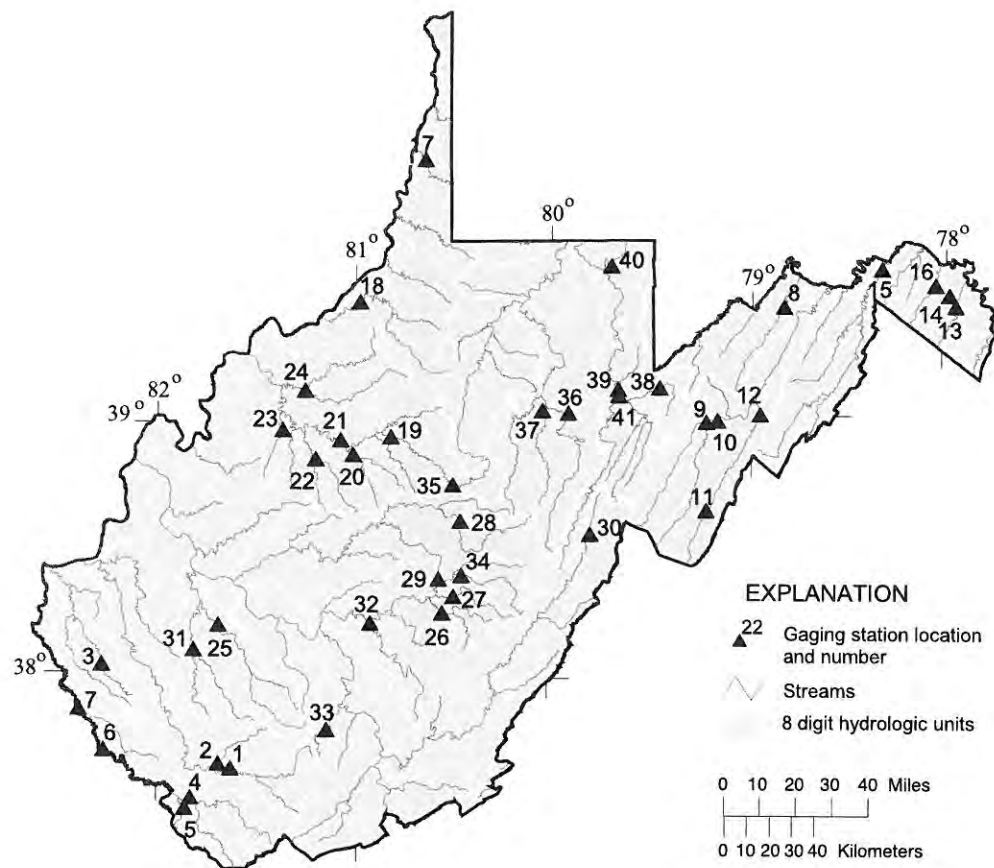


Figure 3. Location of gaging stations and basins for which ground-water recharge was estimated using the streamflow recession-curve displacement method.

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Data Compilations

At the onset of this study it was recognized that there were limitations on published information in the State related to aquifer characteristics such as transmissivity (T), hydraulic conductivity (K), saturated thickness (b), storage coefficient (S), and specific yield (S_y). The cost and time for performing hundreds of aquifer tests to obtain sufficient information to characterize hydraulic properties of aquifers throughout the State would have been prohibitive. Because of limited available data and funding and time constraints, specific-capacity data were used as a foundation for initial estimates of transmissivity. Ground-water scientists commonly use transmissivity estimates based on specific-capacity tests as the basis for quantitative ground-water investigations, especially in areas where aquifer test data are limited (Lohman, 1972).

Specific capacity is simply the discharge of the well divided by the drawdown produced in the well as it is pumped and may be expressed as $C_s = Q/s$, where C_s is the specific capacity in gal/min/ft; Q is the discharge of a pumping well in gal/min, and s is the drawdown in feet produced in the pumping well over a period of time (Freeze and Cherry, 1979). Given certain additional data such as the approximate radius of a well (r), an estimate of the storage coefficient (S), and (or) specific yield (S_y) and the total length of time the well was pumped (t); it is possible to estimate transmissivity (T).

Transmissivity is a primary data element needed for input into analytical or mathematical ground-water flow models. It is defined as "the rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of an aquifer under a unit hydraulic gradient" (Bates and Jackson, 1984). Transmissivity is commonly expressed in units of feet squared per day (cubic feet per day per foot of aquifer or ft^2/d) but is also sometimes seen expressed in the older unit of gallons per day per foot (gpd/ft) or in metric units. The equation for estimating transmissivity from specific capacity (Bentall and others, 1963) data may be written as:

$$T' = Q/s(K - 264 \log_{10} 5S + 264 \log_{10} t)$$

where

Q/s = specific capacity of the well (gpm/ft), S = the storage coefficient or the specific yield of the well,

T' = initial estimate of transmissivity (gpd/ft) adjusted for specific capacity,

K = a constant which varies with well diameter (r), and

t = the total time (in days) of the test over which drawdown was determined.

A 6-inch diameter well ($r=0.5$ ft) has a K of 1,684, a 24-inch well has a K of 1,367, and a 50-foot diameter well has a K of only 469. As alluvial wells typically have a much larger diameter than bedrock wells, two separate equations were used for estimating transmissivity from specific capacity data. Two equations were needed because the storage coefficient and (or) specific yield of the two aquifer types differ so much that one equation could not be applied to both settings. Equation 1 is used for small diameter open borehole wells in fractured bedrock aquifers and equation 2 is applied to data for wells tapping unconsolidated alluvial water table aquifers.

For a 6-inch diameter open-borehole well tapping consolidated bedrock, the equation for estimating transmissivity developed by C.V. Theis (Bentall and others, 1963) may be written as:

$$T' = C(K - 264 \log_{10} 5S + 264 \log_{10} t) \quad (1)$$

where

$C = Q/s$ = specific capacity of the well

This equation was applied to all bedrock wells listed in appendix I. K values used in equation 1 were adjusted for well diameter according to:

K=1,791 for 4-in. well, K=1,737 for 5-in. well, K=1,684 for 6-in. well, K=1,631 for 8-in. well, K=1,577 for 10-in. well, K=1,524 for 12-in. well, and K=1,305 for 30-in. well.

Wells with unknown diameters were assumed to have a diameter of six inches because most wells in fractured rock listed in the GWSI database are domestic home-owner wells, which are typically six inches in diameter.

For 1-foot diameter wells that tap water-table aquifers consisting of unconsolidated sediments (such as are common along the Ohio and Kanawha Rivers), the equation developed for estimating transmissivity from specific capacity may be written as;

$$T' = C(1 + \text{or} - 0.3)(1,300 - 264 \log_{10} 5S + 264 \log_{10} t). \quad (2)$$

The factor (1 ± 0.3) may be adjusted upward for wells having a small diameter, for wells that are poorly developed, and for wells with poorly perforated casing. It may be adjusted downward for larger, better developed wells. A factor of 1.0 was applied to transmissivity estimates made for alluvial wells with diameters less than or equal to 24 inches. A factor of 0.85 was applied to alluvial wells with diameters greater than 24 inches. This approach seems reasonable because most estimates of transmissivity were made for alluvial wells with diameters of 8 to 24 inches and only a few wells had diameters larger than 24 inches.

Both equations were derived from the same general equations but with differing assumptions of basic aquifer properties. Transmissivity cannot be determined explicitly from the two equations described. For values of T' , transmissivity must be determined graphically from a plot of known values of T' and Q/s . For a full discussion of the method used to estimate transmissivity refer to USGS Water-Supply Paper 1536-1 (Bentall and others, 1963). All available specific capacity data and estimates of transmissivity referenced within this report are included in appendix 1.

Finally, for 83 wells there were insufficient data to estimate transmissivity with the methods previously discussed. For those sites where the period of the specific capacity test was unknown and where confined aquifer conditions were expected, transmissivity was estimated using equation 3 (Driscoll, 1986):

$$T = Q/s \times 2,000 \quad (3)$$

Estimates of transmissivity were made using this simplified approach for three wells in alluvium on minor tributary streams and for 87 wells in bedrock. The resulting transmissivity expressed in gpd/ft was then corrected to obtain transmissivity in ft²/d. Transmissivity estimates made using this simplified approach compared favorably with estimates made using the method developed by Theis discussed earlier. This estimation method was not applied to data for wells in alluvium along the Ohio and Kanawha Rivers for two primary reasons. First, estimates made using this simplified approach for Kanawha and Ohio River alluvial wells did not compare favorably with the estimates made using the more quantitative Theis approach. Second, the method is applicable only to confined aquifer settings and the Ohio and Kanawha River alluvial aquifers are typically unconfined to semi-confined. Transmissivities determined for 90

sites using this approach are identified as estimated in appendix 1.

Data Limitations

Published information related to transmissivity, hydraulic conductivity, saturated thickness, storage coefficient and (or) specific yield is limited. The best way to obtain such aquifer-characteristic data is to conduct a series of well-designed long-term aquifer tests. The cost and time for performing such tests prohibit ground-water scientists from obtaining sufficient aquifer-characteristic data. The specific-capacity data from which estimates of transmissivity were made, however, were abundant. Specific-capacity data were available for all geographic areas and aquifers within the State. Transmissivity estimates based on specific-capacity data are intended to be used as a starting point for first approximation ground-water flow models or analytical analyses of wells or well fields. Long-term aquifer tests should be conducted to determine aquifer characteristics for use in mathematical or analytical models if at all possible.

The major assumption made before transmissivity estimates were developed was related to storage coefficient and (or) specific yield. Errors in transmissivity are possible if inappropriate values of storage coefficient are used in the estimation process. Median storage coefficients (0.20, 0.003, and 0.007, respectively) for alluvial aquifers along the Ohio and Kanawha Rivers and for fractured bedrock aquifers were obtained from previously published reports (table 1) and were used in estimating transmissivity.

To understand the margin of error associated with estimating transmissivity, an example for fractured bedrock aquifers, which had the largest range in storage coefficient, is presented. For a 6-inch well with a specific capacity of 0.10 pumped over a 24-hour period, transmissivity was estimated to be 207 gpd/ft, assuming a storage coefficient of 0.007. If storage coefficients of 0.070 or 0.0007 are used, transmissivity estimates of 180 and 233 gpd/ft are obtained. Thus a 12 or 13 percent error in estimated transmissivity is possible based on an order of magnitude error in storage coefficient and (or) specific yield applied to a particular aquifer. This error is small in comparison to the order of magnitude variability in transmissivity that is possible in aquifers.

Table 1. Storage-coefficient and (or) specific-yield data for hydrogeologic units in West Virginia and published reports from which data were obtained

[N/D, no data; Fm., Formation]

Hydrogeologic Unit (Aquifer)	Geologic Age	Storage Coefficient	Method	Reference
Fractured Bedrock Aquifers				
Pottsville Group	Pennsylvanian System	0.007	Aquifer test	Ward and Wilmoth, 1968
Pocono Group	Mississippian System	0.00015	Aquifer test	Ward and Wilmoth, 1968
Pocono Group	Mississippian System	0.0001	Aquifer test	Ward and Wilmoth, 1968
Hampshire Formation	Devonian System	0.015	Channel method	Hobba, 1985
Hampshire Formation	Devonian System	0.015	Channel method	Hobba, 1985
Tonoloway Formation	Silurian System	0.3	Channel method	Hobba, 1985
Rockdale Run Formation	Ordovician System	0.14	Aquifer test	Trainer and Watkins, 1975
Stonehenge Formation	Ordovician System	0.018	Aquifer test	Trainer and Watkins, 1975
Wills Creek Formation	Silurian System	0.008	Aquifer test	Trainer and Watkins, 1975
Wills Creek Formation	Silurian System	0.01	Aquifer test	Trainer and Watkins, 1975
Helderberg Group and Tonoloway Formation	Devonian and Silurian System	0.004	Aquifer test	Trainer and Watkins, 1975
Pocono Group	Mississippian System	0.0042	Aquifer test	Trainer and Watkins, 1975
Pocono Group	Mississippian System	0.0006	Aquifer test	Trainer and Watkins, 1975
Pocono Group	Mississippian System	0.0001	Aquifer test	Schwietering, J.F., 1981
Pocono Group	Mississippian System	0.00015	Aquifer test	Schwietering, J.F., 1981
Pottsville Group	Pennsylvanian System	0.0004	Aquifer test	Wilmoth, 1966
Beekmantown and St. Paul Groups, and Elbrook, Connococheague, and Chambersburg Formations	Cambrian and Ordovician Systems	0.044	Specific yield	Shultz and others, 1995
Beekmantown and St. Paul Groups, and Elbrook, Connococheague, and Chambersburg Formations	Cambrian and Ordovician Systems	0.049	Specific yield	Shultz and others, 1995
Helderberg Group and Tonoloway Fm.	Devonian and Silurian System	0.002-0.004	N/D	Hobba and others, 1972
Tonoloway and Wills Creek Fms.	Silurian System	0.001-0.008	N/D	Hobba and others, 1972

Table 1. Storage-coefficient and (or) specific-yield data for hydrogeologic units in West Virginia and published reports from which data were obtained —Continued

[N/D, no data; Fm., Formation]

Hydrogeologic Unit (Aquifer)	Geologic Age	Storage Coefficient	Method	Reference
Helderburg Group, Tonoloway, Wills Creek, and Williamsport Formations	Devonian and Silurian System	0.001-0.043	N/D	Schwietering, J.F., 1981
Beekmantown Group	Ordovician System	0.0014-0.145	N/D	Hobba and others, 1972
Catoctin Formation	Cambrian or Precambrian System	0.002-0.004	N/D	Hobba and others, 1972
Pocono Group	Pennsylvanian System	0.0006-0.0042	Aquifer test	Schwietering, J.F., 1981
Conemaugh Group	Pennsylvanian System	0.0001-0.031	Aquifer test	Schwietering, J.F., 1981
		0.007	Median for fractured bedrock aquifers	
Alluvial Aquifers				
Alluvium (Ohio River)	Quaternary System	0.29	Aquifer test	Wilmoth, 1966
Alluvium (Ohio River)	Quaternary System	0.2	Aquifer test	Wilmoth, 1966
Alluvium (Ohio River)	Quaternary System	0.16	Aquifer test	Wilmoth, 1966
Alluvium (Ohio River)	Quaternary System	0.22	Aquifer test	Wilmoth, 1966
Alluvium (Ohio River)	Quaternary System	0.19	Aquifer test	Wilmoth, 1966
Alluvium (Ohio River)	Quaternary System	0.2	Aquifer test	Wilmoth, 1966
Alluvium (Ohio River)	Quaternary System	0.21	Aquifer test	Wilmoth, 1966
Alluvium (Ohio River)	Quaternary System	0.15	Aquifer test	W.Va. Bureau for Public Health
Alluvium (Ohio River)	Quaternary System	0.29	Aquifer test	W.Va. Bureau for Public Health
Alluvium (Ohio River)	Quaternary System	0.42	Aquifer test	W.Va. Bureau for Public Health
		0.20	Median for Ohio River Alluvium	
Alluvium (Kanawha River)	Quaternary System	0.004	Aquifer test	Wilmoth, 1966
Alluvium (Kanawha River)	Quaternary System	0.002	Aquifer test	Wilmoth, 1966
		0.003	Median for Kanawha River Alluvium	

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Another assumption used when analyzing aquifer-test data is that the aquifer tested is homogenous and isotropic. Most fractured bedrock aquifers are not homogenous or isotropic at a local scale, but are commonly assumed to be so on a regional scale. For a given well, these assumptions are typically not valid, but for the entire recharge area to a public-supply well field, the assumptions are more realistic. A wide range of transmissivity is possible in a fractured bedrock aquifer; therefore, users of the data are cautioned to not assume that median values referenced in this report are characteristic of an aquifer that they may be evaluating.

AQUIFER CHARACTERISTICS ESTIMATED FROM WELL DATA

All of the specific capacity and transmissivity data referenced within this report (table 2) were determined from well-drawdown data except for storage coefficient and (or) specific yield, which was obtained from published reports (table 1). Estimates of transmissivity presented in appendix 1 were determined from specific-capacity data.

Specific Capacity

Specific capacity of wells in West Virginia is highly variable and is affected by many factors. In bedrock aquifers, the major factor affecting specific capacity is the number, extent, and aperture of fractures encountered by a well bore. The more fractures (joints, faults, and bedding-plane separations) encountered by a well, the higher the specific capacity will be, because bedrock aquifers within West Virginia have little primary porosity. Alluvial aquifers comprise unconsolidated sediments such as sand, silt, clay, gravel, and boulders. The major factor affecting the specific capacity of a well is the proportion of coarse-grained sediments to fine-grained sediments. Alluvial sediments with a high proportion of gravel and sand will generally have a higher specific capacity than sediments with a larger proportion of fine-grained sediments, such as silts and clay.

Alluvial aquifers in West Virginia are primarily in areas bordering the Ohio and Kanawha Rivers. Alluvial sediments also border a few smaller streams throughout the State. The relatively high proportion of sand and gravel glacial outwash in Ohio River sediments produces a highly permeable and productive aquifer (Carlston and Graeff, 1955). Specific capacity of wells completed in Ohio River alluvial aquifers ranges from 4 to 381 gallons per minute per foot of drawdown (gpm/ft) with a median of 31.8 gpm/ft (table 2). These high specific capacities are reflective of highly productive aquifers. Alluvial aquifers along the Kanawha River are comprised of finer grain sediments (sand, silt, and clay) than are alluvial aquifers along the Ohio River. The finer grain sand and silts of Kanawha River alluvial aquifers have much lower specific capacities ranging from 3.64 to 132 gpm/ft with a median of 11.8 gpm/ft (table 2). Consequently, Kanawha River alluvial aquifers are not used as frequently as the Ohio River alluvial aquifers as a source of water for public, industrial, or domestic supply. Finally, alluvial sediments along smaller streams such as the New River, the Little Kanawha River, the West Fork River, the Tygart River, and the ancestral Teays River Valley also can be sources of potable water. The composition of alluvial sediments along these streams is similar hydrologically to Kanawha River alluvial sediments but contains an even higher proportion of silt and clay, so they are rarely used as a source of water supply. Specific capacity of these minor alluvial aquifers ranges from 0.40 to 10.5 gpm/ft with a median of 3.43 gpm/ft (table 2).

Other than alluvial aquifers bordering the Ohio River, ground-water withdrawals in the remainder of the State are primarily from fractured-bedrock aquifers. These sedimentary bedrock aquifers can generally be classified as carbonate (consisting of limestone and dolomite) or as clastic sedimentary rocks (consisting of sandstone, siltstone, shale or coal). In the southern part of the State, wells are commonly drilled into voids left as a result of abandoned underground coal mines. Wells drilled into underground mine voids within the Pocahontas and New River Formations have the highest specific capacities of all aquifers analyzed for the State, commonly exceeding 1,000 gpm/ft (appendix 1 and table 2).

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Table 2. Statistical summary of specific capacity and transmissivity data for hydrogeologic units in West Virginia[gpm/ft, gallons per minute per foot; ft²/d, feet squared per day]

Hydrogeologic Unit (Aquifer)	Specific Capacity (gpm/ft)				Transmissivity (ft ² /d)			
	median value	minimum value	maximum value	number of sites	median value	minimum value	maximum value	number of sites
Ohio River Alluvium	31.8	4.00	381	168	4,800	540	59,000	128
Kanawha River Alluvium	11.8	3.64	132	8	1,600	670	31,000	7
Other Alluvium	3.43	0.40	10.5	4	920	110	2,800	4
Dunkard Group	0.50	0.01	130	31	130	3.0	33,000	31
Monongahela Group	0.57	0.01	10.0	18	150	3.0	27,000	18
Conemaugh Group	0.75	0.01	100	55	170	3.0	24,000	55
Allegheny Formation	3.12	0.02	138	18	850	6.0	41,000	18
Kanawha Formation	2.00	0.01	113	74	520	3.0	31,000	74
New River Formation	1.33	0.09	2,780	18	330	19	750,000	18
Pocahontas Formation	4.95	1.00	1,000	4	1,200	210	270,000	4
Pottsville Group	5.09	0.06	44.1	24	1,300	16	12,000	24
Bluestone and Princeton Formations	2.15	0.13	26.7	11	480	27	6,600	11
Hinton Formation	1.40	0.08	7.50	13	310	19	1,300	13

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Table 2. Statistical summary of specific capacity and transmissivity data for hydrogeologic units in West Virginia —Continued[gpm/ft, gallons per minute per foot; ft²/d, feet squared per day]

Hydrogeologic Unit (Aquifer)	Specific Capacity (gpm/ft)				Transmissivity (ft ² /d)			
	median value	minimum value	maximum value	number of sites	median value	minimum value	maximum value	number of sites
Mauch Chunk Group	5.00	0.38	30.8	15	1,300	83	7,200	15
Greenbrier Group	2.05	0.03	50.0	13	470	8.0	13,000	13
Maccrady Formation and Pocono Group	0.83	0.17	8.67	7	210	33	2,300	7
Hampshire Formation	0.31	0.01	12.5	22	74	3.0	2,900	22
Chemung Group	1.35	0.12	30.7	22	270	32	8,300	22
Brallier and Harell Formations	0.28	0.01	1.60	7	72	3.0	390	7
Upper to middle Devonian units	0.76	0.19	4.29	15	180	44	760	15
Mahantango Formation	0.38	0.01	3.75	10	92	3.0	840	10
Marcellus and Needmore Formations	0.86	0.07	7.00	15	170	16	1,300	15
Onesquethaw Group and Oriskany Sandstone	0.35	0.10	8.00	8	82	19	1,500	8
Helderburg Group, Tonoloway, Wills Creek and Williamsport Formations	0.82	0.07	600	13	200	17	160,000	13

Table 2. Statistical summary of specific capacity and transmissivity data for hydrogeologic units in West Virginia —Continued[gpm/ft, gallons per minute per foot; ft²/d, feet squared per day]

Hydrogeologic Unit (Aquifer)	Specific Capacity (gpm/ft)				Transmissivity (ft ² /d)			
	median value	minimum value	maximum value	number of sites	median value	minimum value	maximum value	number of sites
Clinton Group, Mckenzie and Tuscarora Formations	0.11	0.02	6.50	3	23	6.0	1,100	3
Martinsburg Formation	1.00	0.11	10.0	15	240	23	2,400	15
Trenton, Black River, St. Paul or Beekmantown Groups	2.36	0.01	68.0	32	590	2.0	18,000	32
Conococheague Formation	0.38	0.04	74.3	16	92	9.0	20,000	16
Elbrook Formation	0.46	0.05	34.3	9	100	13	9,200	9
Waynesboro, Tomstown, and Harpers-Weverton-Loudon Formations	0.25	0.02	3.20	9	67	5.0	740	9

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Karst limestone and (or) dolomite aquifers are important sources of water supply in the Greenbrier Valley in Monroe, Greenbrier, and Pocahontas Counties and the Cambrian and Ordovician age karst aquifers are important sources of water supplying Jefferson, Berkeley, and Morgan Counties in West Virginia's Eastern Panhandle. Additionally, several less important (small in areal extent) karst aquifers occur in areas of the Valley and Ridge Province in eastern West Virginia. Most karst aquifers in West Virginia (except for the Greenbrier limestone) have been classified primarily as diffuse-flow karst aquifers rather than as conduit-dominated systems (Jones, 1997), and are generally not as productive as the alluvial aquifers or even many of the clastic sedimentary rocks. Even though very large springs may flow from limestone aquifers, (McColloch, 1986), specific capacities of wells drilled in limestone and dolomite are typically low. The median specific capacities of wells completed in the Greenbrier and Beekmantown Groups are 2.05 and 2.36 gpm/ft, respectively. Median specific capacity for karst limestone/dolomite aquifers of the Helderburg Group and the Tonoloway, Wills Creek, Conococheague, Elbrook, Waynesboro, Tomstown and Harpers-Weverton-Loudon Formations, ranged from a minimum of 0.25 to a maximum of 0.82 gpm/ft.

Other than alluvial sediments along the State's major rivers, the highest median specific capacities (3.12 to 5.09 gpm/ft respectively) are from wells completed in the Pottsville and Mauch Chunk Groups and the Pocahontas and Allegheny Formations (table 2). These units are adjacent to one another and form a band of sandstone, shale and coal dominated by bedrock that outcrops in a southwest to northwest trending band across central West Virginia. Wells drilled in younger age bedrock of the Conemaugh, Monongahela, and Dunkard Groups generally have much lower median specific capacities of 0.50 to 0.75 gpm/ft, respectively. Other than the Chemung Group and the Martinsburg Formation, which have median specific capacities of 1.35 and 1.00 gpm/ft respectively, shale dominated bedrock of Cambrian through Devonian age (table 3), including the McKenzie, Tuscarora, Marcellus, Needmore, Mahantango, Brallier, Harrel, and Hampshire Formations, all have specific capacities less than 1.0 gpm/ft.

Estimates of Transmissivity

The estimates of transmissivity presented were derived mostly from specific-capacity data (appendix 1), although data from a few aquifer tests are included in the data set. The estimates based on specific capacities compare favorably to transmissivity computed by analysis of multi-well aquifer tests. Because transmissivity estimates (table 2) were based on specific-capacity data, trends in transmissivity are similar to those discussed previously for specific capacity. Also, because of the wide range in estimates and a few extreme outliers on the higher end of the range, mean transmissivity for specific geologic units is significantly higher than median values; therefore, within this discussion only references to median values will be made. Aquifers are identified with respect to lithology and geologic system in table 3.

The greatest median transmissivity for a specific geologic unit (table 2) was for the Ohio River alluvium (4,800 ft²/d), and the second highest median transmissivity was for Kanawha River Alluvium (1,600 ft²/d). As noted earlier, the Ohio River Alluvium is the most productive aquifer within the State. The high transmissivity of Ohio River alluvial sediments results from the high proportion of coarse grained gravel and sand within it. The Kanawha River, however, with its higher proportion of sand and silt, is much less transmissive.

Among bedrock aquifers, median transmissivities (table 2) are highest within the Pennsylvanian-age Pocahontas Formation and Pottsville Group and the Mississippian-age Mauch Chunk Group (1,200, 1,300, and 1,300 ft²/d, respectively). These rocks crop out primarily in the southern portion of the State and to a lesser extent within the Valley and Ridge Physiographic Province in West Virginia's Eastern Panhandle. The Pocahontas Formation is characterized by interbedded sequences of sandstone, shale, siltstone, and coal. The Pottsville Group includes the Pocahontas, New River, and Kanawha Formations and is also comprised primarily of sandstone with interbedded shale, siltstone, and coal (Cardwell and others, 1968). The Mauch Chunk Group comprises primarily red, green, and gray shale and sandstone with a few thin limestone units.

Median transmissivities are lowest within Cambrian through Ordovician age strata, which outcrop only in the State's eastern portion. The McKenzie Group, Clinton Formation, and Tuscarora Formation (table 2) have a median transmissivity of only 23 ft²/d.

Cambrian age rocks within the Waynesboro, Tomstown, and Harpers-Weverton-Loudon Formations also have a low median transmissivity of only 67 ft²/d (table 2). Other units with low transmissivities include the Hampshire Formation, Brallier and Harrell Formations, Mahantango Formations, Onesquethaw Group and Oriskany Sandstone, and the Conococheague Formation with median transmissivities of 74, 72, 92, 82, and 92 ft²/d, respectively. All other bedrock aquifers within the State had intermediate values of transmissivity.

Several interesting trends were noticed when examining the specific-capacity and transmissivity data. First, the highest transmissivity estimates docu-

mented (see appendix) were determined for the New River (750,000 ft²/d) and Pocahontas Formations (270,000 ft²/d). These extremely high transmissivities do not represent natural conditions and are characteristic of wells completed in abandoned underground coal mines. Such wells tap aquifers with extreme porosities created by the many interconnected passages in old mines, which are commonly used as sources of water in southern West Virginia. This effect should be considered when developing ground-water flow models for areas within the southern part of the State. Careful examination of old mine maps are useful for determining the location of abandoned mine workings.

Table 3. Hydrogeologic units in West Virginia for which estimates of transmissivity were made including the geologic system and lithology of respective formations or groups

Geologic system	Hydrogeologic Unit (Aquifer)	Dominant lithology
Quaternary	Alluvium	Gravel, sand, silt, and clay
Permian	Dunkard Group	Sandstone,
Pennsylvanian	Monongahela Group	siltstone, shale,
	Conemaugh Group	limestone,
	Allegheny Formation	and coal
	Kanawha Formation	Sandstone,
	New River Formation	siltstone,
Mississippian	Pocahontas Formation	shale and coal
	Pottsville Group	Sandstone and shale
	Mauch Chunk Group	Shale and sandstone
	Hinton Formation	Shale, sandstone, and limestone
	Bluefield, Bluestone, and Princeton Formations	Shale, sandstone, and limestone
	Greenbrier Group	Limestone, shale, and sandstone
Devonian	Maccrady Formation and Pocono Group	Sandstone and shale
	Hampshire Formation	Shales with sandstone
	Chemung Group	Siltstone, sandstone, and shale
	Brallier-Harrell Formations	Shale, siltstone, and sandstone
	Marcellus and Needmore Formations	Shale
	Mahantango Formation	Shale
	Helderburg Group, Tonoloway, Wills Creek, and Williamsport Formations	Limestone, sandstone, and shale
Silurian	Upper and middle Devonian strata	Shale, sandstone, and siltstone
	Oriskany Formation	Sandstone
	Clinton Group, McKenzie and Tuscarora Formations	Shale and sandstone
Ordovician	Juniata and Oswego Formations	Sandstone and shale
	Martinsburg Formation	Shale, limestone, and sandstone
	Trenton, Black River, and St. Paul Groups	
	Beekmantown Group	Limestone and dolomite
Cambrian	Ordovician middle calcareous units	
	Conococheague Formation	
	Elbrook Formation	Limestone, shale, and dolomite
	Antietam, Tomstown, Harpers, Weverton, Loudon, and Waynesboro Formations	Sandstone, shale, quartzite, and dolomite
Pre-Cambrian	Catoctin Formation and other Pre-Cambrian strata	Greenstones or other metamorphic rocks

In addition to underground coal mines, karst aquifers can have extremely high transmissivities if a well drilled in such a terrain intersects a cavernous area. The Helderburg Group-Tonoloway-Wills Creek aquifer, for example, has a maximum transmissivity of 160,000 ft²/d (table 2). Other karst aquifers for which cavernous zones may be present include the Greenbrier Group, Beekmantown Group, Conococheague Formation, Elbrook Formation, Waynesboro Formation, and the Tomstown Dolomite, all in the eastern part of the state. As with underground coal mines, when developing models in aquifers with potential karst topography, the modeler must determine whether ground-water flow in the area to be modeled is characteristic of diffuse or conduit flow. Site-specific aquifer tests and mapping of karst features are useful for determining whether an area to be modeled is underlain by a diffuse or conduit ground-water flow system.

Saturated Thickness of Aquifers

The saturated thickness of an aquifer must be measured or estimated in order to calculate the transmissivity of an aquifer. The saturated thickness of an unconfined aquifer bounded by an impermeable barrier below can be determined from well-log data (to define the bottom depth) and water-level measurements. For example, a surficial, 50-foot thick unconfined aquifer in which the water level is 10 feet below land surface would have a saturated thickness of 40 feet. For fractured bedrock aquifers, determining the saturated thickness is much more difficult, because the bottom of the aquifer may not be well defined. In such aquifers, the fractures that yield water to a well generally pinch out or become narrower (and perhaps disconnected) with depth, and the bottom of the aquifer is defined by the level, or depth, at which ground-water flow becomes negligible.

Saturated thickness and depth to water in alluvial sediments can vary widely. Twelve wells completed in alluvial sediments along the Ohio River between Hancock and Cabell Counties in West Virginia (Carlston and Graeff, 1955) have a median depth of 85 ft, median depth to water of 35 ft, and thus, a median saturated thickness of 50 ft. There is, however, considerable variability from site to site, and site-specific data should be used in model simulations whenever possible. These estimates are similar to those reported for Ohio River alluvial sediments in a ground-water investigation of Mason and Putnam

Counties (Wilmoth, 1966), which reported average well depth of 85 ft, average depth to water of 43 ft, and average saturated thickness of 42 ft.

In Wilmoth's investigation, the average depth of Kanawha River alluvial sediments was estimated to be about 58 ft, average depth to water was 18 ft, and average saturated thickness was approximately 40 ft. A ground-water investigation of Kanawha County (Doll and others, 1960) reported average depths of about 50 ft, average depth to water of 20-24 ft, and average saturated aquifer thickness of 34 ft. As with Ohio River alluvial sediments, there is wide variability between saturated aquifer thickness and depth to water from site to site within Kanawha River alluvial sediments.

For wells completed in fractured bedrock, determination of saturated aquifer thickness is difficult. Only general conceptions of relative thickness are available from published reports. In Berkeley County, well yields generally decrease with increasing well depth (Shultz and others, 1995). Higher well yields are encountered in the upper 150 ft of bedrock and become less as well depth increases. Generally for wells 300 ft and deeper, yields are barely adequate for domestic use (Shultz and others, 1995). For these deeper wells, water is most likely being derived from shallower zones, and the wells were drilled deeper only to intersect additional water-bearing fractures or to provide storage within the casing between periods of pumping. The 300-foot depth of water-yielding fractures was characteristic of both carbonate and non-carbonate rocks within the County but is applicable only to areas in the State's eastern most section, generally in either Jefferson and Berkeley Counties.

In an investigation of ground-water flow processes in sequences of sandstone, shale, siltstone, and coal in southwestern Virginia, bedrock was found to be permeable (transmissivity greater than 0.001 ft²/d) to depths of approximately 100 ft on the basis hydraulic testing of discrete bedrock intervals (Harlow and LeCain, 1993). Coal seams, however, were found to be permeable to depths of approximately 200 ft. Most of these wells were on hilltops and hillsides, and few were located in valley settings.

Circulation depth was analyzed on the basis of the increase in temperature as water flows deeper within an aquifer and is heated by natural thermal gradients within the Earth. For 25 sites analyzed within the Kanawha River Basin in West Virginia, median depths of circulation for wells in hilltop, hillside, and

valley settings were estimated to be 133, 200, and 317 ft, respectively (Kozar, 1998). The 25 sites analyzed are all within the Appalachian Plateaus Physiographic Province. These estimates should not be applied to sites located in the Valley and Ridge Physiographic Province in West Virginia's Eastern Panhandle.

The maximum saturated aquifer thickness, therefore, for most fractured-bedrock aquifers in valley settings in the Appalachian Plateaus Physiographic Province is most likely about 300 ft minus the average depth to water in the area of interest. For fractured-bedrock aquifers in hillside and hilltop areas, saturated thickness is probably 130 to 200 ft, minus the average depth to water in the area of interest. Further hydraulic testing and logging of wells in various aquifers and topographic settings is needed to confirm these simplified estimates.

For wells in the Valley and Ridge, ground-water flow processes are much more complicated than in the Appalachian Plateaus. Not only can ground water flow within the shallow fracture systems near the surface, as is common in the Appalachian Plateaus, but also can flow to great depths along thrust faults or bedding-plane separations. Within the Valley and Ridge, 60 to 98 percent of warm spring discharges are believed to come from depths as great as 1,800 ft (Lessing and others, 1991). These estimates were based on the isotopic signature of water samples collected from warm springs in the region. Side looking airborne radar (SLAR) imagery was used to determine the structural geologic setting in which the springs were located. Thrust faults and other major fractures were found to be major avenues of ground-water flow for the deeply circulating warm springs (Lessing and others, 1991). An investigation of the hydrology and geochemistry of thermal springs in the Valley and Ridge portion of the Appalachians determined that ground-water circulation for thermal springs may be as deep as one mile. There is little data to describe depths of circulation for shallow aquifer systems in the region. Because of the potential for both shallow and deep circulation of ground water within the region, no simple rule can be used to estimate saturated aquifer thickness within the Valley and Ridge. Each site must be evaluated with respect to isotopic signature and (or) dissolved-gas data to determine the depth of ground-water circulation.

Hydraulic Conductivity

Hydraulic conductivity (K), typically expressed in units of feet per day (ft/d), is the transmissivity (T) of an aquifer divided by the saturated thickness of the aquifer (b) and may be expressed by the equation $K = T/b$. Because of the lack and limitations of available data on the saturated thickness of aquifers within the State, and the wide variability of transmissivity within aquifers, Statewide estimates of hydraulic conductivity can not be made from currently available data. Hydraulic conductivity for initial model development may be obtained by dividing the transmissivity data presented in the appendix by the generalized descriptions of saturated thickness presented above, but should be used only for initial estimates where no site-specific data are available.

An alternative approach is to estimate saturated thickness (b) by subtracting the depth to water from the total well depth (p). Because most wells are drilled to a depth at which no significant additional water is encountered during drilling, in most instances, subtracting the depth to water from the well depth will give a rough approximation (p) of saturated thickness. Hydraulic conductivity can then be estimated using the equation $K = T/p$, where depth to water is subtracted from total well depth and substituted in lieu of saturated aquifer thickness (b). For low-yielding wells, however, wells are commonly drilled deeper than the lowest encountered water-bearing zone to provide a storage pocket from which the pump may pull water during periods of peak demand. For low-yielding wells, subtracting the water level from the well depth will most likely yield highly inaccurate estimates of hydraulic conductivity.

Storage Coefficient and Specific Yield

Storage coefficients for confined aquifers generally range from 0.001 to 0.00001, and specific yields for unconfined aquifers generally range from 0.1 to 0.3 and average 0.2 (Lohman, 1972). The median specific yield for alluvial aquifers along the Ohio and Kanawha Rivers, and for fractured-bedrock aquifers are 0.200, 0.003, and 0.007, respectively (table 1). Each of the two alluvial aquifer settings, as well as the fractured-bedrock aquifers, have distinct ranges of storage coefficient and (or) specific yield. The 0.20 average specific yield for wells completed in Ohio River alluvial sediments is characteristic of uncon-

finer aquifers, even though overlying silt and clay units confine the coarser glacial outwash sand and gravel deposits in most localities (Carlston and Graeff, 1955). Aquifers in these settings are unconfined because water levels within the aquifer commonly (except during flood conditions) are well below the base of silt and clay confining units (if present).

For wells completed in Kanawha River alluvial deposits and alluvial aquifers bordering smaller streams, storage coefficients are much less. For two wells completed in Kanawha River alluvial sediments, storage coefficients were 0.002 and 0.004 (average of 0.003). These numbers are at the uppermost region of what is commonly considered a confined aquifer setting. Wells completed in alluvial sediments bordering some of the smaller streams throughout the State most likely have specific yields similar to that of the Kanawha River, but few if any data are available for these minor and relatively unused aquifers.

Storage coefficients of fractured-bedrock aquifers within the State are highly variable, as would be expected, and range from 0.0001 to 0.3, with a median of 0.007 (table 1). Examination of available storage-coefficient data indicates that most fractured-bedrock aquifers within West Virginia may be considered confined to semi-confined. Only two of 25 storage coefficient estimates available for fractured bedrock aquifers are characteristic of unconfined aquifers. Analysis of specific yields for the Tonoloway Formation (0.3) and the Rockdale Run Formation (0.14), indicate both are unconfined aquifers. These two formations are composed of limestone and (or) dolomite. Conduit or solution enlargement of the limestone and dolomite in these formations likely allows rapid infiltration into the karst aquifer, thus yielding a storage coefficient characteristic of unconfined aquifers. Although not indicated by the limited data available in table 1, it is likely that aquifers in similar karst settings may also exhibit unconfined conditions. Diffuse-flow karst aquifers are common in eastern West Virginia, especially in Jefferson and Berkeley Counties, and conduit flow systems occur in karst areas where the Greenbrier limestone crops out, especially in Greenbrier, Monroe, and Pocahontas Counties.

RECHARGE

Once precipitation falls in an aquifer's recharge area, a part of that precipitation runs off into streams, while the remainder percolates into the soil (Winter and others,

1998). Some of the water that runs off is lost to evaporation on and near the land surface, while the part that percolates into the soil is used (transpired) by plants. The remainder infiltrates the soil and continues downward where it recharges ground-water reservoirs (aquifers). It is this portion that is commonly referred to as recharge (Winter and others, 1998). Ground water also may be lost to evaporation and transpiration by plants near discharge areas bordering streams (riparian ET). The remainder of ground water then typically discharges to streams as base flow or recharges deeper aquifers. Base flow discharge of ground water is roughly equivalent to recharge only if there is little riparian ET and recharge or discharge to and from deeper aquifers is negligible. Within this report, recharge refers to the component that actually recharges ground water and is not assumed to be equivalent to base flow discharge.

Recharge data are crucial for developing realistic simulations of ground-water flow. Analysis of streamflow data can provide information on ground-water discharge to streams. From streamflow data, estimates of aquifer recharge can also be made. Streamflow data from 41 gaging stations on unregulated streams (fig. 3 and table 4) throughout West Virginia were analyzed using computer software (Rutledge, 1998) to determine mean recharge rates for selected areas. Estimates were made using the recession-curve displacement method (Rorabaugh, 1964). Data used in these analyses were obtained from the USGS Automated Data Processing Software (ADAPS) database. Data for the entire period of record at each of the gaging stations were used in the analyses, except for certain streams for which shorter periods of record were analyzed to avoid data collected after flood-retention structures were installed in the early 1970's. It is imperative to analyze data for unregulated streams because the storage of water in flood-retention structures radically alters the runoff characteristics of a stream and results in erroneous estimates of recharge.

Estimates of recharge based on records for individual gaging stations are summarized by the major river basin in which they occur (table 4). This approach is considered logical because the stations within each river basin share similar geologic, topographic, and climatological settings. Precipitation, average basin slope, bedrock lithology, bedrock permeability, and topography are a few of the major

Table 4. Mean ground-water recharge rates estimated from streamflow data obtained from 41 gaging stations in West Virginia

[in./yr, inches per year; mi², square miles; Map ID number, map identification number as listed in figure 3]

Station Name	Map ID Number	County	Drainage area (mi ²)	Recharge (in./yr)
Potomac River Basin				
Back Creek near Jones Springs, WV	16	Berkeley	235.	8.5
South Fork South Branch Potomac River at Brandywine, WV	11	Pendleton	103.	9.0
North Fork South Branch Potomac River at Cabins, WV	9	Grant	335.	11.0
Cacapon River near Great Cacapon, WV	15	Morgan	675.	8.7
South Fork South Branch Potomac River near Moorefield, WV	12	Hardy	277.	7.3
Opequon Creek near Martinsburg, WV	13	Berkeley	273.	9.8
South Branch Potomac River near Petersburg, WV	10	Grant	676.	11.6
Tuscarora Creek above Martinsburg, WV	14	Berkeley	11.3	11.4
Patterson Creek near Headsville, WV	8	Mineral	211.	7.3
Mean				9.4
Little Kanawha River Basin and Ohio River Tributaries				
Hughes River at Cisco, WV	24	Ritchie	453.	7.1
Wheeling Creek at Elm Grove, WV	17	Ohio	281.	9.6
Little Kanawha River at Glenville, WV	19	Gilmer	387.	9.3
Little Kanawha River at Grantsville, WV	21	Calhoun	913.	8.8
Middle Island Creek at Little, WV	18	Tyler	458.	8.0
Reedy Creek near Reedy, WV	23	Wirt	79.4	6.7
West Fork Little Kanawha River at Rocksedale, WV	22	Calhoun	205.	8.7
Steer Creek near Grantsville, WV	20	Calhoun	162.	9.2
Mean				8.4
Monongahela River Basin				
Big Sandy Creek at Rockville, WV	40	Preston	200.	21.2
Blackwater River at Davis, WV	38	Tucker	85.9	22.5
Cheat River near Parsons, WV	39	Tucker	722.	19.9
Middle Fork River at Audra, WV	37	Barbour	148.	24.5
Shavers Fork at Parsons, WV	41	Tucker	213.	24.8
Tygart Valley River at Belington, WV	36	Barbour	406.	15.4
Mean				21.4

Table 4. Mean ground-water recharge rates estimated from streamflow data obtained from 41 gaging stations in West Virginia —Continued

[in./yr, inches per year; mi², square miles; Map ID number, map identification number as listed in figure 3]

Station Name	Map ID Number	County	Drainage area (mi ²)	Recharge (in./yr)
Kanawha River Basin (Western Portion)				
Big Coal River at Ashford, WV	25	Boone	391.	11.9
Little Coal River at Danville, WV	31	Boone	269.	11.9
Piney Creek at Raleigh, WV	33	Raleigh	52.7	11.9
Mean				11.9
Kanawha River Basin (Eastern Portion)				
Cherry River at Fenwick, WV	26	Nicholas	150.	27.8
Cranberry River near Richwood, WV	27	Nicholas	80.4	31.6
Elk River Below Webster Springs, WV	28	Webster	266.	23.9
Gauley River at Camden on Gauley, WV	29	Webster	236.	25.2
Greenbrier River at Durbin, WV	30	Pocahontas	133.	21.1
Meadow River near Mount Lookout, WV	32	Nicholas	365.	20.6
Little Kanawha River near Wildcat, WV ¹	35	Braxton	112.	19.8
Williams River at Dyer, WV	34	Webster	128.	26.4
Mean				24.6
Tug, Twelvepole Creek and Guyandotte River Basins				
Guyandotte River at Baileysville, WV	1	Wyoming	306.	14.5
Clear Fork at Clear Fork, WV	2	Wyoming	126.	14.8
East Fork Twelvepole Creek near Dunlow, WV	3	Wayne	38.5	12.4
Tug Fork at Litwar, WV	4	McDowell	504.	11.3
Panther Creek near Panther, WV	5	McDowell	31.0	11.1
Tug Fork at Williamson, WV	6	Mingo	936.	12.5
Tug Fork at Kermit, WV	7	Mingo	1,280.	11.2
Mean				12.6

¹ Although the Little Kanawha River near Wildcat is located in the Little Kanawha River Basin, it has precipitation and recharge rates characteristic of the eastern portion of the Kanawha River Basin.

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factors that affect ground-water recharge. The highest mean ground-water recharge rates within West Virginia occur within a band that extends through the central part of the State within the eastern portion of the Kanawha River Basin (fig. 3). This area of relatively high relief has peaks higher than 4,000 ft and precipitation greater than 50 in./yr. (NOAA, 1982). Mean ground-water recharge within this region is 24.6 in./yr (table 4). This band extends northward towards Pennsylvania and includes the Monongahela River Basin with a mean recharge rate of 21.4 in./yr.

To the west of this central band of high relief topography lies a region of lower relief with much lower average precipitation, approximately 40 inches annually (NOAA, 1982). This area has much lower ground-water recharge rates. Mean recharge for the Tug Fork, Twelvemile Creek, and Guyandotte River Basins is only 12.6 inches. For the western portion of the Kanawha River Basin mean recharge is 11.9 inches. The lowest mean recharge rates in the State occur within the Little Kanawha River Basin and the smaller tributary streams in the region that discharge directly to the Ohio River. Mean recharge for the Little Kanawha River Basin and the Ohio River tributary streams is only 8.4 inches.

The State's third major ground-water region is located in the Valley and Ridge. This area, which lies east of the band of higher altitude topography, is characterized by long linear northeast to southwest trending alternating ridges and valleys. A high altitude rain shadow caused by orographic lifting along the western edge of this area results in lower precipitation within the region, with approximately 30 inches of annual precipitation, except for the extreme eastern tip of the State where annual precipitation averages approximately 40 inches (NOAA, 1982). Mean ground-water recharge rates for the region, which is drained almost entirely by the Potomac River and its tributaries, is 9.4 in./yr (table 4). Precipitation is a major factor affecting ground-water recharge, but bedrock permeability and topographic effects must also be considered when using this data for development of site-specific ground-water flow models.

FUTURE DATA NEEDS

To compile a database that would provide information necessary to delineate source-water protection areas for public-supply wells and well fields throughout West Virginia, future data needs should include addi-

tional data on storage coefficients and (or) specific yield and saturated thicknesses of aquifers. Storage-coefficient and (or) specific-yield data are essential for verifying transmissivity estimates based on specific capacity. Although limited data available for storage coefficient and (or) specific yield are consistent for each of the major aquifer types (alluvial and fractured bedrock), additional data are needed to confirm and further refine understanding of which aquifers within the State are confined and which are unconfined. The only way to obtain such data is by conducting long-term aquifer tests, especially in fractured-bedrock aquifers and alluvial aquifers bordering the Kanawha River and some of the smaller streams. Additional transmissivity estimates are needed for lower Pennsylvanian- and Mississippian-age rocks in southern West Virginia and Ordovician- to Devonian-age rocks in the eastern portion of the State. These transmissivity estimates may be obtained from single-well aquifer tests.

A deficiency exists with respect to data on saturated thickness of aquifers, especially for fractured bedrock aquifers. Aquifer tests and (or) well logging will be necessary to determine the fracture distribution within fractured-bedrock aquifers. Documenting the depth, orientation, and aperture width of significant water-bearing fractures in wells in various bedrock units would also be useful. Logging of wells in various units, especially using acoustic televiwers, is needed to document fracture distribution, depth, and orientation. Heat-pulse flow-meter logs could help to provide similar data on the depth of significant water-bearing fractures. Hydraulic testing could be conducted on discrete intervals in wells to determine the depth and water-producing capacity of significant water-bearing fractures.

SUMMARY AND CONCLUSIONS

Specific-capacity data were obtained from the U.S. Geological Survey National Water Information System database and from files of the West Virginia Bureau for Public Health - Office of Environmental Health Services. The data were used to estimate transmissivity for aquifers located throughout West Virginia. In addition, literature was reviewed to obtain previously published estimates of storage coefficient and (or) specific yield for aquifers within the State. The storage-coefficient and (or) specific-yield data are needed to make estimates of transmissivity from specific-capacity data.

The highest median transmissivity of a specific aquifer in West Virginia (table 2) occurs in Ohio River alluvium ($4,800 \text{ ft}^2/\text{d}$), and the second highest median transmissivity occurs in Kanawha River alluvium ($1,600 \text{ ft}^2/\text{d}$). The lowest median transmissivities occur within older Cambrian through Ordovician age strata which outcrop only within the State's eastern portion. The McKenzie-Tuscarora-Clinton aquifers had a median transmissivity of only $23 \text{ ft}^2/\text{d}$. Cambrian age rocks within the Waynesboro-Tomstown-Harpers-Weverton-Loudon aquifer also had a low median transmissivity of only $67 \text{ ft}^2/\text{d}$ (table 2). Other units with low transmissivities include the Hampshire Formation, Brallier-Harrell Formations, Mahantango Formations, Onesquethaw Group-Oriskany Sandstone, and the Conococheague Formation with median transmissivities of 74, 72, 92, 82, and $92 \text{ ft}^2/\text{d}$ respectively. All other bedrock aquifers had intermediate values of transmissivity.

For bedrock aquifers, the highest median transmissivities of 1,200, 1,300, and $1,300 \text{ ft}^2/\text{d}$ occur within the Pennsylvanian age Pocahontas Formation and Pottsville Group and the Mississippian age Mauch Chunk Group, respectively. These rocks outcrop primarily in the southern coal fields and to a lesser extent within the Valley and Ridge in West Virginia's Eastern Panhandle.

The highest individual transmissivity estimates were determined for the New River ($750,000 \text{ ft}^2/\text{d}$) and Pocahontas Formations ($270,000 \text{ ft}^2/\text{d}$). These transmissivities are extremely high, and are not likely a result of natural processes but are more easily explained as indicative of wells completed in abandoned underground coal mines. Such wells tap aquifers with very high porosities because of the large number of interconnected passages in old mine workings and are commonly used as sources of water in southern West Virginia.

In addition to underground coal mines, karst aquifers can also have extremely high transmissivities if a well completed in such a terrane intersects a large cavernous area, as is evident for the Helderburg Group-Tonoloway-Wills Creek-Williamsport Formations, which has a maximum transmissivity of $160,000 \text{ ft}^2/\text{d}$ (table 2). Other karst aquifers include the Greenbrier Group, Beekmantown Group, Conococheague Formation, Elbrook Formation, Waynesboro Formation, and the Tomstown Dolomite. All of these aquifers are in eastern West Virginia.

An aquifer's saturated aquifer thickness and depth to water can vary widely. Data for twelve wells completed in alluvial sediments along the Ohio River between Hancock and Cabell Counties in West Virginia (Carlston and Graeff, 1955) have a median saturated aquifer thickness of 50 ft. These estimates are similar to those reported for Ohio River alluvial sediments in Mason and Putnam Counties (Wilmoth, 1966), which reported an average saturated thickness of 42 ft. In Wilmoth's investigation, the average saturated thickness of Kanawha River alluvial sediments was estimated to be approximately 40 ft. A groundwater investigation of Kanawha County (Doll and others, 1960) reported average saturated aquifer thickness of 34 ft. There is wide variability of saturated aquifer thickness from site to site within Kanawha River alluvial sediments.

For most fractured-bedrock aquifers in valley settings in the Appalachian Plateaus, the maximum saturated thickness is believed to be approximately 300 ft minus the average depth to water in the area of interest. For fractured-bedrock aquifers in hillside and hilltop areas, saturated thickness is probably 130 to 200 ft minus the average depth to water in the area of interest. Further hydraulic testing and logging of wells in various aquifers and topographic settings are needed to confirm these simplified estimates for wells completed in fractured bedrock. There is no good rule that can be used to estimate saturated thickness for fractured-bedrock aquifers within the Valley and Ridge.

Analysis of available specific-yield data indicates that the Ohio River alluvial aquifer is characteristic of an unconfined aquifer, with a median specific yield of 0.20. The Kanawha River alluvial aquifer has a much lower specific yield (median of 0.003) and is considered a semi-confined aquifer because of its higher composition of fluvial silts and clays. The Ohio River alluvial deposits have coarser grained sand and gravel deposits. Storage coefficients for fractured-bedrock aquifers vary significantly from a minimum of 0.0001 to a maximum of 0.3 with a median of 0.007. Excluding the Stonehenge limestone, Tonoloway Formation, Beekmantown Group, and Rockdale Run Formation, which can exhibit karst characteristics, the maximum storage coefficient for fractured bedrock aquifers was only 0.015. Generally, for fractured-bedrock aquifers, storage-coefficient data are characteristic of confined aquifer settings.

Estimates of recharge were summarized according to the major river basin in which the stream basin occurs (table 4). The highest mean ground-water recharge rates within West Virginia (24.6 inches) occur within a band that extends through the central portion of the State within the eastern portion of the Kanawha River Basin. This area is at relatively high altitude (peaks in excess of 4,000 ft altitude) and has above average precipitation (in excess of 50 in./yr). This band extends northward towards Pennsylvania and includes the Monongahela River Basin, which has a mean recharge of 21.4 in./yr.

To the west of this central band of high altitude topography lies a region of lower relief with much lower average annual precipitation (approximately 40 in./yr). Consequently, this area also has much lower ground-water recharge rates. Mean recharge for the Tug Fork, Twelvemile Creek, and Guyandotte River Basins is only 12.6 in./yr. For the western portion of the Kanawha River basin mean recharge is 11.9 inches. The lowest mean recharge rates within the State (8.4 in./yr) occur within the Little Kanawha River Basin and the smaller tributary streams in the region that discharge directly to the Ohio River.

To the east of the band of higher altitude, in West Virginia's Eastern Panhandle, is an area characterized by long, northeast to southwest trending ridges and valleys. The area is located within a rain shadow resulting from orographic lifting in the higher altitude area to the west. This results in lower precipitation within the region (approximately 30 in./yr). Mean ground-water recharge rates for the region, which is drained almost entirely by the Potomac River and its tributaries, is 9.4 in./yr (table 4).

REFERENCES CITED

- Bates, R.L., and Jackson, J.A., 1984, Dictionary of Geological terms: prepared in cooperation with the American Geological Institute by Anchor Press-Doubleday, New York, NY, p. 534.
- Bentall, R., Brown, R.H., Ferris, J.G., Jacob, C.E., Knowles, D.B., Meyer, R.R., Skibitzke, H.E., and Theis, C.V., 1963, Methods of determining permeability, transmissibility, and drawdown: U.S. Geological Survey Water-Supply Paper 1536-I, p. 331-338.
- Cardwell, D.H., Erwin, R.B., and Woodward, H.P., 1968, Geologic Map of West Virginia: West Virginia Geological and Economic Survey map, 2 sheets, scale 1:250,000.
- Carlston, C.W., and Graeff, G.D., Jr., 1955, Ground-water resources of the Ohio River Valley in West Virginia: West Virginia Geological and Economic Survey v. XXIII, part III, 131 p.
- Doll, W.L., Wilmoth, B.M., and Whetstone, G.W., 1960, Water resources of Kanawha County, West Virginia: West Virginia Geological and Economic Survey Bulletin 20, 189 p.
- Driscoll, F.G., 1986, Groundwater and Wells: Johnson Division, St. Paul, MN, p. 572.
- Freeze, R.A., and Cherry, J.A., 1979, Groundwater: Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 604 p.
- Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G., MODFLOW 2000, the U.S. Geological Survey modular ground-water model—User guide to modularization concepts and the ground-water flow process: U.S. Geological Survey Open-File Report 00-92, 121 p.
- Harlow, G.E., and LeCain, G.D., 1993, Hydrologic characteristics of, and ground-water flow in, coal bearing rocks of southwestern Virginia: U.S. Geological Survey Water-Supply Paper 2388, 36 p.
- Hobba, W.A., Jr., Friel, E.A., and Chisholm, J.L., 1972, Water resources of the Potomac River basin, West Virginia: West Virginia Geological and Economic Survey River Basin Bulletin no. 3, 110 p.
- Hobba, W.A., Jr., 1985, Water in Hardy, Hampshire, and western Morgan Counties, West Virginia: West Virginia Geological and Economic Survey Environmental Geology EGB-19, 91 p.
- Jones, W.K., 1997, Karst Hydrology Atlas of West Virginia: Karst Water Institute Special Publication 4, 111 p.
- Kozar, 1998, Ground-water age data applied to understanding fractured bedrock aquifers in West Virginia: in proceedings of West Virginia nonpoint source conference, Charleston, W.Va., October 1-3, 1998, p. 13.
- Lessing, P., Hobba, W.A., Jr., Dean, S.L., and Kulander, B.R., 1991, Relations between warm springs and geology delineated by side-looking airborne-radar imagery in eastern West Virginia: United States Geological Survey Water Resources Investigation Report 88-4096, 44 p.
- Lohman, S.W., 1972, Ground-Water Hydraulics: U.S. Geological Survey Professional Paper 708, 70 p.
- McColloch, J.S., 1986, Springs of West Virginia: West Virginia Geological and Economic Survey Volume V-6A, 493 p.
- NOAA, 1982, Climate of West Virginia: U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, climatography of the United States, no. 60, 19 p.
- Robison, T.M., 1964 Occurrence and availability of ground water in Ohio County, West Virginia: West Virginia Geological and Economic Survey Bulletin 27, 57 p.
- Rorabaugh, M.I., 1964, Estimating changes in bank storage and ground-water contribution to streamflow: Interna-

- tional Association of Scientific Hydrology, Publication 63, p. 352-363.
- Rutledge, A.T., 1998, Computer programs for describing the recession of ground-water discharge and for estimating mean ground-water recharge and discharge from streamflow records-update: U.S. Geological Survey Water-Resources Investigation Report 98-4148, 43 p.
- Schwietering, J.F., 1981, Brief description of ground water conditions and aquifers in West Virginia with annotated bibliography: West Virginia Geological and Economic Survey Open File Report OF-8102, 121 p.
- Sheets, C.J., and Kozar, M.D., 2000, Ground-water quality in the Appalachian Plateaus, Kanawha Basin, West Virginia: U.S. Geological Survey Water Resources Investigation Report 99-4269, 25 p.
- Shultz, R.A., Hobba, W.A., Jr., and Kozar, M.D., 1995, Geohydrology, ground-water availability, and ground-water quality of Berkeley County, West Virginia, with emphasis on the carbonate-rock area: U.S. Geological Survey Water Resources Investigation Report 93-4073, 88 p.
- Sloto, R.A., and Crouse, M.Y., 1996, HYSEP, a computer program for streamflow hydrograph separation and analysis: U.S. Geological Survey Water Resources Investigation Report 96-4040, 46 p.
- Trainer, F.W., and Watkins, F.A., 1975, A geohydrologic reconnaissance of the upper Potomac River Basin: U.S. Geological Survey Water-Supply Paper 2035, 68 p.
- Ward, P.E., and Wilmoth, B.M., 1968, Ground-water hydrology of the Monongahela River basin in West Virginia: West Virginia Geological and Economic Survey River Basin Bulletin 1, 54 p.
- Wilmoth, B.M., 1966, Ground water in Mason and Putnam Counties, West Virginia: West Virginia Geological and Economic Survey Bulletin 32, 152 p.
- Winter, T.C., Harvey, J.W., Franke, O.L., and Alley, W.M., 1998, Ground Water and Surface Water, a Single Resource: U.S. Geological Survey Circular 1139, 79 p.

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APPENDIX

Specific Capacity and Transmissivity Data Segregated by Aquifer for Selected Wells in West Virginia

The following abbreviations are used in this appendix:

ddmmss	degrees-minutes-seconds of latitude and longitude
in	inches
e	estimated
ft	feet
gpm	gallons per minute
ft bls	feet below land surface
gpm/ft	gallons per minute per foot of drawdown
ft ² /d	feet squared per day
Lit	from literature
N/D	not determined

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
401344080392301	401344	803923	Brooke	79	16	Alluvium (Ohio River)	700		21.8	14	25	50.0	8,400
401346080391801	401346	803918	Brooke	70	10	Alluvium (Ohio River)	200			19.67	0.33	10.2	670
401630080364601	401630	803646	Brooke	71	20	Alluvium (Ohio River)	800	55	34	21		38.1	
401634080364701	401634	803647	Brooke	67	20	Alluvium (Ohio River)	700	44	23	21	9	33.3	4,800
401635080364701	401635	803647	Brooke	67.3	20	Alluvium (Ohio River)	800			20.33	4.25	39.4	5,200
401640080364601	401640	803646	Brooke	69	20	Alluvium (Ohio River)	1250			24.42	15.75	51.2	8,300
401917080354801	401917	803548	Brooke	75	20	Alluvium (Ohio River)	750	47.8	34.8	13.0		57.7	
401939080355301	401939	803553	Brooke	74.5	30	Alluvium (Ohio River)	252	38.75	34.92	3.83	0.8	65.8	8,000
402035080363201	402035	803632	Brooke	74.5	36	Alluvium (Ohio River)	1450					30.0	
402319080374101	402319	803741	Brooke	73	36	Alluvium (Ohio River)	762			14	24	54.0	7,600
402040080364001	402040	803640	Brooke	78	36	Alluvium (Ohio River)	740			25		33.8	
402040080364004	402040	803640	Brooke	78		Alluvium (Ohio River)	710			12		59.0	

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
402040080364005	402040	803640	Brooke	78		Alluvium (Ohio River)	1240			9		138	
402040080364006	402040	803640	Brooke			Alluvium (Ohio River)	1890			14		135	
402040080364008	402040	803640	Brooke			Alluvium (Ohio River)	1685			19		89.0	
2-1-16.A	402040	803640	Brooke	80		Alluvium (Ohio River)	960			23		41.6	
2-1-17.B	402040	803640	Brooke	78.5		Alluvium (Ohio River)	1100			10		110	
2-1-18.C	402040	803640	Brooke	82.8		Alluvium (Ohio River)	200			14		14.3	
2-1-19.D	402040	803640	Brooke	77.5		Alluvium (Ohio River)	600			7		85.7	
2-1-20.E	402040	803640	Brooke	61.5		Alluvium (Ohio River)	1440			11		131	
401336080392501	401336	803925	Brooke	70		Alluvium (Ohio River)	500			32		15.6	
401913080355103	401913	803551	Brooke	75	12	Alluvium (Ohio River)	508	48.25	34.5	13.8	24	37.0	5,600
401933080355501	401933	803555	Brooke	75		Alluvium (Ohio River)	700	53	46	7		100	
402040080364000	402040	803640	Brooke	77		Alluvium (Ohio River)	720	64	46	18		40.0	
402040080364003	402040	803640	Brooke	78		Alluvium (Ohio River)	1150	43	33	10		115	

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Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
Beech Bottom #1	N/D	N/D	Brooke	71	12	Alluvium (Ohio River)	145			10.92	0.33	13.3	1,100
Follansbee #4	N/D	N/D	Brooke	70	20	Alluvium (Ohio River)	800			20.83	49.25	38.4	6,700
Hammond PSD #1	N/D	N/D	Brooke	60	8	Alluvium (Ohio River)	300			9	1.5	33.3	4,300
Hammond PSD #2	N/D	N/D	Brooke	60	8	Alluvium (Ohio River)	300			7	1	42.9	4,700
382521082263201	382521	822632	Cabell	60	12	Alluvium (Ohio River)	300			6.5	24	46.2	7,800
383233082172101	383313	821707	Cabell	90	10	Alluvium (Ohio River)	100	38	35	3	10	33.3	4,800
382445082271201	382445	822712	Cabell	120	8	Alluvium (Ohio River)	300	15	13	1.5	24	200	36,000
382533082255901	382533	822559	Cabell	63	8	Alluvium (Ohio River)	125	53	43	10	6	12.5	1,500
382508082255601	382508	822556	Cabell	80	10	Alluvium (Ohio River)	100	80	60	20	0.25	5.0	670
403444080394501	403444	803945	Hancock	111		Alluvium (Ohio River)	620	81.2	58.2	23.2	24	26.7	4,300
403716080362901	403717	803627	Hancock	76	24	Alluvium (Ohio River)	1140			3.00		381	
403716080363001	403718	803627	Hancock	76	24	Alluvium (Ohio River)	1280			6.5		196	
403718080362301	403720	803619	Hancock	76	24	Alluvium (Ohio River)	1410			4		285	

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
402959080363401	402959	803634	Hancock	117	10	Alluvium (Ohio River)	305			10.6	2	28.8	3,300
403714080361901	403714	803619	Hancock	82		Alluvium (Ohio River)	550	42	32	10	24	55.0	9,200
403714080361902	403714	803619	Hancock	82		Alluvium (Ohio River)	550	42	32	10	24	55.0	9,200
385703081453801	385703	814538	Jackson	93	12	Alluvium (Ohio River)	225	74	59	15	8	15.0	2,000
385705081454001	385704	814540	Jackson	93	8	Alluvium (Ohio River)	250	52	32	20	12	12.5	1,600
385309081512201	385309	815122	Jackson	89	84	Alluvium (Ohio River)	50	53	46	7	0.5	7.14	540
Ravens. Alum F-9	N/D	N/D	Jackson	78	12	Alluvium (Ohio River)	1012			12.7	8	79.7	13,000
394421080503801	394421	805038	Marshall	69	10	Alluvium (Ohio River)	283	57.25	43	14.3	8	19.9	2,500
4-I-1 Old McMechen	395857	804400	Marshall	75	8	Alluvium (Ohio River)	300			17	0.5	17.6	1,400
394935080504901	394935	805049	Marshall	68	20	Alluvium (Ohio River)	650			19	24	34.2	5,500
394443080510501	394443	805105	Marshall	85	20	Alluvium (Ohio River)	850	69	53	16.3	12	52.1	8,000
394446080511301	394446	805113	Marshall	79.5	8	Alluvium (Ohio River)	400	58	43	15	12	26.7	3,700
394450080511701	394450	805117	Marshall	81	20	Alluvium (Ohio River)	700	73	51	22		31.8	

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
394459080511501	394459	805115	Marshall	98.6	10	Alluvium (Ohio River)	250	72	66	6	24	41.7	6,700
395058080444201	395459	804442	Marshall	100	8	Alluvium (Ohio River)	200	90	60	30	22	6.67	960
395434080482001	395428	804824	Marshall	60.5	156	Alluvium (Ohio River)	3000	56	46	10		300	
395502080444201	395502	804442	Marshall	100	8	Alluvium (Ohio River)	300	90	60	30		10.0	
395503080425501	395503	804255	Marshall	67	156	Alluvium (Ohio River)	530				31		53,000 Lit
Salvoy A	N/D	N/D	Marshall			Alluvium (Ohio River)	450				72		40,000 Lit
Salvoy B	N/D	N/D	Marshall			Alluvium (Ohio River)	500				72		33,000 Lit
Salvoy C	N/D	N/D	Marshall			Alluvium (Ohio River)	520				72		31,000 Lit
Salvoy D	N/D	N/D	Marshall			Alluvium (Ohio River)	210				72		27,000 Lit
395537080451501	395537	804515	Marshall	68		Alluvium (Ohio River)	750	46	29	16.5	168	45.5	8,800
395540080451701	395540	804517	Marshall	68		Alluvium (Ohio River)	750	39	30	9	168	83.3	17,000
395601080452801	N/D	N/D	Marshall	75	24	Alluvium (Ohio River)	450			21.5	24	20.9	3,200
Marshall Co. PSD	N/D	N/D	Marshall	70	10	Alluvium (Ohio River)	500			12.58	1.17	39.7	4,400

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
Benwood #1	N/D	N/D	Marshall	70	14	Alluvium (Ohio River)	500			26.75	24	18.7	2,700
Benwood #2	N/D	N/D	Marshall	72	14	Alluvium (Ohio River)	500			27.58	24	18.1	2,700
AEP Krammer	N/D	N/D	Marshall	70	12	Alluvium (Ohio River)	490			1.75	12	280	47,000
AEP Krammer	N/D	N/D	Marshall	71	12	Alluvium (Ohio River)	600			4.33	1.50	139	19,000
Glendale TH1	N/D	N/D	Marshall	75	6	Alluvium (Ohio River)	213			5.1	3	41.8	5,300
Glendale TH2	N/D	N/D	Marshall	78	6	Alluvium (Ohio River)	213			5.38	3	39.6	5,100
Mt. Carbon Co.	395006	804916	Marshall	81	18	Alluvium (Ohio River)	754			5.3	8.5	142	23,000
383959082102001	383959	821016	Mason	85		Alluvium (Ohio River)	450			20		22.5	
383959082102001	384000	821016	Mason	85	13	Alluvium (Ohio River)	300	65	53	12	24	25.0	3,900
383959082102002	383958	821013	Mason	86		Alluvium (Ohio River)	325			12.7		25.6	
383959082102002	383958	821013	Mason	86	13	Alluvium (Ohio River)	325	65	52	13	24	25.0	3,900
383959082102003	383958	821016	Mason	86		Alluvium (Ohio River)	330			15.9		20.8	
383959082102003	383958	821016	Mason	86	13	Alluvium (Ohio River)	325	69	53	16	24	20.3	2,900

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
384456082112601	384456	821126	Mason	72	8	Alluvium (Ohio River)	300	37	20	17	4	17.6	2,000
384618082120801	384618	821208	Mason	83		Alluvium (Ohio River)	325	49	41	8	36	40.6	7,000
384618082121201	384618	821212	Mason	83		Alluvium (Ohio River)	200	47	41	6	30	33.3	5,500
384621082121001	384621	821210	Mason	83		Alluvium (Ohio River)	180	48	41	7	67	25.7	4,300
384628082121201	384628	821212	Mason	83		Alluvium (Ohio River)	217	52	41	11	74	19.7	3,300
385419082071701	385419	820717	Mason	81	20	Alluvium (Ohio River)	500	52.79	39.5	13.3	8.5	37.6	5,500
385420082072101	385420	820721	Mason	84.3	20	Alluvium (Ohio River)	500	61.88	49.25	12.6		39.6	
385421082071801	385421	820718	Mason	84	20	Alluvium (Ohio River)	500	57	42	15	8	33.3	4,800
385421082072001	385421	820720	Mason	84.5	20	Alluvium (Ohio River)	500	56.6	44	12.6	9	39.7	5,700
385421082072301	385421	820723	Mason	84.4	20	Alluvium (Ohio River)	500	61.73	49.67	12.1		41.5	
385422082072201	385422	820722	Mason	84	20	Alluvium (Ohio River)	500	59.7	44.2	15.5	8	32.3	4,700
385735082053801	385735	820538	Mason	71	156	Alluvium (Ohio River)	5500						16,000 Lit
385039082082002	385039	820820	Mason	67		Alluvium (Ohio River)	30	53	50	3	1	10.0	1,100

Received

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

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Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
385207082075301	385207	820753	Mason	94		Alluvium (Ohio River)	250	47	42	5	48	50.0	9,000
385439082065801	385439	820658	Mason	80		Alluvium (Ohio River)	110	60	45	15	48	7.33	1,100
385753081554501	385753	815545	Mason	99.1		Alluvium (Ohio River)	210			25.5	8	8.2	1,100
385802081552601	385802	815526	Mason	80	6	Alluvium (Ohio River)	240	63	53	10	16	24.0	3,500
385802081552602	385802	815526	Mason	80	10	Alluvium (Ohio River)	330	64	53	11	72	30.0	5,300
385804081552501	385804	815525	Mason	80	8	Alluvium (Ohio River)	500	61	55	5.5	48	91.0	17,000
385845081560101	385845	815601	Mason	78		Alluvium (Ohio River)	150	39.6	37	2.3	24	65.2	11,000
385846081560201	385846	815602	Mason	78		Alluvium (Ohio River)	150	41	36	5	24	30.0	4,700
Pt. Pleasant #7	385419	820715	Mason	92	18	Alluvium (Ohio River)	700	70.5	55	15.5	27	45.2	7,500
385737082053801	N/D	N/D	Mason	71	8	Alluvium (Ohio River)	280			9.5	5.5	29.5	3,700
385739082053601	N/D	N/D	Mason	71		Alluvium (Ohio River)	220			7.58	5.5	29.0	3,700
385304081554701	N/D	N/D	Mason	54	12	Alluvium (Ohio River)	125			7.25	4	17.2	1,900
385304081554501	385305	815545	Mason	57	12	Alluvium (Ohio River)	125			7.17	3.5	17.4	1,900

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e. estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
Letart #3	N/D	N/D	Mason	55	12	Alluvium (Ohio River)	225			8	11.5	28.1	4,000
384458082112601	N/D	N/D	Mason	73	8	Alluvium (Ohio River)	220			10.67	4	20.6	2,400
390048082020901	N/D	N/D	Mason	90		Alluvium (Ohio River)	192			4	0.5	48.0	4,800
390051082020801	N/D	N/D	Mason	90		Alluvium (Ohio River)	187			6.67	2	28.0	3,100
385920081581501	N/D	N/D	Mason	94	8	Alluvium (Ohio River)	150			2.33	24	64.4	11,000
385920081581901	N/D	N/D	Mason	93	8	Alluvium (Ohio River)	150			5	23	30.0	4,500
New Haven #3	N/D	N/D	Mason	81	12	Alluvium (Ohio River)	500			11.5	33.33	43.5	7,200
400234080433501	400234	804335	Ohio	84	12	Alluvium (Ohio River)	450	40	36	4	1	112	14,000
400550080431201	400550	804312	Ohio	45		Alluvium (Ohio River)	500	24	19	4.7	6.5	106	16,000
400824080423001	400824	804230	Ohio	56	12	Alluvium (Ohio River)	350	17	14	3	24	117	21,000
Wheeling #2	N/D	N/D	Ohio	84	24	Alluvium (Ohio River)	402			21.75	25.5	18.5	2,700
Wheeling #3	N/D	N/D	Ohio	87	24	Alluvium (Ohio River)	351			22.67	26	15.5	2,100
Wheeling #4	N/D	N/D	Ohio	86	24	Alluvium (Ohio River)	603			18.96	24	31.8	5,100

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
Wheeling #5	N/D	N/D	Ohio	83	24	Alluvium (Ohio River)	603			25.59	24	23.6	3,600
Wheeling #6	N/D	N/D	Ohio	90	26.75	Alluvium (Ohio River)	600			11.64	4	51.5	5,600
392022081213201	392022	812132	Pleasants	53	13	Alluvium (Ohio River)	174			13		13.0	
392022081213901	392022	812139	Pleasants	52.8	12	Alluvium (Ohio River)	300			16.5		18.2	
392023081212601	392023	812126	Pleasants	50	10	Alluvium (Ohio River)	140	35.3	24.6	10.7		13.1	
392334081121501	392334	811215	Pleasants	73.3	18	Alluvium (Ohio River)	200	49.5	46	3.5	72	57.1	11,000
392503081110901	392503	811109	Pleasants	78	12	Alluvium (Ohio River)	715	46.5	35	11.5		62.2	
392554081101301	392554	811013	Pleasants	80	30	Alluvium (Ohio River)	300	48.25	35	13.3	7.67	22.6	2,400
Cyanamid Site 1	N/D	N/D	Pleasants			Alluvium (Ohio River)							6,700 Lit
Cyanamid Site 2	N/D	N/D	Pleasants			Alluvium (Ohio River)							2,300 Lit
Cyanamid Site 3	N/D	N/D	Pleasants			Alluvium (Ohio River)							5,300 Lit
Cyanamid Site 4	N/D	N/D	Pleasants			Alluvium (Ohio River)							23,000 Lit
Cyanamid Site 5	N/D	N/D	Pleasants			Alluvium (Ohio River)							13,000 Lit

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
392315081124001	392315	811240	Pleasants	48	26	Alluvium (Ohio River)	150	48	22	26		5.77	
St. Marys #6	N/D	N/D	Pleasants	81	12	Alluvium (Ohio River)	510			9.41	24	54.2	9,100
392834081061101	392834	810611	Tyler	47.5		Alluvium (Ohio River)	2350	32	12	20		118	
393403080593401	393403	805934	Tyler	52	90	Alluvium (Ohio River)	300	52	27	25	0.5	12.0	670
Friendly test well	N/D	N/D	Tyler	60	8	Alluvium (Ohio River)	152			6.5	22	23.4	3,600
382358082331101	382358	823311	Wayne	58	12	Alluvium (Ohio River)	160			7	56	22.9	4,000
382350082321801	382350	823218	Wayne	61	12	Alluvium (Ohio River)	40	61	51	10	1	4.00	
382410082343801	382410	823438	Wayne	66		Alluvium (Ohio River)	300	52	47	5		60.0	
393622080560901	393622	805609	Wetzel	92	12	Alluvium (Ohio River)	500	57	42	15	2	33.3	4,000
393909080513601	393911	805149	Wetzel	57.5		Alluvium (Ohio River)	328	48.4	37.05	11.40		28.9	
393911080513701	393913	805149	Wetzel	59		Alluvium (Ohio River)	500	42.75	31.58	11.2		44.6	
393937080513801	393938	805150	Wetzel	74.5	20	Alluvium (Ohio River)	550	61	45	16	8	34.4	4,900
394018080513601	394018	805149	Wetzel	82	20	Alluvium (Ohio River)	700	70	54.7	16		43.8	

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
394050080514201	394050	805149	Wetzel	73.3	24	Alluvium (Ohio River)	700			10	24	70.0	12,200
394247080493401	394247	804934	Wetzel	65		Alluvium (Ohio River)	102	40	30	10	12	10.2	1,300
393835080515801	393835	805158	Wetzel	52	240	Alluvium (Ohio River)	700	48	30	18		38.9	
393900080510001	393900	805100	Wetzel	57.5		Alluvium (Ohio River)	440	31.4	30.15	1.25		352	
393912080513601	393912	805136	Wetzel	59	10	Alluvium (Ohio River)	300	44	36	8	240	37.5	7,800
394042080512601	394042	805126	Wetzel	120		Alluvium (Ohio River)	250	120	75	45		5.56	
394247080493402	394247	804934	Wetzel	60	8	Alluvium (Ohio River)	150			8.67	6	17.3	2,300
Grand. Doolin #3	N/D	N/D	Wetzel	61	8	Alluvium (Ohio River)	131			5	1	26.2	2,600
391547081402201	391548	814028	Wood	96	10	Alluvium (Ohio River)	234	84	73	11		21.3	
391548081402401	391546	814031	Wood	93		Alluvium (Ohio River)	213	80	73	7		30.4	
391548081402401	391546	814031	Wood	93	10	Alluvium (Ohio River)	325	85	70	15	24	21.7	3,300
391548081403001	391548	814030	Wood	94	10	Alluvium (Ohio River)	236	82	73	9		26.2	
391550081403401	391550	814034	Wood	86	12	Alluvium (Ohio River)	250					29.0	

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
391551081403201	391551	814032	Wood	83	12	Alluvium (Ohio River)	383	68	61	7		54.7	
391611081402901	391611	814029	Wood	96.5	192	Alluvium (Ohio River)	470			10	103	47.0	7,600
391717081333802	391717	813338	Wood	55	156	Alluvium (Ohio River)	500				9.2		13,000 Lit
391717081333603	391717	813336	Wood	49	156	Alluvium (Ohio River)	165				30		5,600 Lit
391718081333101	391718	813331	Wood	46	156	Alluvium (Ohio River)	200				46.25		35,000 Lit
391752081334201	391752	813342	Wood	80		Alluvium (Ohio River)	350				61.25		17,000 Lit
391929081325201	391929	813252	Wood	100	10	Alluvium (Ohio River)	231			11.1		20.8	
391931081325001	391929	813253	Wood	100	8	Alluvium (Ohio River)	235			16.1		14.6	
391931081325002	391930	813252	Wood	100	8	Alluvium (Ohio River)	267			16.2		16.5	
391931081325003	391930	813251	Wood	100	10	Alluvium (Ohio River)	210			3.55		59.2	
391937081325901	391937	813259	Wood	91	10	Alluvium (Ohio River)	168			5.5		30.5	
391937081330001	391937	813300	Wood	89	10	Alluvium (Ohio River)	310			12		25.8	
391947081331201	391947	813312	Wood	75	13	Alluvium (Ohio River)	500			13.4	8	374	59,000

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
391948081331101	391948	813311	Wood	76	13	Alluvium (Ohio River)	500			14.2	8	35.1	4,900
392131081240901	392058	812347	Wood	64		Alluvium (Ohio River)	300	45	32.3	12.7	24	23.6	3,500
392407081271002	392407	812710	Wood	90	8	Alluvium (Ohio River)	100			10		10.0	
392407081271003	392407	812710	Wood	90	8	Alluvium (Ohio River)	100			10		10.0	
391603081402901	391603	814029	Wood	96	12	Alluvium (Ohio River)	265	72	62	10.38	48	25.5	4,300
G.E. Plastics	391542	814043	Wood	94	12	Alluvium (Ohio River)	250	80.9	73.2	7.7	25	32.5	5,300
Vienna #13	392051	813232	Wood	73.2	12	Alluvium (Ohio River)	299	54.35	37.8	16.55	36	18.1	2,800
Vienna #14	392050	813233	Wood	73.8	12	Alluvium (Ohio River)	351	52	37.45	14.55	36	24.1	4,000
Vienna Green #1T	N/D	N/D	Wood	83.8	12	Alluvium (Ohio River)	500			20.8	24	24.0	3,700
Vienna Green #2T	N/D	N/D	Wood	84.7	12	Alluvium (Ohio River)	457			20.6	24	22.2	3,500
Lubeck #PW-A	N/D	N/D	Wood	66.5	12	Alluvium (Ohio River)	600			27.25	24	22.0	3,500
Lubeck #PW-C	N/D	N/D	Wood	62	12	Alluvium (Ohio River)	500			29.41	24	17.0	2,500
Lubeck #PW-D	N/D	N/D	Wood	67	12	Alluvium (Ohio River)	400			28.57	24	14.0	2,100

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
Union Williams 4	N/D	N/D	Wood	58	12	Alluvium (Ohio River)	500			16.42	5.5	30.5	4,300
392400081273401	392400	812734	Wood	91	12	Alluvium (Ohio River)	600			24.5	4.75	24.5	3,200
											Median	31.8	4,800
											Minimum	4.00	540
											Maximum	381	59,000
381936081354501	381936	813545	Kanawha	58		Alluvium (Kanawha River)	60	24	22	2	8	30.0	6,400
382207081404001	382207	814040	Kanawha	50		Alluvium (Kanawha River)	100	45	32	13	12	7.69	1,600
382303081352301	382303	813523	Kanawha	60	6	Alluvium (Kanawha River)	43	46	40	6	1	7.17	1,100
383150081554803	383147	815552	Putnam	56	38	Alluvium (Kanawha River)	135			8.5		15.9	
383200081554001	383200	815540	Putnam	51.5	24	Alluvium (Kanawha River)	102	42.35	41.35	1	12	102	24,000
383203081554701	383203	815547	Putnam	51.4	24	Alluvium (Kanawha River)	99	37.55	36.8	0.75	12	132	31,000
383704081584501	383704	815845	Putnam	57		Alluvium (Kanawha River)	80	44	22	22	6	3.64	670
383911081570201	383911	815702	Putnam	39		Alluvium (Kanawha River)	10	28	26	2	9	5.00	940

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
											Median	11.8	1,600
											Minimum	3.64	670
											Maximum	132	31,000
375720081041301	375720	810413	Fayette	117		Alluvium (New River)	8	47	27	20		0.40	110e
382551082015501	382551	820155	Putnam	72		Alluvium (Teays River)	11	45	27	18	258	0.61	160
382610082012001	382610	820120	Putnam	24		Alluvium (Teays River)	50	20	12	8		6.25	1,700e
390344081232801	390343	812325	Wirt	55		Alluvium (Little Kanawha River)	105	46	36	10		10.5	2,800e
											Median	3.43	920
											Minimum	0.40	110
											Maximum	10.5	2,800
391731080335801	391731	803358	Harrison	112	8	Dunkard Group	8	80	62	18	16	0.44	120
391734080340201	391734	803402	Harrison	110	8	Dunkard Group	15	67	42	25	1008	0.60	200
385052081391801	385052	813918	Jackson	250		Dunkard Group	6.7		100	150		0.04	11e
384813081420001	384813	814200	Jackson	135	6	Dunkard Group	65	28	27	0.5	4	130	33,000
384820081420101	384820	814201	Jackson	135	6	Dunkard Group	18	28	27	0.5	1	36.0	8,000
384832081420401	384832	814204	Jackson	140	6	Dunkard Group	20	16	15	0.5	4	40.0	9,900
395027080465101	395027	804651	Marshall	75		Dunkard Group	4			17		0.24	64e
New Vrindaban	395705	803605	Marshall	100	8	Dunkard Group	25			30	6	0.83	210

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
394010080060501	394010	800605	Monongalia	96		Dunkard Group	4	21	13	8		0.50	130e
394812080124701	394812	801247	Monongalia	63		Dunkard Group	4	60	20	40	1	0.10	23
394034080202101	394034	802021	Monongalia	68		Dunkard Group	6	29	11	18	2	0.33	79
391226081024901	391226	810249	Ritchie	118	6	Dunkard Group	300			9		33.0	8,800e
391000081024501	391000	810245	Ritchie	122	6	Dunkard Group	12	15	5	10		1.20	320e
391405081004201	391405	810042	Ritchie	60	6	Dunkard Group	7	16	13	3		2.33	630e
391624081024001	391624	810240	Ritchie	110		Dunkard Group	20			110		0.18	48e
391624081024002	391624	810240	Ritchie	182	6	Dunkard Group	40	18	6	12	18	3.33	800
391645080590401	391645	805904	Ritchie	80	8	Dunkard Group	220	20	14	6	6.5	36.7	9,000
391655081100801	391655	811008	Ritchie	57	8	Dunkard Group	110	12	0	12		9.17	2,400e
391700080580001	391700	805800	Ritchie	100	10	Dunkard Group	5	45	20	25	12	0.20	51
384604081262401	384604	812624	Roane	420		Dunkard Group	25	270	50	220		0.11	29e
384711081285101	384711	812851	Roane	56	6	Dunkard Group	5	56	10	46	1	0.11	25
384716081260601	384716	812606	Roane	193	6	Dunkard Group	25	95	40	55	0.50	0.45	98
385352081255401	385352	812554	Roane	120	6	Dunkard Group	1.5	120	20	100		0.02	5e
393750080513701	393750	805137	Wetzel	50	6	Dunkard Group	10	35	15	20		0.50	130e
394058080510301	394058	805103	Wetzel	92	8	Dunkard Group	6	92	80	12	1	0.50	110
394100080272501	394100	802725	Wetzel	96	8	Dunkard Group	35	62	50	12	24	2.92	740
390144081242701	390144	812427	Wirt	100	6	Dunkard Group	16	80	17	63		0.25	67e
390852081214801	390852	812148	Wirt	130		Dunkard Group	10	49	33	16	28	0.63	170

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
390617081355501	390617	813555	Wood	120		Dunkard Group	10			4		2.50	670e
391115081314201	391115	813142	Wood	200		Dunkard Group	2	200	40	160		0.01	3e
391729081323801	391729	813238	Wood	156		Dunkard Group	2	156	100	56		0.04	11e
Median												0.50	130
Minimum												0.01	3
Maximum												130	33,000
385215081033001	385215	810330	Calhoun	110		Monongahela Group	3	110	70	40		0.07	19e
Midway Mart	385745	803140	Lewis	280	6	Monongahela Group	1.5	280	40	240	36	0.01	3
Roanoke Elem	385517	803018	Lewis	100	6	Monongahela Group	8	100	29	71	1.5	0.11	25
393502080140301	393502	801403	Marion	77		Monongahela Group	2	20	16	4	8	0.50	130
384405081582901	384405	815833	Mason	22	30	Monongahela Group	10	19	7	12	8	0.83	170
384425081583801	384425	815838	Mason	103		Monongahela Group	20	60	40	20	8	1.00	250
384618082011001	384618	820110	Mason	50		Monongahela Group	10	40	35	5	48	2.00	580
384827081570701	384827	815707	Mason	70	6	Monongahela Group	10	57	10.5	46.5	0.15	0.22	44
393447080020501	393447	800205	Monongalia	160		Monongahela Group	7	28	8	20	680	0.35	120
393625080005201	393625	800052	Monongalia	123		Monongahela Group	20	120	80	40		0.50	130e
391314081025201	391314	810252	Ritchie	115	8	Monongahela Group	30			10		3.00	800e
391235081080001	391235	810800	Ritchie	55	6	Monongahela Group	10	13	12	1		10.0	27,000e
391337081021501	391337	810215	Ritchie	60	8	Monongahela Group	35	24	15	9		3.89	1,000e
383326081264301	383326	812643	Roane	155	6	Monongahela Group	10	130	110	20	1	0.50	110

Received

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
384707081155201	384707	811552	Roane	44		Monongahela Group	10	12	10	2		5.00	1,300e
384720081155101	384720	811551	Roane	40	7	Monongahela Group	10	13	11	2	24	5.00	1,200e
384815081215801	384815	812158	Roane	320		Monongahela Group	13	122	12	110		0.12	32e
390057081205001	390057	812050	Wirt	130		Monongahela Group	30	90	43	47		0.64	170e
											Median	0.57	150
											Minimum	0.01	3
											Maximum	10.0	27,000
14-1-12	391400	800718	Barbour	110		Conemaugh Group	5			80	3	0.06	15
383713080364101	383713	803641	Braxton	210		Conemaugh Group	2	205	126	79	4	0.03	7
383656080544101	383656	805441	Braxton	32		Conemaugh Group	10	21	9	12	1	0.83	190
384025080482201	384025	804822	Braxton	46		Conemaugh Group	8	2	1	1	1	8.00	1,500
384133080485501	384133	804855	Braxton	78		Conemaugh Group	10	18	13	5	1	2.00	460
384145081001801	384145	810018	Braxton	100		Conemaugh Group	20	27	24	3		6.67	1,800
384410080355701	384410	803557	Braxton	87		Conemaugh Group	0.3	38	32	6		0.05	13
382901082180501	382901	821805	Cabell	85	6	Conemaugh Group	10	55	35	20	1	0.50	110
383155082173601	383155	821736	Cabell	115	6	Conemaugh Group	60	105	70	35	1	1.71	390
383138081094201	383138	810942	Clay	160	6	Conemaugh Group	8	155	100	55	2	0.15	36
383407081055301	383407	810553	Clay	50	6	Conemaugh Group	16	34	24	10	1	1.60	360
383624080593701	383624	805937	Clay	60	6	Conemaugh Group	4	57	27	30		0.13	35e
383659081023201	383659	810232	Clay	100	6	Conemaugh Group	16	60	55	5	1	3.20	720

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
385103080561801	385103	805618	Gilmer	104		Conemaugh Group	50	62	44	18	3	2.78	680
403038080332401	403038	803324	Hancock	95	10	Conemaugh Group	200	41	16.5	24.5	48	8.16	2,100
Oakland PSD #5	N/D	N/D	Hancock	95	10	Conemaugh Group	200			25.92	48	7.72	2,000
391022080200701	391022	802007	Harrison	86	6	Conemaugh Group	3	0.92	0.52	0.4	0.25	7.50	1,300
391450080231201	391450	802312	Harrison	50	5	Conemaugh Group	6.7	4	1	3	12	2.23	590
382542081281001	382542	812810	Kanawha	62	6	Conemaugh Group	17	55	25	30		0.57	150e
382636081432801	382636	814328	Kanawha	73	6	Conemaugh Group	10	22.4	9.54	13	0.5	0.77	170
382845081300301	382845	813003	Kanawha	75	6	Conemaugh Group	4	64.1	33.9	30.2	0.5	0.14	31
383052081244301	383052	812443	Kanawha	75	6	Conemaugh Group	10	65	35	30		0.33	88e
383229081263701	383229	812637	Kanawha	46	6	Conemaugh Group	24	45	15	30	1	0.80	190
382332081432201	382332	814322	Kanawha	41		Conemaugh Group	5	19	16	3	72	1.67	440
382708081344701	382708	813447	Kanawha	130	6	Conemaugh Group	0.8	120	70	50	4	0.01	3
382825081300901	382825	813009	Kanawha	70	6	Conemaugh Group	10	50	20	30	1	0.33	75
382830081313301	382830	813133	Kanawha	111	6	Conemaugh Group	30	90	80	10	0.5	3.00	620
Ireland Headstart	384819	802852	Lewis	380	6	Conemaugh Group	8.9	107	65	42	36	0.21	59
392835080090001	392835	800900	Marion	170		Conemaugh Group	4	170	80	90	2	0.04	9
393525079552601	393525	795526	Monongalia	50		Conemaugh Group	2	15	11	4		0.50	130e
393147080024601	393147	800246	Monongalia	70		Conemaugh Group	3	24	16	8		0.38	100e
393750079521201	393750	795212	Monongalia	216		Conemaugh Group	5	210	180	30	1	0.17	39
393824079573601	393824	795736	Monongalia	605		Conemaugh Group	100	108	73	35		2.86	760e

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
393913079514301	393913	795143	Monongalia	60		Conemaugh Group	5	91	31	60	1	0.08	19
393946079571901	393946	795719	Monongalia	16		Conemaugh Group	3	15	11	4	60	0.75	210
400946080355701	400946	803557	Ohio	452		Conemaugh Group	7	52	49	3	9	2.33	630
393328079481801	393328	794818	Preston	124		Conemaugh Group	300	12	9	3	2	100	24,000
Hendershrouth MHP	392909	795020	Preston	305	6	Conemaugh Group	2.5	70	46	24	4	0.10	25
Hendershrouth MHP	392909	795020	Preston	305	6	Conemaugh Group	3	160	34	126	6	0.02	5
Hendershrouth MHP	392909	795020	Preston	185	6	Conemaugh Group	25	68	28	40	2	0.62	150
381858081575201	381858	815752	Putnam	53		Conemaugh Group	20	20	10	10	1	2.00	460
381900081575801	381900	815758	Putnam	24		Conemaugh Group	20	7	2	5	1	4.00	800
382350082001401	382350	820014	Putnam	100	6	Conemaugh Group	11	50.5	34.93	15.6	0.2	0.67	130
382624081501201	382624	815012	Putnam	94	6	Conemaugh Group	13	30.2	19.28	10.9	0.5	1.19	250
382702082003201	382702	820032	Putnam	70	6	Conemaugh Group	33	19.9	12.52	7.38	0.5	0.93	200
381908081583001	381908	815830	Putnam	43		Conemaugh Group	3	22	20	2	3	1.50	360
382151082011801	382151	820118	Putnam	75		Conemaugh Group	20	20	12	8	2	2.50	590
382340081545702	382340	815457	Putnam	125		Conemaugh Group	10	28	8	20	4	0.50	120
382652081580902	382652	815809	Putnam	175		Conemaugh Group	8	75	33	42	1	0.19	43
391125081161001	391125	811610	Ritchie	35	6	Conemaugh Group	10	23	20	3		3.33	900e
383302081160801	383302	811608	Roane	57	6	Conemaugh Group	24	25	15	10	1	2.40	550
383447081201701	383447	812017	Roane	83	6	Conemaugh Group	12	82	42	40	1	0.30	68
391734080011901	391734	800119	Taylor	385		Conemaugh Group	17	208	55	153	51	0.11	32

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Dis-charge (gpm)	Pro-duction level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capac-ity (gpm/ft)	Trans-miss-ivity (ft ² /d)
392053080023801	392053	800238	Taylor	23		Conemaugh Group	5	25	15	10	4	0.50	120
390457081191401	390457	811914	Wirt	50	6	Conemaugh Group	6	15	6	9	2	0.67	160
											Median	0.75	170
											Minimum	0.01	3
											Maximum	100	24,000
384043080352701	384043	803527	Braxton	30		Allegheny Formation	3	1	0	1	1	3.00	540
382303081121301	382303	811213	Clay	35	6	Allegheny Formation	16	16	12	4		4.00	1,100e
403235080343801	403235	803438	Hancock	120		Allegheny Formation	27	90	60	30	0.5	0.90	200
403244080303801	403244	803038	Hancock	235		Allegheny Formation	7	235	50	185	3	0.04	10
382210081414001	382210	814140	Kanawha	96		Allegheny Formation	69	74	40	34	4	2.03	510
382210081414501	382210	814145	Kanawha	153		Allegheny Formation	150	91	40	51	696	2.94	800
382211081454701	382211	814547	Kanawha	153		Allegheny Formation	120	70	33	37	696	3.24	900
382215081414201	382215	814142	Kanawha	155		Allegheny Formation	220	85	38	47	216	4.68	1,300
382215081414301	382215	814143	Kanawha	156		Allegheny Formation	170	85	39	46	216	3.70	990
382619081331401	382619	813314	Kanawha	300		Allegheny Formation	11	335	170	165	1	0.07	16
392359079442201	392359	794422	Preston	200	8	Allegheny Formation	150	125	100	25	30	6.00	1,400
Tunnelton New #2	N/D	N/D	Preston	200	8	Allegheny Formation	100			3.46	36	28.9	7,800
Bruceton #3	N/D	N/D	Preston	150	6	Allegheny Formation	60			3.23	36	18.6	5,100
Bruceton #4	N/D	N/D	Preston	150	8	Allegheny Formation	25			0.18	36	138	41,000
Camp Roy Weller	N/D	N/D	Preston	400	6	Allegheny Formation	5	380	81	299	48	0.02	6

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
382224081544301	382224	815443	Putnam	80		Allegheny Formation	33	49	9	40		0.82	210e
392150080090201	392150	800902	Taylor	76		Allegheny Formation	34	11	10	1		34.0	9,100e
Dean Conv. Store	385849	800512	Upshur	224	6	Allegheny Formation	20	100	86	14	36	1.43	400
											Median	3.12	850
											Minimum	0.02	6
											Maximum	138	41,000
Junior #1	385845	795701	Barbour	182	6	Kanawha Formation	90			7	24	12.9	3,300
Junior #3	385855	795641	Barbour	218	6	Kanawha Formation	78			4	24	19.5	5,100
Boone Co. 1W	N/D	N/D	Boone	175	6	Kanawha Formation	9			40	2	0.22	52
Boone Co. 2E	N/D	N/D	Boone	325	8	Kanawha Formation	9			50	2	0.18	41
375232081382701	375232	813827	Boone	146	6	Kanawha Formation	10	120	40	80	1	0.13	29
375943081304601	375943	813046	Boone	94	6	Kanawha Formation	30	57.98	55.7	2.28	0.5	2.34	510
380444081351401	380444	813514	Boone	64		Kanawha Formation	7	20.5	7.1	13.4	0.5	0.20	43
380818081502301	380818	815023	Boone	200	6	Kanawha Formation	6	36.7	18.4	18.3	0.5	0.32	70
380939081504801	380939	815048	Boone	130	6	Kanawha Formation	2	96	50.58	45.4	0.1	0.20	39
380613081483601	380613	814836	Boone	150		Kanawha Formation	20	33.5	17.5	16	17	1.25	290
Ind. Coal Co.	375908	814632	Boone	154	6	Kanawha Formation	65	128	59	69		0.94	250e
Macks MHP	380747	814816	Boone	157	6	Kanawha Formation	30		15	10	1	3.00	670
383248080420001	383248	804200	Braxton	32		Kanawha Formation	37	7	6	1	1	37.0	8,200
383449080423402	383449	804234	Braxton	60		Kanawha Formation	10	6	5	1	1	10.0	2,000

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
382131081091501	382131	810915	Clay	50	6	Kanawha Formation	50	23.8	18.8	4.97	0.5	10.1	1,900
382046081094701	382046	810947	Clay	40		Kanawha Formation	5	11	9	2	1	2.50	540
382739080515101	382739	805151	Clay	180		Kanawha Formation	1000	80	40	40	1	25.0	5,300
382740080515501	382740	805155	Clay	180		Kanawha Formation	200	217	42	175	20	1.14	310
382747080514101	382747	805141	Clay	180		Kanawha Formation	200	18	16	2	15	100	28,000
380847081173901	380847	811739	Fayette	92		Kanawha Formation	2	60	46	14		0.14	37
381201081174601	381201	811746	Fayette	311		Kanawha Formation	88	52	35	17	10	5.18	1,200
380402081224701	380402	812247	Kanawha	132	8	Kanawha Formation	100	44.4	38.9	5.47	3	18.3	4,000
381216081450101	381216	814501	Kanawha	80	6	Kanawha Formation	10	50.9	30.7	20.2	0.3	0.31	64
381852081404401	381852	814044	Kanawha	65	6	Kanawha Formation	5	40.3	32.8	7.53	0.3	0.70	150
381916081405001	381916	814050	Kanawha	280	6	Kanawha Formation	15		110	10	0.1	1.50	290
381938081355001	381938	813550	Kanawha	90		Kanawha Formation	90	75	23	52	6	1.73	440
381939081354501	381939	813545	Kanawha	225		Kanawha Formation	115	22	20	2	11	57.5	15,000
381940081354901	381940	813549	Kanawha	100		Kanawha Formation	192	60	26	34	8	5.65	1,300
382210081342901	382210	813429	Kanawha	1860		Kanawha Formation	100	16	12	4	8	25.0	6,200
381102081284901	381102	812849	Kanawha	220		Kanawha Formation	225	9	7	2	18	113	31,000
381509081474101	381509	814741	Kanawha	80		Kanawha Formation	97	41	33	8	1	12.1	2,500
381650081452701	381650	814527	Kanawha	167		Kanawha Formation	10	27	22	5	10	2.00	520
382100081380801	382100	813808	Kanawha	215		Kanawha Formation	196	151	30	121		1.62	430e
382100081380802	382100	813808	Kanawha	215		Kanawha Formation	120	149	28	121		0.99	270e

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

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Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
382101081380501	382101	813805	Kanawha	215		Kanawha Formation	209	150	28	122	12	1.71	460
382101081380502	382101	813805	Kanawha	215		Kanawha Formation	180	120	30	90	12	2.00	540
382105081382101	382105	813821	Kanawha	150		Kanawha Formation	135	130	30	100	1	1.35	310
382143081385601	382143	813856	Kanawha	131		Kanawha Formation	470	39	30	9	10	52.2	14,000
382211081342801	382211	813428	Kanawha	1860		Kanawha Formation	100	16	12	4	8	25.0	6,300
Toll plaza B	380610	812257	Kanawha	210	6	Kanawha Formation	15			0.68	36	22.1	6,000
Atenville Elem	380254	820836	Lincoln	109	6	Kanawha Formation	25	96	40	56	1	0.45	100
374740081424901	374740	814249	Logan	198	8	Kanawha Formation	66	120	36.5	83.5	36	0.79	210
374309081592701	374309	815927	Logan	400	4	Kanawha Formation	96	37	8	29	82	3.31	940
374331081595001	374331	815950	Logan	400	4	Kanawha Formation	73	375	18	357	74	0.20	62
374346082000201	374346	820002	Logan	600	5	Kanawha Formation	186	121	33	88	132	2.11	640
374407082000601	374407	820006	Logan	600	5	Kanawha Formation	120	421	16	405	42	0.30	86
374428082000201	374428	820002	Logan	600	5	Kanawha Formation	165	75	25	50	146	3.30	960
374548081591201	374548	815912	Logan	220	10	Kanawha Formation	58.5	20	3	17.2	1.25	3.40	670
374743081425101	374743	814251	Logan	240	8	Kanawha Formation	89		29		36		
374750081424901	374750	814249	Logan	175	8	Kanawha Formation	56.7		10.82		40		
374804081422801	374804	814228	Logan	200	8	Kanawha Formation	127		22.45		70.67		
374740081424901	374740	814249	Logan	198	8	Kanawha Formation	66		36.5		36		
374737081424301	374737	814243	Logan	210	8	Kanawha Formation	95	71	60		53		
Buffalo PSD #11	N/D	N/D	Logan	225	8	Kanawha Formation	19.6	142	71		18		

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Dis-charge (gpm)	Pro-duction level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capac-ity (gpm/ft)	Trans-miss-ivity (ft ² /d)
374748081430801	374748	814308	Logan	190	8	Kanawha Formation	60		12	87	48	0.69	190
Buffalo PSD #15	N/D	N/D	Logan	200	8	Kanawha Formation	60	27	15		48		
374823081422001	374823	814220	Logan	245	8	Kanawha Formation	181	42.5	30.05		49		
374823081420701	374823	814207	Logan	245	8	Kanawha Formation	340		23	39.5	52	8.61	2,100
374813081420101	374813	814201	Logan	170	8	Kanawha Formation	172	76	36.01		51		
374916081503501	374916	815035	Logan	70	8	Kanawha Formation	36	30.4	29	1.4	0.5	25.7	5,100
Sharples Elem	375447	814833	Logan	60	6	Kanawha Formation	20	55	10	45	1	0.44	100
Marrowbone Dev.	375126	821909	Mingo	81	8	Kanawha Formation	10	75	4	71	24	0.14	37
Marrowbone Dev.	375126	821909	Mingo	210	6	Kanawha Formation	10	175	90	85	24	0.12	33
Marrowbone Dev.	375229	821935	Mingo	1010	8	Kanawha Formation	10	1010	32	978		0.01	3e
381321080411201	381321	804112	Nicholas	78.5	6	Kanawha Formation	2		15.6	23.2	0.7	0.09	20
381533081020301	381533	810203	Nicholas	26	6	Kanawha Formation	6		5.02	2.31	0.3	2.60	550
381552081014801	381552	810148	Nicholas	60		Kanawha Formation	7.5		3.18	16.5	0.1	0.46	88
381623080552701	381623	805527	Nicholas	60	6	Kanawha Formation	12.5		21.66	0.45	0.7	27.7	5,700
381656080543301	381656	805433	Nicholas	48.4	6	Kanawha Formation	1.3	17.69	15.46	2.23	1.5	0.38	90
381754080490401	381754	804904	Nicholas	100	6	Kanawha Formation	7.5		47.5		0.3	0.31	64
381915080371901	381915	803719	Nicholas	72	6	Kanawha Formation	4		9	3.8	0.4	1.05	230
382123080381701	382123	803817	Nicholas	57	6	Kanawha Formation	2	20.9	18.23	2.67	0.5	0.75	160
381513081094201	381513	810942	Nicholas	95.2	6	Kanawha Formation	13.6	13.12	12.81	0.31	1	43.9	9,600
383050080461701	383050	804617	Nicholas	36		Kanawha Formation	5	27	12	15	1	0.33	75

Received

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

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Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
383101080465901	383101	804659	Nicholas	44		Kanawha Formation	7	18	15	3	1	2.33	540
375739081311101	375739	813111	Raleigh	151		Kanawha Formation	30	42.75	39.2	3.55	36	8.45	2,300
375745081302201	375745	813022	Raleigh	150		Kanawha Formation	30	20.5	15	5.5	36	5.45	1,500
375704081263101	375704	812631	Raliegh	84		Kanawha Formation	146	56	15.75	40.3	12	3.63	860
375704081263101	375704	812631	Raliegh	84		Kanawha Formation	108	24	11	13	12	8.31	1,900
Hutte Restaurant	384230	801230	Randolph	150	6	Kanawha Formation	15	4	2	2	4	7.50	1,600
375811082212401	375811	822124	Wayne	108		Kanawha Formation	16	18.8	16.02	1.98	15	8.08	1,900
382038080331801	382038	803318	Webster	109	6	Kanawha Formation	10		18.74	33	0.1	0.30	57
382046080332701	382046	803327	Webster	100		Kanawha Formation	13.3		6.86	0.2		0.16	43
											Median	2.00	520
											Minimum	0.01	3
											Maximum	113	31,000
375610081075301	375610	810753	Fayette	72		New River Formation	3	25	22	3		1.00	270e
380358081045501	380358	810455	Fayette	54		New River Formation	16	37	30	7		2.29	620e
380632080592101	380632	805921	Fayette	141	6	New River Formation	4.3		89.45	2.05	0.1	2.07	400
380708081001601	380708	810016	Fayette	170	6	New River Formation	6		63.5	49.2	0.2	0.12	24
380715080582801	380715	805828	Fayette	160	6	New River Formation	4.8		30.52	12.8	0.2	0.38	78
380844080581001	380844	805810	Fayette	400	6	New River Formation	3	86.1	64.4	21.7	0.3	0.09	19
Page-Kincaid #1	380235	811609	Fayette	165	10	New River Formation	375			71.6	8	5.24	1,100
Page-Kincaid #2	380236	811609	Fayette	150	10	New River Formation	375			28.2	8	13.3	2,900

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

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Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Dis-charge (gpm)	Pro-duction level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capac-ity (gpm/ft)	Trans-miss-ivity (ft ² /d)
380124080405601	380124	804056	Greenbrier	46	6	New River Formation	2		19.4		0.1	0.78	150
380333080435601	380333	804356	Greenbrier	67	6	New River Formation	7.5		21.9		0.2	0.19	39
381415081330001	381415	813300	Kanawha	600		New River Formation	180	130	21	109		1.65	440e
380751080453201	380751	804532	Nicholas	160	6	New River Formation	2.3		50	5	1	0.45	100
381239080563301	381239	805633	Nicholas	140	6	New River Formation	6.5		123	15	2	0.43	100
381724080320901	381724	803209	Nicholas	59.5	6	New River Formation	14.4		3.7	4.8	0.2	3.01	600
381729080320801	381729	803208	Nicholas	51.5	6	New River Formation	6.9		11	0.94	0.1	7.34	1,200
374917081194601	374917	811946	Raleigh	191		New River Formation	400	54	38	16	24	25.0	6,700
Beckley Smokeless	374531	811803	Raleigh	226	6	New River Formation	30	210	157	53	4.75	0.57	150
Ravencliff #2	374026	812808	Wyoming	220	8	New River Formation	752			0.27	17	2780	750,000
Median												1.33	330
Minimum												0.09	19
Maximum												2780	750,000
Northfork No.1	372453	812558	McDowell	205	8	Pocahontas Formation	160	180	20	160	1	1.00	210
Northfork No. 2	372453	812558	McDowell	145	8	Pocahontas Formation	150	120	20	100	1	1.50	320
Kimball+Carswell	N/D	N/D	McDowell	119	8	Pocahontas Formation	250			0.25	2	1000	270,000
373503081225101	373503	812251	Wyoming	286		Pocahontas Formation	258	81.6	51	30.7	30	8.40	2,100
Median												4.95	1,200
Minimum												1.00	210
Maximum												1000	270,000

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

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Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Dis-charge (gpm)	Pro-duction level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capac-ity (gpm/ft)	Trans-miss-ivity (ft ² /d)
390622079595001	390622	795950	Barbour	265		Pottsville Group	100	182	120	62	70	1.61	470
375719081392401	375719	813924	Boone	260		Pottsville Group	270	79	70	9	5	30.0	7,500
375825081425001	375825	814250	Boone	104	8	Pottsville Group	72	32	11	21		3.43	920
382339081064901	382339	810649	Clay	40	6	Pottsville Group	24	9	4	5		4.80	1,300
380815081180701	380815	811807	Fayette	291		Pottsville Group	250	53	40	13	2	19.2	4,300
380236081161002	380236	811610	Fayette	158		Pottsville Group	185	34.74	13.7	21.1	24	8.78	2,100
Thurmond Depot	N/D	N/D	Fayette	255		Pottsville Group	20	39.45	37.8	1.6	30	12.5	3,200
381417081325101	381417	813251	Kanawha	440		Pottsville Group	350	85	21	64	24	5.47	1,300
382250081230601	382250	812306	Kanawha	60	6	Pottsville Group	10	30	15	15	0.5	0.67	150
372312081242601	372312	812426	McDowell	398	8	Pottsville Group	75	36.4	34.7	1.7		44.1	12,000e
393928079510001	393928	795100	Monongalia	154		Pottsville Group	41	72	63	9	8	4.56	1,100
374551081244101	374551	812441	Raleigh	125		Pottsville Group	30	17	16	1		30.0	8,000e
374646081201401	374646	812014	Raleigh	120		Pottsville Group	10	7	6	1	2	10.0	2,100
374933081200201	374933	812002	Raleigh	150		Pottsville Group	402	31	20	11	24	36.5	10,000
375145081280301	375145	812803	Raleigh	186		Pottsville Group	8	41	40	1	24	8.00	2,100
375203081265101	375203	812651	Raleigh	45		Pottsville Group	25	17	8	9		2.78	750e
385618079574501	385618	795745	Randolph	500	10	Pottsville Group	220	149.33	30.1	119.2	24.5	1.84	470
382717080282301	382717	802823	Webster	90	6	Pottsville Group	10	30	27	3		3.33	900e
383413080273001	383413	802730	Webster	83	6	Pottsville Group	10	45	28	17		0.59	160e
373252081294701	373252	812947	Wyoming	247	14	Pottsville Group	220	65	24	41		5.37	1,400e

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

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Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
373627081302201	373627	813022	Wyoming	30	6	Pottsville Group	5	30	10	20		0.25	67e
373629081304301	373629	813043	Wyoming	145	6	Pottsville Group	5	145	60	85		0.06	16e
373837081255301	373837	812553	Wyoming	80	8	Pottsville Group	47				4	3.00	700
373840081255001	373840	812550	Wyoming	80	8	Pottsville Group	45				4	6.00	1,300
											Median	5.09	1,300
											Minimum	0.06	16
											Maximum	44.1	12,000
375239080475801	375239	804758	Fayette	59	6	Bluestone and Princeton Formations	4.6		8.97		0.9	5.70	1,200
375348080453801	375348	804538	Greenbrier	50	6	Bluestone and Princeton Formations	2.4		10.16		0.1	0.45	87
375804080460401	375804	804604	Greenbrier	250	8	Bluestone and Princeton Formations	260			23.10	6.5	11.3	2,500
375905080425901	375905	804259	Greenbrier	60	6	Bluestone and Princeton Formations	8				0.9	1.04	240
375958080450601	375958	804506	Greenbrier	74	6	Bluestone and Princeton Formations	5		9.90		0.5	2.20	480
381353080263101	381353	802631	Greenbrier	77	6	Bluestone and Princeton Formations	5		21.6	38.5	0.2	0.13	27
371809081092001	371809	810920	Mercer	225		Bluestone and Princeton Formations	160	31	25	6	6	26.7	6,600
373020081075601	373020	810756	Mercer	144		Bluestone and Princeton Formations	100	44.1	42.35	1.75	0.7	7.79	1,500

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Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
381925080262301	381925	802623	Webster	58	6	Bluestone and Princeton Formations	10.9		4.18	5.07	1	2.15	480
381929080263001	381929	802630	Webster	65	6	Bluestone and Princeton Formations	5.4		8.41	3.81	0.6	1.40	310
381934080262901	381934	802629	Webster	61.5	6	Bluestone and Princeton Formations	8.3		19.47	7.43	0.5	1.11	240
											Median	2.15	480
											Minimum	0.13	27
											Maximum	26.7	6,600
375343080365601	375343	803656	Greenbrier	67	6	Hinton Formation	2.2				0.2	1.30	250
375457080405301	375457	804053	Greenbrier	65	6	Hinton Formation	6		6.35		0.9	2.10	470
375717080411601	375717	804116	Greenbrier	101	6	Hinton Formation	7.5				0.3	0.50	100
375828080382601	375828	803826	Greenbrier	85	6	Hinton Formation	8.6				0.5	1.40	310
24-unit motel	N/D	N/D	Greenbrier	135	6	Hinton Formation	6	120	45	75	2	0.08	19
372118081040701	372118	810407	Mercer	628	8	Hinton Formation	250			42	15	5.95	1,300
371812081155301	371812	811553	Mercer	237		Hinton Formation	50	36	18	18	4	2.78	670
372135081051001	372135	810510	Mercer	495	10	Hinton Formation	200	353	71	282	15	0.71	170
372144081062401	372144	810624	Mercer	500	8	Hinton Formation	120	60	14	46	24	2.61	680
372629080464601	372629	804646	Monroe	82		Hinton Formation	40	35	25	10	1	4.00	910
372651080491601	372651	804916	Monroe	130		Hinton Formation	30	112	108	4	2	7.50	1,300
372658080464701	372658	804647	Monroe	81		Hinton Formation	30	75	35	40	2	0.75	180

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Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
381059080151201	381059	801512	Pocahontas	240	6	Hinton Formation	3.6		164.8		24	0.24	67
											Median	1.40	310
											Minimum	0.08	19
											Maximum	7.50	1,300
375623081034201	375623	810342	Fayette	91		Mauch Chunk Group	10	47	45	2		5.00	1,300
375807080460001	375807	804600	Greenbrier	85	8	Mauch Chunk Group	260	80	57	23.1	6.5	11.3	2,400
372143081054001	372141	810541	Mercer	445	8	Mauch Chunk Group	300	41	21	20	12	15.0	3,700
372145081053901	372141	810541	Mercer	548	12	Mauch Chunk Group	350	43	11	32	15	10.9	2,400
372147081054901	372143	810545	Mercer	550	8	Mauch Chunk Group	250	43	10	33	15	7.58	1,700
372536080594801	372356	805948	Mercer	421-589		Mauch Chunk Group	116			17.5	4	6.63	1,300
372132081051001	372132	810510	Mercer	247	12	Mauch Chunk Group	400			13	12	30.8	7,200
Vital-18 campground	372404	805243	Mercer	305	6	Mauch Chunk Group	20			6	36	3.33	900
Vital-18 lodge	372404	805243	Mercer	305	6	Mauch Chunk Group	200	305		260	1.03	0.77	170
381843080111801	381843	801118	Pocahontas	85	6	Mauch Chunk Group	5.4		43	2.07	0.5	2.59	560
385612079550701	385612	795507	Randolph	60.1	6	Mauch Chunk Group	21.4	26.4	3.66	22.7	0.5	0.94	200
373151080575601	373151	805756	Summers	110		Mauch Chunk Group	60			20	6	3.00	760
374908080435601	374908	804356	Summers	170	6	Mauch Chunk Group	10	22.98	6.34	16.6	0.5	0.38	83
373719080563001	373719	805630	Summers	151	8	Mauch Chunk Group	60	111	108	3	4	20.0	4,400
382921080224201	382921	802242	Webster	90	6	Mauch Chunk Group	10	50	30	20	1	0.50	110

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
											Median	5.00	1,300
											Minimum	0.38	83
											Maximum	30.8	7,200
374836080300601	374836	803006	Greenbrier	523	6	Greenbrier Group	30	523	417	106	1	0.28	64
Organ Cave	374304	802609	Greenbrier	240	6	Greenbrier Group	45	230	215	15	1	3.00	680
Frankford subdiv.	N/D	N/D	Greenbrier	140	6	Greenbrier Group	6	60	34	26	1	0.23	52
372715080395501	372715	803955	Monroe	50		Greenbrier Group	30	24	12	12	0.4	2.50	540
373528080314501	373528	803145	Monroe	385		Greenbrier Group	20	176	100	76	0.1	0.26	49
373718080314001	373718	803140	Monroe	185		Greenbrier Group	4	140	8	132	24	0.03	8
373732080311501	373732	803115	Monroe	256		Greenbrier Group	20	181	81	100	1	0.20	45
382416080013701	382416	800137	Pocahontas	175	6	Greenbrier Group	57	73.05	71.7	1.35	0.5	6.47	1,300
382500080063501	382500	800635	Pocahontas	54	6	Greenbrier Group	40	50	30.5	19.5	1	2.05	470
Hillsboro #1	380754	801237	Pocahontas	204	8	Greenbrier Group	30			29	72	1.03	290
Alpine Lake #4	392729	793018	Preston	145	8	Greenbrier Group	174			6.9	24	25.2	6,600
385608079544401	385608	795444	Randolph	55	6	Greenbrier Group	100	22	20	2	12	50.0	13,000
Timberline Resort	390233	792405	Tucker	100	6	Greenbrier Group	72	50.08	48	2.08	17	34.6	9,200
											Median	2.05	470
											Minimum	0.03	8
											Maximum	50.0	13,000

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Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
380030080002501	380030	800025	Greenbrier	83		Pocono Group	12	60	26	34		0.35	94e
393435079514101	393435	795141	Monongalia	250		Pocono Group	175	250	40	210	8	0.83	210
393437079514201	393437	795142	Monongalia	180		Pocono Group	180	176	26	150	8	1.20	310
373710080212101	373710	802121	Monroe	50		Maccrady Formation	15	30	15	15		1.00	270e
373805080202001	373805	802020	Monroe	265		Maccrady Formation	15	100	60	40	4	0.38	95
385602079542401	385602	795424	Randolph	42.2	6	Pocono Group	5.1	40.2	10.8	29.4	0.1	0.17	33
385507079313901	385507	793139	Randolph	220	6	Pocono Group	300			34.6	24	8.67	2,300
											Median	0.83	210
											Minimum	0.17	33
											Maximum	8.67	2,300
392509078105801	392509	781058	Berkeley	110	6	Hampshire Formation	25	105	55	50	18	0.50	130
392523078104201	392523	781042	Berkeley	107	6	Hampshire Formation	25	18	16	2	18	12.5	2,900
Woods Resort #8	393453	780606	Berkeley	406	6	Hampshire Formation	10	239.83	45.5	194.3	36	0.05	15
Woods Resort #9	393453	780600	Berkeley	366	6	Hampshire Formation	30	232.58	49	183.6	24	0.16	44
391118078272901	391118	782729	Hampshire	223		Hampshire Formation	10	78	20	58	0.1	0.17	32
391223078255301	391223	782553	Hampshire	36		Hampshire Formation	15	46	9	37	3	0.41	100
391234078254401	391234	782544	Hampshire	245		Hampshire Formation	14	137	52	85	0.1	0.16	31
391720078340801	391720	783408	Hampshire	57		Hampshire Formation	8	47	20	27	0.1	0.30	57
391840078430001	391840	784300	Hampshire	750		Hampshire Formation	5	969	582	387	3	0.01	3
391943078435301	391943	784353	Hampshire	29		Hampshire Formation	6	13	1	12	0.1	0.50	96

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
392322078393301	392322	783933	Hampshire	135		Hampshire Formation	9	31	2	29	0.1	0.31	59
392556078360401	392556	783604	Hampshire	39		Hampshire Formation	8	17	6	11	0.1	0.73	140
392730078273601	392730	782736	Hampshire	185		Hampshire Formation	8	28	26	2	0.1	4.00	670
392921078252500	392921	782525	Hampshire	118		Hampshire Formation	6	96	51	45		0.13	35e
Slanesville School	392214	783152	Hampshire	500	6	Hampshire Formation	70	498	94	404	1	0.17	39
Slanesville School	392214	783152	Hampshire	200	6	Hampshire Formation	40	198	55	143	2	0.28	67
385332078553601	385332	785536	Hardy	180	6	Hampshire Formation	8	38	36.3	1.7	30	4.70	1,200
Lost River Park	385338	785531	Hardy	200	6	Hampshire Formation	47	40.7	17	23.7	36	1.98	540
393138078253101	393138	782531	Morgan	60		Hampshire Formation	8	52	43	9		0.89	240e
Greenbrier tr. 63.7	381525	800059	Pocahontas	125	6	Hampshire Formation	12	86	18	68	8	0.18	47
Greenbrier tr. 69.6	381908	795818	Pocahontas	125	6	Hampshire Formation	20	80	16	64	8	0.31	80
392612079315801	392612	793158	Preston	265		Hampshire Formation	50	40	0	40	5	1.25	320
Median												0.31	74
Minimum												0.01	3
Maximum												12.5	2,900
393002078070201	393002	780702	Berkeley	128		Chemung Group	5			40		0.12	32
391442078413201	391442	784132	Hampshire	182		Chemung Group	8	60	57	3	0.1	2.67	460
391532078405201	391532	784052	Hampshire	71		Chemung Group	3	8	0	8		0.38	100
391742078385501	391742	783855	Hampshire	90		Chemung Group	8	56	52	4	0.1	2.00	310
391756078390701	391756	783907	Hampshire	97		Chemung Group	3	3	1	2		1.50	400

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
391759078372901	391759	783729	Hampshire	30		Chemung Group	12	7	4	3	48	4.00	1,100
391817078392001	391817	783920	Hampshire	60		Chemung Group	6	30	11	19	0.1	0.32	62
391835078372701	391835	783727	Hampshire	64		Chemung Group	8	57	8	49		0.16	43e
391837078392601	391837	783926	Hampshire	66		Chemung Group	5	8	5	3	0.1	1.67	320
391944078422502	391944	784225	Hampshire	523		Chemung Group	9	164	111	53		0.17	45e
392023078385001	392023	783850	Hampshire	148		Chemung Group	12	90	60	30		0.40	110e
392036078383601	392036	783836	Hampshire	36		Chemung Group	8	11	8	3	0.1	2.67	500
392106078381301	392106	783813	Hampshire	85		Chemung Group	8	49	7	42		0.19	51e
392154078372201	392154	783722	Hampshire	70		Chemung Group	3	21	14	7	0.1	0.43	82
392802078425801	392802	784258	Hampshire	41		Chemung Group	35	18	15	3	1	11.7	2,400
390458078331501	390458	783315	Hardy	48	6	Chemung Group	5.9	13	8	5	0.33	1.20	240
381817079563801	381817	795638	Pocahontas	86		Chemung Group	15	15	10	5	1	3.00	640
National Radio Ob	382656	795011	Pocahontas	175	6	Chemung Group	25	86.75	16	70.75	36	0.35	99
National Radio Ob	382656	795011	Pocahontas	175	10	Chemung Group	30	82.83	16	66.83	36	0.45	120
381823079563701	381823	795637	Pocahontas	152	6	Chemung Group	20	30	20	10	1	2.00	460
392618079322701	392618	793227	Preston	207	8	Chemung Group	430			14	36	30.7	8,300
384917079501101	384917	795011	Randolph	24	6	Chemung Group	7.1	7.17	3.2	3.97	0.2	1.80	360
Median												1.35	270
Minimum												0.12	32
Maximum												30.7	8,300

Received

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
391618078532301	391618	785323	Hampshire	392		Brallier Formation	2	389	1	388		0.01	3e
390725078404501	390725	784045	Hardy	45	6	Harrell or Brallier Formations	10	14	6	8	8	1.25	320
393116078474601	393116	784746	Mineral	22		Brallier Formation	8	5	0	5	3	1.60	390
381730079554601	381730	795546	Pocahontas	396		Harrell Shale	12	128	3	125	52	0.10	29
381742079554201	381742	795542	Pocahontas	396		Harrell Shale	9	56	3	53	49	0.17	49
Stuart Recreation	N/D	N/D	Randolph	101	6	Harrell Shale	6	27.17	5.75	21.4	8	0.28	72
384537079552601	384537	795526	Randolph	108	6	Brallier Formation	6	16.5	9	7.5	70	0.80	230
Median												0.28	72
Minimum												0.01	3
Maximum												1.60	390
385537078502001	385537	785020	Hardy	90	6	Upper to Middle Devonian Formations	10	43	3	40	1.25	0.25	57
390339078372001	390339	783720	Hardy	82	6	Upper to Middle Devonian Formations	30	13	6	7	0.25	4.29	760
382601079491101	382601	794911	Pocahontas	100		Upper to Middle Devonian Formations	15	52	26	26	27	0.58	160
384740079540301	384740	795403	Randolph	71.4	6	Upper to Middle Devonian Formations	37.5	16.38	6.33	10.1	0.5	3.73	600
384826079532201	384826	795322	Randolph	85	6	Upper to Middle Devonian Formations	6.5	16.86	5.3	11.6		0.56	150e
385007079523901	385007	795239	Randolph	140	8	Upper to Middle Devonian Formations	7.5	10.47	6.1	4.37	6	1.72	430

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
385051079522001	385051	795220	Randolph	80.3	6	Upper to Middle Devonian Formations	11.5	35.3	12.2	23.1	24	0.50	140
385058079522601	385058	795226	Randolph	86	6	Upper to Middle Devonian Formations	33	17.65	1.28	16.4	2	2.02	480
385059079522901	385059	795229	Randolph	96	6	Upper to Middle Devonian Formations	10.7	31.94	1.84	30.1	4.5	0.36	91
385100079522901	385100	795229	Randolph	98	6	Upper to Middle Devonian Formations	11.1	15.56	1	14.6	1.8	0.76	180
385101079522701	385101	795227	Randolph	97	6	Upper to Middle Devonian Formations	33	27.8	0.93	26.9	0.1	1.23	230
385537079530301	385537	795303	Randolph	84.4	6	Upper to Middle Devonian Formations	10	64	12.07	51.9		0.19	51e
385538079530701	385538	795307	Randolph	80	6	Upper to Middle Devonian Formations	10	57.55	10.84	46.7	0.3	0.21	44
385817079502701	385817	795027	Randolph	33.4	6	Upper to Middle Devonian Formations	21.4	17.2	4	13.2	0.5	1.62	350
385127079520301	385127	795203	Randolph	133	6	Upper to Middle Devonian Formations	11.5	6.5	1.56	4.94	0.5	2.33	510
Median												0.76	180
Minimum												0.19	44
Maximum												4.29	760
392310078081501	392310	780815	Berkeley	55	6	Mahantango Formation	5			15		0.33	88e
393337078013601	393337	780136	Berkeley	117	6	Mahantango Formation	16.6	60	20	40	1	0.42	95

Received

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
393459078025201	393459	780252	Berkeley	53	6	Mahantango Formation	3	53	10	43		0.07	19e
393654078015901	393647	780157	Berkeley	141	6	Mahantango Formation	2	80	40	40	0.5	0.05	11
Deerwood F #1	392452	780700	Berkeley	700	6	Mahantango Formation	32			580	24	0.06	16
392208078433401	392208	784334	Hampshire	129		Mahantango Formation	8	18	7	11	0.1	0.73	140
392009078543001	392009	785430	Mineral	42		Mahantango Formation	6	9	1	8	8	0.75	200
Burlington Elem.	392010	785508	Mineral	410	6	Mahantango Formation	3.5	400	15	385	36	0.01	3
372840080243801	372840	802438	Monroe	68		Mahantango Formation	40	26	6	20	1	2.00	460
383730079144001	383730	791440	Pendleton	40		Mahantango Formation	30	22	14	8	3	3.75	840
Median												0.38	92
Minimum												0.01	3
Maximum												3.75	840
393141078030001	393141	780300	Berkeley	55	6	Marcellus and Needmore Formations	3.3	55	5	50	1	0.07	16
374800080173502	374800	801735	Greenbrier	205		Marcellus Formation	100	521	5	516	521	0.19	62
391247078323301	391247	783233	Hampshire	78		Marcellus Formation	7	7	2	5	0.1	1.40	270
391425078304001	391425	783040	Hampshire	98		Marcellus Formation	8	6	3	3	0.1	2.67	460

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
391923078524901	391923	785249	Hampshire	47		Marcellus Formation	20	14	2	12		1.67	440e
393130078370901	393130	783709	Hampshire	27		Marcellus Formation	35	11	6	5	1	7.00	1,300
390246078380901	390246	783809	Hardy	28	6	Marcellus Formation	5	4	2	2.4	0.13	2.08	400
390306078380501	390306	783805	Hardy	86	6	Marcellus Formation	4	37	11	26.2	0.17	0.15	29
390327078374701	390327	783747	Hardy	60	6	Marcellus Formation	5.6	22	15	6.5	0.35	0.86	170
390741078340001	390741	783400	Hardy	125	6	Marcellus Formation	5.3	6	1	4.6	5	1.15	280
393128078374601	393128	783746	Hampshire	83		Marcellus and Needmore Formations	25	72	49	23	1	1.09	240
Peterkin conf. Cen.	391749	784739	Hampshire	203	6	Marcellus and Needmore Formations	17	160	60	100	36	0.17	48
392154078585001	392154	785850	Mineral	115		Marcellus Formation	25	109	49	60	1	0.42	96
393911078124401	393911	781244	Morgan	450		Marcellus and Needmore Formations	50	270	115	155	62	0.32	92
393001078174101	393001	781741	Morgan	445		Marcellus and Needmore Formations	35	374	1	373	8	0.09	24
Median												0.86	170
Minimum												0.07	16
Maximum												7.00	1,300
390822078395901	390822	783959	Hampshire			Onesquethaw Group	8	12	8	4	0.1	2.00	390
391423078303801	391423	783038	Hampshire	111		Oriskany Sandstone	8	95	70	25	0.1	0.32	62
391639078301002	391639	783010	Hampshire	48		Oriskany Sandstone	3	43	40	3		1.00	270e
392418078435602	392418	784356	Hampshire	398		Oriskany Sandstone	4	219	178	41	0.1	0.10	19

Received

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
392610078423001	392610	784230	Hampshire	85		Oriskany Sandstone	7	56	31	25	0.1	0.28	53
392620078403701	392620	784037	Hampshire	56		Oriskany Sandstone	8	3	2	1	2	8.00	1,500
390235078381501	390235	783815	Hardy	60	6	Oriskany Sandstone	4	34	16	17.8	0.33	0.22	47
Pinnacle Water	393105	785148	Mineral	420	6	Oriskany Sandstone	50			133	12	0.38	100
											Median	0.35	82
											Minimum	0.10	19
											Maximum	8.00	1,500
374834080174501	374834	801745	Greenbrier	400	17.5	Helderburg Group	2400	8	4	4		600	60,000e
Buffalo Gap CC	392000	782725	Hampshire	100	6	Helderburg Group	60	98	25	73	2	0.82	200
392028078265101	392028	782651	Hampshire	145		Wills Creek Formation	9	88	85	3	0.1	3.00	560
385711078453501	385711	784535	Hardy	87	6	Helderburg Group	7.4	33	21	12.2	0.33	0.61	130
385712078453001	385712	784530	Hardy	44	6	Helderburg Group	7.9	20	15	5	0.33	1.58	320
390658078395101	390658	783951	Hardy	98	6	Tonoloway Formation	8	38	30	7.7	0.33	1.04	210
390605078390001	390605	783900	Hardy	25	5	Tonoloway or Wills Creek Formations	7.9	18	0	18.4	0.33	0.43	91
390302078415201	390302	784152	Hardy	132	6	Wills Creek Formation	16	55	44	11	0.75	1.45	320
390701078380801	390701	783808	Hardy	42	6	Tonoloway or Wills Creek Formations	3.6	33	18	14.8	7	0.24	62
393339078493801	393339	784938	Mineral	328		Helderburg Group	60	199	9	190	6	0.32	82
393031078500101	393031	785001	Mineral	200		Tonoloway Formation	100	35	15	20		5.00	1,300e

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
393339078500501	393339	785005	Mineral	300		Tonoloway Formation	45	127	22	105		0.43	120e
Rocket Center	393340	785011	Mineral	740	6	Wills Creek Formation	33	500	40	460	3	0.07	17
											Median	0.82	200
											Minimum	0.07	17
											Maximum	600	160,000
393043078012401	393043	780124	Berkeley	115	6	Mckenzie Formation	65	69	59	10	0.25	6.50	1,100
390232078424501	390232	784245	Hardy	83	6	Clinton Group	7.5	77	9	67.5	0.33	0.11	23
East R. Mt. Over	371520	811103	Mercer	627	6	Tuscarora Sandstone	4	590	336	254	36	0.02	6
											Median	0.11	23
											Minimum	0.02	6
											Maximum	6.50	1,100
392602078040801	392602	780408	Berkeley	81	6	Martinsburg Formation	30	81	20	61	0.5	0.49	110
392059078070801	392059	780708	Berkeley	63	6	Martinsburg Formation	25	57	9	48	0.67	0.52	120
392518077555201	392518	775552	Berkeley	85	6	Martinsburg Formation	22	85	25	60	0.67	0.37	82
393355077523701	393355	775237	Berkeley	110		Martinsburg Formation	71	51.69	40.4	11.3	45	6.27	1,500
393523077512001	393523	775120	Berkeley	60	6	Martinsburg Formation	20	50	30	20		1.00	270e

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
Broad Lane MHP	393454	775122	Berkeley	150	12	Martinsburg Formation	100	140	40	100	12	1.00	240
Midway MHP	393500	775100	Berkeley	205	6	Martinsburg Formation	60	45	34	11	12	5.45	1,300
392403077590001	392403	775900	Berkeley	110	8	Martinsburg Formation	100	65	20	45	24	2.22	520
393039077541201	393039	775412	Berkeley	131	6	Martinsburg Formation	50	35	25	10	0.2	5.00	800
393429077524601	393429	775246	Berkeley	90	6	Martinsburg Formation	9	90	30	60		0.15	40e
393459077521101	393459	775211	Berkeley	90	6	Martinsburg Formation	11	85	5	80		0.14	37e
385419078475602	385419	784756	Hardy	146	6	Martinsburg Formation	6.8	120	58	62.4	0.18	0.11	23
385718078410601	385718	784106	Hardy	100	6	Martinsburg Formation	15	32	30	2.1	0.33	7.50	1,300
390031078353301	390031	783533	Hardy	60	6	Martinsburg Formation	5	39	17	22	0.17	0.23	45
392309077552701	392309	775527	Jefferson	75		Martinsburg Formation	15	29	27	1.5	10	10.0	2,400
Median												1.00	240
Minimum												0.11	23
Maximum												10.0	2,400

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
392910077563701	392910	775637	Berkeley	40	6	Trenton or Black River Groups	16.6	11	9	2		8.30	2,300e
392704077530701	392704	775307	Berkeley	425	6	Beekmantown Group	10	55.37	19.53	35.8	2.6	0.16	39
392902077571301	392902	775713	Berkeley	190	6	Beekmantown Group	10			22	2	0.45	110
393032077563601	393032	775636	Berkeley	364		Beekmantown Group	65	47.1	40.76	6.34	46	10.3	2,800
393139077551401	393139	775514	Berkeley	107	6	Beekmantown Group	3	135	35	100		0.03	8e
393150077563301	393150	775633	Berkeley	114	6	Beekmantown Group	13			0.2	27	65.0	18,000
393315077555601	393315	775556	Berkeley	123	6	Beekmantown Group	15	68.27	49.3	19		0.25	67e
392124078024302	392124	780243	Berkeley	411	8	Beekmantown Group	340	130	70	60	24	5.67	1,400
392124078024305	392124	780243	Berkeley	370		Beekmantown Group	25	90	25	65	24	0.38	100
392128078024902	392128	780249	Berkeley	175	8	Beekmantown Group	175	65	45	20		8.75	2,300e
392128078024903	392128	780249	Berkeley	363	8	Beekmantown Group	150	142	62	80	10	1.88	410
392146078020801	392146	780208	Berkeley	266	6	Beekmantown Group	10	140	90	50	1	0.20	45
392458077542101	392458	775421	Berkeley	410	12	Beekmantown Group	34	8	7	0.5	3	68.0	15,000
392501077541301	392501	775413	Berkeley	191	6	Beekmantown Group	245	105	58	47	1.5	5.21	1,100
392507077540701	392507	775407	Berkeley	191	6	Beekmantown Group	105	114	56	57.8	31	1.82	4,800
392753077584601	392753	775846	Berkeley	470	6	Beekmantown Group	4	470	60	410	1	0.01	2
392941077514301	392941	775143	Berkeley	38	4	Beekmantown Group	22.5	37	35	2.25	3	10.0	2,300
393109077500301	393109	775003	Berkeley	300	6	Beekmantown Group	10	240	90	150		0.07	19e
Harranda MHE	392238	780220	Berkeley	175	6	Beekmantown Group	30	150	60	90	1	0.33	75

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
IRS Computer Fac	392353	775452	Berkeley	250	12	Beekmantown Group	110	117	44	73	4	1.51	290
392429078044001	392429	780440	Berkeley	48.5	6	Beekmantown Group	10	22	20	2		5.00	1,300e
392305078010501	392305	780105	Berkeley	153	12	Beekmantown Group	248	16	11	5	48	49.6	13,000
393333077551001	393333	775510	Berkeley	165	6	Beekmantown Group	5	175	20	155		0.03	8e
391723077534601	391723	775346	Jefferson	556		Beekmantown Group	105		66			0.24	64e
391910077524401	391910	775244	Jefferson	150	6	Beekmantown Group	35	60	50	10		3.50	940e
392105077554601	392105	775546	Jefferson	155	6	Beekmantown Group	115	34	24	9.54		12.1	3,200e
392102077555201	392102	775552	Jefferson	302		Beekmantown Group	100	21	12	9	48	11.1	2,900
392102077555301	392102	775553	Jefferson	120		Beekmantown Group	100	57.9	16.5	41.4	96	2.42	670
392102077555301	392102	775553	Jefferson	120	6	Beekmantown Group	100	63	19	43.5	2	2.30	510
392105077555401	392116	775548	Jefferson	88	6	Beekmantown Group	40	17	14	3.33	17	12.0	2,900
391918077580001	391918	775800	Jefferson	127	6	Beekmantown Group	5	127	18	109		0.05	13e
373449080202501	373449	802025	Monroe	81		Beekmantown Group	30	45	37	8	4	3.75	820
Median												2.36	590
Minimum												0.01	2
Maximum												68.0	18,000
393450077562801	393450	775628	Berkeley	220		Conococheague Formation	13			50		0.26	70e
392340078025101	392340	780251	Berkeley	113	6	Conococheague Formation	15	113	60	53		0.28	75e
392410078030801	392410	780308	Berkeley	69	6	Conococheague Formation	23.3	69	28	41	1	0.57	130

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
392751077593601	392751	775936	Berkeley	350	6	Conococheague Formation	14	89	74	15		0.93	250e
392950077590201	392950	775902	Berkeley	221	6	Conococheague Formation	20	125	95	30	2	0.67	160
393010077580001	393010	775800	Berkeley	150	8	Conococheague Formation	10	65	25	40	8	0.25	63
392053077504401	392053	775044	Jefferson	80		Conococheague Formation	223	12	9	3	8	74.3	20,000
392902077483801	392902	774838	Jefferson	267	6	Conococheague Formation	7	267	105	162	0.83	0.04	9
391507077563101	391507	775631	Jefferson	150	6	Conococheague Formation	11	135	25	110	24	0.10	28
Hunt Field Subdiv.	391558	775315	Jefferson	465	8	Conococheague Formation	200	460	32	428	1	0.47	100
Hunt Field Subdiv.	391558	775315	Jefferson	505	8	Conococheague Formation	100	500	96	404	17	0.25	66
Breckenridge sub.	391914	774956	Jefferson	310	8	Conococheague Formation	300	300	20	280	20	1.07	270
N. Jeff Elem Sch	392205	775253	Jefferson	355	6	Conococheague Formation	50	350	80	270	24	0.19	52
USFWS NETC 3a	N/D	N/D	Jefferson	305	6	Conococheague Formation	15			55	72	0.27	79
USFWS NETC 3c	N/D	N/D	Jefferson	170	8	Conococheague Formation	100			25	72	4.00	1,100
USFWS NETC 4c	N/D	N/D	Jefferson	185	8	Conococheague Formation	100			11	72	9.09	2,400

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diam- eter (in.)	Hydrogeologic Unit (Aquifer)	Dis- charge (gpm)	Pro- duc- tion level (ft bls)	Static level (ft bls)	Draw- down (ft)	Test duration (hours)	Specific Capac- ity (gpm/ft)	Trans- miss- ivity (ft ² /d)
											Median	0.38	92
											Minimum	0.04	9
											Maximum	74.3	20,000
393238077592701	393238	775927	Berkeley	65	6	Elbrook Formation	15	65	30	35	1	0.43	98
Chestnut Ridge HO	392820	780116	Berkeley	185	6	Elbrook Formation	60	170	60	110	1	0.55	130
392849078014301	392849	780143	Berkeley	106	6	Elbrook Formation	20	106	41	65	0.66	0.31	68
391423077522801	391423	775228	Jefferson	200	6	Elbrook Formation	25			4		7	1,900e
391724077520001	391722	775200	Jefferson	67		Elbrook Formation	240	25	18	7	18	34.3	9,200
392045077484401	392045	774844	Jefferson	325		Elbrook Formation	30	332	224	108	13	0.28	75
392344077460001	392344	774600	Jefferson	152	6	Elbrook Formation	23	78	28	50	1	0.46	100
392231077464901	392231	774649	Jefferson	135	6	Elbrook Formation	26	626	66	560		0.05	13e
Walnut Grove	391906	774952	Jefferson	293	6	Elbrook Formation	140	290	80	210	3.5	0.67	160
											Median	0.46	100
											Minimum	0.05	13
											Maximum	34.3	9,200
391736077473401	391736	774734	Jefferson	363		Waynesboro Fm.	64	68	48	20	2	3.20	740
391727077471801	391727	774718	Jefferson	125		Tomstown Dolomite	50	115	15	100	1	0.50	110
391233077483101	391233	774831	Jefferson	185	6	Harpers and Weverton Formations	20	185	50	135	1	0.15	33
391442077472201	391442	774722	Jefferson	110	6	Harpers and Weverton Formations.	17	110	30	80	1	0.21	48

Appendix. Specific capacity and transmissivity data segregated by aquifer for selected wells in West Virginia —Continued

[ddmmss, degrees-minutes-seconds of latitude and longitude; in., inches; e, estimated; ft, feet; gpm, gallons per minute; ft bls, feet below land surface; gpm/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day; Lit, from literature; N/D, not determined]

Site identification number or name	Latitude (ddmmss)	Longitude (ddmmss)	County	Well depth (ft)	Well diameter (in.)	Hydrogeologic Unit (Aquifer)	Discharge (gpm)	Production level (ft bls)	Static level (ft bls)	Draw-down (ft)	Test duration (hours)	Specific Capacity (gpm/ft)	Transmissivity (ft ² /d)
391539077455001	391539	774550	Jefferson	171	6	Harpers and Weverton Formation	2	171	65	106		0.02	5e
391542077454801	391542	774548	Jefferson	135	6	Harpers and Weverton Formations	5	50	30	20		0.25	67e
391623077471601	391623	774716	Jefferson	152	6	Harpers and Weverton Formations	33	62	50	12	1.5	2.75	620
391736077461101	391736	774611	Jefferson	212		Harpers and Weverton Formations	20	212	100	112	1	0.18	41
391819077445601	391819	774456	Jefferson	107		Harpers and Weverton Formations	40	107	44	63	0.25	0.63	130
Median												0.25	67
Minimum												0.02	5
Maximum												3.20	740

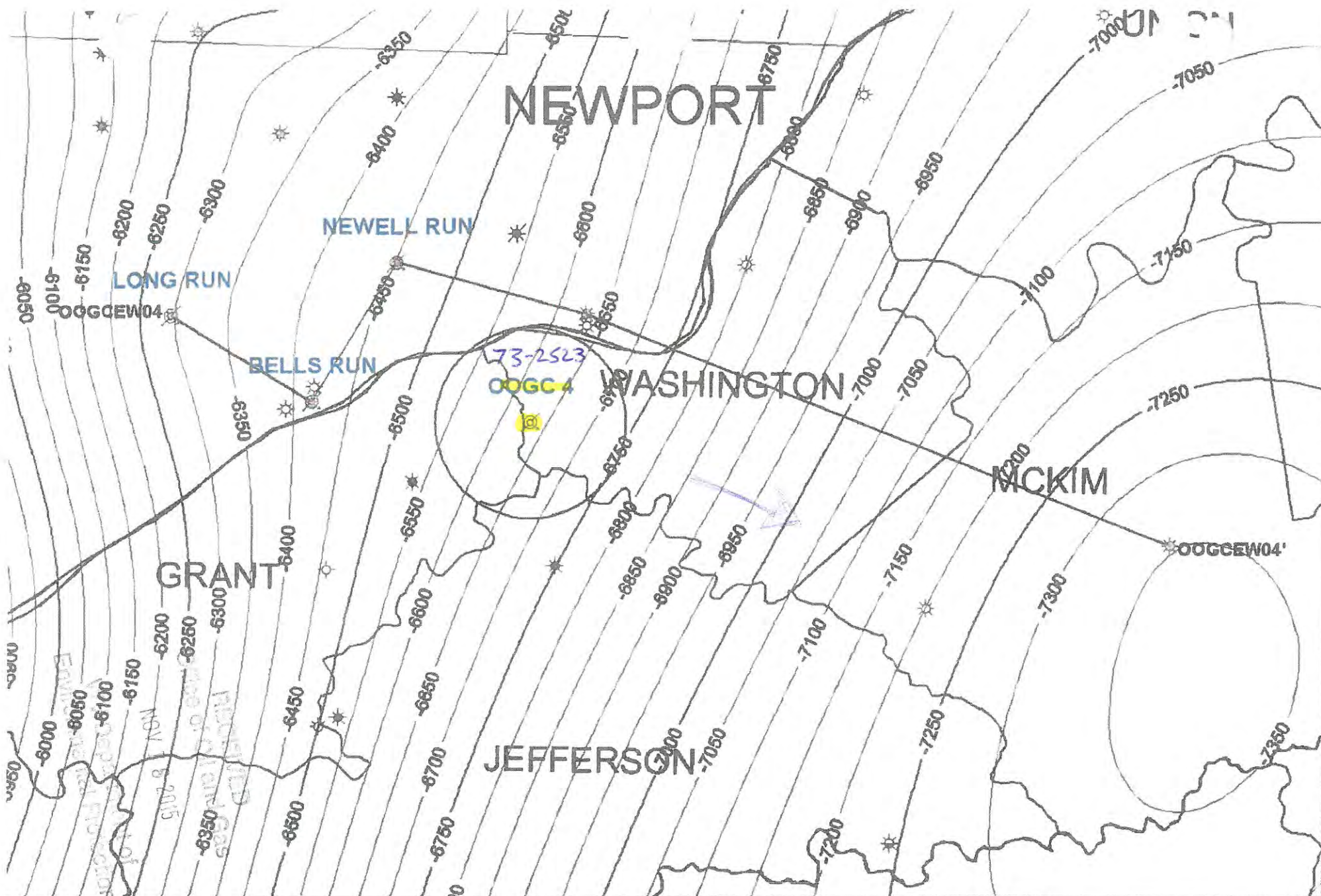
Received

K. Structural Contour Map of the injection formation

See attached Structural Contour map for the top of the Queenston Shale. The Queenston Shale is located just below the Isopach for the Medina Sandstone with proposed injection well identified as OOGC 4.

No structural anomalies were noted.

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NOV 18 2015
New Department of
Environmental Protection



OOGC DISPOSAL WELLS

Straight hole well

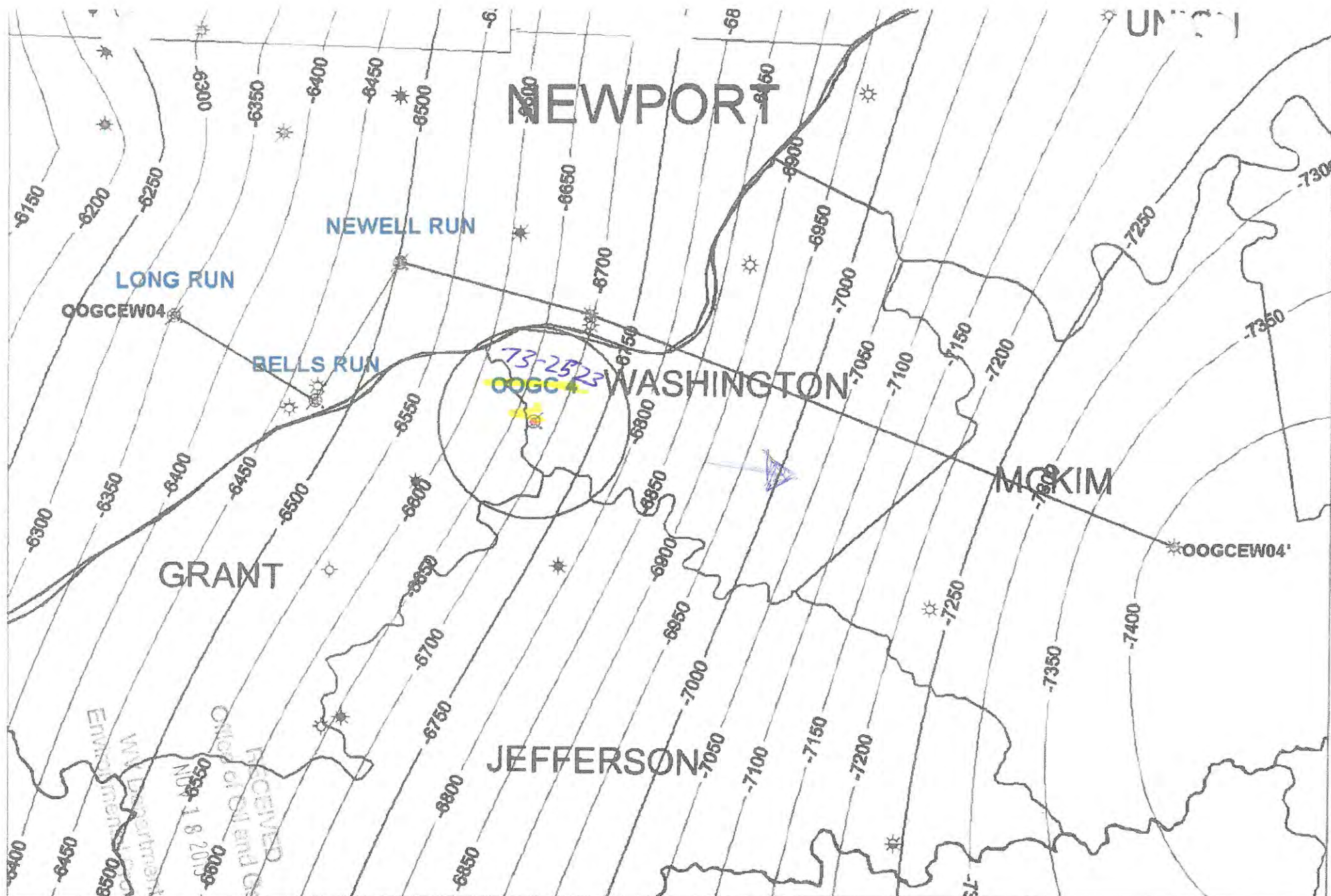
Well Status



APPALACHIAN CRUDE PURCHASERS, INC.

OOGC4 SWD LOCATION
CLINTON STRUCTURE BASE SUBSEA

Author: MCB C. I. = 50 FEET Date: 19 July 2010



OOGC DISPOSAL WELLS

Straight hole well

Well Status



APPALACHIAN CRUDE PURCHASERS, INC.

OOGC4 SWD LOCATION
MEDINA STRUCTURE BASE SURSEA

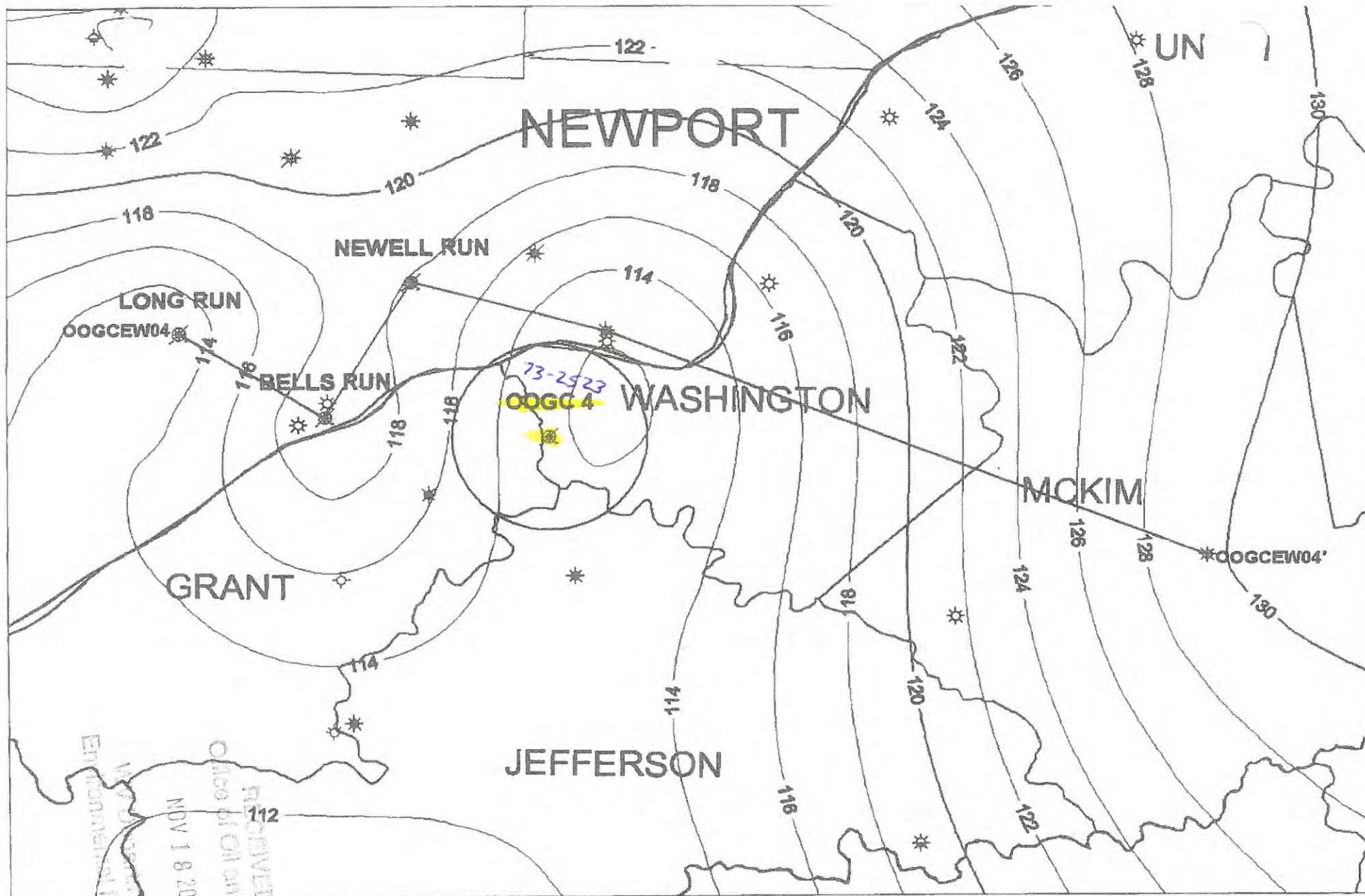
Author: MCB C.L. - 60 WEST Date: 19 July, 2010

L. Isopach map of the injection formation

See attached Isopach for the Medina Sandstone with proposed injection well identified as OOGC 4.

See attached Isopach for the Clinton Sandstone with proposed injection well identified as OOGC 4.

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Office of Oil and Gas
NOV 18 2015
WV Department of
Environmental Protection



OOGC DISPOSAL WELLS

Straight hole well

Well Status



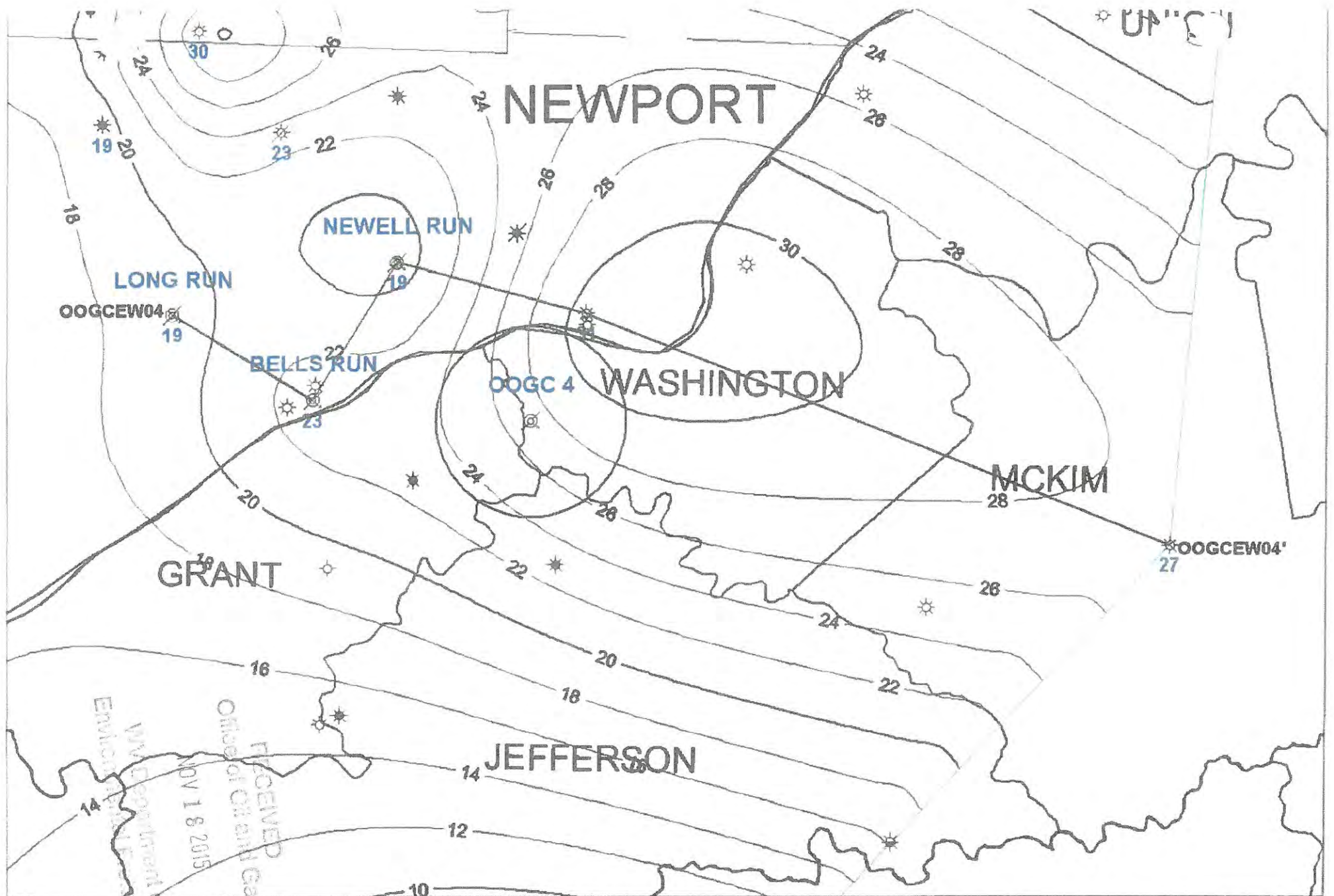
WATINJ



APPALACHIAN CRUDE PURCHASERS, INC.

OOGC4 SWD LOCATION
CLINTON GROSS ISOPACH

Author: HCB	E.I. = 2 FEET	Date: 21 Jan, 2010
Scale: See main box		



OOGC DISPOSAL WELLS

Straight hole well

Well Status



APPALACHIAN CRUDE PURCHASERS, INC.

OOGC4 SWD LOCATION
MEDINA CROSS ISOPACH

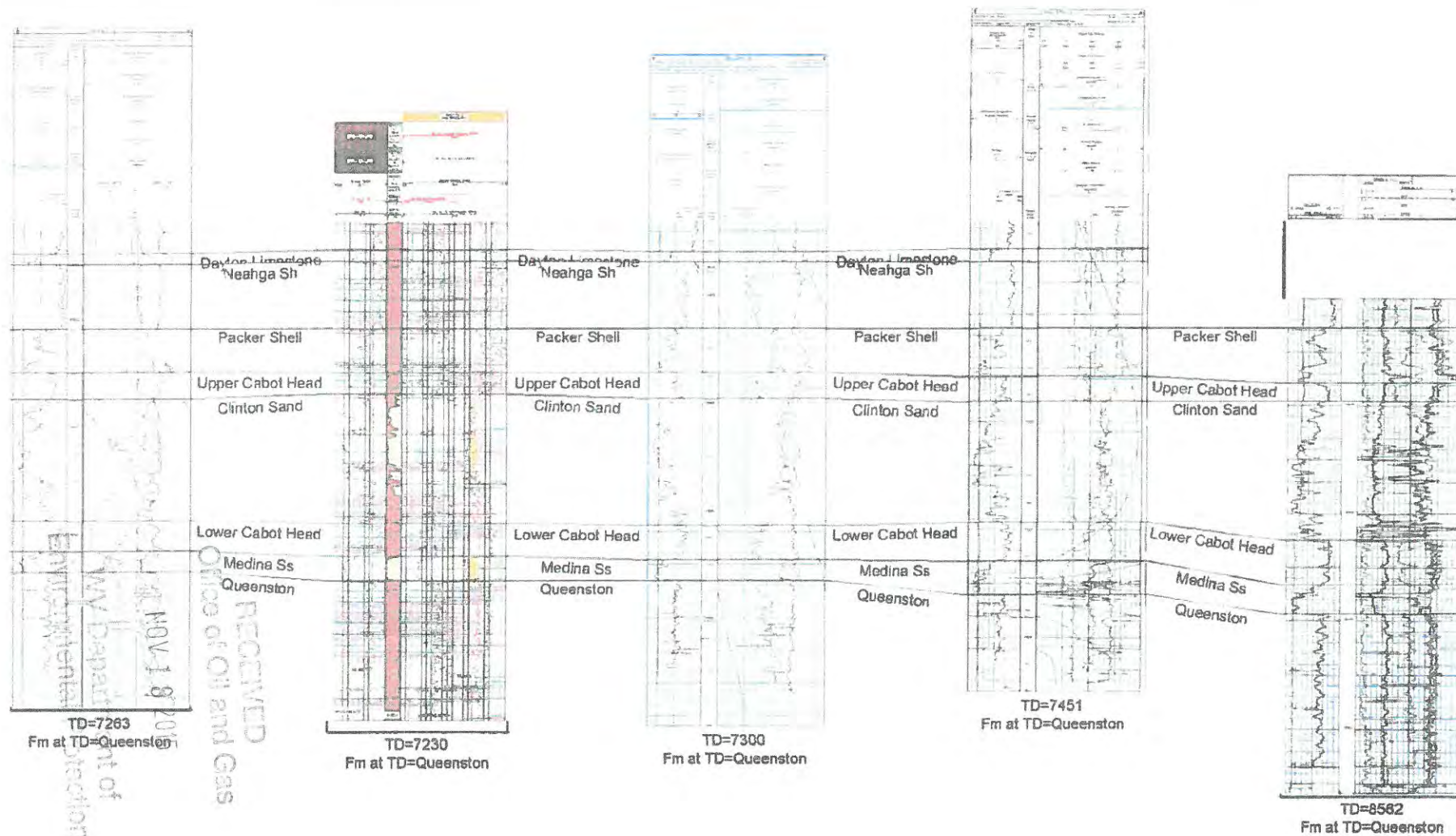
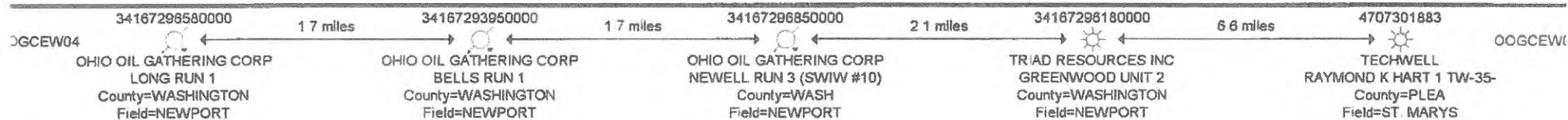
Author: MGE	C. I. = 2 FEET	Date: 29 April, 2010
-------------	----------------	----------------------

Stratigraphic Cross Section "C 4_SWD" : Equally Spaced Logs

Datum = Packer Shell

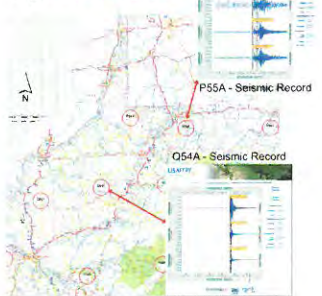
Vertical Scale = 1 in per 100 ft

OOGC4_SWD.xsd; 04/23/10



RECENT EARTHQUAKES IN WEST VIRGINIA

GLENVILLE EARTHQUAKE
7/20/2013 07:38:46 (local)
2.7 Magnitude
Depth: 69,225 ft $\pm$ 8,858 ft



Transportable Array Seismic Stations in WV

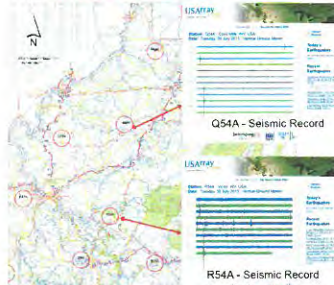
WVGES
GEOLOGY UNDERLIES IT ALL

Regional Structure Map (Ryder and others, 2008)



This earthquake is located within the Rome Trough fault zone. 69,000+ ft depth places it deep within the Trough, at or below the top of the crystalline basement rock and well below any sedimentary rock layers. NOTE: there are no injection wells in Gilmer County and this earthquake originated more than 10 miles below the Marcellus interval.

GLENVILLE EARTHQUAKE
7/30/2013 02:09:05 (local)
2.8 Magnitude
Depth: 41,666 ft $\pm$ 8,530 ft



Transportable Array Seismic Stations in WV

WVGES
GEOLOGY UNDERLIES IT ALL

Regional Structure Map (Ryder and others, 2008)



This second earthquake is located within the Rome Trough fault zone. 42,000 ft depth places it deep within the Trough, at or below the top of the crystalline basement rock and well below any sedimentary rock layers. NOTE: there are no injection wells in Gilmer County and this earthquake originated more than 6 miles below the Marcellus interval.

GLENVILLE EARTHQUAKE
8/16/2013 07:02:21 (local)
2.6 Magnitude
Depth: 20,013 ft $\pm$ 11,155 ft



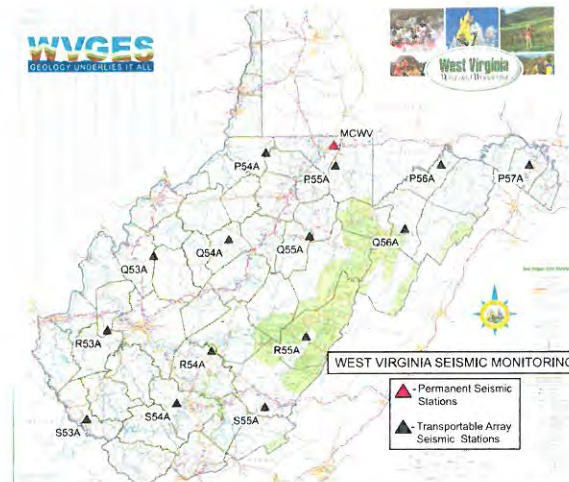
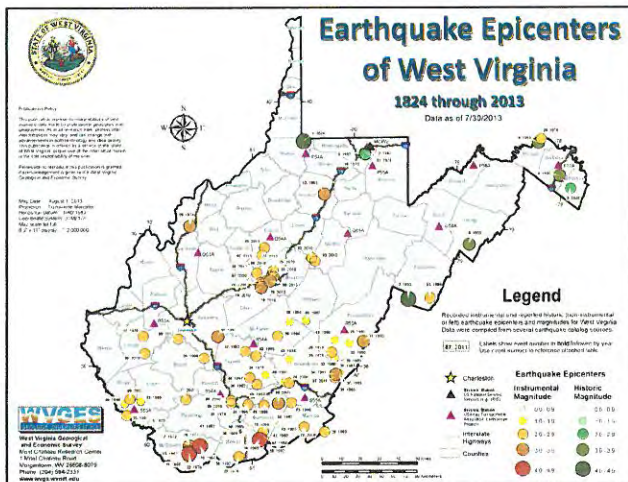
Transportable Array Seismic Stations in WV

WVGES
GEOLOGY UNDERLIES IT ALL

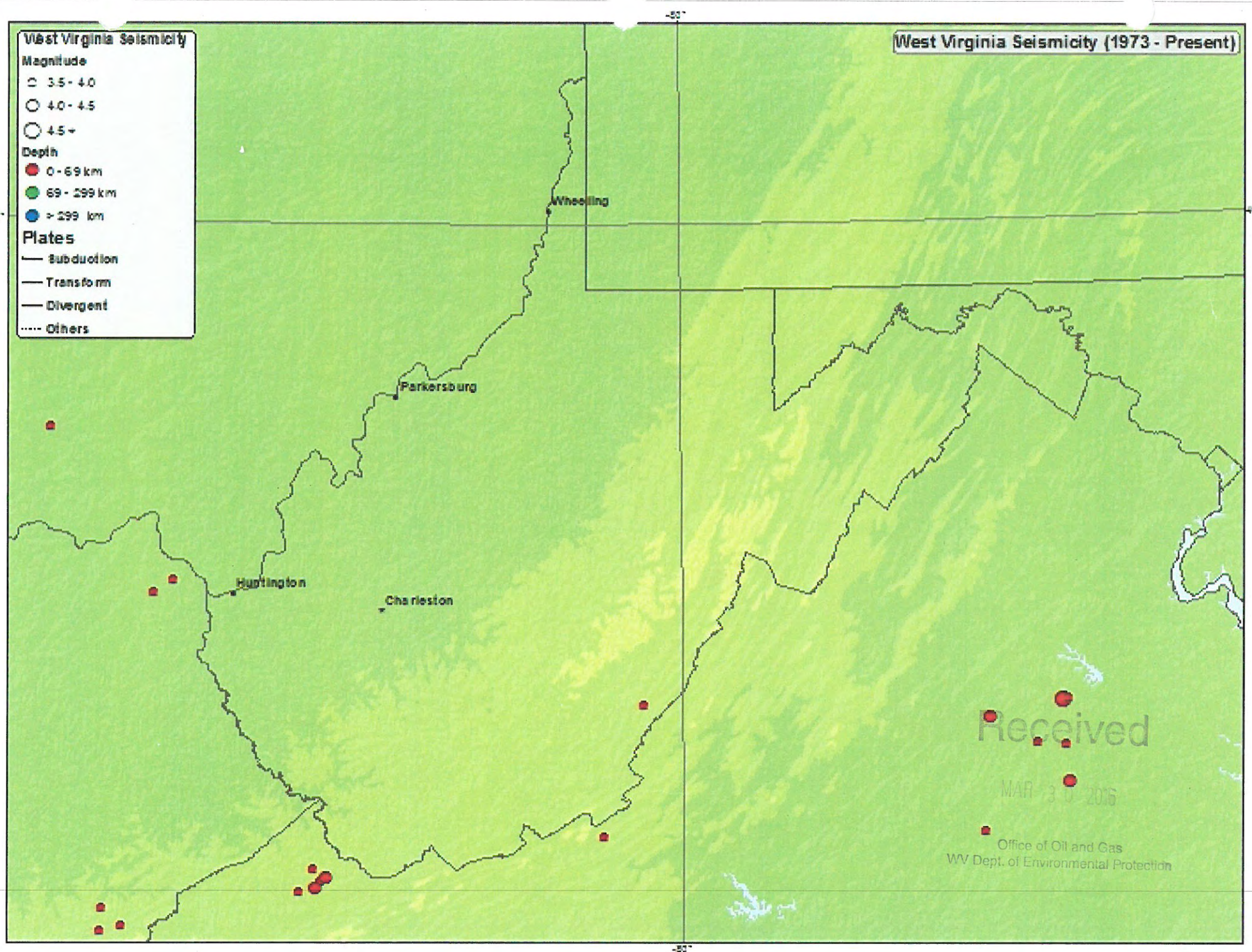
Regional Structure Map (Ryder and others, 2008)



This third earthquake is located within the Rome Trough fault zone. 20,000 ft depth places it deep within the Trough, at or slightly above the top of the crystalline basement rock and possibly within the lower sedimentary rock layers. NOTE: there are no injection wells in Gilmer County and this earthquake originated more than 2.5 miles below the Marcellus interval.

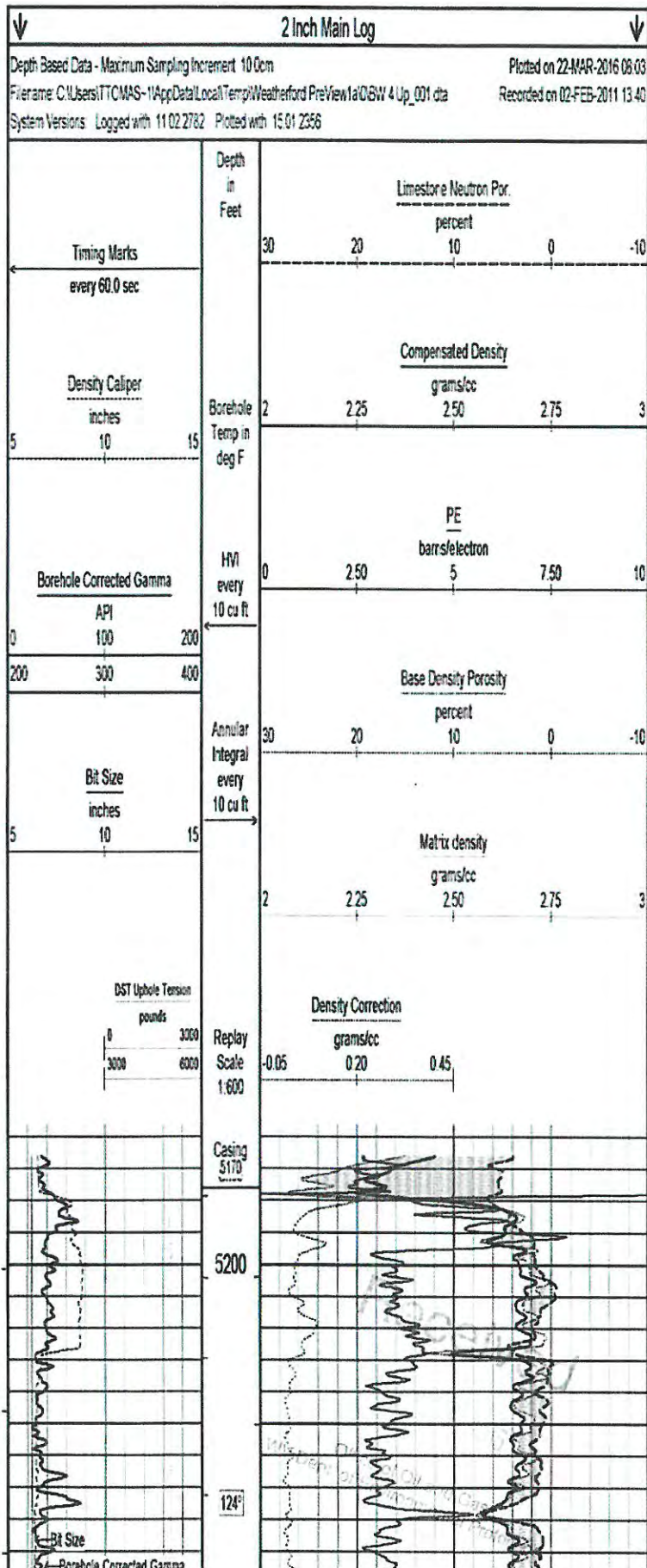
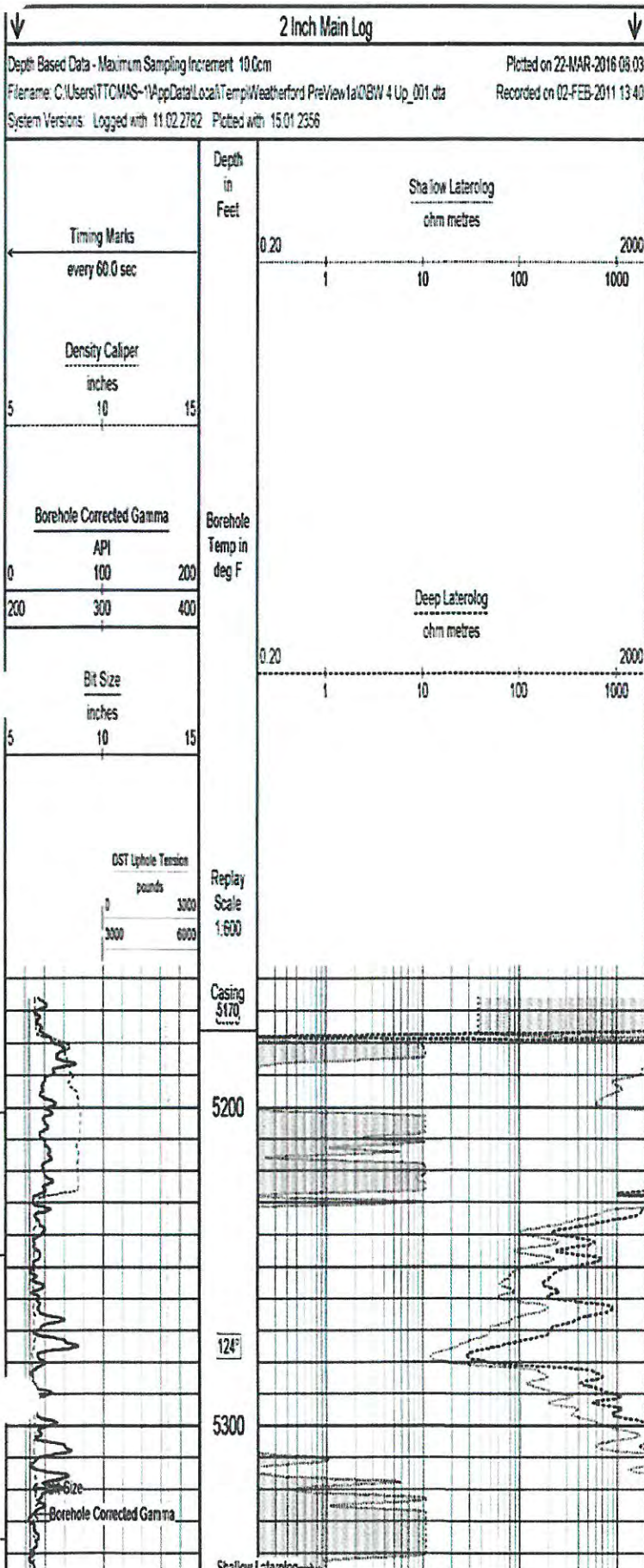


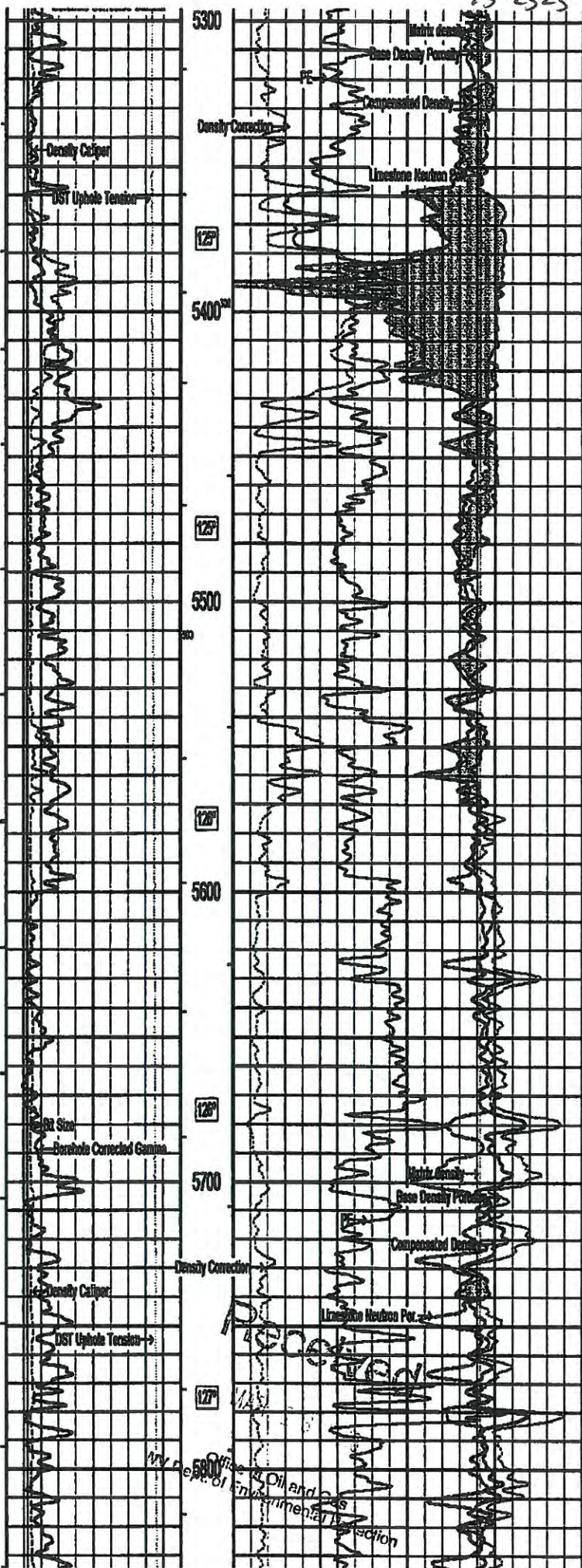
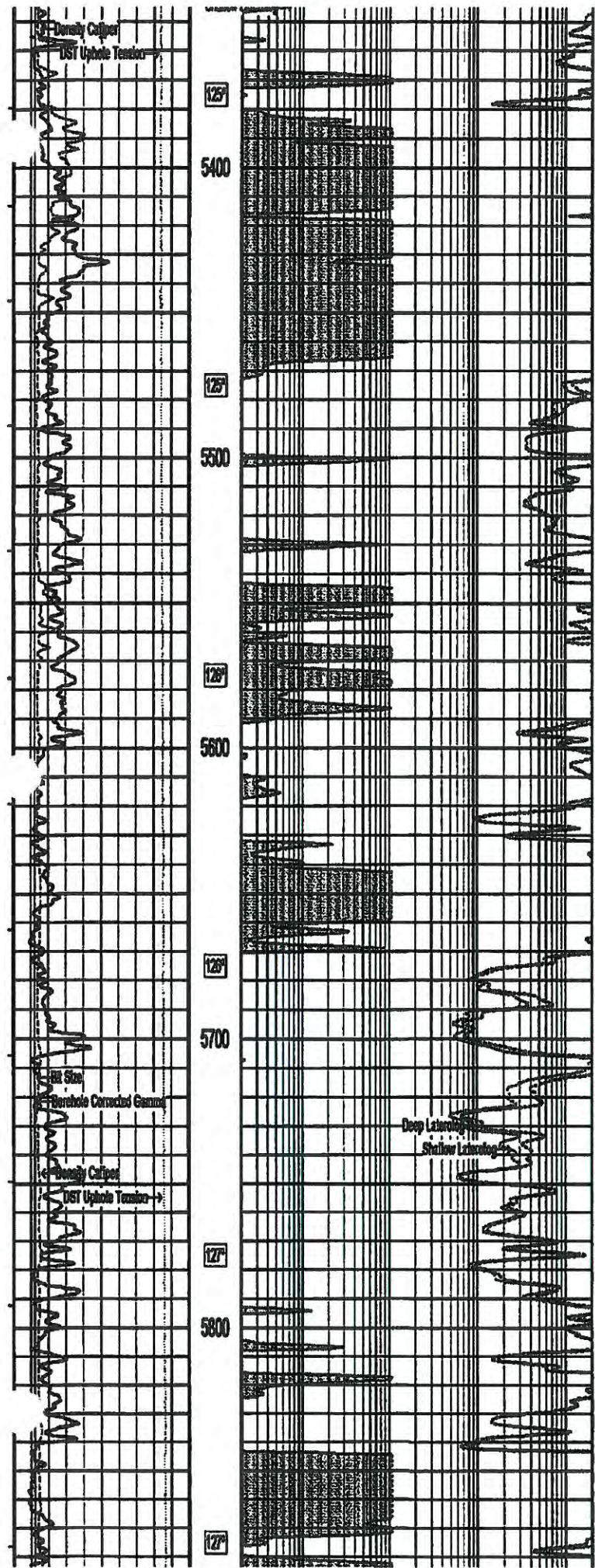
Office of Oil and Gas
WV Dept. of Environmental Protection



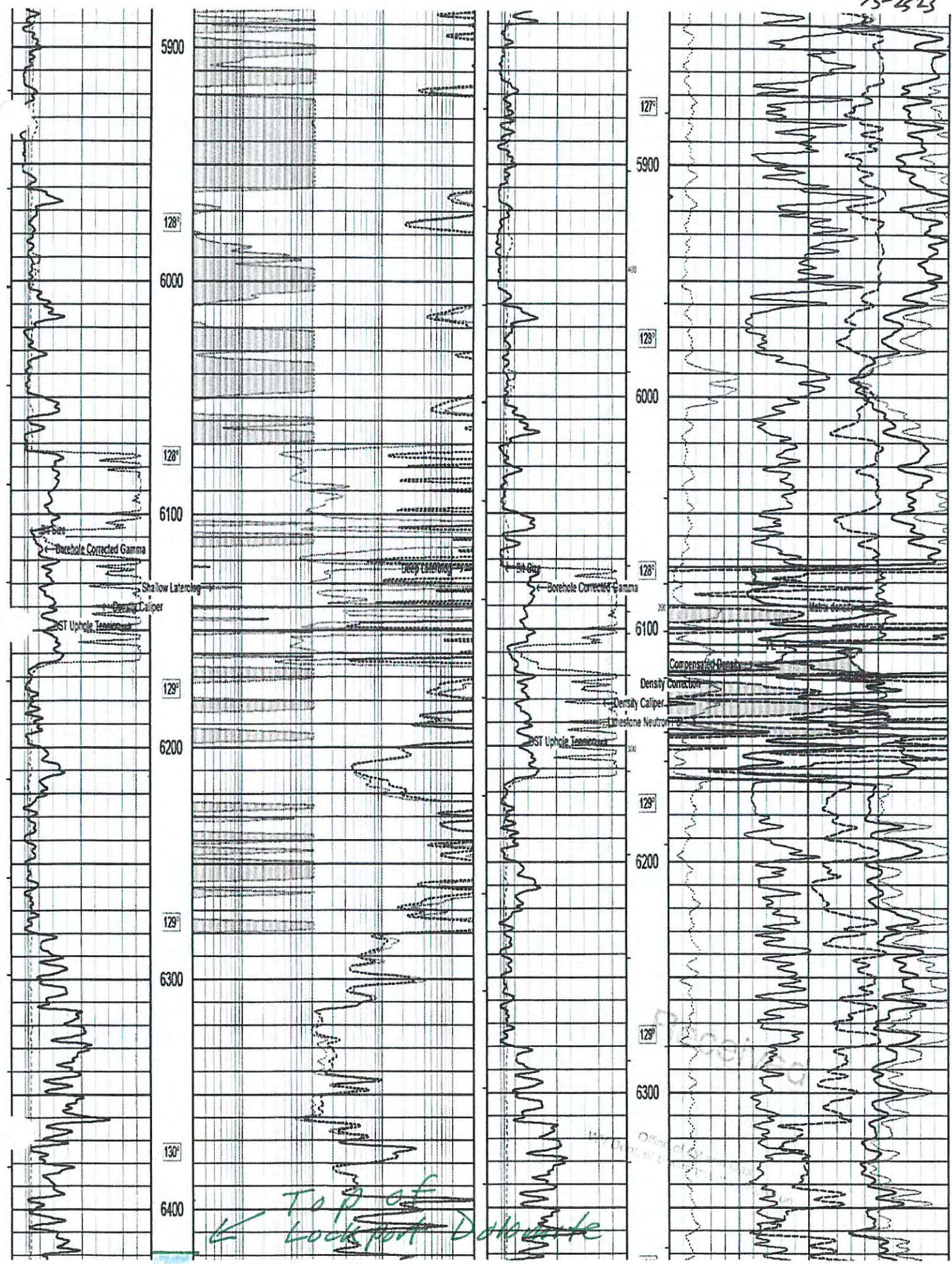
INTERPRETATION OR RECOMMENDATION, WHICH INTERPRETATIONS AND RECOMMENDATIONS SHOULD NOT, THEREFORE, UNDER ANY CIRCUMSTANCES BE RELIED UPON AS THE SOLE OR MAIN BASIS FOR ANY DRILLING, COMPLETION, WELL TREATMENT, PRODUCTION OR FINANCIAL DECISION, OR ANY PROCEDURE INVOLVING ANY RISK TO THE SAFETY OF ANY DRILLING ACTIVITY, DRILLING RIG OR ITS CREW OR ANY OTHER INDIVIDUAL. THE COMPANY HAS FULL RESPONSIBILITY FOR ALL DECISIONS CONCERNING THE SERVICES.

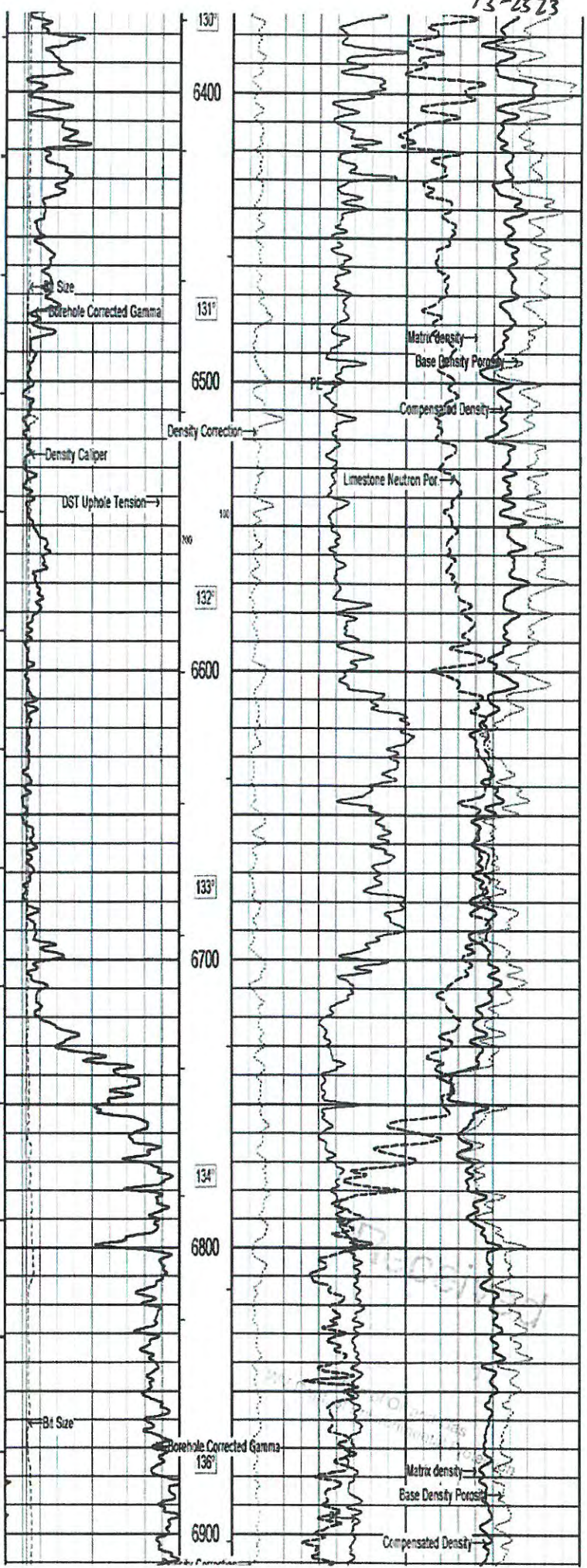
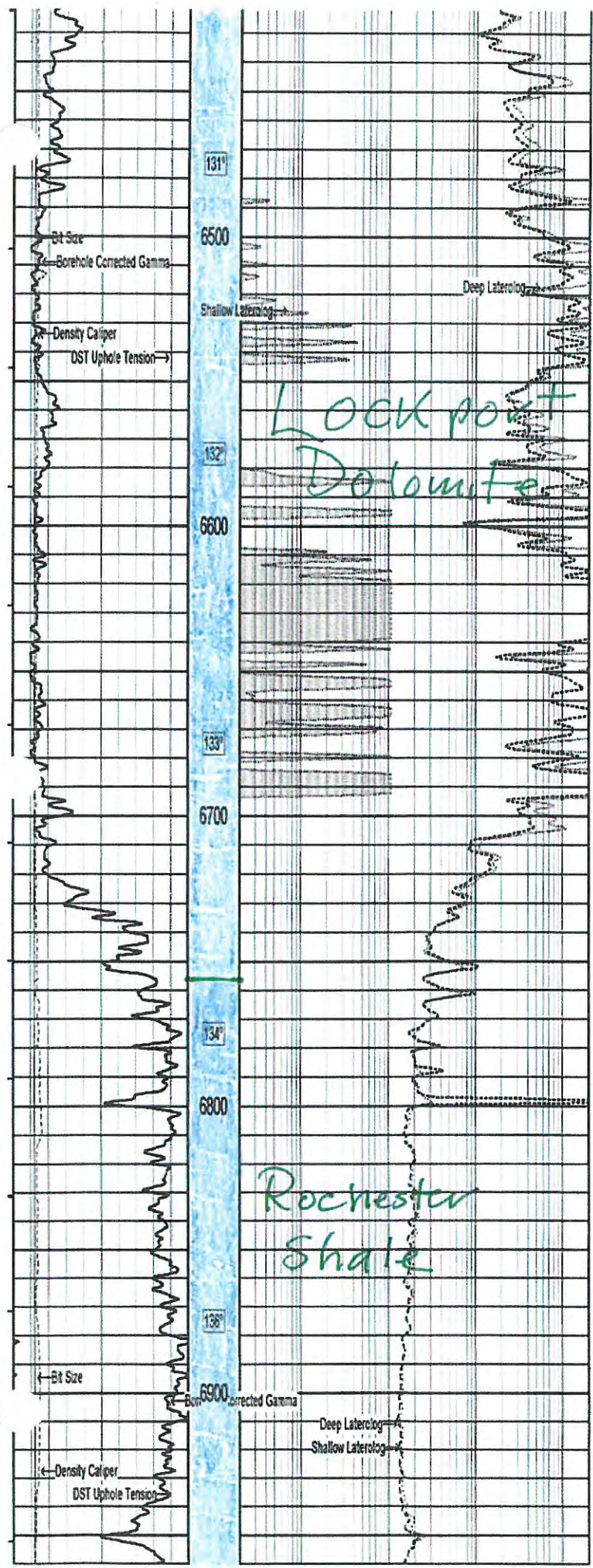
73-2523
INTERPRETATION OR RECOMMENDATION, WHICH INTERPRETATIONS AND RECOMMENDATIONS SHOULD NOT, THEREFORE, UNDER ANY CIRCUMSTANCES BE RELIED UPON AS THE SOLE OR MAIN BASIS FOR ANY DRILLING, COMPLETION, WELL TREATMENT, PRODUCTION OR FINANCIAL DECISION, OR ANY PROCEDURE INVOLVING ANY RISK TO THE SAFETY OF ANY DRILLING ACTIVITY, DRILLING RIG OR ITS CREW OR ANY OTHER INDIVIDUAL. THE COMPANY HAS FULL RESPONSIBILITY FOR ALL DECISIONS CONCERNING THE SERVICES.

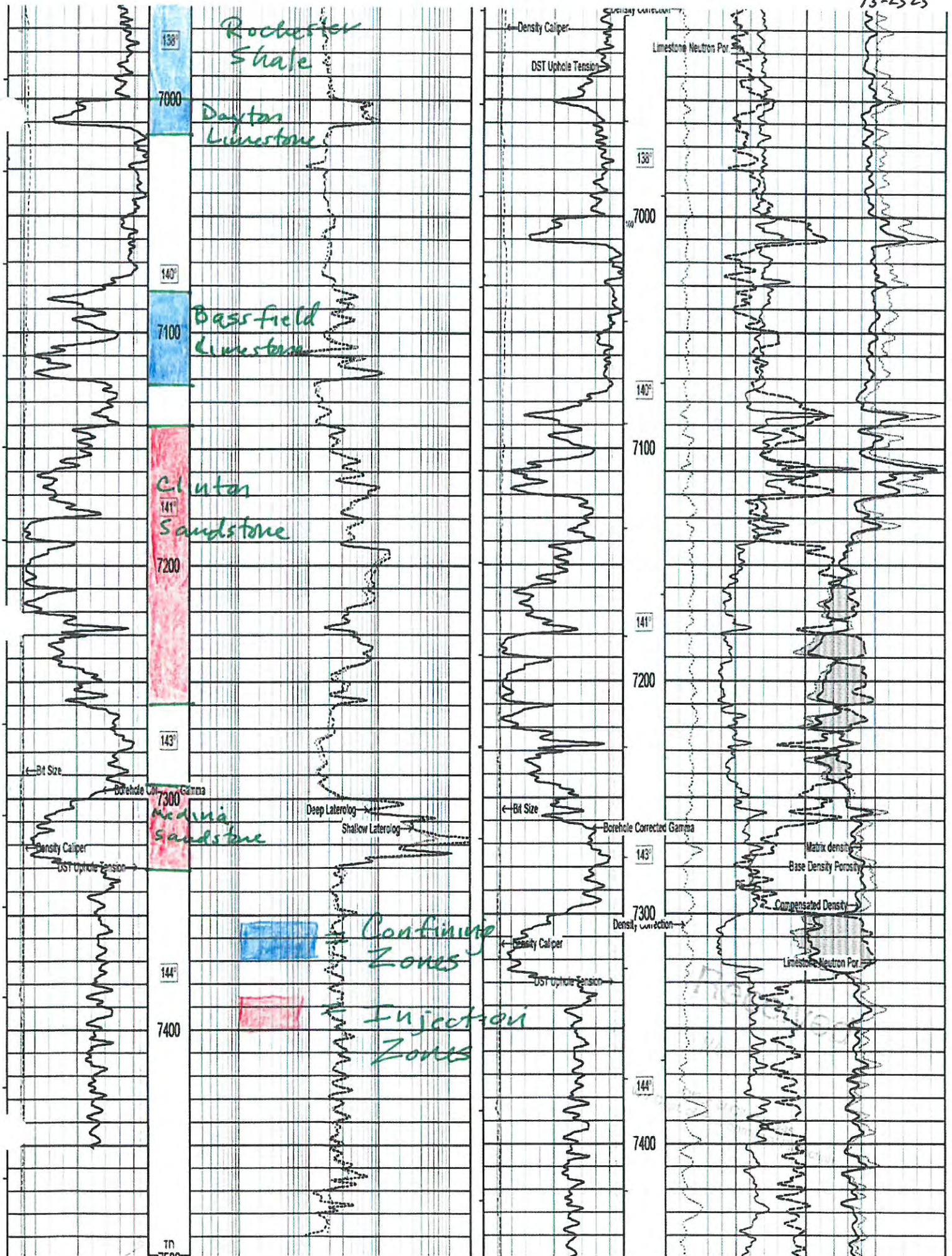




Two side-by-side log plots showing depth (5900 to 6400) versus various geophysical parameters. The left plot includes curves for Borehole Corrected Gamma, Shallow Laterolog, Density Caliper, and DST Uphole Temperature. The right plot includes curves for Borehole Corrected Gamma, Compensated Density, Density Correction, Density Caliper, Limestone Neutron, and DST Uphole Temperature. Both plots show a significant change in data around 6250 depth, marked by a green arrow and text "Top of Lockport Dolomite".







April 29, 2016

Ms. Michelle Taylor
Microbac Laboratories, Inc.
158 Starlite Drive
Marietta, OH 45750

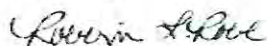
RE: Project: L16040397
Pace Project No.: 30179078

Dear Ms. Taylor:

Enclosed are the analytical results for sample(s) received by the laboratory on April 08, 2016. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,



Robbin Robl
robbin.robl@pacelabs.com
Project Manager

Enclosures

Received
APR 29 2016
Office of Oil and Gas
WV Dept. of Environmental Protection



REPORT OF LABORATORY ANALYSIS

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CERTIFICATIONS

Project: L16040397
Pace Project No.: 30179078

Pennsylvania Certification IDs

Georgia Certification #: C040
1638 Roseytown Rd Suites 2,3&4, Greensburg, PA 15601
L-A-B DOD-ELAP Accreditation #: L2417
Alabama Certification #: 41590
Arizona Certification #: AZ0734
Arkansas Certification
California Certification #: 04222CA
Colorado Certification
Connecticut Certification #: PH-0694
Delaware Certification
Florida/TNI Certification #: E87683
Georgia Certification #: C040
Guam Certification
Hawaii Certification
Idaho Certification
Illinois Certification
Indiana Certification
Iowa Certification #: 391
Kansas/TNI Certification #: E-10358
Kentucky Certification #: 90133
Louisiana DHH/TNI Certification #: LA140008
Louisiana DEQ/TNI Certification #: 4086
Maine Certification #: PA00091
Maryland Certification #: 308
Massachusetts Certification #: M-PA1457
Michigan/PADEP Certification
Missouri Certification #: 235

Montana Certification #: Cert 0082
Nebraska Certification #: NE-05-29-14
Nevada Certification #: PA014572015-1
New Hampshire/TNI Certification #: 2976
New Jersey/TNI Certification #: PA 051
New Mexico Certification #: PA01457
New York/TNI Certification #: 10888
North Carolina Certification #: 42706
North Dakota Certification #: R-190
Oregon/TNI Certification #: PA200002
Pennsylvania/TNI Certification #: 65-00282
Puerto Rico Certification #: PA01457
Rhode Island Certification #: 65-00282
South Dakota Certification
Tennessee Certification #: TN2867
Texas/TNI Certification #: T104704188-14-8
Utah/TNI Certification #: PA014572015-5
USDA Soil Permit #: P330-14-00213
Vermont Dept. of Health: ID# VT-0282
Virgin Island/PADEP Certification
Virginia/VELAP Certification #: 460198
Washington Certification #: C868
West Virginia DEP Certification #: 143
West Virginia DHHR Certification #: 9964C
Wisconsin Certification
Wyoming Certification #: 8TMS-L

Received
APR 30 2016

Office of Oil and Gas
WV Dept. of Environmental Protection

REPORT OF LABORATORY ANALYSIS

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SAMPLE SUMMARY

Project: L16040397
Pace Project No.: 30179078

Lab ID	Sample ID	Matrix	Date Collected	Date Received
30179078001	L16040397	Water	04/07/16 10:00	04/08/16 09:40

Received
APR 27 2016
Office of Oil and Gas
WV Dept. of Environmental Protection

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: L16040397
Pace Project No.: 30179078

Lab ID	Sample ID	Method	Analysts	Analytes Reported
30179078001	L16040397	EPA 901.1	MAH	2

Received
APR 16 2016
Office of Oil and Gas
West Virginia Department of Environmental Protection

REPORT OF LABORATORY ANALYSIS

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PROJECT NARRATIVE

Project: L16040397

Pace Project No.: 30179078

Method: EPA 901.1

Description: 901.1 Gamma Spec

Client: Microbac Laboratories, Inc.-OH

Date: April 29, 2016

General Information:

1 sample was analyzed for EPA 901.1. All samples were received in acceptable condition with any exceptions noted below or on the chain-of custody and/or the sample condition upon receipt form (SCUR) attached at the end of this report.

Hold Time:

The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:

All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:

All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:

All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

Received
APR 30 2016
Office of Oil and Gas
NY Department of Environmental Protection

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS - RADIOCHEMISTRY

Project: L16040397

Pace Project No.: 30179078

Sample: L16040397 **Lab ID: 30179078001** Collected: 04/07/16 10:00 Received: 04/08/16 09:40 Matrix: Water
PWS: Site ID: Sample Type:

Parameters	Method	Act ± Unc (MDC) Carr Trac	Units	Analyzed	CAS No.	Qual
Radium-226	EPA 901.1	4231.700 ± 646.700 (496.700) C:NA T:NA	pCi/L	04/28/16 15:44	13982-63-3	
Radium-228	EPA 901.1	910.220 ± 124.920 (82.610) C:NA T:NA	pCi/L	04/28/16 15:44	15262-20-1	

REPORT OF LABORATORY ANALYSIS

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Received
APR 28 2016
Office of Environmental Quality
West Virginia Department of Environmental Protection

QUALITY CONTROL - RADIOCHEMISTRY

Project: L16040397
Pace Project No.: 30179078

QC Batch: RADC/29112	Analysis Method: EPA 901.1
QC Batch Method: EPA 901.1	Analysis Description: 901.1 Gamma Spec
Associated Lab Samples: 30179078001	

METHOD BLANK: 1064258	Matrix: Water
Associated Lab Samples: 30179078001	

Parameter	Act ± Unc (MDC) Carr Trac	Units	Analyzed	Qualifiers
Radium-226	0.000 ± 100.120 (226.500) C:NA T:NA	pCi/L	04/25/16 14:04	
Radium-228	28.197 ± 34.858 (36.240) C:NA T:NA	pCi/L	04/25/16 14:04	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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Received
APR 27 2016
Office of Oil and Gas
WV Dept of Environmental Protection

QUALIFIERS

Project: L16040397
Pace Project No.: 30179078

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Act - Activity

Unc - Uncertainty: SDWA = 1.96 sigma count uncertainty, all other matrices = Expanded Uncertainty (95% confidence interval).

Gamma Spec = Expanded Uncertainty (95.4% Confidence Interval)

(MDC) - Minimum Detectable Concentration

Trac - Tracer Recovery (%)

Carr - Carrier Recovery (%)

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

REPORT OF LABORATORY ANALYSIS

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Received
APR 29 2016
Hazardous Waste and Gas
Environmental Protection

SUB-CONTRACTED ANALYSES

L#: L16040397

Shipped To: Pace

From: Microbac Laboratories Inc.
158 Starlite Park
Marietta, OH 45750
(740) 373-4071

Heensburg

Shipped Via: Fedex

Report To: Michelle Taylor

P.O. #: _____

TAT Required: _____

****See Chain of Custody for ID's, date and time collected.****

Microbac Workorder Number	Number of Samples	Analyses
L16040397	1 x3 bottles	RAD <u>ea</u>
Ref: SUB OUT L160403 Date: 07Apr16 Dep: Wgt: 12.35 LBS DV: 0.00 Svc: PRIORITY OVERNIGHT TRK: 4729 3639 0183 SHIPPING: 17.88 SPECIAL: 0.00 HANDLING: 0.00 TOTAL: 17.88		
WO#: 30179078 		

Level: 1 2 3 4

Internal COC: YES / NO

Relinquished By <u>Cara Strickland</u>	Date/Time <u>4/7/16 @1630</u>	Comments
Received By <u>[Signature]</u>	Date/Time <u>4/8/16 0940</u>	Cooler Temp <u>14</u>

Form 7-1
Revised 07/18/11

Received
APR 30 2016

Office of Oil and Gas
WV Dept. of Environmental Protection

[illegible]

→ Water (W), Soil (S), Solid Waste (SD), Unknown (X)



Sample Condition Upon Receipt

30179078

Client Name: WV Oil Gathering

Project # _____

Courier: ☒ Fed Ex ☐ UPS ☐ USPS ☐ Client ☐ Commercial ☐ Pace Other _____

Tracking #: 472936390193

Custody Seal on Cooler/Box Present: ☐ yes ☒ no Seals Intact: ☐ yes ☐ no Biological Tissue Is Frozen: Yes No

Packing Material: Bubble Wrap ☒ Bubble Bags _____ None _____ Other _____

Thermometer Used N/A Type of Ice: Wet Blue ☒ None ☐ Samples on Ice, cooling process has begun

Cooler Temp.: Observed Temp.: _____ °C Correction Factor: _____ °C Final Temp: _____ °C

Date and Initials of person examining contents: 4-8-16 NTV

Temp should be above freezing to 6°C			Comments:
Chain of Custody Present:	☒ Yes ☐ No ☐ N/A	1.	
Chain of Custody Filled Out:	☒ Yes ☐ No ☐ N/A	2.	
Chain of Custody Relinquished:	☒ Yes ☐ No ☐ N/A	3.	
Sampler Name & Signature on COC:	☐ Yes ☒ No ☐ N/A	4.	
Samples Arrived within Hold Time:	☒ Yes ☐ No ☐ N/A	5.	
Short Hold Time Analysis (<72hr):	☐ Yes ☒ No ☐ N/A	6.	
Rush Turn Around Time Requested:	☐ Yes ☒ No ☐ N/A	7.	
Sufficient Volume:	☒ Yes ☐ No ☐ N/A	8.	
Correct Containers Used:	☒ Yes ☐ No ☐ N/A	9.	
-Pace Containers Used:	☐ Yes ☒ No ☐ N/A		
Containers Intact:	☒ Yes ☐ No ☐ N/A	10.	
Filtered volume received for Dissolved tests	☐ Yes ☐ No ☒ N/A	11.	
Sample Labels match COC:	☒ Yes ☐ No ☐ N/A	12.	
-Includes date/time/ID/Analysis Matrix:	<u>WT</u>		
All containers needing preservation have been checked.	☒ Yes ☐ No ☐ N/A	13.	
All containers needing preservation are found to be in compliance with EPA recommendation.	☒ Yes ☐ No ☐ N/A		
exceptions: VOA, coliform, TOC, O&G, Phenols	☐ Yes ☒ No	Initial when completed	<u>NTV</u>
Samples checked for dechlorination:	☐ Yes ☐ No ☒ N/A	14.	
Headspace in VOA Vials (>6mm):	☐ Yes ☐ No ☒ N/A	15.	
Trip Blank Present:	☐ Yes ☐ No ☒ N/A	16.	
Trip Blank Custody Seals Present	☐ Yes ☐ No ☒ N/A		
Pace Trip Blank Lot # (if purchased):			

Client Notification/ Resolution: _____ Date/Time: _____

Person Contacted: _____

Comments/ Resolution: _____

Field Data Required? Y / N

Project Manager Review: Brian Moore Date: 4/12/16

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e. out of hold, incorrect preservative, out of temp, incorrect containers)

2D0732523 injectate collection point



© 2016 Google

Google earth

Imagery Date: 9/14/2015 29°22'11.88" N 81°17'26.35" W elev 635 ft eye alt 1805 ft

**APPALACHIAN OIL PURCHASERS LLC BRINE INJECTATE RADIUM 226 AND
RADIUM 228 SAMPLING LOCATION AT EUREKA STATION SURFACE FACILITY,
ST. MARYS, WEST VIRGINIA**

1. Attached is the Google Earth map showing the sampling location within the injection pump house at Appalachian Oil Purchasers LLC for the sampling of the brine injection oilfield fluid wastes being injected into both the BW#4 and Greens Run #1 Class II commercial disposal wells operated by Appalachian Oil Purchasers LLC. Samples were collected by EnLink employee, Garrett Fleming on April 7, 2016 for all required WV DEP, Office of Oil and Gas sampling requirements and constituents for injection fluids being disposed in the BW#4 and Greens Run #1 Class IID commercial disposal wells.
2. The sampling location in UTM NAD83 is 4357906.27 Northing and 474979.03 Easting.

Laboratory Report Number: L15070046

Derrick Lamp
Ohio Oil Gathering Corp.
157 Lower Eureka Lane
St. Mary's, WV 26170

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories. Review and compilation of your report was completed by Microbac's Ohio Valley Division (OVD). If you have any questions, comments, or require further assistance regarding this report, please contact your service representative listed below.

Laboratory Contact:
Michelle Taylor -- Client Services Specialist
(740) 373-4071
Michelle.Taylor@microbac.com

I certify that all test results meet all of the requirements of the accrediting authority listed below. All results for soil samples are reported on a 'dry-weight' basis unless specified otherwise. Analytical results for water and wastes are reported on a 'as received' basis unless specified otherwise. A statement of uncertainty for each analysis is available upon request. This laboratory report shall not be reproduced, except in full, without the written approval of Microbac Laboratories. The reported results are related only to the samples analyzed as received.

This report was certified on July 08 2015



David Vandenberg -- Managing Director

State of Origin: WV
Accrediting Authority: Department of Environmental Protection ID:361
QAPP: Microbac OVD



Microbac Laboratories * Ohio Valley Division
158 Starlite Drive, Marietta, OH 45750 * T: (740) 373-4071 F: (740) 373-4835 * www.microbac.com

RECEIVED
Office of Oil and Gas
NOV 18 2015
WV Department of
Environmental Protection

Record of Sample Receipt and Inspection

Comments/Discrepancies

This is the record of the shipment conditions and the inspection records for the samples received and reported as a sample delivery group (SDG). All of the samples were inspected and observed to conform to our receipt policies, except as noted below.

There were no discrepancies.

Discrepancy

Resolution

Coolers

Cooler #	Temperature Gun	Temperature	COC #	Airbill #	Temp Required?
0019990	H	6.0			X

Inspection Checklist

#	Question	Result
1	Were shipping coolers sealed?	NA
2	Were custody seals intact?	NA
3	Were cooler temperatures in range of 0-6?	Yes
4	Was ice present?	Yes
5	Were COC's received/information complete/signed and dated?	Yes
6	Were sample containers intact and match COC?	Yes
7	Were sample labels intact and match COC?	Yes
8	Were the correct containers and volumes received?	Yes
9	Were samples received within EPA hold times?	Yes
10	Were correct preservatives used? (water only)	Yes
11	Were pH ranges acceptable? (voa's excluded)	Yes
12	Were VOA samples free of headspace (less than 6mm)?	NA

RECEIVED
Office of Oil and Gas
NOV 18 2015
WV Department of
Environmental Protection

Lab Report #: L15070046

Lab Project #: 2167.005

Project Name: WV Oil

Lab Contact: Michelle Taylor

Samples Received

Client ID	Laboratory ID	Date Collected	Date Received
WV OIL-MONTHLY	L15070046-01	07/01/2015 08:45	07/01/2015 10:36

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Microbac Laboratories • Ohio Valley Division
158 Starlite Drive, Marietta, OH 45750 • T: (740)373-4071 F: (740)373-4835
www.microbac.com



Login Number: L15070046
Department: Metals
Analyst: Ji Hu

METHOD

Preparation: SW-846 3015

Analysis: SW-846 6010

HOLDING TIMES

Sample Preparation: All holding times were met.

Sample Analysis: All holding times were met.

PREPARATION

Sample preparation proceeded normally.

CALIBRATION

Initial Calibration: All acceptance criteria were met.

Alternate Source Standards: All acceptance criteria were met.

Interference Check Standards: All acceptance criteria were met.

Continuing Calibration Verification: All acceptance criteria were met.

Continuing Calibration Blank: All acceptance criteria were met.

BATCH QA/QC

Method Blank: All acceptance criteria were met.

Laboratory Control Sample: All acceptance criteria were met.

Serial Dilution/Post Digestion Spikes: WG530179 - All acceptance criteria were met.

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Matrix Spikes: All acceptance criteria were met.

SAMPLES

Samples: WG530179 - Due to the yellow color of the digestate, client sample 01 was analyzed at a dilution for all analytes.

Narrative ID: 101180

Approved By: Maren Beery

Maren Beery

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Certificate of Analysis

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: ICP-THERMO3
Client ID: WV OIL-MONTHLY	Prep Method: 3015	Prep Date: 07/06/2015 08:22
Matrix: Water	Analytical Method: 6010B	Cal Date: 07/07/2015 09:00
Workgroup #: WG530179	Analyst: JYH	Run Date: 07/07/2015 14:21
Collect Date: 07/01/2015 08:45	Dilution: 250	File ID: T3.070715.142121
Sample Tag: DL01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Barium, Total	7440-39-3	837		2.50	1.25
Iron, Total	7439-89-6	124		25.0	12.5
Manganese, Total	7439-96-5	10.8		2.50	1.25
Sodium, Total	7440-23-5	39600		125	62.5

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: TIAMO1
Client ID: WV OIL-MONTHLY	Prep Method: 9040C	Prep Date: N/A
Matrix: Water	Analytical Method: 9040C	Cal Date:
Workgroup #: WG529741	Analyst: SDC	Run Date: 07/01/2015 19:48
Collect Date: 07/01/2015 08:45	Dilution: 1	File ID: T1.070115.1948PH
Sample Tag: 01	Units: UNITS	

Analyte	CAS #	Result	Qual	RL	MDL
pH	10-29-7	5.76	H1	0.000	0.000
Temperature At Determination (C)				0.000	0.000
H1	Sample analysis performed past holding time.				

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: SMARTCHEM2
Client ID: WV OIL-MONTHLY	Prep Method: SM4500-Cl(-)-E-1997	Prep Date: N/A
Matrix: Water	Analytical Method: SM4500-Cl(-)-E-1997	Cal Date: 07/02/2015 12:29
Workgroup #: WG529827	Analyst: DCM	Run Date: 07/02/2015 12:33
Collect Date: 07/01/2015 08:45	Dilution: 1000	File ID: S2150702003.014
Sample Tag: DL01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Chloride	16887-00-6	45500		2000	1000

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Certificate of Analysis

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: OVEN
Client ID: WV OIL-MONTHLY	Prep Method: 160.1/SM2540C	Prep Date: N/A
Matrix: Water	Analytical Method: SM2540-C-1997	Cal Date:
Workgroup #: WG529817	Analyst: AWE	Run Date: 07/02/2015 12:37
Collect Date: 07/01/2015 08:45	Dilution: 1	File ID: EN.1507021237-08
Sample Tag:	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Total Dissolved Solids		141000		1000	500

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: TOC-VWP
Client ID: WV OIL-MONTHLY	Prep Method: 415.1	Prep Date: N/A
Matrix: Water	Analytical Method: 415.1	Cal Date: 05/27/2015 15:47
Workgroup #: WG529761	Analyst: DIH	Run Date: 07/02/2015 20:15
Collect Date: 07/01/2015 08:45	Dilution: 50	File ID: TC07022015.032
Sample Tag: DL01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Total Organic Carbon	TOC	603		50.0	25.0

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: OVEN
Client ID: WV OIL-MONTHLY	Prep Method: 160.2/SM2540D	Prep Date: N/A
Matrix: Water	Analytical Method: SM2540-D-1997	Cal Date:
Workgroup #: WG529708	Analyst: KAJ	Run Date: 07/01/2015 15:09
Collect Date: 07/01/2015 08:45	Dilution: 1	File ID: EN.1507011509-17
Sample Tag:	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Total Suspended Solids		194		5.00	2.50

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Ohio Valley Division Analyst List
July 8, 2015

001 - BIO-CHEM TESTING WVDEP 220	002 - REIC Consultants, Inc. WVDEP 060
003 - Sturm Environmental	004 - MICROBAC PITTSBURGH
005 - ES LABORATORIES	006 - ALCOSAN LABORATORIES
007 - ALS LABORATORIES	008 - BENCHMARK LABORATORIES
010 - MICROBAC CHICAGOLAND	AC - AMBER R. CARMICHAEL
ADC - ANTHONY D. CANTER	ADG - APRIL D. GREENE
AED - ALLEN E. DAVIS	ALS - ADRIANE L. STEED
AWE - ANDREW W. ESSIG	AZH - AFTER HOURS
BJO - BRIAN J. OGDEN	BKT - BRENDAN TORRENCE
BLG - BRENDA L. GREENWALT	BRG - BRENDA R. GREGORY
CAA - CASSIE A. AUGENSTEIN	CAF - CHERYL A. FLOWERS
CEB - CHAD E. BARNES	CJR - COURTNEY J. REXROAD
CLC - CHRYS L. CRAWFORD	CLS - CARA L. STRICKLER
CLW - CHARISSA L. WINTERS	CPD - CHAD P. DAVIS
CSH - CHRIS S. HILL	DAK - DEAN A. KETELSEN
DCM - DAVID C. MERCKLE	DEV - DAVID E. VANDENBERG
DIH - DEANNA I. HESSON	DLB - DAVID L. BUMGARNER
DLP - DOROTHY L. PAYNE	DLW - DIANA L. WRIGHT
DSM - DAVID S. MOSSOR	ECL - ERIC C. LAWSON
ENY - EMILY N. YOAK	EPT - ETHAN P. TIDD
ERP - ERIN R. PORTER	FJB - FRANCES J. BOLDEN
JBK - JEREMY B. KINNEY	JDH - JUSTIN D. HESSON
JDS - JARED D. SMITH	JJS - JOHN J. STE MARIE
JKP - JACQUELINE K. PARSONS	JLL - JOHN L. LENT
JMW - JEANA M. WHITE	JTP - JOSHUA T. PEMBERTON
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JYH - JI Y. HU	KAJ - KELLIE A. JOHNSON
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KEB - KATIE E. BARNES	KHR - KIM H. RHODES
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KRB - KAELY R. BECKER	KRP - KATHY R. PARSONS
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WRR - WESLEY R. RICHARDS	WTD - WADE T. DELONG
XXX - UNAVAILABLE OR SUBCONTRACT	

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List of Valid Qualifiers

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Qualkey: STD

Qualifier	Description
*	Surrogate or spike compound out of range
+	Correlation coefficient for the MSA is less than 0.995
<	Result is less than the associated numerical value.
>	Result is greater than the associated numerical value.
A	See the report narrative
B	Analyte present in method blank
B,H1	Analyte present in method blank. Sample analysis performed past holding time.
B1	Target analyte detected in method blank at or above the method reporting limit
B3	Target analyte detected in calibration blank at or above the method reporting limit
B4	The BOD unseeded dilution water blank exceeded 0.2 mg/L
C	Confirmed by GC/MS
CG	Confluent growth
CT1	The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
DL	Surrogate or spike compound was diluted out
E	Estimated concentration due to sample matrix interference
E,CT1	Estimated results. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
EDL	Elevated sample reporting limits, presence of non-target analytes
EMPC	Estimated Maximum Possible Concentration
F, S	Estimated result below quantitation limit; method of standard additions(MSA)
F,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
FL	Free Liquid
H1	Sample analysis performed past holding time.
H1,CT1	Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guidelines for reque
I	Semiquantitative result (out of instrument calibration range)
J	Estimated value; the analyte concentration was less than the RL/LOQ.
J,B	Analyte detected in both the method blank and sample above the MDL.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
J,P	Estimate; columns don't agree to within 40%
J,S	Estimated concentration; analyzed by method of standard addition (MSA)
L	Sample reporting limits elevated due to matrix interference
L1	The associated blank spike (LCS) recovery was above the laboratory acceptance limits.
L2	The associated blank spike (LCS) recovery was below the laboratory acceptance limits.
M	Matrix effect; the concentration is an estimate due to matrix effect.
N	Tentatively identified compound(TIC)
NA	Not applicable
ND	Not detected at or above the reporting limit (RL/MDL).
ND, B	Not detected at or above the reporting limit (RL). Analyte present in method blank.
ND, CT1	Analyte was not detected. The concentration is below the reported LOD. The cooler temperature at receipt exceeded reg
ND, L	Not detected; sample reporting limit (RL) elevated due to interference
ND, S	Not detected; analyzed by method of standard addition (MSA)
ND,H1	Not detected; Sample analysis performed past holding time.
ND,H1,CT1	Not detected; Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guide
NF	Not found by library search
NFL	No free liquid
NI	Non-ignitable
NR	Analyte is not required to be analyzed
NS	Not spiked
P	Concentrations >40% difference between the two GC columns
Q	One or more quality control criteria failed. See narrative.
QNS	Quantity of sample not sufficient to perform analysis
RA	Reanalysis confirms reported results
RE	Reanalysis confirms sample matrix interference
S	Analyzed by method of standard addition (MSA)
SMI	Sample matrix interference on surrogate
SP	Reported results are for spike compounds only
TIC	Library Search Compound
TNTC	Too numerous to count
TNTC, B	Too numerous to count. Analyte present in method blank.
TNTC,CT1	Too numerous to count. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
TNTC,H1	Too numerous to count. Sample analysis performed past holding time.
U	Analyte was not detected. The concentration is below the reported MDL.
UJ	Undetected; the MDL and RL are estimated due to quality control discrepancies.
UQ	Undetected; the analyte was analyzed for, but not detected.
W	Post-digestion spike for furnace AA out of control limits
X	Exceeds regulatory limit
X, S	Exceeds regulatory limit; method of standard additions (MSA)

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Qualkey: STD

Z Cannot be resolved from isomer - see below

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CHAIN-OF-CUSTODY RECORD

*Water (W), Soil (S), Solid Waste (SD), Unknown (X)

Page 11

Re: Proposed Brine Testing
UIC2D0732523

Dear Jamie,

As we discussed the other day, Appalachian Oil Purchasers, Inc. ("AOP") believes the above-referenced UIC permit is unclear with respect to AOP's obligations to sample and analyze the produced water which is brought to its permitted salt water disposal well (the "Facility") for disposal. In an effort to clarify this issue, AOP proposes the following procedure for the brine testing requirements for the Facility's UIC permit. Specifically, this proposal is in regards to Paragraph No. 27: "Permittee must ensure that monthly composite/representative fluid sample is taken from water brought to the facility from each operator and associated wells testing for pH, Iron, Manganese, Chlorides, Sodium, and Barium. Each sample must list the formation(s) that the water came from. Test Results must be submitted to the Office of Oil and Gas."

AOP proposes the following procedure to satisfy the sampling and reporting requirements of Paragraph No. 27:

- 1.) AOP will collect and analyze water from the line delivering fluids from the gathering facility to the salt water disposal well one time per month. The sample collected will be a monthly (e.g., 30 day) continuous composite sample and will be analyzed for the parameters listed in Paragraph No. 27. The continuous composite sample will be collected by setting the continuous sampling mechanism to collect an aliquot of fluid from the line on a regular basis throughout the month.
- 2.) AOP will collect and analyze water from the pipeline delivering fluids to the facility from outlying WV Gathering tanks one time per month. The sample collected will be a monthly (e.g., monthly) composite sample and will be analyzed for the parameters listed in Paragraph No. 27. The continuous composite sample will be collected by setting the continuous sampling mechanism to collect an aliquot of fluid from the pipeline on a regular basis throughout the month.
- 3.) Each oil or natural gas well that sends more than 300 barrels of produced water/brine to the Facility per month will be sampled and analyzed for the parameters listed in Paragraph No. 27 one time no later than 30 days after first sending produced water to the Facility. Oil or natural gas wells which are expected to send more than 300 barrels of produced water/brine to the Facility per month when it begins operation, will, to the extent practicable, be sampled and analyzed prior to the initiation of injection. The sampling discussed in this paragraph will be a one-time event to create a profile of the brine produced by that well and no additional sampling of the brine from that well will be required.
- 4.) AOP will identify and document the wells which are the source and the associated producing formation(s) for all brine delivered to the Facility.

E. Detailed Analysis of fluids to be injected including specific gravity

From Composite Eureka Station Gathering Facility Sample Collected 04/29/2010 – Source: prior to filtering (See Attached)

pH	6.05
Total Dissolved Solids (TDS)	181,000
Total Suspended Solids (TSS)	494 mg/l
Aluminum	0.211 mg/l
Arsenic	0.139 mg/l
Barium	317 mg/l
Cadmium	not detected
Chromium	not detected
Iron	43.8 mg/l
Lead	not detected
Magnesium	2,840 mg/l
Manganese	5.28 mg/l
Potassium	1,560 mg/l
Sodium	24,200 mg/l
Zinc	0.228 mg/l
Surfactants	19.4 mg/l
Total Kjeldahl Nitrogen	97.0 mg/l
Oil and Grease (HEM)	23.5 mg/l
Total Organic Carbon (TOC)	914 mg/l
Chemical Oxygen Demand(COD)	9,510 mg/l
Acidity	683 mg/l
Chloride	107,000 mg/l
Sulfate	41.6 mg/l
Cyanide	not detected
Phenols (Total Phenolics)	0.0102
Calcium	14,900
BNA – Extractables	see attached 8270 (only Benzyl alcohol 111 ug/l)
Purgeable Aromatics	see attached 8270 (everything else not detected)
Purgeable Halocarbons	8015C (GRO gasoline range organics)
PCBS	see attached 8082 – not detected
Specific Gravity	1.120 (needs redone by Microbac)

Note: Appalachian Oil Purchasers proposes to install an inline sampling device. The intent is to catch regular samples from the injection stream over the course of a month and then have sample analyzed as necessary. Appalachian Oil Purchasers may utilize Champion Technologies to provide levels of Calcium, Magnesium, Barium, Sodium, Chlorides, Sulfates, Bicarbonates, CO₂, TDS, pH, specific gravity, temperature, and pressure.

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LABORATORY REPORT

L10040760

05/11/10 16:09

Submitted By

Microbac Laboratories Inc.
158 Starlite Drive
Marietta, OH 45750
(740) 373-4071
For

Account Name: Ohio Oil Gathering Corp.
Box 430

Frazzysburg, OH 43822
Attention: Mike McKee

Project Number: 2167.001
Project: Misc Samples
Site:

Sample Summary

Client ID	Lab ID	Date Collected	Date Received
INJECTION FLUID	L10040760-01	04/29/2010 09:00	04/29/2010

LI_A_PROD_COVER - Modified 02/06/2008
PDF File ID: 1661472
Report generated: 05/11/2010 16:09



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Microbac Laboratories Inc.

Report Number: L10040760
Report Date: May 11, 2010

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WQ329969
Collect Date: 04/29/2010 09:00
Sample Tag: 01

PrePrep Method: NONE
Prep Method: 3005A
Analytical Method: 6010B
Analyst: PDM
Dilution: 1
Units: mg/L

Instrument: PE-ICP2
Prep Date: 04/30/2010 07:44
Cal Date: 04/30/2010 13:57
Run Date: 04/30/2010 18:18
File ID: P2.043010.181828

Analyte	CAS. Number	Result	Qual	RL	MDL
Aluminum, Total	7429-90-5	0.221		0.100	0.0500
Arsenic, Total	7440-38-2	0.135		0.100	0.0100
Cadmium, Total	7440-43-9		ND	0.0100	0.00250
Chromium, Total	7440-47-3		ND	0.0200	0.00250
Iron, Total	7439-89-6	43.8		0.100	0.0250
Manganese, Total	7439-96-5	5.28		0.0300	0.00500
Zinc, Total	7440-66-6	0.228		0.0200	0.00500

ND Not detected at or above the reporting limit (RL).

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WQ329969
Collect Date: 04/29/2010 09:00
Sample Tag: DL01

PrePrep Method: NONE
Prep Method: 3005A
Analytical Method: 6010B
Analyst: PDM
Dilution: 2
Units: mg/L

Instrument: PE-ICP2
Prep Date: 04/30/2010 07:44
Cal Date: 05/03/2010 10:29
Run Date: 05/03/2010 15:48
File ID: P2.050310.154811

Analyte	CAS. Number	Result	Qual	RL	MDL
Lead, Total	7439-92-1		ND	0.100	0.0200

ND Not detected at or above the reporting limit (RL).

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WQ329969
Collect Date: 04/29/2010 09:00
Sample Tag: DL02

PrePrep Method: NONE
Prep Method: 3005A
Analytical Method: 6010B
Analyst: PDM
Dilution: 100
Units: mg/L

Instrument: PE-ICP2
Prep Date: 04/30/2010 07:44
Cal Date: 05/03/2010 10:29
Run Date: 05/03/2010 15:54
File ID: P2.050310.155408

Analyte	CAS. Number	Result	Qual	RL	MDL
Barium, Total	7440-39-3	317		1.00	0.250
Calcium, Total	7440-70-2	14900		20.0	10.0
Magnesium, Total	7439-95-4	2840		50.0	25.0
Potassium, Total	7440-09-7	1560		100	25.0

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WQ329969
Collect Date: 04/29/2010 09:00
Sample Tag: DL03

PrePrep Method: NONE
Prep Method: 3005A
Analytical Method: 6010B
Analyst: PDM
Dilution: 1000
Units: mg/L

Instrument: PE-ICP2
Prep Date: 04/30/2010 07:44
Cal Date: 05/04/2010 10:45
Run Date: 05/04/2010 13:48
File ID: P2.050410.134835

Analyte	CAS. Number	Result	Qual	RL	MDL
Sodium, Total	7440-23-5	24200		500	250

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Report Number: L10040760
Report Date: May 11, 2010

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: MG110019
Collect Date: 04/29/2010 09:00
Sample Tag: 01

PrePrep Method: NONE
Prep Method: 3510C
Analytical Method: 8082
Analyst: ECL
Dilution: 1
Units: ug/L

Instrument: BP9
Prep Date: 04/30/2010 13:00
Cal Date: 05/02/2010 13:14
Run Date: 05/07/2010 16:10
File ID: 9GR56244.R

Analyte	CAS Number	Result	Qual	RL	MDL
Aroclor-1016	12674-11-3	ND	0.526	0.263	
Aroclor-1221	11104-20-2	ND	0.526	0.263	
Aroclor-1232	11141-16-5	ND	0.526	0.263	
Aroclor-1242	53469-21-9	ND	0.526	0.263	
Aroclor-1248	12672-39-6	ND	0.526	0.263	
Aroclor-1254	11097-69-1	ND	0.526	0.263	
Aroclor-1260	11096-82-5	ND	0.526	0.263	
Surrogate	% Recovery	Lower	Upper	Qual	
2,4,5,6-Tetrachloro-m-xylene	52.8	30	132		
Decachlorobiphenyl	58.6	36	144		

ND Not detected at or above the reporting limit (RL).

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: MG129856
Collect Date: 04/29/2010 09:00
Sample Tag: DL01

PrePrep Method: NONE
Prep Method: 3510C
Analytical Method: 8270C
Analyst: CAA
Dilution: 10
Units: ug/L

Instrument: BPH54
Prep Date: 04/29/2010 13:20
Cal Date: 04/29/2010 18:18
Run Date: 05/01/2010 19:01
File ID: 4MS0773

Analyte	CAS Number	Result	Qual	RL	MDL
1,2,4-Trichlorobenzene	120-82-1	ND	52.6	26.3	
1,2-Dichlorobenzene	95-50-1	ND	52.6	26.3	
1,3-Dichlorobenzene	541-73-1	ND	52.6	26.3	
1,4-Dichlorobenzene	106-46-7	ND	52.6	26.3	
2,4,5-Trichlorophenol	95-95-4	ND	52.6	26.3	
2,4,6-Trichlorophenol	88-06-2	ND	52.6	26.3	
2,4-Dichlorophenol	120-83-2	ND	52.6	26.3	
2,4-Dimethylphenol	105-67-9	ND	52.6	26.3	
2,4-Dinitrophenol	51-28-5	ND	263	132	
2,6-Dinitrotoluene	121-14-2	ND	52.6	26.3	
2,6-Dinitrotoluene	606-20-2	ND	52.6	26.3	
2-Chloronaphthalene	91-58-7	ND	52.6	26.3	
2-Chlorophenol	95-57-9	ND	52.6	26.3	
2-Methylnaphthalene	91-57-6	ND	52.6	26.3	
2-Methylphenol	95-48-7	ND	52.6	26.3	
2-Nitroaniline	88-74-4	ND	263	132	
2-Nitrophenol	88-75-5	ND	52.6	26.3	
3,3'-Dichlorobenzidine	91-94-1	ND	105	26.3	
3,4-Methylphenol	106-44-5	ND	52.6	26.3	
3-Nitroaniline	99-09-2	ND	263	132	
4,6-Dinitro-2-methylphenol	534-52-1	ND	263	132	
4-Bromophenyl-phenylether	103-55-3	ND	52.6	26.3	
4-Chloro-3-methylphenol	59-50-7	ND	52.6	26.3	
4-Chloroaniline	106-47-8	ND	52.6	26.3	
4-Chlorophenyl-phenyl ether	7005-72-3	ND	52.6	26.3	
4-Nitroaniline	100-01-6	ND	263	132	
4-Nitrophenol	100-02-7	ND	263	132	
Acenaphthene	83-32-9	ND	52.6	26.3	
Acenaphthylene	208-96-8	ND	52.6	26.3	
Anthracene	120-12-7	ND	52.6	26.3	
Benzo(a)anthracene	56-55-3	ND	52.6	26.3	
Benzo(a)pyrene	50-32-0	ND	52.6	26.3	
Benzo(b)fluoranthene	205-99-2	ND	52.6	26.3	
Benzo(g,h,i)Perylene	131-24-2	ND	52.6	26.3	
Benzo(k)fluoranthene	207-08-9	ND	52.6	26.3	
Benzoic acid	65-85-0	ND	263	132	

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Report Number: L10040760
Report Date: May 11, 2010

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG329856
Collect Date: 04/29/2010 09:00
Sample Tag: DL01

PrePrep Method: NONE
Prep Method: 5010C
Analytical Method: 8270C
Analyst: CAA
Dilution: 10
Units: ug/L

Instrument: HPMS4
Prep Date: 04/29/2010 13:20
Cal Date: 04/29/2010 18:18
Run Date: 05/01/2010 19:01
File ID: 4MS0773

Analyte	CAS Number	Result	Qual	RL	NDL
Benzyl Alcohol	100-51-6	111		52.6	26.3
Bis(2-Chloroethoxy)Methane	111-91-1	ND		52.6	26.3
Bis(2-Chloroethyl)ether	111-44-4	ND		52.6	26.3
Bis(2-Chloroisopropyl)ether	108-60-1	ND		52.6	26.3
Bis(2-Ethylhexyl)phthalate	117-81-7	ND		105	31.6
Butylbenzylphthalate	95-69-7	ND		52.6	26.3
Chrysene	218-01-9	ND		52.6	26.3
Di-N-Butylphthalate	84-74-2	ND		52.6	26.3
Di-n-octylphthalate	117-84-0	ND		52.6	26.3
Dibenzo(a,h)Anthracene	53-70-3	ND		52.6	26.3
Dibenzofuran	132-64-9	ND		52.6	26.3
Diethylphthalate	84-66-2	ND		52.6	26.3
Dimethylphthalate	131-11-3	ND		52.6	26.3
Fluoranthene	206-44-0	ND		52.6	26.3
Fluorene	86-73-7	ND		52.6	26.3
Hexachlorobenzene	118-74-1	ND		52.6	26.3
Hexachlorobutadiene	87-68-3	ND		52.6	26.3
Hexachlorocyclopentadiene	77-47-4	ND		52.6	26.3
Hexachloroethane	67-72-1	ND		52.6	26.3
Indeno(1,2,3-cd)pyrene	193-39-5	ND		52.6	26.3
Iscophorone	78-59-1	ND		52.6	26.3
N-Nitrosodiphenylamine	86-30-6	ND		52.6	26.3
N-Nitrosodipropylamine	621-64-7	ND		52.6	26.3
Naphthalene	91-20-3	ND		52.6	26.3
Nitrobenzene	98-95-3	ND		52.6	26.3
Pentachlorophenol	87-86-5	ND		263	132
Phenanthrene	85-01-8	ND		52.6	26.3
Phenol	108-95-2	ND		52.6	26.3
Pyrene	129-00-0	ND		52.6	26.3

Surrogate	% Recovery	Lower	Upper	Qual
2,4,6-Tribromophenol	83.3	10	123	
2-Fluorobiphenyl	74.9	43	118	
2-Fluorophenol	35.6	21	100	
Nitrobenzene-d5	72.3	35	114	
p-Terphenyl-d14	79.4	33	141	
Phenol-d5	66.3	10	94	

ND Not detected at or above the reporting limit (RL).

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG330169
Collect Date: 04/29/2010 09:00
Sample Tag: DL01

PrePrep Method: NONE
Prep Method: 5030C/5035A
Analytical Method: 8015C
Analyst: PDM
Dilution: 10
Units: ug/L

Instrument: SP3
Prep Date: 05/06/2010 00:57
Cal Date: 01/11/2010 19:10
Run Date: 05/06/2010 00:57
File ID: 3G349C3

Analyte	CAS Number	Result	Qual	RL	NDL
Gasoline Range Organics	8006-61-7	61300		1000	450
Surrogate	% Recovery	Lower	Upper	Qual	
Chlorobenzene (d)	399	74	138		

* Surrogate or spike compound out of range

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Report Number: L10040760
Report Date: May 11, 2010

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG330527
Collect Date: 04/29/2010 09:00
Sample Tag: DL02

PrePrep Method: NONE
Prep Method: 5030C/5035A
Analytical Method: 8015C
Analyst: ADC
Dilution: 20
Units: ug/L

Instrument: BP1
Prep Date: 05/06/2010 23:04
Cal Date: 01/11/2010 19:18
Run Date: 05/06/2010 23:04
File ID: 3034934

Analyte	CAS. Number	Result	Qual	RL	MDL
Gasoline Range Organics	8006-61-9	28100		2000	900
Surrogate					
Chlorobenzene(s)	Recovery 165	Lower 74	Upper 138		

* Surrogate or spike compound out of range

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG330426
Collect Date: 04/29/2010 09:00
Sample Tag: DL01

PrePrep Method: NONE
Prep Method: 5030C
Analytical Method: 8015C
Analyst: MTS
Dilution: 10
Units: ug/L

Instrument: BPMS10
Prep Date: 05/05/2010 23:40
Cal Date: 04/20/2010 22:26
Run Date: 05/05/2010 23:40
File ID: 10M79200

Analyte	CAS. Number	Result	Qual	RL	MDL
1,1,1,2-Tetrachloroethane	630-20-6	ND	50.0	2.50	
1,1,1-Trichloroethane	71-55-6	ND	50.0	2.50	
1,1,2,2-Tetrachloroethane	79-34-3	ND	50.0	2.00	
1,1,2-Trichloroethane	79-00-5	ND	50.0	2.50	
1,1-Dichloroethane	75-34-3	ND	50.0	1.25	
1,1-Dichloroethane	75-35-4	ND	50.0	5.00	
1,1-Dichloropropene	563-50-6	ND	50.0	2.50	
1,2,3-Trichlorobenzene	87-61-6	ND	50.0	1.50	
1,2,3-Trichloropropene	96-18-4	ND	50.0	5.00	
1,2,4-Trichlorobenzene	120-82-1	ND	50.0	2.00	
1,2,4-Trimethylbenzene	95-63-6	191	50.0	2.50	
1,2-Dibromo-3-chloropropane	96-12-8	ND	50.0	10.0	
1,2-Dibromoethane	106-93-4	ND	50.0	2.50	
1,2-Dichlorobenzene	95-50-1	ND	50.0	1.25	
1,2-Dichloroethane	107-06-2	ND	50.0	2.50	
1,2-Dichloropropane	78-87-5	ND	50.0	2.00	
1,3,5-Trimethylbenzene	108-67-8	122	50.0	2.50	
1,3-Dichlorobenzene	541-73-1	ND	50.0	2.50	
1,3-Dichloropropene	142-28-2	ND	50.0	2.00	
1,4-Dichlorobenzene	106-46-7	ND	50.0	1.25	
1,2-Dichloropropane	994-20-7	ND	50.0	2.50	
2-Butanone	78-93-1	865	100	25.0	
2-Chloroethyl vinyl ether	110-75-8	ND	100	20.0	
2-Chlorotoluene	95-49-8	ND	50.0	1.25	
2-Hexanone	591-78-6	ND	100	25.0	
4-Chlorotoluene	106-43-9	ND	50.0	2.50	
4-Methyl-2-pentanone	108-10-1	ND	100	25.0	
Acetone	67-64-1	2436	100	25.0	
Benzene	71-83-2	673	50.0	1.25	
Bromobenzene	108-86-1	ND	50.0	1.25	
Bromochloromethane	74-97-5	ND	50.0	2.00	
Bromodichloromethane	75-27-4	ND	50.0	2.50	
Bromoform	75-25-2	ND	50.0	5.00	
Bromomethane	74-83-9	ND	100	5.00	
Carbon disulfide	75-15-0	ND	50.0	5.00	
Carbon tetrachloride	56-23-5	ND	50.0	2.50	
Chlorobenzene	108-90-7	ND	50.0	1.25	
Chlorodibromomethane	124-48-1	ND	50.0	2.50	
Chloroethane	75-00-3	ND	100	5.00	
Chloroform	67-66-3	ND	50.0	1.25	
Chloromethane	74-87-3	ND	100	5.00	
cis-1,2-Dichloroethane	156-59-2	ND	50.0	2.50	
cis-1,3-Dichloropropane	10061-01-5	ND	50.0	2.50	

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Report Number: L10040760

Report Date: May 11, 2010

Sample Number: L10040760-01
 Client ID: INJECTION FLUID
 Matrix: Water
 Workgroup Number: NG330426
 Collect Date: 04/29/2010 09:00
 Sample Tag: DL01

PrePrep Method: NONE
 Prep Method: 9030C
 Analytical Method: 8260B
 Analyst: KES
 Dilution: 10
 Units: ug/L

Instrument: HPMS10
 Prep Date: 05/05/2010 23:40
 Cal Date: 04/20/2010 11:26
 Run Date: 05/05/2010 23:40
 File ID: 10M79200

Analyte	CAS Number	Result	Qual	RL	MDL
Dibromomethane	74-95-1		ND	50.0	2.50
Dichlorodifluoromethane	75-71-8		ND	100	2.50
Ethylbenzene	100-41-4	80.3		50.0	2.50
Hexachlorobutadiene	87-68-3		ND	50.0	2.50
Isopropylbenzene	98-82-8		ND	50.0	2.50
m,p-Xylene	179601-23-1	736		50.0	5.00
Methylene chloride	75-09-2		ND	50.0	2.50
n-Butylbenzene	104-51-8		ND	50.0	2.50
n-Propylbenzene	101-65-1		ND	50.0	1.25
Naphthalene	91-20-3		ND	100	2.00
o-Xylene	95-47-6	196		50.0	2.50
p-Isopropyltoluene	99-87-6		ND	50.0	2.50
sec-Butylbenzene	135-98-8		ND	50.0	2.50
Styrene	100-42-5		ND	50.0	1.25
tert-Butylbenzene	98-06-6		ND	50.0	2.50
Tetrachloroethene	127-18-4		ND	50.0	2.50
Toluene	108-88-3	1200		50.0	2.50
trans-1,2-Dichloroethene	156-60-5		ND	50.0	2.50
trans-1,2-Dichloropropene	10061-02-6		ND	50.0	5.00
Trichloroethane	79-01-6		ND	50.0	2.50
Trichlorofluoromethane	75-69-4		ND	100	2.50
Vinyl acetate	108-05-4		ND	100	25.0
Vinyl chloride	75-01-4		ND	100	2.50

Surrogate	% Recovery	Lower	Upper	Qual
1,2-Dichloroethane-d4	95.5	80	120	
4-Bromofluorobenzene	112	85	125	
Dibromofluoromethane	80.1	85	118	*
Toluene-d8	98.9	88	110	

* Surrogate or spike compound out of range

ND Not detected at or above the reporting limit (RL)

Sample Number: L10040760-01
 Client ID: INJECTION FLUID
 Matrix: Water
 Workgroup Number: NG330426
 Collect Date: 04/29/2010 09:00

PrePrep Method: NONE
 Prep Method: 9040C
 Analytical Method: 9040C
 Analyst: BLP
 Dilution: 1
 Units: UNITS

Instrument: ORION-4STA
 Prep Date: 04/29/2010 16:00
 Cal Date:
 Run Date: 04/29/2010 16:00
 File ID: 0510050303243901

Analyte	CAS Number	Result	Qual	RL	MDL
pH	10-25-7	6.05			

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Report Number: L10040760
Report Date: May 11, 2010

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG329708
Collect Date: 04/29/2010 09:00

PrePrep Method: NONE
Prep Method: 160.2
Analytical Method: 160.2
Analyst: BJR
Dilution: 1
Units: mg/L

Instrument: OVEN
Prep Date: 04/29/2010 13:10
Cal Date:
Run Date: 04/29/2010 13:10
File ID: EN.1004291310-11

Analyte	CAS. Number	Result	Qual	RL	MDL
Total Suspended Solids		494		20.0	10.0

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG329505
Collect Date: 04/29/2010 09:00

PrePrep Method: NONE
Prep Method: 160.1
Analytical Method: 160.1
Analyst: BJR
Dilution: 1
Units: mg/L

Instrument: OVEN
Prep Date: 04/30/2010 14:50
Cal Date:
Run Date: 04/30/2010 14:50
File ID: EN.1004301450-25

Analyte	CAS. Number	Result	Qual	RL	MDL
Total Dissolved Solids		181000		1000	500

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG329714
Collect Date: 04/29/2010 09:00

PrePrep Method: NONE
Prep Method: 1664A
Analytical Method: 1664A
Analyst: DLP
Dilution: 1
Units: mg/L

Instrument: HORIZON
Prep Date: 04/29/2010 08:10
Cal Date:
Run Date: 04/29/2010 08:10
File ID: ON.1004290830-12

Analyte	CAS. Number	Result	Qual	RL	MDL
n-Hexane Extractable Material (NEM)		21.5		5.10	2.55

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG329712
Collect Date: 04/29/2010 09:00
Sample Tag: DL01

PrePrep Method: NONE
Prep Method: 325.2
Analytical Method: 325.2
Analyst: DIB
Dilution: 2000
Units: mg/L

Instrument: SMARTCHEM
Prep Date: 04/29/2010 14:09
Cal Date: 04/29/2010 13:15
Run Date: 04/29/2010 14:09
File ID: SC100429004.083

Analyte	CAS. Number	Result	Qual	RL	MDL
Chloride	16887-00-6	107000		4000	2000

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Report Number: L10040760

Report Date: May 11, 2010

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG330017
Collect Date: 04/29/2010 09:00
Sample Tag: DL01

PrePrep Method: NONE
Prep Method: 175.4
Analytical Method: 175.4
Analyst: DJW
Dilution: 2
Units: mg/L

Instrument: SMARTCHEM
Prep Date: 05/01/2010 11:33
Cal Date: 05/01/2010 09:38
Run Date: 05/01/2010 11:33
File ID: SC100501001.345

Analyte	CAS. Number	Result	Qual	RL	MDL
Sulfate	14808-79-8	41.6		10.0	5.00

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG330125
Collect Date: 04/29/2010 09:00

PrePrep Method: NONE
Prep Method: 9014-9010C
Analytical Method: 9014-9010C
Analyst: JWK
Dilution: 1
Units: mg/L

Instrument: UV-120-1V
Prep Date: 05/04/2010 14:30
Cal Date:
Run Date: 05/04/2010 14:30
File ID: 1V.1005041430-21

Analyte	CAS. Number	Result	Qual	RL	MDL
Cyanide	57-12-5		ND	0.0100	0.00500

ND Not detected at or above the reporting limit (RL).

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG330164
Collect Date: 04/29/2010 09:00
Sample Tag: DL01

PrePrep Method: NONE
Prep Method: 351.2
Analytical Method: 351.2
Analyst: JWK
Dilution: 20
Units: mg/L

Instrument: SMARTCHEM4
Prep Date: 05/04/2010 12:01
Cal Date: 05/04/2010 11:50
Run Date: 05/04/2010 12:01
File ID: SC100504002.016

Analyte	CAS. Number	Result	Qual	RL	MDL
Nitrogen, Total Kjeldahl		97.0		4.00	2.00

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG329785
Collect Date: 04/29/2010 09:00

PrePrep Method: NONE
Prep Method: 305.1
Analytical Method: 305.1
Analyst: DLP
Dilution: 1
Units: mg/L

Instrument: BURET
Prep Date: 04/29/2010 13:50
Cal Date:
Run Date: 04/29/2010 13:50
File ID: BT.1004291350-06

Analyte	CAS. Number	Result	Qual	RL	MDL
Acidity		683		10.0	5.00

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Report Number: L10040760
Report Date : May 11, 2010

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG329704
Collect Date: 04/29/2010 09:00
Sample Tag: DL01

PrePrep Method: NONE
Prep Method: 415.1
Analytical Method: 415.1
Analyst: JBK
Dilution: 50
Units: mg/L

Instrument: TOC-VWP
Prep Date: 04/29/2010 15:20
Cal Date: 03/02/2010 11:58
Run Date: 04/29/2010 15:20
File ID: TC04292010.023

Analyte	CAS. Number	Result	Qual	RL	MDL
Total Organic Carbon		914		50.0	25.0

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG329927
Collect Date: 04/29/2010 09:00

PrePrep Method: NONE
Prep Method: SM5540-C-20th
Analytical Method: SM5540-C-20th
Analyst: JBK
Dilution: 10
Units: mg/L

Instrument: UV-120-1V
Prep Date: 04/30/2010 10:50
Cal Date:
Run Date: 04/30/2010 10:50
File ID: 1V.1004301050-05

Analyte	CAS. Number	Result	Qual	RL	MDL
Surfactants		19.4		1.00	0.500

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG330178
Collect Date: 04/29/2010 09:00

PrePrep Method: NONE
Prep Method: BLNCE
Analytical Method: 410.4 MOD
Analyst: DLP
Dilution: 10
Units: mg/L

Instrument: UV-120-1V
Prep Date: 05/03/2010 10:17
Cal Date:
Run Date: 05/03/2010 10:17
File ID: 1V.1005031017-18

Analyte	CAS. Number	Result	Qual	RL	MDL
Chemical Oxygen Demand		9510		1500	100

Sample Number: L10040760-01
Client ID: INJECTION FLUID
Matrix: Water
Workgroup Number: WG330428
Collect Date: 04/29/2010 09:00

PrePrep Method: NONE
Prep Method: 420.1
Analytical Method: 420.1
Analyst: JBK
Dilution: 1
Units: mg/L

Instrument: UV-120-1V
Prep Date: 05/05/2010 12:55
Cal Date:
Run Date: 05/05/2010 12:55
File ID: 1V.1005051255-07

Analyte	CAS. Number	Result	Qual	RL	MDL
Phenolics, Total	64743-01-9	0.0102		0.00556	0.00333

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SECTION 9

Section 9 – Operating Requirements/Data:

1. Eight months of injection volume and pressure data was submitted on separate sheets with the five-year permit renewal application, which included breakdown of daily injection data for each month. Monthly reports (WR-40B) are included. For August of 2015, the average daily injection pressure for the BW#4 was 2,247 psi and the maximum average injection pressure was 2,258 psi. The average injection rate was 172 barrels per day (bpd). The maximum daily injection rate was 333 bpd.
2. All sources of oilfield fluid wastes are hauled into the Eureka Station and unloaded into the large brine storage tanks at this facility. Brine can then be pumped to either WV saltwater disposal wells or through a pipeline under the Ohio River to the Bells Run Station, which has access to four additional Class IID wells in Ohio for disposal. Since all brine fluid wastes for the BW#4 are pumped from the Eureka Station to the surface facility for injection, there is no way to confirm which brine wastes are disposed in certain Class IID disposal wells. The Appalachian Oil Purchasers, LLC brine transportation and storage system is included.
3. New injection fluid sampling has been performed and sample results was submitted by e-mail on April 19, 2016. The injection fluid radiological analysis for Radium 226 and Radium 228 was submitted by e-mail on April 30, 2016.
4. Attached is the list of all sources of injected fluids.
5. Gypton T-92 is a scale inhibitor and is the only chemical treatment being utilized by Appalachian Oil Purchasers, LLC. The MSDS sheet was included. On that MSDS sheet, it lists methanol as 10-30% by weight concentration and sodium phosphate ester salt as 10-30% by weight concentration. The Gypton T-92 is injected at a rate of 0.422 gallons per 100 barrels of brine.
6. The annulus fluid is freshwater with a corrosion inhibitor. Information on the corrosion inhibitor has been previously submitted. The amount of the corrosion inhibitor used in the annular space of the BW#4 was five gallons. Corrosion inhibitor prevents the corrosion of the production casing in the event of a tubing or packer leak which would allow injectate into the annular space. It is typically mixed with 100 barrels of freshwater. Daily annulus pressure is recorded on Monthly Reports WV DEP WR-40B that was included in the original five-year permit renewal. Annulus pressures on the production casing-tubing annulus for August of 2015 ranged from 138 to 281psi. Continuous monitoring of the injection and annulus pressures that demonstrates that the pressures have not equalized indicates that the BW#4 injection well is continuously maintaining mechanical integrity.
7. In the event of loss of mechanical integrity, well failure or leak, the well will be immediately shutdown and taken out of service and all valves and piping closed. Any spill clean-up will be addressed per the SPCC plan. If there is a loss of mechanical integrity or other type of well failure, WV DEP will be immediately notified and a work plan will be developed to get the BW #4 injection well back into operation. During the shutdown of the BW #4 injection well, fluids can be re-routed to other Appalachian Oil Purchasers, Inc. Class II injection wells in WV and Ohio.

[illegible]

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APPENDIX G LIST

Producer	API Number	Well Name	Producing Formation
XTO Energy	4703305541	Harbert East A 1H	MARCELLUS
BECK ENERGY	3411122524	TUEL	BEREA
Chesapeake Appalachia LLC	3700720284	THARP 1 OG WELL	UTICA SHALE
Chesapeake Appalachia LLC	3701520055	WARNER 1 OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3701520229	WARD 627411 1H OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3701520730	JOHNSON 2H OG WELL	MARCELLUS
Chesapeake Appalachia, LLC	3701520731	JOHNSON 5H OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3701520733	ALTON 1H OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3701520734	ALTON 6H OG WELL	MARCELLUS
Chesapeake Appalachia, LLC	3701520755	HOFFMAN 3H OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3702121140	WILMORE COAL 7	MARCELLUS
Atlas Energy Group	3705124267	FAY-PENN 44 OG WELL	MARCELLUS
EQT PRODUCTION	3705925173	590001	MARCELLUS
EQT PRODUCTION	3705925182	590379	MARCELLUS
EQT PRODUCTION	3705925203	590169 #1	MARCELLUS
Atlas Energy Group	3705925223	Carter 11	MARCELLUS
EQT PRODUCTION	3705925282	590207	MARCELLUS
EQT PRODUCTION	3705925283	590219	MARCELLUS
ATLAS ENERGY GROUP	3705925341	HEADLEE UNIT 8 OG WELL	MARCELLUS
EQT PRODUCTION	3705925376	590206	MARCELLUS
EQT PRODUCTION	3705925431	590454	MARCELLUS
Chesapeake Appalachia LLC	3712521608	PINE OAKS (831608)	MARCELLUS
Atlas Energy Group	3712523393	COWDEN 12H OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3712523541	PINE OAKS 8H 627027	MARCELLUS
Chesapeake Appalachia LLC	3712523943	Pine Oaks 6H	MARCELLUS
Chesapeake Appalachia LLC	3712523944	Pine Oaks 10H	MARCELLUS
Atlas Energy Group	3712523963	ROBINHILL 18H OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3712523964	Guy Avolio 10H	MARCELLUS
Chesapeake Appalachia LLC	3712524030	TRAX FARMS INC 1H OG	MARCELLUS
Chesapeake Appalachia LLC	3712524031	TRAX FARMS INV 3H OG WELL	MARCELLUS
Chesapeake Appalachia, LLC	3712524032	TRAX FARMS INC 5H OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3712524033	JOSEPH POWERS 1H OG	MARCELLUS
Chesapeake Appalachia LLC	3712524034	JOSEPH POWERS 3H OG	MARCELLUS
Atlas Energy Group	3712524044	ROBINHILL 15H OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3712524154	VIVIAN HARBISON 3H OG	MARCELLUS
Atlas Energy Group	3712524241	ADDLEMAN 1H OG WELL	MARCELLUS
Chesapeake Appalachia LLC	3712524242	ROBERT SMITH 1H OG	MARCELLUS
Chesapeake Appalachia LLC	3712524244	ROBERT SMITH 5H OG	MARCELLUS
Chesapeake Appalachia, LLC	3713120076	SHAW 2H OG WELL	MARCELLUS
EQT PRODUCTION	4701705625	OXFORD 42	MARCELLUS
EQT PRODUCTION	4701705626	OXFORD #17	MARCELLUS
EQT PRODUCTION	4701705629	510840 OXF43	MARCELLUS
EQT PRODUCTION	4701705629	510840 OXF43	MARCELLUS
EQT PRODUCTION	4701705640	OXFORD 44	MARCELLUS
EQT PRODUCTION	4701705643	OXFORD #16	MARCELLUS
EQT PRODUCTION	4701705644	510842 OXFORD #45	MARCELLUS
EQT PRODUCTION	4701705664	OXFORD #47	MARCELLUS
EQT PRODUCTION	4701705786	511530	MARCELLUS
EQT PRODUCTION	4701705787	511531	MARCELLUS
EQT PRODUCTION	4701705788	512414	MARCELLUS

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EQT PRODUCTION	4701705789	512415	MARCELLUS
EQT PRODUCTION	4701705790	512417	MARCELLUS
EQT PRODUCTION	4701705791	512425	MARCELLUS
EQT PRODUCTION	4701705792	512429	MARCELLUS
EQT PRODUCTION	4701705847	510844	MARCELLUS
EQT PRODUCTION	4701705848	512420	MARCELLUS
EQT PRODUCTION	4701705849	512421	MARCELLUS
EQT PRODUCTION	4701705851	512434	MARCELLUS
EQT PRODUCTION	4701705852	512433	MARCELLUS
EQT PRODUCTION	4701705853	512454	MARCELLUS
EQT PRODUCTION	4701705856	512718	MARCELLUS
EQT PRODUCTION	4701705859	512430	MARCELLUS
EQT PRODUCTION	4701705860	512436	MARCELLUS
EQT PRODUCTION	4701705861	512435	MARCELLUS
EQT PRODUCTION COMPANY	4701705863	512455	MARCELLUS
EQT PRODUCTION	4701705879	512438	MARCELLUS
EQT PRODUCTION COMPANY	4701705883	512437	MARCELLUS
EQT PRODUCTION	4701705884	512456	MARCELLUS
EQT PRODUCTION	4701705889	512475	MARCELLUS
EQT PRODUCTION	4701705890	512451	MARCELLUS
EQT PRODUCTION	4701705891	512452	MARCELLUS
EQT PRODUCTION	4701705892	512473	MARCELLUS
EQT PRODUCTION	4701705893	512474	MARCELLUS
EQT PRODUCTION	4701705894	512480	MARCELLUS
EQT PRODUCTION	4701705895	512481	MARCELLUS
EQT PRODUCTION	4701705898	512717	MARCELLUS
EQT PRODUCTION COMPANY	4701705907	512507	MARCELLUS
EQT Production	4701705908	512508	MARCELLUS
EQT	4701705909	512509	MARCELLUS
EQT	4701705910	512510	MARCELLUS
EQT PRODUCTION COMPANY	4701705911	512511	MARCELLUS
EQT PRODUCTION COMPANY	4701705913	512514	MARCELLUS
EQT	4701705914	512681	MARCELLUS
EQT PRODUCTION	4701705916	512685	MARCELLUS
EQT PRODUCTION	4701705917	512680	MARCELLUS
EQT PRODUCTION	4701705923	512446	MARCELLUS
EQT PRODUCTION	4701705924	512498	MARCELLUS
EQT PRODUCTION	4701705925	512499	MARCELLUS
EQT PRODUCTION	4701705926	512445	MARCELLUS
EQT PRODUCTION	4701705948	513101	MARCELLUS
EQT PRODUCTION	4701705957	513370	MARCELLUS
EQT	4701705958	513369	MARCELLUS
EQT PRODUCTION	4701705959	512512	MARCELLUS
Chesapeake Appalachia LLC	4703301052	MORIS A-658 DAVISSON, A. FAY/LYNDALL	BALLTOWN
Chesapeake Appalachia LLC	4704101997	SKINNER A-535 BLAKE, EDWARD J	BIG INJUN
Chesapeake Appalachia LLC	4704105593	LLOYD MCCAULEY 3H	MARCELLUS
XTO Energy	4704901238	Finn A 10H (2275H)	MARCELLUS
STONE ENERGY	4704902094	POTOCZNY	MARCELLUS
Chesapeake Appalachia LLC	4704902110	832110 EDWIN BUNNER 8	MARCELLUS
Chesapeake Appalachia LLC	4704902119	832212 EDWIN BUNNER 6H	SPEECHLEY
XTO Energy	4704902130	Finn A 9H (2274H)	MARCELLUS
Chesapeake Appalachia LLC	4705101038	ALTMAN 1 ST 1	MARCELLUS
Chesapeake Appalachia LLC	4705101056	YOHO 626518	MARCELLUS
Chesapeake Appalachia LLC	4705101091	STERN 626713	MARCELLUS
Chesapeake Appalachia LLC	4705101092	STERN 626714	MARCELLUS
Chesapeake Appalachia LLC	4705101093	TECO ELSON #626348	MARCELLUS
A B RESOURCES	4705101113	PRENDERGAST	MARCELLUS
A B RESOURCES	4705101134	HIERONONIS #1	MARCELLUS
Chesapeake Appalachia LLC	4705101160	STERN H3 (626700)	MARCELLUS

Chesapeake Appalachia LLC	4705101161	STERN H5 (626701)	MARCELLUS
Chesapeake Appalachia LLC	4705101162	STERN H4 (627011)	MARCELLUS
A B RESOURCES	4705101166	CRAWFORD	FOURTH
Chesapeake Appalachia LLC	4705101178	MASON DIXON FARMS LLC 6H	MARCELLUS
Chesapeake Appalachia, LLC	4705101178	MASON DIXON FARMS LLC 6H	MARCELLUS
A B RESOURCES	4705101190	FRANCIS #1, V	MARCELLUS
A B RESOURCES	4705101221	HART #1	MARCELLUS
A B RESOURCES	4705101222	BARDHALL 1-H	MARCELLUS
A B RESOURCES	4705101224	NEEHOUSE 1H	MARCELLUS
Chesapeake Appalachia LLC	4705101227	MCDOWELL-A #1H	ELK
Chesapeake Appalachia LLC	4705101228	627044 MCDOWELL ETAL	MARCELLUS
Chesapeake Appalachia LLC	4705101229	C G T 627338, 3-H	MARCELLUS
A B RESOURCES	4705101235	CARMICHAEL #1	MARCELLUS
Chesapeake Appalachia LLC	4705101240	STERN H6 (627325)	MARCELLUS
Chesapeake Appalachia LLC	4705101241	MCDOWELL (#B) 10H	MARCELLUS
Chesapeake Appalachia LLC	4705101249	MCDOWELL 627046 6-H, R	MARCELLUS
Chesapeake Appalachia LLC	4705101250	Columbia Gas Transmission 1H	HAVERTY
Chesapeake Appalachia LLC	4705101253	McDowell B 1H	ELK
Chesapeake Appalachia LLC	4705101254	McDowell B 3H	ELK
Chesapeake Appalachia LLC	4705101255	McDowell B 5H	ELK
Chesapeake Appalachia LLC	4705101258	MCDOWELL-A #5H	BRAILER
Chesapeake Appalachia LLC	4705101259	SCHOSTAG 627540 3-H	MARCELLUS
Chesapeake Appalachia LLC	4705101260	SCHOSTAG 627541 7-H	MARCELLUS
Chesapeake Appalachia LLC	4705101261	SCHOSTAG (627542) 9H	MARCELLUS
A B RESOURCES	4705101263	CAVENEY	MARCELLUS
Chesapeake Appalachia LLC	4705101272	C G T 627339 5-H	MARCELLUS
Chesapeake Appalachia LLC	4705101273	WARYCH-10H (627267)	ELK
Chesapeake Appalachia LLC	4705101274	WARYCH-8H (627266)	ELK
Chesapeake Appalachia LLC	4705101275	WARYCH-6H (627265)	ELK
Chesapeake Appalachia LLC	4705101276	MCDOWELL (#B) 6H	MARCELLUS
Chesapeake Appalachia LLC	4705101277	RANDY L & LISA MCDOWELL 8H	MARCELLUS
STONE ENERGY	4705101284	HUNTER #1 (4278-C)	MARCELLUS
Chesapeake Appalachia LLC	4705101290	HAMMERS(627448)#3H	MARCELLUS
Chesapeake Appalachia, LLC	4705101291	O E BURGE 8H	MARCELLUS
Chesapeake Appalachia LLC	4705101292	HAMMERS 627450 -9H	MARCELLUS
Chesapeake Appalachia LLC	4705101296	831189 HARLAN, SCOTT, SHAWN	MARCELLUS
A B RESOURCES	4705101297	CURRY #1	MARCELLUS
Chesapeake Appalachia, LLC	4705101319	831160 HARLAN, SCOTT & SHAWN	MARCELLUS
Trans Energy	4705101320	WHIPKEY 1H WHIPKEY, BRUCE	MARCELLUS
A B RESOURCES	4705101322	TAYLOR #1	MARCELLUS
Chesapeake Appalachia LLC	4705101326	831493 BONNET, ROBERT & LINDA	MARCELLUS
Chesapeake Appalachia LLC	4705101327	831191 BAKER, DONALD	MARCELLUS
Trans Energy	4705101333	WHIPKEY 3H WHIPKEY, BRUCE ET AL	MARCELLUS
Chesapeake Appalachia LLC	4705101336	831723 WARYCK,ARTHUR	MARCELLUS
A B RESOURCES	4705101340	BRYAN #1-H	MARCELLUS
A B RESOURCES	4705101342	WITZGALL	MARCELLUS
A B RESOURCES	4705101343	MCCLAIN	MARCELLUS
GASTAR	4705101377	WENGERD 1H WENGERD, ELI	MARCELLUS
Chesapeake Appalachia, LLC	4705101383	627053 MCDOWELL B 8H REV. RANDALL L. MCDOWELL	MARCELLUS
AB RESOURCES	4705101384	ZIEN #1-H	MARCELLUS
AB RESOURCES	4705101391	STARCOVIC #2H	MARCELLUS
GASTAR	4705101438	CORLEY 4H	MARCELLUS
GASTAR	4705101452	SIMMS UNIT	MARCELLUS
GASTAR	4705101467	HENDRICKSON 1H	MARCELLUS
GASTAR	4705101502	ACCETTOLO 1H	MARCELLUS
GASTAR	4705101503	ACCETTOLO 2H	MARCELLUS
Chesapeake Appalachia LLC	4706100297	POWELL, E. A-1	BENSON
Chesapeake Appalachia LLC	4706101111	PAWLAK, REBECCA J.	HUNTERSVILLE CHERT

Chesapeake Appalachia LLC	4706101386	ROGERS, ODIS J. 62831	ORISKANY
Chesapeake Appalachia LLC	4706101386	ROGERS, ODIA J. 62831	ORISKANY
Chesapeake Appalachia LLC	4706101395	NEW AUGUSTA INC.	MARCELLUS
Chesapeake Appalachia LLC	4706101614	832598 RELIANCE MINERALS INC. 8H	MARCELLUS
Chesapeake Appalachia LLC	4706900061	832294 GEORGE GANTZER 8H GANTZER, GEORGE & PATRI	MARCELLUS
Chesapeake Appalachia LLC	4706900063	ESTHER WEEKS 1H	MARCELLUS
Chesapeake Appalachia LLC	4707700508	Bray Liston 8H	BENSON
Chesapeake Appalachia LLC	4707700509	Bray Liston 3H	BENSON
Hard Rock Exploration, Inc	4708704686	HR-441 CAVENDER, OTIS	LOWER HURON
EQT PRODUCTION	4709101100	511398RS M16H1	MARCELLUS
EQT PRODUCTION	4709101111	511438	MARCELLUS
Chesapeake Appalachia LLC	4709702908	SHOBE A-1837 SHOBE, FRED & NOLA B.	MARCELLUS
Chesapeake Appalachia LLC	4709703021	DALE L WINFREE 1	HELERBERG
Chesapeake Appalachia LLC	4709703245	622920 OGDEN, JAMES & BENSON RUBY	MARCELLUS
Chesapeake Appalachia LLC	4709703444	CYRUS KERR KIMP ETUX 1	MARCELLUS
Chesapeake Appalachia LLC	4709703500	Ralph Harper Lumber 2H	MARCELLUS
Chesapeake Appalachia LLC	4709703502	Ralph Harper Lumber 1H	MARCELLUS
Chesapeake Appalachia LLC	4709703514	Arthur Chidister 1H	MARCELLUS
Chesapeake Appalachia LLC	4709703515	MICHAEL G MOODY ETAL 1 ORISKANY SANDSTONE	MARCELLUS
Chesapeake Appalachia LLC	4709703516	FAY & RUTH SKINNER 1H	MARCELLUS
Chesapeake Appalachia LLC	4709703559	RALPH G LIPPS 3H	MARCELLUS
EQT PRODUCTION	4709703586	511415	MARCELLUS
Chesapeake Appalachia LLC	4709703662	DELMAR LIGHT 3H	MARCELLUS
Chesapeake Appalachia LLC	4709703665	Delmar Light 1H	BRAILER
Chesapeake Appalachia LLC	4709703669	Mike Ross 8H	MARCELLUS
Chesapeake Appalachia LLC	4709703670	Mike Ross 6H	MARCELLUS
Chesapeake Appalachia LLC	4709703671	CRAIG BESSINGER 8H	MARCELLUS
Chesapeake Appalachia LLC	4709703672	Craig Bessinger 10H	MARCELLUS
Chesapeake Appalachia LLC	4709703673	Craig Bessinger 6H	MARCELLUS
Chesapeake Appalachia LLC	4709703674	Mike Ross 10H	MARCELLUS
Chesapeake Appalachia LLC	4709703683	Edward Gower 8H	MARCELLUS
Chesapeake Appalachia LLC	4709703684	Edward Gower 10H	MARCELLUS
Chesapeake Appalachia LLC	4709703686	831599 JAMES OGDEN 3H	MARCELLUS
Chesapeake Appalachia LLC	4709703689	Dale Winfree 3H	BENSON
Chesapeake Appalachia LLC	4709703690	Dale Winfree 5H	GREENLAND GAP
Chesapeake Appalachia LLC	4709703691	Mark Harper 3H	MARCELLUS
Chesapeake Appalachia LLC	4709703707	831667 TALL TREES &	MARCELLUS
Chesapeake Appalachia LLC	4709703708	831679 TALL TREES & LAND	MARCELLUS
Chesapeake Appalachia LLC	4709703719	LYNETTE HOWES 3H	MARCELLUS
Chesapeake Appalachia, LLC	4709703727	832004 TALL TREES 10H TALL TREES & LAND LLC	MARCELLUS
Chesapeake Appalachia LLC	4709703728	EDWARD GOWER 6H	MARCELLUS
Chesapeake Appalachia LLC	4709703761	832409 James Ogden 1H	MARCELLUS
Chesapeake Appalachia LLC	4710302231	HOHMAN 625531	MARCELLUS
Chesapeake Appalachia LLC	4710302236	MARIN R WHITEMAN JR 1	MARCELLUS
Chesapeake Appalachia LLC	4710302331	DURIG H-1	MARCELLUS
Chesapeake Appalachia LLC	4710302333	DIXON, MASON	MARCELLUS
EQT PRODUCTION	4710302348	P & G 29-510845	MARCELLUS
Chesapeake Appalachia LLC	4710302364	DAVIS 3-H	MARCELLUS
Chesapeake Appalachia LLC	4710302366	LUCKY D-H4 (626889)	MARCELLUS
Chesapeake Appalachia LLC	4710302371	DURIG H-5	MARCELLUS
Chesapeake Appalachia LLC	4710302375	Daniel Durig 5H	BALLTOWN
Chesapeake Appalachia LLC	4710302376	DURIG H-2	MARCELLUS
Chesapeake Appalachia LLC	4710302403	DAVIS 2-H	MARCELLUS
Chesapeake Appalachia LLC	4710302408	KELLY 10-H 627040	MARCELLUS
EQT PRODUCTION	4710302414	511391	MARCELLUS
Chesapeake Appalachia LLC	4710302423	MESSENGER 3H	MARCELLUS

Chesapeake Appalachia LLC	4710302424	MESSENGER 5H	MARCELLUS
Chesapeake Appalachia LLC	4710302427	LUCKY D-H3 (627002)	MARCELLUS
Chesapeake Appalachia LLC	4710302428	LUCKY D-H1 (627003)	MARCELLUS
STONE ENERGY	4710302432	LANTZ #4	MARCELLUS
Chesapeake Appalachia LLC	4710302434	Chesapeake Appalachia 1H	FOX
Chesapeake Appalachia LLC	4710302435	Chesapeake Appalachia 3H	HAVERTY
Chesapeake Appalachia LLC	4710302436	Chesapeake Appalachia 5H	MARCELLUS
Chesapeake Appalachia LLC	4710302437	CHESAPEAKE A-PAD 627256 6H	MARCELLUS
Chesapeake Appalachia LLC	4710302438	CHESAPEAKE A-PAD 627257 8H	MARCELLUS
Chesapeake Appalachia LLC	4710302439	CHESAPEAKE A PAD 627528 10H	MARCELLUS
Chesapeake Appalachia LLC	4710302440	WHITEMAN 627375 8-H	MARCELLUS
Chesapeake Appalachia LLC	4710302447	627249 (5H) STANSBERRY, FOX GORDON - EST.	MARCELLUS
Chesapeake Appalachia LLC	4710302448	627250 (10H) STANSBERRY,GORDON	MARCELLUS
Chesapeake Appalachia LLC	4710302449	WHITEMAN 627374 5-H	MARCELLUS
Chesapeake Appalachia LLC	4710302453	BERISFORD 627251 3-H	MARCELLUS
Chesapeake Appalachia LLC	4710302454	BERISFORD 627252 5-H	MARCELLUS
Chesapeake Appalachia LLC	4710302458	627376 HOHMAN HBP S 1H	MARCELLUS
Chesapeake Appalachia LLC	4710302459	627377 HOHMAN HBP S 3H	MARCELLUS
Chesapeake Appalachia LLC	4710302461	BERISFORD 627675, 1-H	MARCELLUS
Chesapeake Appalachia LLC	4710302469	JOHNSON 627389 1-H,F	MARCELLUS
Chesapeake Appalachia LLC	4710302470	JOHNSON 627390 3-H,F	MARCELLUS
STONE ENERGY	4710302476	LANTZ-MILLS UNIT CPF	MARCELLUS
Chesapeake Appalachia LLC	4710302479	RINE 1H	MARCELLUS
Chesapeake Appalachia LLC	4710302480	RINE #3-H, 627391	FOX
Chesapeake Appalachia LLC	4710302481	RINE #5H 627392	FOX
Chesapeake Appalachia, LLC	4710302482	HOHMAN 3H	MARCELLUS
Chesapeake Appalachia LLC	4710302483	Hohman 1H	GANTZ
Chesapeake Appalachia LLC	4710302484	SABER 8H	HAVERTY
Chesapeake Appalachia LLC	4710302485	SABER 3H	HAVERTY
Chesapeake Appalachia, LLC	4710302486	HOHMAN 5H	MARCELLUS
Chesapeake Appalachia LLC	4710302511	SABER 10H	FOX
Chesapeake Appalachia LLC	4710302527	Saber 1H	HAVERTY
Chesapeake Appalachia LLC	4710302528	SABER 6H	HAVERTY
Chesapeake Appalachia LLC	4710302533	Saber 5H	HAVERTY
Chesapeake Appalachia LLC	4710302536	RINE #6H 627683	BENSON
EQT PRODUCTION	4710302538	511421	MARCELLUS
Chesapeake Appalachia LLC	4710302545	Floyd Johnson 10H	FOX
Chesapeake Appalachia LLC	4710302546	FLOYD JOHNSON 8H	MARCELLUS
STONE ENERGY	4710302551	LANTZ - MILLS UNIT #2-1	MARCELLUS
GRENADIER ENERGY	4710302557	SHREVE,KENNETH	MARCELLUS
STONE ENERGY	4710302558	MILLS WETZEL 1H(4640)	MARCELLUS
STONE ENERGY	4710302569	MAURY	MARCELLUS
GRENADIER ENERGY	4710302572	PRINE 1H,LLOYD	MARCELLUS
GRENADIER ENERGY	4710302579	JOLLIFFE #1 H	MARCELLUS
GRENADIER ENERGY	4710302580	SIZEMORE #1-H	MARCELLUS
STONE ENERGY	4710302599	NICE ET AL UNIT A 1H	MARCELLUS
STONE ENERGY	4710302603	NICE B#3H	MARCELLUS
Chesapeake Appalachia LLC	47010302428	LUCKY D-H1 (627003)	MARCELLUS

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
1	OH	APPALACHIAN ENERGY RESOURCES	MONROE	GREEN	FETTY #1	34111242130000	FIFTH SAND
2	OH	APPALACHIAN ENERGY RESOURCES	MONROE	WAYNE	SMITH #3, BERNARD	34111242250000	FIFTH SAND
3	OH	BECK ENERGY CORP	MONROE	BENTON	CISLER #1, KENNY	34111242060000	MARCELLUS SHALE
4	OH	BECK ENERGY CORP	MONROE	BENTON	EARLEY #2, DAVE	34111242070000	MARCELLUS SHALE
5	OH	BECK ENERGY CORP	MONROE	BENTON	ROMICK #1, M	34111241480000	FIFTH SAND
6	OH	BECK ENERGY CORP	MONROE	BENTON	SCHMIDT, C	34111237300000	OHIO SHALE
7	OH	BECK ENERGY CORP	MONROE	CENTER	DANNEMILLER #1	34111241570000	FIFTH SAND
8	OH	BECK ENERGY CORP	MONROE	CENTER	FRONTZ #1	34111239790000	BEREA/GORDON
9	OH	BECK ENERGY CORP	MONROE	CENTER	GEHRIG, TERRY	34111241800000	FIFTH SAND
10	OH	BECK ENERGY CORP	MONROE	CENTER	GEITGEY #1	34111241590000	BEREA/GORDON
11	OH	BECK ENERGY CORP	MONROE	CENTER	HUDSON #1	34111240990000	BEREA/GORDON
12	OH	BECK ENERGY CORP	MONROE	CENTER	LINDAMOOD 1 & 2	34111239600000	BEREA/GORDON
13	OH	BECK ENERGY CORP	MONROE	CENTER	MORRIS #1, D	34111240790000	FIFTH SAND
14	OH	BECK ENERGY CORP	MONROE	CENTER	NORRIS	34111241740000	FIFTH SAND
15	OH	BECK ENERGY CORP	MONROE	CENTER	PLATT, JIMMY	34111242580000	BEREA/GORDON
16	OH	BECK ENERGY CORP	MONROE	CENTER	POTTER #1	34111239700000	BEREA/GORDON
17	OH	BECK ENERGY CORP	MONROE	CENTER	POTTS	34111241600000	FIFTH SAND
18	OH	BECK ENERGY CORP	MONROE	CENTER	TAYLOR	34111241940000	FIFTH SAND
19	OH	BECK ENERGY CORP	MONROE	CENTER	VILLAGE OF WOODSFIELD	34111242360000	BEREA/GORDON
20	OH	BECK ENERGY CORP	MONROE	CENTER	YONAK #1	34111241380000	FIFTH SAND
21	OH	BECK ENERGY CORP	MONROE	FRANKLIN	WELLA #1	34111241900000	BEREA/GORDON
22	OH	BECK ENERGY CORP	MONROE	JACKSON	BELFORD	34111238990000	BEREA
23	OH	BECK ENERGY CORP	MONROE	JACKSON	KRIEG - USA	34111238950000	WEIR
24	OH	BECK ENERGY CORP	MONROE	MALAGA	LANDEFELD	34111227350000	OHIO SHALE
25	OH	BECK ENERGY CORP	MONROE	SUMMIT	CHRISTMAN	34111229370000	OHIO SHALE
26	OH	BECK ENERGY CORP	MONROE	SUMMIT	HINDERLONG #1	34111229400000	OHIO SHALE
27	OH	BECK ENERGY CORP	MONROE	SUMMIT	WARD	34111242370000	BEREA/GORDON
28	OH	BECK ENERGY CORP	MONROE	WAYNE	CAMPTI-LUDWIG	34111241320000	FIFTH SAND
29	OH	BECK ENERGY CORP	MONROE	WAYNE	DENBOW #2	34111241840000	FIFTH SAND
30	OH	BECK ENERGY CORP	MONROE	WAYNE	HUFFMAN #2, M	34111242440000	BEREA/GORDON
31	OH	BECK ENERGY CORP	MONROE	WAYNE	JOHN	34111241750000	BEREA/GORDON
32	OH	BECK ENERGY CORP	MONROE	WAYNE	ROTHENBUHLER	34111242410000	BEREA/GORDON
33	OH	BECK ENERGY CORP	MONROE	WAYNE	RUSINOFF #1	34111241520000	FIFTH SAND
34	OH	BECK ENERGY CORP	WASHINGTON	SALEM	MILLER #5	34167263980000	OHIO SHALE
35	OH	BRASEL & BRASEL	GALLIA	ADDISON	BOSTER, C	34053208350000	BEREA
36	OH	BRASEL & BRASEL	GALLIA	ADDISON	BRADBURY-QUEEN #1	34053204170000	BEREA
37	OH	BRASEL & BRASEL	GALLIA	ADDISON	BRASEL - HARRIS #1,2,3	34053208510000	BEREA
38	OH	BRASEL & BRASEL	GALLIA	ADDISON	R.O.J. CORP 1-2-3-4-5-6B	34053203250000	BEREA
39	OH	BRASEL & BRASEL	GALLIA	ADDISON	SMITH 1 & 3	34053202180000	BEREA
40	OH	BUCKEYE OIL PRODUCING CO	LAWRENCE	MASON	MUISE	34087204660000	COWRUN
41	OH	C & N OIL & GAS COMPANY LLC	ATHENS	ROME	BURSON - SAMPSON	3400921117000	BEREA
42	OH	C-GAS EXPLORATION INC	FAIRFIELD	BERNE	SCHOLL	34045212110000	ROSE RUN
43	OH	C-GAS EXPLORATION INC	FAIRFIELD	BERNE	SCHOLL-LAMB #2	34045212120000	ROSE RUN
44	OH	C-GAS EXPLORATION INC	HOLMES	MECHANIC	HERSHBERGER #1-2453	34075248780000	ROSE RUN
45	OH	C-GAS EXPLORATION INC	LICKING	HARRISON	FOOR UNIT #2	34089257180000	ROSE RUN
46	OH	C-GAS EXPLORATION INC	LICKING	LIBERTY	ANGUS UNIT #1	34089255380000	TREMPEALEAU
47	OH	C-GAS EXPLORATION INC	LICKING	LIBERTY	HANNAHS UNIT 2	34089255920000	TREMPEALEAU
48	OH	C-GAS EXPLORATION INC	LICKING	LIBERTY	HANNAHS UNIT 3-2308	34089256040000	ROSE RUN
49	OH	C-GAS EXPLORATION INC	LICKING	LIBERTY	NUNN #3	34089256210000	TREMPEALEAU
50	OH	C-GAS EXPLORATION INC	LICKING	LIBERTY	NUNN UNIT #2	34089255910000	ROSE RUN
51	OH	C-GAS EXPLORATION INC	LICKING	LIBERTY	STIERS UNIT #3	34089256060000	KYOX
52	OH	C-GAS EXPLORATION INC	LICKING	LIBERTY	WHITE UNIT #3-2105	34089255440000	TREMPEALEAU

APP. G cont

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
53	OH	C-GAS EXPLORATION INC	LICKING	ST ALBANS	CRANE	34089257250000	ROSE RUN
54	OH	C-GAS EXPLORATION INC	LICKING	ST ALBANS	DYSART #1	34089256690000	TREMPEALEAU
55	OH	C-GAS EXPLORATION INC	LICKING	ST ALBANS	HOLBROOK #1	34089255510000	ROSE RUN
56	OH	C-GAS EXPLORATION INC	LICKING	ST ALBANS	KING UNIT #3	34089255950000	TREMPEALEAU
57	OH	C-GAS EXPLORATION INC	LICKING	ST ALBANS	PICKRELL #1	34089256410000	ROSE RUN
58	OH	C-GAS EXPLORATION INC	LICKING	ST ALBANS	REEVES UNIT #1	34089255780000	ROSE RUN
59	OH	C-GAS EXPLORATION INC	MUSKINGUM	BLUE ROCK	KING UNIT #1	34119230990000	MEDINA
60	OH	C-GAS EXPLORATION INC	MUSKINGUM	FALLS	POLK #1	34119280630000	ROSE RUN
61	OH	C-GAS EXPLORATION INC	MUSKINGUM	LICKING	WRIGHT #1	34119278770000	ROSE RUN
62	OH	CHESAPEAKE APPALACHIA LLC	FAIRFIELD	HOCKING	QUEEN 723125	34045212280000	BEEKMANTOWN
63	OH	CHESAPEAKE APPALACHIA LLC	HOCKING	LAUREL	RISER-BIGHAM 722939	34073234200000	BEEKMANTOWN
64	OH	CHESAPEAKE APPALACHIA LLC	HOCKING	MARION	RUSHCREEK 723454	34073234860000	ROSE RUN
65	OH	CHESAPEAKE APPALACHIA LLC	HOCKING	PERRY	BAINTER 723054	34073234950000	
66	OH	CHESAPEAKE APPALACHIA LLC	HOCKING	SALT CREEK	T & D PROPERTIES 724436	34073235370000	QUEENSTON
67	OH	CORTLAND ENERGY	PICKAWAY	MADISON	BROWN, JAMES L	34129200640000	TREMPEALEAU
68	OH	DERBY OPERATING CORPORATION	NOBLE	ELK	MASON 1-2	34121225140000	OHIO SHALE
69	OH	DERBY OPERATING CORPORATION	NOBLE	ELK	SCHOTT #3	34121225230000	OHIO SHALE
70	OH	DERBY OPERATING CORPORATION	NOBLE	ELK	SMITH #3,H	34121225170000	OHIO SHALE
71	OH	ENERVEST OPERATING	FAIRFIELD	WALNUT	KAUFFMAN	34045212590000	ROSE RUN
72	OH	ENERVEST OPERATING	FAIRFIELD	WALNUT	SOLIDAY	34045211860000	ROSE RUN
73	OH	ENERVEST OPERATING	HOCKING	GREEN	HOCKING VALLEY PROD 149	34073608920000	
74	OH	GARY W CHAPMAN	PERRY	HOPEWELL	BARR, DANIEL	34127235410000	CLINTON
75	OH	GAS ENTERPRISE CO	MONROE	WASHINGTON	ENGLISH	34111200490000	BIG INJUN
76	OH	GEOMAXX EXPLORATION CO	MUSKINGUM	MONROE	WHARTON #1	34119286620000	BEREA
77	OH	GEOMAXX EXPLORATION CO	MUSKINGUM	MONROE	WHARTON #2A	34119286630000	BEREA
78	OH	GEOMAXX EXPLORATION CO	MUSKINGUM	MONROE	WHARTON #3	34119286660000	BEREA
79	OH	GEOMAXX EXPLORATION CO	MUSKINGUM	MONROE	WHARTON #4	34119286670000	BEREA
80	OH	GEOMAXX EXPLORATION CO	MUSKINGUM	MONROE	WHARTON #5	34119286690000	BEREA
81	OH	GEOMAXX EXPLORATION CO	MUSKINGUM	MONROE	WHARTON #6	34119286720000	BEREA
82	OH	GEOMAXX EXPLORATION CO	MUSKINGUM	MONROE	WHARTON #7	34119286730000	BEREA
83	OH	GEOMAXX EXPLORATION CO	MUSKINGUM	MONROE	WHARTON #8	34119286740000	BEREA
84	OH	GEOMAXX EXPLORATION CO	MUSKINGUM	MONROE	WHARTON #9	34119286750000	BEREA
85	OH	GEOPETRO INC	FAIRFIELD	BERNE	HOUSEHOLDER #1	34045211890000	BEEKMANTOWN
86	OH	GEOPETRO INC	FAIRFIELD	RUSH CREEK	BERRY	34045212320000	ROSE RUN
87	OH	HARRY BOYD	MONROE	FRANKLIN	BOYD, HARRY	34111241230000	BEREA/GORDON
88	OH	HOPCO RESOURCES INC	COSHOCTON	BETHLEHEM	LAPP UNIT #1	34031265910000	ROSE RUN
89	OH	HOUGHTON INVESTMENTS, LLC	MORROW	FRANKLIN	HIGGINS	34117234010000	TREMPEALEAU
90	OH	INDIAN HILLS RESOURCES LLC	WASHINGTON	SALEM	APPLEGARTH #1	34167283990000	CLINTON
91	OH	JAMES R. SMAL	NOBLE	SHARON	COMBS #1	34121230060000	CLINTON
92	OH	JD DRILLING	MEIGS	RUTLAND	O'BRIEN #2-3-4, JAMES & ROBERTA	34105222060000	BEREA
93	OH	JD DRILLING	VINTON	KNOX	HANING, FLOYD & MARY	34163208160000	BEREA
94	OH	KEN-OIL	PERRY	CLAYTON	MORRIS - PENNINGTON UNIT #1	34127272600000	ROSE RUN
95	OH	KILBARGER INVESTMENTS	HOCKING	GOOD HOPE	HAMBY	34073234350000	ROSE RUN
96	OH	KILLBUCK OILFIELD SERVICE	HOLMES	KILLBUCK TWP	MOORE #1,I	34075241350000	CLINTON
97	OH	KNOX ENERGY	KNOX	HARRISON	NORRIS	34083243000000	CLINTON
98	OH	KNOX ENERGY	KNOX	HARRISON	NORRIS, T	34083243410000	CLINTON
99	OH	KNOX ENERGY	KNOX	MIDDLEBURY	HOFFMAN #2	34083242340000	CLINTON
100	OH	KNOX ENERGY	KNOX	MIDDLEBURY	WAGNER #3	34083243260000	CLINTON
101	OH	KNOX ENERGY	LICKING	BURLINGTON	MCDANIEL UNIT #3	34089259780000	CLINTON
102	OH	KNOX ENERGY	LICKING	LIBERTY	FOGG UNIT #1	34089257060000	KNOX
103	OH	KNOX ENERGY	MEIGS	BEDFORD	WILLIAMS # 2 & 3	34105223570000	2ND BERE
104	OH	KNOX ENERGY	MORGAN	MEIGSVILLE	HANN #1	34115223220000	CLINTON

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
105	OH	LIBERTY OIL & GAS	MEIGS	ORANGE	KIBBLE, FRANCIS	34105218360000	BEREA
106	OH	MALLET ENERGY	GUERNSEY	KNOX	LUSK #1	34059216540000	CLINTON
107	OH	MALLET ENERGY	MUSKINGUM	BLUE ROCK	OHIO POWER #10	34119244530000	BEREA
108	OH	NGO DEVELOPMENT CORP	LICKING	UNION	OURS UNIT #1	34089257870000	ROSE RUN
109	OH	NGO DEVELOPMENT CORP	LICKING	UNION	OURS UNIT #2	34089258160000	ROSE RUN
110	OH	NORTHWOOD ENERGY CORPORATION	MORGAN	MEIGSVILLE	BOOKMAN	34115216830000	MEDINA
111	OH	NORTHWOOD ENERGY CORPORATION	MUSKINGUM	MEIGS	RAYNER #1 & 2	34119260220000	CLINTON
112	OH	NORTHWOOD ENERGY CORPORATION	NOBLE	NOBLE	GORDON	34121216680000	CLINTON
113	OH	NORTHWOOD ENERGY CORPORATION	NOBLE	NOBLE	SMITH, L	34121216490000	CLINTON
114	OH	NORTHWOOD ENERGY CORPORATION	NOBLE	SHARON	BOYD, C	34121216380000	CLINTON
115	OH	NORTHWOOD ENERGY CORPORATION	NOBLE	SHARON	BOYD, M	34121217530000	CLINTON
116	OH	NORTHWOOD ENERGY CORPORATION	NOBLE	SHARON	OGLE #2 & 3	34121233960000	CLINTON
117	OH	PC EXPLORATION INC	BELMONT	WASHINGTON	BOAN/MARCUM #2-1	34013205830000	MARCELLUS SHALE
118	OH	PC EXPLORATION INC	BELMONT	YORK	BOAN #2	34013205910000	
119	OH	PETROX	ATHENS	DOVER	SUNDAY CREEK COAL 18B	34009228350000	CLINTON
120	OH	PETROX	ATHENS	TRIMBLE	DRY DOCK COAL CO 59TR	34009228960000	CLINTON
121	OH	PETROX	ATHENS	TRIMBLE	OHIO MINING CO #1	34009227730000	CLINTON
122	OH	PETROX	ATHENS	TRIMBLE	SCC #73, 132, 142	34009232890000	CLINTON
123	OH	PETROX	ATHENS	TRIMBLE	SCC 56-81-109-129-148	34009233720000	CLINTON
124	OH	PETROX	ATHENS	TRIMBLE	SCC 622-123-124-139-140	34009232670000	CLINTON
125	OH	PETROX	ATHENS	TRIMBLE	SUNDAY CREEK COAL # 120 & 121	34009232700000	CLINTON
126	OH	PETROX	ATHENS	TRIMBLE	SUNDAY CREEK COAL #131	34009232770000	CLINTON
127	OH	PETROX	FAIRFIELD	RUSH CREEK	BLOSSER, MARGARET H	34045202890000	CLINTON
128	OH	PETROX	HOCKING	FALLS GORE	PROCTOR, LYDIA A	34073604090000	CLINTON
129	OH	PETROX	HOCKING	WARD	SCC #21R, 25R & 35	34073224830000	CLINTON
130	OH	PETROX	HOCKING	WARD	SCC 67-48-51-68-69-77-91-153	34073604090000	CLINTON
131	OH	PETROX	HOCKING	WARD	SCC 84-108 ETAL	34073230700000	CLINTON
132	OH	PETROX	HOCKING	WARD	SUNDAY CREEK 126-145	34073232090000	CLINTON
133	OH	PETROX	HOCKING	WARD	SUNDAY CREEK #43	34073226670000	CLINTON
134	OH	PETROX	HOCKING	WARD	SUNDAY CREEK 2-135-155-146	34073233030000	CLINTON
135	OH	PETROX	HOCKING	WARD	SUNDAY CREEK COAL #19	34073224670000	CLINTON
136	OH	PETROX	HOCKING	WARD	SUNDAY CREEK COAL #3 & 15	34073219860000	CLINTON
137	OH	PETROX	HOCKING	WARD	SUNDAY CREEK COAL 24R	34073220010000	CLINTON
138	OH	PETROX	HOCKING	WARD	SUNDAY CREEK COAL 31R & 32R	34073220410000	CLINTON
139	OH	PETROX	HOCKING	WARD	SUNDAY CREEK COAL CO #3	34073216750000	CLINTON
140	OH	PETROX	HOCKING	WARD	SUNDAY CREEK COAL CO #34	34073224840000	CLINTON
141	OH	PETROX	MUSKINGUM	BLUE ROCK	HARLAN #1, D	34119273360000	CLINTON
142	OH	PETROX	MUSKINGUM	BLUE ROCK	MITCHELL, V	34119230920000	CLINTON
143	OH	PETROX	MUSKINGUM	MEIGS	ANDERSON #21	34119252240000	CLINTON
144	OH	PHILLIPS EXPLORATION	BELMONT	MEAD	GULLEY #1	34013206030000	MARCELLUS SHALE
145	OH	PHILLIPS EXPLORATION	MONROE	SWITZERLAND	MARCUM #8-1	34013205840000	DEVONIAN SHALE
146	OH	PROGRESSIVE OIL AND GAS	VINTON	KNOX	BROOKS, KENNY	34163604110000	BEREA
147	OH	RALPH L MCAULEY	WASHINGTON	ADAMS	BASNETT #1	34167225400000	BEREA
148	OH	RICHARD C POLING	PICKAWAY	WASHINGTON	GREENLEE	34129201160000	ROSE RUN
149	OH	ROBERT REED	NOBLE	OLIVE	REED #1, ROBERT	34121215310000	CLINTON
150	OH	SCION ENERGY, INC	MORROW	PERRY	KRABILL - LANKER #1	34117242080000	
151	OH	SCION ENERGY, INC	MORROW	PERRY	SCOTT #1	34117242090000	
152	OH	SCION ENERGY, INC	MORROW	PERRY	SMITH - MORRISON #1	34117242100000	
153	OH	TATUM PETROLEUM	HOLMES	HARDY	SHIRLEY #1	34075251460000	ROSE RUN
154	OH	TATUM PETROLEUM	MUSKINGUM	WAYNE	KAY #1	34119286210000	BEEKMANTOWN
155	OH	TATUM PETROLEUM	MUSKINGUM	WAYNE	KELLY J-1 8638	34119286380000	
156	OH	TJ'S OIL & GAS	COSHOCTON	PIKE	CODY #1	34031251730000	CLINTON

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
157	OH	TRIAD ENERGY CORP OF WV INC	MORGAN	CENTER	REMLEIGH #1	34115214590000	BEREA
158	OH	TRIAD ENERGY CORP OF WV INC	MORGAN	CENTER	WILEY UNIT	34115215460000	CLINTON
159	OH	TRIAD ENERGY CORP OF WV INC	WASHINGTON	AURELIUS	TORPY, C D	34167242170000	BEREA
160	OH	WHITACRE ENTERPRISES, INC.	MONROE	CENTER	BROWN #2, V	34111242500000	FIFTH SAND/GORDON
161	OH	WHITACRE ENTERPRISES, INC.	MONROE	CENTER	GRIFFITH #1,L	34111242200000	FIFTH SAND/GORDON
162	OH	WHITACRE ENTERPRISES, INC.	MONROE	CENTER	JANUARY, T	34111242570000	FIFTH SAND/GORDON
163	OH	WHITACRE ENTERPRISES, INC.	MONROE	CENTER	KING #2,C	34111242420000	FIFTH SAND/GORDON
164	OH	WHITACRE ENTERPRISES, INC.	MONROE	CENTER	KING #3,B	34111242470000	FIFTH SAND/GORDON
165	OH	WHITACRE ENTERPRISES, INC.	MONROE	CENTER	KING #5,C	34111241700000	FIFTH SAND/GORDON
166	OH	WHITACRE ENTERPRISES, INC.	MONROE	CENTER	KING #6,C	34111242460000	FIFTH SAND/GORDON
167	OH	WHITACRE ENTERPRISES, INC.	MONROE	CENTER	MCLAUGHLIN #1,R	34111242110000	FIFTH SAND/GORDON
168	OH	WHITACRE ENTERPRISES, INC.	MONROE	SUMMIT	CARPENTER #2,D	34111242430000	FIFTH SAND/GORDON
169	OH	WHITACRE ENTERPRISES, INC.	MONROE	SUMMIT	CARPENTER, D	34111242050000	FIFTH SAND/GORDON
170	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	BARTENSCHLAG #3	34111241280000	FIFTH SAND/GORDON
171	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	BATES #2,R	34111241360000	FIFTH SAND/GORDON
172	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	BRIGHT #4, DAVID	34111241960000	FIFTH SAND/GORDON
173	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	BRIGHT #5, DAVID	34111240770000	FIFTH SAND/GORDON
174	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	BRIGHT #6, DAVID	34111241990000	FIFTH SAND/GORDON
175	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	BRIGHT #8, DAVE	34111242520000	FIFTH SAND/GORDON
176	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	CISLER #1,C/GOV'T	34111241980000	FIFTH SAND/GORDON
177	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	FILLIPELLI #1,F	34111240930000	FIFTH SAND/GORDON
178	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	KOEHLER #2,P	34111241630000	FIFTH SAND/GORDON
179	OH	WHITACRE ENTERPRISES, INC.	MONROE	WAYNE	SMITHBERGER #3,C	34111242230000	FIFTH SAND/GORDON
180	WV	A B RESOURCES	MARSHALL	THREE	HART #1	4705101221	MARCELLUS SHALE
181	WV	A B RESOURCES	MARSHALL	THREE	PRENDERGAST	4705101113	MARCELLUS SHALE
182	WV	A B RESOURCES LLC	MARSHALL	ONE	NEEHOUSE 1H	4705101224	MARCELLUS SHALE
183	WV	A B RESOURCES LLC	MARSHALL	THREE	CARMICHAEL #1	4705101235	MARCELLUS SHALE
184	WV	A B RESOURCES LLC	MARSHALL	THREE	CAVENEY #1-H	4705101263	MARCELLUS SHALE
185	WV	ABARTA OIL & GAS COMPANY INC	BARBOUR	SOUTH	BOLYARD #1, E	4700102860	HAVARTY, ELK, RILEY
186	WV	ABARTA OIL & GAS COMPANY INC	BARBOUR	SOUTH	MOUSER #1, A	4700102963	ELK, RILEY, BENSON, 5TH, BAYARD
187	WV	ABARTA OIL & GAS COMPANY INC	BARBOUR	SOUTH	POLING #1,TIM	4700102962	HAVARTY, ELK, 5TH, BAYARD
188	WV	APPALACHIAN GAS AND OIL TRUST	DODDRIDGE	CENTRAL	MORAN #1	4701705704	RILEY, BENSON, ALEXANDER, WARREN, BRADFORD
189	WV	APPALACHIAN GAS AND OIL TRUST	DODDRIDGE	NEW MILTON	ARPS #8	4701705841	WEIR, BEREA, GORDON, B MONDAY, KEENER, BIG INJUN
190	WV	APPALACHIAN GAS AND OIL TRUST	DODDRIDGE	NEW MILTON	ARPS #9	4701705842	WEIR, BEREA, GORDON, B MONDAY, KEENER, BIG INJUN
191	WV	APPALACHIAN GAS AND OIL TRUST	DODDRIDGE	WEST UNION	BALLOUZ #2	4701705242	RILEY, BENSON, ALEXANDER, WARREN, BRADFORD
192	WV	APPALACHIAN GAS AND OIL TRUST	DODDRIDGE	WEST UNION	RANDOLPH #4, G	4701705686	INJUN, WEIR, B MONDAY, KEENER
193	WV	APPALACHIAN GAS AND OIL TRUST	RITCHIE	MURPHY	MILLER 1M	4708509811	ALEXANDER, ELK
194	WV	APPALACHIAN GAS AND OIL TRUST	RITCHIE	UNION	BAKER #3	4708509835	BIG INJUN
195	WV	APPALACHIAN GAS AND OIL TRUST	RITCHIE	UNION	CRANE #2, W C	4708509345	INJUN, WEIR
196	WV	APPALACHIAN GAS AND OIL TRUST	RITCHIE	UNION	CRANE #3,W C	4708509368	INJUN, WEIR
197	WV	APPALACHIAN GAS AND OIL TRUST	RITCHIE	UNION	CRONIN #2	4708509724	BLUE MONDAY, INJUN
198	WV	APPALACHIAN GAS AND OIL TRUST	RITCHIE	UNION	SHEFFER #3	4708509586	LITTLE INJUN, WEIR
199	WV	BIALEK OIL & GAS CORP	RITCHIE	CLAY	MCGINNIS	4708508367	
200	WV	BLACK CROW OIL LLC	ROANE	NORTHERN	GOFF, LIDDY	4708701943	
201	WV	BLACK CROW OIL LLC	ROANE	WALTON	HUNT #4, CS	4708704641	
202	WV	BLACK CROW OIL LLC	ROANE	WALTON	HUNT #5, C S	4708704642	
203	WV	BLACK CROW OIL LLC	ROANE	WALTON	HUNT 1-3, C S	4708701072	
204	WV	BLACK CROW OIL LLC	ROANE	WESTERN	HUNT CS #6	4708704643	
205	WV	BLACK CROW OIL LLC	ROANE	WESTERN	SUMMERS #1	4708701373	
206	WV	BLACK ROCK ENTERPRISE LLC	HARRISON	SOUTHWEST	BENEDUM #2	4703304993	
207	WV	BOWIE INC	HARRISON	SOUTHWEST	MAXWELL #18	4703304810	
208	WV	BOWIE INC	HARRISON	SOUTHWEST	MAXWELL #19	4703305196	

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
209	WV	BOWIE INC	HARRISON	SOUTHWEST	MORRISON #1	4703304251	
210	WV	BOWIE INC	HARRISON	SUBURBAN	MAXWELL #08	4703304454	
211	WV	BOWIE INC	HARRISON	SUBURBAN	MAXWELL #10	4703304558	
212	WV	BOWIE INC	HARRISON	UNION	SHAWHAN #1	4703304664	
213	WV	BOWIE INC	HARRISON	UNION	WALKER #1	4703304849	
214	WV	BRAXTON OIL & GAS CORP	GILMER	GLENVILLE	DARNELL #2	4702102542	
215	WV	BUCKEYE OIL PRODUCING CO	CALHOUN	CENTER	BENNETT HEIRS #10	4701303025	
216	WV	BUCKEYE OIL PRODUCING CO	CALHOUN	CENTER	HUNTER-BENNETT #2	4701304684	
217	WV	BUCKEYE OIL PRODUCING CO	CALHOUN	CENTER	JACKSON #1, A H	4701303083	
218	WV	BUCKEYE OIL PRODUCING CO	CALHOUN	CENTER	PARSON #2	4701304685	
219	WV	BUCKEYE OIL PRODUCING CO	CALHOUN	CENTER	SCOTT, W.T.	4701301960	
220	WV	BUCKEYE OIL PRODUCING CO	RITCHIE	MURPHY	MILLER #24	4701304583	
221	WV	BUCKEYE OIL PRODUCING CO	RITCHIE	MURPHY	MILLER #27	4701304674	
222	WV	BUCKEYE OIL PRODUCING CO	WIRT	BURNING SPRINGS	PIEDMONT M-J #1	4710501349	
223	WV	BUCKEYE OIL PRODUCING CO	WIRT	BURNING SPRINGS	PIEDMONT M-J #2	4710501350	
224	WV	CABOT OIL & GAS CORPORATION	PUTNAM	POCATALICO	CABOT #100	4707901452	
225	WV	CHARITY GAS INC	GILMER	TROY	HECKERT HEIRS	4702100853	
226	WV	CHESAPEAKE APPALACHIA LLC	BRAXTON	OTTER	WELL 626407	4700702539	
227	WV	CHESAPEAKE APPALACHIA LLC	GILMER	GLENVILLE	MINIGH 910193	4702101442	
228	WV	CHESAPEAKE APPALACHIA LLC	GILMER	GLENVILLE	MOORE A1002, B	4702103763	
229	WV	CHESAPEAKE APPALACHIA LLC	HARRISON	NORTHERN	LOWE A -953	4703302556	
230	WV	CHESAPEAKE APPALACHIA LLC	LEWIS	COURT HOUSE	DIOCESE OF WHEELING A-1701	4704103546	
231	WV	CHESAPEAKE APPALACHIA LLC	LEWIS	COURT HOUSE	LAMB 1196	4704103207	
232	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	C G T 627338, 3-H	4705101229	
233	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	C G T 627339 5-H	4705101272	
234	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	HAMMERS (627450) #9H	4705101292	
235	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	HAMMERS (627448) #3H	4705101290	
236	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	MCDOWELL (#B) 10H	4705101241	
237	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	MCDOWELL (#B) 6H	4705101249	
238	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	MCDOWELL 627044 3-H, R	4705101228	
239	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	MCDOWELL 627046 6-H, R	4705101249	
240	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	STERN 626713	4705101092	
241	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	STERN 626714	4705101091	
242	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	STERN H3 (626700)	4705101160	
243	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	STERN H4 (627011)	4705101162	
244	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	STERN H5 (626701)	4705101161	
245	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	STERN H6 (627325)	4705101240	
246	WV	CHESAPEAKE APPALACHIA LLC	MARSHALL	THREE	TECO ELSON #626348	4705101093	
247	WV	CHESAPEAKE APPALACHIA LLC	UPSHUR	BANKES	QUEEN A-567	4709701645	
248	WV	CHESAPEAKE APPALACHIA LLC	UPSHUR	BUCKHANNON	625970 SAPP	4709703291	
249	WV	CHESAPEAKE APPALACHIA LLC	UPSHUR	BUCKHANNON	SUMMER A-719	4709701794	
250	WV	CHESAPEAKE APPALACHIA LLC	UPSHUR	BUCKHANNON	WELL # 911111	4709702398	
251	WV	CHESAPEAKE APPALACHIA LLC	UPSHUR	MEADE	LIGHT 625795	4709703253	
252	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	ALTMAN 625530	4705101038	
253	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	A-PAD 627258	4710302439	
254	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	BERISFORD 627251 3-H	4710302453	
255	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	BERISFORD 627252 5-H	4710302454	
256	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	BERISFORD 627675, 1-H	4710302461	
257	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	BROGEN 626790	4710302364	
258	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	CHESAPEAKE A-PAD 627256 6-H	4710302437	
259	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	CHESAPEAKE A-PAD 627257 8-H	4710302438	
260	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	DAVIS 2-H	4709701570	

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
261	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	HOHMAN 625531	4710302231	
262	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	JOHNSON 627389 1-H,F	4710302469	
263	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	KELLY 10-H 627040	4710302408	
264	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	LUCKY D-H1 (627002)	4710302427	
265	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	LUCKY D-H1 (627003)	4710302428	
266	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	LUCKY D-H3 (627002)	4710302427	
267	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	LUCKY D-H4 (626889)	4710302366	
268	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	LUCKY D-H8 (626888)	4710302371	
269	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	PROCKO 625599	4710302236	
270	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	WHITEMAN 627374 5-H	4710302449	
271	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	WHITEMAN 627375 8-H	4710302440	
272	WV	CHESAPEAKE APPALACHIA LLC	WETZEL	PROCTOR	YOHO 626518	4705101056	
273	WV	CONTINENTAL PETROLEUM	GILMER	GLENVILLE	GROVE	4702101922	
274	WV	COW RUN ENERGY LLC	PLEASANTS	BELMONT	BURNING SPRINGS #1	4707302492	
275	WV	CRESTON WELL SERVICES INC	WIRT	BURNING SPRINGS	GIBSON #1	4701502440	
276	WV	DB EXPLORATION LLC	LEWIS	COURT HOUSE	SCHLEE #5	4704105248	
277	WV	DIVERSIFIED RESOURCES INC	LEWIS	HACKERS CREEK	SMITH D 104	4704104732	
278	WV	DIVERSIFIED RESOURCES INC	LEWIS	SKIN CREEK	SUMMERS D-95	4704104523	
279	WV	DOMINION APPALACHIAN	DODDRIDGE	GREENBRIER	PLAUGER 10150	4701703338	GORDON
280	WV	DOMINION APPALACHIAN	GILMER	GLENVILLE	LIVELY 3-11258	4709701278	
281	WV	DOMINION APPALACHIAN	LEWIS	FREEMANS CREEK	404034	4704105548	
282	WV	DOMINION APPALACHIAN	LEWIS	HACKERS CREEK	11121, DADI TIERNEY #1	4704103287	
283	WV	DOMINION APPALACHIAN	LEWIS	HACKERS CREEK	ROHR #5	4704103508	
284	WV	DOMINION APPALACHIAN	UPSHUR	BUCKHANNON	CARTER 10189	4709702790	
285	WV	DOMINION APPALACHIAN	UPSHUR	WASHINGTON	BOYLES #1 11902	4700701120	
286	WV	DOMINION EXPL & PROD INC	BARBOUR	NORTH	487	4700102051	
287	WV	DOMINION EXPL & PROD INC	BARBOUR	NORTH	5195	4700102736	
288	WV	DOMINION EXPL & PROD INC	BARBOUR	NORTH	33238	4700102987	MARCELLUS
289	WV	DOMINION EXPL & PROD INC	BARBOUR	NORTH	33306	4700102985	MARCELLUS
290	WV	DOMINION EXPL & PROD INC	BARBOUR	NORTH	33914	4700103072	MARCELLUS
291	WV	DOMINION EXPL & PROD INC	BARBOUR	NORTH	34535	4700103049	SPEECHLY, RILEY, BENSON, ELK
292	WV	DOMINION EXPL & PROD INC	BARBOUR	NORTH	34601	4700103050	SPEECHLY, BALLTOWN RILEY
293	WV	DOMINION EXPL & PROD INC	BARBOUR	WEST	2529	4700102294	
294	WV	DOMINION EXPL & PROD INC	BARBOUR	WEST	5581	4700102781	
295	WV	DOMINION EXPL & PROD INC	BARBOUR	WEST	32670	4700102923	RILEY, BENSON
296	WV	DOMINION EXPL & PROD INC	DODDRIDGE	CENTRAL	33928	4701705772	ELIZABETH, SPEECHLEY, BENSON, ALEXANDER
297	WV	DOMINION EXPL & PROD INC	DODDRIDGE	COVE	32667	4701705559	
298	WV	DOMINION EXPL & PROD INC	DODDRIDGE	COVE	33255	4701705730	BIG INJUN, WEIR, GORDON
299	WV	DOMINION EXPL & PROD INC	DODDRIDGE	COVE	33258	4701705741	BIG INJUN, GORDON
300	WV	DOMINION EXPL & PROD INC	DODDRIDGE	COVE	33262	4701705742	BIG INJUN, GORDON
301	WV	DOMINION EXPL & PROD INC	DODDRIDGE	COVE	33263	4701705728	BIG INJUN, WEIR, GORDON
302	WV	DOMINION EXPL & PROD INC	DODDRIDGE	GRANT	7180	4701705035	BIG INJUN, SQUAW, GORDON, B MONDAY, SALT SAND
303	WV	DOMINION EXPL & PROD INC	DODDRIDGE	GRANT	8489	4701705111	BIG INJUN, GORDON, BENSON
304	WV	DOMINION EXPL & PROD INC	DODDRIDGE	GRANT	8522	4701705744	MAXTON, SQUAW, GORDON
305	WV	DOMINION EXPL & PROD INC	DODDRIDGE	NEW MILTON	14121	4701705013	BENSON, BALLTOWN, GORDON, 30'
306	WV	DOMINION EXPL & PROD INC	DODDRIDGE	NEW MILTON	33929	4701705773	WARREN, BRADFORD, BENSON, ALEXANDER
307	WV	DOMINION EXPL & PROD INC	GILMER	CENTER	FURR 32691	4702105616	
308	WV	DOMINION EXPL & PROD INC	GILMER	DEKLAB	15458	4702105516	
309	WV	DOMINION EXPL & PROD INC	GILMER	TROY	31195	4702105655	
310	WV	DOMINION EXPL & PROD INC	GILMER	TROY	32723	4702105569	
311	WV	DOMINION EXPL & PROD INC	GILMER	TROY	32783	4702105587	
312	WV	DOMINION EXPL & PROD INC	GILMER	TROY	32787	4702105667	

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
313	WV	DOMINION EXPL & PROD INC	HARRISON	NORTHERN	15102	4703304940	
314	WV	DOMINION EXPL & PROD INC	HARRISON	NORTHERN	15105	4703305071	
315	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHEAST	14656	4703305125	
316	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14462	4703304674	
317	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14467	4703304701	
318	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14469	4703304818	
319	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14470	4703304815	
320	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14654	4703305168	
321	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14773	4703305046	
322	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14775	4703305051	
323	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14776	4703305069	
324	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14782	4703305058	
325	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	14798	4703305032	
326	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	15189	4703305156	
327	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	32645	4703305150	
328	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	33898	4703305197	
329	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	ANDREWS 2088	4703303280	
330	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	HAYMOND 3222,L	4703303538	
331	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	MORRISON 2841	4703303486	
332	WV	DOMINION EXPL & PROD INC	HARRISON	SOUTHWEST	RHOADS 3651	4703304325	
333	WV	DOMINION EXPL & PROD INC	HARRISON	SUBURBAN	14674	4703305089	
334	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	6572	4704104832	
335	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	6607	4704104872	
336	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	14264	4704104945	
337	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	14381	4704105022	
338	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	14394	4704105024	
339	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	14573	4704105078	
340	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	14577	4704105366	
341	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	14616	4704105214	
342	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	14619	4704105260	
343	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	14951	4704105469	
344	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	15054	4704105167	
345	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	#32906	4704105497	
346	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	DOORY 32897, J T	4704105489	
347	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	DORRY #32896	4704105488	
348	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	HULL 32953	4704105498	
349	WV	DOMINION EXPL & PROD INC	LEWIS	COURT HOUSE	MOODY #14839	4704105082	
350	WV	DOMINION EXPL & PROD INC	LEWIS	FREEMANS CREEK	14139	4704105459	
351	WV	DOMINION EXPL & PROD INC	LEWIS	FREEMANS CREEK	14474	4704105165	
352	WV	DOMINION EXPL & PROD INC	LEWIS	FREEMANS CREEK	14605	4704105182	
353	WV	DOMINION EXPL & PROD INC	LEWIS	FREEMANS CREEK	32987	4704105546	
354	WV	DOMINION EXPL & PROD INC	LEWIS	FREEMANS CREEK	ALFRED #32898,G C	4704105490	
355	WV	DOMINION EXPL & PROD INC	LEWIS	FREEMANS CREEK	COLE 6204	4704104633	
356	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	5045	4704101971	
357	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	6405	4704104790	
358	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	6432	4704104793	
359	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	6517	4704105217	
360	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	14632	4704105408	
361	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	15178	4704105370	
362	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	31235	4704105470	
363	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	31236	4704105471	
364	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	33241	4704105432	

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No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
365	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	34624	4704105518	
366	WV	DOMINION EXPL & PROD INC	LEWIS	HACKERS CREEK	HOOVER 14618	4704105259	
367	WV	DOMINION EXPL & PROD INC	MONONGALIA	EASTERN	7122	4708702110	
368	WV	DOMINION EXPL & PROD INC	MONONGALIA	EASTERN	7124	4708702112	
369	WV	DOMINION EXPL & PROD INC	PRESTON	VALLEY	7132	4707700179	
370	WV	DOMINION EXPL & PROD INC	RITCHIE	MURPHY	31313	4708509822	
371	WV	DOMINION EXPL & PROD INC	RITCHIE	MURPHY	33706	4708509789	
372	WV	DOMINION EXPL & PROD INC	RITCHIE	MURPHY	33709	4708509800	
373	WV	DOMINION EXPL & PROD INC	RITCHIE	MURPHY	#33708	4708509790	
374	WV	DOMINION EXPL & PROD INC	RITCHIE	UNION	JARVIS 14745, H M	4708509329	
375	WV	DOMINION EXPL & PROD INC	RITCHIE	UNION	JARVIS 15320, H M	4708509762	
376	WV	DOMINION EXPL & PROD INC	TAYLOR	EASTERN	33279	4709101112	
377	WV	DOMINION EXPL & PROD INC	TAYLOR	EASTERN	33280	4709101113	
378	WV	DOMINION EXPL & PROD INC	TAYLOR	EASTERN	33282	4709101115	
379	WV	DOMINION EXPL & PROD INC	UPSHUR	MEADE	33172	4709703664	
380	WV	DOMINION EXPL & PROD INC	UPSHUR	WARREN	HILDRETH 3040	4709702811	
381	WV	DORWARD ENERGY CORP	GILMER	GLENVILLE	LYNCH #1	4702101958	
382	WV	DORWARD ENERGY CORP	GILMER	GLENVILLE	LYNCH #3	4702105501	
383	WV	DORWARD ENERGY CORP	GILMER	GLENVILLE	LYNCH #4	4702105493	
384	WV	DORWARD ENERGY CORP	GILMER	GLENVILLE	LYNCH #6	4702105495	
385	WV	DORWARD ENERGY CORP	GILMER	GLENVILLE	LYNCH #9	4702105496	
386	WV	DORWARD ENERGY CORP	GILMER	TROY	BURKHAMMER #4	4702105583	
387	WV	DORWARD ENERGY CORP	GILMER	TROY	BURKHAMMER #5	4702105497	
388	WV	DORWARD ENERGY CORP	GILMER	TROY	LUCKEY #4	4702105492	
389	WV	DORWARD ENERGY CORP	GILMER	TROY	LUCKY #3	4702105582	
390	WV	DORWARD ENERGY CORP	LEWIS	FREEMANS CREEK	HALL #3	4704104679	
391	WV	DORWARD ENERGY CORP	LEWIS	HACKERS CREEK	ERVIN #2	4704105104	
392	WV	DORWARD ENERGY CORP	LEWIS	HACKERS CREEK	ERVIN #3	4704105105	
393	WV	DORWARD ENERGY CORP	RITCHIE	MURPHY	VALENTINE 1&4	4708508936	
394	WV	EAST RESOURCES INC	GILMER	TROY	BRANNON, PINKARD	4702101564	
395	WV	EAST RESOURCES INC	GILMER	TROY	RYMER #10, A L	4702103181	
396	WV	EAST RESOURCES INC	HARRISON	SOUTHEAST	LYNCH #44	4703301797	
397	WV	EAST RESOURCES INC	HARRISON	SOUTHWEST	LYNCH #110	4703304906	
398	WV	EAST RESOURCES INC	HARRISON	SOUTHWEST	LYNCH #209	4703304881	
399	WV	EAST RESOURCES INC	HARRISON	SOUTHWEST	LYNCH #3	4703301778	
400	WV	EAST RESOURCES INC	HARRISON	SOUTHWEST	LYNCH #31	4703301791	
401	WV	EAST RESOURCES INC	HARRISON	SOUTHWEST	LYNCH 210	4703305255	
402	WV	EAST RESOURCES INC	LINCOLN	DUVAL	GRASS #3, J M	4704302249	
403	WV	EAST RESOURCES INC	LINCOLN	DUVAL	HORSE CREEK-92	4704301502	
404	WV	EAST RESOURCES INC	LINCOLN	DUVAL	JONES #10-17, GENNIE	4704301497	
405	WV	EAST RESOURCES INC	LINCOLN	THREE	GRIFFITH #1, AUSTIN	4704300389	
406	WV	EAST RESOURCES INC	LINCOLN	THREE	GRIFFITH M1, AUSTIN	4704303409	
407	WV	EAST RESOURCES INC	LINCOLN	TWO	GRIFFITH 200-202, AUSTIN	4704303399	
408	WV	EAST RESOURCES INC	MARRION	MANNINGTON	WEBB, PHOEBE	4703302068	
409	WV	EAST RESOURCES INC	MONONGALIA	WESTERN	ACCHA #4, EDDY	4706100473	
410	WV	EAST RESOURCES INC	ROANE	SMITHFIELD	KAUFMAN #7	4708700985	
411	WV	EAST RESOURCES INC	WETZEL	GRANT	HOYT #82, LS WILEYVILLE UNIT 1	4710301003	
412	WV	EAST RESOURCES INC	WETZEL	GRANT	SHUMAN HEIRS #5	4710301107	
413	WV	EAST RESOURCES INC	WETZEL	ONE	WALTERS #4	4710300288	
414	WV	EASTERN AMERICAN ENERGY CORP	BRAXTON	HOLLY	JACKSON #2, E	4700702494	
415	WV	EASTERN AMERICAN ENERGY CORP	BRAXTON	OTTER	JACKSON #1, E	4700702128	
416	WV	EASTERN AMERICAN ENERGY CORP	BRAXTON	OTTER	JACKSON #4, DELPHA	4700702194	

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
417	WV	EASTERN AMERICAN ENERGY CORP	DODDRIDGE	WEST UNION	8-280	4701702944	
418	WV	EASTERN AMERICAN ENERGY CORP	DODDRIDGE	WEST UNION	LEADER BRAND #3	4701705462	ALEXANDER, BENSON, RILEY, BALLTOWN, WARREN
419	WV	EASTERN AMERICAN ENERGY CORP	GILMER	GLENVILLE	FULTON #7	4702103376	
420	WV	EASTERN AMERICAN ENERGY CORP	RANDOLPH	CHEAT	MCNEAL	4708300141	
421	WV	EASTERN AMERICAN ENERGY CORP	RITCHIE	CLAY	JK 1117	4708507270	
422	WV	ENERVEST APPALACHIA LP	WOOD	STEELE	BRYANT	4710701586	
423	WV	EQT PRODUCTION COMPANY	BRAXTON	BIRCH	ROS #78-510838	4700702589	
424	WV	EQT PRODUCTION COMPANY	BRAXTON	OTTER	BOGGS 7732	4700700090	
425	WV	EQT PRODUCTION COMPANY	BRAXTON	SALT LICK	DRAKE #1	4700700929	
426	WV	EQT PRODUCTION COMPANY	BRAXTON	SALT LICK	STOUT #3	4700700988	
427	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	510844	4701705726	
428	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	511530	4701705786	
429	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	511531	4701705787	MARCELLUS
430	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	512414	4701705788	
431	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	512415	4701705789	
432	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	512417	4701705790	
433	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	512420	4701705848	
434	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	512421	4701705849	
435	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	512425	4701705791	
436	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	512429	4701705792	
437	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	15108421 OXFORD 45	4701705644	GENESSEE
438	WV	EQT PRODUCTION COMPANY	DODDRIDGE	COVE	510840 OXF43	4701705629	MARCELLUS
439	WV	EQT PRODUCTION COMPANY	GILMER	DEKLAB	TIERNEY #479	4702104556	
440	WV	EQT PRODUCTION COMPANY	GILMER	GLENVILLE	JACKSON #1A	4702103907	
441	WV	EQT PRODUCTION COMPANY	GILMER	GLENVILLE	MARTINO 368	4702104313	
442	WV	EQT PRODUCTION COMPANY	GILMER	GLENVILLE	WHITING #5-A	4702102745	
443	WV	EQT PRODUCTION COMPANY	LEWIS	HACKERS CREEK	BER-#30 510866	4704105268	
444	WV	EQT PRODUCTION COMPANY	LEWIS	SKIN CREEK	ROA #59-511061	4704105347	
445	WV	EQT PRODUCTION COMPANY	LINCOLN	TWO	LINCOLN LAND #27	4704302904	
446	WV	EQT PRODUCTION COMPANY	PRESTON	VALLEY	DALTON A-802	4707700198	
447	WV	EQT PRODUCTION COMPANY	PRESTON	VALLEY	W V BOARD OF GOV A-808	4707700201	
448	WV	EQT PRODUCTION COMPANY	TAYLOR	WESTERN	510993	4709101102	
449	WV	EQT PRODUCTION COMPANY	TAYLOR	WESTERN	511398RS M16H1	4709101100	
450	WV	EQT PRODUCTION COMPANY	WETZEL	ONE	P & G 29-510845	4710302292	
451	WV	EXCO - NORTH COAST ENERGY INC	BARBOUR	WEST	WENTZ #3	4700102981	MARCELLUS
452	WV	EXCO - NORTH COAST ENERGY INC	BARBOUR	WEST	WENTZ #4	4700102982	MARCELLUS
453	WV	EXCO - NORTH COAST ENERGY INC	DODDRIDGE	CENTER	HURST JR.	4701700728	BIG INJUN
454	WV	EXCO - NORTH COAST ENERGY INC	HARRISON	SOUTHEAST	CHILDERS #1	4703304470	
455	WV	EXCO - NORTH COAST ENERGY INC	HARRISON	SOUTHEAST	PETTITO #1	4703304399	
456	WV	EXCO - NORTH COAST ENERGY INC	HARRISON	SOUTHEAST	WAGNER #1	4703304495	
457	WV	EXCO - NORTH COAST ENERGY INC	HARRISON	SUBURBAN	ANDERSON #1	4703304467	
458	WV	EXCO - NORTH COAST ENERGY INC	HARRISON	SUBURBAN	BURNSWARTH #1	4703304468	
459	WV	EXCO - NORTH COAST ENERGY INC	HARRISON	SUBURBAN	PHILLIPS #2	4703304489	
460	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	COURT HOUSE	MCINTOSH #1	4704104949	
461	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	BISHOP #2	4703304564	
462	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	CLAIRE-LINGER #2	4704104916	
463	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	DAWSON #2	4704105442	
464	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	HARMAN #3	4704104701	
465	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	HERSHMAN #4	4704104813	
466	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	HERSMAN #3 STOCK TANK	4704104337	
467	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	KEIL #1	4704104699	
468	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	LONG #4	4704104270	

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No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
469	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	LONG #8	4704104278	
470	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	LONG #9	4704104297	
471	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	MAYES #2	4704104309	
472	WV	EXCO - NORTH COAST ENERGY INC	LEWIS	HACKERS CREEK	MAYES #3	4704104700	
473	WV	EXCO - NORTH COAST ENERGY INC	TYLER	MCELROY	WEESE	4709500996	
474	WV	EXCO - NORTH COAST ENERGY INC	UPSHUR	BANKES	RIFFLE #1, C	4709703156	
475	WV	EXCO - NORTH COAST ENERGY INC	UPSHUR	MEADE	BOYD #2	4709700158	
476	WV	EXCO - NORTH COAST ENERGY INC	UPSHUR	MEADE	MCQUAIN #1	4709703106	
477	WV	EXCO - NORTH COAST ENERGY INC	UPSHUR	MEADE	WIMER A-1	4704101063	
478	WV	EXCO - NORTH COAST ENERGY INC	UPSHUR	WARREN	LONG #7	4704104277	
479	WV	FRANCIS WELL SERVICE	JACKSON	RAVENWOOD	FRANCIS #4	4703501750	
480	WV	FRANCIS WELL SERVICE	JACKSON	RAVENWOOD	STEWART #1	4710500458	
481	WV	G & S OIL AND GAS	RITCHIE	GRANT	LIGHT #5	4708506841	
482	WV	GALLATIN FUELS INC	MARION	MANNINGTON	NICHENKE #7 KIM LISA TEAGARDEN	4704901751	
483	WV	GALLATIN FUELS INC	MARION	MANNINGTON	RIGGS #1	4704901455	
484	WV	GALLATIN FUELS INC	MARION	MANNINGTON	RIGGS #3	4704901827	
485	WV	GASSEARCH CORPORATION	HARRISON	NORTHERN	HANNAH #1	4703304516	
486	WV	GASTAR EXPLORATION USA INC	MONONGALLA	WESTERN	JEFFORY #1	4706101579	
487	WV	GASTAR EXPLORATION USA INC	HARRISON	SUBURBAN	GALVIN #1	4703305161	
488	WV	HARDEE PETROLEUM CO	CLAY	UNION	ELK #25	4701502868	
489	WV	HORIZON ENERGY CORP	GILMER	GLENVILLE	MERTZ 3A	4702105223	
490	WV	HORIZON ENERGY CORP	GILMER	GLENVILLE	PARKER #4A	4704104437	
491	WV	HORIZON ENERGY CORP	LEWIS	COURT HOUSE	HEATER #1	4702104214	
492	WV	HORIZON ENERGY CORP	LEWIS	COURT HOUSE	MERTZ #12-A	4704104471	
493	WV	HORIZON ENERGY CORP	LEWIS	COURT HOUSE	MONEY PENNY #1, BURL	4704100614	
494	WV	HORIZON ENERGY CORP	LEWIS	HACKERS CREEK	LINGER #1, CLARE	4700700568	
495	WV	JERRY LONG	BRAXTON	OTTER	THOMAS 1-4	4700702588	
496	WV	K PETROLEUM INC	GILMER	CENTER	HENDERSON #7	4702104980	
497	WV	MEADOW RIDGE DEVELOPMENT LLC	MARION	LINCOLN	ATHA #1	4704902000	
498	WV	MEADOW RIDGE DEVELOPMENT LLC	MARION	LINCOLN	RINEHART #1 (PIT WATER)	4704901797	
499	WV	MEADOW RIDGE DEVELOPMENT LLC	WETZEL	ONE	LANTZ #1	4710302334	
500	WV	MEADOW RIDGE DEVELOPMENT LLC	WETZEL	ONE	LANTZ #4	4710302432	
501	WV	MEADOW RIDGE DEVELOPMENT LLC	WETZEL	ONE	LANTZ #9	4710302433	
502	WV	MEADOW RIDGE DEVELOPMENT LLC	WETZEL	ONE	LANTZ UNIT #1A	4710302476	
503	WV	MIDWEST ENERGY, INC.	BARBOUR	SOUTH	ZIRKLE	4700102700	
504	WV	MIKE ROSS INC	BRAXTON	SALT LICK	MADDIE #1	4700702413	
505	WV	MIKE ROSS INC	BRAXTON	SALT LICK	STOUT 101	4700702257	
506	WV	MIKE ROSS INC	GILMER	TROY	LAMB #1	4702104996	
507	WV	MIKE ROSS INC	RITCHIE	UNION	BLIZZARD #1	4708509668	
508	WV	MIKE ROSS INC	RITCHIE	UNION	DEBERRY #1	4708301148	ELK, BENSON, BALLTOWN
509	WV	MOTTO ENERGY INC	GILMER	DEKLAB	STALNAKER #1	4702103556	
510	WV	MOUNTAIN V OIL & GAS	HARRISON	NORTHERN	CATHERS #10	4703305095	
511	WV	MOUNTAIN V OIL & GAS	UPSHUR	MEADE	WOODY #3	4709703626	
512	WV	MOUNTAIN V OIL & GAS	UPSHUR	WASHINGTON	CARR #1, BOB	4709703426	
513	WV	MURRAY HILL ENERGY	HARRISON	NORTHERN	ORR #2	4703305127	
514	WV	PATCHWORK OIL & GAS LLC	PLEASANTS	MCIM	WILLOW ISLAND - HAMMETT #1	4707302513	
515	WV	PDC MOUNTAINEER LLC	LEWIS	FREEMANS CREEK	GRIGGS & ALFRED 5-9-7	4704101059	
516	WV	PERKINS OIL AND GAS INC	RITCHIE	CLAY	THOMAS #6	4708509727	BIG INJUN
517	WV	PERKINS PRODUCTION CO LLC	RITCHIE	CLAY	WESTFALL	4708502796	
518	WV	PETROLEUM RESOURCES	GILMER	GLENVILLE	DAVIS 1A, 2A & 3A	4702105148	
519	WV	PETROLEUM RESOURCES	GILMER	GLENVILLE	FISHER S A 1 & 4	4702101870	
520	WV	PETROLEUM RESOURCES	GILMER	GLENVILLE	HENDRICKS A1 & A3	4702102159	

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
521	WV	PETROLEUM RESOURCES	GILMER	GLENVILLE	TUMBLIN 5A & 6A	4702104689	
522	WV	PETROLEUM RESOURCES	GILMER	GLENVILLE	VAN HORN 99 #2	4702104692	
523	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	CLAY	HAUGHT FAMILY TRUST P2	4708509337	DEVONIAN SERIES
524	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	GRANT	GRIM - MORRIS P3	4708509333	DEVONIAN SERIES
525	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	GRANT	HOVER 1481	4708507407	
526	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	GRANT	STEVENS 1340	4708505757	
527	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	AYERS P-1, FAY	4708509480	DEVONIAN SERIES
528	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	CAMPBELL #P-1	4708509602	DEVONIAN SERIES
529	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	FAY HEIRS P-2	4708509481	DEVONIAN SERIES
530	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	GRIMM-MORRIS P-4	4708509332	DEVONIAN SERIES
531	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	IRELAND #PH 3	4708509449	DEVONIAN SERIES
532	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	IRELAND #PH 4	4708509450	DEVONIAN SERIES
533	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	IRELAND P H 1	4708509477	DEVONIAN SERIES
534	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	JOHNSON P-1	4708509530	
535	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	MORGAN P-1	4708509505	
536	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	MORRIS #4	4708509174	
537	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	NOTTINGHAM P-4	4708509260	
538	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	PRINCE #1351	4708502832	
539	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	WARNER P-1	4708509267	
540	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	MURPHY	WELCH #1406,N	4708506451	
541	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	UNION	HOVER 1481	4708507407	
542	WV	QUEST EASTERN RESOURCE LLC	RITCHIE	UNION	PRUNTY P-1A	4708507738	
543	WV	QUEST EASTERN RESOURCE LLC	UPSHUR	MEADE	CRAWFORD PL 1	4704105231	
544	WV	QUEST EASTERN RESOURCE LLC	WETZEL	ONE	WVCC #5	4710302468	
545	WV	RANDY LANCASTER	TYLER	MCELROY	MCCORMICK #5	4709500519	
546	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	CBM #1	4701502747	
547	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	CBM #10	4701502756	
548	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	CBM #11	4701502757	
549	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	CBM #3	4701502749	
550	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	CBM #4	4701502750	
551	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	CBM #5	4701502751	
552	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	CBM #6	4701502752	
553	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	CBM #8	4701502754	
554	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	CBM #9	4701502755	
555	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	PMOG #83	4701502780	
556	WV	RANGE RES - PINE MOUNTAIN INC	CLAY	BUFFALO	PMOG 90	4701502774	
557	WV	RITCHIE PETROLEUM	DODDRIDGE	CENTRAL	DOAK #1, R	4701701466	
558	WV	ROGERS & SONS	CALHOUN	SHERMAN	BOURNE #3,P.A.	4701303793	
559	WV	RUBIN RESOURCES INC	JACKSON	RIPLEY	HAMB #4	4703502060	
560	WV	STALNAKER ENERGY CORPORATION	LEWIS	COURT HOUSE	HEATER 440	4704105358	
561	WV	STALNAKER ENERGY CORPORATION	LEWIS	COURT HOUSE	TULLEY 412	4704105233	
562	WV	STONE ENERGY CORPORATION	MARSHALL	THREE	HUNTER #1 (4278-C)	4705101284	
563	WV	STONE ENERGY CORPORATION	WETZEL	ONE	LEASURE #2 (4280-C)	4710302526	
564	WV	STONE ENERGY CORPORATION	WETZEL	ONE	WILLEY #1 (4281-C)	4710302525	
565	WV	STONE ENERGY CORPORATION	WETZEL	PROCTOR	MASON #1	4710302569	
566	WV	SUTTON'S EXPL & PROD CO LLC	GILMER	TROY	ASHLEY #4	4702105464	
567	WV	SUTTON'S EXPL & PROD CO LLC	LEWIS	FREEMANS CREEK	WOOFER #2,BETTY	4704105315	
568	WV	SUTTON'S EXPL & PROD CO LLC	LEWIS	FREEMANS CREEK	WOOFER #4, BETTY	4704105479	
569	WV	TERM ENERGY CORPORATION	GILMER	GLENVILLE	BOILON #4	472101591	
570	WV	TERM ENERGY CORPORATION	GILMER	GLENVILLE	BUDMOORE #1	4702101544	
571	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #05	4708509164	
572	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #06	4708509003	

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
573	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #07	4708509358	
574	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #11	4708509165	
575	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #13	4708509065	
576	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #27	4708509289	
577	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #28	4708509559	
578	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #30	4708509396	
579	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #32	4708509560	
580	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	FOX #36	4708509564	
581	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	LAYFIELD	4708504765	
582	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	RICHARDS 1 & 2, L	4708509565	
583	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	ROLLINS, D	4708509570	
584	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	ROLLINS, J	4708509567	
585	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	SIX #1	4708509367	
586	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	SNYDER #1	4708509752	
587	WV	TERM ENERGY CORPORATION	RITCHIE	GRANT	WASHBURN #3	4708509558	
588	WV	TEXAS KEYSTONE INC	BARBOUR	NORTH	SMITH #5, ROY	4700102913	ELK, BALLTOWN
589	WV	THREE M GAS CO	ROANE	NORTHERN	EPLING #1, D R	4708704580	
590	WV	TOMBSTONE RESOURCES LLC	DODDRIDGE	MCCLELLAN	ODELL #2	4701705702	MARCELLUS
591	WV	TOMBSTONE RESOURCES LLC	DODDRIDGE	MCCLELLAN	RAGER #5	4701705725	
592	WV	TRANS ENERGY INC	MARION	LINCOLN	BLACKSHEARS #101	4704901077	
593	WV	TRANS ENERGY INC	WETZEL	GRANT	WELCH #4, M J	4710301276	
594	WV	TRANS ENERGY INC	WETZEL	GRANT	WYATT #758	4710301148	
595	WV	TRANS ENERGY INC	WETZEL	ONE	DEWHURSH #73(PIT WATER)	4710302286	
596	WV	TRANS ENERGY INC	WETZEL	ONE	HART #28H	4710302411	
597	WV	TRIAD ENERGY CORP OF WV INC	CLAY	HENRY	FIELDS #721	4701502818	
598	WV	TRIAD ENERGY CORP OF WV INC	CLAY	HENRY	FIELDS #722	4701502814	
599	WV	TSR ENTERPRISE	RITCHIE	GRANT	RICHARDS #4	4708509623	
600	WV	US EXPLORATION LLC	PLEASANTS	MCKIM	RAWSON, B F	4707300605	
601	WV	WACO OIL AND GAS CO	DODDRIDGE	GRANT	HUDSON 1923	4701705743	
602	WV	WACO OIL AND GAS CO	MARION	GRANT	SANDS 1476 & WOODS 1481	4704901412	
603	WV	WHITTLE CORPORATION	RITCHIE	GRANT	ROLLINS-HFT	4708509479	
604	WV	WHITTLE CORPORATION	RITCHIE	GRANT	TAPP	4708504644	
605	WV	WHITTLE CORPORATION	RITCHIE	MURPHY	BARKER	4708509285	
606	WV	WHITTLE CORPORATION	RITCHIE	MURPHY	BARKER #1584	4708509610	
607	WV	WHITTLE CORPORATION	RITCHIE	MURPHY	BARKER #W-1606	4708509777	
608	WV	WHITTLE CORPORATION	RITCHIE	MURPHY	BARKER 1585	4708509611	
609	WV	WHITTLE CORPORATION	RITCHIE	MURPHY	GOFF 1594	4708509758	
610	WV	WHITTLE CORPORATION	RITCHIE	MURPHY	GOFF 1599	4708509821	
611	WV	WHITTLE CORPORATION	RITCHIE	MURPHY	GOFF 1600	4708509816	
612	WV	WHITTLE CORPORATION	RITCHIE	UNION	ADKINS 1597	4708509741	
613	WV	WHITTLE CORPORATION	RITCHIE	UNION	PROPS 1598	4708509742	
614	WV	WHITTLE CORPORATION	RITCHIE	UNION	REGER - GILL 1388	4708506359	
615	WV	WHITTLE CORPORATION	RITCHIE	UNION	SPRUCE GROVE 1588	4708509691	
616	WV	XTO ENERGY INC	GILMER	GLENVILLE	ARBuckle - GARRET #1	4702102287	
617	WV	XTO ENERGY INC	GILMER	GLENVILLE	CONRAD #1	4702101709	
618	WV	XTO ENERGY INC	GILMER	GLENVILLE	COTTRILL 1	4702101806	
619	WV	XTO ENERGY INC	GILMER	GLENVILLE	COTTRILL 2	4702101821	
620	WV	XTO ENERGY INC	GILMER	GLENVILLE	CRADDOX	4702101881	
621	WV	XTO ENERGY INC	GILMER	GLENVILLE	DELTA - GARRETT	4702102288	
622	WV	XTO ENERGY INC	GILMER	GLENVILLE	GROVES #1	4702101020	
623	WV	XTO ENERGY INC	GILMER	GLENVILLE	LUZADER #2	4702104874	
624	WV	XTO ENERGY INC	GILMER	GLENVILLE	MARKLEY #1-2	4702102733	

No.	State	Producer Name	County	Township	Farm	API Number	Producing Formation(s)
625	WV	XTO ENERGY INC	GILMER	GLENVILLE	MCHENRY #1	4702102519	
626	WV	XTO ENERGY INC	GILMER	GLENVILLE	POST #2, A A	4702101729	
627	WV	XTO ENERGY INC	GILMER	GLENVILLE	TERRY #1710	4702105371	
628	WV	XTO ENERGY INC	GILMER	GLENVILLE	TERRY #2095	4702105484	
629	WV	XTO ENERGY INC	HARRISON	NORTHERN	MARTIN #E-193, R	4703304149	
630	WV	XTO ENERGY INC	HARRISON	SOUTHEAST	HANSFORD #1999	4703304735	
631	WV	XTO ENERGY INC	HARRISON	SOUTHEAST	HARRISON #2018	4703304766	
632	WV	XTO ENERGY INC	HARRISON	SOUTHWEST	BAKER 1588	4703304462	
633	WV	XTO ENERGY INC	HARRISON	SOUTHWEST	ROMIG #1709	4703304508	
634	WV	XTO ENERGY INC	HARRISON	SOUTHWEST	UMB 6 #E-238, API 47-033-7395	4703307395	
635	WV	XTO ENERGY INC	HARRISON	SUBURBAN	FARIS #1976	4703304714	
636	WV	XTO ENERGY INC	HARRISON	SUBURBAN	HORNER #1970	4703304709	
637	WV	XTO ENERGY INC	HARRISON	SUBURBAN	PORTER #1969	4703304696	
638	WV	XTO ENERGY INC	LEWIS	HACKERS CREEK	CARROLL #1 DO429	4709703166	
639	WV	XTO ENERGY INC	MARION	GRANT	JUSTICE #1	4710901448	
640	WV	XTO ENERGY INC	MARION	GRANT	MURPHY 1450	4704901502	
641	WV	XTO ENERGY INC	RITCHIE	GRANT	DONNELLY #2	4708506130	
642	WV	XTO ENERGY INC	UPSHUR	WARREN	FOGG,FRANNIE	4709703164	
643	WV	XTO ENERGY INC	UPSHUR	WARREN	MCPHERSON #1 00401	4709703152	

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STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH /YEAR (MM/YYYY): 01/2015WELL NO. BW4API NO. 47- 073 - 02523

PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLs AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	15	173	1	2,256		101	100.78		
2	16	155	1	2,255		101	202.01		
3	18	164	1	2,255		119	320.53		
4	19	148	1	2,250		124	444.89		
5	16	156	1	2,252		107	551.97		
6	15	164	1	2,256		100	652		
7	13	146	2	2,256		82	734.11		
8	10	135	2	2,255		64	798.19		
9	17	141	2	2,256		112	909.83		
10	19	143	2	2,257		123	1033.3		
11	16	133	1	2,254		102	1134.93		
12	4	155	1	2,255		26	1161.31		
13	0	268	1	2,244		3	1164.01		
14	1	369	1	2,254		5	1169.01		
15	2	364	1	2,255		15	1184.37		
16	3	365	1	2,257		20	1204.29		
17	1	356	1	2,256		3	1207.63		
18	0	390	1	2,255		1	1208.18		
19	0	415	1	2,246		3	1211.12		
20	0	416	1		2,254	0	1211.12		
21	0	426	1	2,227		2	1212.92		
22	0	433	2		2,249	0	1212.92		
23	0	436	4		2,220	0	1212.92		
24	0	438	4		2,221	0	1212.92		
25	0	440	4		2,219	0	1212.92		
26	1	434	4	2,217		7	1219.48		
27	0	386	3		2,243	0	1219.48		
28	1	387	2	2,218		7	1226.79		
29	0	381	2		2,245	0	1226.79		
30	1	411	3	2,216		4	1230.43		
31	9	402	5	2,244		59	1289.06		
TOTALS	198	440	5	2,257	2,254	1,289	1,289	0	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

 BY: Derrick Lamp
 TITLE: _____

 Digitally signed by Derrick Lamp
 DN: cn=Derrick Lamp, o=AOP, ou=AOP,
 email=derrick.lamp@enlink.com, c=US
 Date: 2015.01.15 15:42:08 -0500

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WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH /YEAR (MM/YYYY): 02/2015
WELL NO. BW4
API NO. 47- 073 - 02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLs AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	0	300	1		2,245	0	0		
2	1	408	1	2,213		5	4.81		
3	6	428	1	2,239		40	44.92		
4	7	414	1	2,239		46	91.12		
5	11	341	1	2,231		74	165.14		
6	14	245	1	2,241		92	257.47		
7	19	222	2	2,244		123	380.63		
8	14	168	2	2,238		96	476.79		
9	18	190	2	2,240		116	593.13		
10	15	168	1	2,240		99	692.16		
11	18	190	1	2,242		117	809.16		
12	7	177	1	2,245		50	858.66		
13	3	229	1	2,246		22	880.22		
14	7	273	1	2,243		50	930.42		
15	9	333	1	2,242		60	990.78		
16	8	280	1	2,249		54	1044.62		
17	15	266	1	2,251		160	1204.46		
18	18	297	1	2,253		311	1515.68		
19	19	310	1	2,255		258	1773.2		
20	23	260	1	2,255		218	1991.34		
21	18	258	1	2,254		255	2246.82		
22	23	215	2	2,238		337	2583.65		
23	22	185	4	2,251		276	2859.43		
24	20	193	4	2,250		163	3022.63		
25	17	140	3	2,254		143	3165.26		
26	10	167	3	2,255		81	3246.01		
27	15	208	3	2,253		136	3382.03		
28	22	193	2	2,256		233	3615.51		
29							3615.51		
30							3615.51		
31							3615.51		
TOTALS	379	428	4	2,256	2,245	3,616	3,616	0	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY: **Derrick Lamp**
TITLE: _____

Digitally signed by Derrick Lamp
DN: cn=Derrick Lamp, o=AOP, ou=AOP,
email=derrick.lamp@erlink.com, c=US
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STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH /YEAR (MM/YYYY): 03/2015
WELL NO. BW4
API NO. 47- 073 - 02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLs AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	23	95	1	2,244		244	243.75		
2	23	85	1	2,248		242	485.38		
3	20	90	1	2,257		184	669.04		
4	19	144	1	2,246		170	839.2		
5	21	125	1	2,247		190	1028.93		
6	23	123	1	2,249		208	1236.9		
7	20	124	2	2,241		188	1425.15		
8	17	123	1	2,257		163	1587.92		
9	19	118	2	2,257		167	1755.25		
10	23	131	1	2,251		195	1949.98		
11	3	106	1	2,237		21	1971.17		
12	0	254	1		2,227	0	1971.17		
13	0	339	2		2,224	0	1971.17		
14	0	351	1		2,221	0	1971.17		
15	0	367	1		2,219	0	1971.17		
16	1	380	1	2,216		18	1989.17		
17	0	389	1		2,223	0	1989.17		
18	2	332	2	2,223		18	2007.5		
19	23	391	1	2,241		344	2351.8		
20	20	209	1	2,250		177	2528.8		
21	10	120	1	2,250		86	2614.63		
22	0	212	2		2,250	0	2614.63		
23	0	345	3		2,249	0	2614.63		
24	0	400	4		2,246	0	2614.63		
25	0	408	3		2,244	0	2614.63		
26	0	405	2		2,242	0	2614.63		
27	4	410	3	2,256		17	2631.58		
28	23	398	2	2,248		69	2700.49		
29	23	231	1	2,252		141	2841.91		
30	8	155	1	2,243		52	2894.35		
31	11	247	1	2,250		74	2967.99		
TOTALS	336	410	4	2,257	2,250	2,968	2,968	0	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY: Derrick Lamp
TITLE: _____

Digitally signed by Derrick Lamp
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WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH / YEAR (MM/YYYY): 04/2015WELL NO. BW4API NO. 47- 073 - 02523

PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	21	264	1	2,256		126	126.41	5	
2	11	167	1	2,255		63	189.68	4	
3	0	229	1		2,245	0	189.68	0	
4	0	366	1		2,242	0	189.68	0	
5	0	390	1		2,241	0	189.68	0	
6	18	402	1	2,243		93	282.56	3	
7	12	271	2	2,257		65	347.53	3	
8	0	243	2		2,245	0	347.53	0	
9	0	385	2		2,240	0	347.53	0	
10	0	405	1		2,241	0	347.53	0	
11	0	414	1		2,241	0	347.53	0	
12	0	419	1		2,238	0	347.53	0	
13	0	422	2		2,234	0	347.53	0	
14	0	425	1		2,239	0	347.53	0	
15	0	428	1		2,236	0	347.53	0	
16	0	429	1		2,232	0	347.53	0	
17	0	430	1		2,231	0	347.53	0	
18	0	427	2		2,230	0	347.53	0	
19	0	428	1		2,227	0	347.53	0	
20	0	435	1		2,228	0	347.53	0	
21	0	431	1		2,225	0	347.53	0	
22	0	438	2		2,230	0	347.53	0	
23	0	433	4		2,231	0	347.53	0	
24	8	429	4	2,245		117	464.62	3	
25	17	385	3	2,248		244	708.18	7	
26	17	265	3	2,253		236	944.38	6	
27	14	257	3	2,256		150	1094.68	4	
28	13	241	2	2,248		119	1213.65	7	
29	16	210	2	2,252		176	1389.9	6	
30	6	198	2	2,243		99	1488.84	3	
31							1488.84		
TOTALS	153	438	4	2,257	2,245	1,489	1,489	7	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY:

Derrick Lamp

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STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH /YEAR (MM/YYYY): 05/2015
WELL NO. BW4
API NO. 47- 073 - 02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLs AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	3	198	1	2,252		38	37.56	12	
2	0	302	1	2,251		0	37.56	10	
3	0	377	1	2,226		0	37.56	0	
4	0	396	1	2,224		0	37.56	0	
5	0	406	1	2,221		0	37.56	0	
6	0	413	1	2,220		0	37.56	0	
7	0	418	2	2,219		0	37.56	0	
8	0	421	2	2,218		0	37.56	0	
9	0	424	2	2,216		0	37.56	0	
10	0	427	2	2,214		0	37.56	0	
11	0	429	1	2,213		0	37.56	0	
12	0	431	1	2,212		0	37.56	0	
13	0	432	1	2,212		0	37.56	0	
14	0	434	1	2,209		0	37.56	0	
15	0	435	1	2,208		0	37.56	0	
16	0	436	1	2,210		0	37.56	0	
17	0	437	1	2,207		0	37.56	0	
18	0	439	0	2,207		0	37.56	0	
19	0	440	1	2,209		0	37.56	0	
20	0	440	1	2,217		0	37.56	0	
21	12	440	1	2,192		227	264.73	18	
22	19	302	2	2,252		419	684.07	22	
23	16	223	4	2,231		365	1049.12	23	
24	10	223	4	2,229		227	1276.31	220	
25	0	223	4	2,223		0	1276.31	0	
26	8	223	4	2,222		90	1366.47	15	
27	8	223	3	2,222		87	1453.74	14	
28	0	223	2	2,222		0	1453.74	0	
29	16	223	2	2,221		176	1629.99	17	
30	6	223	2	2,222		99	1728.93	17	
31	0	245	1	2,217		0	1728.93	0	
TOTALS	98	440	4	2,252	0	1,729	1,729	220	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY:

Derrick Lamp

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STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH /YEAR (MM/YYYY): 06/2015
WELL NO. BW4
API NO. 47- 073 - 02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLs AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	0	403	1	2,220		0	0	0	
2	0	408	1	2,218		0	0	0	
3	0	411	1	2,216		0	0	0	
4	0	415	1	2,215		0	0	0	
5	0	418	1	2,215		0	0	0	
6	0	420	1	2,214		0	0	0	
7	0	422	2	2,212		0	0	0	
8	8	423	2	2,212		106	106.41	0	
9	11	314	2	2,251		144	250.61	14	
10	3	214	2	2,226		64	315.03	16	
11	0	336	1	2,256		0	315.03	14	
12	0	406	1	2,207		0	315.03	0	
13	0	416	1	2,205		0	315.03	0	
14	0	423	1	2,203		0	315.03	0	
15	5	427	1	2,202		64	379.37	0	
16	7	357	1	2,257		91	470.75	12	
17	0	322	1	2,257		0	470.75	21	
18	8	402	0	2,254		101	571.83	0	
19	6	323	1	2,246		84	656.31	9	
20	0	269	1	2,258		0	656.31	10	
21	0	392	1	2,205		0	656.31	0	
22	0	409	2	2,202		0	656.31	0	
23	5	416	4	2,201		76	732.72	0	
24	14	327	4	2,245		236	968.91	11	
25	16	225	4	2,258		264	1232.8	16	
26	13	164	4	2,257		231	1464.14	14	
27	13	170	3	2,256		236	1699.77	15	
28	15	157	2	2,255		271	1971.07	13	
29	16	137	2	2,257		176	2147.32	17	
30	6	144	2	2,213		99	2246.26	17	
31							2246.26		
TOTALS	145	427	4	2,258	0	2,246	2,246	21	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY:

TITLE: _____

Derrick Lamp

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STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH / YEAR (MM/YYYY): 07/2015WELL NO. BW4API NO. 47- 073 - 02523

PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLs AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	10	181	1	2,257		96	95.83	11	
2	14	257	1	2,243		147	242.46	8	
3	12	191	1	2,248		136	378.57	9	
4	19	176	1	2,256		218	596.2	7	
5	18	117	1	2,257		212	808.56	8	
6	18	130	1	2,257		211	1019.95	8	
7	17	130	2	2,257		175	1195.26	9	
8	19	122	2	2,257		160	1355.73	8	
9	17	121	2	2,256		118	1473.67	6	
10	16	117	1	2,255		120	1593.73	6	
11	16	114	1	2,256		116	1709.81	6	
12	13	129	1	2,257		96	1805.92	6	
13	0	157	1	2,233		0	1805.92	0	
14	9	141	1	2,233		69	1874.8	6	
15	7	132	1	2,234		50	1925.16	5	
16	13	125	1	2,242		96	2021.54	5	
17	11	121	1	2,237		88	2109.74	5	
18	10	119	0	2,242		70	2180.21	6	
19	14	120	1	2,241		102	2282.52	5	
20	15	117	1	2,257		112	2394.08	5	
21	5	168	1	2,257		37	2430.83	6	
22	0	178	2	2,234		0	2430.83	5	
23	0	210	3	2,232		0	2430.83	0	
24	0	215	3	2,230		0	2430.83	0	
25	0	230	4	2,228		0	2430.83	0	
26	0	245	2	2,227		0	2430.83	0	
27	0	259	3	2,225		0	2430.83	0	
28	11	252	2	2,235		83	2513.46	0	
29	13	162	2	2,243		97	2610.29	17	
30	17	138	2	2,239		119	2729.51	17	
31	18	125		2,241		166	2895.6	19	
TOTALS	331	259	4	2,257	0	2,896	2,896	19	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY: **Derrick Lamp**
TITLE: _____

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STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 08/2015
WELL NO. BW4
API NO. 47-073 - 02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLs AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	14	178	1	2,257		148	148.44	8	
2	15	162	1	2,251		158	306.05	8	
3	21	156	2	2,257		214	520.47	10	
4	21	152	1	2,243		211	731.75	11	
5	22	157	1	2,257		226	958.06	11	
6	17	150	1	2,253		173	1130.64	8	
7	22	149	1	2,253		234	1364.31	12	
8	20	138	2	2,232		219	1583.28	11	
9	22	142	2	2,243		225	1808.59	11	
10	21	145	1	2,240		217	2025.57	10	
11	19	151	1	2,256		200	2225.91	9	
12	22	156	2	2,257		232	2458.18	10	
13	22	149	1	2,258		226	2683.84	10	
14	22	147	1	2,254		227	2911.26	9	
15	23	153	1	2,257		236	3147.07	11	
16	21	155	1	2,253		225	3372.27	9	
17	4	165	1	2,250		42	3414	3	
18	0	189	1		2,233	0	3414	0	
19	17	144	1	2,245		175	3589.02	8	
20	20	142	1	2,257		214	3803.29	10	
21	23	154	1	2,254		292	4095.63	12	
22	23	139	1	2,247		333	4428.86	14	
23	22	157	3	2,257		282	4711.27	13	
24	19	154	3	2,248		226	4937.74	11	
25	18	145	2	2,257		175	5112.82	9	
26	20	144	1	2,247		208	5320.43	10	
27	0	189	3	2,235		0	5320.46	0	
28	0	197	2		2,231	0	5320.46	0	
29	0	201	2		2,226	0	5320.46	0	
30	0	250	2		2,224	0	5320.46	0	
31	0	281			2,221	0	5320.46	0	
TOTALS	490	281	3	2,258	2,233	5,320	5,320	14	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY: Derrick Lamp
TITLE: _____

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STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 1/2014

WELL NO. BW4

API NO. 47-073 -02523

PERMIT NO.

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2258 ____ PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	0.00	700.77	1.49	2235.53		0.00	110484.43	0	0
2	9.81	738.50	1.38	2236.95		86.69	110484.43	0	0
3	17.24	581.19	1.19	2251.08		132.34	110571.12	2.528687254	7.521614075
4	12.42	312.32	0.97	2254.67		53.43	110703.45	3.859145866	6.117133999
5	0.00	449.67	0.83	2257.32		0.00	110756.88	1.558124386	3.760900497
6	19.68	685.26	1.09	2246.84		82.66	110756.88	0	0
7	15.87	797.76	2.15	2256.79		44.86	110839.54	2.409339642	3.306675148
8	10.85	820.22	2.07	2255.64		29.89	110884.40	1.304772575	2.320488024
9	23.44	815.24	2.04	2257.44		116.27	110914.29	0.871658964	2.087098503
10	23.42	539.40	1.88	2249.96		271.24	111030.56	3.389387704	4.615023851
11	23.43	222.93	1.42	2253.67		271.98	111301.80	7.917742964	11.64091663
12	23.44	195.65	1.14	2248.49		121.02	111573.79	7.932387696	10.84294777
13	23.44	332.26	1.25	2256.73		192.08	111694.80	3.52864512	6.391363907
14	23.44	279.34	1.10	2249.43		275.47	111886.88	5.60113591	8.173583603
15	8.61	173.36	0.91	2248.19		82.63	112162.35	8.033162519	8.180009651
16	0.00	360.70	0.93	2256.91		0.00	112244.98	2.406939231	8.171788502
17	0.00	574.37	0.68	2242.83		0.00	112244.98	0	0
18	14.52	614.93	0.03	2238.95		96.79	112244.98	0	0
19	23.44	539.90	1.69	2251.55		152.14	112341.77	2.827972219	4.884701586
20	23.44	355.08	1.54	2249.96		151.63	112493.91	4.435525706	4.62435317
21	12.20	284.76	1.58	2252.55		71.66	112645.55	4.420373918	4.592623138
22	0.09	310.02	2.37	2254.92		0.24	112717.21	2.090388749	4.59213748
23	3.08	288.71	4.31	2255.38		10.93	112717.45	0.007044848	2.538591146
24	4.30	285.96	4.06	2256.74		15.07	112728.38	0.320076215	2.633178091
25	23.44	286.07	3.65	2257.10		72.85	112743.45	0.440678394	2.605882406
26	7.19	405.94	3.80	2254.97		18.70	112816.30	2.121802734	2.49455409
27	3.13	535.74	3.30	2256.86		9.79	112835.01	0.544575269	1.920220017
28	7.38	643.05	2.11	2248.96		22.24	112844.80	0.287409955	2.320185781
29	5.56	644.40	2.05	2248.55		14.68	112867.04	0.649627965	2.290721989
30	7.60	644.40	2.84	2248.55		55.46	112881.72	0.425303122	2.126679182
31	23.44	644.40	5.58	2248.55		158.64	112937.18	1.618367543	5.250255013
TOTALS	393.89	485.88		2251.03		2611.39	112937.18		

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT. BY: _____

TITLE: _____

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 2/2014

WELL NO. BW4

API NO. 47-073 -02523

PERMIT NO.

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	23.44	307.07	1.19	2252		142.45	113095.82	5.06	4.63
2	23.44	305.00	0.97	2254		142.55	113238.27	4.33	4.15
3	7.83	298.77	0.83	2255		47.63	113380.83	4.32	4.16
4	0.00	438.83	1.09	2258		0.00	113428.46	4.32	1.39
5	0.00	596.08	2.15	2252		0.00	113428.46	0.00	0.00
6	4.05	781.66	2.07	2249		20.71	113428.46	0.00	0.00
7	23.44	604.55	2.04	2258		113.23	113449.17	4.57	0.60
8	23.44	474.10	1.88	2253		110.91	113562.40	3.59	3.30
9	23.44	456.48	1.42	2255		110.91	113673.30	3.41	3.24
10	7.94	424.07	1.14	2252		31.45	113784.22	3.40	3.24
11	2.53	333.65	1.25	2258		5.45	113815.66	3.40	0.91
12	1.30	308.41	1.10	2258		2.88	113821.11	2.00	0.16
13	6.80	454.28	0.91	2258		20.84	113823.99	1.67	0.09
14	23.44	712.94	0.93	2255		93.12	113844.84	2.41	0.61
15	23.44	501.11	0.68	2250		184.20	113937.95	5.49	2.71
16	22.33	279.72	0.03	2224		175.51	114122.16	5.52	5.37
17	10.60	270.50	1.69	2258		108.23	114297.66	5.53	5.12
18	23.44	265.86	1.54	2245		254.91	114405.89	7.24	3.16
19	23.44	174.39	1.58	2229		254.84	114660.80	7.62	7.43
20	16.19	170.49	2.37	2244		175.92	114915.64	7.58	7.43
21	0.00	225.63	4.31	2258		0.00	115091.56	7.56	5.13
22	0.00	524.87	4.06	2251		0.00	115091.56	0.00	0.00
23	0.00	587.63	3.65	2252		0.00	115091.56	0.00	0.00
24	7.74	612.23	3.80	2253		48.09	115091.56	0.00	0.00
25	23.44	566.79	3.30	2239		226.37	115139.65	4.50	1.39
26	23.44	281.92	2.11	2247		353.83	115366.02	12.09	6.60
27	23.42	147.31	2.05	2258		214.53	115719.84	12.11	10.32
28	23.44	228.99	2.84	2254		129.77	115934.38	6.41	6.26
29									
30									
31									
TOTALS	391.99	404.76		2251.05		2968.32	115934.38	12.11	3.12

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT. BY: _____

TITLE: _____

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 3/2014
WELL NO. BW4
API NO. 47-073 -02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2258 _____ PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLs AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	23.44	207.07	2.19	2258		110.56	116064.15	6.41	3.79
2	23.44	205.00	1.97	2252		110.81	116174.71	3.39	3.22
3	23.44	238.77	1.83	2251		110.50	116285.52	3.39	3.23
4	23.44	238.83	2.09	2258		109.41	116396.02	3.40	3.22
5	23.44	296.08	2.15	2258		180.91	116505.43	3.67	3.19
6	6.83	381.66	2.07	2246		62.49	116686.34	6.40	5.28
7	0.00	304.55	2.14	2258		0.00	116748.83	6.41	1.82
8	0.00	378.80	1.98	2238		0.00	116748.83	0.00	0.00
9	21.79	351.38	1.42	2235		144.72	116748.83	0.00	0.00
10	5.37	384.47	1.14	2258		10.47	116893.55	10.02	4.40
11	0.00	383.69	1.25	2258		0.00	116904.02	1.66	0.30
12	0.00	348.91	1.40	2257		0.00	116904.02	0.00	0.00
13	0.00	384.21	1.91	2253		0.00	116904.02	0.00	0.00
14	0.00	432.94	1.93	2256		0.00	116904.02	0.00	0.00
15	0.00	491.11	1.68	2258		0.00	116904.02	0.00	0.00
16	0.00	479.72	1.03	2250		0.00	116904.02	0.00	0.00
17	15.08	370.50	1.69	2247		45.05	116904.02	0.00	0.00
18	23.44	262.86	1.54	2254		62.47	116949.06	2.44	1.31
19	23.44	379.13	1.53	2250		61.13	117011.53	2.00	1.82
20	23.44	356.49	1.37	2249		60.09	117072.66	1.93	1.78
21	23.42	395.63	1.31	2250		438.98	117132.75	1.92	1.75
22	23.44	474.17	1.76	2258		606.39	117571.73	23.49	12.82
23	23.44	487.33	1.65	2258		377.59	118178.12	20.61	17.68
24	23.44	414.21	1.80	2253		208.01	118555.70	11.76	11.01
25	0.92	496.73	2.30	2251		3.55	118763.71	6.51	6.06
26	0.00	486.12	2.11	2220		0.00	118767.27	2.73	0.10
27	0.00	347.71	2.05	2221		0.00	118767.27	0.00	0.00
28	0.00	328.69	2.24	2222		0.00	118767.27	0.00	0.00
29	0.00	373.91	2.51	2221		0.00	118767.27	0.00	0.00
30	0.00	344.38	2.11	2241		0.00	118767.27	0.00	0.00
31	0.00	387.51	2.41	2256		0.00	118767.27	0.00	0.00
TOTALS	331.23	368.15	1.82	2248.23		2703.12	118767.27	23.49	2.67

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT. BY: _____

TITLE: _____

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 4/2014
WELL NO. BW4
API NO. 47-073 -02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2258 _____ PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	0.00	631.55	1.49	2257		0.00	118767.27	0.00	0.00
2	0.00	637.24	1.38	2256		0.00	118767.27	0.00	0.00
3	0.00	641.78	1.19	2252		0.00	118767.27	0.00	0.00
4	0.00	645.57	1.97	2258		0.00	118767.27	0.00	0.00
5	0.00	546.08	1.83	2256		0.00	118767.27	0.00	0.00
6	0.00	711.66	1.09	2253		0.00	118767.27	0.00	0.00
7	0.00	609.51	2.15	2257		0.00	118767.27	0.00	0.00
8	0.00	474.10	2.07	2257		0.00	118767.27	0.00	0.00
9	0.00	456.48	2.04	2254		0.00	118767.27	0.00	0.00
10	0.00	484.07	1.88	2256		0.00	118767.27	0.00	0.00
11	0.00	358.65	1.42	2255		0.00	118767.27	0.00	0.00
12	0.00	408.81	1.14	2256		0.00	118767.27	0.00	0.00
13	0.00	496.18	1.25	2254		0.00	118767.27	0.00	0.00
14	0.00	719.94	1.10	2255		0.00	118767.27	0.00	0.00
15	0.00	502.81	1.91	2258		0.00	118767.27	0.00	0.00
16	0.00	679.72	1.93	2252		0.00	118767.27	0.00	0.00
17	0.00	577.50	1.68	2253		0.00	118767.27	0.00	0.00
18	0.00	665.76	1.03	2256		0.00	118767.27	0.00	0.00
19	0.00	674.69	1.02	2250		0.00	118767.27	0.00	0.00
20	0.00	574.40	1.54	2252		0.00	118767.27	0.00	0.00
21	0.00	525.62	1.58	2250		0.00	118767.27	0.00	0.00
22	0.00	584.87	2.37	2221		0.00	118767.27	0.00	0.00
23	0.00	534.63	4.31	2242		0.00	118767.27	0.00	0.00
24	0.00	612.79	4.06	2244		0.00	118767.27	0.00	0.00
25	0.00	567.71	3.65	2246		0.00	118767.27	0.00	0.00
26	0.00	582.12	3.80	2248		0.00	118767.27	0.00	0.00
27	0.00	548.89	3.30	2248		0.00	118767.27	0.00	0.00
28	0.00	528.59	2.11	2240		0.00	118767.27	0.00	0.00
29	0.00	674.31	2.05	2238		0.00	118767.27	0.00	0.00
30	0.00	620.38	2.84	2240		0.00	118767.27	0.00	0.00
31									
TOTALS	0.00	575.88	2.03	2250.47		0.00	118767.27	0.00	0.00

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT. BY: _____

TITLE: _____

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 05/2014

WELL NO. BW #4

API NO. 47- 073 - 02523

PERMIT NO.

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	0	546	2		2,240	0	0		
2	0	541	2		2,240	0	0		
3	0	509	2		2,240	0	0		
4	0	474	1		2,240	0	0		
5	0	421	1		2,248	0	0		
6	0	456	1		2,250	0	0		
7	0	446	1		2,251	0	0		
8	0	456	1		2,251	0	0		
9	0	454	2		2,249	0	0		
10	0	398	1		2,249	0	0		
11	0	418	1		2,248	0	0		
12	15	431	1	2,221		336	335.93	16	10
13	23	312	1	2,234		549	885.03	16	16
14	23	298	1	2,257		489	1374.37	14	14
15	7	322	1	2,238		148	1522.01	14	14
16	0	351	2		2,251	0	1522.01		
17	0	400	2		2,251	0	1522.01		
18	0	437	2		2,251	0	1522.01		
19	0	517	3		2,227	0	1522.01		
20	0	519	3		2,228	0	1522.01		
21	0	526	3		2,224	0	1522.01		
22	0	512	2		2,227	0	1522.01		
23	0	537	2		2,221	0	1522.01		
24	12	542	2	2,225		308	1830.48	20	9
25	23	528	1	2,230		357	2187.21	20	10
26	23	528	1	2,235		251	2438.23	8	7
27	23	574	1	2,230		348	2786.64	14	10
28	22	520	1	2,246		518	3304.92	21	15
29	23	574	1	2,250		530	3835.4	21	15
30	23	527	1	2,248		440	4275.41	21	15
31	23	536	1	2,249		234	4509.09	15	13
TOTALS	244	574	3	2,257	2,251	4,509	4,509	21	7

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY: Derrick Lamp

TITLE: Operations Foreman

Digitally signed by Derrick Lamp
DN: cn=Derrick Lamp, ou=Appalachian Oil Purchasers, o=Operations
witnessed by a self-proclaimed notary
Date: 2014.12.01 11:04:00 -0400

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 6/2014
WELL NO. BW4
API NO. 47-073 -02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	23.44	331.55	1.49	2248		180.91	123276.36	8.31	5.40
2	18.75	337.24	1.38	2244		194.80	123457.27	9.74	7.27
3	17.11	341.78	1.19	2245		255.34	123652.07	14.38	10.45
4	17.68	345.57	1.97	2242		200.28	123907.41	8.64	7.93
5	20.41	346.08	1.83	2237		90.71	124107.70	5.94	3.11
6	20.75	311.66	1.09	2231		199.19	124198.41	7.98	6.72
7	17.66	309.51	2.15	2231		280.27	124397.59	12.78	11.11
8	16.91	374.10	2.07	2238		109.76	124677.87	6.11	4.54
9	17.23	356.48	2.04	2246		116.00	124787.63	5.21	4.71
10	16.40	384.07	1.88	2230		142.18	124903.63	7.68	6.07
11	0.00	358.65	1.42		2239	0.00	125045.81	0.00	0.00
12	0.00	408.81	1.14		2239	0.00	125045.81	0.00	0.00
13	0.00	496.18	1.25		2241	0.00	125045.81	0.00	0.00
14	0.00	719.94	1.10		2240	0.00	125045.81	0.00	0.00
15	0.00	502.81	1.91		2238	0.00	125045.81	0.00	0.00
16	0.00	679.72	1.93		2228	0.00	125045.81	0.00	0.00
17	0.00	577.50	1.68		2227	0.00	125045.81	0.00	0.00
18	0.00	665.76	1.03		2226	0.00	125045.81	0.00	0.00
19	0.00	674.69	1.02		2224	0.00	125045.81	0.00	0.00
20	17.89	374.40	1.54	2240		357.00	125045.81	15.76	13.97
21	17.21	325.62	1.58	2248		360.00	125402.81	17.01	14.64
22	18.67	384.87	2.37	2249		363.00	125762.81	15.42	13.61
23	17.30	334.63	4.31	2247		153.00	126125.81	8.82	6.19
24	13.19	312.79	4.06	2247		103.92	126278.81	6.81	5.52
25	17.20	367.71	3.65	2240		119.12	126382.73	5.31	4.85
26	15.55	382.12	3.80	2240		96.30	126501.84	5.90	4.34
27	13.82	348.89	3.30	2242		81.45	126598.14	6.30	4.12
28	13.48	328.59	2.11	2244		79.38	126679.59	5.37	4.12
29	12.06	374.31	2.05	2246		71.02	126758.97	5.91	4.12
30	8.15	320.38	2.84	2241		49.55	126829.99	5.57	4.25
31									
TOTALS	350.86	412.55	2.04	2241.73	2233.58	3603.19	126829.99	6.17	4.90

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT. BY: _____
TITLE: _____

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 7/2014
WELL NO. BW4
API NO. 47-073 -02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2258 _____ PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	4.47	432.42	1.49	2241		29.76	126878.01	1.446789	4.907891
2	12.90	471.80	1.38	2243		85.24	126907.77	0.868197	4.830069
3	13.89	404.70	1.19	2241		91.14	126993.01	2.48586	4.771254
4	13.41	387.08	0.97	2242		87.78	127084.15	2.658106	4.732744
5	13.73	377.43	0.83	2241		90.16	127171.93	2.560465	4.736721
6	12.28	375.13	1.09	2244		80.71	127262.09	2.627757	4.735923
7	10.97	379.96	2.15	2243		72.46	127342.80	2.355698	5.508362
8	7.86	395.69	2.07	2243		52.33	127415.26	2.113076	4.738508
9	3.49	419.46	2.04	2242		23.45	127467.59	1.801028	4.772223
10	10.26	450.82	1.88	2242		68.05	127491.03	0.692253	4.821728
11	10.79	449.80	1.42	2242		69.64	127559.08	1.985541	4.808309
12	0.00	457.32	1.14		2241	0.00	127628.72	2.029623	4.724952
13	0.00	429.61	1.25		2241	0.00	127628.72	0	0
14	0.00	438.67	1.10		2242	0.00	127628.72	0	0
15	0.00	458.01	1.91		2242	0.00	127628.72	0	0
16	0.00	451.33	1.93		2238	0.00	127628.72	0	0
17	0.00	462.06	1.68		2237	0.00	127628.72	0	0
18	0.00	440.69	1.33		2237	0.00	127628.72	0	0
19	0.00	446.74	1.69		2237	0.00	127628.72	0	0
20	0.00	447.29	1.54		2237	0.00	127628.72	0	0
21	0.00	459.08	1.58		2237	0.00	127628.72	0	0
22	0.00	452.96	2.37		2236	0.00	127628.72	0	0
23	0.00	461.28	4.31		2237	0.00	127628.72	0	0
24	5.55	452.09	4.06	2243		55.35	127628.72	0	0
25	13.58	459.67	3.65	2246		125.47	127684.07	1.616349	8.367643
26	10.31	472.95	3.80	2244		95.35	127809.54	3.657006	6.518098
27	10.38	456.12	3.30	2245		96.73	127904.89	2.782375	6.532262
28	9.66	449.61	2.11	2237		68.04	128001.62	2.820799	6.567497
29	5.06	442.85	2.05	2242		32.92	128069.66	1.983121	6.512378
30	0.00	446.27	2.84		2242.00	0.00	128102.58	0.959914	4.744612
31	0.00	439.22	5.58		2239.00	0.00	128102.58	0	0
TOTALS	168.59	437.68	2.12	2242.43		1224.57	128102.58	1.21	8.37

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT. BY: _____

TITLE: _____

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 08/2014

WELL NO. BW #4

API NO. 47-073 - 02523

PERMIT NO.

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	0	440	1		2,239	0	0		
2	0	446	1		2,238	0	0		
3	0	449	1		2,239	0	0		
4	0	452	1		2,239	0	0		
5	0	458	1		2,239	0	0		
6	0	459	1		2,239	0	0		
7	0	468	2		2,239	0	0		
8	0	472	2		2,239	0	0		
9	0	476	2		2,239	0	0		
10	0	477	1		2,239	0	0		
11	0	483	1		2,239	0	0		
12	0	498	1		2,230	0	0		
13	0	502	1		2,228	0	0		
14	0	501	1		2,227	0	0		
15	0	506	1		2,227	0	0		
16	0	504	1		2,227	0	0		
17	0	501	1		2,227	0	0		
18	0	509	1		2,226	0	0		
19	0	510	1		2,226	0	0		
20	0	511	1		2,225	0	0		
21	0	512	1		2,225	0	0		
22	0	510	2		2,225	0	0		
23	0	516	3		2,223	0	0		
24	0	511	3		2,223	0	0		
25	0	509	3		2,222	0	0		
26	0	512	3		2,221	0	0		
27	0	514	3		2,221	0	0		
28	0	514	2		2,221	0	0		
29	0	516	2		2,221	0	0		
30	0	515	2		2,220	0	0		
31	0	516	5		2,220	0	0		
TOTALS	0	516	5	0	2,239	0	0	0	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY: Derrick Lamp
TITLE: Operations Foreman

Digitally signed by Derrick Lamp
DN: cn=Derrick Lamp, ou=Appalachian Oil Purchasers, o=Operations
Appalachian Oil Purchasers, c=US
Date: 2014.08.07 11:04:04 -0400

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH / YEAR (MM/YYYY): 09/2014

WELL NO. BW4

API NO. 47- 073 - 02523

PERMIT NO.

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	0	516	5		2,219		0		
2	0	510	3		2,219		0		
3	0	505	2		2,219		0		
4	0	508	2		2,219		0		
5	0	512	2		2,219		0		
6	0	511	2		2,219		0		
7	0	508	2		2,219		0		
8	0	506	1		2,215		0		
9	0	510	1		2,215		0		
10	0	502	1		2,215		0		
11	4	203	1	2,219		126	126.37	20	
12	3	235	1	2,216		87	213.32	19	
13	0	345	1		2,214		213.32		
14	0	446	1		2,214		213.32		
15	0	468	1		2,214		213.32		
16	0	479	1		2,212		213.32		
17	0	485	1		2,212		213.32		
18	0	492	1		2,212		213.32		
19	0	501	1		2,212		213.32		
20	0	503	1		2,211		213.32		
21	0	502	1		2,210		213.32		
22	0	507	1		2,209		213.32		
23	0	507	1		2,208		213.32		
24	0	505	1		2,208		213.32		
25	0	511	1		2,208		213.32		
26	0	511	1		2,208		213.32		
27	0	515	1		2,208		213.32		
28	0	510	1		2,206		213.32		
29	0	509	1		2,206		213.32		
30	0	510	1		2,206		213.32		
31							213.32		
TOTALS	7	516	5	2,219	2,219	213	213	20	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY: Derrick Lamp
TITLE:Digitally signed by Derrick Lamp
DN: cn=Derrick Lamp, o=West Virginia Department of Environmental Protection, email=Derrick.Lamp@wvdepr.com, c=US
Date: 2014.10.13 14:20:05 -0400

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 10/2014

WELL NO. BW4

API NO. 47- 073 - 02523

PERMIT NO.

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	0	511	1		2,206		0		
2	0	505	1		2,206		0		
3	0	501	2		2,205		0		
4	0	511	1		2,205		0		
5	0	507	2		2,204		0		
6	7	346	1	2,209		135	135.22		
7	15	350	2	2,245		397	532.61		
8	19	348	1	2,248		364	896.39		
9	6	320	1	2,231		88	984.55		
10	0	300	1		2,231		984.55		
11	0	310	2		2,231		984.55		
12	0	316	1		2,231		984.55		
13	0	318	1		2,222		984.55		
14	0	342	2		2,221		984.55		
15	0	388	2		2,219		984.55		
16	0	390	1		2,219		984.55		
17	0	395	1		2,219		984.55		
18	0	392	2		2,219		984.55		
19	0	401	1		2,219		984.55		
20	0	427	1		2,219		984.55		
21	0	452	2		2,219		984.55		
22	0	479	1		2,213		984.55		
23	0	498	1		2,213		984.55		
24	0	515	1		2,212		984.55		
25	0	505	1		2,211		984.55		
26	0	501	2		2,210		984.55		
27	0	512	2		2,210		984.55		
28	0	505	2		2,210		984.55		
29	0	510	1		2,210		984.55		
30	0	510	1		2,209		984.55		
31	0	514	1		2,209		984.55		
TOTALS	46	515	2	2,248	2,231	985	985	0	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY: Derrick Lamp
TITLE: _____

Digitally signed by Derrick Lamp
DN: cn=Derrick Lamp, o=Enlink (AQ), ou=Foreman,
email=Derrick.Lamp@enlink.com, c=US
Date: 2014.10.18 12:46:18 -0500

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 11/2014

WELL NO. BW#4

API NO. 47- 073 - 02523

PERMIT NO.

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	0				2,208		0		
2	0				2,207		0		
3	0				2,208		0		
4	0				2,208		0		
5	0				2,206		0		
6	0				2,207		0		
7	0				2,205		0		
8	0				2,205		0		
9	0				2,205		0		
10	10			2,251		317	316.84		
11	15			2,247		433	749.44		
12	7			2,247		184	933.82		
13	0				2,227		933.82		
14	1			2,232		11	944.33		
15	5			2,250		67	1010.86		
16	1			2,231		21	1031.81		
17	1			2,233		26	1058.22		
18	7			2,233		29	1086.85		
19	3			2,232		15	1101.84		
20	3			2,230		14	1116.04		
21	2			2,228		11	1126.7		
22	2			2,228		9	1135.96		
23	1			2,225		2	1137.76		
24	0				2,214		1137.76		
25	0				2,214		1137.76		
26	0				2,210		1137.76		
27	1			2,215		3	1140.45		
28	0			2,209		0	1140.49		
29	0				2,208		1140.49		
30	0				2,207		1140.49		
31							1140.49		
TOTALS	59	0	0	2,251	2,227	1,140	1,140	0	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY: **Derrick Lamp**
TITLE: _____

Digitally signed by Derrick Lamp
DN: cn=Derrick Lamp, o=Erlank (ADF), ou=Foreman,
email=derrick.lamp@erlank.com, c=US
Date: 2014.12.17 04:10:05-0500

WR-40 B

STATE OF WEST VIRGINIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
REPORT FOR WASTE DISPOSAL WELLS

MONTH/YEAR (MM/YYYY): 12/2014
WELL NO. BW4
API NO. 47-073 - 02523
PERMIT NO. _____

OPERATOR NAME: Appalachian Oil Purchasers

*****MAXIMUM PERMITTED INJECTION PRESSURE 2,258 PSIG.*****

DAY	OPERATING HOURS	ANNULUS PRESSURES (PSIG)		MAXIMUM DAILY INJECTION PRESSURE (PSIG)	SHUT IN PRESSURE (PSIG)	VOLUME IN BBLS AND/OR MCF.		RATE IN GALLONS PER MINUTE	
		TUBING	OTHER			DAILY	ACCUMULATED	MAXIMUM	MINIMUM
1	2			2,211		8	7.73		
2	10			2,240		91	98.71		
3	13			2,241		344	442.48		
4	16			2,256		404	846.82		
5	14			2,256		282	1128.52		
6	5			2,250		99	1227.8		
7	5			2,245		87	1314.74		
8	1			2,226		22	1336.68		
9	3			2,224		42	1378.62		
10	6			2,221		73	1451.4		
11	4			2,224		60	1511.73		
12	0				2,220	0	1511.73		
13	0				2,222	0	1511.73		
14	0				2,218	0	1511.73		
15	0				2,219	0	1511.73		
16	0				2,218	0	1511.73		
17	3			2,226		32	1543.23		
18	20			2,232		295	1838.43		
19	20			2,243		167	2005.21		
20	24			2,236		249	2254.04		
21	24			2,236		274	2527.71		
22	24			2,233		274	2801.52		
23	16			2,236		192	2993.75		
24	10			2,255		118	3111.59		
25	23			2,236		127	3238.79		
26	21			2,244		126	3365.01		
27	22			2,241		136	3500.64		
28	22			2,241		140	3641.12		
29	23			2,241		149	3790.1		
30	18			2,256		115	3904.93		
31	13			2,254		90	3994.93		
TOTALS	362	0	0	2,256	2,222	3,995	3,995	0	0

I HEREBY CERTIFY THAT THE INFORMATION ON THIS REPORT IS TRUE AND CORRECT.

BY:

Derrick Lamp

TITLE:

Digitally signed by Derrick Lamp
DN: cn=Derrick Lamp, o=AOP, ou=AOP,
email=derricklamp@enlink.com, c=US
Date: 2015.01.15 15:42:08 -0500

Laboratory Report Number: L15070046

Derrick Lamp
Ohio Oil Gathering Corp.
157 Lower Eureka Lane
St. Mary's, WV 26170

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories. Review and compilation of your report was completed by Microbac's Ohio Valley Division (OVD). If you have any questions, comments, or require further assistance regarding this report, please contact your service representative listed below.

Laboratory Contact:
Michelle Taylor – Client Services Specialist
(740) 373-4071
Michelle.Taylor@microbac.com

I certify that all test results meet all of the requirements of the accrediting authority listed below. All results for soil samples are reported on a 'dry-weight' basis unless specified otherwise. Analytical results for water and wastes are reported on a 'as received' basis unless specified otherwise. A statement of uncertainty for each analysis is available upon request. This laboratory report shall not be reproduced, except in full, without the written approval of Microbac Laboratories. The reported results are related only to the samples analyzed as received.

This report was certified on July 08 2015



David Vandenberg – Managing Director

State of Origin: WV
Accrediting Authority: Department of Environmental Protection ID:361
QAPP: Microbac OVD



Microbac Laboratories * Ohio Valley Division
158 Starlite Drive, Marietta, OH 45750 * T: (740) 373-4071 F: (740) 373-4835 * www.microbac.com



Record of Sample Receipt and Inspection

Comments/Discrepancies

This is the record of the shipment conditions and the inspection records for the samples received and reported as a sample delivery group (SDG). All of the samples were inspected and observed to conform to our receipt policies, except as noted below.

There were no discrepancies.

Discrepancy

Resolution

Coolers

Cooler #	Temperature Gun	Temperature	COC #	Airbill #	Temp Required?
0019990	H	6.0			X

Inspection Checklist

#	Question	Result
1	Were shipping coolers sealed?	NA
2	Were custody seals intact?	NA
3	Were cooler temperatures in range of 0-6?	Yes
4	Was ice present?	Yes
5	Were COC's received/information complete/signed and dated?	Yes
6	Were sample containers intact and match COC?	Yes
7	Were sample labels intact and match COC?	Yes
8	Were the correct containers and volumes received?	Yes
9	Were samples received within EPA hold times?	Yes
10	Were correct preservatives used? (water only)	Yes
11	Were pH ranges acceptable? (voa's excluded)	Yes
12	Were VOA samples free of headspace (less than 6mm)?	NA

Lab Report #: L15070046

Lab Project #: 2167.005

Project Name: WV Oil

Lab Contact: Michelle Taylor

Samples Received

Client ID	Laboratory ID	Date Collected	Date Received
WV OIL-MONTHLY	L15070046-01	07/01/2015 08:45	07/01/2015 10:36

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www.microbac.com

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Office of Oil and Gas
NOV 18 2015
WV Department of
Environmental Protection



Login Number: L15070046
Department: Metals
Analyst: Ji Hu

METHOD

Preparation: SW-846 3015

Analysis: SW-846 6010

HOLDING TIMES

Sample Preparation: All holding times were met.

Sample Analysis: All holding times were met.

PREPARATION

Sample preparation proceeded normally.

CALIBRATION

Initial Calibration: All acceptance criteria were met.

Alternate Source Standards: All acceptance criteria were met.

Interference Check Standards: All acceptance criteria were met.

Continuing Calibration Verification: All acceptance criteria were met.

Continuing Calibration Blank: All acceptance criteria were met.

BATCH QA/QC

Method Blank: All acceptance criteria were met.

Laboratory Control Sample: All acceptance criteria were met.

Serial Dilution/Post Digestion Spikes: WG530179 - All acceptance criteria were met.

Matrix Spikes: All acceptance criteria were met.

SAMPLES

Samples: WG530179 - Due to the yellow color of the digestate, client sample 01 was analyzed at a dilution for all analytes.

Narrative ID: 101180

Approved By: Maren Beery

Maren Beery

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Office of Oil and Gas
NOV 18 2015
WV Department of
Environmental Protection
Generated at Jul 8, 2015 11:20

Certificate of Analysis

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: ICP-THERMO3
Client ID: WV OIL-MONTHLY	Prep Method: 3015	Prep Date: 07/06/2015 08:22
Matrix: Water	Analytical Method: 6010B	Cal Date: 07/07/2015 09:00
Workgroup #: WG530179	Analyst: JYH	Run Date: 07/07/2015 14:21
Collect Date: 07/01/2015 08:45	Dilution: 250	File ID: T3.070715.142121
Sample Tag: DL01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Barium, Total	7440-39-3	837		2.50	1.25
Iron, Total	7439-89-6	124		25.0	12.5
Manganese, Total	7439-96-5	10.8		2.50	1.25
Sodium, Total	7440-23-5	39600		125	62.5

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: TIAMO1
Client ID: WV OIL-MONTHLY	Prep Method: 9040C	Prep Date: N/A
Matrix: Water	Analytical Method: 9040C	Cal Date:
Workgroup #: WG529741	Analyst: SDC	Run Date: 07/01/2015 19:48
Collect Date: 07/01/2015 08:45	Dilution: 1	File ID: T1.070115.1948PH
Sample Tag: 01	Units: UNITS	

Analyte	CAS #	Result	Qual	RL	MDL
pH	10-29-7	5.76	H1	0.000	0.000
Temperature At Determination (C)				0.000	0.000
H1	Sample analysis performed past holding time.				

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: SMARTCHEM2
Client ID: WV OIL-MONTHLY	Prep Method: SM4500-Cl(-)-E-1997	Prep Date: N/A
Matrix: Water	Analytical Method: SM4500-Cl(-)-E-1997	Cal Date: 07/02/2015 12:29
Workgroup #: WG529827	Analyst: DCM	Run Date: 07/02/2015 12:33
Collect Date: 07/01/2015 08:45	Dilution: 1000	File ID: S2150702003.014
Sample Tag: DL01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Chloride	16887-00-6	45500		2000	1000

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NOV 18 2015

WV Department of
Environmental Protection

Certificate of Analysis

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: OVEN
Client ID: WV OIL-MONTHLY	Prep Method: 160.1/SM2540C	Prep Date: N/A
Matrix: Water	Analytical Method: SM2540-C-1997	Cal Date:
Workgroup #: WG529817	Analyst: AWE	Run Date: 07/02/2015 12:37
Collect Date: 07/01/2015 08:45	Dilution: 1	File ID: EN.1507021237-08
Sample Tag:	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Total Dissolved Solids		141000		1000	500

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: TOC-VWP
Client ID: WV OIL-MONTHLY	Prep Method: 415.1	Prep Date: N/A
Matrix: Water	Analytical Method: 415.1	Cal Date: 05/27/2015 15:47
Workgroup #: WG529761	Analyst: DIH	Run Date: 07/02/2015 20:15
Collect Date: 07/01/2015 08:45	Dilution: 50	File ID: TC07022015.032
Sample Tag: DL01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Total Organic Carbon	TOC	603		50.0	25.0

Sample #: L15070046-01	PrePrep Method: N/A	Instrument: OVEN
Client ID: WV OIL-MONTHLY	Prep Method: 160.2/SM2540D	Prep Date: N/A
Matrix: Water	Analytical Method: SM2540-D-1997	Cal Date:
Workgroup #: WG529708	Analyst: KAJ	Run Date: 07/01/2015 15:09
Collect Date: 07/01/2015 08:45	Dilution: 1	File ID: EN.1507011509-17
Sample Tag:	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Total Suspended Solids		194		5.00	2.50

Microbac Laboratories Inc.
Ohio Valley Division Analyst List
July 8, 2015

001 - BIO-CHEM TESTING WVDEP 220	002 - REIC Consultants, Inc. WVDEP 060
003 - Sturm Environmental	004 - MICROBAC PITTSBURGH
005 - ES LABORATORIES	006 - ALCOSAN LABORATORIES
007 - ALS LABORATORIES	008 - BENCHMARK LABORATORIES
010 - MICROBAC CHICAGOLAND	AC - AMBER R. CARMICHAEL
ADC - ANTHONY D. CANTER	ADG - APRIL D. GREENE
AED - ALLEN E. DAVIS	ALS - ADRIANE L. STEED
AWE - ANDREW W. ESSIG	AZH - AFTER HOURS
BJO - BRIAN J. OGDEN	BKT - BRENDAN TORRENCE
BLG - BRENDA L. GREENWALT	BRG - BRENDA R. GREGORY
CAA - CASSIE A. AUGENSTEIN	CAF - CHERYL A. FLOWERS
CEB - CHAD E. BARNES	CJR - COURTNEY J. REXROAD
CLC - CHRYS L. CRAWFORD	CLS - CARA L. STRICKLER
CLW - CHARISSA L. WINTERS	CPD - CHAD P. DAVIS
CSH - CHRIS S. HILL	DAK - DEAN A. KETELSEN
DCM - DAVID C. MERCKLE	DEV - DAVID E. VANDENBERG
DIH - DEANNA I. HESSON	DLB - DAVID L. BUMGARNER
DLP - DOROTHY L. PAYNE	DLW - DIANA L. WRIGHT
DSM - DAVID S. MOSSOR	ECL - ERIC C. LAWSON
ENY - EMILY N. YOAK	EPT - ETHAN P. TIDD
ERP - ERIN R. PORTER	FJB - FRANCES J. BOLDEN
JBK - JEREMY B. KINNEY	JDH - JUSTIN D. HESSON
JDS - JARED D. SMITH	JJS - JOHN J. STE MARIE
JKP - JACQUELINE K. PARSONS	JLL - JOHN L. LENT
JMW - JEANA M. WHITE	JTP - JOSHUA T. PEMBERTON
JWR - JOHN W. RICHARDS	JWS - JACK W. SHEAVES
JYH - JI Y. HU	KAJ - KELLIE A. JOHNSON
KAT - KATHY A. TUCKER	KDW - KATHRYN D. WELCH
KEB - KATIE E. BARNES	KHR - KIM H. RHODES
KKB - KERRI K. BUCK	KRA - KATHY R. ALBERTSON
KRB - KAELY R. BECKER	KRP - KATHY R. PARSONS
LEC - LAURA E. CARPENTER	LKN - LINDA K. NEDEFF
LLS - LARRY L. STEPHENS	LSB - LESLIE S. BUCINA
MBK - MORGAN B. KNOWLTON	MDA - MIKE D. ALBERTSON
MDC - MIKE D. COCHRAN	MES - MARY E. SCHILLING
MLB - MEGAN L. BACHE	MMB - MAREN M. BEERY
MRT - MICHELLE R. TAYLOR	MSW - MATT S. WILSON
PDM - PIERCE D. MORRIS	PIT - MICROBAC WARRENDAL
PRL - PAIGE R. LAMB	PSW - PEGGY S. WEBB
QX - QIN XU	RAH - ROY A. HALSTEAD
REK - BOB E. KYER	RLB - BOB BUCHANAN
RM - RAYMOND MALEKE	RNP - RICK N. PETTY
RST - ROBIN S. TURNER	SAV - SARAH A. VANDENBERG
SCB - SARAH C. BOGOLIN	SDC - SHALYN D. CONLEY
SLM - STEPHANIE L. MOSSBURG	SLP - SHERI L. PFALZGRAF
TB - TODD BOYLE	TGF - TIM G. FELTON
TMB - TIFFANY M. BAILEY	TMM - TAMMY M. MORRIS
VC - VICKI COLLIER	WJB - WILL J. BEASLEY
WRR - WESLEY R. RICHARDS	WTD - WADE T. DELONG
XXX - UNAVAILABLE OR SUBCONTRACT	

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List of Valid Qualifiers

July 08, 2015

Qualkey: STD

Qualifier	Description
*	Surrogate or spike compound out of range
+	Correlation coefficient for the MSA is less than 0.995
<	Result is less than the associated numerical value.
>	Result is greater than the associated numerical value.
A	See the report narrative
B	Analyte present in method blank
B,H1	Analyte present in method blank. Sample analysis performed past holding time.
B1	Target analyte detected in method blank at or above the method reporting limit
B3	Target analyte detected in calibration blank at or above the method reporting limit
B4	The BOD unseeded dilution water blank exceeded 0.2 mg/L
C	Confirmed by GC/MS
CG	Confluent growth
CT1	The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
DL	Surrogate or spike compound was diluted out
E	Estimated concentration due to sample matrix interference
E,CT1	Estimated results. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
EDL	Elevated sample reporting limits, presence of non-target analytes
EMPC	Estimated Maximum Possible Concentration
F, S	Estimated result below quantitation limit; method of standard additions(MSA)
F,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
FL	Free Liquid
H1	Sample analysis performed past holding time.
H1,CT1	Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guidelines for reque
I	Semiquantitative result (out of instrument calibration range)
J	Estimated value; the analyte concentration was less than the RL/LOQ.
J,B	Analyte detected in both the method blank and sample above the MDL.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
J,P	Estimate; columns don't agree to within 40%
J,S	Estimated concentration; analyzed by method of standard addition (MSA)
L	Sample reporting limits elevated due to matrix interference
L1	The associated blank spike (LCS) recovery was above the laboratory acceptance limits.
L2	The associated blank spike (LCS) recovery was below the laboratory acceptance limits.
M	Matrix effect; the concentration is an estimate due to matrix effect.
N	Tentatively identified compound(TIC)
NA	Not applicable
ND	Not detected at or above the reporting limit (RL/MDL).
ND, B	Not detected at or above the reporting limit (RL). Analyte present in method blank.
ND, CT1	Analyte was not detected. The concentration is below the reported LOD. The cooler temperature at receipt exceeded reg
ND, L	Not detected; sample reporting limit (RL) elevated due to interference
ND, S	Not detected; analyzed by method of standard addition (MSA)
ND,H1	Not detected; Sample analysis performed past holding time.
ND,H1,CT1	Not detected; Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guide
NF	Not found by library search
NFL	No free liquid
NI	Non-ignitable
NR	Analyte is not required to be analyzed
NS	Not spiked
P	Concentrations >40% difference between the two GC columns
Q	One or more quality control criteria failed. See narrative.
QNS	Quantity of sample not sufficient to perform analysis
RA	Reanalysis confirms reported results
RE	Reanalysis confirms sample matrix interference
S	Analyzed by method of standard addition (MSA)
SMI	Sample matrix interference on surrogate
SP	Reported results are for spike compounds only
TIC	Library Search Compound
TNTC	Too numerous to count
TNTC, B	Too numerous to count. Analyte present in method blank.
TNTC,CT1	Too numerous to count. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
TNTC,H1	Too numerous to count. Sample analysis performed past holding time.
U	Analyte was not detected. The concentration is below the reported MDL.
UJ	Undetected; the MDL and RL are estimated due to quality control discrepancies.
UQ	Undetected; the analyte was analyzed for, but not detected.
W	Post-digestion spike for furnace AA out of control limits
X	Exceeds regulatory limit
X, S	Exceeds regulatory limit; method of standard additions (MSA)

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Environmental Protection

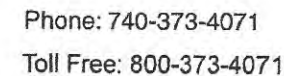
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Qualkey: STD

Z Cannot be resolved from isomer - see below

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158 Starlite Drive
Marietta, OH 45750



CHAIN-OF-CUSTODY RECORD

[illegible]

*Water (W), Soil (S), Solid Waste (SD), Unknown (X)

Material Safety Data Sheet

Gyptron® T-92

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	Gyptron® T-92
Product use	Scale Inhibitor
Manufacturer	Champion Technologies, Inc. P.O. Box 450499 Houston, TX, 77245 USA
Telephone	1-281-431-2561 (Champion)
In case of emergency	1-800-424-9300 (CHEMTREC) 1-703-527-3887 (CHEMTREC - International)

2. HAZARDS IDENTIFICATION

Physical state	liquid
Color	Clear. Amber.
Emergency overview	WARNING! Flammable. Harmful. Irritant. Keep away from heat, sparks and flame.

Potential health effects

Inhalation	Possible risk of irreversible effects.
Ingestion	Possible risk of irreversible effects. Irritating to mouth, throat and stomach.
Skin	Possible risk of irreversible effects. Irritating to skin.
Eyes	Irritating to eyes.
Chronic effects	No known significant effects or critical hazards.

See toxicological information (section 11)

3. COMPOSITION/INFORMATION ON INGREDIENTS

<u>Name</u>	<u>CAS no.</u>	<u>Weight %</u>
Methanol	67-56-1	10 - 30
Sodium phosphate ester salt	Proprietary	10 - 30

4. FIRST AID MEASURES

Eye contact	Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Get medical attention.
Skin contact	Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention.
Inhalation	Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway.
Ingestion	Wash out mouth with water. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Do not induce vomiting unless directed to do so by medical personnel. Get medical attention. Never give anything by mouth to an unconscious person.

Protection of first-aiders	No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.
Notes to physician	No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5. FIRE-FIGHTING MEASURES

Flash point	82 °F (27.8 °C), Pensky-Martens. Closed cup
Flammability of the product	Flammable liquid. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. Runoff to sewer may create fire or explosion hazard.
<u>Extinguishing media</u>	
Suitable	Use dry chemical, CO2, water spray (fog) or foam.
Not suitable	Do not use water jet.
Special exposure hazards	Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.
Hazardous combustion products	carbon dioxide, carbon monoxide, nitrogen oxides, phosphorus oxides
Special protective equipment for fire-fighters	Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.
Special remarks on fire hazards	Not available.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).
Environmental precautions	Avoid contact of spilled material with soil and prevent runoff entering surface waterways. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods for cleaning up

Small spill	Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble or absorb with an inert dry material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.
Large spill	Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7. HANDLING AND STORAGE

Handling	Use only with adequate ventilation. Put on appropriate personal protective equipment (see section 8). Wear appropriate respirator when ventilation is inadequate. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Avoid contact with eyes, skin and clothing. Avoid breathing vapor or mist. Do not enter storage areas and confined spaces unless adequately ventilated. Eliminate all ignition sources. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container. Workers should wash hands and face before eating, drinking and smoking.
Storage	Store in accordance with local regulations. Store in a segregated and approved area. Keep container in a well-ventilated area. Store in the original container or an approved alternative made from a compatible material. Keep tightly closed when not in use. Separate from oxidizing materials. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Personal protection

Hands	Use chemical-resistant, impervious gloves.
Eyes	Safety eyewear should be used when there is a likelihood of exposure.
Body	Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory	If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Occupational exposure limits

<u>Component</u>	<u>Source</u>	<u>Type</u>	<u>PPM</u>	<u>MG/M3</u>	<u>Notes</u>
Methanol	OSHA PEL	TWA	200 ppm	260 mg/m3	
	NIOSH REL	TWA	200 ppm	260 mg/m3	SKIN
	NIOSH REL	STEL	250 ppm	325 mg/m3	SKIN
	ACGIH TLV	TWA	200 ppm	262 mg/m3	SKIN
	ACGIH TLV	STEL	250 ppm	328 mg/m3	SKIN

SKIN - Skin absorption can contribute significantly to overall exposure.

Engineering measures	Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
Hygiene measures	Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Wash contaminated clothing before reusing. Emergency baths, showers, or other equipment appropriate for the potential level of exposure should be located close to the workstation location.
Environmental exposure controls	Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	liquid
-----------------------	--------

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Color	Clear. Amber.
Odor	Not available.
Odor threshold	Not available.
Boiling/condensation point	Not available.
Pour point	-40 °F (-40.0 °C)
Flash point	82 °F (27.8 °C), Pensky-Martens. Closed cup
Flammable limits	Lower: Not available. Upper: Not available.
Auto-ignition temperature	Not available.
pH	4.0 - 5.0, Method (neat)
Evaporation rate	Not available.
Solubility	Water
Vapor density	Not available.
Relative density	1.2482 - 1.2816 @ 60 °F (15.6 °C)
Vapor pressure	Not available.
Viscosity	Dynamic: 25 - 35 cPs @ 75 °F (23.9 °C)
Octanol/water partition coefficient (LogPow)	Not available.

Note: Typical values only - not to be interpreted as sales specifications

10. STABILITY AND REACTIVITY

Stability	The product is stable.
Hazardous polymerization	Under normal conditions of storage and use, hazardous polymerization will not occur.
Conditions to avoid	Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.
Materials to avoid	oxidizing materials
Hazardous decomposition products	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

11. TOXICOLOGICAL INFORMATION

Acute toxicity

<u>Substance</u>	<u>Test type</u>	<u>Species</u>	<u>Dose</u>
Methanol	LD50 Oral	Rat	5,600 mg/kg
	LD50 Oral	Mouse	5,800 mg/kg
	LD50 Oral	Rabbit	14,200 mg/kg
	LC50 Inhalation	Mouse	41000 ppm
	LC50 Inhalation	Rat	64000 ppm
	LC50 Inhalation	Rabbit	81,000 mg/m3
	LD50 Dermal	Rabbit	15,800 mg/kg

Irritation/Corrosion

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Not available.

Target organ effects Methanol: Ingestion may cause blindness.

Carcinogenicity

None of the components are listed.

12. ECOLOGICAL INFORMATION

Environmental effects No known significant effects or critical hazards.

Other adverse effects None known.

13. DISPOSAL CONSIDERATIONS

Waste disposal The generation of waste should be avoided or minimized wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations. Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14. TRANSPORT INFORMATION

Refer to the bill of lading or container label for DOT or other transportation hazard classification. Additionally, be aware that shipping descriptions may vary based on mode of transport, shipment volume or weight, container size or type, and/or origin and destination. Consult your company's Hazardous Materials / Dangerous Goods expert or your legal counsel for information specific to your situation.

15. REGULATORY INFORMATION

HCS Classification

Component

Methanol
Sodium phosphate ester salt

Classification

Irritant., Target organ effects, Occupational exposure limits
Irritant.

U.S. Federal regulations

CERCLA: Hazardous substances - Reportable quantity:

Substance

Methanol

Reportable quantity

5000 lbs

Product Reportable quantity

41,876 lb, 3,977 gal US

Substance

Methanol

Product spills equal to or exceeding the threshold above trigger the reporting requirements under CERCLA for the listed hazardous substance. Report the spill or release to the National Response Center (NRC) at (800) 424-8802.

SARA Title III Section 302 Extremely hazardous substances (40 CFR Part 355):

None of the components are listed.

SARA 311/312 MSDS distribution - chemical inventory - hazard identification:

Immediate (acute) health hazard. Delayed (chronic) health hazard. Fire hazard.

SARA 313 - Supplier notification

Component

Methanol

CAS no.

67-56-1

Weight %

10 - 30

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Clean Water Act (CWA) 307:

None of the components are listed.

Clean Water Act (CWA) 311:

None of the components are listed.

Clean Air Act (CAA) 112 accidental release prevention:

None of the components are listed.

Clean Air Act (CAA) 112 regulated flammable substances:

None of the components are listed.

Clean Air Act (CAA) 112 regulated toxic substances:

None of the components are listed.

State regulations

Massachusetts Substances: The following components are listed: Methanol.

New Jersey Hazardous Substances: The following components are listed: Methanol.

Pennsylvania RTK Hazardous Substances: The following components are listed: Methanol.

California Prop. 65

Not available.

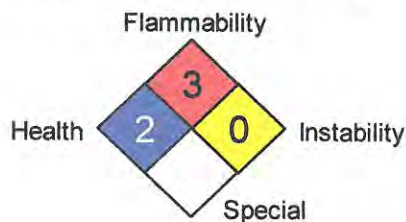
International regulations

United States inventory (TSCA 8b): All components are listed or exempted.

Canada inventory (DSL): All components are listed or exempted.

16. OTHER INFORMATION

National Fire Protection Association (U.S.A.):



Prepared by	Product Stewardship (1-281-431-2561)
Date of issue	06/03/2010
Date of previous issue	06/03/2010
Version	3.0

Disclaimer

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

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CLEARWATER™
Engineered Chemistry

Material Safety Data Sheet

PACKER INHIBITOR

HEALTH	*	2
FLAMMABILITY		3
PHYSICAL HAZARD		0
PERSONAL PROTECTION		

1. Product and Company Identification

Material name	PACKER INHIBITOR
Patent Number	Not available
Revision date	June-21-2011
Version No.	4
CAS #	Mixture
Product use	Corrosion Inhibitor
Manufacturer information	Clearwater™ International L.L.C. 100 Leetsdale Industrial Drive Leetsdale, PA 15056 US CHEMTREC 1-800-424-9300/703-527-3887
Emergency	CHEMTREC 1-800-424-9300/703-527-3887
Supplier information	Clearwater™ International L.L.C. 100 Leetsdale Industrial Drive Leetsdale, PA 15056 US
Supplier emergency telephone number(s)	CHEMTREC 1-800-424-9300/703-527-3887

2. Hazards Identification

Emergency overview	Will be easily ignited by heat, spark or flames. Irritating to respiratory system. Prolonged exposure may cause chronic effects.
OSHA regulatory status	This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects	
Routes of exposure	Inhalation. Skin contact. Ingestion. Eye contact.
Eyes	This product causes eye burns. Risk of serious damage to eyes. Do not get this material in contact with eyes.
Skin	Causes skin burns. Do not get this material in contact with skin.
Inhalation	Causes burns. Prolonged inhalation may be harmful. Irritating to respiratory system. Do not breathe dust/fume/gas/mist/vapors/spray.
Ingestion	Ingestion may produce burns to the lips, oral cavity, upper airway, esophagus and possibly the digestive tract. May cause delayed lung damage. Do not ingest. Components of the product may be absorbed into the body by ingestion.
Target organs	Eyes. Gastrointestinal tract. Lungs. Respiratory system. Skin.
Chronic effects	Shortness of breath. May cause delayed lung damage.
Signs and symptoms	Discomfort in the chest. Shortness of breath. Cough.
Potential environmental effects	Components of this product are hazardous to aquatic life. May cause long-term adverse effects in the environment.

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Engineered Chemistry™

3. Composition / Information on Ingredients

Components	CAS #	Percent
Acetic Acid	64-19-7	7 - 13
Methanol	67-56-1	40 - 70
Ammonium bisulfite	10192-30-0	15 - 40

4. First Aid Measures

First aid procedures

Eye contact

Immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact

Wash off with soap and water. Get medical attention if irritation develops or persists.

Inhalation

If breathing is difficult, remove to fresh air and keep at rest in a position comfortable for breathing. Get medical attention immediately.

Ingestion

If swallowed, seek medical advice immediately and show this container or label. Do not induce vomiting without medical advice.

Notes to physician

In case of shortness of breath, give oxygen. Keep victim warm. Symptoms may be delayed.

General advice

In case of shortness of breath, give oxygen. Keep victim warm. Call a physician if symptoms develop or persist. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire Fighting Measures

Flammable properties

Flammable by OSHA criteria. Containers may explode when heated. Runoff to sewer may cause fire or explosion hazard.

Extinguishing media

Suitable extinguishing media

Water. Foam. Dry chemical. Carbon dioxide (CO₂).

Unsuitable extinguishing media

Do not use a solid water stream as it may scatter and spread fire.

Protection of firefighters

Specific hazards arising from the chemical

Fire may produce irritating, corrosive and/or toxic gases.

Protective equipment and precautions for firefighters

In the event of fire and/or explosion do not breathe fumes. Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask. If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also consider initial evacuation for 800 meters (1/2 mile) in all directions. ALWAYS stay away from tanks engulfed in flame. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Withdraw immediately in case of rising sound from venting safety devices or any discoloration of tanks due to fire. Move containers from fire area if you can do it without risk. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Use water spray to cool unopened containers. Cool containers with flooding quantities of water until well after fire is out.



CLEARWATER™
Engineered Chemistry

6. Accidental Release Measures

Personal precautions

Ensure adequate ventilation. Keep people away from and upwind of spill/leak. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering. Keep unnecessary personnel away. Stay upwind. Keep out of low areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not contaminate water.

Methods for containment

Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Use water spray to reduce vapors or divert vapor cloud drift. Prevent entry into waterways, sewers, basements or confined areas.

Methods for cleaning up

Should not be released into the environment.

Large Spills: Dike far ahead of liquid spill for later disposal. Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. After removal flush contaminated area thoroughly with water.

Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean contaminated surface thoroughly.

Never return spills in original containers for re-use.

7. Handling and Storage

Handling

Do not handle or store near an open flame, heat or other sources of ignition. Use only with adequate ventilation. Wash thoroughly after handling. Avoid prolonged exposure.

Storage

Prevent electrostatic charge build-up by using common bonding and grounding techniques. Store in a closed container away from incompatible materials.

8. Exposure Controls / Personal Protection

Exposure limits

ACGIH

Components

CAS

TWA

STEL

Ceiling

Methanol

67-56-1

200 ppm

250 ppm

Not established

Acetic Acid

64-19-7

10 ppm

15 ppm

Not established

OSHA

Components

CAS

TWA

STEL

Ceiling

Methanol

67-56-1

200 ppm

Not established

Not established

Acetic Acid

64-19-7

10 ppm

Not established

Not established

Engineering controls

Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

Eye / face protection

Do not get this material in contact with eyes. Wear chemical goggles. Face-shield.

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Skin protection

Do not get this material in contact with skin. Do not get this material on clothing. Wear chemical protective equipment that is specifically recommended by the manufacturer. It may provide little or no thermal protection. Use chemical splash goggles and face shield (ANSI Z87.1 or approved equivalent). Protective gloves. Impervious gloves. Structural firefighters protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations.

Respiratory protection

Wear positive pressure self-contained breathing apparatus (SCBA). When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

General hygiene considerations

Do not get this material in contact with eyes. Do not get this material in contact with skin. Do not get this material on clothing. When using do not eat or drink. Keep away from food and drink. Handle in accordance with good industrial hygiene and safety practice.

9. Physical & Chemical Properties

Appearance	Liquid.
Color	yellow - amber
Odor	Not assigned.
Odor threshold	Not available
Physical state	Liquid.
Form	Liquid.
pH	5 - 8
Melting point	-29.2 °F (-34.15 °C) estimated
Freezing point	Not available
Boiling point	129.2 °F (54.44 °C) estimated
Flash point	80 °F (26.7 °C)
Evaporation rate	Not available
Flammability	Not available.
Flammability limits in air, upper, % by volume	Not available
Flammability limits in air, lower, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	0.97 - 1
Relative density	0.9849 g/cm ³ estimated
Solubility (water)	Not available
Partition coefficient (n-octanol/water)	Not available
Auto-ignition temperature	390.2 °F (199 °C) estimated
Decomposition temperature	Not available
VOC	42.8 % estimated

10. Chemical Stability & Reactivity Information

Chemical stability	Risk of ignition. Stable at normal conditions.
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Conditions to avoid	Heat, flames and sparks.
Incompatible materials	Peroxides, Strong oxidizing agents, Strong acids, Caustics.
Hazardous decomposition products	Irritants, Toxic gas, May include oxides of nitrogen, May include oxides of phosphorus.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Acute effects	Acute LD50: 10386 mg/kg estimated, Rat, Oral Acute LD50: 11503 mg/kg estimated, Rat, Dermal Acute LC50: 35 mg/l/4h estimated, Rat, Inhalation Causes burns.
----------------------	--

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

Acetic Acid	64-19-7	Inhalation LC50 Rat: 11.4 mg/L/1H; Oral LD50 Rat: 3310 mg/kg; Dermal LD50 Rabbit: 1060 mg/kg
Methanol	67-56-1	Inhalation LC50 Rat: 83.2 mg/L/4H; Inhalation LC50 Rat: 64000 ppm/4H; Oral LD50 Rat: 5628 mg/kg; Dermal LD50 Rabbit: 15800 mg/kg

Local effects	Irritating to respiratory system.
Chronic effects	Hazardous by OSHA criteria. Prolonged or repeated exposure may cause lung injury. Prolonged exposure may cause chronic effects.
Carcinogenicity	Not expected to be hazardous by OSHA criteria.
Neurological effects	Not expected to be hazardous by OSHA criteria.

12. Ecological Information

Ecotoxicity	LC50 1273 mg/L estimated, Fish, 96,00 Hours,
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Ecotoxicity - Freshwater Fish Species Data

Acetic Acid	64-19-7	96 Hr LC50 Pimephales promelas: 88 mg/L [static]; 96 Hr LC50 Lepomis macrochirus 75 mg/L
Methanol	67-56-1	96 Hr LC50 Pimephales promelas: 28100 mg/L [flow-through]; 96 Hr LC50 Oncorhynchus mykiss: 13200 mg/L

Ecotoxicity - Microtox Data

Acetic Acid	64-19-7	5 min EC50 Photobacterium phosphoreum: 8.8 mg/L; 15 min EC50 Photobacterium phosphoreum: 8.8 mg/L; 25 min EC50 Photobacterium phosphoreum: 8.8 mg/L
Methanol	67-56-1	5 min EC50 Photobacterium phosphoreum: 43000 mg/L; 15 min EC50 Photobacterium phosphoreum: 40000 mg/L; 25 min EC50 Photobacterium phosphoreum: 39000 mg/L

Ecotoxicity - Water Flea Data

Acetic Acid	64-19-7	24 Hr EC50 Daphnia magna: 95 mg/L
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Environmental effects	Harmful to aquatic life.
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Ecotoxicity - Freshwater Fish Species Data

Acetic Acid	64-19-7	96 Hr LC50 Pimephales promelas: 88 mg/L [static]; 96 Hr LC50 Lepomis macrochirus 75 mg/L
Methanol	67-56-1	96 Hr LC50 Pimephales promelas: 28100 mg/L [flow-through]; 96 Hr LC50 Oncorhynchus mykiss: 13200 mg/L

Ecotoxicity - Microtox Data

Acetic Acid	64-19-7	5 min EC50 Photobacterium phosphoreum: 8.8 mg/L; 15 min EC50 Photobacterium phosphoreum: 8.8 mg/L; 25 min EC50 Photobacterium phosphoreum: 8.8 mg/L
Methanol	67-56-1	5 min EC50 Photobacterium phosphoreum: 43000 mg/L; 15 min EC50 Photobacterium phosphoreum: 40000 mg/L; 25 min EC50 Photobacterium phosphoreum: 39000 mg/L

Ecotoxicity - Water Flea Data

Acetic Acid	64-19-7	24 Hr EC50 Daphnia magna: 95 mg/L
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13. Disposal Considerations

Waste codes

D001: Waste Flammable material with a flash point <140 F

U.S. - RCRA (Resource Conservation & Recovery Act) - U Series Wastes - Acutely Toxic Wastes & Other Hazardous Characteristics

Methanol

67-56-1

waste number U154 (Ignitable waste)

Disposal instructions

Dispose of this material and its container at hazardous or special waste collection point. Do not allow this material to drain into sewers/water supplies. If discarded, this product is considered a RCRA ignitable waste, D001. Incinerate the material under controlled conditions in an approved incinerator. Do not incinerate sealed containers. Dispose in accordance with all applicable regulations.

14. Transport Information

Department of Transportation (DOT) Requirements

Basic shipping requirements:

Proper shipping name Flammable liquids, n.o.s. (Methanol)

Hazard class 3

UN number UN1993

Packing group III

Additional information:

Packaging non bulk 202

Packaging bulk 242

ERG number 128



Department of Transportation (DOT) Requirements

Bulk

Basic shipping requirements:

Proper shipping name Flammable liquids, n.o.s. (Methanol)

Hazard class 3

UN number UN1993

Packing group III

Additional information:

Packaging non bulk 202

Packaging bulk 242

ERG number 128



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Canadian Transportation of Dangerous Goods (TDG) Requirements

Basic shipping requirements:

Proper shipping name	FLAMMABLE LIQUID, TOXIC, N.O.S. (Methanol)
Hazard class	3
Subsidiary hazard class	6.1
UN number	UN1992
Packing group	III
Additional information:	
Special provisions	16
ERG number	128



IMDG

Basic shipping requirements:

Proper shipping name	FLAMMABLE LIQUID, TOXIC, N.O.S. (Methanol)
Hazard class	3
Subsidiary hazard class	6.1
UN number	1992
Packing group	III



IATA

Basic shipping requirements:

Proper shipping name	Flammable liquid, n.o.s. (Methanol)
Hazard class	3
UN number	1993
Packing group	III



15. Regulatory Information

Labelling

Contains Acetic Acid, Ammonium bisulfite, Methanol

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

FEMA (Flavor and Extract Manufacturers Association) - FEMA Numbers

Acetic Acid	64-19-7	2006
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U.S. - CERCLA/SARA - Section 313 - Emission Reporting

Methanol	67-56-1	1.0 % de minimis concentration
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U.S. - FDA - Direct Food Additives

Methanol	67-56-1	21 CFR 173.250
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U.S. - FDA - Food Additives Generally Recognized as Safe (GRAS)

Acetic Acid	64-19-7	21 CFR 184.1005
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Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical Yes

CERCLA (Superfund) reportable quantity

Methanol: 5000.0000

Ammonium bisulfite: 5000.0000

Acetic Acid: 5000.0000

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - Yes
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of New and Existing Chemicals (EINECS)	No
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations

Canada - WHMIS - Ingredient Disclosure List

Acetic Acid	64-19-7	1 %
Ammonium bisulfite	10192-30-0	1 %
Methanol	67-56-1	1 %

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State regulations

This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

U.S. - Massachusetts - Right To Know List

Acetic Acid	64-19-7	Present
Ammonium bisulfite	10192-30-0	Present
Methanol	67-56-1	Present

U.S. - Minnesota - Hazardous Substance List

Acetic Acid	64-19-7	Present
Methanol	67-56-1	Skin

U.S. - New Jersey - Right to Know Hazardous Substance List

Acetic Acid	64-19-7	sn 0004
Ammonium bisulfite	10192-30-0	sn 0090
Methanol	67-56-1	sn 1222

U.S. - Pennsylvania - RTK (Right to Know) List

Acetic Acid	64-19-7	Environmental hazard
Ammonium bisulfite	10192-30-0	Environmental hazard
Methanol	67-56-1	Environmental hazard

U.S. - Rhode Island - Hazardous Substance List

Acetic Acid	64-19-7	Toxic; Flammable
Methanol	67-56-1	Toxic; Flammable

U.S. - Texas - Effects Screening Levels - Long Term

Acetic Acid	64-19-7	10 ppb ESL; 25 µg/m3 ESL
Methanol	67-56-1	200 ppb ESL; 262 µg/m3 ESL

U.S. - Texas - Effects Screening Levels - Short Term

Acetic Acid	64-19-7	100 ppb ESL; 250 µg/m3 ESL
Methanol	67-56-1	2000 ppb ESL; 2620 µg/m3 ESL

16. Other Information

HMIS® ratings

Health: 2*
Flammability: 3
Physical hazard: 0

NFPA ratings

Health: 2
Flammability: 3
Instability: 0

Prepared by

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Elmendorf, Texas 78112
210-626-0850

Disclaimer

THIS PRODUCT'S HEALTH AND SAFETY INFORMATION IS PROVIDED TO ASSIST OUR CUSTOMERS IN ASSESSING COMPLIANCE WITH HEALTH, SAFETY AND ENVIRONMENTAL REGULATIONS. THE INFORMATION CONTAINED HEREIN IS BASED ON DATA AVAILABLE TO US, AND IS BELIEVED TO BE ACCURATE, ALTHOUGH NO GUARANTEE OR WARRANTY IS PROVIDED OR IMPLIED BY THE COMPANY IN THIS RESPECT. SINCE THE USE OF THIS PRODUCT IS WITHIN THE EXCLUSIVE CONTROL OF THE USER, IT IS THE USER'S RESPONSIBILITY TO DETERMINE THE CONDITIONS OF SAFE USE. SUCH CONDITIONS MUST COMPLY WITH ALL GOVERNMENTAL REGULATIONS.

Issue date

June-21-2011

MSDS sections updated

Product and Company Identification; Alternate Trade Names

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SECTION 10

Section 10 – Monitoring:

1. Appalachian Oil Purchasers, Inc. monitors injection pressure, annulus pressure, and injection volumes daily through an electronic remote monitoring system. All injection pressures and annular pressures at BW#4 are monitored in real-time using a SCADA pressure recording system which is attached to the injection tubing and to the tubing-casing annular space and is recorded at Appalachian Oil Purchasers, LLC office. Photos of the monitoring system was previously supplied in the site security section. Injection volumes are recorded by volumetric flow meters that monitors the flow rates at BW#4. All of this data allows collection of all parameters required with WV DEP WR-40 reports.
2. Pipelines are made of fiberspar (documents previously provided to WV DEP) and are routinely monitored and inspected by Appalachian Oil Purchasers, LLC field personnel. Pressure monitoring of the pipeline is also accomplished. Mechanical integrity pressure tests (MITs) are conducted on both the pipeline and on the production casing-tubing annulus of the BW#4 at least once every five years to demonstrate mechanical integrity. All MITs are reported on WV DEP WR-37 reports. Any workovers that require removal and replacement/repair of the tubing and packer will additionally require that an MIT is performed on the production casing-tubing annulus. WV DEP will be properly notified in advance of any MITs to be performed on the BW#4 injection well.
3. All fluids are tracked electronically through Appalachian Oil Purchasers, Inc. database system, which includes volumes, dates, and sources transported by truck or pipeline to the Eureka Station facility (tracking and processing system diagrams and narrative for documenting records has been previously submitted to WV DEP).

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N. Provide a list of the API numbers for all wells to be serviced by the brine disposal well including the producing formation.

Attached find a list of the wells known at this time that will be serviced by the proposed brine disposal well. The list is believed to account for approximately 80% of the volumes to be disposed. Additional wells and facilities will be added to the list as they become available.

Brine is delivered to the Eureka Station by three methods: Appalachian Oil Purchasers' trucks, a pipeline owned by Appalachian Oil Purchasers, and third party haulers. Third party haulers represent ~35% of all fluids that are delivered to Eureka Station. All hauled fluids are identified and measured electronically at the Eureka Station. Brine flows to the Eureka station via a 74 mile pipeline.

The entire pipeline is constructed of Fiberspar (see Attached product description) inserted into steel casing. The pipeline pressure is continuously monitored at various points along the pipeline. A typical pipeline station consists of a truck unloading pad, tank storage contained within a dike, and a main line discharge pump. All facilities are enclosed in chain-linked fence and all gates are secured with locks. The facilities are well lit with security lights and are marked with emergency contact signs. Listed below are the station descriptions from south to north.

Stockly Station: This station supports a truck unloading facility and uses 2 reciprocating pumps, each 125 HP, to move product through the pipeline. This is the southernmost pump station along the pipeline. Two tanks are located at this station: 400 bbl and 3,224 bbl.

Tariff Station – Oil only and no brine.

Richardson Station - Oil only and no brine.

Brooksville Station - This station supports a truck unloading facility and uses a single 200 HP reciprocating pump (electrically driven) to move product through the pipeline. Three tanks are located at this station: 2,401 bbl, 1,751 bbl, and 15,000 bbl.

MacFarlan Station - This station supports a truck unloading facility and uses a single 35 HP reciprocating pump (electrically driven) to inject product into the pipeline. One 1,176 bbl tank is located at this station: 1,176 bbl.

Nutter Fork Station - This station supports a truck unloading facility and uses a single 180 HP reciprocating pump (natural gas engine driven) to move product through the pipeline. One tank is located at this station: 15,000 bbl.

Eureka Station - This is the station that contains the water conditioning equipment and storage (See Attached schematics for details). This station supports a truck unloading facility and uses multiple centrifugal pumps (electrically driven) to transfer products between tanks and to Bells Run Station, located across the Ohio River. Five tanks are located at this station: 4,500 bbl, 4,500 bbl, 18,119 bbl, 19,106 bbl, and 27,613 bbl.

FiberSpar Pipeline West Virginia Oil Gathering

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Legend

Oil Pipeline

Oil Pipeline

Oil Pipeline



BRINE PROCESS FLOW DESCRIPTION

Step 1 - RECEIPT AND PROCESS OF PIPELINE BRINE

Both oil and brine are received from Ohio and West Virginia Pipelines. The West Virginia pipeline is pumped to the south side of the Ohio River (Eureka Station) from our Nutter Fork Station approximately 10 miles upstream. The Ohio Pipeline is pumped from our Corning Station approximately 55 miles upstream. Both are measured by Coriolis meter as the pipelines enter the stations. These meters determine volume, density, temperature and type of fluid received and reports it to the SCADA system. The oil is directed into either tank 1 or 2 on the north side of the Ohio River (Bells Run Station).

Step 2 - RECEIPT AND PROCESS BELLS RUN TRUCK OIL AND BRINE

We have two truck unloading lines at Bells Run where oil and brine loads are delivered. The fluid goes through a strainer and then is measured. This system is currently being upgraded to Coriolis measurement and tied into the SCADA system. Then oil or brine is then sent to either tank 1 or 2.

Step 3 - BRINE AND OIL SEPARATED IN TANKS 1 & 2, UNCONDITIONED BRINE TRANSFERRED TO TANK 675

The oil and brine received from trucks and pipelines is then allowed to settle out. This results in oil and water that may have been dispersed into each other to separate into an oil layer on top of a water layer. This allows the water to be pulled off sumps in the bottoms of the tanks and the water is then transferred to tank 675. This water is metered on both sides of the.

Step 4 - EUREKA TRUCK RECEIPT - SEPARATION OF BRINE TO TANK 675 AND OIL TO TANK 474"

Truck deliveries are different at Eureka. First the water goes through two sets of strainers before it is pumped through the meter. The meter, which detects fluid density, controls valves that direct the oil into the oil tank (474) and the brine to the brine tank (675).

There are three delivery lines here and a fourth is being added. Each is individually controlled and measured. Information is captured at this point for each truck that is delivered. The amount of oil and water as well as other information is recorded to our information system.

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Step 5 - SECONDARY SEPARATION OF OIL AT TANK 675 TRANSFERRED TO TANK 474

Because a small amount of separation may still take place in the unconditioned water in tank 675, The system is designed so that this secondary separation of oil can be transferred to the oil tank 474.

Step 6 - SECONDARY SEPARATION OF WATER AT TANK 474, TRANSFERRED TO TANK 675

Likewise water may accumulate in the bottom of the oil tank 474 and this secondary water can be transferred to 675.

Step 7 - PRIMARY WATER CONDITIONING FROM TANK 675 TO TANK 701

The primary water conditioning and filtering involves several steps. First the water can be directed through an API Oil/Water Separator if needed. This provides another level of protection. The next step is an automated back washable filtering system called by the manufacturer the "Zero Gravity" system. This cleans the water of particles down to 35 microns in size. Next the brine is filtered through a replaceable media bag type system that catches most of the remaining material down to 10 microns and then the replaceable cartridge filtering cleans the remaining material down to 10 microns. This conditioned water is then stored into tank 701.

Step 8 - AUXILLARY BRINE HOLDING IN 294 AND 295 BEFORE TRANSFER TO PUMP HOUSES

This brine is then transferred to tanks 294 and 295 for final holding before being pumped to final filtering located at the pump houses.

Step 9 - FROM TANKS 294 AND 295 TO BELLS RUN PUMP HOUSES, FINAL FILTERING AND INJECTION HOLDING TANKS

The brine is then pumped to the Bells Run Pump house where it under goes final filtering. This consists of two stages both 10 micron bags and cartridges. This final conditioned water is then stored in the injection holding tanks.

Step 10 - BELLS RUN INJECTION HOLDING TANKS TO PUMPS, METERS AND WELL 1, 2 AND 3

This injection water is pumped by the injection pumps to the local Bells Run well (Well #1) or approximately 3 miles to the Long Run well (Well #2) or 2 ½ miles to the Newell Run well (Well #3). The water is measured at the outlet of each of the 3 injection systems before being sent to the well.

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Step 11- FROM TANKS 294 AND 295 TO EUREKA PUMP HOUSE, FINAL
FILTERING AND INJECTION HOLDING TANKS"

The brine will be pumped to the Eureka pump house where it will under go final filtering. This will consist of two stages both 10 micron bags and cartridges. This final conditioned water will be stored in an injection holding tank.

Step 12 - EUREKA INJECTION HOLDING TANK TO PUMPS, METER AND WELL
“

The injection water will be pumped by the injection pumps to the Pleasant County site approximately 3 miles away. The water will be measured at the outlet before being sent to the well. All volumes and pressures will be recorded by the SCADA system.

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Clearfield Energy

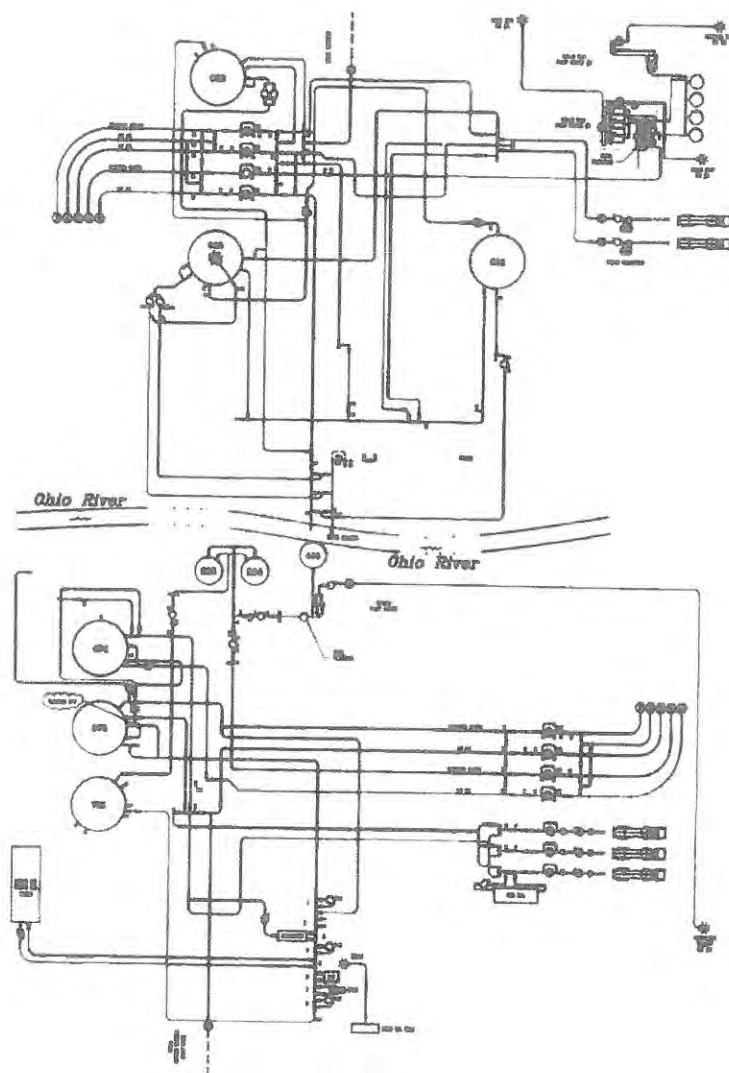
Brine Process Flow

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Bells Run/Eureka Station Overview



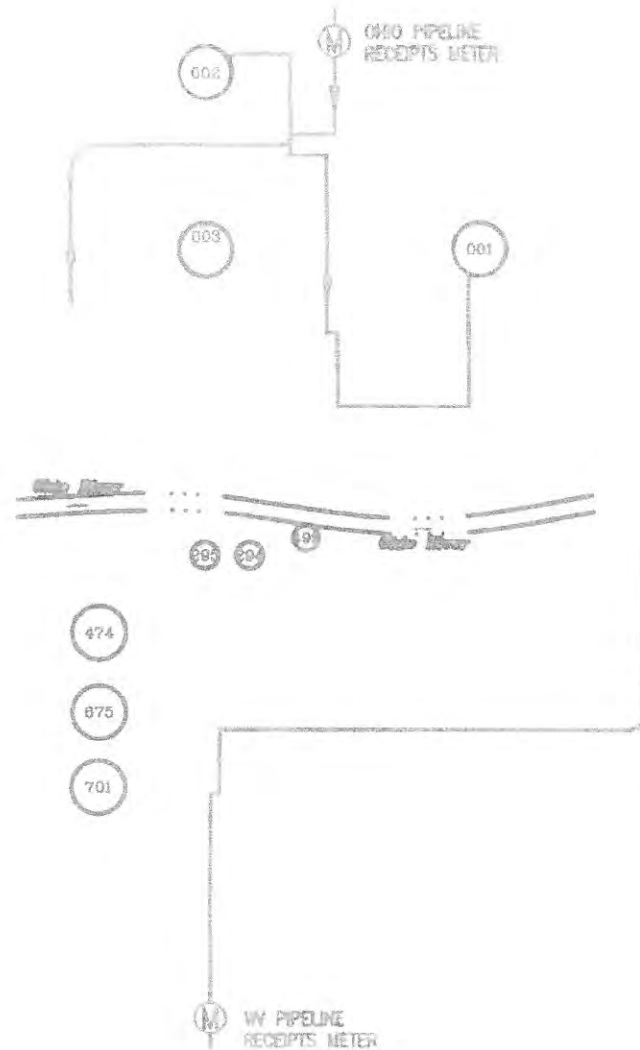
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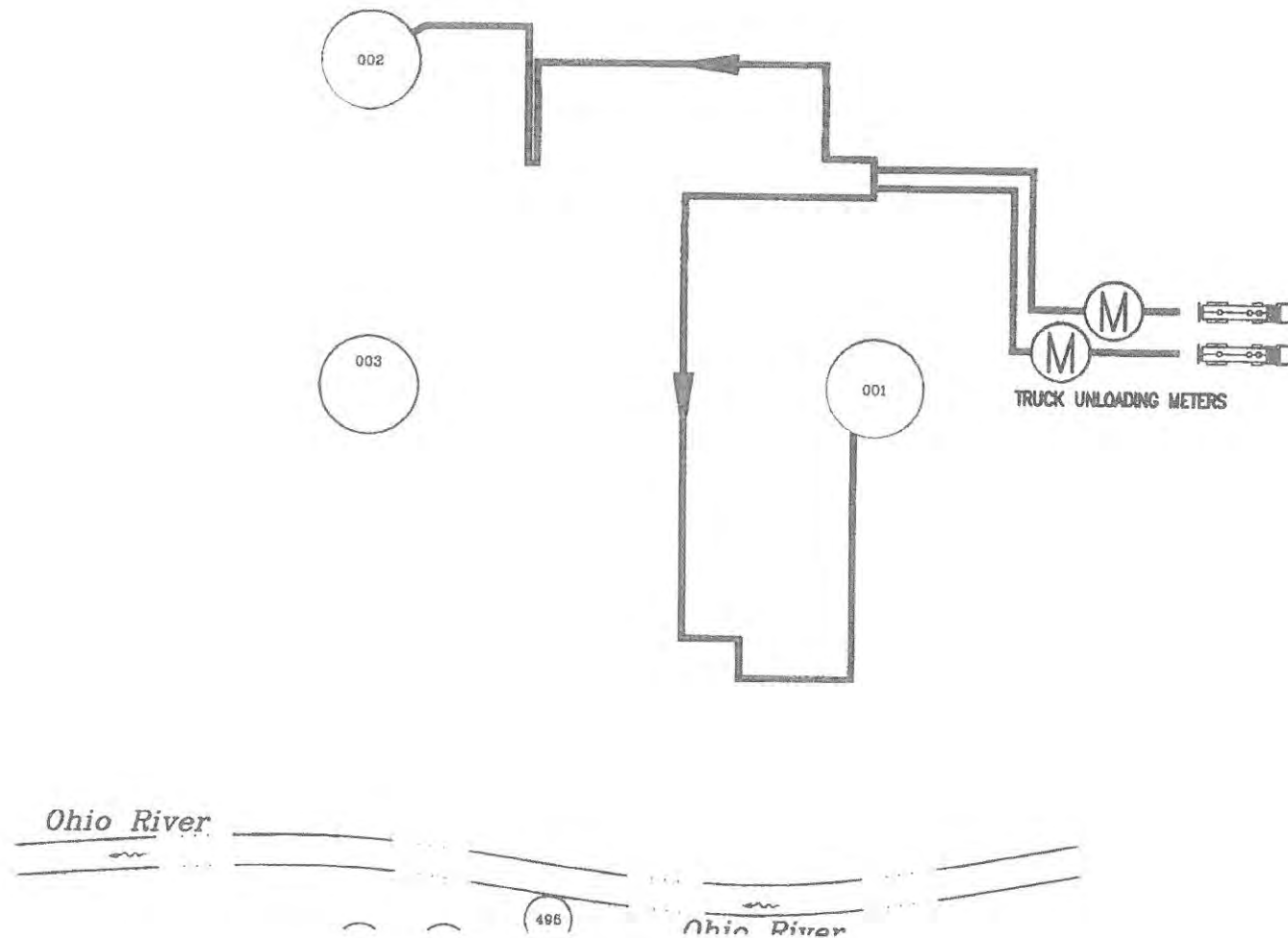
Step 1 - Receipt & Processing of Pipeline Brine



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Step 2 - Receipt & Process Bells Run Brine/Oil

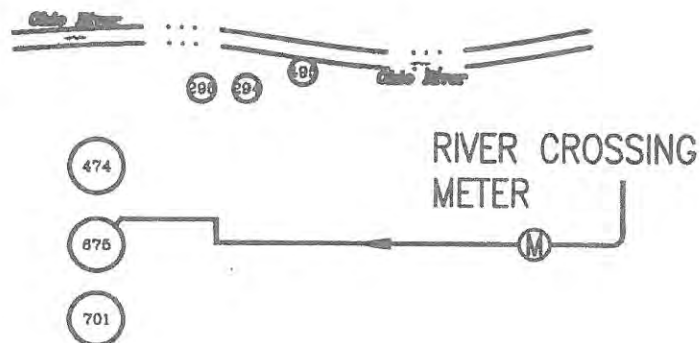
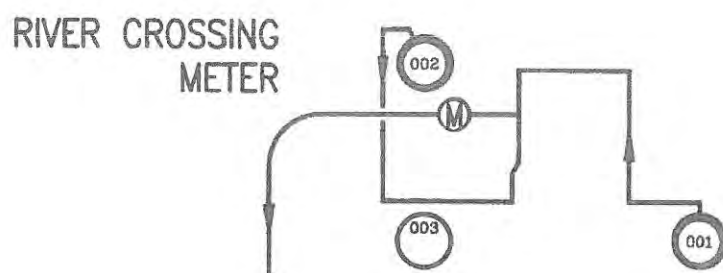


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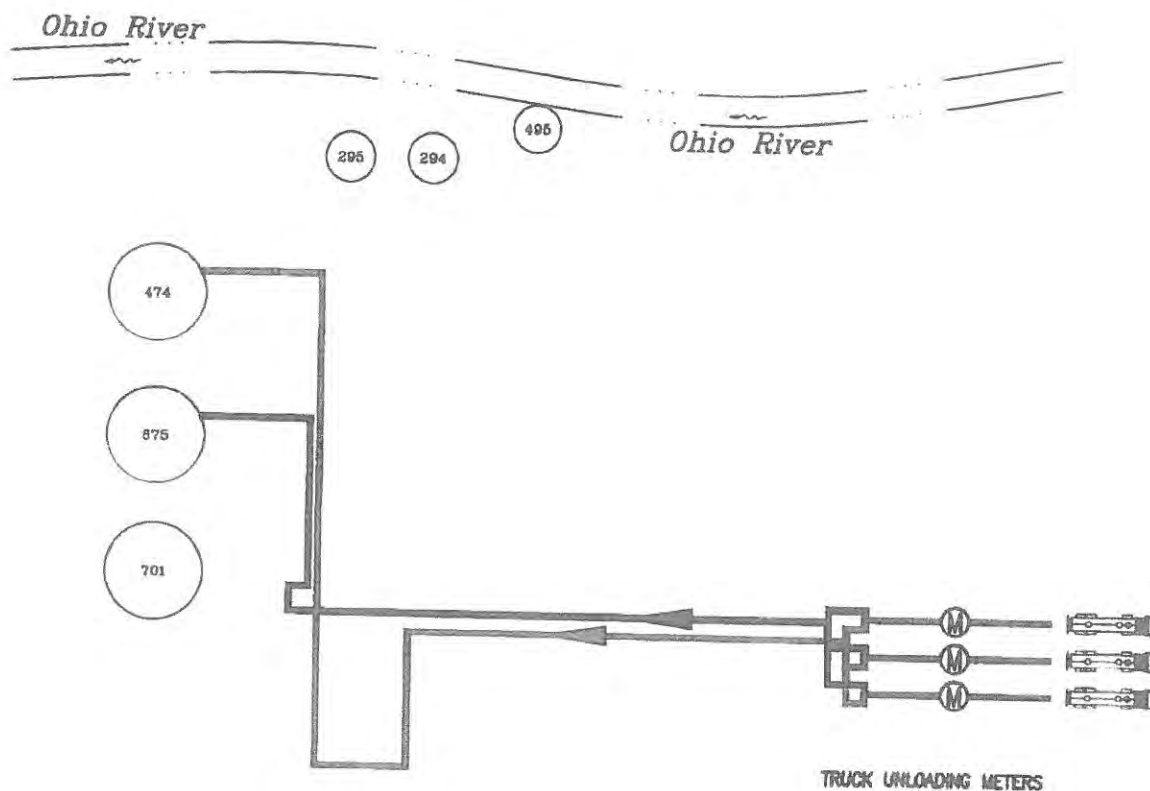
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Step 3 - Brine Separated in Tanks 1 & 2, Unconditioned Brine Transferred to Tank 675



Step 4 - Eureka Truck Receipt – Separation of Brine to Tank 675, Oil to Tank 474



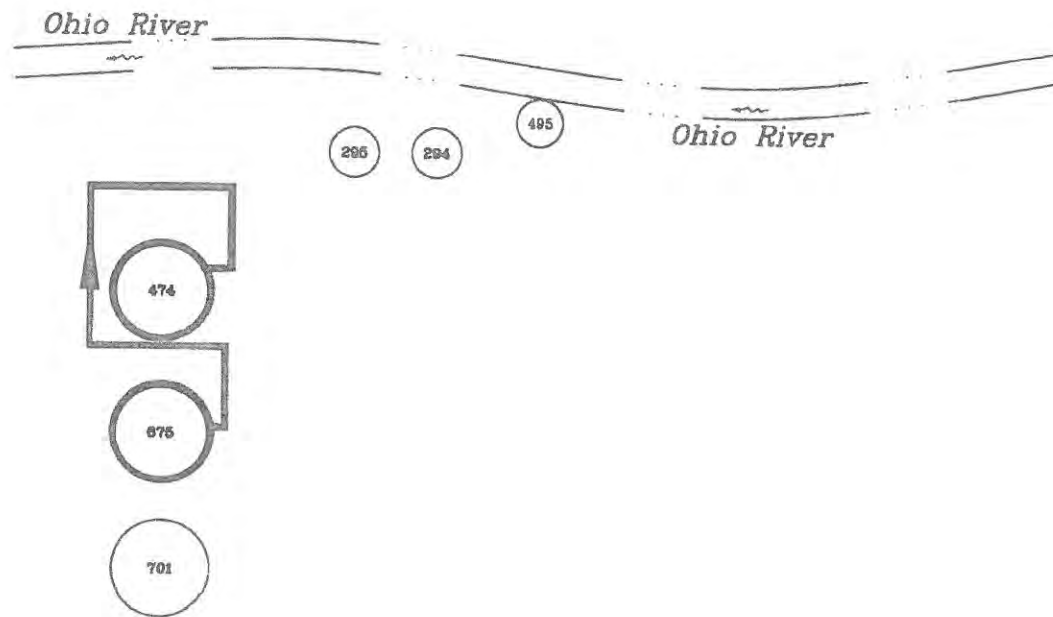
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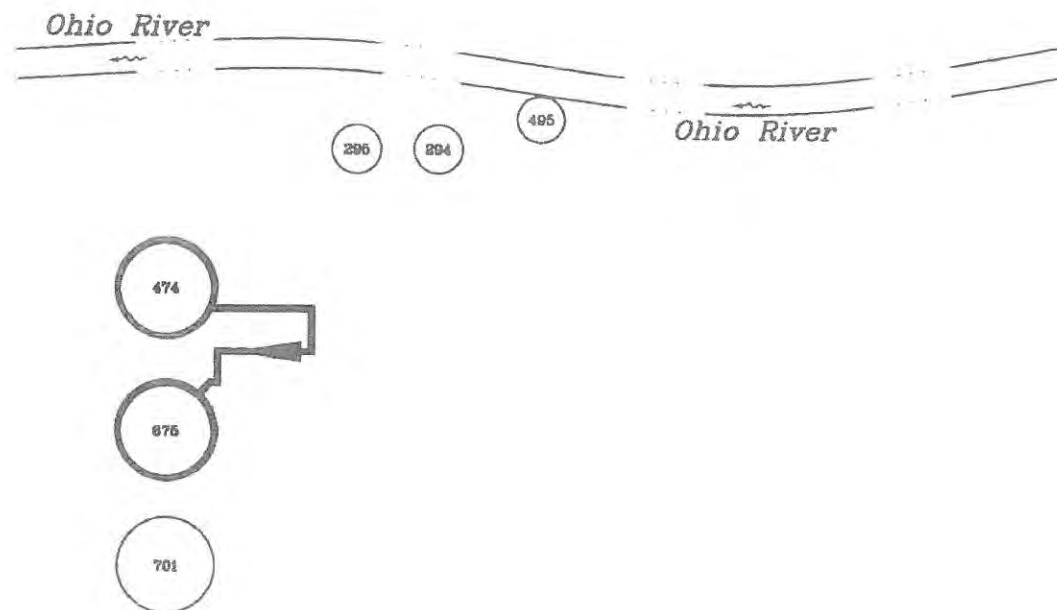
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Step 5 - Any Secondary Separation of Oil that May Occur at Tank 675 is Transferred to Tank 474



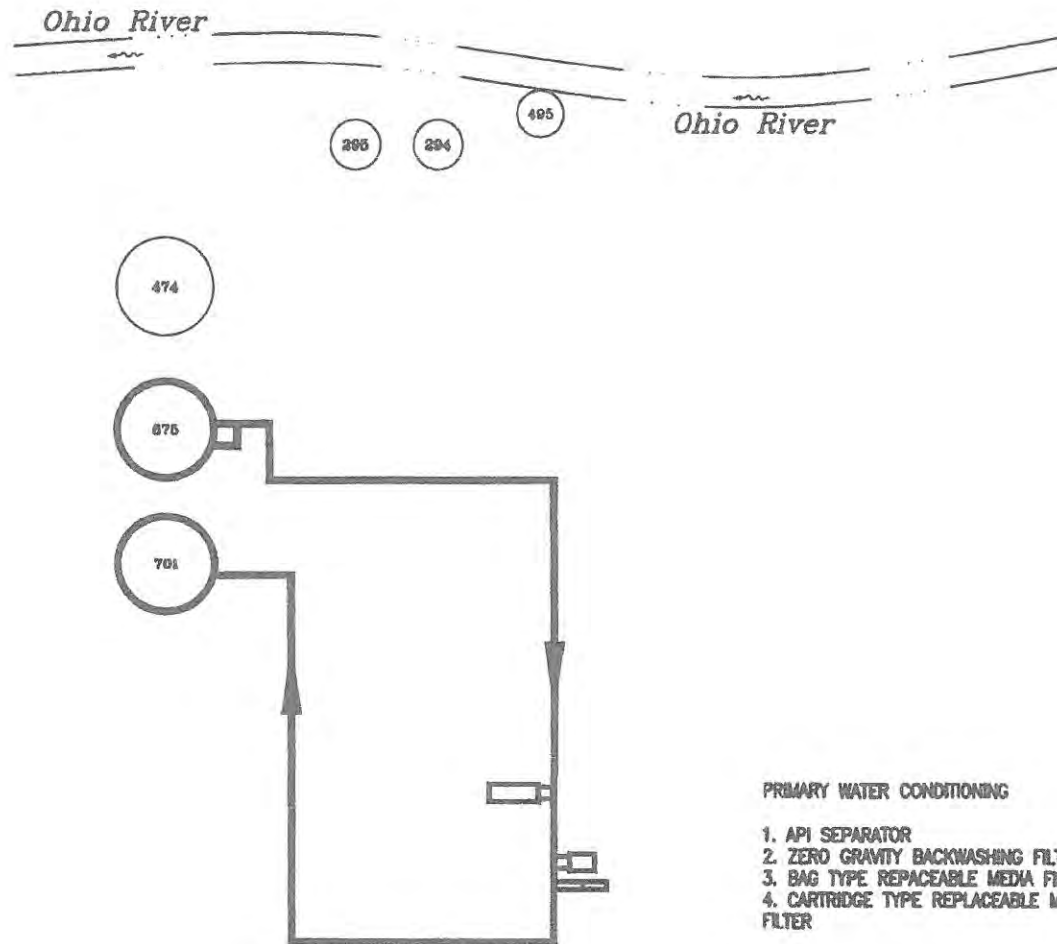
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Step 6 - Any Secondary Separation of Water That May Occur at Tk 474 is Transferred to 675



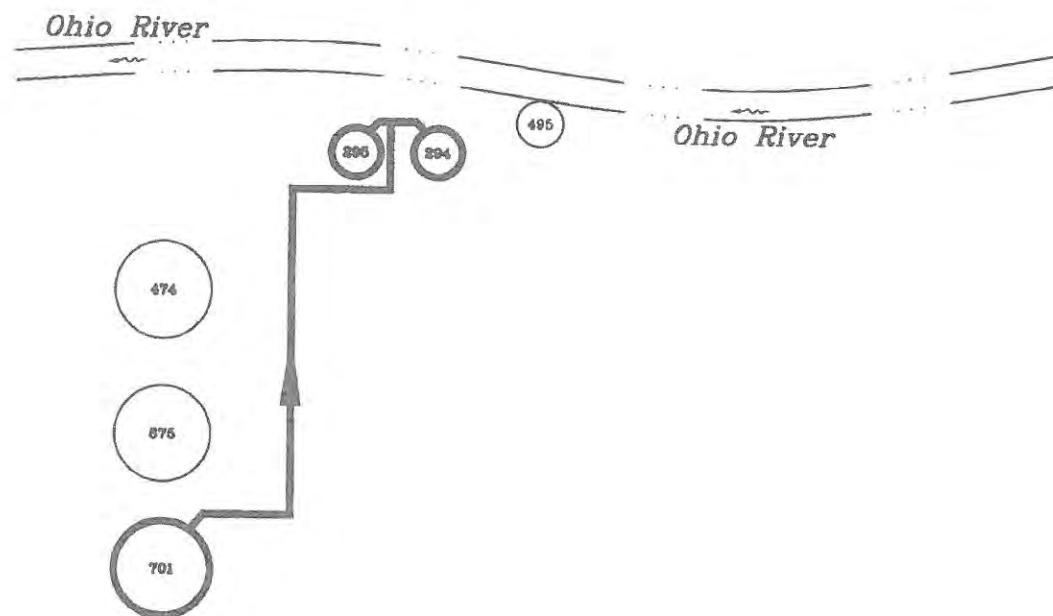
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Step 7 - Primary Water Conditioning from Tank 675 to Tank 701



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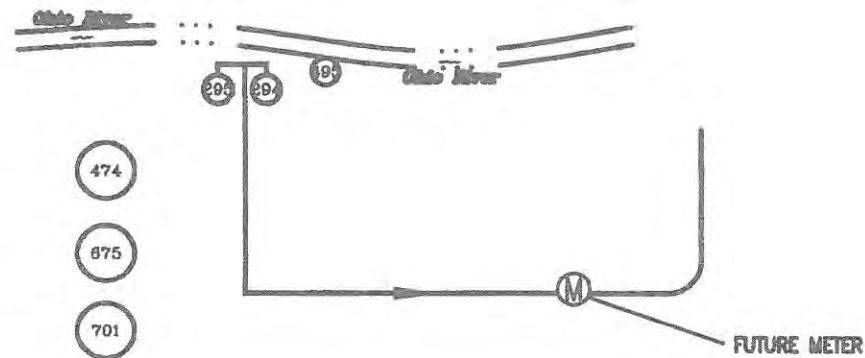
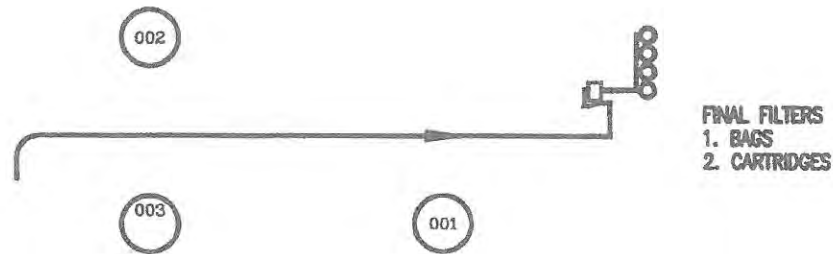
Step 8 - Auxiliary Holding in Tanks 294, 295 Before Transfer to Pump houses



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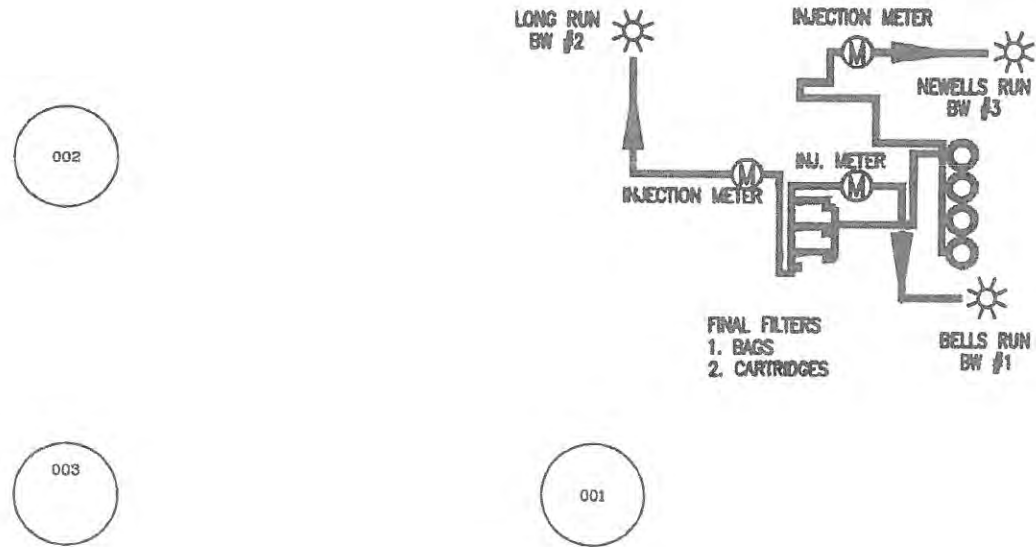
Step 9 - From Tanks 294, 295 Through Final Filters into Injection Holding Tanks



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Step 10 - Bells Run Injection Holding Tanks to Pumps, Meters, and Wells 1, 2, & 3



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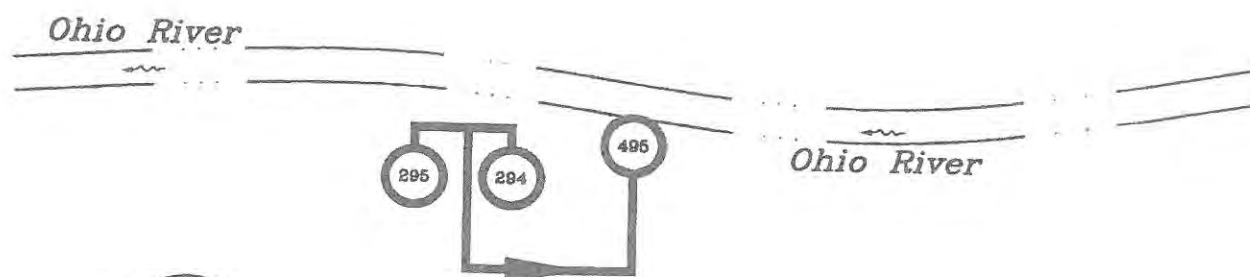
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Ohio River

(485)

Ohio River

Step 11 - From Tanks 294, 295 Through Eureka Final Filtering into Injection Holding Tank 495



474

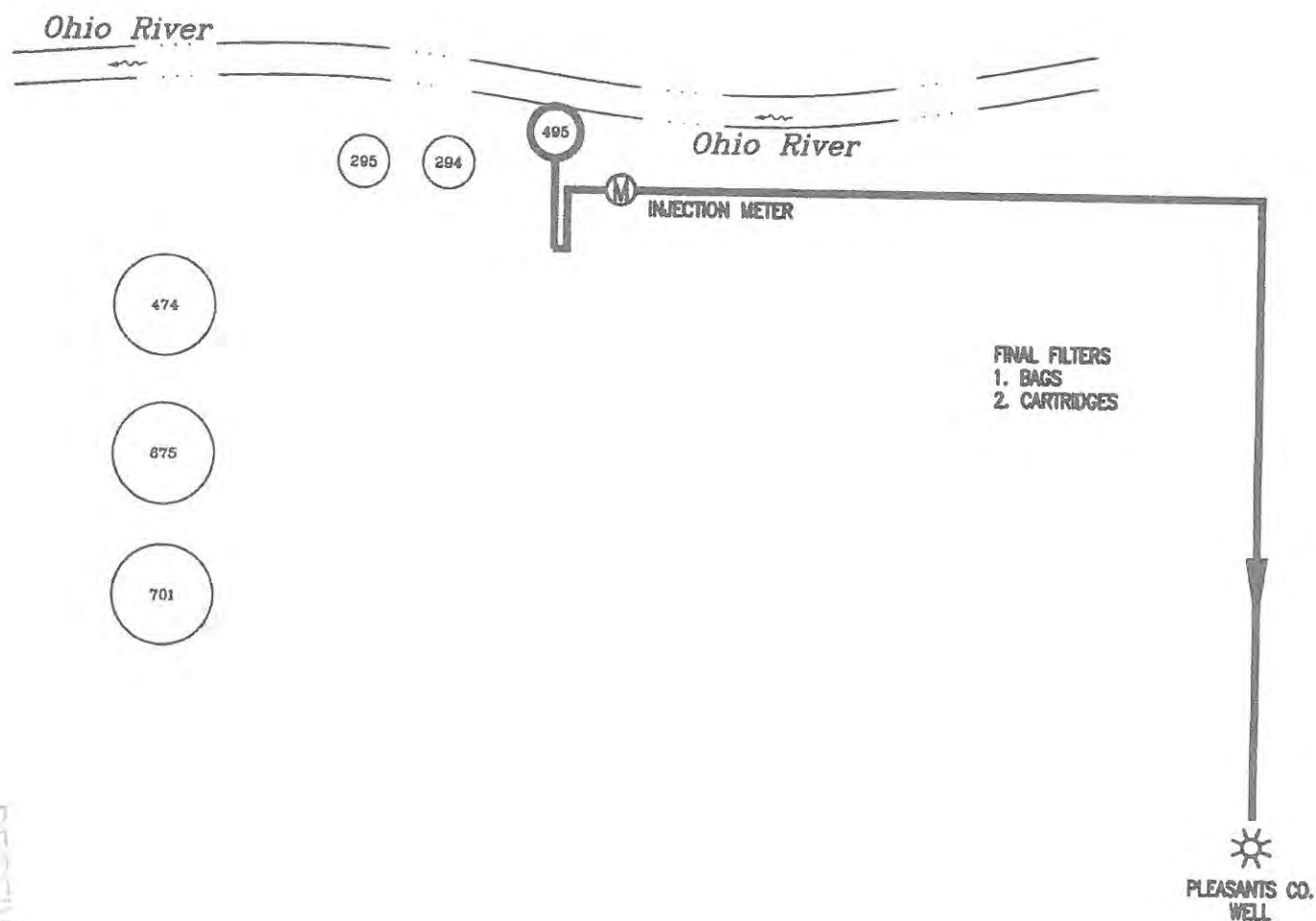
675

701

FINAL FILTERS
1. BAGS
2. CARTRIDGES

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Step 12 - Eureka Injection Holding Tank to Pump, Meter, and Well



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SECTION 11

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APPENDIX H

GROUNDWATER PROTECTION PLAN

Facility Name: BW #4 well

County: Pleasants

Facility Location:

Postal Service Address:	97 Forest City Drive Saint Marys, WV 26170	
Latitude and Longitude:	39.3757888/-81.246795	

Contact Information:

Person:	Robert Douglas, Environmental Field Specialist
Phone Number:	(304) 665-2461
E-mail Address:	robert.douglas@enlink.com

Date: 11/11/2015

1. A list of all operations that may contaminate the groundwater.

The operations that can potentially cause contamination would be the wellhead, injection pipeline, and tank battery. Potential leaks from the wellhead or a leak in the pipeline has the possibility to contaminate. Any leaks or spills within the tank battery would be contained within the secondary containment.

2. A description of procedures and facilities used to protect groundwater quality from the list of potential contaminant sources above.

Appalachian Oil Purchasers, LLC routinely conducts inspections of this facility and monitors injection volumes and pressures daily. An SPCC plan has been developed and is in place. A copy of the SPCC plan is attached.

Received

SEP - 7 2016

3. List procedures to be used when designing and adding new equipment or operations.

Any addition of new equipment or well workover operations will be conducted in a manner to ensure there is primary and secondary containment to prevent and spills or leakage onto the ground surface. Procedures will be followed as developed in the SPCC plan.

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4. Summarize all activities at your facility that are already regulated for groundwater protection.

The activities at the BW #4 Class IID injection well that are regulated for groundwater protection would include the injection well, monitoring of injection pressures and volumes, maintaining mechanical integrity of the well and injection pipeline, and ensure the tank battery facility is in compliance and has primary and secondary containment.

5. Discuss any existing groundwater quality data for your facility or an adjacent property.

Appalachian Oil Purchasers, LLC has established groundwater monitoring of an unused private water well and installed two groundwater monitoring wells near the BW #4 injection well facility. Monitoring well #1 is 146 feet deep and Monitoring well #2 is 124 feet deep. Groundwater sampling is routinely conducted at these sites and the most current lab results are attached to this application. The one-mile radius demonstrates that all residences are connected to municipal water supplies.

6. Provide a statement that no waste material will be used for deicing or fill material on the property unless allowed by another rule.

No fluid or solid wastes from the BW #4 injection well facility will be used for deicing or fill material.

7. Describe the groundwater protection instruction and training to be provided to the employees. Job procedures shall provide direction on how to prevent groundwater contamination.

All Appalachian Oil Purchasers, LLC field personnel have been thoroughly trained with detailed instruction and training. They are familiar with the procedures outlined in the Spill Prevention, Control, and Countermeasures (SPCC) plan developed for the BW #4 injection well. These procedures are discussed in detail on pages 15-17 of the SPCC plan. Additionally, all personnel have been through the appropriate Health & Safety Training and the company-wide Emergency Preparedness Response Plan (EPRP).

Received

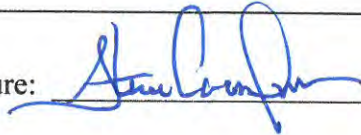
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8. Include provisions for inspections of all GPP elements and equipment. Inspections must be made quarterly at a minimum.

Appalachian Oil Purchasers, Inc. conducts regular monthly inspections of the facility, but may also do routine daily walk-throughs to ensure compliance of the all groundwater protection plan elements and equipment.

Signature: _____



Date: _____

11-13-15

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July 16, 2010

**Ground Water and Surface Water Monitoring Plan
Pleasants County Class II UIC Permit Application
Appalachian Oil Purchasers Inc.**

Appalachian Oil Purchasers Inc. identified eleven permit numbers within the quarter mile area of review based on state data (WVDEP or WVGES). Plugging reports were available for two wells, two additional wells indicated they had been plugged, and the fifth well had a completion date but not a plugging date. An extensive field review has identified two additional wells. Efforts will continue to identify the remaining four wells, but they may or may not be identified in the future. However, no completion or plugging reports are expected to be found for the six 90000 series wells in Table I below.

Table I					
Permit Number	Farm Name and Number	Depth	Status	Comp Date	P&A Date
2516	Hammett #4	265	P&A		11/04/2009
2517	Hammett #1	350	P&A		10/29/2009
30342	Herman Strausburg #1	1,127 (BI)	P&A		01/20/1950
30348	George Hendricks #9	1,568 (BR)	P&A		01/12/1950
70140	Rebecca Graham #1	1,100? (BI)		08/05/1926	
90021					
90217					
90218					
90219					
90220					
91313					

Therefore, Appalachian Oil Purchasers proposes the following ground water and surface water monitoring plan as part of UIC permit application for their proposed commercial salt water disposal well in Pleasants County, West Virginia.

The ground water monitoring plan addresses pre-drill fresh water testing, AOR well review and identification, new well construction, new fresh water well monitoring wells, post drilling/completion fresh water testing, and pipelines and wellhead monitoring.

I. Pre-drill Fresh Water Testing

It should first be noted that there are no fresh water wells within the quarter-mile area of review. While there are fresh water wells within a 1 mile area of review, most residents appear to be connected to a public fresh water source. Every water well owner contacted within the 1 mile area of review indicated that their well water was unsuitable for drinking except for one.

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Fresh water sources tested by Appalachian within the ¼ mile AOR included French Creek and a spring. Fresh water sources within the 1 mile AOR included J. Malone well, the Abicht House well and the Abicht barn well (See Map I for location of fresh water test sites)

Fresh water sources were tested for the following components: Barium, Iron, Manganese, Sodium, ph, Total Dissolved solids, and Chlorides. All testing was completed by Microbac, 158 Starlite Drive, Marietta, Ohio 45750 (740-373-4071). All results are in mg/l with the exception of pH. See Table I below for a summary of the test results.

Table I - Summary of Fresh Water Testing								
	Test Date	Barium	Iron	Mg	Na	pH	TDS	Cl
French Creek	06/01/2010	0.056	0.405	0.194	19.9	8.56	210	27.1
Spring	07/02/2010	0.109	0.484	0.016	33.4	7.50	424	32.3
Malone Well	06/25/2010	0.378	0.683	0.066	106.0	7.38	424	48.8
Abicht house	06/23/2010	0.329	16.300	0.686	39.4	6.66	438	26.0
Abicht barn	06/23/2010	0.303	11.800	0.267	15.1	6.65	288	33.2

Mr. Malone has offered the use of his well for monitoring purposes as needed. While not within the ¼ mile AOR the well provides a means of monitoring the fresh water quality in this area. AOP proposes to monitor Mr. Malone's fresh water well on an semi-annual basis and eventually annual basis since it is the closest to the proposed salt water disposal well.

Additional fresh water testing is being completed and results will be provided as they become available.

II. Quarter Mile Area of Review Well identification

As noted above, a review of the WVDEP Office of Oil and Gas website identified eleven abandoned wells within the quarter-mile area of review. Five of the eleven well records were identified. The remaining six wells are 90000 series wells with no records available.

WVDEP Office of Oil and Gas recognizes that there are four series of permitted wells in Pleasants County (from WVGES): Regular series, 30000 series, 70000 series, and 90000 series

Regular-series wells were permitted since 1929 when permitting became required in the state.

30000-series wells were drilled prior to the onset of permitting requirements in 1929 and abandoned after 1929; identified by WVDEP as the "Abandoned-series" of well permits; and assigned an artificial in-house "permit number"

70000-series wells are "by-farm" wells, generally drilled prior to 1929, with no official assigned permit number; these wells are sorted by farm name and assigned artificial in-house sequential "permit numbers" beginning with 70001 in each county in which they occur; also included are

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wells generally drilled prior to 1929 with no official permit number and identified with alphabetic designations in older Survey publications; and

90000-series: Wells generally drilled prior to 1929 for which the Survey has a location but no other precise information about the farm name, operator, or completion of the wells; assigned an artificial in-house "permit number" beginning with 90001 in each county.

In an effort to identify the six remaining 90,000 series wells in question, AOP began a ground search. AOP first contracted a surveyor to stake the locations based on the state latitudes and longitudes. When no wells were identified at the latitudes and longitudes, AOP then attempted to begin reviewing the area around the staked sites and by using a metal detector. The extensive search effort involving many man hours and so far has resulted in the identification of six wells.

AOP took additional steps to identify the 90,000 series wells by locating old wells from a vintage map. The additional wells were located by sizing the map to approximately the same size as a 7.5 minute topographic map.

III. New Well Construction

The following casing program is proposed for new well construction to minimize the possibility of ground water contamination: 22" conductor set at 20' and cemented to surface, 16" set at 500' and cemented to surface, 11 3/4" set at 1,800' and cemented to surface, 8 5/8" set at 5,100' and cemented back to the top of the Newburg, and 4 1/2" casing set at 7,450' with ~750 of cement above the top of the uppermost perforated interval.

The multiple strings cemented to surface assist in minimizing the possibility of ground water contamination even though there may be offset wells in unknown status.

IV. New Fresh Water Monitoring Wells

To further provide ground water monitoring, AOP proposes drilling 2 fresh water wells by a certified contractor offsetting the proposed salt water disposal well.

The 2 new fresh water monitoring wells would be constructed according to that required for potable water usage. The wells would be secured to minimize the possibility of surface contamination.

AOP proposes to monitor the fresh water wells by testing for Barium, Iron, Manganese, Sodium, ph, Total Dissolved solids, and Chlorides on an semi-annual basis and then to an annual basis.

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V. Post Drilling and Completion Fresh Water Testing

After the salt water disposal well has been drilled, completed, mechanical integrity test completed, and the well approved for injection, Appalachian Oil Purchasers will monitor on a semi annual basis the two new fresh water wells and the Malone well.

VI. Pipeline and Wellhead Monitoring

There will be no permanent brine storage tanks on the location of the proposed salt water disposal well.

The well will be serviced by a Fiber Spar pipeline with brine gathered at a facility approximately 2 miles away. The majority of the pipeline will be inserted into an existing pipeline and then a spur will be constructed from the existing pipeline to the well. The pipeline will be pressure tested prior to being put into service and then pressure tested annually. The pressure on the pipeline will be monitored continuously

The pressure on the tubing and tubing-casing annulus will be monitored continuously by remote (scada) monitoring.

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Laboratory Report Number: L15070050

Derrick Lamp
Ohio Oil Gathering Corp.
157 Lower Eureka Lane
St. Mary's, WV 26170

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories. Review and compilation of your report was completed by Microbac's Ohio Valley Division (OVD). If you have any questions, comments, or require further assistance regarding this report, please contact your service representative listed below.

Laboratory Contact:
Michelle Taylor – Client Services Specialist
(740) 373-4071
Michelle.Taylor@microbac.com

I certify that all test results meet all of the requirements of the accrediting authority listed below. All results for soil samples are reported on a 'dry-weight' basis unless specified otherwise. Analytical results for water and wastes are reported on a 'as received' basis unless specified otherwise. A statement of uncertainty for each analysis is available upon request. This laboratory report shall not be reproduced, except in full, without the written approval of Microbac Laboratories. The reported results are related only to the samples analyzed as received.

This report was certified on July 08 2015



David Vandenberg – Managing Director

State of Origin: WV
Accrediting Authority: Department of Environmental Protection ID:361
QAPP: Microbac OVD



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Microbac Laboratories * Ohio Valley Division
158 Starlite Drive, Marietta, OH 45750 * T: (740) 373-4071 F: (740) 373-4835 * www.microbac.com

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Record of Sample Receipt and Inspection

Comments/Discrepancies

This is the record of the shipment conditions and the inspection records for the samples received and reported as a sample delivery group (SDG). All of the samples were inspected and observed to conform to our receipt policies, except as noted below.

There were no discrepancies.

Discrepancy

Resolution

Coolers

Cooler #	Temperature Gun	Temperature	COC #	Airbill #	Temp Required?
0019990	H	6.0			X

Inspection Checklist

#	Question	Result
1	Were shipping coolers sealed?	NA
2	Were custody seals intact?	NA
3	Were cooler temperatures in range of 0-6?	Yes
4	Was ice present?	Yes
5	Were COC's received/information complete/signed and dated?	Yes
6	Were sample containers intact and match COC?	Yes
7	Were sample labels intact and match COC?	Yes
8	Were the correct containers and volumes received?	Yes
9	Were samples received within EPA hold times?	Yes
10	Were correct preservatives used? (water only)	Yes
11	Were pH ranges acceptable? (voa's excluded)	Yes
12	Were VOA samples free of headspace (less than 6mm)?	NA

Lab Report #: L15070050

Lab Project #: 2167.005

Project Name: WV Oil

Lab Contact: Michelle Taylor

Samples Received

Client ID	Laboratory ID	Date Collected	Date Received
#44	L15070050-01	06/30/2015 14:45	07/01/2015 10:36

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Certificate of Analysis

Sample #: L15070050-01	PrePrep Method: N/A	Instrument: ICP-THERMO3
Client ID: #44	Prep Method: 3015	Prep Date: 07/06/2015 10:50
Matrix: Water	Analytical Method: 6010B	Cal Date: 07/07/2015 09:00
Workgroup #: WG530181	Analyst: JYH	Run Date: 07/07/2015 15:40
Collect Date: 06/30/2015 14:45	Dilution: 1	File ID: T3.070715.154031
Sample Tag: 01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Barium, Total	7440-39-3	0.132		0.0100	0.00500
Iron, Total	7439-89-6	10.6		0.100	0.0500
Manganese, Total	7439-96-5	0.0810		0.0100	0.00500
Sodium, Total	7440-23-5	426		0.500	0.250

Sample #: L15070050-01	PrePrep Method: N/A	Instrument: TIAMO1
Client ID: #44	Prep Method: 9040C	Prep Date: N/A
Matrix: Water	Analytical Method: 9040C	Cal Date:
Workgroup #: WG529741	Analyst: SDC	Run Date: 07/01/2015 20:05
Collect Date: 06/30/2015 14:45	Dilution: 1	File ID: T1.070115.2005PH
Sample Tag: 01	Units: UNITS	

Analyte	CAS #	Result	Qual	RL	MDL
pH	10-29-7	7.48	H1	0.000	0.000
Temperature At Determination (C)				0.000	0.000
H1	Sample analysis performed past holding time.				

Sample #: L15070050-01	PrePrep Method: N/A	Instrument: SMARTCHEM2
Client ID: #44	Prep Method: SM4500-Cl(-)-E-1997	Prep Date: N/A
Matrix: Water	Analytical Method: SM4500-Cl(-)-E-1997	Cal Date: 07/02/2015 11:18
Workgroup #: WG529802	Analyst: DCM	Run Date: 07/02/2015 11:32
Collect Date: 06/30/2015 14:45	Dilution: 10	File ID: S2150702002.028
Sample Tag: DL01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Chloride	16887-00-6	567		20.0	10.0

Microbac Laboratories Inc.
Ohio Valley Division Analyst List
July 8, 2015

001 - BIO-CHEM TESTING WVDEP 220	002 - REIC Consultants, Inc. WVDEP 060
003 - Sturm Environmental	004 - MICROBAC PITTSBURGH
005 - ES LABORATORIES	006 - ALCOSAN LABORATORIES
007 - ALS LABORATORIES	008 - BENCHMARK LABORATORIES
010 - MICROBAC CHICAGOLAND	AC - AMBER R. CARMICHAEL
ADC - ANTHONY D. CANTER	ADG - APRIL D. GREENE
AED - ALLEN E. DAVIS	ALS - ADRIANE L. STEED
AWE - ANDREW W. ESSIG	AZH - AFTER HOURS
BJO - BRIAN J. OGDEN	BKT - BRENDAN TORRENCE
BLG - BRENDA L. GREENWALT	BRG - BRENDA R. GREGORY
CAA - CASSIE A. AUGENSTEIN	CAF - CHERYL A. FLOWERS
CEB - CHAD E. BARNES	CJR - COURTNEY J. REXROAD
CLC - CHRYS L. CRAWFORD	CLS - CARA L. STRICKLER
CLW - CHARISSA L. WINTERS	CPD - CHAD P. DAVIS
CSH - CHRIS S. HILL	DAK - DEAN A. KETELSEN
DCM - DAVID C. MERCKLE	DEV - DAVID E. VANDENBERG
DIH - DEANNA I. HESSON	DLB - DAVID L. BUMGARNER
DLP - DOROTHY L. PAYNE	DLW - DIANA L. WRIGHT
DSM - DAVID S. MOSSOR	ECL - ERIC C. LAWSON
ENY - EMILY N. YOAK	EPT - ETHAN P. TIDD
ERP - ERIN R. PORTER	FJB - FRANCES J. BOLDEN
JBK - JEREMY B. KINNEY	JDH - JUSTIN D. HESSON
JDS - JARED D. SMITH	JJS - JOHN J. STE MARIE
JKP - JACQUELINE K. PARSONS	JLL - JOHN L. LENT
JMW - JEANA M. WHITE	JTP - JOSHUA T. PEMBERTON
JWR - JOHN W. RICHARDS	JWS - JACK W. SHEAVES
JYH - JI Y. HU	KAJ - KELLIE A. JOHNSON
KAT - KATHY A. TUCKER	KDW - KATHRYN D. WELCH
KEB - KATIE E. BARNES	KHR - KIM H. RHODES
KKB - KERRI K. BUCK	KRA - KATHY R. ALBERTSON
KRB - KAEELY R. BECKER	KRP - KATHY R. PARSONS
LEC - LAURA E. CARPENTER	LKN - LINDA K. NEDEFF
LLS - LARRY L. STEPHENS	LSB - LESLIE S. BUCINA
MBK - MORGAN B. KNOWLTON	MDA - MIKE D. ALBERTSON
MDC - MIKE D. COCHRAN	MES - MARY E. SCHILLING
MLB - MEGAN L. BACHE	MMB - MAREN M. BEERY
MRT - MICHELLE R. TAYLOR	MSW - MATT S. WILSON
PDM - PIERCE D. MORRIS	PIT - MICROBAC WARRENDALE
PRL - PAIGE R. LAMB	PSW - PEGGY S. WEBB
QX - QIN XU	RAH - ROY A. HALSTEAD
REK - BOB E. KYER	RLB - BOB BUCHANAN
RM - RAYMOND MALEKE	RNP - RICK N. PETTY
RST - ROBIN S. TURNER	SAV - SARAH A. VANDENBERG
SCB - SARAH C. BOGOLIN	SDC - SHALYN D. CONLEY
SLM - STEPHANIE L. MOSSBURG	SLP - SHERI L. PFALZGRAF
TB - TODD BOYLE	TGF - TIM G. FELTON
TMB - TIFFANY M. BAILEY	TMM - TAMMY M. MORRIS
VC - VICKI COLLIER	WJB - WILL J. BEASLEY
WRR - WESLEY R. RICHARDS	WTD - WADE T. DELONG
XXX - UNAVAILABLE OR SUBCONTRACT	

Microbac Laboratories Inc.

List of Valid Qualifiers

July 08, 2015

Qualkey: STD

Qualifier	Description
*	Surrogate or spike compound out of range
+	Correlation coefficient for the MSA is less than 0.995
<	Result is less than the associated numerical value.
>	Result is greater than the associated numerical value.
A	See the report narrative
B	Analyte present in method blank
B,H1	Analyte present in method blank. Sample analysis performed past holding time.
B1	Target analyte detected in method blank at or above the method reporting limit
B3	Target analyte detected in calibration blank at or above the method reporting limit
B4	The BOD unseeded dilution water blank exceeded 0.2 mg/L
C	Confirmed by GC/MS
CG	Confluent growth
CT1	The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
DL	Surrogate or spike compound was diluted out
E	Estimated concentration due to sample matrix interference
E,CT1	Estimated results. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
EDL	Elevated sample reporting limits, presence of non-target analytes
EMPC	Estimated Maximum Possible Concentration
F, S	Estimated result below quantitation limit; method of standard additions(MSA)
F,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
FL	Free Liquid
H1	Sample analysis performed past holding time.
H1,CT1	Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guidelines for requ
I	Semiquantitative result (out of instrument calibration range)
J	Estimated value; the analyte concentration was less than the RL/LOQ.
J,B	Analyte detected in both the method blank and sample above the MDL.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
J,P	Estimate; columns don't agree to within 40%
J,S	Estimated concentration; analyzed by method of standard addition (MSA)
L	Sample reporting limits elevated due to matrix interference
L1	The associated blank spike (LCS) recovery was above the laboratory acceptance limits.
L2	The associated blank spike (LCS) recovery was below the laboratory acceptance limits.
M	Matrix effect; the concentration is an estimate due to matrix effect.
N	Tentatively identified compound(TIC)
NA	Not applicable
ND	Not detected at or above the reporting limit (RL/MDL).
ND, B	Not detected at or above the reporting limit (RL). Analyte present in method blank.
ND, CT1	Analyte was not detected. The concentration is below the reported LOD. The cooler temperature at receipt exceeded reg
ND, L	Not detected; sample reporting limit (RL) elevated due to interference
ND, S	Not detected; analyzed by method of standard addition (MSA)
ND,H1	Not detected; Sample analysis performed past holding time.
ND,H1,CT1	Not detected; Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guide
NF	Not found by library search
NFL	No free liquid
NI	Non-ignitable
NR	Analyte is not required to be analyzed
NS	Not spiked
P	Concentrations >40% difference between the two GC columns
Q	One or more quality control criteria failed. See narrative.
QNS	Quantity of sample not sufficient to perform analysis
RA	Reanalysis confirms reported results
RE	Reanalysis confirms sample matrix interference
S	Analyzed by method of standard addition (MSA)
SMI	Sample matrix interference on surrogate
SP	Reported results are for spike compounds only
TIC	Library Search Compound
TNTC	Too numerous to count
TNTC, B	Too numerous to count. Analyte present in method blank.
TNTC,CT1	Too numerous to count. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
TNTC,H1	Too numerous to count. Sample analysis performed past holding time.
U	Analyte was not detected. The concentration is below the reported MDL.
UJ	Undetected; the MDL and RL are estimated due to quality control discrepancies.
UQ	Undetected; the analyte was analyzed for, but not detected.
W	Post-digestion spike for furnace AA out of control limits
X	Exceeds regulatory limit
X, S	Exceeds regulatory limit; method of standard additions (MSA)

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List of Valid Qualifiers

July 08, 2015

Qualkey: STD

Z Cannot be resolved from isomer - see below

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WV Department of
Environmental Protection

Toll Free: 800-373-4071



CHAIN-OF-CUSTODY RECORD

*Water (W), Soil (S), Solid Waste (SD), Unknown (X)

Page 8

Laboratory Report Number: L15070052

Derrick Lamp
Ohio Oil Gathering Corp.
157 Lower Eureka Lane
St. Mary's, WV 26170

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories. Review and compilation of your report was completed by Microbac's Ohio Valley Division (OVD). If you have any questions, comments, or require further assistance regarding this report, please contact your service representative listed below.

Laboratory Contact:
Michelle Taylor – Client Services Specialist
(740) 373-4071
Michelle.Taylor@microbac.com

I certify that all test results meet all of the requirements of the accrediting authority listed below. All results for soil samples are reported on a 'dry-weight' basis unless specified otherwise. Analytical results for water and wastes are reported on a 'as received' basis unless specified otherwise. A statement of uncertainty for each analysis is available upon request. This laboratory report shall not be reproduced, except in full, without the written approval of Microbac Laboratories. The reported results are related only to the samples analyzed as received.

This report was certified on July 08 2015



David Vandenberg – Managing Director

State of Origin: WV
Accrediting Authority: Department of Environmental Protection ID:361
QAPP: Microbac OVD



Microbac Laboratories * Ohio Valley Division
158 Starlite Drive, Marietta, OH 45750 * T: (740) 373-4071 F: (740) 373-4835 * www.microbac.com

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Environmental Protection

Record of Sample Receipt and Inspection

Comments/Discrepancies

This is the record of the shipment conditions and the inspection records for the samples received and reported as a sample delivery group (SDG). All of the samples were inspected and observed to conform to our receipt policies, except as noted below.

There were no discrepancies.

Discrepancy

Resolution

Coolers

Cooler #	Temperature Gun	Temperature	COC #	Airbill #	Temp Required?
0019990	H	6.0			X

Inspection Checklist

#	Question	Result
1	Were shipping coolers sealed?	NA
2	Were custody seals intact?	NA
3	Were cooler temperatures in range of 0-6?	Yes
4	Was ice present?	Yes
5	Were COC's received/information complete/signed and dated?	Yes
6	Were sample containers intact and match COC?	Yes
7	Were sample labels intact and match COC?	Yes
8	Were the correct containers and volumes received?	Yes
9	Were samples received within EPA hold times?	Yes
10	Were correct preservatives used? (water only)	Yes
11	Were pH ranges acceptable? (voa's excluded)	Yes
12	Were VOA samples free of headspace (less than 6mm)?	NA

Microbac

Lab Report #: L15070052

Lab Project #: 2167.005

Project Name: WV Oil

Lab Contact: Michelle Taylor

Samples Received

Client ID

Laboratory ID

Date Collected

Date Received

#45

L15070052-01

06/30/2015 14:50

07/01/2015 10:36

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Certificate of Analysis

Sample #: L15070052-01	PrePrep Method: N/A	Instrument: ICP-THERMO3
Client ID: #45	Prep Method: 3015	Prep Date: 07/06/2015 10:50
Matrix: Water	Analytical Method: 6010B	Cal Date: 07/07/2015 09:00
Workgroup #: WG530181	Analyst: JYH	Run Date: 07/07/2015 15:48
Collect Date: 06/30/2015 14:50	Dilution: 1	File ID: T3.070715.154829
Sample Tag: 01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Barium, Total	7440-39-3	0.124		0.0100	0.00500
Iron, Total	7439-89-6	0.555		0.100	0.0500
Manganese, Total	7439-96-5	0.293		0.0100	0.00500
Sodium, Total	7440-23-5	421		0.500	0.250

Sample #: L15070052-01	PrePrep Method: N/A	Instrument: TIAMO1
Client ID: #45	Prep Method: 9040C	Prep Date: N/A
Matrix: Water	Analytical Method: 9040C	Cal Date:
Workgroup #: WG529741	Analyst: SDC	Run Date: 07/01/2015 20:13
Collect Date: 06/30/2015 14:50	Dilution: 1	File ID: TI.070115.2013PH
Sample Tag: 01	Units: UNITS	

Analyte	CAS #	Result	Qual	RL	MDL
pH	10-29-7	6.78	H1	0.000	0.000
Temperature At Determination (C)				0.000	0.000
H1	Sample analysis performed past holding time.				

Sample #: L15070052-01	PrePrep Method: N/A	Instrument: SMARTCHEM2
Client ID: #45	Prep Method: SM4500-Cl(-)-E-1997	Prep Date: N/A
Matrix: Water	Analytical Method: SM4500-Cl(-)-E-1997	Cal Date: 07/02/2015 11:18
Workgroup #: WG529802	Analyst: DCM	Run Date: 07/02/2015 11:33
Collect Date: 06/30/2015 14:50	Dilution: 10	File ID: S2150702002.030
Sample Tag: DL01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Chloride	16887-00-6	568		20.0	10.0

Microbac Laboratories Inc.
Ohio Valley Division Analyst List
July 8, 2015

001 - BIO-CHEM TESTING WVDEP 220	002 - REIC Consultants, Inc. WVDEP 060
003 - Sturm Environmental	004 - MICROBAC PITTSBURGH
005 - ES LABORATORIES	006 - ALCOSAN LABORATORIES
007 - ALS LABORATORIES	008 - BENCHMARK LABORATORIES
010 - MICROBAC CHICAGOLAND	AC - AMBER R. CARMICHAEL
ADC - ANTHONY D. CANTER	ADG - APRIL D. GREENE
AED - ALLEN E. DAVIS	ALS - ADRIANE L. STEED
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REK - BOB E. KYER	RLB - BOB BUCHANAN
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VC - VICKI COLLIER	WJB - WILL J. BEASLEY
WRR - WESLEY R. RICHARDS	WTD - WADE T. DELONG
XXX - UNAVAILABLE OR SUBCONTRACT	

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List of Valid Qualifiers

July 08, 2015

Qualkey: STD

Qualifier	Description
*	Surrogate or spike compound out of range
+	Correlation coefficient for the MSA is less than 0.995
<	Result is less than the associated numerical value.
>	Result is greater than the associated numerical value.
A	See the report narrative
B	Analyte present in method blank
B,H1	Analyte present in method blank. Sample analysis performed past holding time.
B1	Target analyte detected in method blank at or above the method reporting limit
B3	Target analyte detected in calibration blank at or above the method reporting limit
B4	The BOD unseeded dilution water blank exceeded 0.2 mg/L
C	Confirmed by GC/MS
CG	Confluent growth
CT1	The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
DL	Surrogate or spike compound was diluted out
E	Estimated concentration due to sample matrix interference
E,CT1	Estimated results. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
EDL	Elevated sample reporting limits, presence of non-target analytes
EMPC	Estimated Maximum Possible Concentration
F, S	Estimated result below quantitation limit; method of standard additions(MSA)
F,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
FL	Free Liquid
H1	Sample analysis performed past holding time.
H1,CT1	Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guidelines for requ
I	Semiquantitative result (out of instrument calibration range)
J	Estimated value; the analyte concentration was less than the RL/LOQ.
J,B	Analyte detected in both the method blank and sample above the MDL.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
J,P	Estimate; columns don't agree to within 40%
J,S	Estimated concentration; analyzed by method of standard addition (MSA)
L	Sample reporting limits elevated due to matrix interference
L1	The associated blank spike (LCS) recovery was above the laboratory acceptance limits.
L2	The associated blank spike (LCS) recovery was below the laboratory acceptance limits.
M	Matrix effect; the concentration is an estimate due to matrix effect.
N	Tentatively identified compound(TIC)
NA	Not applicable
ND	Not detected at or above the reporting limit (RL/MDL).
ND, B	Not detected at or above the reporting limit (RL). Analyte present in method blank.
ND, CT1	Analyte was not detected. The concentration is below the reported LOD. The cooler temperature at receipt exceeded reg
ND, L	Not detected; sample reporting limit (RL) elevated due to interference
ND, S	Not detected; analyzed by method of standard addition (MSA)
ND,H1	Not detected; Sample analysis performed past holding time.
ND,H1,CT1	Not detected; Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guide
NF	Not found by library search
NFL	No free liquid
NI	Non-ignitable
NR	Analyte is not required to be analyzed
NS	Not spiked
P	Concentrations >40% difference between the two GC columns
Q	One or more quality control criteria failed. See narrative.
QNS	Quantity of sample not sufficient to perform analysis
RA	Reanalysis confirms reported results
RE	Reanalysis confirms sample matrix interference
S	Analyzed by method of standard addition (MSA)
SMI	Sample matrix interference on surrogate
SP	Reported results are for spike compounds only
TIC	Library Search Compound
TNTC	Too numerous to count
TNTC, B	Too numerous to count. Analyte present in method blank.
TNTC,CT1	Too numerous to count. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
TNTC,H1	Too numerous to count. Sample analysis performed past holding time.
U	Analyte was not detected. The concentration is below the reported MDL.
UJ	Undetected; the MDL and RL are estimated due to quality control discrepancies.
UQ	Undetected; the analyte was analyzed for, but not detected.
W	Post-digestion spike for furnace AA out of control limits
X	Exceeds regulatory limit
X, S	Exceeds regulatory limit; method of standard additions (MSA)

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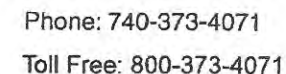
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Qualkey: STD

Z Cannot be resolved from isomer - see below

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CHAIN-OF-CUSTODY RECORD

^aWater (W), Soil (S), Solid Waste (SD), Unknown (X)

Page 8

Laboratory Report Number: L15070048

Derrick Lamp
Ohio Oil Gathering Corp.
157 Lower Eureka Lane
St. Mary's, WV 26170

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories. Review and compilation of your report was completed by Microbac's Ohio Valley Division (OVD). If you have any questions, comments, or require further assistance regarding this report, please contact your service representative listed below.

Laboratory Contact:
Michelle Taylor – Client Services Specialist
(740) 373-4071
Michelle.Taylor@microbac.com

I certify that all test results meet all of the requirements of the accrediting authority listed below. All results for soil samples are reported on a 'dry-weight' basis unless specified otherwise. Analytical results for water and wastes are reported on a 'as received' basis unless specified otherwise. A statement of uncertainty for each analysis is available upon request. This laboratory report shall not be reproduced, except in full, without the written approval of Microbac Laboratories. The reported results are related only to the samples analyzed as received.

This report was certified on July 08 2015



David Vandenberg – Managing Director

State of Origin: WV
Accrediting Authority: Department of Environmental Protection ID:361
QAPP: Microbac OVD



Microbac Laboratories * Ohio Valley Division
158 Starlite Drive, Marietta, OH 45750 * T: (740) 373-4071 F: (740) 373-4835 * www.microbac.com

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Record of Sample Receipt and Inspection

Comments/Discrepancies

This is the record of the shipment conditions and the inspection records for the samples received and reported as a sample delivery group (SDG). All of the samples were inspected and observed to conform to our receipt policies, except as noted below.

There were no discrepancies.

Discrepancy

Resolution

Coolers

Cooler #	Temperature Gun	Temperature	COC #	Airbill #	Temp Required?
0019990	H	6.0			X

Inspection Checklist

#	Question	Result
1	Were shipping coolers sealed?	NA
2	Were custody seals intact?	NA
3	Were cooler temperatures in range of 0-6?	Yes
4	Was ice present?	Yes
5	Were COC's received/information complete/signed and dated?	Yes
6	Were sample containers intact and match COC?	Yes
7	Were sample labels intact and match COC?	Yes
8	Were the correct containers and volumes received?	Yes
9	Were samples received within EPA hold times?	Yes
10	Were correct preservatives used? (water only)	Yes
11	Were pH ranges acceptable? (voa's excluded)	Yes
12	Were VOA samples free of headspace (less than 6mm)?	NA

Lab Report #: L15070048

Lab Project #: 2167.005

Project Name: WV Oil

Lab Contact: Michelle Taylor

Samples Received

Client ID	Laboratory ID	Date Collected	Date Received
#18	L15070048-01	06/30/2015 15:30	07/01/2015 10:36

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Certificate of Analysis

Sample #: L15070048-01	PrePrep Method: N/A	Instrument: ICP-THERMO3
Client ID: #18	Prep Method: 3015	Prep Date: 07/06/2015 08:22
Matrix: Water	Analytical Method: 6010B	Cal Date: 07/07/2015 09:00
Workgroup #: WG530179	Analyst: JYH	Run Date: 07/07/2015 12:17
Collect Date: 06/30/2015 15:30	Dilution: 1	File ID: T3.070715.121712
Sample Tag: 01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Barium, Total	7440-39-3	0.374		0.0100	0.00500
Iron, Total	7439-89-6	4.32		0.100	0.0500
Manganese, Total	7439-96-5	0.133		0.0100	0.00500
Sodium, Total	7440-23-5	97.7		0.500	0.250

Sample #: L15070048-01	PrePrep Method: N/A	Instrument: TIAMO1
Client ID: #18	Prep Method: 9040C	Prep Date: N/A
Matrix: Water	Analytical Method: 9040C	Cal Date:
Workgroup #: WG529741	Analyst: SDC	Run Date: 07/01/2015 19:57
Collect Date: 06/30/2015 15:30	Dilution: 1	File ID: TI.070115.1957PH
Sample Tag: 01	Units: UNITS	

Analyte	CAS #	Result	Qual	RL	MDL
pH	10-29-7	7.59	H1	0.000	0.000
Temperature At Determination (C)				0.000	0.000
H1	Sample analysis performed past holding time.				

Sample #: L15070048-01	PrePrep Method: N/A	Instrument: SMARTCHEM2
Client ID: #18	Prep Method: SM4500-Cl(-)-E-1997	Prep Date: N/A
Matrix: Water	Analytical Method: SM4500-Cl(-)-E-1997	Cal Date: 07/02/2015 11:18
Workgroup #: WG529802	Analyst: DCM	Run Date: 07/02/2015 11:30
Collect Date: 06/30/2015 15:30	Dilution: 1	File ID: S2150702002.026
Sample Tag: 01	Units: mg/L	

Analyte	CAS #	Result	Qual	RL	MDL
Chloride	16887-00-6	41.5		2.00	1.00

Microbac Laboratories Inc.
Ohio Valley Division Analyst List
July 8, 2015

001 - BIO-CHEM TESTING WVDEP 220	002 - REIC Consultants, Inc. WVDEP 060
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005 - ES LABORATORIES	006 - ALCOSAN LABORATORIES
007 - ALS LABORATORIES	008 - BENCHMARK LABORATORIES
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XXX - UNAVAILABLE OR SUBCONTRACT	

Microbac Laboratories Inc.

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July 08, 2015

Qualkey: STD

Qualifier	Description
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+	Correlation coefficient for the MSA is less than 0.995
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A	See the report narrative
B	Analyte present in method blank
B,H1	Analyte present in method blank. Sample analysis performed past holding time.
B1	Target analyte detected in method blank at or above the method reporting limit
B3	Target analyte detected in calibration blank at or above the method reporting limit
B4	The BOD unseeded dilution water blank exceeded 0.2 mg/L
C	Confirmed by GC/MS
CG	Confluent growth
CT1	The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
DL	Surrogate or spike compound was diluted out
E	Estimated concentration due to sample matrix interference
E,CT1	Estimated results. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
EDL	Elevated sample reporting limits, presence of non-target analytes
EMPC	Estimated Maximum Possible Concentration
F, S	Estimated result below quantitation limit; method of standard additions(MSA)
F,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
FL	Free Liquid
H1	Sample analysis performed past holding time.
H1,CT1	Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guidelines for reque
I	Semiquantitative result (out of instrument calibration range)
J	Estimated value; the analyte concentration was less than the RL/LOQ.
J,B	Analyte detected in both the method blank and sample above the MDL.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ.
J,CT1	Estimated value; the analyte concentration was less than the RL/LOQ. The cooler temperature at receipt exceeded regula
J,P	Estimate; columns don't agree to within 40%
J,S	Estimated concentration; analyzed by method of standard addition (MSA)
L	Sample reporting limits elevated due to matrix interference
L1	The associated blank spike (LCS) recovery was above the laboratory acceptance limits.
L2	The associated blank spike (LCS) recovery was below the laboratory acceptance limits.
M	Matrix effect; the concentration is an estimate due to matrix effect.
N	Tentatively identified compound(TIC)
NA	Not applicable
ND	Not detected at or above the reporting limit (RL/MDL).
ND, B	Not detected at or above the reporting limit (RL). Analyte present in method blank.
ND, CT1	Analyte was not detected. The concentration is below the reported LOD. The cooler temperature at receipt exceeded reg
ND, L	Not detected; sample reporting limit (RL) elevated due to interference
ND, S	Not detected; analyzed by method of standard addition (MSA)
ND,H1	Not detected; Sample analysis performed past holding time.
ND,H1,CT1	Not detected; Sample analysis performed past holding time. The cooler temperature at receipt exceeded regulatory guide
NF	Not found by library search
NFL	No free liquid
NI	Non-ignitable
NR	Analyte is not required to be analyzed
NS	Not spiked
P	Concentrations >40% difference between the two GC columns
Q	One or more quality control criteria failed. See narrative.
QNS	Quantity of sample not sufficient to perform analysis
RA	Reanalysis confirms reported results
RE	Reanalysis confirms sample matrix interference
S	Analyzed by method of standard addition (MSA)
SMI	Sample matrix interference on surrogate
SP	Reported results are for spike compounds only
TIC	Library Search Compound
TNTC	Too numerous to count
TNTC, B	Too numerous to count. Analyte present in method blank.
TNTC,CT1	Too numerous to count. The cooler temperature at receipt exceeded regulatory guidelines for requested testing.
TNTC,H1	Too numerous to count. Sample analysis performed past holding time.
U	Analyte was not detected. The concentration is below the reported MDL.
UJ	Undetected; the MDL and RL are estimated due to quality control discrepancies.
UQ	Undetected; the analyte was analyzed for, but not detected.
W	Post-digestion spike for furnace AA out of control limits
X	Exceeds regulatory limit
X, S	Exceeds regulatory limit; method of standard additions (MSA)

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Qualkey: STD

Z Cannot be resolved from isomer - see below

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Marietta, OH 45750



CHAIN-OF-CUSTODY RECORD

Phone: 740-373-4071

Toll Free: 800-373-4071

*Water (W), Soil (S), Solid Waste (SD), Unknown (X)

APPENDIX F

Area Permit Wells

[illegible]

Make as many copies as necessary and include page numbers as appropriate.

Page ____ of ____

Promoting a healthy environment.

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SECTION 12

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Section 12 – Plugging and Abandonment:

1. In the event the BW #4 Class IID injection well becomes incapable of injection and needs to be plugged and abandoned, the well will be plugged and abandoned in accordance with WV DEP regulations 22-6-24 – Methods of Well Plugging.
2. The proposed Plugging and Abandonment Plan for the BW#4 is attached.

Received

MAR 28 2016

Office of Oil and Gas
WV Dept. of Environmental Protection

**PROPOSED PLUGGING AND ABANDONMENT PLAN FOR APPALACHIAN OIL
PURCHASERS, LLC – BW #4 UIC2D0732523**

ALL Consulting has developed the plugging and abandonment plan for the BW#4 commercial saltwater disposal well located in Pleasants County, West Virginia. The first five cement plugs and 6% gel spacers between cement plugs will be emplaced through tubing. The remaining plugs will be emplaced through both the uncemented 4-1/2" and 7" casings after they are ripped. The proposed plugging and abandonment plan is as follows:

- Pump heavy brine through tubing and packer to "kill" the well. Unseat packer and pull tubing and packer out of the well.
- 1st Cement Plug - Run back into well with tubing to a depth of approximately 7,100 feet and displace 15.6 pound per gallon Class A cement with 2% gel from total depth of 7,500 feet back to 6,900 feet (600-foot cement plug) inside 4-1/2" production casing to cover the Clinton and Medina sandstones injection zone..
- 2nd Cement Plug – Emplace a 15.6 pound per gallon Class A cement with 2% gel plug inside the 4-1/2" production casing from a depth of 5,900 to 6,000 feet to cover the cement plug required above the Salina Group salt units.
- 3rd Cement Plug – Emplace a 15.6 pound per gallon Class A cement with 2% gel plug inside the 4-1/2" production casing from a depth of 5,450 to 5,350 feet to cover the Oriskany Sandstone.
- 4th Cement Plug – Emplace a 15.6 pound per gallon Class A cement with 2% gel plug inside the 4-1/2" production casing from a depth of 5,150 to 4,950 feet to cover the Marcellus Shale.
- 5th Cement Plug – Emplace a 15.6 pound per gallon Class A cement with 2% gel plug inside the 4-1/2" production casing from a depth of 4,300 to 4,000 feet to cover the "Gordon" oil and gas zone.
- Pull tubing out of the well. Run in with gamma ray-CCL-cement bond log and accurately determine the top of the cement behind the 4-1/2" production casing. Then run back into the well with wireline casing buster and rip the 4-1/2" production casing directly above the top of the cement.
- 6th Cement Plug – Emplace a 15.6 pound per gallon Class A cement with 2% gel plug across the rip of the 4-1/2" production casing at a depth of approximately 3,850 to 3,700 feet (will be determined by cement bond log) to cover the rip plug on the 4-1/2" production casing.
- Pull remaining uncemented 4-1/2" production casing from the well. Run in with gamma ray-CCL-cement bond log and determine the top of cement behind the 7" intermediate string casing. Run back into well with wireline casing buster and rip 7" intermediate directly above the top of the cement.
- 7th Cement Plug – Emplace a 15.6 pound per gallon Class A cement with 2% gel plug at a depth of approximately 2,850 to 2,700 feet (will be determined by cement bond log) to cover the rip plug on the 7" intermediate casing.

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- 8th Cement Plug – Emplace a 15.6 pound per gallon Class A cement with 2% gel plug at a depth from 1,950 to 1,850 feet to cover the casing shoe of the 9-5/8" intermediate casing string.
- 9th Cement Plug – Emplace a 15.6 pound per gallon Class A cement with 2% gel plug from a depth of 1,650 to 1,550 feet to cover the Berea Sandstone.
- 9th Cement Plug – Emplace a 15.6 pound per gallon Class A cement with 2% gel plug from a depth of 550 feet back to the surface to cover the coal seams, freshwater aquifers, and surface casing plug.
- Erect 30" permanent steel monument [per Section 35-4-5 (5) (b)] pipe with plate tack welded on top with API No. (1/2" lettering) burned into the plate. If landowner wants casing cut below grade, request variance from WV DEP and tack well plate with API No. on cut-off casing.
- Reclaim and vegetate the site per WV DEP regulations, remove all surface equipment, and purge buried pipelines.

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SECTION 13

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Section 13 – Additional Bonding:

1. Additional bonding is on file at WV DEP for the BW #4 Class IID commercial injection well.

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SECTION 14

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Section 14 – Financial Responsibility:

1. Appendix I is attached.
2. Attached is the current Certificate of Liability Insurance for EnLink Midstream, LLC, which includes subsidiary Appalachian Oil Purchasers, Inc.

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APPENDIX I

Requirement for Financial Responsibility to Plug/Abandon an Injection Well

To: WV Department of Environmental Protection
Office of Oil and Gas
601 57th Street, SE
Charleston, West Virginia 25304-2345
ATTN: Underground Injection Control Program

From: Appalachian Oil Purchasers, Inc.
157 Lower Eureka Lane
Saint Marys, West Virginia 26170

Date: 11/13/15

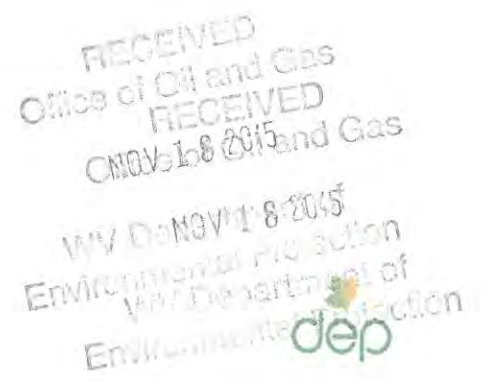
Subject: Underground Injection Control (UIC) Permit Application
UIC2D0732523
Requirement for Financial Responsibility

I, Steve Cornelison, verify in accordance with 47CSR13-13.7.g., that I will maintain financial responsibility and resources to close, plug, and abandon underground injection wells(s) in a manner prescribed by the Chief of the Office of Oil and Gas.

Name: Steve Cornelison

Signature: [Signature]

Date: 11-13-15





CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY)

3/4/2015

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER MHBT Inc. 8144 Walnut Hill Lane, 16th Fl Dallas TX 75231		CONTACT NAME: Cynthia Young PHONE (A/C, No, Ext): 972-770-1600 FAX (A/C, No): 972-770-1699 E-MAIL: cynthia_young@mhbtc.com ADDRESS: cynthia_young@mhbtc.com	
INSURED EnLink Midstream, LLC** 2501 Cedar Springs, Ste 100 Dallas TX 75201		INSURER(S) AFFORDING COVERAGE	
ENLINMID		INSURER A: National Union Fire Ins Co Pittsbur 19445	
		INSURER B: Lexington Insurance Company 19437	
		INSURER C: American Guarantee & Liability Ins 26247	
		INSURER D:	
		INSURER E:	
		INSURER F:	

COVERAGES

CERTIFICATE NUMBER: 2075906303

REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS
A	GENERAL LIABILITY ☒ COMMERCIAL GENERAL LIABILITY ☐ CLAIMS-MADE ☒ OCCUR ☒ Contractual ☒ Explosion GEN'L AGGREGATE LIMIT APPLIES PER: ☒ POLICY ☐ PRO-JECT ☐ LOC			GL1903245	3/7/2015	5/1/2016	EACH OCCURRENCE \$1,000,000 DAMAGE TO RENTED PREMISES (Ea occurrence) \$1,000,000 MED EXP (Any one person) \$100,000 PERSONAL & ADV INJURY \$1,000,000 GENERAL AGGREGATE \$2,000,000 PRODUCTS - COMP/OP AGG \$2,000,000 Time Element Polluti \$1,000,000
A	AUTOMOBILE LIABILITY ☒ ANY AUTO ☒ ALL OWNED AUTOS ☒ HIRED AUTOS ☐ SCHEDULED AUTOS ☒ NON-OWNED AUTOS			CA3632254	3/7/2015	5/1/2016	COMBINED SINGLE LIMIT (Ea accident) \$1,000,000 BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$ \$
B	☒ UMBRELLA LIAB ☒ OCCUR ☐ EXCESS LIAB ☐ CLAIMS-MADE DED ☒ RETENTION \$10,000			023815851	3/7/2015	5/1/2016	EACH OCCURRENCE \$5,000,000 AGGREGATE \$5,000,000 \$
A	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below			WC019177500	3/7/2015	3/7/2016	☒ WC STATU-TORY LIMITS ☐ OTH-ER E.L. EACH ACCIDENT \$1,000,000 E.L. DISEASE - EA EMPLOYEE \$1,000,000 E.L. DISEASE - POLICY LIMIT \$1,000,000
C	2nd Umbrella-Per Occurrence			AEC594896500	3/7/2015	5/1/2016	Occ-\$5,000,000 Agg-\$5,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

PLEASE SEE ALL PAGES ATTACHED FOR ADDITIONAL COVERAGE INFORMATION...

Named Insured's

Acacia Natural Gas Corp. I, Inc. (Delaware)
Acacia Natural Gas L.L.C. (Delaware)
Ascension Pipeline Company, LLC (Delaware)
Bridgeline Holdings, L.P. (Delaware)
See Attached...

CERTIFICATE HOLDER**CANCELLATION**

Ohio Department of Natural Resources
Division of Oil and Gas Resources Management
2045 Morse Road, F-2
Columbus OH 43229-6693

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE



ADDITIONAL REMARKS SCHEDULE

Page 1 of 3

CY MIDT Inc.		NAMED INSURED EnLink Midstream, LLC** 2501 Cedar Springs, Ste 100 Dallas TX 75201	
POLICY NUMBER			
CARRIER	NAIC CODE	EFFECTIVE DATE:	

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 FORM TITLE: CERTIFICATE OF LIABILITY INSURANCE

Bridgeline, LLC
 Chandeaur Pipe Line, LLC (Delaware)
 Crosstex Permian I (Fed. Tax JV only)
 EnLink Calcasieu, LLC (Delaware)
 EnLink Crude Marketing, LLC (Delaware)
 EnLink D.C. Gathering Company, JV - (Texas)
 EnLink Energy GP, LLC (Delaware)
 EnLink Gas Marketing, LP (Texas)
 EnLink GOM, LLC
 EnLink LIG Liquids, LLC (Louisiana)
 EnLink LIG, LLC (Louisiana)
 EnLink Louisiana Gathering, LLC (Louisiana)
 EnLink Midstream, Inc. (Delaware)
 EnLink Midstream, LLC (Delaware)
 EnLink Midstream Finance Corporation (Delaware)
 EnLink Midstream GP, LLC (Delaware)
 EnLink Midstream Holdings GP, LLC (Delaware)
 EnLink Midstream Holdings, LP (Delaware)
 EnLink Midstream Manager, LLC (Delaware)
 EnLink Midstream Operating GP, LLC (Delaware)
 EnLink Midstream Operating, LP (Delaware)
 EnLink Midstream Partners, LP (Delaware)
 EnLink Midstream Services, LLC (Texas)
 EnLink NGL Marketing, LP (Texas)
 EnLink NGL Pipeline, LP (Texas)
 EnLink North Texas Gathering, LP (Texas)
 EnLink North Texas Pipeline, LP (Texas)
 EnLink Pelican, LLC (Delaware)
 EnLink Permian, LLC
 EnLink Permian II, LLC
 EnLink Processing Services, LLC (Delaware)
 EnLink Texas NGL Pipeline, LLC (Texas)
 EnLink Texas Processing, LP (Texas)
 EnLink Tuscaloosa, LLC (Louisiana)
 Sabine Hub Services LLC (Delaware)
 Sabine Pipe Line LLC (Delaware)
 Sabine Pass Plant Facility Joint Venture (Texas, d/b/i Louisiana)
 SWG Pipeline, L.L.C. (Texas)
 E2 Appalachian Compression, LLC (Delaware)
 E2 Energy Services, LLC (Delaware)
 E2 Ohio Compression, LLC (Delaware)
 EnLink ORV Holdings, Inc. (Delaware)
 West Virginia Oil Gathering, LLC (Delaware)
 Appalachian Oil Purchasers, LLC (Delaware)
 Kentucky Oil Gathering, LLC (Delaware)
 Ohio Oil Gathering II, LLC (Delaware)
 Ohio Oil Gathering III, LLC (Delaware)
 Ohio River Valley Pipeline, LLC
 OOGC Disposal Company I, LLC (Delaware)
 Clearfield Ohio Holdings, Inc. (Ohio)
 M&B Gas Services, LLC (Delaware)
 LPC Crude Oil Marketing, LLC
 LPC Crude Oil II, LLC
 LPC Crude Oil, Inc.
 LPC Crude Oil Pipeline, LLC

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ADDITIONAL REMARKS SCHEDULE

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POLICY NUMBER		EFFECTIVE DATE:	
CARRIER	NAIC CODE		

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 FORM TITLE: CERTIFICATE OF LIABILITY INSURANCE

Additional Insured form #61712 (9/01) applies to the General Liability Policy
Additional Insured Primary & Non Contributory Insurance Form form 74434 Edition 10/99
Commercial General Liability Coverage Form CG0001 edition 12-07 Other Insurance Section of Form.
CG 24 17 Edition 10 01 Contractual Liability 50' - Railroads

Waiver of Subrogation form #CG24 04 edition 10 93 applies to the General Liability Policy
Waiver of Subrogation form #WC42 03 04A edition 01 00 applies to the Workers Compensation Policy.

Additional Insured form #87950 edition 10/05 applies to the Business Auto policy

Waiver of subrogation form #62897 edition (6/95) applies to the Business Auto policy

Additional Insured "Insurance Primary as to certain Additional Insureds" Form #74445 Edition 10/99 applies to Business Auto policy

Coverage for Certain Operations In Connection with Railroads - Form CA 20 70 10/01

Pollution Liability-Broadened Coverage for Covered Autos-Business Auto, Motor Carrier and Truckers Coverage Form #CA 99 48 03 06
applies to Business Auto Policy.

Time Element Pollution Endorsement 62257 Edition 01/09
Collapse and Underground Hazards included in GL coverages

The General Liability policy includes a blanket additional insured endorsement to the certificate holder only when there is a written contract
between the named insured and the certificate holder that requires such status.

The General Liability policy contains an endorsement with "Primary and NonContributory" wording that may apply only when there is a written
contract between the named insured and the certificate holder that requires such wording.

The General Liability policy contains a blanket waiver of subrogation endorsement that may apply only when there is a written contract
between the named insured and the certificate holder that requires such wording.

The Automobile Liability policy contains language that provides additional insured status to the certificate holder only when there is a written
contract between the named insured and the certificate holder that requires such status.

The Automobile liability policy includes waiver of subrogation wording that may apply only when there is a written contract between the named
insured and the certificate holder that requires such wording.

The Worker's Compensation policy includes a waiver of subrogation endorsement that may apply only when there is a written contract
between the named insured and the certificate holder that requires such wording.

The General Liability, Automobile Liability, Worker's Compensation and Excess liability policy(ies) includes a blanket notice of cancellation to
the certificate holder endorsement, providing for (30) days' advance written notice if the policy is canceled by the company, or 10 days'
written notice before the policy is canceled for nonpayment of premium. Notice is sent to certificate holders with mailing addresses on file with
the agent or the company. The endorsement does not provide for notice of cancellation to the certificate holder if the named insured
requests cancellation.

Workers Compensation Policy provides coverage for States of Kentucky, Louisiana, Texas and West Virginia. Other States Covered: All
States covered except monopolistic states and the following states: New Hampshire, Puerto Rico, and Virgin Islands.

Workers Compensation policy provides Alternate Employer Endorsement per form #WC 00 03 01A that applies to any entity required by
in contract with you before loss. Applies in any State where work is being performed on a project where written contract applies.

Stop Gap Coverage for State of Ohio applies.



ADDITIONAL REMARKS SCHEDULE

Page 3 of 3

ICY EnLink Midstream, LLC		NAMED INSURED EnLink Midstream, LLC** 2501 Cedar Springs, Ste 100 Dallas TX 75201	
POLICY NUMBER			
CARRIER	NAIC CODE	EFFECTIVE DATE:	

ADDITIONAL REMARKS

THIS ADDITIONAL REMARKS FORM IS A SCHEDULE TO ACORD FORM,

FORM NUMBER: 25 FORM TITLE: CERTIFICATE OF LIABILITY INSURANCE

Workers Compensation Policy provides Longshore Harbor Workers Compensation Act coverage per form #WC000106A.
 Workers Compensation Policy provides Maritime coverage per form #WC000201A.
 Workers Compensation Policy provides Voluntary Compensation Maritime coverage per form #WC000203.

** TIME ELEMENT POLLUTION DOES NOT APPLY TO THE FOLLOWING ENTITIES:

Clearfield Energy, Inc. (Pennsylvania)
 Clearfield Holdings, Inc. (Delaware)
 West Virginia Oil Gathering Corporation (West Virginia)
 Appalachian Oil Purchasers, Inc. (Delaware)
 Kentucky Oil Gathering Corporation (Kentucky)
 Ohio Oil Gathering Corporation II (Delaware)
 Ohio Oil Gathering Corporation III (Delaware)
 OOG Disposal Company I (Ohio)
 Clearfield Ohio Holdings, Inc. (Ohio)
 Pike Natural Gas Company (Ohio)
 Eastern Natural Gas Company (Ohio)
 Southeastern Natural Gas Company (Ohio)
 M & B Services, Inc. (Delaware)

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APPENDIX J

Site Security for Commercial Facilities

Provide a detailed description of the method(s) utilized at the facility to restrict or prohibit illegal dumping of unauthorized waste or vandalism at the facility.

1. Complete enclosure of all wells, holding tank/pits and manifold assemblies within a chain link or other suitable fencing; and
2. Require that all gates and other entry points be locked when the facility is unattended; or
3. Providing tamper-proof seals for the master valve on each well (a "lock-out" or chain & padlock system would be more secure; however, these devices could create a potential safety hazard if the well needed to be quickly shut in due to an emergency); and
4. Installing locking caps on all valves and connections on holding tanks, unloading racks, and headers.

The BW#4 injection well and surface facility is located in a remote area and access to the lease road is fenced with a locked gate. Signage is attached to the gate with proper warnings and identification of the well site. The surface facility dike area is 20' x 62' with 41" high walls for secondary containment. The wellhead is enclosed above-ground in a well house to protect it from the elements and is locked, but also to limit access to the valves on the injection well. Additionally, continuous annular and injection tubing pressure monitoring is accomplished on the BW#4 injection well. Attached is a separate document with photographs of the gate and signage, lock and chain at the gate, valving, surface facility and dike area showing secondary containment, well house enclosure, and wellhead with monitoring equipment.

The entire site is fenced and locked. Appalachian Oil Purchasers, LLC routinely conduct on-site inspections of the BW#4 well site and surface facility. The site is also under video camera surveillance and the entire site is fenced. Valves on the pipeline into the secondary containment are locked. The injection pump is within a locked building.

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**BW #4, UIC 2D0732523 PLEASANTS COUNTY, WEST
VIRGINIA**

**LEASE ROAD, ACCESS GATE, SURFACE FACILITY, WELLHEAD AND
WELLHEAD ENCLOSURE PHOTOGRAPHS**



Figure 1 – Photograph of Access Road and Gate to the BW#4 Well Location.

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Figure 2 – Photograph of Chain and Lock on Gate that Limits Access to the BW#4 Wellsite.

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Figure 3 – Photograph of BW#4 Surface Facility.

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Figure 4 – BW#4 Secure Well House.

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Figure 5 – BW#4 Wellhead Assembly and Annular Pressure Monitoring Equipment Below Enclosure.

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Figure 6 – BW#4 Injection Tubing with Gate Valve and Pressure Monitoring
System Inside Enclosure.

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**BW #4, UIC 2D0732523 PLEASANTS COUNTY, WEST
VIRGINIA**

ADDITIONAL SITE SECURITY DETAILS



Figure 1 - Locked building with security camera

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Figure 2 - Close-up photograph of 24-hour surveillance security camera.

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Figure 3 - Locked wellhead enclosure.

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Figure 4 - Pipeline and locking valves as additional security measures.

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Figure 5 – Secondary containment.

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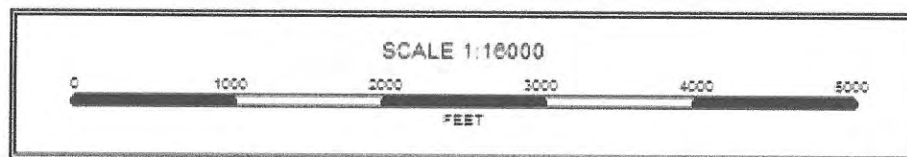
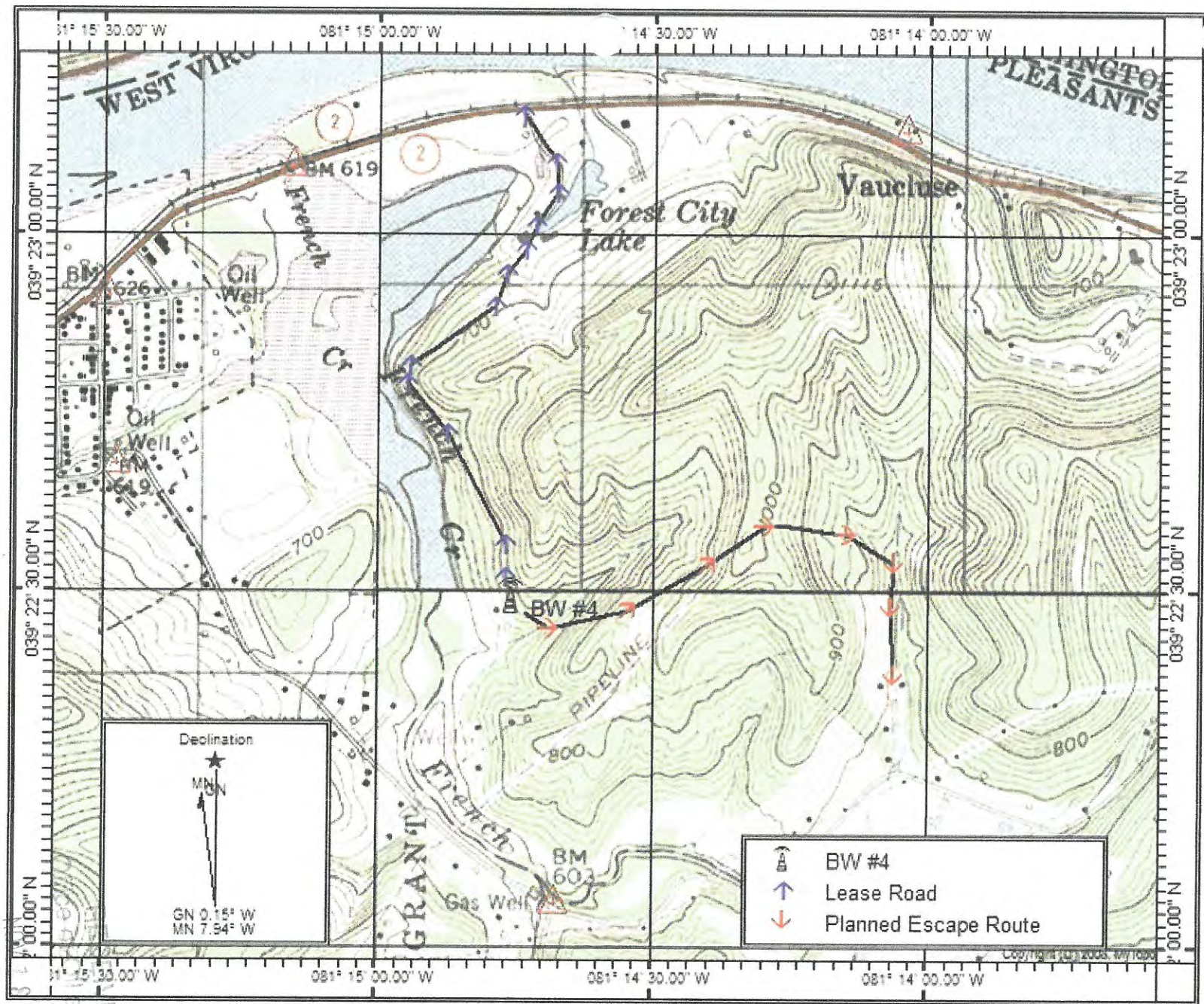


Figure 6 – Locked gate and fencing around entire site.

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APPENDIX K

**Identify permit or construction approvals received
or applied for under the following programs:**

Permit/approvals	ID Number
Hazardous Waste Management Program under RCRA	NA
NPDES Program	NA
Prevention of Significant Deterioration (PSD)	NA
Nonattainment Program	NA
Dredge or Fill	NA
NPDES/NPDES – Stormwater	NA
WVDEP – Office of Waste Management (OWM) – Solid Waste Facility	NA
WVDEP – OWM – RCRA (Hazardous Waste TSD or Transporter)	NA
WVDEP – OWM – UST	NA
CERCLA – Superfund	NA
WV Voluntary Remediation – Brownfields	NA
FIFRA – Federal Insecticide, Fungicide and Rodenticide Act	NA
Well Head Protection Program (WHPP)	NA
Underground Injection Control (UIC)	UIC2D0732523
Toxic Substances Control Act (TSCA)	NA
Best Management Plans	NA
Management of Used Oil	NA
Other Relevant Permits (Specify):	
	NA

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Spill Prevention, Control, and Countermeasure Plan (SPCC)

**EnLink Midstream
Brine Well #4 SWD
544 Forest City Dr.
St. Marys, West Virginia 26170**

**Prepared For:
ENLINK MIDSTREAM**

**APRIL 2015
REF. NO. 089077 (18)**

**Prepared by:
Conestoga-Rovers
& Associates**

1755 Wittington Place, Suite 500
Dallas, Texas
United States 75234

Office: (972) 331-8500
Fax: (972) 331-8501

web: <http://www.CRAworld.com>

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**CONESTOGA-ROVERS
& ASSOCIATES**

**List of Figures
(Following Text)**

Figure 1	Vicinity Map
Figure 2	Facility Diagram

**List of Tables
(Following Text)**

Table 1	Oil Handling and Secondary Containment Capacity Summary
Table 2	Secondary Containment Calculations

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Appendix A	Professional Engineer Certification
Appendix B	SPCC Plan Revision Log
Appendix C	Management Approval
Appendix D	Inspection Program
Appendix E	Incident Report Forms

List of Exhibits

Exhibit 1	40 CFR PART 112.7.A.3.VI – Contacts
Exhibit 2	Emergency Phone Numbers
Exhibit 3	SPCC Site Inspection Form
Exhibit 4	Facility Drainage System Form
Exhibit 5	Certification of the Applicability of the Substantial Harm Criteria

Section 1.0 Purpose

This Spill Prevention, Control, and Countermeasure (SPCC) Plan (Plan) complies with the federal oil pollution prevention requirements of 40 CFR Part 112. It demonstrates contingency planning and implementation of operating procedures and best management practices to prevent and control the discharge of pollutants resulting from spill events at Brine Well #4 SWD (Facility/Site) in St. Marys, West Virginia. EnLink Midstream (EnLink) personnel operate Brine Well #4 SWD.

This SPCC Plan addresses each section of the regulations individually with the response immediately following. Section 2.0 addresses the federal regulations. West Virginia also requires a Spill Prevention Response Plan (SPRP) per W. Va. Code § 22-30-9. The SPRP for this Facility has been submitted under a separate cover.

Section 2.0 Federal Spill Prevention, Control, and Countermeasure Plan 40 CFR part 11

2.1 General Applicability

§112.1(a)(1): *This part establishes procedures, methods, equipment, and other requirements to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable waters of the United States or adjoining shorelines, or into or upon the waters of the contiguous zone, or in connection with activities under the Outer Continental Shelf Lands Act or the Deepwater Port Act of 1974, or that may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States (including resources under the Magnuson Fishery Conservation and Management Act).*

§112.1(a)(2): *As used in this part, words in the singular also include the plural and words in the masculine gender also include the feminine and vice versa, as the case may require.*

§112.1(b): *Except as provided in paragraph (d) of this section, this part applies to any owner or operator of a non-transportation-related onshore or offshore facility engaged in drilling, producing, gathering, storing, processing, refining, transferring, distributing, using, or consuming oil and oil products, which due to its location, could reasonably be expected to discharge oil in quantities that may be harmful, as described in part 110 of this chapter, into or upon the navigable waters of the United States or adjoining shorelines, or into or upon the waters of the contiguous zone, or in connection with activities under the Outer Continental Shelf Lands Act or the Deepwater Port Act of 1974, or that may affect natural resources belonging to, appertaining to, or under the exclusive management authority of the United States (including resources under the Magnuson Fishery Conservation and Management Act) that has oil in:*

- (1) Any aboveground container;
- (2) Any completely buried tank as defined in Sec. 112.2;
- (3) Any container that is used for standby storage, for seasonal storage, or for temporary storage, or not otherwise "permanently closed" as defined in Sec. 112.2; and
- (4) Any "bunkered tank" or "partially buried tank" as defined in Sec. 112.2, or any container in a vault, each of which is considered an aboveground storage container for purposes of this part.



§112.1(c): As provided in section 313 of the Clean Water Act (CWA), departments, agencies, and instrumentalities of the Federal government are subject to this part to the same extent as any person.

§112.1(d): Except as provided in paragraph (f) of this section, this part does not apply to:

§112.1(d)(1): The owner or operator of any facility, equipment, or operation that is not subject to the jurisdiction of the Environmental Protection Agency (EPA) under section 311(j)(1)(C) of the CWA, as follows:

- (i) Any onshore or offshore facility, that due to its location, could not reasonably be expected to have a discharge as described in paragraph (b) of this section. This determination must be based solely upon consideration of the geographical and location aspects of the facility (such as proximity to navigable waters or adjoining shorelines, land contour, drainage, etc.) and must exclude consideration of manmade features such as dikes, equipment or other structures, which may serve to restrain, hinder, contain, or otherwise prevent a discharge as described in paragraph (b) of this section.
- (ii) Any equipment, or operation of a vessel or transportation-related onshore or offshore facility which is subject to the authority and control of the U.S. Department of Transportation, as defined in the Memorandum of Understanding between the Secretary of Transportation and the Administrator of EPA, dated November 24, 1971 (Appendix A of this part).
- (iii) Any equipment, or operation of a vessel or onshore or offshore facility which is subject to the authority and control of the U.S. Department of Transportation or the U.S. Department of the Interior, as defined in the Memorandum of Understanding between the Secretary of Transportation, the Secretary of the Interior, and the Administrator of EPA, dated November 8, 1993 (Appendix B of this part).

§112.1(d)(2): Any facility which, although otherwise subject to the jurisdiction of EPA, meets both of the following requirements:

- (i) The completely buried storage capacity of the facility is 42,000 U.S. gallons or less of oil. For purposes of this exemption, the completely buried storage capacity of a facility excludes the capacity of a completely buried tank, as defined in Sec. 112.2, and connected underground piping, underground ancillary equipment, and containment systems, that is currently subject to all of the technical requirements of part 280 of this chapter or all of the technical requirements of a State program approved under part 281 of this chapter, or the capacity of any underground oil storage tanks deferred under 40 CFR part 280 that supply emergency diesel generators at a nuclear power generation facility licensed by the Nuclear Regulatory Commission and subject to any Nuclear Regulatory Commission provision regarding design and quality criteria, including, but not limited to, 10 CFR part 50. The completely buried storage capacity of a facility also excludes the capacity of a container that is "permanently closed," as defined in Sec. 112.2 and the capacity of intra-facility gathering lines subject to the regulatory requirements of 49 CFR part 192 or 195.
- (ii) The aggregate aboveground storage capacity of the facility is 1,320 U.S. gallons or less of oil. For the purposes of this exemption, only containers with a capacity of 55 U.S. gallons or greater are counted. The aggregate aboveground storage capacity of a facility excludes:
 - a. The capacity of a container that is "permanently closed" as defined in Sec. 112.2;
 - b. The capacity of a "motive power container" as defined in Sec. 112.2;
 - c. The capacity of hot-mix asphalt or any hot-mix asphalt container;
 - d. The capacity of a container for heating oil used solely at a single-family residence;
 - e. The capacity of pesticide application equipment and related mix containers; and
 - f. The capacity of any milk and milk product container and associated piping and appurtenances.

§112.1(d)(3): Any offshore oil drilling, production, or workover facility that is subject to the notices and regulations of the Minerals Management Service, as specified in the Memorandum of Understanding between the Secretary of



Transportation, the Secretary of the Interior, and the Administrator of EPA, dated November 8, 1993 (Appendix B of this part).

§112.1(d)(4): Any completely buried storage tank, as defined in Sec. 112.2, and connected underground piping, underground ancillary equipment, and containment systems, at any facility, that is subject to all of the technical requirements of part 280 of this chapter or a State program approved under part 281 of this chapter, or any underground oil storage tanks including below-grade vaulted tanks, deferred under 40 CFR part 280, as originally promulgated, that supply emergency diesel generators at a nuclear power generation facility licensed by the Nuclear Regulatory Commission, provided that such a tank is subject to any Nuclear Regulatory Commission provision regarding design and quality criteria, including, but not limited to, 10 CFR part 50. Such emergency generator tanks must be marked on the facility diagram as provided in Sec. 112.7(a)(3), if the facility is otherwise subject to this part.

§112.1(d)(5): Any container with a storage capacity of less than 55 gallons of oil.

§112.1(d)(6): Any facility or part thereof used exclusively for wastewater treatment and not used to satisfy any requirement of this part. The production, recovery, or recycling of oil is not wastewater treatment for purposes of this paragraph.

§112.1(d)(7): Any "motive power container," as defined in Sec. 112.2. The transfer of fuel or other oil into a motive power container at an otherwise regulated facility is not eligible for this exemption.

§112.1(d)(8): Hot-mix asphalt, or any hot-mix asphalt container.

§112.1(d)(9): Any container for heating oil used solely at a single-family residence.

§112.1(d)(10): Any pesticide application equipment or related mix containers.

§112.1(d)(11): Intra-facility gathering lines subject to the regulatory requirements of 49 CFR part 192 or 195, except that such a line's location must be identified and marked as "exempt" on the facility diagram as provided in Sec. 112.7(a)(3), if the facility is otherwise subject to this part.

§112.1(d)(12): Any milk and milk product container and associated piping and appurtenances.

§112.1(e): This part establishes requirements for the preparation and implementation of Spill Prevention, Control, and Countermeasure (SPCC) Plans. SPCC Plans are designed to complement existing laws, regulations, rules, standards, policies, and procedures pertaining to safety standards, fire prevention, and pollution prevention rules. The purpose of an SPCC Plan is to form a comprehensive Federal/State spill prevention program that minimizes the potential for discharges. The SPCC Plan must address all relevant spill prevention, control, and countermeasures necessary at the specific facility. Compliance with this part does not in any way relieve the owner or operator of an onshore or an offshore facility from compliance with other Federal, State, or local laws.

§112.1(f): Notwithstanding paragraph (d) of this section, the Regional Administrator may require that the owner or operator of any facility subject to the jurisdiction of EPA under section 311(j) of the CWA prepare and implement an SPCC Plan, or any applicable part, to carry out the purposes of the CWA.

§112.1(f)(1): Following a preliminary determination, the Regional Administrator must provide a written notice to the owner or operator stating the reasons why he must prepare an SPCC Plan, or applicable part. The Regional Administrator must send such notice to the owner or operator by certified mail or by personal delivery. If the owner or operator is a corporation, the Regional Administrator must also mail a copy of such notice to the registered agent, if any and if known, of the corporation in the State where the facility is located.



§112.1(f)(2): Within 30 days of receipt of such written notice, the owner or operator may provide information and data and may consult with the Agency about the need to prepare an SPCC Plan, or applicable part.

§112.1(f)(3): Within 30 days following the time under paragraph (b)(2) of this section within which the owner or operator may provide information and data and consult with the Agency about the need to prepare an SPCC Plan, or applicable part, the Regional Administrator must make a final determination regarding whether the owner or operator is required to prepare and implement an SPCC Plan, or applicable part. The Regional Administrator must send the final determination to the owner or operator by certified mail or by personal delivery. If the owner or operator is a corporation, the Regional Administrator must also mail a copy of the final determination to the registered agent, if any and if known, of the corporation in the State where the facility is located.

§112.1(f)(4): If the Regional Administrator makes a final determination that an SPCC Plan, or applicable part, is necessary, the owner or operator must prepare the Plan, or applicable part, within six months of that final determination and implement the Plan, or applicable part, as soon as possible, but not later than one year after the Regional Administrator has made a final determination.

§112.1(f)(5): The owner or operator may appeal a final determination made by the Regional Administrator requiring preparation and implementation of an SPCC Plan, or applicable part, under this paragraph. The owner or operator must make the appeal to the Administrator of EPA within 30 days of receipt of the final determination under paragraph (b)(3) of this section from the Regional Administrator requiring preparation and/or implementation of an SPCC Plan, or applicable part. The owner or operator must send a complete copy of the appeal to the Regional Administrator at the time he makes the appeal to the Administrator. The appeal must contain a clear and concise statement of the issues and points of fact in the case. In the appeal, the owner or operator may also provide additional information. The additional information may be from any person. The Administrator may request additional information from the owner or operator. The Administrator must render a decision within 60 days of receiving the appeal or additional information submitted by the owner or operator and must serve the owner or operator with the decision made in the appeal in the manner described in paragraph (f)(1) of this section.

This section of the regulation is for reference only.

2.2 40 CFR Part 112.2 - Definitions

§112.2: For the purposes of this part:

Adverse weather means weather conditions that make it difficult for response equipment and personnel to clean up or remove spilled oil, and that must be considered when identifying response systems and equipment in a response plan for the applicable operating environment. Factors to consider include significant wave height as specified in Appendix D to this part (as appropriate), ice conditions, temperatures, weather-related visibility, and currents within the area in which the systems or equipment is intended to function.

Alteration means any work on a container involving cutting, burning, welding, or heating operations that changes the physical dimensions or configuration of the container.

Animal fat means a non-petroleum oil, fat, or grease of animal, fish, or marine mammal origin.

Breakout tank means a container used to relieve surges in an oil pipeline system or to receive and store oil transported by a pipeline for reinjection and continued transportation by pipeline.

Bulk storage container means any container used to store oil. These containers are used for purposes including, but not limited to, the storage of oil prior to use, while being used, or prior to further distribution in commerce. Oil-filled electrical, operating, or manufacturing equipment is not a bulk storage container.

Bunkered tank means a container constructed or placed in the ground by cutting the earth and re-covering the container in a manner that breaks the surrounding natural grade, or that lies above grade, and is covered with earth, sand, gravel, asphalt, or other material. A bunkered tank is considered an aboveground storage container for purposes of this part.

Completely buried tank means any container completely below grade and covered with earth, sand, gravel, asphalt, or other material.

Containers in vaults, bunkered tanks, or partially buried tanks are considered aboveground storage containers for purposes of this part.

Complex means a facility possessing a combination of transportation-related and non-transportation-related components that is subject to the jurisdiction of more than one Federal agency under section 311(j) of the CWA.

Contiguous zone means the zone established by the United States under Article 24 of the Convention of the Territorial Sea and Contiguous Zone, that is contiguous to the territorial sea and that extends nine miles seaward from the outer limit of the territorial area.

Contract or other approved means means:

- (1) A written contractual agreement with an oil spill removal organization that identifies and ensures the availability of the necessary personnel and equipment within appropriate response times; and/or
- (2) A written certification by the owner or operator that the necessary personnel and equipment resources, owned or operated by the facility owner or operator, are available to respond to a discharge within appropriate response times; and/or
- (3) Active membership in a local or regional oil spill removal organization that has identified and ensures adequate access through such membership to necessary personnel and equipment to respond to a discharge within appropriate response times in the specified geographic area; and/or
- (4) Any other specific arrangement approved by the Regional Administrator upon request of the owner or operator.

Discharge includes, but is not limited to, any spilling, leaking, pumping, pouring, emitting, emptying, or dumping of oil, but excludes discharges in compliance with a permit under section 402 of the CWA; discharges resulting from circumstances identified, reviewed, and made a part of the public record with respect to a permit issued or modified under section 402 of the CWA, and subject to a condition in such permit; or continuous or anticipated intermittent discharges from a point source, identified in a permit or permit application under section 402 of the CWA, that are caused by events occurring within the scope of relevant operating or treatment systems. For purposes of this part, the term discharge shall not include any discharge of oil that is authorized by a permit issued under section 13 of the River and Harbor Act of 1899 (33 U.S.C. 407).

Facility means any mobile or fixed, onshore or offshore building, property, parcel, lease, structure, installation, equipment, pipe, or pipeline (other than a vessel or a public vessel) used in oil well drilling operations, oil production, oil refining, oil storage, oil gathering, oil processing, oil transfer, oil distribution, and oil waste treatment, or in which oil is used, as described in appendix A to this part. The boundaries of a facility depend on several site-specific factors, including but not limited to, the ownership or operation of buildings, structures, and equipment on the same site and types of activity at the site. Contiguous or non-contiguous buildings, properties, parcels, leases, structures, installations, pipes, or pipelines under the ownership or operation of the same person may be considered separate facilities. Only this definition governs whether a facility is subject to this part.

Farm means a facility on a tract of land devoted to the production of crops or raising of animals, including fish, which produced and sold, or normally would have produced and sold, \$1,000 or more of agricultural products during a year.

Fish and wildlife and sensitive environments means areas that may be identified by their legal designation or by evaluations of Area Committees (for planning) or members of the Federal On-Scene Coordinator's spill response structure (during responses). These areas may include wetlands, National and State parks, critical habitats for endangered or threatened species, wilderness and natural resource areas, marine sanctuaries and estuarine



reserves, conservation areas, preserves, wildlife areas, wildlife refuges, wild and scenic rivers, recreational areas, national forests, Federal and State lands that are research national areas, heritage program areas, land trust areas, and historical and archaeological sites and parks. These areas may also include unique habitats such as aquaculture sites and agricultural surface water intakes, bird nesting areas, critical biological resource areas, designated migratory routes, and designated seasonal habitats.

Injury means a measurable adverse change, either long- or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge, or exposure to a product of reactions resulting from a discharge.

Loading/unloading rack means a fixed structure (such as a platform, gangway) necessary for loading or unloading a tank truck or tank car, which is located at a facility subject to the requirements of this part. A loading/unloading rack includes a loading or unloading arm, and may include any combination of the following: piping assemblages, valves, pumps, shut-off devices, overfill sensors, or personnel safety devices.

Maximum extent practicable means within the limitations used to determine oil spill planning resources and response times for on-water recovery, shoreline protection, and cleanup for worst case discharges from onshore non-transportation-related facilities in adverse weather. It includes the planned capability to respond to a worst case discharge in adverse weather, as contained in a response plan that meets the requirements in Sec. 112.20 or in a specific plan approved by the Regional Administrator.

Mobile refueler means a bulk storage container onboard a vehicle or towed, that is designed or used solely to store and transport fuel for transfer into or from an aircraft, motor vehicle, locomotive, vessel, ground service equipment, or other oil storage container.

Motive power container means any onboard bulk storage container used primarily to power the movement of a motor vehicle, or ancillary onboard oil-filled operational equipment. An onboard bulk storage container which is used to store or transfer oil for further distribution is not a motive power container. The definition of motive power container does not include oil drilling or workover equipment, including rigs.

Navigable waters of the United States means "navigable waters" as defined in section 502(7) of the FWPCA, and includes:

- (1) All navigable waters of the United States, as defined in judicial decisions prior to passage of the 1972 Amendments to the FWPCA (Pub. L. 92-500), and tributaries of such waters;
- (2) Interstate waters;
- (3) Intrastate lakes, rivers, and streams which are utilized by interstate travelers for recreational or other purposes; and
- (4) Intrastate lakes, rivers, and streams from which fish or shellfish are taken and sold in interstate commerce.

Non-petroleum oil means oil of any kind that is not petroleum-based, including but not limited to: Fats, oils, and greases of animal, fish, or marine mammal origin; and vegetable oils, including oils from seeds, nuts, fruits, and kernels.

Offshore facility means any facility of any kind (other than a vessel or public vessel) located in, on, or under any of the navigable waters of the United States, and any facility of any kind that is subject to the jurisdiction of the United States and is located in, on, or under any other waters.

Oil means oil of any kind or in any form, including, but not limited to: fats, oils, or greases of animal, fish, or marine mammal origin; vegetable oils, including oils from seeds, nuts, fruits, or kernels; and, other oils and greases, including petroleum, fuel oil, sludge, synthetic oils, mineral oils, oil refuse, or oil mixed with wastes other than dredged spoil.

Oil-filled operational equipment means equipment that includes an oil storage container (or multiple containers) in which the oil is present solely to support the function of the apparatus or the device. Oil-filled operational equipment is not considered a bulk storage container, and does not include oil-filled manufacturing equipment flow-through process). Examples of oil-filled operational equipment include, but are not limited to, hydraulic systems, lubricating systems (e.g., those for pumps, compressors and other rotating equipment, including pumpjack



lubrication systems), gear boxes, machining coolant systems, heat transfer systems, transformers, circuit breakers, electrical switches, and other systems containing oil solely to enable the operation of the device.

Oil Spill Removal Organization means an entity that provides oil spill response resources, and includes any for-profit or not-for-profit contractor, cooperative, or in-house response resources that have been established in a geographic area to provide required response resources.

Onshore facility means any facility of any kind located in, on, or under any land within the United States, other than submerged lands.

Owner or operator means any person owning or operating an onshore facility or an offshore facility, and in the case of any abandoned offshore facility, the person who owned or operated or maintained the facility immediately prior to such abandonment.

Partially buried tank means a storage container that is partially inserted or constructed in the ground, but not entirely below grade, and not completely covered with earth, sand, gravel, asphalt, or other material. A partially buried tank is considered an aboveground storage container for purposes of this part.

Permanently closed means any container or facility for which:

- (1) All liquid and sludge has been removed from each container and connecting line; and
- (2) All connecting lines and piping have been disconnected from the container and blanked off, all valves (except for ventilation valves) have been closed and locked, and conspicuous signs have been posted on each container stating that it is a permanently closed container and noting the date of closure.

Person includes an individual, firm, corporation, association, or partnership.

Petroleum oil means petroleum in any form, including but not limited to crude oil, fuel oil, mineral oil, sludge, oil refuse, and refined products.

Produced water means a storage container at an oil production facility used to store the produced water after initial oil/water separation, and prior to reinjection, beneficial reuse, discharge, or transfer for disposal.

Production facility means all structures (including but not limited to wells, platforms, or storage facilities), piping (including but not limited to flowlines or intra-facility gathering lines), or equipment (including but not limited to workover equipment, separation equipment, or auxiliary non-transportation-related equipment) used in the production, extraction, recovery, lifting, stabilization, separation or treating of oil (including condensate), or associated storage or measurement, and is located in an oil or gas field, at a facility. This definition governs whether such structures, piping, or equipment are subject to a specific section of this part.

Regional Administrator means the Regional Administrator of the Environmental Protection Agency, in and for the Region in which the facility is located.

Repair means any work necessary to maintain or restore a container to a condition suitable for safe operation, other than that necessary for ordinary, day-to-day maintenance to maintain the functional integrity of the container and that does not weaken the container.

Spill Prevention, Control, and Countermeasure Plan; SPCC Plan, or Plan means the document required by Sec. 112.3 that details the equipment, workforce, procedures, and steps to prevent, control, and provide adequate countermeasures to a discharge.

Storage capacity of a container means the shell capacity of the container.

Transportation-related and non-transportation-related, as applied to an onshore or offshore facility, are defined in the Memorandum of Understanding between the Secretary of Transportation and the Administrator of the Environmental Protection Agency, dated November 24, 1971, (Appendix A of this part).

United States means the States, the District of Columbia, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, Guam, American Samoa, the U.S. Virgin Islands, and the Pacific Island Governments.



Vegetable oil means a non-petroleum oil or fat of vegetable origin, including but not limited to oils and fats derived from plant seeds, nuts, fruits, and kernels.

Vessel means every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water, other than a public vessel.

Wetlands means those areas that are inundated or saturated by surface or groundwater at a frequency or duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include playa lakes, swamps, marshes, bogs, and similar areas such as sloughs, prairie potholes, wet meadows, prairie river overflows, mudflats, and natural ponds.

Worst case discharge for an onshore non-transportation-related facility means the largest foreseeable discharge in adverse weather conditions as determined using the worksheets in Tables 1 and 2 to this part.

This section of the regulation is for reference only.

2.3 40 CFR PART 112.3 – Requirement to Prepare and Implement a Spill Prevention, Control, and Countermeasure Plan

§112.3: The owner or operator of an onshore or offshore facility subject to this section must prepare in writing and implement a Spill Prevention Control and Countermeasure Plan (hereafter “SPCC Plan” or “Plan”), in accordance with §112.7 and any other applicable section of this part.

§112.3(a)(1): Except as otherwise provided in this section, if your facility, or mobile or portable facility, was in operation on or before August 16, 2002, you must maintain your Plan, but must amend it, if necessary to ensure compliance with this part, and implement the amended Plan no later than November 10, 2011. If such a facility becomes operational after August 16, 2002, through November 10, 2011, and could reasonably be expected to have a discharge as described in §112.1(b), you must prepare and implement a Plan on or before November 10, 2011. If such a facility (excluding oil production facilities) becomes operational after November 10, 2011, and could reasonably be expected to have a discharge as described in §112.1(b), you must prepare and implement a Plan before you begin operations. You are not required to prepare a new Plan each time you move a mobile or portable facility to a new site; the Plan may be general. When you move the mobile or portable facility, you must locate and install it using the discharge prevention practices outlined in the Plan for the facility. The Plan is applicable only while the mobile or portable facility is in a fixed (non-transportation) operating mode.

The following sections of the regulation are not applicable to the Facility:

- **§112.3(a)(2)**
- **§112.3(b)**
- **§112.3(c)**

§112.3(d): Except as provided in §112.6, a licensed Professional Engineer must review and certify a Plan for it to be effective to satisfy the requirements of this part.

§112.3(d)(1): By means of this certification the Professional Engineer attests:

- (i) That he is familiar with the requirements of this part;
- (ii) That he or his agent has visited and examined the facility;
- (iii) That the Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards, and with the requirements of this part;
- (iv) That procedures for required inspections and testing have been established;



- (v) That the Plan is adequate for the facility; and
- (vi) That, if applicable, for a produced water container subject to §112.9(c)(6), any procedure to minimize the amount of free-phase oil is designed to reduce the accumulation of free-phase oil and the procedures and frequency for required inspections, maintenance and testing have been established and are described in the Plan.

§112.3(d)(2): Such certification shall in no way relieve the owner or operator of a facility of his duty to prepare and fully implement such Plan in accordance with the requirements of this part.

A licensed Professional Engineer has reviewed and certified this SPCC Plan. A copy of this certification is in Appendix A of this SPCC Plan.

§112.3(e): If you are the owner or operator of a facility for which a Plan is required under this section, you must:

§112.3(e)(1): Maintain a complete copy of the Plan at the facility if the facility is normally attended at least four hours per day, or at the nearest field office if the facility is not so attended; and

§112.3(e)(2): Have the Plan available to the Regional Administrator for on-site review during normal working hours.

A copy of the SPCC Plan is maintained and kept at the Facility. The SPCC Plan will be made available to authorized representatives of the West Virginia Department of Environmental Protection or the EPA Regional Administrator for on-Site review during normal working hours.

2.4 40 CFR PART 112.4 – Amendment of Spill Prevention, Control and Countermeasure Plan By Regional Administrator

§112.4: If you are the owner or operator of a facility subject to this part, you must:

§112.4(a): Notwithstanding compliance with §112.3, whenever your facility has discharged more than 1,000 U.S. gallons of oil in a single discharge as described in §112.1(b), or discharged more than 42 U.S. gallons of oil in each of two discharges as described in §112.1(b), occurring within any twelve month period, submit the following information to the Regional Administrator within 60 days from the time the facility becomes subject to this section:

§112.4(a)(1): Name of the facility;

§112.4(a)(2): Your name;

§112.4(a)(3): Location of the facility;

§112.4(a)(4): Maximum storage or handling capacity of the facility and normal daily throughput;

§112.4(a)(5): Corrective action and countermeasures you have taken, including a description of equipment repairs and replacements;

§112.4(a)(6): An adequate description of the facility, including maps, flow diagrams, and topographical maps, as necessary;

§112.4(a)(7): The cause of such discharge as described in §112.1(b), including a failure analysis of the system or subsystem in which the failure occurred;

§112.4(a)(8): Additional preventive measures you have taken or contemplated to minimize the possibility of recurrence; and

§112.4(a)(9): Such other information as the Regional Administrator may reasonably require pertinent to the Plan or discharge.

The above mentioned information will be submitted to the Regional Administrator within 60 days if and whenever the Facility has discharged more than 1,000 U.S. gallons of oil in a

single discharge, or discharged more than 42 U.S. gallons of oil in each of two (2) discharges occurring within any 12-month period.

2.5 40 CFR PART 112.5 – Amendment of Spill Prevention, Control, and Countermeasure Plan By Owners or Operators

§112.5: *If you are the owner or operator of a facility subject to this part, you must:*

§112.5(a): *Amend the SPCC Plan for your facility in accordance with the general requirements in §112.7, and with any specific section of this part applicable to your facility, when there is a change in the facility design, construction, operation, or maintenance that materially affects its potential for a discharge as described in §112.1(b). Examples of changes that may require amendment of the Plan include, but are not limited to: commissioning or decommissioning containers; replacement, reconstruction, or movement of containers; reconstruction, replacement, or installation of piping systems; construction or demolition that might alter secondary containment structures; changes of product or service; or revision of standard operation or maintenance procedures at a facility. An amendment made under this section must be prepared within six months, and implemented as soon as possible, but not later than six months following preparation of the amendment.*

As required by 40 CFR Part 112.5(a), this SPCC Plan will be amended and implemented prior to or concurrent with any Facility modification that involves a change in the Facility design, construction, storage capacity, operation, or maintenance that materially affects the potential for a discharge. Reviews and/or amendments of the SPCC Plan will be documented using Appendix B, B-1 and B-2.

§112.5(b): *Notwithstanding compliance with paragraph (a) of this section, complete a review and evaluation of the SPCC Plan at least once every five years from the date your facility becomes subject to this part; or, if your facility was in operation on or before August 16, 2002, five years from the date your last review was required under this part. As a result of this review and evaluation, you must amend your SPCC Plan within six months of the review to include more effective prevention and control technology if the technology has been field-proven at the time of the review and will significantly reduce the likelihood of a discharge as described in §112.1(b) from the facility. You must implement any amendment as soon as possible, but not later than six months following preparation of any amendment. You must document your completion of the review and evaluation, and must sign a statement as to whether you will amend the Plan, either at the beginning or end of the Plan or in a log or an appendix to the Plan. The following words will suffice, "I have completed review and evaluation of the SPCC Plan for (name of facility) on (date), and will (will not) amend the Plan as a result."*

The SPCC Plan will be reviewed every five (5) years and amended within 180 days of the review to include more effective prevention and control technology if such technology will significantly reduce the likelihood of a spill event and if such technology has been field proven at the time of the review. Reviews and/or amendments of the SPCC Plan will be documented using Appendix B, B-1, and B-2.

§112.5(c): *Except as provided in §112.6, have a Professional Engineer certify any technical amendments to your Plan in accordance with §112.3(d).*



Received

Any technical amendments of this SPCC Plan will be recertified by a Professional Engineer using Appendix B-2.

2.6 40 CFR PART 112.6 –Qualified Facilities Plan Requirements

§112.6: *Qualified facilities meeting the Tier I applicability criteria in §112.3(g)(1) are subject to the requirements in paragraph (a) of this section. Qualified facilities meeting the Tier II applicability criteria in §112.3(g)(2) are subject to the requirements in paragraph (b) of this section.*

The Facility has elected to have this SPCC Plan certified by a Professional Engineer; therefore, this section of the regulation is not applicable to the Facility.

2.7 40 CFR PART 112.7 – General Requirements for Spill Prevention, Control, and Countermeasure Plans

§112.7: *If you are the owner or operator of a facility subject to this part you must prepare a Plan in accordance with good engineering practices. The Plan must have the full approval of management at a level of authority to commit the necessary resources to fully implement the Plan. You must prepare the Plan in writing. If you do not follow the sequence specified in this section for the Plan, you must prepare an equivalent Plan acceptable to the Regional Administrator that meets all of the applicable requirements listed in this part, and you must supplement it with a section cross-referencing the location of requirements listed in this part and the equivalent requirements in the other prevention plan. If the Plan calls for additional facilities or procedures, methods, or equipment not yet fully operational, you must discuss these items in separate paragraphs, and must explain separately the details of installation and operational start-up. As detailed elsewhere in this section, you must also:*

This SPCC Plan has the full approval of management at a level to commit the necessary resources to implement it fully (Appendix C). This SPCC Plan follows the sequence specified in 40 CFR Part 112.7.

§112.7(a)(1): *Include a discussion of your facility's conformance with the requirements listed in this part.*

This SPCC Plan details the actions that the Facility must follow in order to comply with the federal oil pollution prevention requirements of 40 CFR Part 112. It demonstrates contingency planning and implementation of operating procedures and best management practices to prevent and control the discharge of pollutants resulting from spill events at the Facility.

§112.7(a)(2): *Comply with all applicable requirements listed in this part. Except as provided in §112.6, your Plan may deviate from the requirements in paragraphs (g), (h)(2) and (3), and (i) of this section and the requirements in subparts B and C of this part, except the secondary containment requirements in paragraphs (c) and (h)(1) of this section, and §§112.8(c)(2), 112.8(c)(11), 112.9(c)(2), 112.9(d)(3), 112.10(c), 112.12(c)(2), and 112.12(c)(11), where applicable to a specific facility, if you provide equivalent environmental protection by some other means of spill prevention, control, or countermeasure. Where your Plan does not conform to the applicable requirements in paragraphs (g), (h)(2) and (3), and (i) of this section, or the requirements of subparts B and C of this part, except the secondary containment requirements in paragraph (c) and (h)(1) of this section, and §§112.8(c)(2), 112.8(c)(11), 112.9(c)(2), 112.10(c), 112.12(c)(2), and 112.12(c)(11), you must state the reasons for nonconformance in your Plan and describe in detail alternate methods and how you will achieve equivalent environmental protection. If the*



Regional Administrator determines that the measures described in your Plan do not provide equivalent environmental protection, he may require that you amend your Plan, following the procedures in §112.4(d) and (e).

This SPCC Plan complies with the requirements of 40 CFR Part 112 and does not deviate from the requirements in paragraphs (g), (h)(2) and (3), and (i) of this section and the requirements in subparts B and C of this part, and Sections 112.8(c)(2), 112.8(c)(11), 112.9(c)(2), 112.10(c), 112.12(c)(2), and 112.12(c)(11).

§112.7(a)(3): Describe in your Plan the physical layout of the facility and include a facility diagram, which must mark the location and contents of each fixed oil storage container and the storage area where mobile or portable containers are located. The facility diagram must identify the location of and mark as "exempt" underground tanks that are otherwise exempted from the requirements of this part under §112.1(d)(4). The facility diagram must also include all transfer Terminals and connecting pipes, including intra-facility gathering lines that are otherwise exempted from the requirements of this part under §112.1(d)(11). You must also address in your Plan:

The Brine Well #4 SWD is located in Pleasants County southwest of St. Marys, West Virginia. The Facility is located at 39.375679 degrees north, -81.246753 degrees west. The Facility's primary functions are to receive produced water solution via pipeline and tank trucks from surrounding oil and gas facilities and store it in two (2) 500 barrel (bbl) bulk storage tanks, and dispose of it via deep injection well. A list of ASTs can be found in Table 1.

The two (2) 500 bbl produced water solution storage tanks are atmospheric field erected steel tanks constructed to API 650 specifications. These tanks are contained in a steel, lined berm which is adequately sized to contain the entire contents of the largest tank plus precipitation from a 25-year, 24-hour rainfall event. The list of the tanks is provided in Table 1 and the secondary containment volume calculation is provided in Table 2.

Small amounts of water accumulated in the diked areas are allowed to evaporate. Prior to discharge, terminal personnel will inspect accumulated rainwater and verify that the water is clear and free of a sheen. If a sheen is observed, the rainwater will be treated using sorbent or other applicable means. Dike draining events are inspected and logged in the Facility Drainage System Form (Exhibit 4).

The produced water solution bulk storage tanks are protected from vehicular traffic by their containment dike. All piping within the containment dike is supported by pipe supports and can be easily inspected. If a release were to occur, the material would be contained in the diked area. If the dike was breached, the material would flow southwest. The tanks are in an area that is inspected monthly and are used on a daily basis. Therefore, a release would be readily identified and responded to in a timely fashion. Due to the containment, the potential for an off-Site release from this area is considered low.



The Facility also contains two (2) 55 gallon turbine oil drums. The drums are located within a brick building with concrete flooring. If there were to be a release from the drums, the building would contain the release.

Piping and Instrumentation Diagrams (P&IDs) for the piping are maintained at the Facility. A Vicinity Map and Facility Diagram are shown on Figures 1 and 2, respectively.

- (i) *The type of oil in each fixed container and its storage capacity. For mobile or portable containers, either provide the type of oil and storage capacity for each container or provide an estimate of the potential number of mobile or portable containers, the types of oil, and anticipated storage capacities;*

See Figure 2 and Table 1 for the location and storage capacity of oil at the Facility. Pipelines and tank trucks are used to transfer products at the Facility.

- (ii) *Discharge prevention measures including procedures for routine handling of products (loading, unloading, and facility transfers, etc.);*

Facility personnel are trained to follow standard operating procedures during oil handling and chemical transfer activities. Truck unloading procedures are described below:

Make sure the vehicle tank is properly vented before starting to unload. If you are not certain that the trailer is properly vented, you must contact your supervisor and request permission to open the trailer dome before starting to load or unload. Qualified drivers must remain in attendance during unloading activities and follow the Department of Transportation regulations as outlined in 49 CFR Part 177 and Green Run SWD's operational procedures.

- (iii) *Discharge or drainage controls such as secondary containment around containers and other structures, equipment, and procedures for the control of a discharge; and*

Storage tanks at the Facility have secondary containment provided by a steel berm. Table 2 includes the secondary containment volume calculations.

- (iv) *Countermeasures for discharge discovery, response, and cleanup (both the facility's capability and those that might be required of a contractor).*

Facility personnel are required to perform monthly inspections throughout the Facility. These inspections facilitate prompt discharge discovery in the event of equipment failure.

During movements, standard operating procedures ensure prompt discovery of a discharge by requiring appropriate Facility personnel to be in attendance during unloading operations.

Leaks will be detected by Facility personnel during monthly inspections or during daily walk-throughs. In the event that a leak or discharge is detected, Facility personnel will take all



appropriate measures to safely stop and contain the discharge. If the discharge is significant, the designated person accountable for oil spill prevention, and/or the Facility Response Coordinator will be notified.

Procedures for response and reporting spills can be found in Section 3.0 of this SPCC Plan, and the company-wide Emergency Preparedness Response Plan (EPRP). Contact information can be found in Exhibits 1 and 2. Spill kits containing absorbent materials are kept in various places throughout the Facility. The Facility will contact the following entities for oil and chemical spill response:

National Response Center (NRC)

(800) 424-8802

BBU Services

(800) 837-8064

Weavertown Environmental Group

(800) 746-4850

(v) *Methods of disposal of recovered materials in accordance with applicable legal requirements; and*

Guidelines for the cleanup and disposal of any spilled material can be found in Section 3.0, and are in accordance with applicable legal requirements.

(vi) *Contact list and phone numbers for the facility response coordinator, National Response Center, cleanup contractors with whom you have an agreement for response, and all appropriate Federal, State, and local agencies who must be contacted in case of a discharge as described in §112.1(b).*

Contact information can be found in Exhibits 1 and 2.

§112.7(a)(4): *Unless you have submitted a response plan under §112.20, provide information and procedures in your Plan to enable a person reporting a discharge as described in §112.1(b) to relate information on the exact address or location and phone number of the facility; the date and time of the discharge, the type of material discharged; estimates of the total quantity discharged; estimates of the quantity discharged as described in §112.1(b); the source of the discharge; a description of all affected media; the cause of the discharge; any damages or injuries caused by the discharge; actions being used to stop, remove, and mitigate the effects of the discharge; whether an evacuation may be needed; and, the names of individuals and/or organizations who have also been contacted.*

Procedures for reporting a discharge are in Section 3.1.

§112.7(a)(5): *Unless you have submitted a response plan under §112.20, organize portions of the Plan describing procedures you will use when a discharge occurs in a way that will make them readily usable in an emergency, and include appropriate supporting material as appendices.*



Spill cleanup guidance is included in Section 3.0, reporting guidance is included in Section 3.1, and emergency phone numbers are listed in Exhibit 2.

§112.7(b): *Where experience indicates a reasonable potential for equipment failure (such as loading or unloading equipment, tank overflow, rupture, or leakage, or any other equipment known to be a source of a discharge), include in your Plan a prediction of the direction, rate of flow, and total quantity of oil which could be discharged from the facility as a result of each type of major equipment failure.*

Table 1 lists the tank capacities and, predicted direction and flow rate if uncontained or containment failure.

§112.7(c): *Provide appropriate containment and/or diversionary structures or equipment to prevent a discharge as described in §112.1(b), except as provided in paragraph (k) of this section for qualified oil-filled operational equipment, and except as provided in §112.9(d)(3) for flowlines and intra-facility gathering lines at an oil production facility. The entire containment system, including walls and floor, must be capable of containing oil and must be constructed so that any discharge from a primary containment system, such as a tank, will not escape the containment system before cleanup occurs. In determining the method, design, and capacity for secondary containment, you need only to address the typical failure mode, and the most likely quantity of oil that would be discharged. Secondary containment may be either active or passive in design. At a minimum, you must use one of the following prevention systems or its equivalent:*

§112.7(c)(1): *For onshore facilities:*

- (i)** *Dikes, berms, or retaining walls sufficiently impervious to contain oil;*
- (ii)** *Curbing or drip pans;*
- (iii)** *Sumps and collection systems;*
- (iv)** *Culverting, gutters, or other drainage systems;*
- (v)** *Weirs, booms, or other barriers;*
- (vi)** *Spill diversion ponds;*
- (vii)** *Retention ponds; or*
- (viii)** *Sorbent materials.*

SPCC-related material is stored within secondary containment. Any spill would be contained, in the order listed below, by:

- Secondary containment control structures
- Spill kits (i.e., booms, sorbent pads)

Leaks will be detected by Station Operator/Facility Foreman during monthly inspections or during daily Site activities. Routine visual inspections are documented if a condition is found. In the event that a leak or discharge is detected, Facility personnel will take appropriate measures to safely stop and contain the discharge. If the discharge is significant, the designated person accountable for oil spill prevention, and/or the Facility Response Coordinator will be notified. The procedures for responding to spills are located in Section 3.0 of this SPCC Plan.

The Facility is equipped with safety alarm devices, shut-in valves, sumps, fluid collection systems, and secondary containment (storage tanks) to protect against discharges to navigable water as a result of equipment failure or malfunction. Overflow devices for each tank are shown on Table 1.

Flow lines and gathering pipelines are equipped with the following protection systems: wrapped/coated piping, impressed current, cathodic protection, pressure shutdown systems, and are visually inspected, where exposed.

§112.7(c)(2): For offshore facilities:

- (i) Curbing or drip pans; or
- (ii) Sumps and collection systems.

This section of the regulation is not applicable to the Facility.

§112.7(d): Provided your Plan is certified by a licensed Professional Engineer under §112.3(d), or, in the case of a qualified facility that meets the criteria in §112.3(g), the relevant sections of your Plan are certified by a licensed Professional Engineer under §112.6(d), if you determine that the installation of any of the structures or pieces of equipment listed in paragraphs (c) and (h)(1) of this section, and §§112.8(c)(2), 112.8(c)(11), 112.9(c)(2), 112.10(c), 112.12(c)(2), and 112.12(c)(11) to prevent a discharge as described in §112.1(b) from any onshore or offshore facility is not practicable, you must clearly explain in your Plan why such measures are not practicable; for bulk storage containers, conduct both periodic integrity testing of the containers and periodic integrity and leak testing of the valves and piping; and, unless you have submitted a response plan under §112.20, provide in your Plan the following:

§112.7(d)(1): An oil spill contingency plan following the provisions of part 109 of this chapter.

§112.7(d)(2): A written commitment of manpower, equipment, and materials required to expeditiously control and remove any quantity of oil discharged that may be harmful.

The Facility does not consider the installation of any of the structures or pieces of equipment listed in paragraphs (c) and (h)(1) of this section, and 112.8(c)(2), 112.8(c)(11), 112.9(c)(2), 112.10(c), 112.12(c)(2), and 112.12(c)(11) to prevent a discharge as described in 112.1(b) from the Facility, not practicable.

§112.7(e): Inspections, tests, and records. Conduct inspections and tests required by this part in accordance with written procedures that you or the certifying engineer develop for the facility. You must keep these written procedures and a record of the inspections and tests, signed by the appropriate supervisor or inspector, with the SPCC Plan for a period of three years. Records of inspections and tests kept under usual and customary business practices will suffice for purposes of this paragraph.

An overview of the inspection program is provided in Appendix D. Qualified Facility personnel perform and document, at a minimum, monthly visual inspections (Exhibit 3) of SPCC-related storage tanks, valves, piping systems, and unloading areas, in accordance with



Facility-developed standard operating procedures. Tanks and containers are inspected for visible signs of damage or stress including cracks, leaks, and corrosion.

Visual inspections of storage vessels must be combined with other non-destructive shell testing, and comparison records must be kept. Tanks are integrity inspected and tested in accordance with American Petroleum Institute (API) Method 653 inspection procedures.

Records of the monthly inspections and tests are signed by the appropriate supervisor or inspector, and maintained for a minimum period of three (3) years. Records of inspections, tests and discharge records are maintained in paper files or electronic records. Integrity inspections records are maintained for the life of the tanks.

§112.7(f): *Personnel, training, and discharge prevention procedures. (1) At a minimum, train your oil-handling personnel in the operation and maintenance of equipment to prevent discharges; discharge procedure protocols; applicable pollution control laws, rules, and regulations; general facility operations; and, the contents of the facility SPCC Plan.*

Appropriate Facility personnel will be trained to follow standard operating procedures that address the prevention of discharges during the operation of equipment during oil handling or chemical transfer activities. Facility personnel will also be trained annually regarding pollution control laws, rules, and regulations; general Facility operations; and the contents of the Facility SPCC Plan.

§112.7(f)(2): *Designate a person at each applicable facility who is accountable for discharge prevention and who reports to facility management.*

The designated person accountable for oil spill prevention and/or the Facility Response Coordinator (as outlined in Appendix C) will be accountable for discharge prevention.

§112.7(f)(3): *Schedule and conduct discharge prevention briefings for your oil-handling personnel at least once a year to assure adequate understanding of the SPCC Plan for that facility. Such briefings must highlight and describe known discharges as described in §112.1(b) or failures, malfunctioning components, and any recently developed precautionary measures.*

Appropriate Facility personnel receive initial briefing on the contents of this SPCC Plan including discharge procedure protocols; pollution control laws, discharge prevention briefings, and general Facility operations. Follow-up training is conducted once per year on discharge procedure protocols; pollution control laws, rules, and regulations; general Facility operations; known discharges or failures that have occurred; malfunctioning components; and any recently developed precautionary measures.

§112.7(g): *Security (excluding oil production facilities). Describe in your Plan how you secure and control access to the oil handling, processing and storage areas; secure master flow and drain valves; prevent unauthorized access to*

starter controls on oil pumps; secure out-of-service and loading/unloading connections of oil pipelines; and address the appropriateness of security lighting to both prevent acts of vandalism and assist in the discovery of oil discharges.

Master drain valves on bulk storage tanks remain locked, plugged, or blinded. Pumps are secured by placing them in the "off" position when not in use. In addition, pumps are located in areas accessible to authorized personnel only. Loading/unloading connections are securely capped or blank-flanged when not in service or when in standby service for an extended period of time. Sufficient lighting is provided throughout the Facility to allow for spill detection as well as prevention and discovery of vandalism.

§112.7(h): *Facility tank car and tank truck loading/unloading rack (excluding offshore facilities).*

§112.7(h)(1): *Where loading/unloading rack drainage does not flow into a catchment basin or treatment facility designed to handle discharges, use a quick drainage system for tank car or tank truck loading/unloading racks. You must design any containment system to hold at least the maximum capacity of any single compartment of a tank car or tank truck loaded or unloaded at the facility.*

§112.7(h)(2): *Provide an interlocked warning light or physical barrier system, warning signs, wheel chocks or vehicle brake interlock system in the area adjacent to a loading/unloading rack, to prevent vehicles from departing before complete disconnection of flexible or fixed oil transfer lines.*

§112.7(h)(3): *Prior to filling and departure of any tank car or tank truck, closely inspect for discharges the lowermost drain and all outlets of such vehicles, and if necessary, ensure that they are tightened, adjusted, or replaced to prevent liquid discharge while in transit.*

This Facility does not utilize loading racks; therefore, this section of the regulation is not applicable.

§112.7(i): *If a field-constructed aboveground container undergoes a repair, alteration, reconstruction, or a change in service that might affect the risk of a discharge or failure due to brittle fracture or other catastrophe, or has discharged oil or failed due to brittle fracture failure or other catastrophe, evaluate the container for risk of discharge or failure due to brittle fracture or other catastrophe, and as necessary, take appropriate action.*

The storage containers at the Facility have had no major tank repairs or modifications that might affect the structural integrity of the steel. Facility management is aware that in the event modifications are made to storage containers, an evaluation must be conducted to determine if the structural integrity of the container is sufficient to safely manage the material to be stored and prevent brittle fracture or catastrophic failure. The storage containers are inspected using the American Petroleum Institute (API) Method 653 inspection procedures.

§112.7(j): *In addition to the minimal prevention standards listed under this section, include in your Plan a complete discussion of conformance with the applicable requirements and other effective discharge prevention and containment procedures listed in this part or any applicable more stringent State rules, regulations, and guidelines.*



EnLink has submitted a Spill Prevention Response Plan (SPRP) pursuant to W. Va. Code § 22-30-9.

§112.7(k): *Qualified Oil-filled Operational Equipment. The owner or operator of a facility with oil-filled operational equipment that meets the qualification criteria in paragraph (k)(1) of this sub-section may choose to implement for this qualified oil-filled operational equipment the alternate requirements as described in paragraph (k)(2) of this sub-section in lieu of general secondary containment required in paragraph (c) of this section.*

§112.7(k)(1): *Qualification Criteria—Reportable Discharge History: The owner or operator of a facility that has had no single discharge as described in §112.1(b) from any oil-filled operational equipment exceeding 1,000 U.S. gallons or no two discharges as described in §112.1(b) from any oil-filled operational equipment each exceeding 42 U.S. gallons within any twelve month period in the three years prior to the SPCC Plan certification date, or since becoming subject to this part if the facility has been in operation for less than three years (other than oil discharges as described in §112.1(b) that are the result of natural disasters, acts of war or terrorism); and*

§112.7(k)(2): *Alternative Requirements to General Secondary Containment. If secondary containment is not provided for qualified oil-filled operational equipment pursuant to paragraph (c) of this section, the owner or operator of a facility with qualified oil-filled operational equipment must:*

- (i) *Establish and document the facility procedures for inspections or a monitoring program to detect equipment failure and/or a discharge; and*
- (ii) *Unless you have submitted a response plan under §112.20, provide in your Plan the following:*
 - (A)** *An oil spill contingency plan following the provisions of part 109 of this chapter.*
 - (B)** *A written commitment of manpower, equipment, and materials required to expeditiously control and remove any quantity of oil discharged that may be harmful.*

The Brine Well #4 SWD Facility has not had a single discharge into navigable waters of any oil-filled operational equipment exceeding 1,000 U.S. gallons or two (2) discharges exceeding 42 U.S. gallons in the past five (5) years.

The Facility is equipped with safety alarm devices, shut-in valves, and secondary containment (storage tanks) to protect against discharge to navigable water as a result of equipment failure or malfunction.

Flow lines and gathering pipelines are equipped with various protection systems (e.g., wrapped/coated piping, cathodic protection, pressure shut down systems, etc.), and visually inspected, where exposed.

2.8 40 CFR PART 112.8 – Spill Prevention, Control and Countermeasure Plan Requirements for Onshore Facilities (Excluding Production Facilities)

§112.8: *If you are the owner or operator of an onshore facility (excluding a production facility), you must:*

§112.8(a): *Meet the general requirements for the Plan listed under §112.7, and the specific discharge prevention and containment procedures listed in this section.*

§112.8(b): *Facility drainage. (1) Restrain drainage from diked storage areas by valves to prevent a discharge into the drainage system or facility effluent treatment system, except where facility systems are designed to control*

such discharge. You may empty diked areas by pumps or ejectors; however, you must manually activate these pumps or ejectors and must inspect the condition of the accumulation before starting, to ensure no oil will be discharged. (2) Use valves of manual, open-and-closed design, for the drainage of diked areas. You may not use flapper-type drain valves to drain diked areas. If your facility drainage drains directly into a watercourse and not into an on-site wastewater treatment plant, you must inspect and may drain uncontaminated retained stormwater, as provided in paragraphs (c)(3)(ii), (iii), and (iv) of this section.

Water is visually inspected prior to any discharge. If a sheen is observed, the accumulated water will be treated using sorbent or other applicable means. Dike draining events are inspected and are logged in the Facility Drainage System Form (Exhibit 4).

Table 1 includes the potential failure scenarios and Table 2 includes the secondary containment calculation.

§112.8(b)(3): Design facility drainage systems from undiked areas with a potential for a discharge (such as where piping is located outside containment walls or where tank truck discharges may occur outside the loading area) to flow into ponds, lagoons, or catchment basins designed to retain oil or return it to the facility. You must not locate catchment basins in areas subject to periodic flooding.

Absorbent materials are located in various locations throughout the Facility. Oil released will be removed using a vacuum truck if there is sufficient volume.

Leaks will be detected by Facility personnel during daily walk-throughs and monthly documented inspections. ASTs at the Facility are visited at a minimum of once a day by EnLink Facility personnel. Routine visual inspections are documented if a condition is found.

In the event that a leak or discharge is detected, Facility personnel will take appropriate measures to safely stop and contain the discharge. If the discharge is significant, the designated person accountable for oil spill prevention, and/or the Facility Response Coordinator will be notified. The procedures for responding to spills are located in Section 3.0 of this SPCC Plan.

The Facility is equipped with safety alarm devices, shut-in valves and secondary containment (storage tanks) to protect against oil discharges to navigable water as a result of equipment failure or malfunction. The safety alarm device for each tank is listed on Table 1.

§112.8(b)(4): If facility drainage is not engineered as in paragraph (b)(3) of this section, equip the final discharge of all ditches inside the facility with a diversion system that would, in the event of an uncontrolled discharge, retain oil in the facility.

Discharge (spills) from undiked areas will be contained with booms, absorbent material, drip pans, or removed using a vacuum truck if there is sufficient volume.

§112.8(b)(5): Where drainage waters are treated in more than one treatment unit and such treatment is continuous, and pump transfer is needed, provide two “lift” pumps and permanently install at least one of the pumps. Whatever techniques you use, you must engineer facility drainage systems to prevent a discharge as described in §112.1(b) in case there is an equipment failure or human error at the facility.

This section of the regulation is not applicable to the Facility.

§112.8(c): Bulk storage containers. **(1)** Not use a container for the storage of oil unless its material and construction are compatible with the material stored and conditions of storage such as pressure and temperature.

Bulk storage containers are constructed of a material that is compatible with the material being stored and the conditions of storage (including pressure and temperature). Storage facilities have been fail-safe engineered, as far as practicable, to prevent spills.

§112.8(c)(2): Construct all bulk storage tank installations (except mobile refuelers and other non-transportation-related tank trucks) so that you provide a secondary means of containment for the entire capacity of the largest single container and sufficient freeboard to contain precipitation. You must ensure that diked areas are sufficiently impervious to contain discharged oil. Dikes, containment curbs, and pits are commonly employed for this purpose. You may also use an alternative system consisting of a drainage trench enclosure that must be arranged so that any discharge will terminate and be safely confined in a facility catchment basin or holding pond.

Secondary containment for the SPCC-related storage tank is provided by a steel berm. Details of the storage area, its secondary containment, and its capability to hold the contents of the largest tank are included in Tables 1 and 2.

§112.8(c)(3): Not allow drainage of uncontaminated rainwater from the diked area into a storm drain or discharge of an effluent into an open watercourse, lake, or pond, bypassing the facility treatment system unless you:

- (i)** Normally keep the bypass valve sealed closed;
- (ii)** Inspect the retained rainwater to ensure that its presence will not cause a discharge as described in §112.1(b);
- (iii)** Open the bypass valve and reseal it following drainage under responsible supervision; and
- (iv)** Keep adequate records of such events, for example, any records required under permits issued in accordance with §§122.41(j)(2) and 122.41(m)(3) of this chapter.

Drainage from the diked area is controlled by a manual valve kept closed and locked except during intentional draining events. Water is visually inspected prior to opening the drain valves. If a sheen is observed, the accumulated water will be treated using sorbent or other applicable means. Dike draining events are inspected and are logged in the Facility Drainage System Form (Exhibit 4).

§112.8(c)(4): Protect any completely buried metallic storage tank installed on or after January 10, 1974 from corrosion by coatings or cathodic protection compatible with local soil conditions. You must regularly leak test such completely buried metallic storage tanks.

The Facility has no completely buried tanks.



§112.8(c)(5): *Not use partially buried or bunkered metallic tanks for the storage of oil, unless you protect the buried section of the tank from corrosion. You must protect partially buried and bunkered tanks from corrosion by coatings or cathodic protection compatible with local soil conditions.*

The Facility has no partially buried tanks.

§112.8(c)(6): *Test or inspect each aboveground container for integrity on a regular schedule and whenever you make material repairs. You must determine, in accordance with industry standards, the appropriate qualifications for personnel performing tests and inspections, the frequency and type of testing and inspections, which take into account container size, configuration, and design (such as containers that are: shop-built, field-erected, skid-mounted, elevated, equipped with a liner, double-walled, or partially buried). Examples of these integrity tests include, but are not limited to: visual inspection, hydrostatic testing, radiographic testing, ultrasonic testing, acoustic emissions testing, or other systems of non-destructive testing. You must keep comparison records and you must also inspect the container's supports and foundations. In addition, you must frequently inspect the outside of the container for signs of deterioration, discharges, or accumulation of oil inside diked areas. Records of inspections and tests kept under usual and customary business practices satisfy the recordkeeping requirements of this paragraph.*

Qualified Facility personnel perform and document, at a minimum, monthly visual inspections of SPCC-related storage tanks, valves, and unloading areas in accordance with Facility operating procedures. Tanks and containers are inspected for visible signs of damage or stress including cracks, leaks, and corrosion. Secondary containment structures are inspected for leaks, cracks, erosion, standing water, debris, trash, etc.

Visual inspections of storage vessels must be combined with other non-destructive shell testing, and comparison records must be kept. Tanks are integrity inspected and tested every 10 years in accordance with API guidelines or other nationally recognized guidelines. Integrity tests are compared to previous integrity inspections as required by appropriate guidelines to determine if repair or maintenance to the tank system is required. Integrity inspection records are maintained for the life of the tanks.

§112.8(c)(7): *Control leakage through defective internal heating coils by monitoring the steam return and exhaust lines for contamination from internal heating coils that discharge into an open watercourse, or pass the steam return or exhaust lines through a settling tank, skimmer, or other separation or retention system.*

This section of the regulation is not applicable to the Facility.

§112.8(c)(8): *Engineer or update each container installation in accordance with good engineering practices to avoid discharges. You must provide at least one of the following devices:*

- (i) High liquid level alarms with an audible or visual signal at a constantly attended operation or surveillance Terminal. In smaller facilities an audible air vent may suffice.*
- (ii) High liquid level pump cutoff devices set to stop flow at a predetermined container content level.*
- (iii) Direct audible or code signal communication between the container gauger and the pumping Terminal.*



- (iv) *A fast response system for determining the liquid level of each bulk storage container such as digital computers, telepulse, or direct vision gauges. If you use this alternative, a person must be present to monitor gauges and the overall filling of bulk storage containers.*
- (v) *You must regularly test liquid level sensing devices to ensure proper operation.*

The produced water solution bulk storage tanks are equipped with side reading automatic gauges and high level alarms. The automatic gauges and high level alarms are monitored from the Operations Control Center (OCC). The gauge is inspected monthly to verify its operational integrity.

§112.8(c)(9): *Observe effluent treatment facilities frequently enough to detect possible system upsets that could cause a discharge as described in §112.1(b).*

This section of the regulation is not applicable to the Facility.

§112.8(c)(10): *Promptly correct visible discharges which result in a loss of oil from the container, including but not limited to seams, gaskets, piping, pumps, valves, rivets, and bolts. You must promptly remove any accumulations of oil in diked areas.*

Visual oil leaks from containers are promptly corrected. Guidelines for the cleanup and disposal of any spilled material can be found in Section 3.0.

§112.8(c)(11): *Position or locate mobile or portable oil storage containers to prevent a discharge as described in §112.1(b). Except for mobile refuelers and other non-transportation-related tank trucks, you must furnish a secondary means of containment, such as a dike or catchment basin, sufficient to contain the capacity of the largest single compartment or container with sufficient freeboard to contain precipitation.*

Mobile 55-gallon drums of turbine oil are used at the Facility. Currently, these drums are located inside of a building, however, if these drums are removed, the Facility ensures the drums are located within the appropriate secondary containment with sufficient capacity to hold 110% of the largest mobile container.

§112.8(d): *Facility transfer operations, pumping, and facility process. (1) Provide buried piping that is installed or replaced on or after August 16, 2002, with a protective wrapping and coating. You must also cathodically protect such buried piping installations or otherwise satisfy the corrosion protection standards for piping in part 280 of this chapter or a State program approved under part 281 of this chapter. If a section of buried line is exposed for any reason, you must carefully inspect it for deterioration. If you find corrosion damage, you must undertake additional examination and corrective action as indicated by the magnitude of the damage.*

Pipelines into the Facility and product lines exiting the Facility are cathodically protected against corrosion. If a section of buried line is exposed, it will be inspected for deterioration. If deterioration is detected, additional examinations and corrective action measures will be implemented. Additional information can be found in the EnLink Corrosion Manual.

§112.8(d)(2): *Cap or blank-flange the terminal connection at the transfer point and mark it as to origin when piping is not in service or is in standby service for an extended time.*

The terminal connection for any piping that is not in service or in standby service for an extended time is/will be capped or blind-flanged, and will either be demolished or marked as to origin.

§112.8(d)(3): *Properly design pipe supports to minimize abrasion and corrosion and allow for expansion and contraction.*

Pipe supports are designed to minimize abrasion and corrosion and allow for expansion and contraction, hence minimizing the potential for pipe leaks potentially resulting in a spill.

§112.8(d)(4): *Regularly inspect all aboveground valves, piping, and appurtenances. During the inspection you must assess the general condition of items, such as flange joints, expansion joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces. You must also conduct integrity and leak testing of buried piping at the time of installation, modification, construction, relocation, or replacement.*

The monthly visual inspection will assess the general condition of flange joints, expansion joints, valve glands and bodies, catch pans, hose supports, locking of valves, and metal surfaces. Records of these inspections are kept on file for a minimum of five (5) years. If installation, modifications, construction, relocations, or replacement of additional buried piping is required, integrity and leak testing will be performed.

§112.8(d)(5): *Warn all vehicles entering the facility to be sure that no vehicle will endanger aboveground piping or other oil transfer operations.*

Vehicular traffic into the Facility is carefully monitored and kept to a minimum. Signage is placed at the entrance to the Facility warning drivers of above-ground piping.

2.9 40 CFR PART 112.9, 112.10, 112.11, and 112.12

These sections of the regulation are not applicable to this Facility.

2.10 40 CFR PART 112.20 – Facility Response Plans

§112.20(a): *The owner or operator of any non-transportation-related onshore facility that, because of its location, could reasonably be expected to cause substantial harm to the environment by discharging oil into or on the navigable waters or adjoining shorelines shall prepare and submit a facility response plan to the Regional Administrator, according to the following provisions:*

Based on the Substantial Harm Criteria Applicability Form (Exhibit 5), the Facility does not have the potential to cause substantial harm to the environment in the event of a discharge.

Section 3.0 40 CFR Part 112.7.a.5 - Guidelines for Cleaning Up Spills

Facility personnel are required to perform Facility walk-throughs during daily activities. Facility personnel also perform monthly area inspections throughout the Facility. These inspections facilitate prompt discharge discovery in the event of equipment failure.

Standard Operating Procedures ensure prompt discovery of a discharge by requiring appropriate Facility personnel to be in attendance at all times during unloading operations.

Potential spills may occur from equipment failure (e.g., tank rupture or leaks) or operational error (e.g., tank overflow). Potential spills may be expected primarily in the storage tank area. Spills may range from relatively minor occurrences (e.g., small leaks or drips) to major occurrences (e.g., catastrophic failure of a hose) as outlined in Table 1.

In the event of a minor spill, the material will be recovered and re-used, if possible. Otherwise, it will be absorbed using dirt, sand, absorbent pads, or loose absorbent material and disposed of properly at a permitted Facility.

The following corrective actions and countermeasures will be implemented in the event of a major spill or release.

1. Contact the EnLink Operations Control Center.
2. Eliminate potential spark sources, and if possible and safe to do so, identify and shut down the source of the discharge.
3. Contain the spilled material within the secondary containment or, if outside the secondary containment, by using oil absorbent, granular absorbent and/or absorbent pads, to the greatest extent possible to reduce the area of the spill.
4. Once the material is confined, immediately notify the Qualified Individual (QI) of the type, estimated amount, and location of the spilled material.
5. If the spilled material escapes the diked area and causes a film or sheen upon or discoloration of the surface of a receiving water or violates water quality standards, the QI will immediately notify the National Response Center and appropriate United States Coast Guard personnel.
6. The QI will immediately notify an outside spill cleanup contractor if outside assistance is required.
7. The QI will document the spill by completing the EnLink Environmental Incident Report Form (Appendix E) and will provide proper written notification to appropriate agencies.
8. The recovered materials will be placed in designated containers for recycle or disposal at an approved permitted facility.

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Original to [illegible]
[illegible]

In summary, the nature of Facility operations, in combination with secondary containment and other control measures, provides considerable protection from the possibility of spilled material reaching waters of the State of West Virginia.

3.1 Notification Regulations and Procedures for Unauthorized Discharges

The Oil Pollution Act (40 CFR 110) requires all spills that reach navigable waterways have to be reported as soon as possible to the National Response Center (NRC) at the toll free number 1 (800) 424-8802. The NRC will then notify local authorities responsible for coordinating spill control.

Upon discovery of a spill, The Qualified Individual (QI) or Alternate QI must be notified immediately.

Qualified Individual (QI)	
Steve Cornelison, Director of Operations <i>Primary Qualified Individual (QI)</i>	Office: (304) 665-2461 Cell: (304) 679-4154
Derrick Lamp, Facility Foreman <i>Alternate Qualified Individual (AQI)</i>	Office: (304) 665-2461 Cell: (740) 891-1912
Steve Cunningham, Pipeline Foreman <i>Alternate Qualified Individual (AQI)</i>	Office: (304) 354-9331 Cell: (790) 328-5042

In addition to the QI/AQI the following company personnel are to be notified:

Corporate Personnel	
Stan Golemon, Sr. V.P. Engineering and Operations	Office: (214) 953-9529 Cell: (214) 240-8086
Michael LeBlanc, V.P. Operations	Office: (225) 692-6936 Cell: (985) 688-6835
Sean Atkins, V.P. Environmental Health and Safety	Office: (214) 721-9360 Cell: (469) 417-9612
Herb Harless Director of Health and Safety	Office: (214) 721-9376 Cell: (281) 545-8388
Kent Veron Director of Environmental Compliance	Office: (214) 721-9592 Cell: (225) 773-7127
EnLink Pipeline Control Center	(866) 394-9839

In the event the Facility has a discharge of more than 1,000 U.S. gallons of oil into navigable waters in a single event, or two (2) discharges or more of 42 gallons or more in a 12 month period of time, Facility personnel will submit the following information within 60 days of the

spill event to the EPA Regional Administrator, and within 30 days to the West Virginia Environmental Protection Agency.

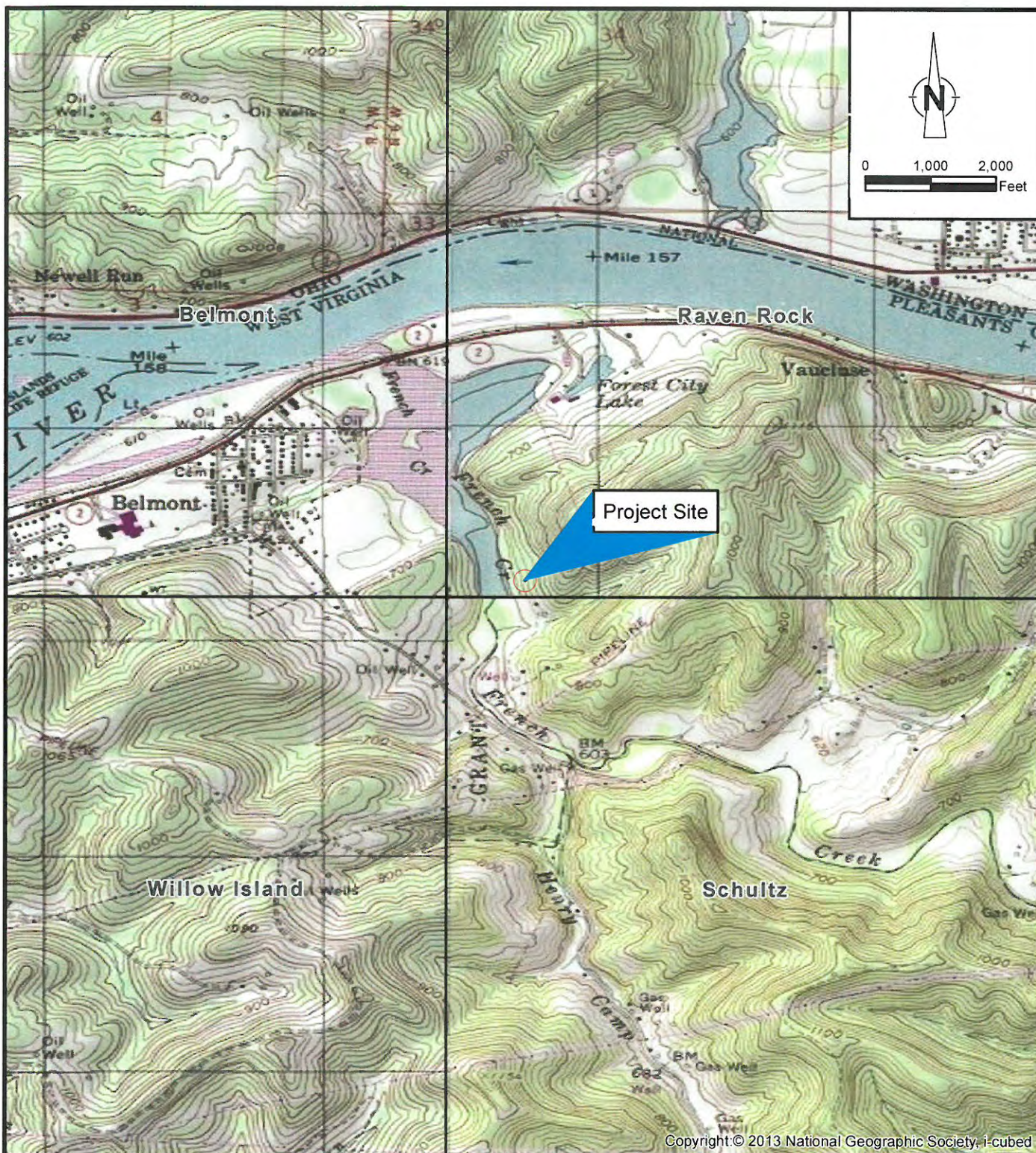
- (1) Name of the facility
- (2) Name of person submitting written notification
- (3) Location of the facility
- (4) Maximum storage or handling capacity of the facility and normal daily throughput;
- (5) Corrective action and countermeasures taken, including a description of equipment repairs and replacements
- (6) An adequate description of the facility, including maps, flow diagrams, and topographical maps, as necessary
- (7) The cause of such discharge as described in 40 CFR 112.1(b), including a failure analysis of the system or subsystem in which the failure occurred
- (8) Additional preventive measures taken or contemplated to minimize the possibility of recurrence; and
- (9) Such other information as the EPA Regional Administrator may reasonably require pertinent to the Plan or discharge.



Figures



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SOURCE: USGS 7.5 Minute Topographic Maps.
 "WILLOW ISLAND, BELMONT, SCHULTZ, AND RAVEN ROCK WEST VIRGINIA AND OHIO"

LAT/LONG: 39.375679 NORTH, -81.246753 WEST
 COORDINATE: NAD83 DATUM, DECIMAL DEGREES



figure 1
 VICINITY MAP
 BRINE WELL # 4 SWD
 ST MARYS, WEST VIRGINIA
 EnLink Midstream

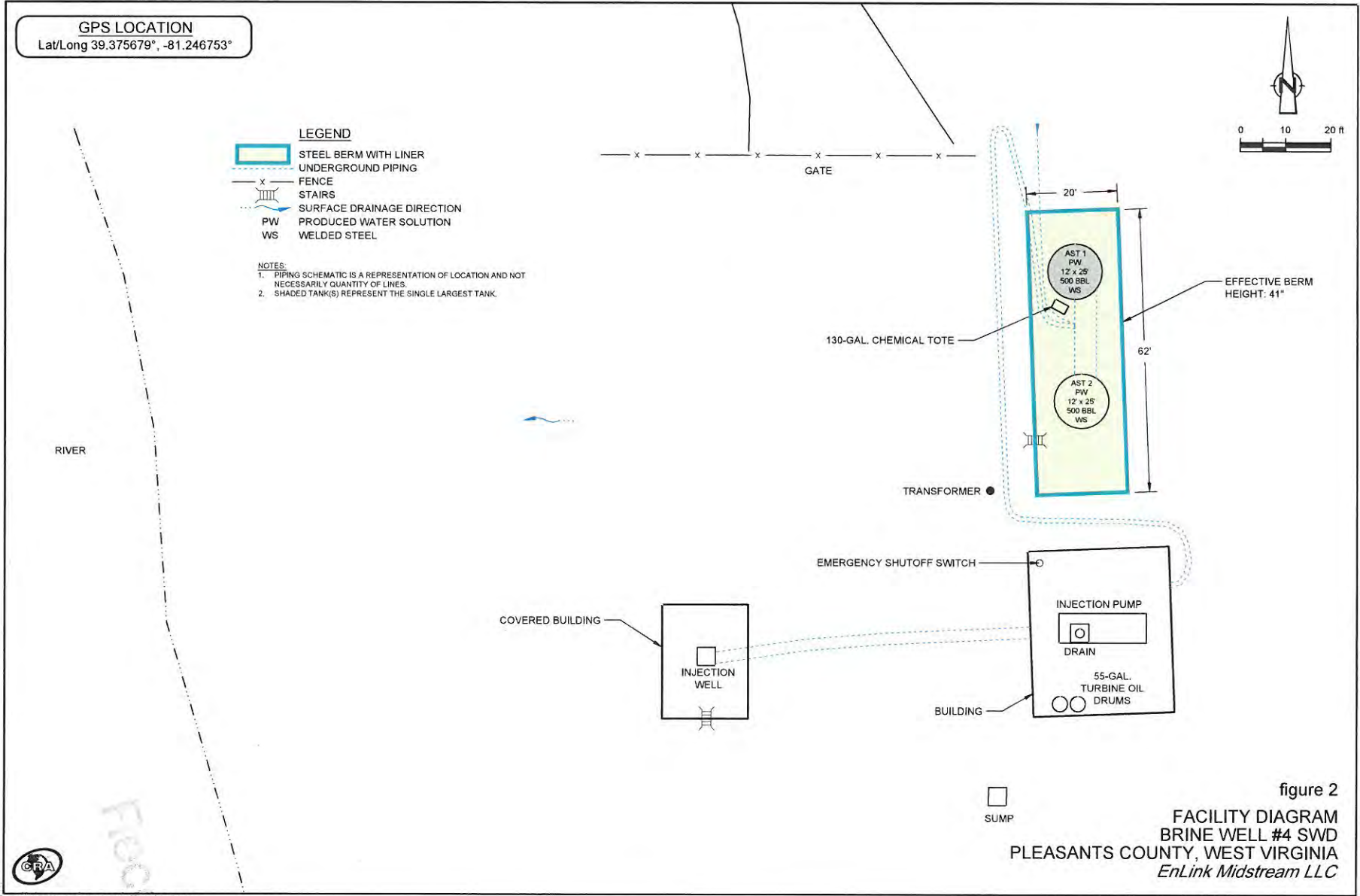


figure 2
FACILITY DIAGRAM
BRINE WELL #4 SWD
PLEASANTS COUNTY, WEST VIRGINIA
EnLink Midstream LLC

Tables



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Table 1

Oil Handling and Secondary Containment Capacity Summary
Brine Well #4 SWD
EnLink Midstream

Tank ID	Material Stored	Container Size (bbls)	Container Type/Design Standard/ Fabrication	Year Installed	Overflow Fail Safe ^a	Roof Type	Type of Worst Case Failure; Alternative Types of Failures	Type of Secondary Containment	Largest Container Capacity within Containment		Gross Secondary Containment Volume	Precipitation Freeboard Available after 100% Release of Largest Container + a 25-yr 24-hr Rainfall	Predicted Direction & Flow Rate if Uncontained or Containment Fails
									gals	bbls	gals	gals	
Aboveground Oil Storage Tank(s)												Excess/Deficiency	
AST 1	Produced Water Solution	500	Steel/Shop Fabricated	2012	DV, HHA	Vertical Fixed Roof	Instantaneous ¹ ; Rupture/Leak/Overfill	Steel with Liner	21,000	500	31,692	4,323	Secondary containment is sufficient for a largest container release plus a 25-yr 24-hr rainfall event. If oil were released, it would flow toward the west; flow rate will be relative to size of release.
AST 2	Produced Water Solution	500	Steel/Shop Fabricated	2012	DV, HHA	Vertical Fixed Roof	Instantaneous ¹ ; Rupture/Leak/Overfill	Steel with Liner	21,000	500			
Truck Loading/Unloading Areas ^a													
No Truck Loading at this Facility.													

Notes:

- 1 - Instantaneous failure equates to the total volume of the containment released in less than 1 minute.
 2 - Loading/unloading area does not need to have sized secondary containment.
 3 - DV- Direct Visual, HHA- High High Level Alarm

WV Dept. of Environmental Protection
 Office of Oil and Gas
 CRA 089077 (18)
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Table 2

Secondary Containment Calculations
Brine Well #4 SWD
EnLink Midstream

Secondary Containment Area	
Containment Type	Steel with Liner
Length (ft)	62.00
Width (ft)	20.00
Height (ft)	3.42
Containment Volume (gals)	31,692.47

Largest Tank 1 - 500 bbl Produced Water Solution Tank	
Largest Tank Shell Volume (gals)	21,000.00

Displacements	
1-500 bbl Produced Water Solution Tank (gals)	2,890.59

Calculation Summary	
Containment Volume (gals)	31,692.47
Rainfall Displacement Volume (gals)	3,478.44
Largest Tank Shell Volume (gals)	21,000.00
Total Displaced Volume (gals)	2,890.59
Excess/ Deficiency for a 100% release plus a 25-yr 24-hr rainfall (gals)	4,323.44

NOAA 25-YR 24-HR [Technical Paper 40, Rainfall Frequency Atlas of the United States for Durations from 30 minutes to 24 Hours and Return Periods from 1 to 100 Years (1961)]	
Rainfall (in)	4.50
Area (ft ²)	1,240.00
Rainfall Displacement Volume (gals)	3,478.44

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 NOV 13 2015
 WV Dept. of Environmental Protection
 Office of Oil and Gas
 CRA-089077 (18)

Appendices



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Appendix A

Professional Engineer Certification



Appendix A

BRINE WELL #4 SWD – ST.MARYS, WEST VIRGINIA

40 CFR Part 112.3.D.1 - PROFESSIONAL ENGINEER CERTIFICATION

I have reviewed and evaluated the Spill Prevention, Control, and Countermeasure Plan for the Brine Well #4 SWD – St.Marys, West Virginia.

I hereby certify that:

- (i) I am familiar with the requirements of 40 CFR 112;
- (ii) I or my agent visited and examined the facility;
- (iii) This Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and with the requirements set forth by 40 CFR 112;
- (iv) The procedures for inspections and testing as required by 40 CFR 112 have been established; and
- (v) This Plan is adequate for the Brine Well #4 – St.Marys, West Virginia.

Certified by:

Ashley P. Valentine
Professional Engineer

Ashley P. Valentine
Signature

5/19/15
Date Reviewed

66785
State Registration Number



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Appendix B
SPCC Plan Revision Log



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APR 14 2015
1:00 PM
CONESTOGA-ROVERS & ASSOCIATES

**APPENDIX B
SPCC PLAN REVISION LOG
BRINE WELL #4 SWD**

This appendix lists the previous revisions to the SPCC Plan prior to this Plan. Non-technical and Technical amendments are located in Appendix B-1 and B-2, respectively.

Review/Amendment Date	Description of Review/Amendment	Affected Pages	P.E. Certification



APPENDIX B-1
TYPICAL SPCC PLAN REVIEW AND EVALUATION FORM
BRINE WELL #4 SWD – ST.MARYS, WEST VIRGINIA
[40 CFR 112.5.b]

The SPCC Plan will be reviewed and evaluated, at a minimum, once every five years. Each review is documented below and indicates if the Plan required amendment. All technical amendments will be certified by a Professional Engineer and documented in Appendix B-2. Administrative amendments will be documented in Appendix B-1.

I have reviewed and evaluated the SPCC Plan for Brine Well #4 SWD, West Virginia. Based on my review and evaluation, the Plan was

Amended/Not Amended

Signature, Date

Amended/Not Amended

Signature, Date

Amended/Not Amended

Signature, Date

Amended/Not Amended

Signature, Date

Amended/Not Amended

Signature, Date

Amended/Not Amended

Signature, Date

Amended/Not Amended

Signature, Date

Amended/Not Amended

Signature, Date

APPENDIX B-2
TYPICAL SPCC PLAN CERTIFICATION FOR TECHNICAL AMENDMENTS
BRINE WELL #4 SWD
[40 CFR 112.5.B]

PROFESSIONAL ENGINEER CERTIFICATION

I have reviewed and evaluated the Spill Prevention, Control, and Countermeasure Plan for the Brine Well #4 SWD – St. Marys, West Virginia.

I hereby certify that:

- (i) I am familiar with the requirements of 40 CFR 112;
- (ii) I or my agent visited and examined the facility;
- (iii) This Plan has been prepared in accordance with good engineering practice, including consideration of applicable industry standards and with the requirements set forth by 40 CFR 112;
- (iv) The procedures for inspections and testing as required by 40 CFR 112 have been established; and
- (v) This Plan is adequate for the Brine Well #4 SWD – St. Marys, West Virginia.

Certified by:

Professional Engineer

Signature

Date Reviewed

State Registration Number



Received

NOV 10 2015
Office of the State Engineer
1100 11th Street, NW
Washington, DC 20540

Appendix C Management Approval



Received

NOV 14 2015

Appendix C
Management Approval
BRINE WELL #4 SWD – ST.MARYS, WEST VIRGINIA
[40 CFR 112.7]

I hereby approve the contents of this Spill Prevention, Control, and Countermeasure Plan (SPCC Plan) and have the authority to commit the necessary resources to implement the SPCC Plan. The SPCC Plan is, to the best of my knowledge, true and accurate. This Plan has the full approval of the EnLink Midstream management and will be implemented as required by 40 CFR 112.7.

The position of Director of Operations is the designated person accountable for oil spill prevention at the Facility.

Steve Cornelison
Director of Operations
EnLink Midstream

Date

Appendix C
Management Approval
BRINE WELL #4 SWD – ST.MARYS, WEST VIRGINIA
[40 CFR 112.7]

I hereby approve the contents of this Spill Prevention, Control, and Countermeasure Plan (SPCC Plan) and have the authority to commit the necessary resources to implement the SPCC Plan. The SPCC Plan is, to the best of my knowledge, true and accurate. This Plan has the full approval of the EnLink Midstream management and will be implemented as required by 40 CFR 112.7.

The positions of Facility Foreman and Pipeline Foreman are the alternate designated persons accountable for oil spill prevention at the facility.

Derrick Lamp
Facility Foreman
EnLink Midstream

Date

Steve Cunningham
Pipeline Foreman
EnLink Midstream

Date

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Appendix D Inspection Program



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NOV 11 2015

Appendix D Inspection Program Brine Well #4 SWD – St. Marys, West Virginia

Records of inspections and tests required by 40 CFR part 112 signed by the appropriate supervisor or inspector must be kept with the SPCC Plan for a period of three years. Records of inspections and tests conducted under usual and customary business practices will suffice. Documentation of the following inspections and tests should be kept with the SPCC Plan.

Note: This is intended to be a generalized listing of inspection and testing procedures. Additional pages/forms may be added to this plan as needed to record specific equipment inspection and testing results.

Daily Inspection Procedures:

Tanks, Equipment and Piping: (Note—Satellite wells/piping/etc. will be inspected as/when visited.)

1. Visually inspect storage tanks, particularly following a sudden change in atmospheric temperature, to detect possible system upsets capable of causing a discharge.
2. Visually inspect visible portion of piping for leaks and the area over buried and/or submerged portions of piping for evidence of leaks (i.e., soil stains, sheens, bubbles, etc.).
3. Visually inspect all equipment for proper operation and condition, including gauges, sight glasses, level controls, pressure controls, and signs of connection leaks.
4. Visually inspect control valve packing and pump packing for leaks.
5. Visually inspect all block valves, unions, flange connections, and piping for leaks.
6. Inspect traps, drip pans, drains, and sumps for oil accumulation and proper operation of level controls and pumps.
7. Inspect tank seams, surfaces, and bases for leaks and external corrosion. Special attention should be given to seams and locations where piping contacts the ground or waterline.
8. Visually inspect vent system outlets and sump piping or gutters to ensure they are not obstructed.
9. Inspect area surrounding tanks, piping and equipment for oil sheens or accumulations, spilled material, soil discoloration, or stressed vegetation.

Secondary Containment:

1. Inspect secondary containment for integrity and surrounding area for sheens or accumulations.
2. Inspect containment for level of precipitation versus available capacity, side and floor permeability, debris, and erosion.
3. Inspect area surrounding containment for presence of spilled material, debris, or stressed vegetation.

Note: Daily visual inspections are usually not recorded. Record as described below if a repair is required.

Monthly Inspection Procedures:**Daily Inspection Items:**

The items listed as part of the daily inspection procedures will be documented during the monthly inspection.

Equipment:

Follow the inspection and testing procedures for the facility's pollution prevention equipment and systems:

1. Sump Systems and Sump Pumps
2. Pumps used to drain diked areas (if applicable)
3. Spare Pumps

Annual Inspection Procedures:**Tanks, Supports, and Foundations:**

1. Inspect tank supports, stairways, and walkways for evidence of deterioration.
2. Verify the integrity of all tank foundations and shells.
3. Determine that tank capacity is appropriate for anticipated volumes.
4. Verify that tanks are equipped with unobstructed equalizing lines and functional hatches, vent valves, and flame arrestors (as applicable).
5. Verify the integrity of secondary containment systems (as applicable).
6. Test all high level shutdown devices to assure proper setting and operation.

Flow-through process vessels and operational equipment: (See Table 1)

1. Verify the integrity of secondary containment systems.
2. Inspect any flow-through process vessels and operational equipment lacking secondary containment (Table 1) for leaks, corrosion, or other condition that could lead to a discharge.
3. Inspect surrounding areas for presence of spilled material.

Record the date of inspection and inspector's initials on Tank and Equipment Inspection Form. If inspection / testing reveal repairs are required, report malfunctioning equipment and subsequent repair / replacement on Tank Inspection / Maintenance Record Form.

Appendix E Incident Report Forms



Notification Data Sheet

The Facility will utilize the following form to relate information in the event of a discharge:

Date: _____ Time: _____

INCIDENT DESCRIPTION

Reporter's Full Name: _____ Position: _____
Day Phone Number: _____ Evening Phone Number: _____
Company: _____ Organization Type: _____
Facility Address: _____ Owner's Address: _____

Facility Latitude: _____ Facility Longitude: _____

Spill Location: _____

(if not at Facility)

Responsible Party's Name: _____ Phone Number: _____

Responsible Party's Address: _____

Source and/or cause of discharge: _____

Nearest City: _____

County: _____ State: _____ Zip code: _____

Section: _____ Township: _____ Range: _____ County: _____

Distance from City: _____ Direction from City: _____

Container Type: _____ Container Storage Capacity: _____

Facility Oil Storage Capacity: _____

Material: _____

Total Quantity Released	Water Impact (YES or NO)	Quantity into Water

RESPONSE ACTION(S)

Action(s) taken to Correct, Control, or Mitigate Incident: _____

Number of Injuries: _____ Number of Deaths: _____

Evacuation(s): _____ Number Evacuated: _____

Damage Estimate: _____

More information about impacted medium: _____

CALLER NOTIFICATIONS

National Response Center (NRC): 1-800-424-8802

Additional Notifications (Circle all applicable): State Other

ADDITIONAL INFORMATION

Any information about the incident not recorded elsewhere in this report: _____

NOTE: DO NOT DELAY NOTIFICATION PENDING COLLECTION OF ALL INFORMATION.

Submittal of Information to Regional Administrator for Qualified Discharge(s)

In the event of a qualified discharge or discharges, this page can be utilized to provide official notification to the Regional Administrator. If the Facility has had a discharge or discharges which meet one of the following two criteria, then this report must be submitted to the Regional Administrator within 60 days. (Check as appropriate)

- ☐ This Facility has experienced a reportable spill as referenced in 40 CFR Part 112.1(b) of 1,000 gallons or more.
- ☐ This Facility has experienced two (2) reportable spills (as referenced in 40 CFR Part 112.1(b)) of greater than 42 gallons each within a 12-month period.

Facility Name and Location: _____

Facility Contact Person (Name, address/phone number): _____

Facility maximum storage or handling capacity: _____

Facility normal daily throughput: _____

Describe the corrective action and countermeasures taken (include description of equipment repairs and replacements): _____

Describe the Facility (maps, flow diagrams, and topographical maps attached as necessary): _

Describe the cause of discharge (as referenced in 40 CFR Part 112.1(b)) including failure analysis of the system:

Describe the preventive measures taken or contemplated to be taken to minimize the possibility of recurrence: _____

Other pertinent information: _____

- A copy of this report is also to be sent to the appropriate state agency in charge of oil pollution control activities.

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Exhibits

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Exhibit 1
40 CFR PART 112.7.A.3.VI – Contacts

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Exhibit 1
Contacts
Brine Well #4 SWD – St. Marys, West Virginia
[40 CFR PART 112.7.A.3.VI]

A complete list of emergency phone numbers is provided in Exhibit 2.

<i>Contact</i>	<i>Telephone (office)</i>	<i>Home/Cell</i>
Steve Cornelison, Director of Operations	304-665-2461	304-679-4154
Derrick Lamp, Facility Foreman	304-665-2461	740-891-1912
Steve Cunningham, Pipeline Foreman	304-354-9331	740-328-5042
Local Emergency Assistance Departments		
National Response Center	800-424-8802	N/A
West Virginia Department of Environmental Protection Spill Line	800-642-3074	N/A
US EPA, Region III Emergency Response Hotline	800-438-2474 215-814-5000	N/A
St. Marys Fire Department	911 or 304-684-7122	N/A
Wetzel County Hospital	911 or 304-758-5100	N/A
Pleasants County Sheriff Department	911 or 304-684-2285	N/A



Exhibit 2
Emergency Phone Numbers



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Exhibit 2
Emergency Phone Numbers
Brine Well #4 SWD – St. Marys, West Virginia

FACILITY CONTACTS

Steve Cornelison, Director of Operations	Office: (304) 665-2461 Cell: (304) 679-4154
Derrick Lamp, Facility Foreman	Office: (304) 665-2461 Cell: (740) 891-1912

FEDERAL, STATE, AND LOCAL AGENCIES

West Virginia Department of Environmental Protection Spill Line	(800) 642-3074
National Response Center (NRC)	(800) 424-8802
St. Mary's Fire Department	911 or (304) 684-7122
Pleasants County Sheriff Department	911 or (304) 684-2285
US EPA, Region III Emergency Response Hotline	(800) 438-2474 or (215) 814-5000

MISCELLANEOUS EMERGENCY TELEPHONE NUMBERS

Chemtrec	(800) 424-9300
Safetec	(800) 704-9215
Emergency Planning & Community Right to Know OSHA – Occupational Safety and Health Administration	(800) 321-6742
Substance Identification	(800) 848-6538

SPILL RESPONSE CONTRACTOR

BBU Services	(800) 837-8064
Weavertown Environmental Group	(800) 746-4850



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NESTOGA-ROVERS ASSOCIATES



SPCC SITE INSPECTION FORM

Inspector Name and Title:

Inspection Location/Tank ID:

Inspection Date:

Complete 1 form for each tank storing oil (slop oil, condensate, lube oil, etc.).
Retain completed and signed forms within facility's records for at least 5 years.

Visually inspect each tank's outer shell & foundation noting the following:

1	Presence of drips, leaks or weeps	☐ No	☐ Yes		*Ask your EH&S representative for proper labels & NFPA designations
2	Presence of discoloration or stains	☐ No	☐ Yes		
3	Presence of early signs of corrosion	☐ No	☐ Yes		
4	Liquid level gauge in good working condition	☐ Yes	☐ No		
5	Paint and/or insulation in good condition	☐ Yes	☐ No		
6	Tank has proper label & 2 NFPA diamonds*	☐ Yes	☐ No		
7	Cracked foundation and/or supports	☐ No	☐ Yes		
8	Stains in the foundation	☐ No	☐ Yes		
9	Tank's bottom plate (if visible) in good condition	☐ Yes	☐ No	☐ N/A	
10	Interstitial space in double walled tank is free of liquids	☐ Yes	☐ No	☐ N/A	

Visually inspect auxiliary pipes/valves, transfer equipment noting the following:

11	Leaks at joints, seams & valves	☐ No	☐ Yes		*Ask your EH&S representative for replacement signs
12	Discoloration, stains & peeling paint	☐ No	☐ Yes		
13	Signs of cracks or corrosion	☐ No	☐ Yes		
14	Bowing of aboveground pipe	☐ No	☐ Yes		
15	Pooling of oil under or near the pipe lines	☐ No	☐ Yes		
16	Stained ground under or near the loading line	☐ No	☐ Yes		
17	Warning sign* posted in the loading area	☐ Yes	☐ No		
18	Drain valves locked & secured	☐ Yes	☐ No		

Inspect secondary containment noting the following:

19	Cracks, settling, erosion	☐ No	☐ Yes		*Accumulated rain water may be discharged from the containment ONLY if it passes the inspection; see SPCC plan for the inspection form
20	Drain valve closed or plugged	☐ Yes	☐ No	☐ N/A	
21	Drain valve in good operating condition	☐ Yes	☐ No	☐ N/A	
22	Drainage ditch sluice gate in good operating condition (if applicable)	☐ Yes	☐ No	☐ N/A	
23	Free of standing rain water*	☐ Yes	☐ No		
24	Free of standing oil or oil stains	☐ Yes	☐ No		
25	Free of misc. items or debris	☐ Yes	☐ No		

Inspect spill response equipment inventory available onsite noting the following:

26	If applicable, available in sufficient quantities	☐ Yes	☐ No	
Ensure that spill response equipment is located in a designated location & is easily accessible to personnel on an as-needed basis. Promptly place a replacement order for used materials. See Emergency Action Plan for contact information for local oil spill response organization(s). Example of typical spill response equipment: absorbent pads, booms, broom, shovel, poly bags, over-pack drum, PPE, etc.				

Record facility-wide observations:

27	Fence, gates & lights in good condition	☐ Yes	☐ No	
28	Signs of erosion threatening structural integrity	☐ No	☐ Yes	
29	Stains on access road & ground surface	☐ No	☐ Yes	

Anything marked in the shaded column above requires corrective action; include your comments below:

Submit ORIGINAL completed inspection form to your Supervisor. Supervisor must review the form, ensure completion of corrective action(s) if any, and sign below:

Supervisor's Name

Signature

Date

Exhibit 4
Facility Drainage System Form



Received

Exhibit 4 Facility Drainage System Form Removal of Rain Water

Diked areas may only be pumped out or drained of water with approval from supervisory personnel. Operating personnel visually inspect for oil before pumping out water and provide constant surveillance while draining or pumping rainwater from secondary containment areas. Drain valves (if installed) are sealed/locked in the closed position when not in use. Only clean water may be discharged from the containment area. Water which has a sheen must not be discharged from the containment area. Contaminated water must be treated so that it does not have a sheen prior to being discharged from the containment area or transported off site by a licensed hazardous waste or waste oil contractor for disposal.

RECORDS:

<i>Codes for Area Drained</i>	
Code #	Description
1	
2	
3	
4	
5	
6	
7	
8	

DATE	AREA DRAINED CODE	INCHES DRAINED	PRESENCE OF SHEEN (Y/N)	COMMENTS	INSPECTOR'S SIGNATURE

Exhibit 5
Certification of the Applicability of the Substantial Harm Criteria



**CERTIFICATION OF THE APPLICABILITY OF SUBSTANTIAL HARM CRITERIA
BRINE WELL #4 SWD**

Facility Name: Brine Well #4 SWD
Facility Address: EnLink Midstream Brine Well #4 SWD 544 Forest City Dr. St. Marys, West Virginia 26170

1. Does the facility transfer oil over water to or from vessels and does the facility have a total oil storage capacity greater than or equal to 42,000 gallons?

YES _____ NO X _____

2. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and does the facility lack secondary containment that is sufficiently large to contain the capacity of the largest aboveground oil storage tank plus sufficient freeboard to allow for precipitation within any aboveground storage tank area?

YES _____ NO X _____

3. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the appropriate formula in Attachment C-III to this appendix or a comparable formula¹) such that a discharge from the facility could cause injury to fish and wildlife and sensitive environments? For further description of fish and wildlife and sensitive environments, see Appendices I, II, and III to DOC/NOAA's "Guidance for Facility and Vessel Response Plans: Fish and Wildlife and Sensitive Environments" (see Appendix E of this part, Section 10 for availability) and the applicable Area Contingency Plan.

YES _____ NO X _____

4. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the appropriate formula in Attachment C-III to this appendix or a comparable formula¹) such that a discharge from the facility would shut down a public drinking water intake²?

YES _____ NO X _____

5. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and has the facility experienced a reportable oil discharge in an amount greater than or equal to 10,000 gallons within the last five years?

YES _____ NO X _____

CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals responsible for obtaining this information, I believe that the submitted information is true, accurate, and complete.

Signature

Steve Cornelison

Name (please type or print)

Director of Operations

Title

Date

¹ If a comparable formula is used, documentation of the reliability and analytical soundness of the comparable formula must be attached to this form.

² For the purposes of 40 CFR Part 112, public drinking water intakes are analogous to public water systems as described at 40 CFR 143.2(c).